Exploring cardiovascular risk and outcomes in primary care consulters for osteoarthritis using longitudinal electronic primary care data

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Declaration

This PhD was partly funded by the Keele University ACORN studentship obtained at the Primary Care Centre. The original topic of this PhD project was titled Improving care and quality of life for adults with osteoarthritis at risk of cardiovascular disease. The initial research idea and PhD proposal was developed by Dr Dahai Yu. Throughout the PhD project, with guidance from my supervisors Dr Dahai Yu, Dr Ross Wilkie and Professor Mamas A. Mamas, I developed the ideas around and managed the direction of the thesis. The project uses data from electronic health records of UK primary care patients. In the early stage of the project, Dr Dahai Yu and colleagues led the completion of the Independent Scientific Advisory Committee (ISAC) application (ISAC reference: 18_031) and the submission of the study protocol for access to Clinical Practice Research Datalink (CPRD) GOLD data. My supervisors supported the planning of my analyses and the writing and presentation of chapters. I conducted all analyses and wrote the chapters myself. I received guidance on the search strategy for the systematic review from my supervisors and the systematic review team at the Primary Care Centre Versus Arthritis, especially Dr Nadia Corp.

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Context of the thesis

I was awarded a BSc (Hons) Public Health degree from the University of Wolverhampton in 2015. My interest in public health led me to complete a Master of Public Health at the University of Sheffield in 2016. The research components of this degree sparked my aspiration for a career in research and led to me completing a Master of Research in Epidemiology at the University of Newcastle in 2017. Through my work on the association between body fat distribution and gestational diabetes, this degree strengthened my research interest in epidemiology and subsequently led to me applying for the PhD studentship advertised at the Arthritis Research UK Primary Care Centre (the older name of Primary Care Centre Versus Arthritis). My biggest challenge was adopting a primary care view on osteoarthritis and cardiovascular health, with a strong emphasis on implications for clinical practice.

I was a full-time student at Keele University for the first three years (2017-2020) of the PhD project. At the end of 2020, I moved back to my hometown, Shenzhen in China, and began to work as a research assistant at a local hospital due to financial difficulties through the coronavirus (COVID-19) pandemic. With the help of my supervisors and Immigration Compliance at Keele University, I was able to continue my PhD work as a distance learner until the end of the project.

Abstract

For adults aged 45 and over in the United Kingdom (UK), osteoarthritis is a common reason for consultation with primary care. Cardiovascular disease (CVD) is a common comorbidity with osteoarthritis; two in five people with osteoarthritis also have CVD. In the UK, primary care is often the first point of contact for people in need of osteoarthritis management and CVD preventive services.

This thesis aims to assess the prevalence of CVD risk factors, the level of CVD risk and outcomes in primary care consulters with osteoarthritis in comparison to those without osteoarthritis. To address this question, the thesis includes a series of retrospective cohort studies using CPRD GOLD, a large representative primary care EHR database, and linked data in the UK between 1992-2017. The consistently higher prevalence of modifiable cardiovascular risk factors (CVRFs), variables that are associated with a higher risk of CVD events, in the osteoarthritis population was revealed in chapter 2 and the socioeconomic inequality in these CVRFs was found in chapter 3. The thesis could then try to understand that if ruling out the impact of CVRFs, what is the excess risk of CVD due to osteoarthritis. The thesis then tried to use the established risk score (sex-specific Framingham risk score) to predict the CVD risk and to assess the following preventative treatments in the osteoarthritis and non-osteoarthritis populations in Chapter 4. If the score performs well, we could then estimate the risk difference (excess risk) based on the established risk score. Unfortunately, its overall prediction performance was not good, as found in chapter 5. We then applied the frailty Cox model (conditional Cox model) based on the matched cohorts, controlling demographical variables, period effect, and coding variation at the practice level, adjusting lifestyles, body measurements, clinical measurements, and treatments to estimate the

excess risk of CVD due to osteoarthritis. As the finding in Chapter 6, there was a significant excess risk of CVD for osteoarthritis, and higher in men, the elder and the deprived population. Importantly, the excess risk was also observed in the youngest age group (35-44 years). There could be potential unmeasured confounders, but the findings consistently suggest that clinical effectiveness, cost-effectiveness, and acceptability of potential preventive care strategies under the current screening criteria should be further addressed in the osteoarthritis population in the UK.

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List of abbreviations

AAA	Abdominal aortic aneurysm
ACC	American College of Cardiology
ACE	Angiotensin-converting-enzyme
ADA	American Diabetes Association
ADL	Activities of daily living
AF	Atrial fibrillation
AGE	Advanced glycation end products
AHA	American Heart Association
AMED	Allied and Complementary Medicine Database
ARB	Angiotensin-receptor blocker
BMI	Body mass index
BNF	British National Formulary
CALIBER	CArdiovascular research using LInked Bespoke studies and Electronic health Records
CCB	Calcium-channel blocker
CCG	Clinical Commissioning Group
CHD	Coronary heart disease
CI	Confidence interval
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CiPCA	Consultations in Primary Care Archive
CKD	Chronic kidney disease
CPRD	Clinical Practice Research Datalink
CT	Computerised tomography
CVD	Cardiovascular disease
CVRF	Cardiovascular risk factor
DBP	Diastolic blood pressure
DIP	Distal interphalangeal
DPP	Dipeptidyl peptidase
EHR	Electronic health records
EUROASPIRE	European Action on Secondary and Primary Prevention by Intervention to Reduce Events
GDP	Gross domestic product
GFR	Glomerular filtration rate
GLP	Glucagon-like peptide
GP	General practitioner
HDL	High-density lipoprotein
HES	Hospital Episode Statistics
HF	Heart failure

HR	Hazard Ratio
HRQoL	Health-related quality of life
HSCIC	Health and Social Care Information Centre
HSE	Health Survey for England
ICD	International Classification of Diseases
ICPC	International Classification of Primary Care
IHD	Ischemic heart disease
IHS	International Society of Hypertension
IMD	Index of Multiple Deprivation
IQR	Interquartile range
ISAC	Independent Scientific Advisory Committee
JBS	Joint British Societies
KL	Kellgren–Lawrence
LDL	Low-density lipoprotein
LINH	Information Network of General Practice
MEDLINE	Medical literature analysis and retrieval system online
MEMO	Medicines Monitoring
MeSH	Medical Subject Headings
MHRA	Medicine and Healthcare Products Regulatory Agency
MI	Myocardial infarction
MRI	Magnetic resonance imaging
NHS	National Health Service
NICE	National Institute for Health and Clinical Excellence
NSAID	Non-steroidal anti-inflammatory drug
NSTEMI	Non-ST-elevation myocardial infarction
OA	Osteoarthritis
OGTT	Oral glucose tolerance test
OHID	Office for Health Improvement and Disparities
ONS	Office for National Statistics
OR	Odds ratio
PAD	Peripheral arterial disease
PH	Proportional hazards
PHE	Public Health England
PIP	Proximal interphalangeal
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PRR	Prevalence rate ratio
QOF	Quality and Outcomes Framework
QoL	Quality of life
QUIPS	Quality in Prognosis Studies
RII	Relative index of inequality

RR	Relative risk
SBP	Systolic blood pressure
SD	Standard deviation
SES	Socioeconomic status
SF	Short Form
SIGN	Scottish Intercollegiate Guidelines Network
SII	Slope index of inequality
STEMI	ST-elevation myocardial infarction
T2DM	Type 2 diabetes mellitus
TC	Total cholesterol
THIN	The Health Improvement Network
THR	Total hip replacement
TIA	Transient ischaemic attack
TKR	Total knee replacement
UK	United Kingdom
US	United States of America
UTS	Up to standard
VS	Versus
WHO	World Health Organization

Publications and presentations arising from this thesis

Publications:

- Huang, X., Yu, D., Wilkie, R. and Mamas, M., 2021. Higher predicted 10-year risk for cardiovascular disease in primary care consulters for osteoarthritis. International Journal of Epidemiology, 50(Supplement_1), pp.dyab168-295.(Abstract) (Appendix A)

- Huang, X., Wilkie, R., Mamas, M. and Yu, D., 2021. Prevalence of cardiovascular risk factors in osteoarthritis patients derived from primary care records: a systematic review of observational studies. Journal of Diabetes and Clinical Research. 2021; 3(3):68-77. (Appendix B)

Oral presentations:

- Huang, X., Wilkie, R., Mamas, M. and Yu, D. Period prevalence of three modifiable cardiovascular risk factors in people with and without osteoarthritis in the United Kingdom; analysis using CPRD. Public Health England Public Health Research and Science Conference 2019. Manchester. 9 April 2019

- Huang, X., Wilkie, R., Mamas, M. and Yu, D. Association between deprivation, primary care diagnosed osteoarthritis, and the prevalence of modifiable cardiovascular risk factors in England 1992-2017. Public Health England Public Health Research and Science Conference 2020.

- Huang, X., Wilkie, R., Mamas, M. and Yu, D. Higher predicted 10-year risk for cardiovascular disease in primary care consulters for osteoarthritis. World Congress of Epidemiology 2021. 6 September 2021.

Chapter 1: Introduction

This thesis describes a series of studies that used routinely collected data from longitudinal primary care electronic health records (EHRs) to explore cardiovascular risk and outcomes in primary care consulters with osteoarthritis. These studies have (i) estimated the prevalence of risk factors for cardiovascular disease (CVD) and their association with socioeconomic status in primary care consulters for osteoarthritis in the United Kingdom (UK), comparing these with consulters without osteoarthritis, (ii) compared the predicted CVD risk using a currently used risk score between the UK primary care consulters with and without osteoarthritis, (iii) assessed the prevalence of preventive treatments among individuals with a high predicted CVD risk in the UK primary care consulters with osteoarthritis comparing to those without osteoarthritis (iv) assessed the performance of a currently used risk score in predicting CVD risk in the UK primary care consulters with osteoarthritis, (v) assessed the excess risk of developing CVD events in the UK primary care consulters with osteoarthritis. The first chapter introduces the health conditions of osteoarthritis and CVD and the potential to use primary care EHR data to explore the risk of CVD in people with osteoarthritis. It describes a systematic review of studies using primary care EHRs to estimate the prevalence of cardiovascular risk factors (CVRFs) in consulters with osteoarthritis compared with those without osteoarthritis. This chapter also concludes with the rationale and outline for the work described in subsequent chapters.

1.1 Osteoarthritis and cardiovascular disease

1.1.1 Osteoarthritis

Osteoarthritis is the most common joint condition and one of the leading causes of global disability (Cross et al., 2014). In 2017, it was estimated that 303 million people had osteoarthritis worldwide (James et al., 2018). The knee, hip, hand, and spine are the anatomical areas most likely to be affected by osteoarthritis, but any synovial joint can develop this condition (O'Neill et al., 2018). Osteoarthritis can affect all tissues of a synovial joint, as well as extracapsular structures such as muscle (strength and mass) (Glyn-Jones et al., 2015). Pathological changes that occur due to osteoarthritis in synovial joints include progressive loss and destruction of articular cartilage, thickening of the subchondral bone, the formation of osteophytes, variable degrees of inflammation of the synovium, degeneration of ligaments, and hypertrophy of the joint capsule (Glyn-Jones et al., 2015). Contrary to the traditional belief that osteoarthritis is the result of the “wear and tear” of joints, it is now generally accepted to be an inflammatory disease that is triggered by many factors including traumatic injuries and low-grade inflammation related to ageing and metabolic syndrome (Berenbaum, 2013, Mobasheri and Batt, 2016). Osteoarthritis is now recognised to have a slow but efficient repair process that often compensates for the initial trigger. However, in some cases, the repair process fails either due to overwhelming trauma or compromised repair, eventually resulting in the presentation of symptoms (Bijlsma, Berenbaum and Lafeber, 2011). Symptoms of osteoarthritis have varying degrees of severity, but mainly include joint pain accompanied by stiffness and reduced physical functioning. The burden of osteoarthritis can extend beyond physical symptoms to quality of life (Conaghan et al., 2015).

1.1.1.1 Defining osteoarthritis

Osteoarthritis is classified according to the structural changes identified through radiography (radiographic) and/or clinical symptoms (symptomatic or clinical) (Berenbaum, 2013, Mobasheri and Batt, 2016). People with an osteoarthritis diagnosis in their electronic health records may have this through diagnosis via symptoms or radiography, or a combination of both.

Clinical symptoms of osteoarthritis

Joint pain is the dominant symptom that causes people to visit primary care (Bijlsma et al., 2011). Joint stiffness can also be experienced by people with osteoarthritis. This stiffness often occurs in the morning and follows a period of inactivity (Sellam & Berenbaum, 2010). It generally resolves within 30 minutes, unlike rheumatoid arthritis which often results in a longer period (usually greater than 30 minutes) of stiffness. Loss of joint movement and functions are also common reasons for people with osteoarthritis to visit healthcare (Bijlsma et al., 2011).

There are guidelines and criteria to facilitate the diagnosis of osteoarthritis. The National Institute for Health and Clinical Excellence (NICE) guidelines (2014) are one example and are proposed to facilitate the identification of osteoarthritis in health care in the UK. These guidelines suggest that osteoarthritis is more likely to be present in people over the age of 45, as well as in those who experienced joint pain related to activities and joint stiffness in the morning lasting less than 30 minutes.

A physical examination can confirm joint involvement and exclude pain and functional syndromes of alternative joint diseases such as rheumatoid arthritis (Bijlsma et al., 2011).

Objective symptoms that can add to the indication that osteoarthritis is present are:

- Restricted passive movement (the inability of a joint to perform a full range of motion without the involvement of the patient) (Sellam & Berenbaum, 2010).
- Crepitus (a sensation of crunching or crackling, is commonly felt on passive or active movement of a joint with osteoarthritis) or swelling in the joints (Zhang et al., 2010)
- Joint deformities in severe diseases (caused by the outgrowth of bone and other joint damage that involves cartilage, subchondral bone, synovium, articular capsule, ligaments, and muscles) (Sharma et al., 2013). Heberden's and Bouchard's nodes are typical bony deformities in the distal interphalangeal (DIP) and proximal interphalangeal (PIP) joints, respectively.

<u>Radiographic osteoarthritis</u>

Radiographic osteoarthritis is defined by the structural changes seen on radiographs, including loss of joint space, osteophyte formation, and the presence of subarticular sclerosis and cyst (Altman and Gold, 2007). Although imaging is seldom required to confirm the osteoarthritis diagnosis it can be used to monitor disease progression and to establish the severity of joint damage (Berenbaum, 2013, Mobasheri and Batt, 2016). The Kellgren–Lawrence (KL) grading system categorises the severity of radiographic osteoarthritis of knees, hips, and hands, by allocating one of the five grades (grade 0: none; 1: doubtful; 2: minimal; 3: moderate; 4: severe) at various joint sites by comparison with a standard radiographic atlas (Kellgren and Lawrence, 1957; Altman and Gold, 2007). The classification of severity is according to a sequence of osteophyte formation, joint space loss, sclerosis, and cyst of subarticular bone (Table 1.1).

Plain radiography is the gold standard in the imaging of osteoarthritic joints (Georgiev et al., 2016). Apart from plain radiographs, other techniques have been developed such as computerised tomography (CT), ultrasound, and magnetic resonance imaging (MRI), but are unlikely to become the standard in the imaging of osteoarthritic joints (Berenbaum, 2013, Mobasheri and Batt, 2016).

Table 1.1 The Kellgren–Lawrence criteria for the assessment of osteoarthritis (Kellgren and Lawrence, 1957)

KL grade	Severity	Radiographic features
0	None	No features of osteoarthritis
1	Doubtful	Minute osteophyte, doubtful significance
2	Minimal	Definite osteophyte, unimpaired joint space
3	Moderate	Moderate diminution of joint space
4	Severe	Joint space greatly impaired with sclerosis of subchondral bone

Severe osteoarthritis is often characterised by both radiographic evidence and self-reported symptoms by patients (McGonagle et al., 2010). However, there is only a modest relationship between self-reported symptoms and structural changes, especially in the early stage of osteoarthritis (Finan et al., 2013). Radiographic osteoarthritis can occur irrespective of whether symptoms are reported by the patient; and osteoarthritis symptoms may present without radiographic evidence (Glyn-Jones et al., 2015; Lawrence, 2016). In a cross-sectional study conducted in the UK, only about half of patients with radiographic osteoarthritis reported symptoms, and only about one-third of patients with knee pain had a radiographic diagnosis (Peat et al., 2006). Similarly, Arden and Nevitt (2006) suggested that 20-40% of those with severe radiographic knee osteoarthritis had no pain. The reason for this discordance remains unclear, although it is likely in part due to plain radiography being an insensitive indicator of the structural changes in the joint that cause pain (O'Neill et al., 2018).

1.1.1.2 Epidemiology of osteoarthritis

The epidemiology of osteoarthritis provides an understanding of risk factors and the extent of the occurrence of the condition and its impact.

Prevalence of osteoarthritis

Estimates of frequency (absolute numbers, prevalence and incidence) vary depending on the definitions of osteoarthritis applied and the populations in which the frequency is estimated. Despite the variance, osteoarthritis is accepted as the most common joint condition globally (Cross et al., 2014). It is estimated that 303 million people had osteoarthritis worldwide (James et al., 2018). In the UK, it is estimated that 8.75 million adults aged 45 or over have sought treatment for osteoarthritis in primary care between 2004-2010 (Arthritis Research UK, 2013). The number of people with osteoarthritis is predicted to almost double within the next two decades due to the ageing population and increasing obesity (a risk factor for osteoarthritis) in the UK (Briggs et al., 2012).

Using EHR data collected in the UK (Consultations in Primary Care Archive (CiPCA)), the prevalence of osteoarthritis in adults aged 45 years and over is estimated to be 33%, with 18% having knee osteoarthritis and 8% having hip osteoarthritis (Arthritis Research UK, 2013). Although not using EHR data, prevalence rates of knee and hip osteoarthritis were similar in the United States of America; data from the Johnston County Osteoarthritis Project indicated that the prevalence of symptomatic knee and hip osteoarthritis isis 17% and 10% respectively in adults over the age of 45 years (Jordan et al., 2009). The estimated prevalence of osteoarthritis based on radiographic features is often higher compared to symptomatic osteoarthritis within the same population (O'Neill et al., 2018). In the Osteoarthritis Initiative study, for example, the prevalence of radiographic osteoarthritis was estimated as 41.4%, while the prevalence of symptomatic hand osteoarthritis was 16.9% (Eaton et al., 2022)). The prevalence of osteoarthritis varied by population characteristics including age and sex (Dutta et al., 2016, Haugen et al., 2011). In the Framingham study, the prevalence of both radiographic and symptomatic osteoarthritis at the knee, hip, and hand increased with age, with a greater apparent increase in women than in men (Felson et al., 1987, Haugen et al., 2011). The gender difference in age-standardised prevalence was seen for both radiographic (44.2% in women vs. 37.7% in men and symptomatic hand osteoarthritis (15.9% in women vs. 8.2% in men) (Haugen et al., 2011).

Incidence of osteoarthritis

Using data from the 2020 primary care records (Clinical Practice Research Datalink) in England, the annual incidence of osteoarthritis at any joint was estimated at 16.1/1000 person-years among people aged 45 years and over with a higher rate in women (20.1/1000 person-years) than in men (12.0/1000 person-years) (Yu et al., 2015). Studies commonly report that the incidence of osteoarthritis increased with age and with rates higher in women than in men (O’Neill et al., 2018, Prieto-Alhambra et al., 2014; Yu et al., 2017). The incidence rate of clinical osteoarthritis of knee and hip has been reported to progressively increase from 50 years old, peaking at 75-80 years in a population-based study using primary care records in Spain between 2006-2010 (Prieto-Alhambra et al., 2014).

1.1.1.3 Risk factors for osteoarthritis

The onset of osteoarthritis in an individual is a multifactorial process with a complex interplay between local joint-level and systemic risk factors (Mobasheri and Batt, 2016). Joint-level risk factors include joint injury or surgery, occupations, intense physical activity, and biomechanical changes involving cartilage, subarticular bones, ligament, joint alignment, and muscle density (Johnson and Hunter; 2014). Systemic risk factors include non-modifiable risk factors such as increasing age, female gender, genetics, and ethnicity, as well as modifiable risk factors such as nutrition, and bone density (Glyn-Jones et al., 2015). However, some factors, for example, being overweight/obese may increase the risk of developing osteoarthritis through both joint-level and systemic factors. Key risk factors for osteoarthritis are:

Age

Age is accepted as the strongest systemic risk factor for osteoarthritis (Glyn-Jones et al., 2015, Johnson and Hunter, 2014), but the underlying mechanism of the positive association between higher osteoarthritis risk and age is not yet fully understood. A possible mechanism is an age-related reduction in the capacity for joint tissues to adjust to biomechanical changes that may be mediated by the accumulation of risk factors such as excessive joint loading caused by obesity (Litwic et al., 2013).

Gender

Women were found to have a higher incidence and prevalence of osteoarthritis than men. Additionally, postmenopausal women have a higher prevalence and severity of osteoarthritis than men of a similar age (Glyn-Jones et al., 2015). Sex hormones such as oestrogen and the difference in pain sensitivity may play a role in gender inequality in the occurrence of osteoarthritis symptoms (Rollman and Lautenbacher, 2001, Wluka, et al., 2000). However, the effects of sex hormones and whether they have pronociceptive or antinociceptive effects remain unclear as research on human pain has shown conflicting findings (Mogil et al., 2012). The gender difference in pain sensitivity is likely to explain why more women present with osteoarthritis symptoms as women are more sensitive to pain than men.

Genetics

Genetic factors play an important role in the development of osteoarthritis. Twin studies that compared the occurrence of osteoarthritis in monozygotic and dizygotic twins suggested that over half of knee and hip osteoarthritis and 40% of hand osteoarthritis were contributed by the difference in genes (Valdes and Spector, 2011). Genome-wide association studies have identified a series of susceptibility genetic loci that were associated with the development of osteoarthritis, but the findings from these studies have not been replicated in all populations (Zengini et al., 2018).

Obesity

Overweight or obesity is an important modifiable risk factor for the development of osteoarthritis (Johnson and Hunter, 2014), especially in weight-bearing joints such as the hip and knee, through increasing mechanical load (Glyn-Jones et al., 2015). A recent meta-analysis summarised the odds of developing knee osteoarthritis as being 2.66 (95% CI 2.15–3.28) higher in people with obesity than those of normal weight; it is 1.98 (95% CI 1.57–2.20) higher in those who were overweight (Silverwood et al., 2018). The risk of knee osteoarthritis increases with increasing body mass index (BMI) (Jiang et al., 2012). In addition to mechanical loading, the link between obesity and systemic factors, potentially including systemic inflammation, has been suggested to explain the link between obesity and osteoarthritis in joints not impacted by increased loading such as hand joints (Jiang et al., 2016). Obesity may also increase the occurrence of osteoarthritis by its effects on metabolic syndrome (e.g., diabetes, hypertension, and dyslipidaemia) (Abella et al., 2014). Metabolic syndrome can be induced by obesity through an inflammatory environment as adipose tissues express cytokines and adipocytokines and can be related to a long-term low-grade inflammatory state that influences the pathogenesis of osteoarthritis. Weight management and reducing overweight/obesity have been suggested to prevent osteoarthritis (O'Neill et al., 2018). Findings from the Framingham study indicate that a reduction in BMI by 2kg/m^2 or more units was related to a significantly reduced risk of knee osteoarthritis (OR: 0.46, 95% CI 0.24 to 0.86) (Felson et al., 2012).

Joint-level risk factors

Joint injuries such as ligament tears can lead to tissue damage, abnormal joint mechanics, and changed load distribution that contributes to the increased susceptibility to further joint damage (Glyn-Jones et al., 2015). Occupations or sports that involve repetitive and excessive loads on the joint are also related to a high risk of development of osteoarthritis in the stressed joint (O'Neill et al., 2018).

1.1.1.4 Impact of osteoarthritis

The impact of osteoarthritis is wide-ranging on the individual and society. The following is a summary of three key areas (physical health, quality of life and economic impact).

Physical health

Joint pain is the main reason that people with osteoarthritis seek health care (Bijlsma et al., 2011). The joint pain then affects their physical health and limits physical function in the affected individuals (e.g., limitations in walking and daily activities of living) (Bushmakin et al., 2011, Stubbs, Hurley and Smith, 2015). Subsequently, this goes on to impact their work participation and social participation (Bushmakin et al., 2011). Physical limitation is also related to a loss of activity. For example, people with knee pain and difficulties with activities of daily living due to knee osteoarthritis have higher levels of physical inactivity which is an important risk factor for mortality and other comorbidities such as CVD (Fernandes and Valdes, 2015, Stubbs, Hurley and Smith, 2015).

Quality of Life

Osteoarthritis negatively impacts the quality of life (QoL), which is often measured subjectively using instruments (e.g., Short Form-36) that quantify individuals' physical, material, social and emotional wellbeing, development, and activity (Alkan et al., 2014, Geryk et al., 2015). A study using the Short Form-36 reported poorer QoL in osteoarthritis patients compared with those without osteoarthritis (Alkan et al., 2014). Studies assessing health-related quality of life (HRQoL) (an individual's perceived physical and mental health functioning) in osteoarthritis patients have found similar results (Bushmakin et al., 2011; Geryk et al., 2015). For example, data from the United States have shown that osteoarthritis patients had poorer HRQoL than the general population (Geryk et al., 2015).

Economic burden

In addition to influences on individuals, osteoarthritis confers an enormous burden on society and the economy, with a total cost accounting for 0.25-0.50% of the gross domestic product (GDP) (Puig-Junoy and Zamora, 2015). In the UK, osteoarthritis is a leading cause of work loss, costing the economy approximately £18 billion annually (Conaghan et al., 2015). A review of the economic costs of osteoarthritis in the UK calculated the annual costs for osteoarthritis in healthcare (expenditure on the treatment of osteoarthritis and the associated use of hospital resources) at £1 billion (Chen et al., 2012). These estimates were underestimated due to limited published data about osteoarthritis costs in the UK. The demand for total knee replacements (TKR) and total hip replacements (THR) may also represent the costs of osteoarthritis as osteoarthritis remains the most common indicator for this option of surgery. The total numbers of TKR and THR conducted in the UK are estimated to increase to over 1.2 million and 439,000, respectively, by 2035 (Culliford et al., 2015). Thus, the future economic burden of osteoarthritis may be greater due to the increasing demand for total joint arthroplasty.

1.1.1.5 Comorbidity

People with osteoarthritis are more likely to experience comorbidities than people that do not have the condition (Kadam, Jordan and Croft, 2004; Swain et al., 2020; van Oostrom et al., 2012). A recent meta-analysis of 15 studies with 773,592 participants reported that the pooled prevalence of comorbidity in osteoarthritis patients was 67% versus 56% in those without osteoarthritis (Swain et al., 2020). A study of approximately 11,000 osteoarthritis cases and 12,000 controls without osteoarthritis aged over 50 years in the UK general practice reported that osteoarthritis cases were more likely to have six or more comorbidities compared to controls (odds ratio: 2.35, 95%CI (2.16 to 2.55)) after the adjustment for age, sex and social class (Kadam, Jordan and Croft, 2004). The two most common non-musculoskeletal comorbidities with osteoarthritis were identified by data from over 52,000 patients aged over 55 years registered for primary care in the Netherlands; these were diabetes (26.0%) and coronary heart disease (23.6%) (van Oostrom et al., 2012).

Summary of osteoarthritis:

- Osteoarthritis is a highly prevalent joint condition globally.
- The main risk factors for osteoarthritis include age, sex, obesity, occupation, bone density, joint injury or disease, joint abnormalities, and genetic factors.
- The prevalence of osteoarthritis is predicted to increase over the coming decades due to the ageing population and rising obesity rates.
- Osteoarthritis has a considerable impact on patients, resulting in pain, disability, reduced quality of life, and other comorbidities (particularly cardiovascular disease and diabetes).
- The economic burden of osteoarthritis on patients and society is large.

1.1.2 Cardiovascular disease

CVD is the most common cause of death globally (Roth et al., 2017). The Global Burden of Disease study reported that in 2015, there were 17.92 million deaths worldwide that were attributable to CVD, increasing from 12.59 million deaths in 1990 (Roth et al., 2017). In the UK, CVD is a leading cause of death, accounting for almost one-third of all deaths (Bhatnagar et al., 2015). There are 168,000 deaths caused by CVD in the UK annually (British Heart Foundation, 2022). CVD refers to a range of diseases of the heart and the blood vessels (World Health Organization (WHO), 2021). It can be congenital or inherited but it is mainly due to atherosclerosis which can be prevented (Santos-Gallego et al., 2014). Atherosclerosis is a process initiated by a variety of triggers, mainly including high blood cholesterol, high blood glucose, hypertension, and smoking, that result in the activation of arterial endothelium, allowing the migration of lipids, especially low-density lipoproteins (LDL), into the arterial wall. The process results in a cascade of vascular modifications including intimal thickening, fatty streak, pathologic intimal thickening, fibroatheromas, vulnerable plaque, and ruptured plaque (Bergheanu et al., 2017). Inflammation is a regulatory process that plays an important role in the formation and progression of atherosclerotic plaque (Santos-Gallego et al., 2014). For example, long-term inflammation produces pro-inflammatory mediators such as advanced glycation end products (AGE) that have been found to accelerate vascular inflammation and the formation of plaque (Galkina and Ley, 2009). Atherosclerosis can result in a reduced amount of oxygen and other nutrients reaching the surrounding tissues due to restricted blood flow over the plaque and may trigger the presence of thrombus through plaque rupture, eventually leading to symptoms of CVD (Bergheanu et al., 2017). Common subtypes of CVD include coronary heart disease (CHD), heart failure (HF), cerebrovascular disease (stroke, and transient ischaemic attack (TIA)), and peripheral arterial disease (PAD) (Bhatnagar et al., 2015; British Heart Foundation, 2022; WHO, 2021). Definitions of these have been comprehensively reported by published papers and included in clinical guidelines (NICE, 2016, Powers et al., 2019). A brief discussion of common definitions of these CVD types is presented in the following section.

1.1.2.1 Defining cardiovascular disease

CHD is the leading reason of CVD mortality globally (Joseph et al., 2017). It occurs when the blood vessels (coronary arteries) supplying the heart muscle are narrowed or blocked (Montalescot et al., 2013). The reduction of blood flow in the narrowed artery can result in a clinical condition called angina (Ambrosio et al., 2016). Stable angina is defined as chest pain which may also extend to the arms, neck, jaw, or shoulder during exercise. Unstable angina is chest pain that occurs not only during exercise but also at rest. If a blood clot in an artery's lumen stops blood flow, the heart muscle in the perfusion area of the blocked artery begins to die, resulting in the clinical condition known as myocardial infarction (MI) (O'Gara et al., 2013). An incomplete blockage of the coronary artery can lead to a non-ST-elevation myocardial infarction (NSTEMI) and a complete blockage can cause a more severe infarct, called ST-elevation myocardial infarction (STEMI) (O'Gara et al., 2013). The major signs of MI consist of chest pain during no exertion, symptoms of ischaemia such as shortness of breathing and nausea, and changes in electrocardiography.

HF occurs when the ability of ventricular filling or ejection of blood is reduced or lost, causing the heart to fail to meet the demand for blood and oxygen in the body (Yancy et al., 2013). HF is often a result of a previous disorder that affects the heart, which mainly includes

CHD, hypertension, and abnormalities of ventricular diastolic function, valves, myocardium, heart rhythm, or conduction (Ponikowski et al., 2016). The main symptoms of HF include shortness of breath especially when lying flat, general fatigue, nausea, and swelling of the feet and ankles (Yancy, et al., 2013).

A stroke occurs when an artery supplying the brain is either blocked by a clot (ischaemic stroke) or bursts (haemorrhagic stroke) resulting in necrosis of brain cells, and focal neurologic symptoms lasting more than 24 hours (Powers et al., 2019). The symptoms of stroke can include asymmetric weakness of the face, arm and leg, speech disturbance, sudden headache, and loss or blurring of vision (Powers et al., 2019). A TIA occurs when the blockage of the arteries is temporary without lasting necrosis of brain cells, leading to the occurrence of stroke symptoms lasting less than 24 hours (Al Kasab et al., 2017). Additional symptoms of haemorrhagic stroke can include neck stiffness, intolerance of light, loss of consciousness, and seizures (Al Kasab et al., 2017).

PAD is a clinical condition of the narrowing or blockage of the peripheral arteries including carotid, vertebral, upper extremity, mesenteric, renal, and lower extremity vessels, most commonly in lower extremity vessels (Tendera et al., 2011). Symptoms of PAD may not be experienced by many patients and vary by vascular sites. Using PAD in the lower extremity as an example, patients may have pain in the extremities when they walk, which is quickly relieved at rest (Tendera et al., 2011). Other symptoms can include poorly healing wounds of the extremities, numbness or weakness in the extremities

1.1.2.2 Epidemiology of cardiovascular disease

Prevalence of cardiovascular disease

There are an estimated 422.7 million people who had CVD in the world (Roth et al., 2017). In the UK, using primary care data collected as part of practice linked to the Quality and Outcomes Framework (QOF) there are an estimated 5.5 million people with CVD (Bhatnagar et al., 2015). CHD was the most common type of CVD in the UK, affecting 2.29 million people, followed by stroke/TIA (1.18 million), HF (0.49 million), and PAD (0.45 million). The QOF data also indicated a reduction in the prevalence of CVD from 2004 to 2013 (Bhatnagar et al., 2015). However, the total number of prescriptions and operations for the prevention and treatment of CVD has increased over the last few decades (Townsend et al., 2014).

Incidence of cardiovascular disease

The incidence of CVD has decreased in many countries, including the UK over the last 20 years; this reduction can be attributed in part to improved CVD prevention in primary care (Joseph et al., 2017, Lee, Shafe and Cowie, 2011). The UK primary care data indicated that the stroke incidence rate reduced to 1.04 /1000 person-years in 2008, from 1.48 /1000 person-years in 1999; a reduction of 30% (Lee, Shafe and Cowie, 2011). MI incidence in the UK is also decreasing (Scarborough et al., 2010); the age-standardised incidence rate of MI has reduced by about 10% from 2005 to 2007 in England and by about 25% from 2000 to 2008 in Scotland. However, the CHD incidence in the UK is still high, for example, 444/100,000 person-years in men and 216/100,000 person-years in women in 2008

(Scarborough et al., 2010).

Mortality from cardiovascular disease

Despite a decrease in its incidence, CVD remains one of the most common causes of death globally. The Global Burden of Disease study estimated that there were 17.92 million deaths due to CVD worldwide in 2015, increasing from 12.59 million in 1990 (Roth et al., 2017). CHD was the most common cause of CVD deaths, accounting for 8.92 million deaths, followed by stroke (6.33 million deaths). In 2015, the age-standardized CVD mortality rates in the world and Western Europe were estimated at 286/100,000 and 157 /100,000, respectively (Roth et al., 2017).

In the UK, CVD is also a leading cause of death, accounting for 28% of the total deaths (Bhatnagar et al., 2015). The age-standardised CVD mortality rate calculated in the UK in 2013 was 275 /100,000, which declined by 74% from 1,045/100,000 in 1969 (Bhatnagar et al., 2015). The decrease in the mortality rate in the UK is partly a result of the lower prevalence of tobacco use, the improvement in prevention, and better CVD treatment (Schwalm et al., 2016).

1.1.2.3 Primary prevention for cardiovascular disease

Given that CVD remains a leading cause of morbidity and mortality worldwide, primary prevention is essential to reduce the occurrence and burden of the disease and is encouraged in health policies and clinical guidelines (Joseph et al., 2017). In the UK, primary care is the first point of care for people in need of CVD prevention and a range of national strategies has been introduced to improve CVD prevention in the primary care setting over the past decades. One example is the QOF which was introduced in 2004 to encourage the most prevalent risk factors for CVD (smoking, diabetes, hypertension, and obesity) to be identified and recorded in primary care. Notably, indicators of lipid modification such as the prescription rate of statins were added for CVD primary prevention in 2010 (QOF, 2019). Another example is the National Health Service (NHS) Health Check, a primary care-based program introduced in 2009 which involves five-yearly screening, measurement of CVRFs, assessment of 10-year CVD risk, and lifestyle advice in all individuals aged 40-74 years without existing CVD in England (Artac et al., 2013).

Clinical guidelines for CVD prevention commonly recommend that risk prediction tools are essential for the prevention of CVD by identifying individuals at risk and informing the provision of advice on healthier lifestyles, pharmacological treatments, and other healthcare interventions (NICE, 2016; Rossello et al., 2019). Risk prediction tools are developed from multivariable algorithms, in which relative weights are assigned to each predictor to calculate the likelihood of a specific outcome over a specified time (Passantino et al., 2015). Many risk prediction tools have been developed for CVD, such as QRISK (Hippisley-Cox, Coupland & Brindle, 2017), Framingham risk score (Anderson et al., 2008), and ASSIGN (Woodward et al., 2007), and have been used to support informed treatment decisions about the initiation or adjustment of preventive interventions. These tools are generally based on easy-to-measure, low-cost, widely available, and easy-to-understand (for the healthcare provider and patient) factors, such as age, gender, diabetes, hypertension, blood cholesterol, obesity, and socioeconomic factors. The use of risk prediction tools for CVD prevention varies by country (Rossello et al., 2019). In the UK, for example, the NICE guidelines currently recommend the primary preventive practice starting with the assessment of the 10-year CVD risk for consulters aged 40-84 years with the use of a formal risk prediction tool, such as the QRISK (Hippisley-Cox, Coupland & Brindle, 2017). An estimated 10-year CVD risk is expressed as a proportion (%) of developing a CVD within 10 years among people with the same predictor profile. Lifestyle advice (e.g., smoking cessation, weight loss, healthy diet, physical activity, reducing alcohol consumption) is provided to all individuals who have had a CVD risk assessment, regardless of their risk score. According to the updated guidance in 2016, all consulters with an estimated 10-year CVD risk of 10% or over (previously greater than or equal to 20% until 2014) predicted by QRISK2 are considered eligible for statins treatment for CVD primary prevention (NICE, 2016). However, the threshold for offering statin treatment varies by country depending on the cost-effectiveness. For example, the treatment threshold remains at 20% in Scotland (Scottish Intercollegiate Guidelines Network (SIGN), 2017) and 10% in England. Consulters with modifiable CVRFs such as obesity, smoking, hypertension, and type 2 diabetes mellitus (T2DM) are provided management (e.g., antihypertensive and antidiabetic drugs) according to other NICE guidelines for managing each risk factor (NICE, 2016).

1.1.2.4 Risk factors for cardiovascular disease

Risk factors for CVD can be characterised as non-modifiable or modifiable risk factors (Damen et al., 2016; NICE, 2016). Non-modifiable factors including older age, male sex, and family history of CVD, and modifiable factors including smoking, hypertension, obesity, T2DM, and dyslipidaemia have been widely established by previous studies such as the Framingham Heart Study (Mahmood et al., 2014). These risk factors have been used by risk prediction tools, such as the Framingham risk score (Anderson et al., 2008) and the QRISK models (Hippisley-Cox et al., 2017) to assess an individual's CVD risk. To date, numerous factors (e.g., ethnicity, socioeconomic status (SES), rheumatoid arthritis, migraine, corticosteroid use, systemic lupus erythematosus, severe mental disorders, and erectile dysfunction) have been reported to be associated with CVD and have been added to some clinical prediction tools such as the QRISK (Hippisley-Cox et al., 2017).

Among multiple factors associated with CVD, modifiable risk factors including hypertension, obesity, dyslipidaemia, T2DM, smoking, and SES are common targets in clinical prediction tools or public health actions for primary CVD prevention (NICE, 2016, QOF, 2019, Public Health England (PHE), 2019). These factors are analysed in this thesis and their details are described as follows:

Hypertension

Hypertension is typically classified as primary or secondary (Poulter, Prabhakaran and Caulfield, 2015). Primary hypertension, also known as essential or idiopathic hypertension, generally occurs without a specific cause and may be due to a complex interaction between genetic factors, lifestyles, and the environment. In the contrast, secondary hypertension usually has a clear primary cause such as pre-existing kidney disease. Hypertension is mostly defined by the measurement of systolic blood pressure (SBP) or diastolic blood pressure

(DBP) (Poulter, Prabhakaran and Caulfield, 2015). Most national guidelines, such as NICE guidelines (2015), and international guidelines, such as the World Health Organization (WHO) (WHO and International Society of Hypertension (IHS) Writing Group, 2003), have provided clinical criteria for hypertension: an SBP measured at 140 mm Hg or greater, or a DBP of at 90 mm Hg or greater. The most recent criteria recommended by the 2017 American College of Cardiology (ACC)/American Heart Association (AHA) guideline is an SBP measured at 130 mm Hg or greater, or a DBP of 80 mm Hg or greater (Muntner et al., 2018).

Hypertension is one of the most important modifiable risk factors for CVD (NICE, 2015). Global data demonstrate that about half of CHD and two-thirds of stroke or TIA are attributable to hypertension (WHO and IHS Writing Group, 2003). In the UK, hypertension has been reported to be independently associated with the incidence of a wide range of CVD such as CHD, stroke, and HF (Rapsomaniki et al., 2014). SBP is also continuously associated with CVD risks, with each 2 mmHg increase associated with a 7% raised risk of CHD mortality and a 10% raised risk of stroke mortality (NICE, 2015a). Strategies for lowering blood pressure and management of hypertension are increasingly important to prevent CVD (WHO and IHS Writing Group, 2003). Drug treatment, such as angiotensin-converting-enzyme (ACE) inhibitors, angiotensin receptor blockers (ARBs), beta-blockers, calcium-channel blockers (CCBs), and thiazide-like diuretics, as well as lifestyle modification, such as weight loss, physical activity, and healthy diet (e.g., lower salt intake), can effectively lower blood pressure and have been the most common strategies for controlling hypertension in CVD primary prevention in the UK (NICE, 2015a).

Obesity

Obesity is commonly defined with the use of body mass index (BMI), which is measured by dividing the weight of an individual by the square of the height of the individual (NICE, 2014). The globally recommended cut-off point, above which adults are having obesity, is a BMI of 30 kg/m^2 (WHO, 2018). The severity of obesity increases with BMI (grade 1: BMI 30–34.9 kg/m^2; grade 2: 35–39.9 kg/m^2; grade 3: ≥ 40 kg/m^2) (NICE, 2014). Although it is considered an effective measure of population-level obesity, BMI may not represent the same degree of obesity in different persons with the same estimate. Central obesity, characterised by fat concentrated in the abdomen, is used to further measure the individual-level distribution of obesity (WHO, 2011). It is typically defined by a waist circumference of over 94cm for males and over 80cm for females, or a waist-hip ratio of over 0.9 for males and over 0.85 for females (WHO, 2011). In the UK clinical settings, the WHO threshold of waist circumference is also used as an indicator of obesity at high risk of ill health while a waist circumference of over 102 cm for males and over 88 cm for females is an indicator of obesity at very high risk of ill health (NICE, 2014).

Obesity measured with BMI has been reported to directly increase the risk of CVD (Clark, Fonarow and Horwich, 2014) as well as the development of other CVRFs such as hypertension, dyslipidaemia, and T2DM (NICE, 2014). Individuals with a BMI ≥ 30 kg/m^2 or over were about two times more at risk of developing HF than those with normal BMI in approximately six thousand participants in the Framingham heart study (Kenchaiah et al., 2002). Measurements of central obesity using waist-hip ratio and waist circumference are also associated with CVD, with each 0.01 unit rise in waist-hip ratio and 1cm rise in waist circumference related to a 5% and 2% increase in the risk of CVD, respectively (De Koning et al., 2007). Given the important effects of obesity on health, strategies to manage obesity to reduce the risk of CVD as well as other diseases (e.g., T2DM) have been recommended by NICE guidelines (NICE, 2014). These strategies focus on weight management, physical activity, and lifestyle changes assisted using BMI and waist circumference thresholds.

Dyslipidaemia

Dyslipidaemia, also called lipid abnormalities, is a range of conditions in which the amount of lipids in the blood is abnormal (Ascaso et al., 2007). Its clinical expression is usually characterised by high levels of total cholesterol (TC), low-density lipoprotein (LDL) cholesterol and triglyceride, and low levels of high-density lipoprotein (HDL) cholesterol (NICE, 2016). In the UK, the Joint British Societies (JBS) (2005) clinical guidelines provided audit levels for TC and LDL-C of 5 and 3 mmol/l, respectively. Desirable levels for HDL-C have been reported to be more than 1.0 mmol/l in males and 1.2 mmol/l in females, and for triglycerides to be less than 1.7 mmol/l in individuals attending general practice in the UK (Phatak et al., 2009).

High levels of TC, LDL cholesterol, and triglycerides are associated with increased CHD risk (NICE, 2016; Nordestgaard & Varbo, 2014; Ridker, 2014). By contrast, levels of HDL cholesterol are inversely related to the risk of CHD, with low HDL levels effectively predicting high risk and high levels predicting low risk (Rader and Hovingh, 2014). The presence of dyslipidaemia has been independently associated with various metabolic changes, such as increased levels of prothrombotic factors, that are involved in producing atheromatous plaques in arteries (von Eckardstein et al., 2005), resulting in a higher risk for CVD events caused by atherosclerosis and the formation of blood clots. Dyslipidaemia is also associated with an increased risk of developing T2DM (Grundy et al., 2006), which subsequently increases the CVD risk. In the UK, treatment of dyslipidaemia, including high levels of TC, LDL-C, and triglyceride, with the use of statins is a central approach to the prevention of CVD (NICE, 2016).

Type 2 diabetes mellitus

T2DM is the most common type of diabetes (90%) characterised by insulin resistance and decreased insulin production, in contrast to the complete loss of insulin production due to the destruction of the pancreatic β-cells in type 1 diabetes mellitus, which is a less common diabetes type (American Diabetes Association (ADA), 2014, NICE, 2020b). National guidance for T2DM diagnosis in the UK is largely based on WHO recommendations (NICE, 2020b). The oral glucose tolerance test (OGTT) is widely used to obtain fasting and 2-hour plasma glucose levels to detect diabetes (WHO, 1999). Current T2DM diagnostic value of a fasting plasma glucose level of over 7.0 mmol/L or a plasma glucose level of over 11.1 mmol/L two hours after 75g anhydrous glucose in an OGTT (WHO, 1999). The measurement of glycated haemoglobin (HbA1c) has also been recommended and a value of 48 mmol/mol (6.5%) and over is used as an additional criterion for diagnosing diabetes (WHO, 2011).

The strong relationship between T2DM and other CVRFs, including obesity, hypertension, and dyslipidaemia, has been recognised and as a result, T2DM substantially increases CVD risks (Kelly et al., 2009). The long-term high blood glucose level in T2DM is also related to chronic harm, malfunctioning, and failure of arteries, as well as increased prothrombotic factors, which then increases the risk of developing CVD (ADA, 2014). Individuals with diabetes had a two-fold higher risk of stroke compared to general populations, according to the findings of a WHO multinational study (Morrish et al., 2001). Individualised care for T2DM includes dietary advice, bariatric surgery, pharmacological treatments (e.g., metformin, dipeptidyl peptidase- 4 (DPP- 4) inhibitors, pioglitazone, sodium-glucose co-transporter-2 (SGLT-2) inhibitors, glucagon-like peptide- 1 (GLP- 1) mimetics, and sulfonylureas) and insulin has been recommended in the UK (NICE, 2020b).

Smoking

The harmful effects of smoking have been investigated over decades and existing evidence shows that smoking increases the risk of various diseases including CVD as well as mortality rates (Doll et al., 2004, PHE, 2014). The prevalence of smoking was estimated to be 16% in adults in England in 2019, reducing from 27% in 1993 (Health and Social Care Information Centre (HSCIC), 2020). However, smoking has been one of the most common causes of death, accounting for 21% of mortality in males and 13% of mortality in England in 2014 (HSCIC, 2016, NICE,2015b). Smoking has been found to raise the risk of CHD by increasing blood pressure, promoting the build-up of blood clots, and decreasing HDL levels (Doll et al., 2004). To address the harmful effects of smoking, a range of interventions has been in place and smoking cessation has been included in CVD primary prevention in the UK (NICE, 2016).

Socioeconomic status

SES is defined as a measure of an individual's or a community's combined economic and social status (Baker, 2014). In high-income countries, lower SES is generally associated with both poor risk factor profile and increased CVD risk while its effects varied in low- and middle-income countries (Rosengren et al, 2019). In England, the Index of Multiple Deprivation (IMD) 2015 is a measure of SES that can be calculated at the neighbourhood level (Department for Communities & Local Government, 2015). IMD was based on seven domains of socioeconomic deprivation: employment; income; education; health; crime; barriers to housing and services; and living environment (Smith et al., 2015). The IMD deciles can be used to rank small areas from the 10% most deprived to the 10% least deprived. Neighbourhood SES provides information on living circumstances, which are not captured by individual-level information. For instance, neighbourhoods may influence the health of individuals through their effects on achieved education, occupation, income, and access to health care services and resources (Charlton et al., 2013). Previous studies using data from English primary care have reported that living in deprived neighbourhoods was associated with an increased CVD risk in both general populations (Lang et al., 2016) and people with existing comorbidities (Charlton et al., 2013). Reducing socioeconomic inequality (e.g., offering outreach programs to enhance the uptake of risk factor assessment and reduction in more disadvantaged communities) has been included in public health strategies to prevent CVD such as the NHS Long Term Plan and PHE's CVD prevention ambitions (PHE, 2019).

1.1.2.5 Impact of cardiovascular disease

As with osteoarthritis, CVD has a wide-ranging impact. The following sections summarise the impact on physical health, quality of life and economic burden:

Physical health

Patients with CVD experience poorer physical health compared to the general population (Sin et al., 2015, Squire et al., 2017). In a study of 960 patients with CHD in the United States, patients' exercise capacity was reduced over a five-year period which was also associated with reduced ability to perform activities of daily living, which did not correspond with measures of the severity of the disease (measured by angina frequency and left ventricular ejection fraction) (Sin et al., 2015). The reduction in physical health in CVD patients appears to be influenced by the presence of risk factors for CVD and other comorbidities (De Smedt et al., 2013, Squire et al., 2017). In a cross-sectional study of two hundred adults with HF in England, a reduction in physical functioning related to mobility and daily activities was associated with a larger number of comorbidities (hypertension, dyslipidaemia, DM, kidney dysfunction, and other CVD events) (Squire et al., 2017). Similarly, an analysis of over eight thousand patients with CHD in the European Action on Secondary and Primary Prevention by Intervention to Reduce Events (EUROASPIRE III) study demonstrated that physical functioning decreased with the increasing number of coexisting conditions, including hypertension, dyslipidaemia, smoking, physical inactivity and central obesity (De Smedt et al., 2013).

Quality of Life

CVD is associated with a reduction in QoL (Wikman et al., 2011). Data from over 37,000 adults in the United States showed a significantly poorer HRQoL measured by Short Form (SF)-12 in individuals with CHD than in non-CHD adults (Xie et al., 2008). The EUROASPIRE III survey also reported a poor HRQoL in CHD patients, particularly in females, elder individuals, those with lower SES, and those with more cardiovascular risk factors (De Smedt et al., 2013). Reduced HRQoL in CVD patients is associated with an increased risk of death (Grool et al., 2012). A cohort study of over four thousand patients with CVD (CHD, stroke, TIA, PAD, and AAA) found that a ten-point reduction in HRQoL measured using the SF-36 was associated with a significant increase in risk of mortality during a median four years of follow-up, even when adjusting for other cardiovascular risk factors (Grool et al., 2012).

Economic burden

In addition to the burden of CVD on individuals, there are significant direct and indirect economic costs. The estimate of the direct costs (that is for healthcare) for CVD is £9 billion per year in the UK (British Heart Foundation, 2022). The indirect costs are estimated at £19 billion per year, based on disability, premature mortality, and informal expenditures outside of healthcare funds (British Heart Foundation, 2022). In England, Clinical Commissioning Groups (CCGs) reported that NHS spent a total of 4.3 billion pounds on CVD in 2014 (Townsend et al., 2015). Unscheduled care (urgent care and emergency transport) showed the highest cost for overall CVD, making up 40% of total expenditure. The second highest CVD cost is found within primary prescribing, occupying 23% of total expenditure.

Summary of CVD:

- CVD is the leading cause of morbidity and mortality worldwide.
- Reducing the mortality of CVD greatly depends on the success of preventive strategies directly targeting CVD and its risk factors.
- Risk assessment is essential in the prevention of CVD and multivariable algorithms are recommended to inform risk factor treatment in national guidelines.
- Common CVRFs targeted by risk algorithms include non−modifiable factors such as age, sex, and modifiable risk factors such as smoking, hypertension, obesity, dyslipidaemia, diabetes, and socioeconomic status.
- The burden of CVD on patients and society is considerable.

1.1.3 Association between osteoarthritis and cardiovascular disease

The previous discussions highlighted that both osteoarthritis and CVD are common conditions worldwide and exert a significant burden on individual patients and society. A high level of co-occurrence of the two diseases has been reported. A recent systematic review of 15 studies showed that 38.4% of osteoarthritis patients had coexisting CVD and the estimate was as low as 9% in those without osteoarthritis (Hall et al., 2016). The review also reported that osteoarthritis patients were at an increased risk of developing HF compared with those without osteoarthritis (relative risk (RR): 2.80, 95%CI 2.25 to 3.49). Osteoarthritis is also associated with some risk factors for CVD, particularly metabolic syndromes that are involved in the pathology of both diseases (Baudart et al., 2017, Louati et al., 2015, Singh et al., 2002). Two meta-analyses suggested the higher prevalence of dyslipidaemia (odds ratio: 1.98, 95%CI 1.43 to 2.75) (Baudart et al., 2017) and diabetes (1.41, 1.21 to 1.65) (Louati et al., 2015) in people with osteoarthritis compared to those without. In a national population-based survey in the United States, the prevalence of a range of CVRFs was higher in people with osteoarthritis than those without (hypertension (40% vs 25%), central obesity (67% vs 35%), high TC (32% vs 24%), elevated triglyceride (50% vs 29%), low HDL cholesterol (13% vs 12%), high blood glucose (31% vs 11%), and diabetes (11% vs 6%)) (Singh et al., 2002). However, the association between osteoarthritis and other CVRFs such as smoking is unclear. Previous systematic reviews have shown an association between smoking and a decreased risk of osteoarthritis (Hui, Doherty, and Zhang, 2011, Kong et al., 2017). Data from a national survey in Korea in 2013–2015 have shown a lower prevalence of smoking in people with osteoarthritis (5.1%) compared with those without (14.6%) (Kwon et al., 2020). The inverse association between smoking and osteoarthritis is not confirmed due to the high level of heterogeneity and the potential for selection bias in previous studies (Kong et al., 2017).

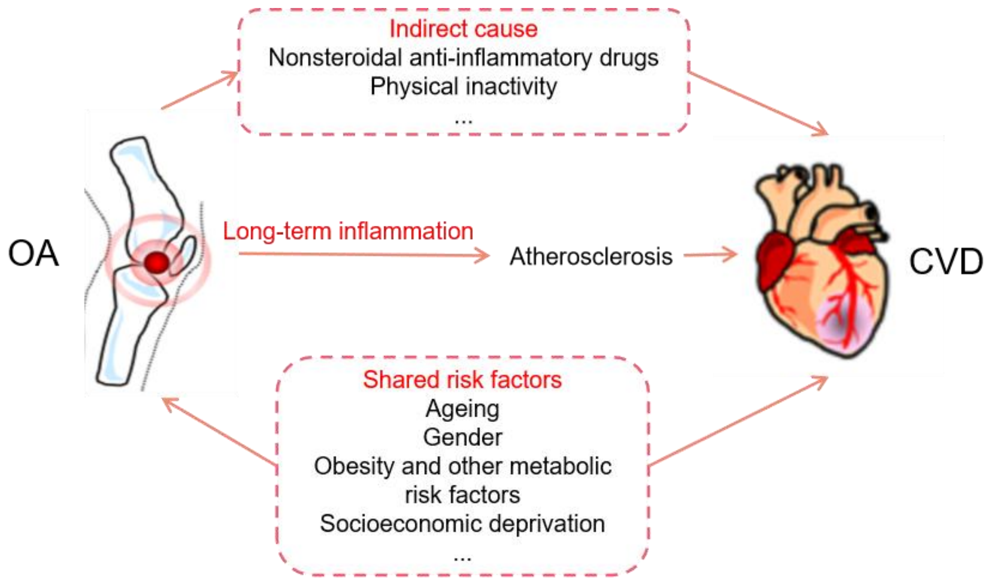


Figure 1.1. Putative mechanisms underlying the relationship between osteoarthritis and cardiovascular disease. OA, osteoarthritis; CVD, cardiovascular disease.

There are some possible reasons for the association between osteoarthritis and CVD (Der Khatchadourian, Moreno-Hay & de Leeuw, 2014) (Figure 1.1). One reason is that there are shared risk factors (e.g., ageing, gender, obesity and other metabolic risk factors, and socioeconomic deprivation). Another is that there is a shared pathophysiological link through long-term inflammation which contributes to atherosclerotic changes in CVD (Der Khatchadourian, Moreno-Hay & de Leeuw, 2014). The adverse influences of physical inactivity and disability due to osteoarthritis will also increase the risk of the development of CVD and hypertension. Pharmacological treatment of osteoarthritis (e.g., anti-inflammatory drugs) has also been suggested to increase the CVD risk through side effects such as increased blood pressure. For example, non-steroidal anti-inflammatory drugs (NSAIDs) which are commonly used pain-relief drugs for treating osteoarthritis have been reported to increase the risk of hypertension (Wehling, 2014.).

The presence of coexisting CVD and risk factors is associated with poorer wellbeing and health outcomes in people with osteoarthritis. A cohort study in England that followed 1,163 osteoarthritis patients for 14 years found an association between premature mortality and baseline CVD (hazard ratio: 1.38, 95%CI 1.12 to 1.71) and a history of diabetes (1.95, 1.31 to 2.90) (Nuesch et al., 2011). Caporali et al (2005) reported that CVD, hypertension, and diabetes were associated with a decreased Quality of Life (QoL) and worsened joint function in over 29,000 osteoarthritis patients. The poor outcomes related to coexisting CVD may be responsible for an increase in the consumption of health and social care resources in osteoarthritis populations (Covinsky et al., 2008).

Currently, the optimal CVD preventive strategy for people with osteoarthritis is unclear with no clear recommendations in national guidelines specifically for this patient group. A direct relationship between osteoarthritis and incident CVD is unclear as it is likely to be explained by the known relationship between other risk factors such as obesity and osteoarthritis. This might be the reason why people with osteoarthritis are not currently recognised as a target group for more intensive CVD prevention. However, people with osteoarthritis are highly likely to experience a range of barriers to engaging in health promotion campaigns and to accessing health care (Choojaturo et al., 2019), such as their higher levels of pain, higher levels of weight, and lower levels of joint function. Thus, people with osteoarthritis may have limited participation in formal CVD risk assessment and preventive services provided by primary care physicians, resulting in poor outcomes. Unravelling pathways are needed to establish if a causal link does exist between osteoarthritis and CVD and would inform CVD prevention in people with osteoarthritis. Given the high occurrence of CVD in patients with osteoarthritis, improving CVD prevention in patients with osteoarthritis will help to reduce the burden of these two coexisting conditions.

Summary of the association between osteoarthritis and CVD:

- CVD is highly prevalent among people with osteoarthritis
- People with osteoarthritis are more likely to develop CVD compared to those without
- The high CVD risk among people with osteoarthritis is concerning, given that both osteoarthritis and CVD have a considerable burden on patients and society worldwide.
- The optimal CVD preventive strategy for people with osteoarthritis is unclear with no clear recommendations in national guidelines specifically for this patient group.
- There is an enormous need for high-quality research to ensure people with osteoarthritis receive effective CVD prevention.

1.2 Primary care electronic health records (EHRs)

1.2.1 Primary care data

Primary care is an ideal setting to prevent disease, reduce mortality and promote a more equitable distribution of health (Starfield et al., 2005). Primary care-driven health systems, such as that of the UK, appear to offer important advantages in terms of cost containment, the health status of the population, and a range of other health-related outcomes in comparison with systems more based on specialist care (Starfield et al., 2005). In the UK, primary care provides the first point of contact for non-emergency health conditions in the NHS (Williams et al., 2012). Secondary care provides specialist care within the context of this, either at the request of primary care or directly but with full disclosure to the primary care. Nearly all individuals (98% of the general population) in the UK are registered with a primary care general practitioner (GP) who oversees patients' healthcare and acts as the gatekeeper to the healthcare system (Herrett et al., 2015).

Primary care provides important data for monitoring diseases. In the UK, most chronic diseases such as osteoarthritis and CVD risk management take place in general practices (Hinton et al., 2018). Monitoring of diseases can be conducted at a national level through the QOF as discussed previously (QOF, 2019). The QOF, a pay-for-performance scheme, was introduced in 2004 which encourages the most prevalent and resource-intensive diseases in the UK to be recorded and the indicator thresholds for the management of diseases are achieved by GPs. As a result of this regular monitoring policy, primary care data provides opportunities for real-world assessment of disease occurrence and management.

1.2.2 EHRs

EHRs are digital records that contain information on the health conditions of patients and the care that they have received from healthcare professionals (e.g., referrals for tests and their results, care plans, current treatments, clinical notes, and correspondence between healthcare professionals) (Rooney, 2016). EHR data are recorded by healthcare providers during episodes of care (for example, a visit to a GP). The wide digitisation of clinical records in healthcare systems and the efforts made to improve the quality of recording offer opportunities to provide evidence that can be seamlessly translated into practices (Hemingway et al., 2017, Schinasi et al., 2018).

1.2.3 Opportunities and challenges of using primary care electronic health records in research

The digitalisation of health records was encouraged following the development of computer technology in the 1960s; before then, health information was traditionally recorded on paper and stored in folders (Evans, 2016). However, the wide adoption of EHRs had been limited by expensive facilities, data entry errors, poor initial physicians' acceptance, and lack of financial motivation until the late 1980s when hardware became more affordable, powerful, and compact and the use of personal computers, local area networks, and the internet-enabled efficient reading of clinical information (Evans, 2016). Since then, networks of EHRs from multiple sites have been initiated and found to be valuable for not only the convenience of physicians to access patients' information but also for medical research and health service planning. In the UK, EHRs which collected data on primary care consultations have provided information for clinical practice and disease surveillance and influenced decision-making in various government agencies such as the Public Health England (PHE) and the National Institute for Health and Care Excellence (NICE) (Kousoulis, Rafi & de Lusignan, 2015). For example, studies using the Clinical Practice Research Datalink (CPRD) data have derived evidence for the NICE guidance on recognition and referral for suspected cancers (NICE, 2017, Shephard et al., 2015, Stapley et al., 2012).

In recent years, central repositories and networks of EHRs that benefit research have been adopted internationally, again, due to the increased use of computer technologies and policies that accelerate the development of databases and improvements in data quality. Primary care databases, particularly in the UK, have provided data for research, with advantages including large sample size, good representativeness, detailed patient information, and linkage to multiple health-related data sources (Casey et al., 2016, Herrett et al., 2015). In the UK, primary care EHRs have representative populations as general practitioners are the gatekeeper in the country's healthcare system and broadly cover the general population (over 98% registered with a GP) (Jordan et al., 2014, Herrett et al., 2015). The size of national-level primary care databases in the UK is one of the largest in the world (e.g., over 4.4 million active patients have been included in the CPRD GOLD by 2013) (Herrett et al., 2015).

Many primary care EHR databases share their data with researchers. For example, data from the UK CPRD is available to researchers worldwide through approvals by the Medicine and Healthcare Products Regulatory Agency (MHRA) Independent Scientific Advisory Committee (ISAC) (Williams et al., 2012, Mannan et al., 2017). A robust linkage methodology (using a trusted third party, NHS Digital) used by the CPRD has allowed access to additional data sources including secondary care data from the Hospital Episode Statistics (HES), death registration data from the Office for National Statistics (ONS), National Cancer Registration and Analysis Service; Mental Health Services Data Set; and small-area deprivation data (Wolf et al., 2019).

The routinely collected information contained within primary care EHRs has the potential to improve the quality of patient care, reduce the workload for healthcare workers, facilitate monitoring and evaluation of health programs, and provide timely data for decision-making (Buntin et al., 2011). Primary care EHRs with routine and continuing data offer the opportunity for feasible ongoing surveillance and research (already collected data reduces time and need for additional resources), offer the potential to identify representative populations, and could minimise information bias based on objective measurements.

Feasibility

As data are routinely collected and become available to approved research that holds a licence, studies using primary care EHRs can efficiently assemble large-scale cohorts; in contrast, prospective research requires a longer period of time, as well as a larger number of resources for the recruitment process, the maintenance of large sample size and the collection of data (Pujades-Rodriguez et al., 2014, Shah et al., 2015). This means that prospective research (such as a prospective cohort study) needs substantial funds to organise follow-up visits and may experience dropouts over time (Galea & Tracy, 2007). The longitudinal nature of primary care EHRs allows the study of long-term conditions and risk factors for diseases, as well as carrying out trend analyses of disease occurrence (Crooks, Card & West, 2013, Manolio et al., 2012). Although it may be difficult to re-contact patients within most EHRs due to confidentiality concerns, the available linkage across healthcare systems in specific servers such as the Cardiovascular research using LInked Bespoke studies and Electronic health Records (CALIBER) in the UK enables successful tracking of participants for research (Denaxas et al., 2012, Herrett et al., 2015).

Representativeness

Primary care EHRs offer representative populations in countries where primary care practices are the first point of contact for patients to meet their daily healthcare needs (Ludwick & Doucette, 2009). A limitation of recruiting participants in typical epidemiologic studies is that the interest of individuals with characteristics in research participation varies, resulting in concerns about selection bias and external validity (Galea & Tracy, 2007). Selection bias may be reduced in studies that use primary care EHRs in healthcare systems using general practices as the gatekeeper; taking the UK as an example, over 98% of the population is registered with a primary care practitioner and the general practice population can be representative of local populations. However, as the healthcare-seeking behaviour of individuals may vary in meaningful aspects, such as access to health services, gender, ethnicity, and socioeconomic status (Adamson et al., 2003; Cookson et al., 2016), tests of representativeness are required in EHR-based studies. Such tests have been conducted for primary care EHR databases by comparing key variables including age, gender, geographical and ethnicity with other population-based data sources (e.g., census data and national surveys) and the results suggested that patients from primary care EHRs were broadly representative of the general population in terms of these variables (García-Gil et al., 2011, Herrett et al., 2015, Mathur et al., 2013). For example, patients in the CPRD GOLD showed comparable age and gender distributions compared with the UK census data in 2011 (Herrett et al., 2015).

Minimised information bias

Information bias such as recall bias is particularly problematic in case-control studies where participants with existing diseases are more likely to report prior events, leading to misclassification of exposure status (Szklo & Nieto, 2014). Due to EHRs having dates when information is entered and coding of events that occurred during healthcare visits, they may prevent information bias in studies of such variables (Smeeth et al., 2004). Observation bias could also be minimised in EHR-based studies as data are collected based on clinical reports and healthcare providers and patients are not aware of outcomes or exposures of interest (Casey et al., 2016).

EHRs in primary care have common issues regarding data quality with EHRs in other settings (Weiskopf & Weng, 2013). The incompleteness of data can vary depending on the variable being collected, the patient group, and the practice, and may change over time. For example, the incompleteness of recording differed by 14% for LDL and 28% for blood pressure across EHRs in eight clinical sites in the United States from 2001 to 2004 (Goulet et al., 2007). Primary care EHR data on risk factors such as BMI and blood pressure are recorded more frequently in those with an existing health issue (Herrett et al., 2015). This might result in differential misclassification and then a tendency away from the null measure of the association between a risk factor and a health issue based on completed data (Herrett et al., 2010). Moreover, primary care EHRs cannot frequently collect data about various non-clinical, mild, self-resolving, and short-lived conditions for which individuals do not seek care and are likely to result in an underestimation of such conditions (Adler & Stead, 2015). For example, only half of the participants in the CPRD database had a record of alcohol consumption which is a behavioural risk factor that many people do not seek care for, and the proportion of increased-/high-risk drinking was lower compared with the self-reported data in 2016 (Mansfield et al., 2019). This suggests an underestimated number of patients who are "risky" drinkers using primary care EHRs in the UK and who therefore might not be targeted for interventions preventing alcohol-use disorders. In contrast, typical epidemiologic studies can use pre-specified protocols to gather information that is not routinely collected in EHRs (Chen et al., 2015, Joseph et al., 2016).

Another commonly raised concern regarding the data quality of primary care EHRs is the inaccuracy of recording (Weiskopf & Weng, 2013). While the measurement of a variable is generally standardised in research collecting new data, the same variable in primary care EHRs might be coded in different ways by different physicians, practices and databases. This is likely to generate non-differential (an outcome is misclassified to the same degree in the exposed and unexposed groups) or differential misclassification (the degree of misclassification differs between the exposed and unexposed groups). This could then lead to bias in the association between exposures and outcomes in epidemiologic research studies. For example, information about smoking status is presented in various locations of the CPRD EHRs, such as codes of smoking or cessation in clinical and referral files, prescriptions for smoking cessation in therapy files or records of smoking status in additional files (Booth, Prevost & Gulliford, 2013). The CPRD data showed a potential non-differential misclassification of current smoking between men and women in 2007 (both genders had a 0.4% higher prevalence than the self-reported estimate) and a differential misclassification in 2010 (0.6% higher in men and 3.3% higher in women). Thus, a comprehensive standardised list of codes is required to identify a single condition for studies using the same primary care EHR database. Moreover, due to the lack of standardised code lists and the variation in clinical focus and recording across data systems, studies investigating the same variables might generate inconsistent findings (Chan, Fowles & Weiner, 2010).

Despite several limitations, primary care EHRs remain suitable for research as substantial efforts are increasingly made to address their issues relating to data quality (Thiru, Hassey & Sullivan, 2003). Incentive schemes, such as the QOF in the UK have contributed to the improvement of data recording in primary care EHRs, where completeness of QOF items such as smoking status and TC in the CPRD database has increased since 2004 when the scheme was launched (Herrett et al., 2015). In analyses based on primary care EHRs, the incompleteness of data has been addressed by using complex algorithms including imputation (Bhaskaran et al., 2013, Weiskopf & Weng, 2013). For example, a study using the CPRD data of individuals aged 16 and over in 2003-2010 reported that the mean BMI value adjusted by multiple imputations was closer to the national estimate from the Health Survey England (≤0.37 kg/m^2 underestimation) compared with the unadjusted value based on the completed data (0.75–1.1 kg/m^2) (Bhaskaran et al., 2013). A comparison of primary care EHRs with external data sources has been used to assess data accuracy (Weiskopf & Weng, 2013). Many primary care databases such as the CPRD have shown comparable diagnoses of multiple conditions with external sources including disease registries, secondary care data, questionnaires to physicians, and population-based surveys (Ferguson et al., 2018, Hemingway et al., 2017, Herrett et al., 2010, Kivimaki et al., 2017, Rahman et al., 2016, Ramos et al., 2012). Rigorous methodological approaches such as standardised disease definitions have also been piloted to enhance the comparability of primary care EHR data across systems using different care delivery or coding practices (Jordan et al., 2014). Although not as common as completeness and accuracy, other aspects of data quality such as concordance (e.g., different data elements for the same condition within EHRs generate consistent values), plausibility (e.g., data from EHRs generate consistent values with general medical knowledge) and currency (e.g., data are recorded within a specific time period) have also been assessed for primary care EHRs (Weiskopf & Weng, 2013). For example, a study tested the plausibility of primary care EHR data in the Information System for the Development of Research in Primary Care (SIDIAP) in Spain by re-evaluating the generally accepted associations of risk factors including smoking, hypertension, diabetes, obesity, and dyslipidaemia, with the incidence of CVD and reported consistent findings with existing epidemiologic evidence (Ramos et al., 2012).

There is now a growing number of studies that use data from large databases of primary care EHRs such as the Clinical Practice Research Datalink (CPRD) (Wolf et al., 2019), the Health Improvement Network (THIN) (Vallerand et al., 2018), and QResearch in the UK (Jack et al., 2019), as evidenced by over 2,000 publications using CPRD data in 30 years (Wolf et al., 2019). The following sections provide examples of studies of osteoarthritis or CVD that have used primary care EHRs.

Estimating prevalence and incidence

In a primary care EHR database, prevalence rates can be calculated by relating the number of people consulting for a condition to the number of populations registered in the database at a point or in a period (Jordan et al., 2007). The twelve-month period prevalence of osteoarthritis in people aged ≥ 15 years in 2011 in the UK has been estimated using data from a national database (CPRD) and regional database (CiPCA) (9.4% cf. 9.8%) (Jordan et al., 2007). Data on the prevalence of a range of CVDs, such as myocardial infarction (2.46% in men; 0.87% in women of all ages in 2014), have also been obtained through the CPRD (Bhatnagar et al., 2015).

Incident cases of a condition can be identified from primary care EHRs using a new consultation of a condition and the exclusion of previous consultations about the same condition within a specific period (Yu et al., 2017). The incidence of diagnosed osteoarthritis in CPRD has been reported as 6.3/1000 person-years in people aged ≥ 45 years in 2013; in this study, an incident case was classified as a person who had consulted for osteoarthritis and had not had any consultation for the condition in the last three years (Yu et al., 2017). Incidence rates of heart failure (e.g., 332/100,000 person-years in people aged ≥ 16 years in 2014) have also been derived from the CPRD data with the exclusion of prevalent cases (individuals with a diagnosis within the first 12 months of registration) (Conrad et al., 2018).

Given the longitudinal nature, primary care EHRs are suitable for the assessment of temporal trends in prevalence and incidence. Trends in the occurrence of osteoarthritis and CVD as well as risk factors (e.g., obesity, diabetes and hypertension) have been generated using the UK primary care EHRs (Conrad et al., 2018, Sinnott et al., 2017, van Jaarsveld, Gulliford, 2015, Yu et al., 2017, Zghebi et al., 2017). For example, the estimated annual prevalence for type 2 diabetes mellitus (T2DM) in people aged ≥ 16 years based on the CPRD data has shown an increasing trend from 3.2% in 2004 to 5.3% in 2014 (Zghebi et al., 2017).

Identifying associations

The longitudinal data in primary care databases allow longitudinal analysis for associations between different conditions. For example, a study used primary care EHRs with data linkage to secondary care, disease registry and mortality data from the CALIBER in the UK to examine associations between T2DM and the incidence of 12 different types of CVD in 1.9 million adults (Shah et al., 2015). This study confirmed the widely accepted associations of T2DM with an increased incidence of several CVD (PAD, HF, and stable angina). It also reported novel associations between T2DM and a reduced incidence of abdominal aortic aneurysm (AAA) and subarachnoid haemorrhage. Such findings of associations have important implications for planning preventative interventions for CVD and revealing the aetiology of different types of diseases.

Studying multiple variables, subgroups and rare conditions

Researchers can use EHRs to include multiple exposures and outcomes simultaneously, to test associations in multiple subgroups, and to identify rare conditions. The CALIBER database has allowed researchers to estimate age-specific associations of blood pressure with 12 CVD in 1.25 million patients (Rapsomaniki et al., 2014). The large sample size enabled researchers to have adequate patients under observation in multiple age and gender subgroups and to identify differences in the association across subgroups. EHRs can also help researchers to investigate rare conditions. This is evidenced by the fact that QResearch data allowed researchers to observe a four-fold increased incidence of stroke (a rare event in children) in the first 0–6 months after chickenpox in people under the age of 18 years (Thomas et al., 2013).

Development and validation of prediction models

The representative cohorts assembled from primary care EHRs can be used to develop and validate various predictive models to assist decision-making for clinicians and patients. For example, the QResearch database has provided primary care data on eight million patients for researchers to assign QRISK algorithms which predict the 10-year risk of CVD in adults and to improve the prediction in the English population by including variables (e.g., small-area socioeconomic deprivation) in EHRs that were not considered in previous models based on primary data collection, such as the Framingham model (D'Agostino et al., 2008, Hippisley-Cox, Coupland & Brindle, 2017). Another primary care EHR database in the UK, the THIN, has also been used to develop prediction models. For example, THIN data on 39,000 patients with severe mental illnesses were used to develop models to predict the 10-year risk of CVD for this patient group (Osborn et al., 2015). These models included additional variables (e.g., prescriptions for antidepressants) and performed better compared with the Framingham model which overestimated the risk in this patient group (Osborn et al., 2015).

Location-level research

The study of the distribution of a health-related issue across socioeconomic status and the impact of location-specific exposures on health is feasible with the use of EHR data. The routinely collected and updated information about patients' addresses in EHRs have allowed the linkage of postcodes to community-level data (Pujades-Rodriguez et al., 2014, Roth et al., 2014, Tomayko et al., 2015). Data from the CALIBER database, for example, were used to evaluate the association between neighbourhood socioeconomic deprivation and the incidence of 12 CVD and results showed heterogeneous associations between gender, age, and type of CVD (Pujades-Rodriguez et al., 2014).

Summary of primary care EHRs:

- Primary care is the first point of access to health care for most non-emergency needs in a health system.
- Routinely recorded data from primary care electronic health records (EHRs) provide readily available information on events arising from consultations and important lifestyle factors.
- Primary care EHRs provide opportunities for research investigating disease occurrence and associations in large and representative populations with long-term follow-up.
- The main issues of using primary care EHRs in research include incomplete data, the lack of standardized coding, and data not captured in consultations.
- Primary care EHRs will remain a valuable research resource as many efforts are increasingly made to improve the quality of data and increase the amount of information collected.

1.3 Rationale for using primary care EHRs to explore cardiovascular risk in people with osteoarthritis

Primary care is the front-line setting to prevent CVD in people with osteoarthritis, a large patient group with poor CVD outcomes (Hall et al., 2016). Consultations for osteoarthritis and many CVRFs and events have been recorded in primary care in the UK (Herrett et al., 2015) (Table 1.2). For example, Read codes for osteoarthritis, risk factors (e.g., smoking) and events (e.g., acute myocardial infarction) in the CPRD have been reported to be consistent with a reference data source (Booth, Prevost & Gulliford, 2013, Ferguson et al., 2018, Herrett et al., 2010, Herrett et al., 2013, Kivimaki et al., 2017). Primary care EHRs are readily available for analysis of the occurrence and management of CVD risk in people with osteoarthritis (Jordan et al., 2007). Primary care EHRs provide real-world insights that may lead to immediate improvements in healthcare, such as ensuring that risk factor management is provided to consulters in need. The potential use of primary care EHRs in research regarding CVD and osteoarthritis is discussed in the following section.

Table 1.2 Selected data that are available in primary care EHRs (taking CPRD Gold as an example database) for research focusing on osteoarthritis and cardiovascular disease (Herrett et al., 2015)

Sources	Types of data	Examples	Coding system
Primary care	Demographics	Age, sex, postcode	Read codes, 3rd version; British National Formulary (BNF) codes
	Health behaviours	Smoking status	
	Diagnoses and symptoms	Hypertension, diabetes, osteoarthritis, joint pain	
	Signs	Systolic and diastolic blood pressure, height and weight (used to derive body mass index)	
	Prescriptions	Analgesics, antihypertensive drugs, antidiabetic drugs, statins	
	Laboratory data	Total blood cholesterol, HDL-cholesterol, LDL-cholesterol, triglycerides	
Linkage to secondary care (Hospital Episode Statistics (HES))	Reasons for outpatient and inpatient admissions	Cardiovascular disease diagnoses	International Classification of Diseases, 10th version (ICD-10)
Linkage to administrative databases	Socioeconomic status	Small area deprivation	English Index of Multiple Deprivation (2015); Townsend score
	Office for National Statistics (ONS) Death Registration Data	Causes of death	ICD-10

1.3.1 Determining the occurrence of CVRFs and outcomes in people with osteoarthritis

EHRs from primary care where morbidities are often routinely coded and recorded during consultations allow the estimation of the occurrence of CVRFs and events based on individuals consulting and diagnostic labels in their coded medical histories. Consultation prevalence can be estimated as the proportion of people who have at least one consultation for a condition in all the population registered with the practices in the database in a certain time period (Zghebi et al., 2017). Incident cases in primary care EHRs can be defined as individuals having a certain length of time free from a diagnosis prior to their current diagnosis. These estimates of prevalence and incidence of CVRF and CVD provide information on the potential need for healthcare use for primary CVD prevention. At the present, there has been little research that has used primary care EHR data to describe the occurrence of cardiovascular comorbidities in people with osteoarthritis.

1.3.2 Monitoring trends in the occurrence of CVRFs and outcomes over time in people with osteoarthritis

The longitudinal nature of primary care EHRs allows the study of time trends in the prevalence of incidence of cardiovascular comorbidity in people with osteoarthritis. A challenge is that the time trend in the occurrence of a disease derived from primary care EHRs may be affected by improvements in data recording and changes in the choice of codes or diagnostic criteria (Tate et al., 2017). For example, the annual diabetes incidence rate based on diagnostic codes (e.g., Read term ‘Type 2 diabetes mellitus’) had not increased since 2004 (when the UK QOF was introduced) in the CPRD while the rate continued to increase until 2012 and remained stable thereafter when non-diagnosis codes (e.g., Read term ‘Diabetic nephropathy’) were included (Tate et al., 2017). However, this also means that the annual estimate of the occurrence of cardiovascular comorbidity is still useful in monitoring real-time clinical and coding practice and the reflection of the current health status of people with osteoarthritis.

1.3.3 Discovering the potential association between osteoarthritis and CVD outcomes

Longitudinal studies using large datasets of primary care EHRs can explore associations between potential causes and cardiovascular comorbidity in representative populations. The wide coverage of data and linkage to other characteristics such as socioeconomic deprivation allows the calculation of risk ratios for multiple exposures and outcomes. For example, primary care EHR data have been used to generate associations of T2DM, systolic and DBP, deprivation with the incidence of CVD in the general population (Pujades-Rodriguez et al., 2014, Rapsomaniki et al., 2014, Shah et al., 2015). However, few studies have used primary care EHRs to discover many other factors such as osteoarthritis that may increase the CVD risk and are routinely assessed in primary care settings. There is a need to obtain a clear picture of the risk factor profile in primary care populations with osteoarthritis to inform the optimal CVD risk assessment and management, the essential step of primary prevention strategies (NICE, 2016).

1.3.4 Assessing primary prevention for cardiovascular disease in people with osteoarthritis

As guidelines for primary CVD prevention in clinical practices have recommended the management of modifiable risk factors, information on management helps to understand how well modifiable risk factors are treated and whether current guidelines work in people with osteoarthritis. Management of CVRFs in people with osteoarthritis can be investigated using primary care EHRs based on data describing prescriptions. In primary care databases in the UK, for example, types and doses of prescribed treatments for CVRFs (e.g., statins, ACE inhibitors), can be directly obtained from the British National Formulary (BNF) codes (Reeves et al., 2014). Information on treatments can help to monitor the management and assess the treatment effectiveness in people with a diagnosis. For example, data from the CPRD and QResearch have confirmed the effect of statins on reducing deaths in patients with ischaemic heart diseases (IHD) (Reeves et al., 2014). However, there is limited data on whether people with osteoarthritis with CVRFs are being managed in line with clinical guidelines and whether the treatment is effective to improve their outcomes.

Summary of rationale:

- High-quality research is required to inform optimal CVD preventive strategies for people with osteoarthritis to reduce the burden of these two common and highly coexisting conditions.
- In many health systems such as the NHS in the UK, primary care is the front-line setting for the delivery of services that manage patients with osteoarthritis, identify their CVRFs, assess and control their CVD risk.
- Large primary care EHR databases provide potentially available data on the diagnosis and treatment of a wide range of conditions including osteoarthritis, CVRFs and CVD events.
- Using primary care EHRs in research has the potential to inform the CVD prevention for osteoarthritis patients at all phases of care; beginning with the identification of patients who are at risk, implementing evidence-based treatment for primary prevention, and monitoring risk factors and outcomes longitudinally.

1.4. A systematic review of evidence from primary care EHRs around the prevalence of CVRFs in people with osteoarthritis

As outlined above, the burden of coexisting CVD and osteoarthritis, and the opportunities of using primary care EHRs to better understand risk would help to refine strategies for CVD primary prevention. Two previously published systematic reviews concluded that osteoarthritis was associated with a higher prevalence of dyslipidaemia (Baudart et al., 2017) and diabetes (Louati et al., 2015), respectively. However, their conclusions were based on data from a mixed healthcare setting, predominantly secondary care. The results of these reviews did not provide evidence of the extent of co-occurrence of CVRFs and osteoarthritis in primary care, which is the front-line setting to provide CVD risk assessment and preventive interventions for people with osteoarthritis. Estimating the prevalence of CVRFs in consulters with osteoarthritis in primary care EHRs will allow an understanding of the extent of co-occurrence and the potential need for a focused approach to target these risk factors in people with osteoarthritis. This thesis then presents a systematic review which aimed to comprehensively search for, identify and then summarise studies that have used primary care EHRs to estimate the prevalence of CVRFs in consulters for osteoarthritis compared to those without.

This work attempted to answer the following question:

- In studies using primary care EHRs, is the prevalence of routinely recorded CVRFs among consulters with osteoarthritis different to those without osteoarthritis

1.4.1 Methods

This review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for reporting systematic reviews and meta-analyses (Liberati et al., 2009).

1.4.1.1 Eligibility criteria

To identify appropriate studies, the following criteria linked to study type, participants, controls and outcomes were applied.

Types of studies

Only cross-sectional, case-control and cohort studies, as well as post hoc analyses of such studies, were considered eligible for this review. This review was limited to studies published in English due to the lack of resources for translation. No restriction was imposed on the study setting, country or publication date.

Studies with non-observational design (e.g., trials, reviews, intervention studies, animal studies, and qualitative studies) were excluded. Finally, studies with neither abstract nor full text were also excluded.

Types of participants

Possible participants were humans of any age with osteoarthritis in this review. The presence of osteoarthritis was defined by records from the participants (i.e., self-reported osteoarthritis history or self-reported physician diagnosis), or the physician (i.e., diagnostic osteoarthritis based on current clinical guidelines or radiographic evidence). No restriction was imposed on participants' age, gender, ethnicity or the severity or localisation of osteoarthritis.

Participants with non-osteoarthritis rheumatic diseases (e.g., rheumatoid arthritis, spondyloarthropathy, crystal arthropathy, lupus, fibromyalgia, and low back pain) were excluded. Participants who were sampled based on any modifiable CVRF (e.g., obesity) were also excluded because they would not offer a true representation of the population with osteoarthritis.

Types of controls

Controls that were humans of any age without osteoarthritis were considered eligible in this review. Controls that were sampled from a different disease population compared with participants with osteoarthritis were excluded from this review.

Types of outcome measures

Primary outcome measures for this review were the estimated prevalence or raw count data of six CVRFs, including smoking, hypertension, obesity, dyslipidaemia, diabetes and CKD in participants with and without osteoarthritis. These six risk factors were chosen in this review because they are included in the QOF indicators which represent the most common conditions in general practices and major public health concerns in the UK (QOF, 2019). The outcomes status was defined by records from the participants (i.e. self-reported or self-reported physician diagnostic CVRFs) or the physician (i.e. diagnosis based on current guidelines), or a recorded clinical indicator (i.e. high blood pressure, high BMI/waist circumference/waist-hip ratio, high blood glucose, high HbA1c, high blood TC/LDL-

C/triglyceride, low blood HDL-C, high serum creatinine, low glomerular filtration rate (GFR) or receiving treatment (i.e. antihypertensive drugs, lipid-lowering drugs, antidiabetic drugs, insulin, dialysis).

1.4.1.2 Search methods

One reviewer (XH) identified studies by searching in electronic databases, scanning reference lists of related studies, hand-searching abstracts of main congresses of osteoarthritis and congresses of cardiology, and searching websites of related organisations.

The search was conducted in eight electronic databases of health care information that were considered to be comprehensive sources of potentially eligible articles, including MEDLINE (1946 to present), EMBASE (1974 to present), CINAHL (1937 to present), AMED (1985 to present), PubMed (1966 to present), PsychINFO (1806 to present), Web of Science (1950 to present) and Cochrane library (1993 to present). The foundation of the search strategy for each database used in this review was formed from seven search strategies that were previously applied to Cochrane reviews (Lo et al., 2017, Belisario et al., 2013, Musini et al., 2017, Palmer et al., 2017, Saiz et al., 2017, van Driel et al., 2016) of CVRFs and observational studies. This review's search strategies also included Medical Subject Headings (MeSH) and free-text terms that related to 'osteoarthritis', 'joint pain', 'smoking', 'hypertension', 'obesity', 'dyslipidaemia', 'diabetes', 'chronic kidney disease' and 'observational studies. The detailed search strategies were presented in Appendix 1. The last electronic search was conducted on 27 November 2021.

In addition to electronic searching, checking reference lists of all eligible studies obtained from electronic searching and related reviews was also carried out to identify additional studies that might be missed by electronic searching.

1.4.1.3 Selection of studies

The selection process in this review included three stages – title screening, abstract screening and full-text screening. A total of three reviewers (XH, DY and RW) were involved in this process. The first reviewer (XH) recorded primary reasons for exclusion through the screening process and made a final list of included studies and a list of excluded full texts once the screening was completed. The first reviewer also conducted a training session on how to select studies for inclusion in this review with the use of a standardised checklist of eligibility criteria (as outlined above) with other reviewers. The first reviewer kept track of the titles and abstracts of all citations generated by the electronic search and removed duplications, non-English citations and citations with no available abstract. According to the information from titles of all English citations with available abstracts, the first reviewer marked “no” for ineligible citations (reviews, trials, therapeutic studies, intervention studies, qualitative studies, and titles with no information about osteoarthritis and CVRFs), “yes/possible” for possibly eligible citations. To check the degree of consensus on whether to include a title for abstract screening, two second reviewers (DY and RW) independently marked one hundred titles that were randomly selected without awareness of the first reviewer’s decision. Inter-reviewer agreement to include a title for abstract screening was substantial (Fleiss’s kappa = 0.78, $p<0.001$).

After the removal of ineligible titles, the first reviewer marked “no” for ineligible citations and “yes/possible” for possibly eligible citations by scanning abstract content. Subsequently, each second reviewer marked half of the abstracts with no awareness of the decisions of other reviewers. When both the first reviewer and one of the second reviewers marked “yes/possible”, the citation was included for full-text screening. When both reviewers marked “no”, the citation was removed from further screening. When a disagreement on the inclusion of a citation occurred, the abstract was passed to another second reviewer for moderation and a final decision is made by all reviewers.

After the removal of ineligible abstracts, the first reviewer marked “no” for ineligible full-text studies and “yes/possible” for studies that were eligible to be included in this review. Similar to the strategy used for abstract screening, each second reviewer assessed the eligibility of half of the full texts and disagreement was solved by another second reviewer.

1.4.1.4 Data extraction and management

One reviewer (XH) independently extracted data about key information (e.g., study design, country, age and gender distribution in the study population, characteristics of the primary care database used, the definition of osteoarthritis, the definition of CVRFs, prevalence estimates) from the full text of included studies and another two reviewers (DY and RW) verified the extracted data.

1.4.1.5 Assessment of quality of included studies

Three reviewers (XH, DY and RW) independently examined the risk of bias in included studies using the Quality in Prognosis Studies (QUIPS) tool and resolved disagreements by consensus (Hayden et al., 2013). The QUIPS tool offers criteria for assessing six important domains of bias, including participation, attrition, measurement of exposure, measurement of outcomes, confounding account and statistical analysis. The overall risk of bias in a domain was low where reviewers rated "yes' or "not applicable", moderate where reviewers rated "partial" or "unsure" and high where reviewers rated "no" to the summary statement of the domain.

1.4.1.6 Data analysis

Meta-analysis was considered to assess the pool prevalence estimate of each CVRF in osteoarthritis using a random-effects model (Higgins et al., 2019) but it was not appropriate due to the high statistical heterogeneity obtained and the marked variation in population characteristics, definition of CVRFs, and inclusion of potential confounders between studies. The small number of included studies made it impossible to conduct subgroup analyses to assess if the prevalence estimate is influenced by age, gender or location of osteoarthritis.

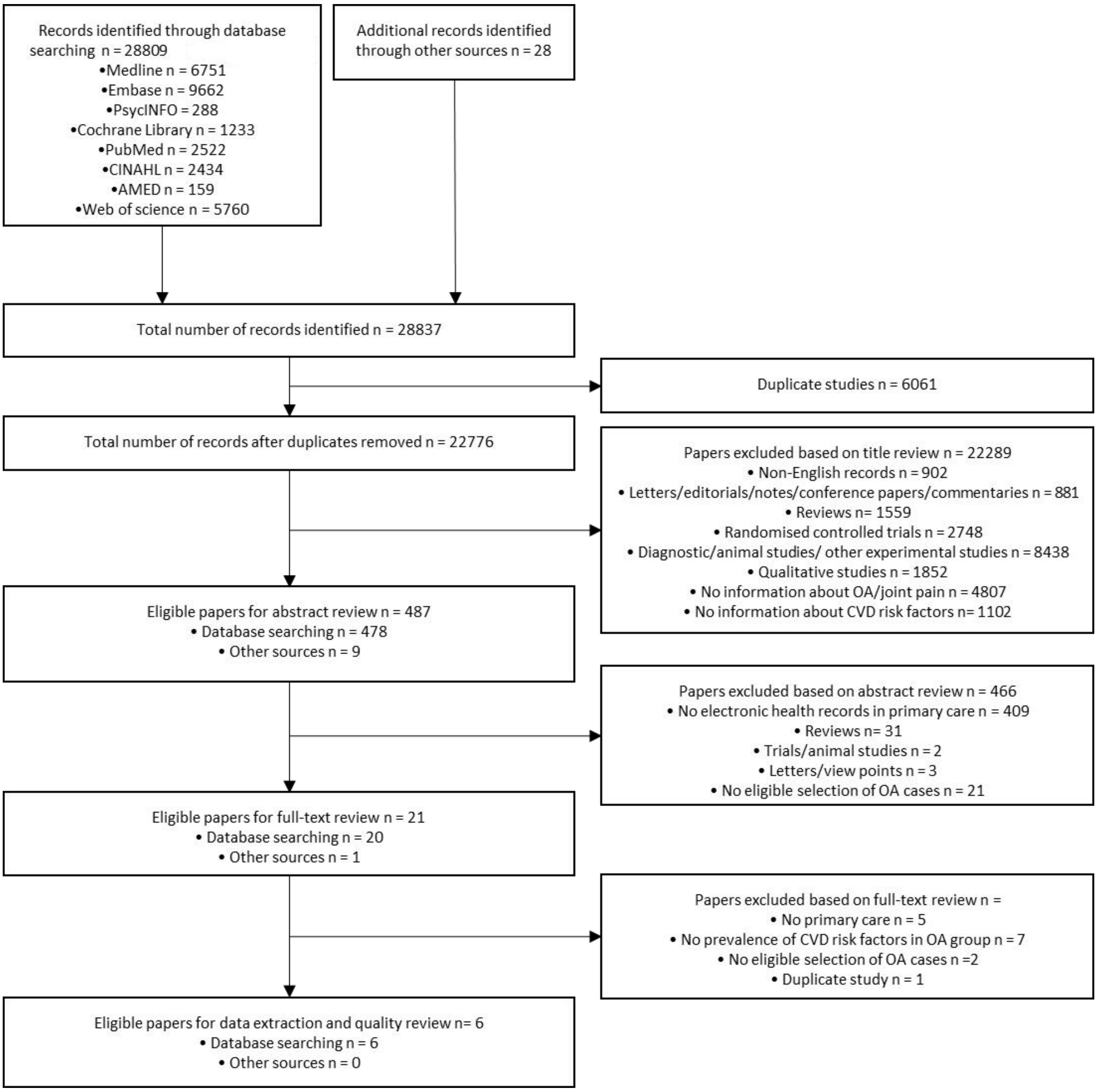
Prevalence estimates of each CVRF in consulters with and without osteoarthritis from the studies included were narratively presented in tables and texts. Raw counts were obtained to calculate the odds ratio (OR) and confidence interval (CI) of each CVRF between consulters with and without osteoarthritis. A narrative review was performed to explore potential sources of heterogeneity between included studies for age, gender, length of prevalence period, characteristics of the primary care database used, the definition of osteoarthritis, the definition of CVRFs, and inclusion of potential confounders.

1.4.2 Results

1.4.2.1 Search and study selection

Figure 1.2 shows the flow of the studies in this systematic review, including the reasons for exclusion. The literature search identified 22,776 citations after the removal of 6,061 duplications. After the title and abstract review, 21 papers remained for the eligibility review of full texts, of which 6 studies were eligible for data extraction (Doubova & Perez-Cuevas, 2015, Leyland et al., 2016, Nielen et al., 2012, Prieto-Alhambra et al., 2014, Rahman et al., 2013, Sheng et al., 2012).

Figure 1.2 Flow diagram of articles in the systematic review. OA, osteoarthritis; CVD, cardiovascular disease.



1.4.2.2 Risk of bias within studies

A summary of the risk of bias assessment of the six studies included is presented in Table 1.3. Studies were of low risk of bias in most domains when assessed using the QUIPS tool. For the domain of 'study confounding', only two studies were rated as having a moderate risk of bias due to a failure to account for potential confounders when comparing prevalence estimates among consulters with and without osteoarthritis (Nielen et al., 2012, Prieto-Alhambra et al., 2014). Methodological advantages across the included studies using primary care EHRs were the objective measurement of osteoarthritis and CVRFs using a medical record and the representativeness of the general practice population.

Table 1.3 Risk of bias in included studies

Study ID	Study participation	Study attrition	Exposure measurement	Outcome measurement	Study confounding	Statistical analysis and reporting
	Agreed risk of bias	Agreed risk of bias	Agreed risk of bias	Agreed risk of bias	Agreed risk of bias	Agreed risk of bias
Doubova 2015	Low	Low	Low	Low	Low	Low
Leyland 2016	Low	Low	Low	Low	Low	Low
Nielen 2012	Low	Low	Low	Low	Moderate	Low
Prieto-Alhambra 2014	Low	Low	Low	Low	Moderate	Low
Rahman 2013	Low	Low	Low	Low	Low	Low
Sheng 2012	Low	Low	Low	Low	Low	Low

1.4.2.3 Study characteristics

The six studies included estimated the prevalence of at least one of the six predefined CVRFs in consulters with osteoarthritis (Doubova & Perez-Cuevas, 2015, Nielen et al., 2012, Prieto-Alhambra et al., 2014, Rahman et al., 2013, Sheng et al., 2012), of which three comparing the prevalence among consulters with and without osteoarthritis (Nielen et al., 2012, Prieto-Alhambra et al., 2014, Rahman et al., 2013) (Table 1.4). Four of these were cohort studies (Leyland et al., 2016, Prieto-Alhambra et al., 2014, Rahman et al., 2013, Sheng et al., 2012) and two were cross-sectional studies (Doubova & Perez-Cuevas, 2015, Nielen et al., 2012). Primary care EHR data used in these included studies were from regional databases of general practice consultation records in British Columbia, Canada (n=1) (Rahman et al., 2013), in Catalonia, Spain (n=2) (Leyland et al., 2016, Prieto-Alhambra et al., 2014), and Tayside, Scotland (n=1) (Sheng et al., 2012); a national database of consultations from practices in the Netherlands (Nielen et al., 2012), and computerised health records from four general practices within Mexico City, Mexico (Doubova & Perez-Cuevas, 2015). The mean age of osteoarthritis populations across studies ranged from 58 to 70 years and non-osteoarthritis populations ranged from 51 to 61 years. Females comprised 59.2% to 74.4% of osteoarthritis populations and 50.2% to 59.0% of non-osteoarthritis populations in included studies.

Table 1.4 Characteristics of included studies

Study author, publication year	Data source	Primary care EHRs	Identification of OA	Sample size	Mean age (years)	Females (%)	CVD (%)
Doubova et al, 2015	Mexican Institute of Social Security EHRs	Regional EHRs containing around 585,535 persons' medical information from four primary care practices in Mexico City, Mexico	At least one visit with an ICD-10 code for knee and hip OA (M160-M17X)	OA: 8991	OA: 60	OA: 69%	OA: 4.5%
Leyland et al, 2016	Information System for Development of Primary Care Research (SIDIAP)	A regional database containing over 5.5 million persons' medical information from over 270 primary care practices in Catalonia, Spain	At least one visit with an ICD-10 code for knee OA (M17)	OA: 97677	OA: 68	OA: 66%	Not reported
Nielen et al, 2012	Netherlands Information Network of General Practice (LINH)	A national database containing around 360,000 persons' medical information from 96 primary care practices in the Netherlands	At least one visit with an ICPC-1 code for knee and hip OA (L89 and/or L90)	OA: 4040 Non-OA: 158439	OA: 70; Non-OA: 51	OA: 69% Non-OA: 50%	OA: 5.8% Non-OA: 2.0%
Prieto-Alhambra et al, 2014	SIDIAP	A regional database containing over 5.5 million persons' medical information from over 270 primary care practices in Catalonia, Spain	At least one visit with an ICD-10 code for knee, hip and hand OA (M17, M16, M15.1, M15.2, M18)	Knee OA: 96222; Hip OA: 30350; Hand OA: 37590 Non-OA: 2955289	Knee OA: 67; Hip OA: 69; Hand OA: 64; Non-OA: 61	Knee OA: 64% Hip OA: 58% Hand OA: 74% Non-OA: 50%	Knee OA: 3.3% Hip OA: 4.0% Hand OA: 3.5% Non-OA: Not

							reported
Rahman et al, 2013	British Columbia Ministry of Health administrative database	A regional database containing 600,000 randomly selected residents' health information in British Columbia, Canada	At least two visits with an ICD-9 (715) or ICD-10 code for OA (M15–M19)	OA: 12745 Non-OA: 36886	OA: 58; Non-OA: 58	OA: 60% Non-OA: 59%	OA: 0% Non-OA: 0%
Sheng et al, 2012	Medicines Monitoring (MEMO) Unit record-linked databases	A regional database containing resident's health information in Tayside, Scotland	At least one visit with an ICD-9 (715) or ICD-10 code for OA (M15-19, or M47)	OA: 1269	OA: 69	OA: 59%	OA: 1.6%

OA, osteoarthritis; CVD, cardiovascular disease; EHRs, electronic health records; ICD-9, International Statistical Classification of Diseases and Related Health Problems 9th version; ICD-10, International Statistical Classification of Diseases and Related Health Problems 10th version; ICPC-1, International Classification of Primary Care 1ST version

1.4.2.4 Narrative synthesis

Prevalence of CVRFs in osteoarthritis

Five studies provided prevalence estimates of hypertension in osteoarthritis with a range from 19.7% to 55.5% (Doubova & Perez-Cuevas, 2015, Nielen et al., 2012, Prieto-Alhambra et al., 2014, Rahman et al., 2013, Sheng et al., 2012) (Table 1.5).

Five studies reported prevalence estimates of diabetes in osteoarthritis with a range from 5.2% to 18.6% (Doubova & Perez-Cuevas, 2015, Nielen et al., 2012, Prieto-Alhambra et al., 2014, Rahman et al., 2013, Sheng et al., 2012).

Four studies that assessed the obesity prevalence in osteoarthritis showed a range between 34.4% and 51.6% (Leyland et al., 2016, Prieto-Alhambra et al., 2014, Rahman et al., 2013, Doubova & Perez-Cuevas, 2015).

Two studies estimated the prevalence of dyslipidaemia in osteoarthritis (Nielen et al., 2012, Rahman et al., 2013). One estimate (6.0%) was from an osteoarthritis population aged 20 and over without a history of CVD in a study using an administrative database in British Columbia, Canada (Rahman et al., 2013). Another estimate (13.3%) was from consulters with knee or hip osteoarthritis aged over 30 years provided by a study using a national primary care database in the Netherlands (Nielen et al., 2012).

Only one of the studies reported the prevalence of chronic kidney disease (1.8% in consulters with knee or hip osteoarthritis aged 20 and over from four practices in Mexico City) (Doubova & Perez-Cuevas, 2015) and one study estimated the prevalence of smoking (12.5% in knee osteoarthritis patients aged over 40 years with no history of knee replacement over a six-year) (Leyland et al., 2016).

Table 1.5 Findings from included studies

Study author, publication year	CVRFs	Prevalence period	Prevalence of risk factors in OA	Prevalence of risk factors in non-OA	OR (95%CI)
Leyland et al, 2016	Current smoking	6 years	12.5% N=12233/97677	-	-
	Obesity (BMI≥30 kg/m²)		50.4% N=49200/97677	-	-
Doubova et al, 2015	Hypertension	2 years	44.7% N=4019/8991	-	-
	Obesity (BMI≥30 kg/m²)		39.7% N=3569/8991	-	-
	Diabetes		17.3% N=1555/8991	-	-
	Chronic kidney disease		1.8% N=162/8991	-	-
Nielen et al, 2012	Hypertension (ICPC code K86 and/or K87)	3 years	38.5% N=1555/4040	13.3% N =21072/158439	**4.08 (3.82, 4.35)**
	Dyslipidaemia (ICPC code T93).		13.3% N=537/4040	6.0% N=9506/158439	**2.34 (2.13, 2.56)**
	Diabetes (type 2 diabetes mellitus: ICPC code T90)		16.5% N=666/4040	-	-
Prieto-Alhambra et al, 2014	Hypertension	5 years	hand 45.0% N=16928/37590; hip 53.6% N=16252/30350; knee 55.5% N=53377/96222	-	-
	Obesity (BMI≥30 kg/m²)		Hand: 36.8%; N=10129/37590; hip: 40.0% N=9235/30350; knee: 51.6% N=38508/96222	21.9% N=332792/1519598	Hand: 2.**08 (2.03, 2.13) Hip: 2.38 (2.32, 2.44) Knee: 3.80 (3.74,**

					3.86)
	Diabetes		Hand: 13.8% N=5199/37590; hip: 18.4% N=5577/30350; knee: 18.6% N=17901/96222	-	-
Rahman et al, 2013	Hypertension (ICD-9 code 401)	5 years	19.7% N=2511/12745	16.4% N=6049/36886	**1.25 (1.19, 1.32)**
	Obesity (BMI≥30 kg/m^2)		34.4% N=4384/12745	17.7% N=6529/36886	**2.44 (2.33, 2.55)**
	Dyslipidaemia (ICD-9 code 272)		6.0% N=765/12745	4.9% N=1807/36886	**1.24 (1.14, 1.35)**
	Diabetes (type 2 diabetes mellitus: ICD-9 code 250)		5.2% N=663/12745	4.7% N=1734/36886	**1.11 (1.02, 1.22)**
Sheng et al, 2012	Hypertension (prescription of antihypertensive drugs)	3 years	35.5% N=451/1269	-	-
	Diabetes		14.3% N=181/1269	-	-

OA, osteoarthritis; CVD, cardiovascular disease; OR, odds ratio; 95%CI, 95% confidence interval; Estimates in **bold**, statistically significant

Association between osteoarthritis and CVRFs

Three out of the six studies provided estimates of the prevalence of CVRFs in consulters with and without osteoarthritis (Nielen et al., 2012, Prieto-Alhambra et al., 2014, Rahman et al., 2013) (Table 1.5). All three studies reported a positive association between osteoarthritis and CVRFs; this was reported for hypertension (Rahman et al., 2013, Nielen et al., 2012), obesity (Prieto-Alhambra et al., 2014, Rahman et al., 2013), dyslipidaemia (Nielen et al., 2012, Rahman et al., 2013), and T2DM (Rahman et al., 2013). Only one study accounted for confounders; the odds ratios (ORs) calculated based on the age-gender-standardised prevalence estimates showed that osteoarthritis was significantly associated with a higher prevalence of hypertension (OR 1.25, 95%CI 1.19 to 1.32), obesity (OR 2.44, 95%CI 2.33 to2.55), dyslipidaemia (OR 1.24, 95%CI 1.14 to 1.35) and T2DM (1.11, 95%CI 1.02 to 1.22) (Rahman et al., 2013).

1.4.2.5 Potential sources of heterogeneity

Heterogeneity by age and gender

None of the studies reported age- or gender-stratified prevalence of any CVRFs in the osteoarthritis population. The mean age and gender distribution of the osteoarthritis population varied markedly between studies reporting prevalence estimates of hypertension, obesity, hypertension or diabetes. Regarding dyslipidaemia, the study in which the osteoarthritis population had a higher mean age (70 years), and proportion of females (69%) reported a higher prevalence estimate (13.3% vs. 6.0%) compared with another study (mean age: 58 years; the proportion of females: 60%) (Rahman et al., 2013, Nielen et al., 2012).

Heterogeneity by definition and locality of osteoarthritis

The prevalence of CVRFs varied between osteoarthritis populations with different joints affected, but this variation might be due to differences in the population. Four studies identified knee and/or hip osteoarthritis (Doubova & Perez-Cuevas, 2015, Leyland et al., 2016, Nielen et al., 2012); two identified generalised osteoarthritis (Rahman et al., 2013, Sheng et al., 2012); and one identified hand osteoarthritis (Prieto-Alhambra et al., 2014). Among the four studies reporting obesity, knee and/or hip osteoarthritis populations had the highest prevalence (39.7%-51.5%); the hand osteoarthritis population reported a lower estimate (36.8%); and the generalised osteoarthritis population the lowest (34.4%) (Rahman et al., 2013, Leyland et al., 2016, Doubova & Perez-Cuevas, 2015, Prieto-Alhambra et al., 2014). However, the difference in the prevalence is likely to be affected by differences in the age and gender distribution of the osteoarthritis sample. Between the two studies reporting dyslipidaemia, the knee and/or hip osteoarthritis population in one study showed a higher prevalence (13.3% vs. 6.0%) than the generalised osteoarthritis population in the other study (Rahman et al., 2013, Nielen et al., 2012). Whether joint location explained the variation in the prevalence of hypertension or diabetes between studies was unclear. Only one study reported joint-specific prevalence of risk factors (18); based on data from the SIDIAP database, consulters with knee osteoarthritis had the highest prevalence estimate of hypertension (55.5%), obesity (51.6%) and T2DM (18.6%); hip osteoarthritis had a slightly lower figure (53.6%, 40.0% and 18.4%); and hand osteoarthritis with the lowest estimate (45.0%, 36.8% and 13.8%).

The most used coding standard for osteoarthritis identification in the included studies (n=5) was the International Statistical Classification 9th (ICD-9) or 10th version (ICD-10) but the choice of codes was unique in each study (Table 1.4). The broadest definition of osteoarthritis (ICD-9 code 715 and ICD-10 code M15-19, or M47) among studies using ICD codes was adopted by Sheng et al (2012) who reported a prevalence rate of hypertension as 35.5% and diabetes as 14.3% in osteoarthritis (Sheng et al., 2012). Only one study used the International Classification of Primary Care 1st version (ICPC-1) to identify knee and hip osteoarthritis cases and estimated the prevalence of hypertension at 38.5%, dyslipidaemia at 13.3% and diabetes at 16.5% in osteoarthritis (Nielen et al., 2012).

Heterogeneity by definition of CVRFs

Only two studies reported codes used to identify CVRFs and there were inconsistencies between them (Nielen et al., 2012, Rahman et al., 2013). Nielen's (2012) study which used the ICPC-1 code reported a higher prevalence of CVRFs (hypertension: 38.5%, dyslipidaemia: 13.3%, and T2DM: 16.5%) in osteoarthritis patients compared with Rahman et al. (2013)'s study which used ICD-9 code (hypertension 19.7%, dyslipidaemia 6.0%, and T2DM 5.2%).

1.4.3 Discussion

1.4.3.1 Summary of evidence

This review summarised evidence from primary care EHRs to estimate the prevalence of CVRFs in people with osteoarthritis and compared this to those without osteoarthritis. Studies using primary care EHRs showed that the estimated prevalence of hypertension, obesity, dyslipidaemia and T2DM was higher in consulters with osteoarthritis than those without. This review did not identify any study comparing the prevalence estimates of smoking and chronic kidney disease between consulters with and without osteoarthritis. Only one study reported an association between osteoarthritis and increased CVRFs after matching for age and gender. The robustness of these findings is unclear due to the small number of studies reviewed, the heterogeneous populations studied, the heterogeneous disease definitions used, and the limited confounders adjusted.

Comparison of study results was challenging because of the difference in population characteristics. Although it was also not clear whether variations in age and gender distribution between osteoarthritis populations affected the reported prevalence estimates of CVRFs from the evidence base identified by this systematic review, as older age and female gender may confound the observed association between osteoarthritis and CVRFs. The risk of CVD events, as well as risk factors including dyslipidaemia, hypertension and diabetes, are higher in older age groups (Corella & Ordovás, 2014). Thus, an older population was likely to include more cases of CVRFs compared with a younger population. This might contribute to our findings that the association between osteoarthritis and CVRFs observed from age- and gender-matched populations with and without osteoarthritis (Rahman et al., 2013) was smaller than that from unmatched populations (Nielen et al., 2012, Prieto-Alhambra et al., 2014).

1.4.3.2 Comparisons with other studies

The prevalence of some CVRFs in consulters with osteoarthritis derived from primary care EHRs is similar to that from other data sources. Data from 168 outpatients with osteoarthritis found a slightly lower prevalence of obesity at 30% compared with estimates from the reviewed studies (range 34.4%- 51.6%) (Meek et al., 2013). A population-based survey including 24.3 million adults with osteoarthritis aged 35 and over reported prevalence estimates of hypertension (40%) and diabetes (11%) in osteoarthritis within the prevalence range (hypertension: 19.7% to 55.5%, diabetes: 5.2% to 18.6%) identified by this systematic review (Singh et al., 2002). However, prevalence estimates of current smoking (20%) and dyslipidaemia (32%) in osteoarthritis from the survey were markedly higher than those derived from primary care EHRs used in the reviewed studies (current smoking: 12.2%, dyslipidaemia: 13.3%) (Leyland et al., 2016, Nielen et al., 2012, Rahman et al., 2013). This suggests that smoking and dyslipidaemia in people who consult general practices for osteoarthritis may not be robustly identified or coded in primary care EHRs, and as a result may be undertreated in this population. The prevalence of chronic kidney disease in osteoarthritis (0.8%) from the survey was similar to that of the included study reporting related figures (1.8%) (Singh et al., 2002). However, the different measurements of CVRFs (e.g., laboratory data vs. doctor's diagnosis) and the lack of information on diagnostic criteria used in each study make it hard to confirm the disparity in prevalence between studies.

The findings of this review suggest that people consulting primary care with osteoarthritis had higher prevalence rates of hypertension, obesity, dyslipidaemia and T2DM than those without osteoarthritis. These findings are consistent with what has been shown in other settings (Baudart et al., 2017, Singh et al., 2002). They are also in line with a population-based survey which suggested that the United States population aged over 35 years with osteoarthritis had a higher prevalence of hypertension (40% vs.25%), dyslipidaemia (32% vs.24%) as well as diabetes (11% vs. 6%) than the general population without osteoarthritis (Singh et al., 2002).

1.4.3.3 Strengths and limitations

This review provides a synthesis of evidence on the prevalence of CVRFs in osteoarthritis derived from primary care EHRs and shows the potential of using this data source to identify high CVD risk groups. The focus on data from primary care EHRs allowed the identification of studies with large sample sizes, good reflection of routine practice and internal reference groups for comparing consulters with and without osteoarthritis.

Like all studies, there are limitations in this systematic review. The small number of reviewed studies and the high heterogeneity in age and gender distribution, definition of osteoarthritis and CVRFs made it impossible to conduct a statistical combination of prevalence estimates. However, a narrative review of possible reasons for variation which has been performed in this study is useful for avoiding potentially biased results generated by pooling estimated from studies with high heterogeneity (Dickersin, 2002). This review did not provide insights into whether there are differences in CVRF profile depending on the severity/period of the osteoarthritis. The severity/period of osteoarthritis might affect the prevalence estimate of CVRFs because chronic inflammation included in osteoarthritis aetiology has often been proposed to explain the link between osteoarthritis and CVD (Fernandes & Valdes, 2015). An additional limitation is the potentially under-reported CVRFs in EHRs. Data from EHRs might under-detect some risk factors (such as those not included in quality incentive schemes), resulting in an underestimate of actual prevalence (Violan et al., 2014). In the reviewed studies, CVRFs more frequently registered in primary care EHRs might be conditioned by the fact that they are of interest, such as hypertension, obesity and diabetes in many quality incentive schemes. There was a limited adjustment for confounders, such as age and gender, which may have a substantial impact on the observed association between osteoarthritis and CVRFs in the reviewed studies.

1.4.3.4 Conclusions

This systematic review identified a small number of studies using primary care EHRs to estimate the prevalence of CVRFs in consulters with osteoarthritis or compare this with those without osteoarthritis. Only one study reported that people who have consulted for osteoarthritis were more likely to have hypertension, obesity, dyslipidaemia and diabetes compared with those without osteoarthritis and this was independent of the age and gender difference between the two populations. Other studies also reported a higher prevalence of these risk factors in people with osteoarthritis but failed to adjust for confounders including age and gender. The small number of studies and high heterogeneity identified across the studies fails to indicate the expected higher prevalence of CVRFs in consulters with osteoarthritis. Moreover, this review found no study using a national database from UK primary care. This suggests that further studies using large-scale and well-representative primary care EHR data are required to compare the prevalence of CVRFs between consulters with and without osteoarthritis. Such studies should consider using a similar method, including age-and gender-subgroup analyses and comparable methods identifying risk factors and conditions, and adjusting for potential confounders.

Summary of the systematic review:

- While the UK has large nationwide primary care EHR databases, none of the six reviewed studies used such data source from this country to determine the prevalence of CVRFs among consulters for osteoarthritis.
- Only three of the reviewed studies were comparative studies that reported the prevalence of CVRFs in both consulters with and without osteoarthritis.
- Reported prevalence estimates of obesity, diabetes, hypertension and dyslipidaemia were higher in people with osteoarthritis across studies.
- Given the difference in population and practice between nations and coding between systems, further research is required to determine the occurrence of CVRFs with osteoarthritis recorded in representative primary care databases to optimize care and inform preventive strategies.

As stated above, people with osteoarthritis are a very large population; around 8.75 million (one in three) adults aged 45 or over have consulted general practices for osteoarthritis in the UK in 2004-2010 (Arthritis Research UK, 2013). A large part (two in five) of this population is likely to have poor CVD outcomes (Hall et al., 2016), subsequent premature deaths caused by CVD (Nuesch et al., 2011) and reduced quality of life (Caporali et al, 2005). Primary care is the first point of care for people in need of osteoarthritis management and CVD preventive services (e.g., CVRF identification, formalised CVD risk prediction and pharmacological treatments). Routinely collected EHR data in UK primary care provide opportunities to explore CVD risk (risk factor profile or excess risk) in people with osteoarthritis and to provide evidence that can be seamlessly translated into practices of CVD prevention. However, the current systematic review found no study that has used primary care EHRs to give a clear picture of the CVD risk factor profile in a representative UK primary care population with osteoarthritis. The next study described in this thesis aims to use national primary care EHRs to explore CVD risk and outcomes in consulters with osteoarthritis to inform the CVD prevention strategies in the UK. These data will hopefully inform strategies that aim at reducing premature death and improving the quality of life in osteoarthritis populations.

1.5 Thesis outline

This thesis describes a series of retrospective cohort studies that used CPRD GOLD, a national database of primary care EHRs in the UK, and linked data to assess the CVD risk and outcomes in consulters with osteoarthritis. The content of the following chapters is:

Chapter 2 presents a study that estimated the prevalence of modifiable CVRFs in consulters with and without osteoarthritis.

Chapter 3 presents a study that examined the socioeconomic inequality in the prevalence of modifiable CVRFs in consulters with and without osteoarthritis.

Chapter 4 presents a study that estimated the prevalence of high 10-year CVD risk, predicted by an established risk score (the Framingham risk score), in consulters with and without osteoarthritis. This study also estimated the prevalence of preventive treatments (e.g., statins) among those with a high predicted 10-year CVD risk in consulters with and without osteoarthritis.

Chapter 5 presents a study that examined the performance of the Framingham risk score in predicting 10-year CVD risk in consulters with and without osteoarthritis.

Chapter 6 presents a study that estimated the excess CVD risk in osteoarthritis with control of age, gender, practice, consultation year, modifiable CVRFs, socioeconomic status, and preventive treatments.

Chapter 7 presents a summary of findings from the previous chapters, a discussion of the strengths and limitations of these studies, and finally, the conclusions and implications for clinical practice and future research.

Chapter 2: Prevalence of modifiable CVRFs in the UK primary care consulters with and without newly diagnosed osteoarthritis between 1992-2017

2.1 Introduction

The studies described in this thesis use EHR data from primary care where osteoarthritis and CVD risk are primarily managed. The data have recorded the occurrence of both conditions and provide the opportunity to estimate the prevalence of modifiable CVRFs in consulters with and without osteoarthritis. The advantages of analyses using primary care EHR data are described in the previous chapter (section 1.2.3) and include representativeness to general population samples, and identification of doctor-diagnosed health conditions, allowing analysis of multiple variables. Although people with osteoarthritis have been reported to have a higher prevalence of CVRFs than those without osteoarthritis, as summarized in the systematic review in Chapter one (section 1.4), estimates from primary care EHRs were scarce. Moreover, although there is a study estimating the prevalence of CVRFs in people with osteoarthritis from one nation of the UK, Scotland (Sheng et al., 2012), few studies addressed this question using a UK representative population. Given the large number of people with osteoarthritis consulting primary care in the UK (Arthritis Research UK, 2013) and the association between osteoarthritis and poor CVD outcomes (Hall et al., 2015), estimating the prevalence of modifiable CVRFs in primary care data provides an understanding of whether there is an increased need to manage these factors in people with osteoarthritis in primary care. This can also lead to further research on the cost-effectiveness and acceptability of tailored care strategies for those with osteoarthritis to improve their future CVD outcomes.

This chapter provides estimates of both annual and period (26-year) prevalence of each and the number of five modifiable CVRFs (smoking, obesity, hypertension, T2DM, and dyslipidaemia; CKD was not included as it is currently irreversible) routinely recorded in the primary care between 1992-2017. Both annual and period prevalence will also be estimated in the subpopulation by sex, age group, and geographical region to map the subpopulation with higher prevalence. Prevalence rate ratios between the population with osteoarthritis and the population without osteoarthritis were also estimated to help understand the potential extra health burden for the population with osteoarthritis to facilitate future improvement in strategies to prevent CVD health outcomes.

2.1.1 Aim and objectives

This chapter aimed to estimate both the annual and period prevalence of modifiable CVRFs routinely recorded and managed in primary care among consulters with newly diagnosed osteoarthritis and their age-, sex-, and practice-matched controls.

This work attempted to answer the following question:

- Does the prevalence of routinely recorded modifiable CVRFs differ between consulters with and without osteoarthritis in the UK primary care settings between 1992-2017?

2.2 Methods

2.2.1 Setting and study design

The study was a retrospective cohort study. Two matched cohorts were identified: an incident osteoarthritis cohort aged 35 and over and a non-osteoarthritis cohort. The study population were extracted from the Clinical Practice and Research Datalink (CPRD) GOLD database. CPRD GOLD is a national primary care EHR database including anonymised data from patient records on demographics, diagnoses, symptoms, prescriptions, referrals, immunizations, lifestyle factors, tests and results, extracted from general practices using the Vision system (Herrett et al., 2015). CPRD GOLD includes data on 11.3 million patients from 974 practices across the UK, of whom 4.4 million were active and current contributors (9.6% of the UK population). Data in CPRD GOLD are separated into ten parts including practice, patient, staff, consultation, clinical, therapy, referral, test, immunisation, and additional details (Herrett et al., 2015). Practices' data include practice identifiers and geographical regions which are recorded as 13 UK regions (one of ten regions in England, with Northern Ireland, Scotland and Wales as the other three regions) in CPRD GOLD. Patients in CPRD GOLD have been given a unique identifier to other parts of data that are mainly recorded using Read codes 2nd version, a clinical classification system (Chisholm, 1990). This system includes over 250,000 codes for not only diseases but also medical history, symptoms, signs, examination findings, diagnostic procedures, therapies, lifestyle factors, and demographical information. Data on laboratory results are added to patients' records through links to laboratories. Prescription data are recorded using a British National Formulary code with the product name, quantity and dosage instruction automatically. Practice staff could add the data fed back from other sources to patients' records.

2.2.2 Osteoarthritis cohort

All individuals aged 35 and over who had an incident diagnosis of osteoarthritis between January 1992 and December 2017 with up-to-standard data and registration in CPRD GOLD for at least three years prior to the date of the incident diagnosis of osteoarthritis were eligible (read codes are shown in Appendix 3.1). People with osteoarthritis with a history of osteoarthritis diagnosis prior to the incident diagnosis of osteoarthritis were excluded to make sure the first date of osteoarthritis diagnosis is the index date. Individuals who transferred out or died prior to the incident diagnosis of osteoarthritis were excluded. People with osteoarthritis without an age-, sex- and practice-matched control without osteoarthritis were also excluded. The date of the incident osteoarthritis consultation was the index date for inclusion in the study.

2.2.3 Non-osteoarthritis cohort

Controls were assigned an index date identical to that of matched people with osteoarthritis. Controls without osteoarthritis were defined as individuals aged 35 and over, with at least one primary care consultation or clinical event (i.e., symptom, diagnosis, therapy, test, referral, immunisation) between January 1992 and December 2017 (to exclude ghost-patients), with up-to-standard data and registration in CPRD GOLD for at least three years prior to the index consultation, and without a history of osteoarthritis diagnosis within three years prior to or after the index date. Individuals who transferred out or died prior to the index consultation were excluded. One control without osteoarthritis was matched for each osteoarthritis individual based on age stratification (35-44, 45-54, 55-64, 65-74, 85 and over), sex, and practice by risk set sampling (Borgan, Goldstein, & Langholz, 1995).

2.2.4 Identification of modifiable CVRFs

Five modifiable CVRFs, including smoking status, obesity, hypertension, T2DM and dyslipidaemia, recorded within three years prior to the index consultation of each study participant were identified.

Smoking status was recorded as current and former/never using Read codes listed in Appendix 2.2. Individuals with no record of smoking status within three years prior to the index consultation were assumed as never smoked.

Obesity was identified using a body mass index (BMI) (Read code: 22K..00) ≥ 30 kg/m^2 (World Health Organization, 2018). Individuals without recorded BMI within three years prior to the index consultation were excluded from the complete case analyses for obesity. When more than one BMI assessment was recorded within three years prior to the index consultation, the nearest one to the date of the index consultation was adopted.

Hypertension diagnosis was identified using Read codes shown in Appendix 2.3. Individuals with no record of hypertension diagnosis were classified as non-hypertensive.

T2DM diagnosis was identified using Read codes shown in Appendix 2.4. Individuals with no record of T2DM diagnosis were classified as non-diabetes.

Dyslipidaemia was identified using a high TC level (≥5 mmol/L), high triglyceride level (≥1.7 mmol/L or low HDL cholesterol level (<1.0 mmol/L for men and <1.2 mmol/L for women). Individuals with normal lipid profiles or those without recorded lipid profiles within three years prior to the index consultation were classified as non-dyslipidaemia. When more than one lipid profile was recorded within three years prior to the index consultation, the nearest one to the date of the index consultation was adopted.

Individuals with a record of ≥1, ≥2, and ≥3 of the five above-listed modifiable CVRFs within three years prior to the index consultation were also identified.

2.2.5 The validity of osteoarthritis and CVRFs coding in CPRD GOLD

Osteoarthritis diagnosis in CPRD GOLD has previously been highly consistent with other indicators of the disease (e.g., positive predictive value of hip osteoarthritis diagnoses in CPRD GOLD compared with diagnosis based on radiological evidence: 80%) (Ferguson et al., 2018) (Yu, Jordan & Peat, 2018). Estimates of CVRFs recorded in CPRD GOLD have been reported to have a strong agreement with those derived from other data sources. The prevalence of current smoking in the CPRD GOLD was similar to the smoking prevalence from the Health Survey for England (HSE) data (CPRD GOLD: 24.3% in 2011; HSE: 24.2% in 2011) (Booth, Prevost & Gulliford, 2013). BMI estimates from the CPRD GOLD were also close to BMI estimates from the HSE data (mean BMI in CPRD GOLD: 26.3 kg/m^2 in 2010; HSE: 27.3 kg/m^2 in 2010) (Bhaskaran et al., 2013). Period prevalence estimates of diabetes from the CPRD GOLD and secondary care data were similar in myocardial infarction patients between 2003 and 2009 (CPRD GOLD: 18.2%; secondary care: 17.8%) (Herrett et al., 2013). Estimates of blood pressure and lipid levels in myocardial infarction patients from CPRD GOLD were also consistent with those from secondary care data (e.g., mean SBP in both CPRD GOLD and secondary care: 145 mm Hg; mean total serum cholesterol in both CPRD GOLD and secondary care: 5.4mmol/L in 2003-2009) (Herrett et al., 2013).

2.2.6 Data cleaning

CPRD GOLD data for 507,352 individuals with incident osteoarthritis recorded between 1992 and 2017 were extracted using STATA/MP 14.2 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP) on 12 September 2018. The criteria for data cleaning included:

- Individuals from practices with an up-to-standard date within three years prior to the index date were excluded
- Individuals who had first registration data within three years prior to the index date were excluded
- Individuals who transferred out or were recorded as died prior to the index date (delayed records) were excluded

The same criteria were applied to individuals with no incident osteoarthritis following the matching procedure.

2.2.7 Statistical analyses

Analyses were performed using STATA/MP 14.2 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP). The period prevalence with 95% confidence intervals (CIs) of individual modifiable CVRFs and number of CVRFs ≥1, ≥2, and ≥3 was calculated for osteoarthritis and non-osteoarthritis populations between 1992 and 2017. The period prevalence was calculated as the overall proportion of individuals having CVRFs in the cohort in the 26-year study period (1992-2017).

Complete case analyses for the prevalence of obesity and number of ≥1, ≥2, and ≥3 CVRFs were processed within risk sets (both case and control) with at least one recorded BMI measurement within three years prior to the index consultation. The period prevalence was compared between the osteoarthritis and non-osteoarthritis cohort along a relative measure expressed as a prevalence rate ratio (PRR). A PRR =1 indicates no difference in the prevalence between the two cohorts. A PRR>1 indicates a higher prevalence and a PRR<1 indicates a lower prevalence in the osteoarthritis cohort compared with controls. PRRs with 95% confidence intervals (CIs) between the two cohorts were calculated using a Poisson regression model. Poisson regression is a statistical model used when the dependent variable is a count (i.e., non-negative whole number: 0, 1, 2, …) (Cameron et al., 2013). The model sets:

$$\lambda = \exp\{b_0 + b_1x_1 + b_2x_2 + \dots + b_px_p\}$$

Where λ =the predicted count on the dependent variable, (x_1, x_2, …, x_p) = set of independent variables, b_0 =intercept, (b_1, b_2, …, bp) = size of regression coefficients.

Poisson regression assumes a Poisson distribution—a type of distribution which is truncated at 0, highly skewed in the positive direction, and exhibits equidispersion (i.e., the mean of the variable that is equal to the variance) (Cameron & Trivedi, 2013). When overdispersion is present (i.e., the variance is greater than the mean) Poisson regression may still be appropriate but statistical corrections must be incorporated into the model. One common reason for overdispersion is excess zeros but this was rarely observed in the current analyses. The STATA vce(robust) option was used with the model to automatically obtain robust standard errors for the parameter estimates as recommended by Cameron and Trivedi (2009) to control for mild overdispersion.

Although the overall study sample was large, there were smaller sample sizes in multiple subgroups where extreme association might be identified. The Poisson regression model is a count-based simple model with fewer parameters and offers consistent baseline estimates even in small samples (Chen et al., 2018), thus it is an appropriate option for the current study. Logistic regression is also a commonly used model for studying associations between exposures and categorical outcomes, but it is highly likely to overestimate risk ratios when outcomes are common (Chen et al., 2018). The robust Poisson model is generally preferable because it offers unbiased estimates of risk ratios. As the current study was interested in the prevalence of common CVRFs, Poisson regression was chosen.

Previous studies have highlighted that CVD risk varies with population characteristics such as age, sex, and geographical location (Bhatnagar et al., 2015, Forouhi & Wareham, 2018, McDonald et al., 2009, Ng et al., 2014, Zghebi et al., 2017). For example, the UK primary care data showed that the prevalence of diagnosed T2DM was higher in older age, in women than men, in Wales than in other UK nations in 2014 (Zghebi et al., 2017). To examine whether population characteristics have influenced the difference in the prevalence of modifiable CVRFs between osteoarthritis and non-osteoarthritis consulters, a stratification analysis by age groups (35-44, 45-54, 55-64, 65-74, 75-84, 85 and over), sex (female and male), and geographical regions (North East, North West, Yorkshire & The Humber, East Midlands, West Midlands, East of England, South West, South Central, London, South East Coast, Northern Ireland, Scotland, Wales) was conducted. Regional disparities in the occurrence of morbidities have been reported in the CPRD and these may relate to differences in service provision (Mathur et al., 2017). To illustrate differences in prevalence between consulters with and without osteoarthritis, the study used a STATA/MP 14.2 to visually display regional data on PRR between the two cohorts. Shapefiles for UK boundaries were imported (ONS, 2019) and maps were created to illustrate the difference in estimates by region.

During the study period, there have been interventions to improve care for modifiable CVRFs. For example, the Quality Outcome Framework (QOF) (QOF, 2019) was launched in 2004 and NICE (2016) guidelines were introduced in 2008 to improve the identification and treatment of modifiable CVRFs. Such interventions may have period effects on the occurrence of modifiable CVRFs and the difference between patient groups (Lee et al., 2011). To examine whether modifiable CVRFs in osteoarthritis and non-osteoarthritis consulters are influenced by the introduction of such interventions or other events, trends in annual prevalence estimates and PRRs by year were described.

Analysis based on imputed data

Multiple imputation is a statistical method used to handle missing data (Jakobsen et al., 2017). When using multiple imputation, missing values are firstly replaced by a random sample of plausible values imputations generated by the chosen imputation model (Rubin, 1987). Then, the analysis is conducted separately for each imputed dataset. Finally, the results obtained from each imputed dataset analysis are combined into single multiple imputation results. Multiple imputation is appropriate for handling missing data when missing at random is assumed; the proportions of missing data are above 5% and below 40% (Jakobsen et al., 2017). To deal with the missing data on BMI (used to define obesity), the multiple imputation process was used in this study. Although it could not be confirmed that values such as BMI in the current study were missing at random, multiple imputation was still selected to check whether the missingness changes the study results as there were no resources to trace people with missing values using EHRs.

Chained equations were used to impute missing values of BMI as the outcome and all other variables including age group, sex, region, index year of consultation, smoking status, hypertension, T2DM, and lipid profiles as covariates. The number of imputations (12) was based on the fraction (11.58) of those without recorded BMI among all subjects (Rubin, 1987). Estimates of period prevalence and PRRs for obesity, and the number of ≥1, ≥2 and ≥3 CVRFs in cohorts with and without osteoarthritis were then repeated using imputed data on BMI within a multiple imputation framework (using 12 imputations) (Rubin, 1987). These estimates were compared to the complete case analysis.

Summary of study methods:

- The study used routintely collected data from a longitudinal primary care dataset, CPRD GOLD, in the UK.
- Age-, sex-, practice- and index year-matched osteoarthritis and non-osteoarthritis cohorts were derived.
- Period prevalence of individual and multiple modifiable CVRFs in the matched cohorts between 1992-2017 were estimated
- Poisson models were used to obtain the prevalence rate ratio of modifiable CVRFs between the matched cohorts.
- Stratified analyses by age, sex, geographical region, and calendar year
- To handle the missing values, analyses were repeated based on imputed data.

2.3 Results

2.3.1 Characteristics of the study population

Between 1992 and 2017, a total of 409,791 consulters with newly diagnosed osteoarthritis aged 35 and over were identified from the CPRD GOLD (Figure 2.1). Among them, 215,190 (52.51%) had at least one age-, sex- and practice-matched control without osteoarthritis and were included in this study. Demographic characteristics of the overall osteoarthritis consulters in CPRD GOLD and those included in this study are presented in Table 2.1. These two populations were similar in age and sex distribution, region, and index year (Table 2.1). The 215,190 osteoarthritis consulters and 215,190 matched controls were included in the study and their demographic characteristics were shown in Table 2.2. The mean age of the osteoarthritis consulters was 62.62 years and that of controls without osteoarthritis was 62.41 years. The age group 55-64 had the largest sample of the study population (35.52%), and the age group 35-44 had the smallest (5.28%). Both the osteoarthritis consulters and controls had 64.79% of women. Among the 13 UK regions, North West provided the largest sample for the study population (8.48%) while the smallest was from North East (2.13%). The largest sample of the study population was in 2008 (8.55%) and the smallest was in 1992 (0.42%).

Figure 2.1. Flow chart of the study subjects. OA, osteoarthritis; CPRD, Clinical Practice Research Datalink; BMI, body mass index. N in the source of non-OA controls=507,352.

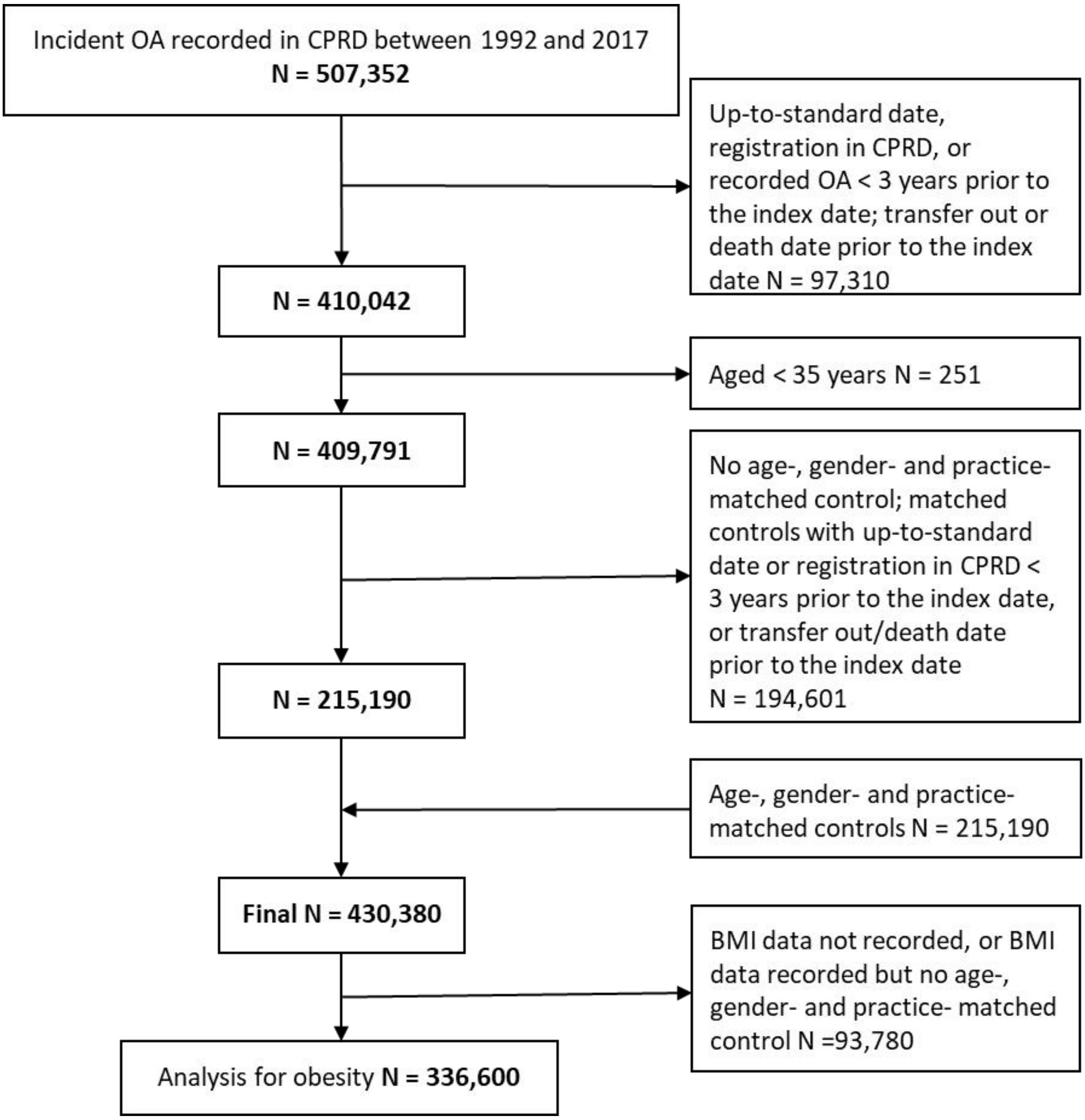


Table 2.1 Characteristics of incident OA consulters aged ≥35 in CPRD, 1992-2017

	All	With controls	Without controls
No. patients	409791	215190	194601
Age			
mean ± SD years	65.32 ± 12.25	62.62 ± 11.53	68.31 ± 12.32
35-44, n (%)	18124 (4.42)	11360 (5.28)	6764 (3.48)
45-54, n (%)	65076 (15.88)	43852 (20.38)	21224 (10.91)
55-64, n (%)	114317 (27.90)	69988 (32.52)	44327 (22.78)
65-74, n (%)	109893 (26.82)	53631 (24.92)	56260 (28.91)
75-84, n (%)	78457 (19.15)	31030 (14.42)	47429 (24.37)
85+, n (%)	23924 (5.84)	5329 (2.48)	18597 (9.56)
Sex, n (%)			
Female	249050 (60.77)	139426 (64.79)	109624 (56.33)
Male	160740 (39.22)	75764 (35.21)	84976 (43.67)
Unknown	1 (0.00)	0 (0.00)	1 (0.00)
Region, n (%)			
North East	8859 (2.16)	4593 (2.13)	4266 (2.19)
North West	52979 (12.93)	27200 (12.64)	25779 (13.25)
Yorkshire & The Humber	19265 (4.70)	9277 (4.31)	9988 (5.13)
East Midlands	17804 (4.34)	8960 (4.16)	8844 (4.54)
West Midlands	43164 (10.53)	22256 (10.34)	20908 (10.74)
East of England	36066 (8.80)	18103 (8.41)	17963 (9.23)
South West	35041 (8.55)	18251 (8.48)	16790 (8.63)
South Central	38776 (9.46)	20656 (9.60)	18120 (9.31)
London	29986 (7.32)	15763 (7.33)	14223 (7.31)
South East Coast	35953 (8.77)	19290 (8.96)	16663 (8.56)
Northern Ireland	11761 (2.87)	6430 (2.99)	5331 (2.74)
Scotland	35781 (8.73)	20521 (9.54)	15260 (7.84)
Wales	44356 (10.82)	23890 (11.10)	20466 (10.52)
Calendar year of index consultation, n (%)			
1992	2319 (0.57)	905 (0.42)	1414 (0.73)
1993	5926 (1.45)	2362 (1.10)	3564 (1.83)
1994	7093 (1.73)	2970 (1.38)	4123 (2.12)
1995	7544 (1.84)	3248 (1.51)	4296 (2.21)
1996	8602 (2.10)	3879 (1.80)	4723 (2.43)
1997	9361 (2.29)	4522 (2.10)	4839 (2.49)
1998	9581 (2.34)	5031 (2.34)	4550 (2.34)
1999	10987 (2.68)	5478 (2.55)	5509 (2.83)
2000	11924 (2.91)	5572 (2.59)	6352 (3.26)
2001	13508 (3.30)	6074 (2.82)	7434 (3.82)
2002	16146 (3.94)	7248 (3.37)	8898 (4.57)
2003	20483 (5.00)	9449 (4.39)	11034 (5.67)
2004	23436 (5.72)	11210 (5.21)	12226 (6.28)
2005	25452 (6.21)	12952 (6.02)	12500 (6.42)

2006	24804 (6.05)	13720 (6.38)	11084 (5.70)
2007	25454 (6.21)	15946 (7.41)	9508 (4.89)
2008	25557 (6.24)	18391 (8.55)	7166 (3.68)
2009	24702 (6.03)	15698 (7.29)	9004 (4.63)
2010	22840 (5.57)	12890 (5.99)	9950 (5.11)
2011	22224 (5.42)	11314 (5.26)	10910 (5.61)
2012	20627 (5.03)	9718 (4.52)	10909 (5.61)
2013	19428 (4.74)	8738 (4.06)	10690 (5.49)
2014	17576 (4.29)	8245 (3.83)	9331 (4.79)
2015	14686 (3.58)	7470 (3.47)	7216 (3.71)
2016	10972 (2.68)	6358 (2.95)	4614 (2.37)
2017	8559 (2.09)	5802 (2.70)	2757 (1.42)

OA, osteoarthritis; SD, standard deviation

Table 2.2 Demographical characteristics of the study population

	OA	Non-OA
No. patients	215190	215190
Age		
mean ± SD years	62.62 ± 11.53	62.41±11.87
35-44, n (%)	11360 (5.28)	11360 (5.28)
45-54, n (%)	43852 (20.38)	43852 (20.38)
55-64, n (%)	69988 (32.52)	69988 (32.52)
65-74, n (%)	53631 (24.92)	53631 (24.92)
75-84, n (%)	31030 (14.42)	31030 (14.42)
85+, n (%)	5329 (2.48)	5329 (2.48)
Sex, n (%)		
Female	139426 (64.79)	139426 (64.79)
Male	75764 (35.21)	75764 (35.21)
Ethnicity, n (%)		
White	69363 (32.23)	58357 (27.12)
Other ethnicity groups	2705 (1.26)	2232 (1.04)
Not recorded	143122 (66.51)	154601 (71.84)
Marital status, n (%)	91499 (100.00)	186054 (100.00)
Single	2063 (2.25)	4607 (2.48)
Married	16843 (18.41)	29702 (15.96)
Widowed	1962 (2.14)	2283 (1.23)
Divorced	1065 (1.16)	1652 (0.89)
Separated	280 (0.31)	473 (0.25)
Engaged/ co-habiting / remarried / stable relationship / civil partnership	242 (0.26)	443 (0.24)
Unknown	56232 (61.46)	116751 (62.75)
Data not entered	12812 (14.00)	30143 (16.20)
Region, n (%)		
North East	4593 (2.13)	4593 (2.13)
North West	27200 (12.64)	27205 (12.64)
Yorkshire & The Humber	9277 (4.31)	9275 (4.31)
East Midlands	8960 (4.16)	8957 (4.16)
West Midlands	22256 (10.34)	22250 (10.34)
East of England	18103 (8.41)	18101 (8.41)
South West	18251 (8.48)	18249 (8.48)
South Central	20656 (9.60)	20655 (9.60)
London	15763 (7.33)	15767 (7.33)
South East Coast	19290 (8.96)	19294 (8.97)
Northern Ireland	6430 (2.99)	6434 (2.99)
Scotland	20521 (9.54)	20519 (9.54)
Wales	23890 (11.10)	23891 (11.10)
Calendar year of index consultation, n (%)		

1992	905 (0.42)	905 (0.42)
1993	2362 (1.10)	2362 (1.10)
1994	2970 (1.38)	2970 (1.38)
1995	3248 (1.51)	3248 (1.51)
1996	3879 (1.80)	3879 (1.80)
1997	4522 (2.10)	4522 (2.10)
1998	5031 (2.34)	5031 (2.34)
1999	5478 (2.55)	5478 (2.55)
2000	5572 (2.59)	5572 (2.59)
2001	6074 (2.82)	6074 (2.82)
2002	7248 (3.37)	7248 (3.37)
2003	9449 (4.39)	9449 (4.39)
2004	11210 (5.21)	11210 (5.21)
2005	12952 (6.02)	12952 (6.02)
2006	13720 (6.38)	13720 (6.38)
2007	15946 (7.41)	15946 (7.41)
2008	18391 (8.55)	18391 (8.55)
2009	15698 (7.29)	15698 (7.29)
2010	12890 (5.99)	12890 (5.99)
2011	11314 (5.26)	11314 (5.26)
2012	9718 (4.52)	9718 (4.52)
2013	8738 (4.06)	8738 (4.06)
2014	8245 (3.83)	8245 (3.83)
2015	7470 (3.47)	7470 (3.47)
2016	6358 (2.95)	6358 (2.95)
2017	5802 (2.70)	5802 (2.70)

OA, osteoarthritis; SD, standard deviation

At least one BMI measurement was recorded within three years prior to the index consultation for 168,300 (78.21%) of the 215,190 sets of osteoarthritis consulters and matched controls. These individuals became the denominator population for the complete case analysis of prevalence estimates for obesity and the number of CVRFs. Table 2.3 shows the demographic characteristics of osteoarthritis consulters included in the complete case analysis with a comparison to the overall osteoarthritis consulters in the study. These two populations were similar in terms of age and sex distribution, region and index year (e.g., the mean age was 62.62 ± 11.53 and 62.38 ± 11.02, and the proportion of females was 64.79% and 67.07%, for the overall sample and the complete data sample, respectively).

Table 2.3 Demographical characteristics of osteoarthritis consulters included in the complete case analysis

	Overall	Included in complete case analysis
No. patients	215190	168300
Age		
mean ± SD years	62.62 ± 11.53	62.38 ± 11.02
35-44, n (%)	11360 (5.28)	8109 (4.82)
45-54, n (%)	43852 (20.38)	33881 (20.13)
55-64, n (%)	69988 (32.52)	57178 (33.97)
65-74, n (%)	53631 (24.92)	43849 (26.05)
75-84, n (%)	31030 (14.42)	22787 (13.54)
85+, n (%)	5329 (2.48)	2496 (1.48)
Sex, n (%)		
Female	139426 (64.79)	112876 (67.07)
Male	75764 (35.21)	55424 (32.93)
Region, n (%)		
North East	4593 (2.13)	3616 (2.15)
North West	27200 (12.64)	21930 (13.03)
Yorkshire & The Humber	9277 (4.31)	7168 (4.26)
East Midlands	8960 (4.16)	7118 (4.23)
West Midlands	22256 (10.34)	18248 (10.84)
East of England	18103 (8.41)	13825 (8.21)
South West	18251 (8.48)	12996 (7.72)
South Central	20656 (9.60)	15207 (9.04)
London	15763 (7.33)	12184 (7.24)
South East Coast	19290 (8.96)	15100 (8.97)
Northern Ireland	6430 (2.99)	5271 (3.13)
Scotland	20521 (9.54)	16763 (9.96)
Wales	23890 (11.10)	18874 (11.21)
By calendar year, n (%)		
1992	905 (0.42)	592 (0.35)
1993	2362 (1.10)	1641 (0.98)
1994	2970 (1.38)	2139 (1.27)
1995	3248 (1.51)	2439 (1.45)
1996	3879 (1.80)	2970 (1.76)
1997	4522 (2.10)	3502 (2.08)
1998	5031 (2.34)	3881 (2.31)
1999	5478 (2.55)	4357 (2.59)
2000	5572 (2.59)	4417 (2.62)
2001	6074 (2.82)	4830 (2.87)
2002	7248 (3.37)	5850 (3.48)
2003	9449 (4.39)	7693 (4.57)
2004	11210 (5.21)	9170 (5.45)

2005	12952 (6.02)	10471 (6.22)
2006	13720 (6.38)	11085 (6.59)
2007	15946 (7.41)	12765 (7.58)
2008	18391 (8.55)	14573 (8.66)
2009	15698 (7.29)	12470 (7.41)
2010	12890 (5.99)	10216 (6.07)
2011	11314 (5.26)	8838 (5.25)
2012	9718 (4.52)	7457 (4.43)
2013	8738 (4.06)	6546 (3.89)
2014	8245 (3.83)	6110 (3.63)
2015	7470 (3.47)	5458 (3.24)
2016	6358 (2.95)	4575 (2.72)
2017	5802 (2.70)	4255 (2.53)

OA, osteoarthritis; SD, standard deviation

2.3.2 Period prevalence of modifiable CVRFs in consulters with and without osteoarthritis

The period (26-year) prevalence of current smoking was 24.07 (95%CI: 23.89, 24.25) %, obesity was 39.47 (39.24, 39.70) %, hypertension was 37.45 (37.25, 37.66) %, T2DM was 8.44 (8.32, 8.56) %, dyslipidaemia was 68.31 (68.11, 68.50) %, number of ≥1 CVRFs was 90.15 (90.01, 90.29) %, ≥2 CVRFs was 57.89 (57.65, 58.12) % and ≥3 CVRFs was 24.36 (24.15, 24.56) %in consulters with osteoarthritis. The corresponding prevalence was 18.66 (18.50, 18.83) %, 34.80 (34.58, 35.03) %, 27.67 (27.49, 27.86) %, 7.61 (7.50, 7.72) %, 57.13 (56.92, 57.34) %, 87.43 (87.27, 87.59) %, 50.88 (50.64, 51.11) %, and 20.64 (20.45, 20.83) in those without osteoarthritis (Table 2.4). The PRR for hypertension was 1.35 (1.34 to 1.37), obesity was 1.13 (1.12 to 1.15), current smoking was 1.29 (1.27 to 1.31), dyslipidaemia was 1.20 (1.19 to 1.20), T2DM was 1.11 (1.09 to 1.13), number of ≥1 CVRFs was 1.19 (1.18, 1.20), ≥2 CVRFs was 1.34 (1.33, 1.35) and ≥3 CVRFs was 1.39 (1.37, 1.41) between consulters with and without osteoarthritis.

Table 2.4 Period prevalence of modifiable CVRFs in OA and non-OA populations, 1992-2017

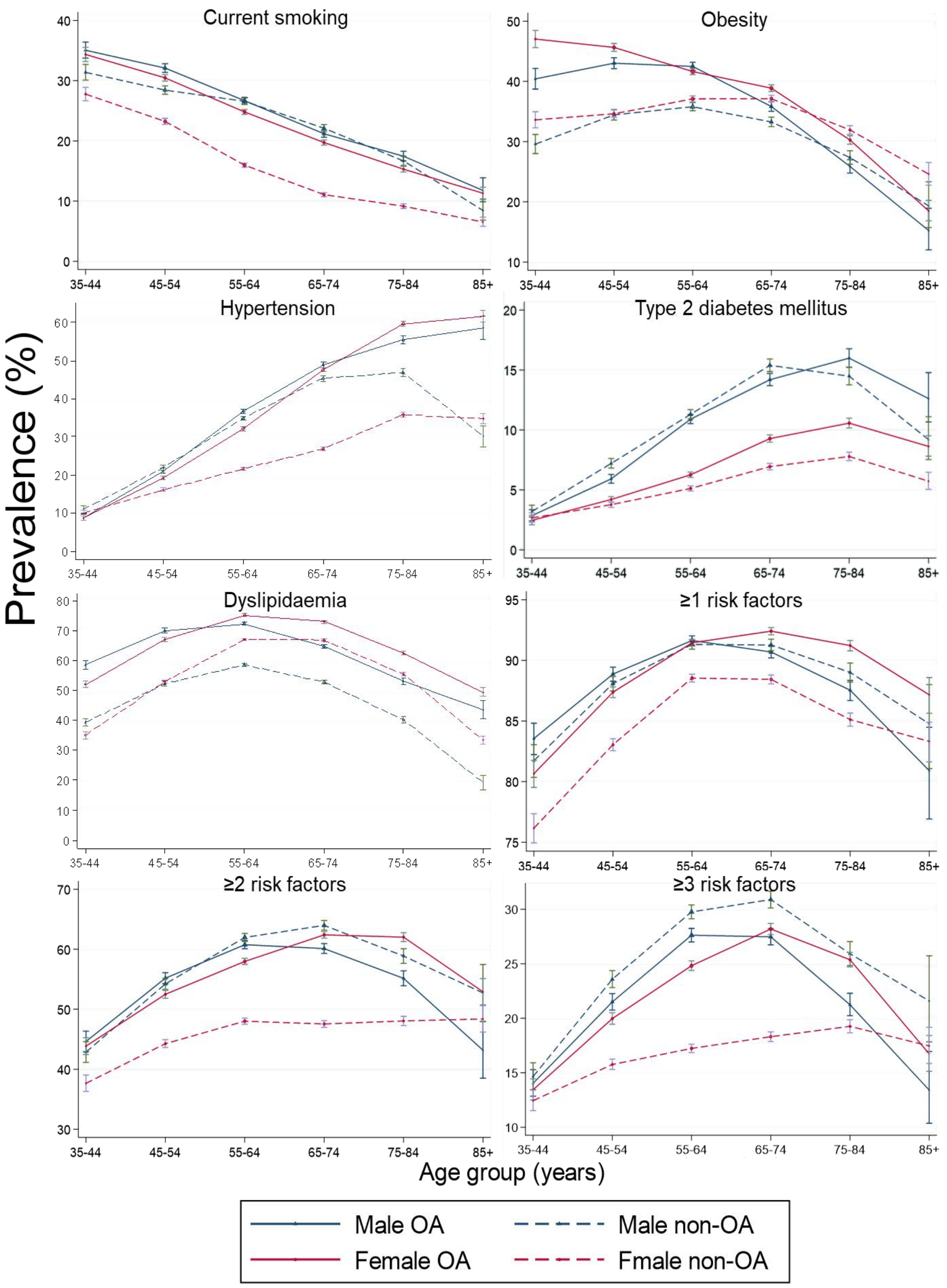
CVRF	OA			Non-OA			Prevalence rate ratio (95%CI)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Current smoking	215190	51799	24.07 (23.89, 24.25)	215190	40165	18.66 (18.50, 18.83)	**1.29 (1.27, 1.31)**
Obesity	168300	66429	39.47 (39.24, 39.70)	168300	58574	34.80 (34.58, 35.03)	**1.13 (1.12, 1.15)**
Hypertension	215190	80589	37.45 (37.25, 37.66)	215190	59553	27.67 (27.49, 27.86)	**1.35 (1.34, 1.37)**
Type 2 diabetes mellitus	215190	18160	8.44 (8.32, 8.56)	215190	16369	7.61 (7.50, 7.72)	**1.11 (1.09, 1.13)**
Dyslipidaemia	215190	146988	68.31 (68.11, 68.50)	215190	122934	57.13 (56.92, 57.34)	**1.20 (1.19, 1.20)**
Number of ≥ 1 CVRF	168300	151726	90.15 (90.01, 90.29)	168300	147151	87.43 (87.27, 87.59)	**1.03 (1.03, 1.03)**
Number of ≥ 2 CVRFs	168300	97427	57.89 (57.65, 58.12)	168300	85624	50.88 (50.64, 51.11)	**1.14 (1.13, 1.14)**
Number of ≥ 3 CVRFs	168300	40995	24.36 (24.15, 24.56)	168300	34734	20.64 (20.45, 20.83)	**1.18 (1.17, 1.20)**

CVRF, cardiovascular risk factor; OA, osteoarthritis; D, denominator; N, numerator; 95%CI, 95% confidence interval; Estimates in **bold**, statistically significant

2.3.3 Period prevalence of modifiable CVRFs in consulters with and without osteoarthritis stratified by age and sex

The age-and sex-specific period PRR between the two cohorts varied for each CVRF or different numbers of CVRFs (Appendix 2.5).

Figure 2.2. Period prevalence of modifiable cardiovascular risk factors by OA status, age group and gender, 1992-2017. OA, osteoarthritis



Period prevalence of current smoking by age and sex

The prevalence of current smoking decreased by age in both genders and both osteoarthritis and control cohorts (Figure 2.2). The prevalence was consistently higher in people with osteoarthritis than those without osteoarthritis in women, but the difference was smaller in men (Figure 2.2). For women, the prevalence was higher in consulters with osteoarthritis compared to controls overall (PRR: 1.51, 95%CI: 1.49-1.53). For men, the prevalence was also higher in consulters with osteoarthritis compared to controls overall (PRR: 1.04 (1.02, 1.06)).

Period prevalence of obesity by age and sex

The prevalence of obesity was higher in people with osteoarthritis than those without osteoarthritis in both gender in younger age groups, but the difference was smaller in older age groups (Figure 2.2). For women, the prevalence was higher in the osteoarthritis cohort compared to controls overall (PRR: 1.12 (1.11, 1.14)). For men, the prevalence was also higher in the osteoarthritis cohort compared to controls overall (PRR: 1.16 (1.14, 1.18)).

Period prevalence of hypertension by age and sex

The prevalence of hypertension was higher in people with osteoarthritis than those without osteoarthritis in both gender in older age groups, but the difference was smaller in younger age groups (Figure 2.2). For women, the prevalence was higher in the osteoarthritis cohort compared to controls overall (PRR: 1.57 (1.55, 1.59)) (Appendix 2.5.3). For men, the prevalence was also higher in the osteoarthritis cohort compared to controls overall (PRR: 1.07 (1.06, 1.09)).

Period prevalence of T2DM by age and sex

The prevalence of T2DM was higher in people with osteoarthritis than those without osteoarthritis in both gender in older age groups, but the difference was smaller in younger age groups (Figure 2.2). For women, the prevalence was higher in the osteoarthritis cohort compared to controls overall (PRR: 1.28 (1.24, 1.31)) and in elder groups (e.g., 1.51 (1.29, 1.76) in the 85+age group), but not in the youngest group (0.92 (0.74, 1.14) in the 35-44 age group) (Appendix 2.5.4). For men, a lower prevalence was observed in the osteoarthritis cohort overall (PRR: 0.96 (0.93, 0.98)) and younger groups (e.g., 0.89 (0.72, 1.12) in the 35-44 age group), but a higher prevalence was still observed in elder groups (e.g., 1.37 (1.07, 1.76) in the 85+ age group).

Period prevalence of dyslipidaemia by age and sex

The prevalence of dyslipidaemia was consistently higher in people with osteoarthritis than those without osteoarthritis in both genders (Figure 2.2). gendersFor women, the prevalence was higher in the osteoarthritis cohort compared to controls overall (PRR: 1.16 (1.15, 1.16)) (Appendix 2.5.5). For men, the prevalence was also higher in the osteoarthritis cohort compared to controls overall (PRR: 1.28 (1.27, 1.29)).

Period prevalence of number of ≥1 CVRFs by age and sex

The prevalence of number of ≥1 CVRFs was consistently higher in people with osteoarthritis than those without osteoarthritis in women but the difference was not observed in men (Figure 2.2).For women, the prevalence was higher in the osteoarthritis cohort compared to controls overall (PRR: 1.05 (1.04, 1.05)) (Appendix 2.5.6). For men, the higher prevalence in the osteoarthritis cohort was not observed overall (PRR: 1.00 (1.00, 1.00)).

Period prevalence of number of ≥2 CVRFs by age and sex

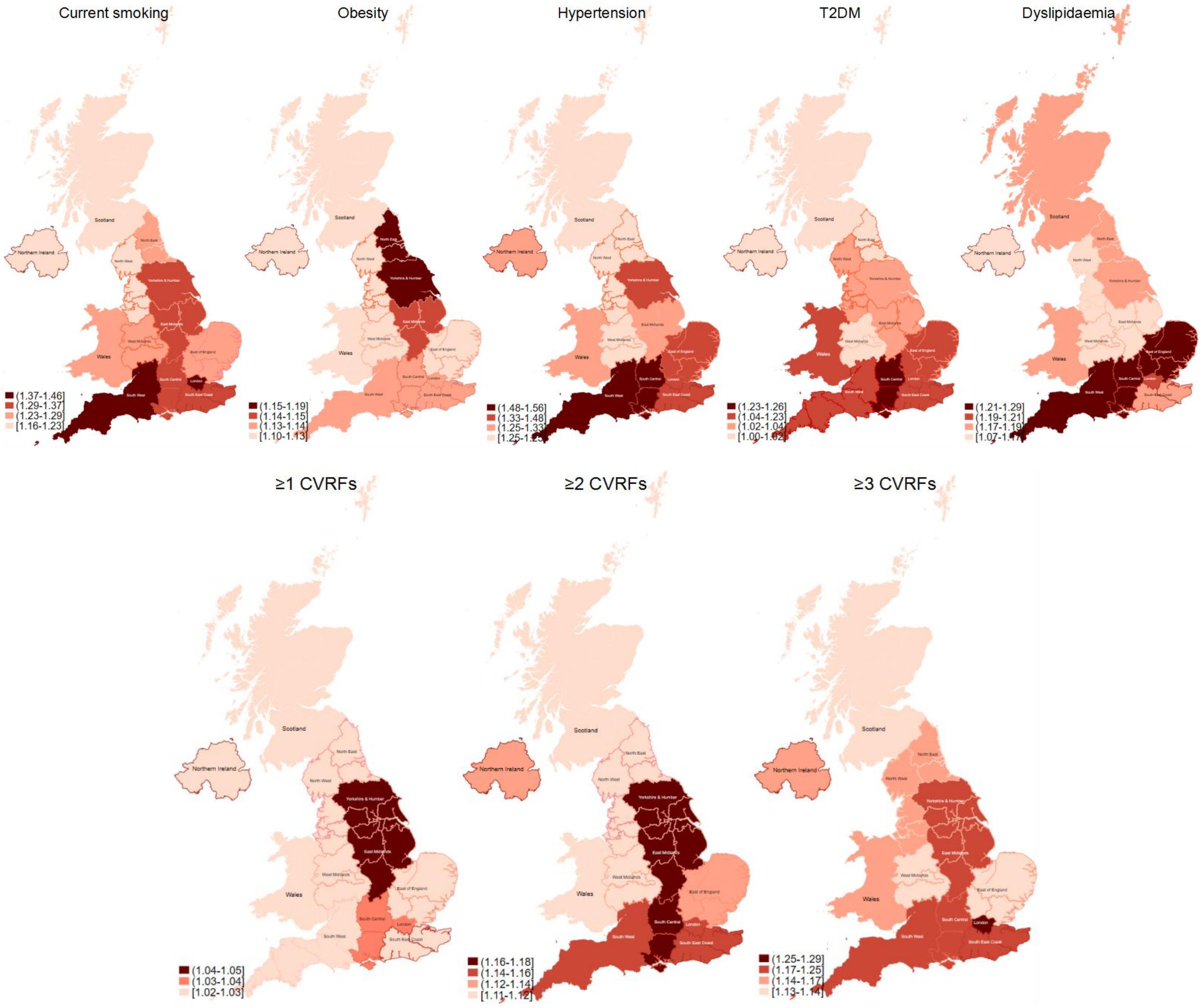
The prevalence of number of ≥2 CVRFs was consistently higher in people with osteoarthritis than those without osteoarthritis in women but the difference was not observed in men (Figure 2.2). For women, the prevalence was higher in the osteoarthritis cohort compared to controls overall (PRR: 1.24 (1.23, 1.25)) (Appendix 2.5.7). For men, in contrast, a lower prevalence was observed in the osteoarthritis cohort overall (PRR: 0.97 (0.96, 0.98)).

Period prevalence of number of ≥3 CVRFs by age and sex

The prevalence of number of ≥3 CVRFs was consistently higher in women with osteoarthritis than those without osteoarthritis but the difference was reversed in men (Figure 2.2). For women, the prevalence was higher in the osteoarthritis cohort compared to controls overall (PRR: 1.40 (1.37, 1.42)) (Appendix 2.5.8). For men, in contrast, a lower prevalence was observed in the osteoarthritis cohort overall (PRR: 0.90 (0.88, 0.92)) (Appendix 2.5.8).

2.3.4 Period prevalence of modifiable CVRFs in consulters with and without osteoarthritis stratified by region

Figure 2.3. Period PRRs of modifiable cardiovascular risk factors between people with and without osteoarthritis by region, 1992-2017. The darker colour represents a higher PRR.



The maps of period PRRs of modifiable CVRFs in consulters with and without osteoarthritis were shown in Figure 2.3. For individual CVRF, the prevalence was generally higher in the osteoarthritis cohort compared with controls across regions with the highest PRR in not only northernbut also southern English regions (detailed estimates in Appendix 2.6). For the number of CVRFs, the higher prevalence in the osteoarthritis cohort was consistent across regions with the highest PRRs in Yorkshire and Humber, East Midlands, and London.

Period prevalence of current smoking by region

The prevalence was consistently higher in the osteoarthritis cohort compared with controls across regions, with the highest PRR in South West (1.46 (1.39, 1.53)) and the lowest PRR in Scotland (1.46 (1.39, 1.53)).

Period prevalence of obesity by region

The prevalence was consistently higher in the osteoarthritis cohort compared with controls across regions, with the highest PRR in Yorkshire and Humber (1.19 (1.13, 1.26)) and the lowest PRR in Northern Ireland (1.10 (1.03, 1.16)).

Period prevalence of hypertension by region

The prevalence was consistently higher in the osteoarthritis cohort compared with controls across regions, with the highest PRR in South Central (1.56 (1.52, 1.61)) and the lowest PRR in North East (1.25 (1.17, 1.33)).

Period prevalence of T2DM by region

The prevalence was higher in the osteoarthritis cohort compared with controls in southern English regions and Wales with the highest PRR in South Central (1.26 (1.17, 1.36)), but not in other regions (e.g., 1.00 (0.85, 1.17) in North East).

Period prevalence of dyslipidaemia by region

The prevalence was consistently higher in the osteoarthritis cohort compared with controls across regions, with the highest PRR in South West (1.29 (1.26, 1.31)) and the lowest PRR in East Midlands (1.07 (1.05, 1.10)).

Period prevalence if number of ≥1 CVRFs by region

The prevalence was consistently higher in the osteoarthritis cohort compared with controls across regions, with the highest PRR in Yorkshire & The Humber, and East Midlands (1.05 (1.03, 1.06)) and the lowest PRR in North East (1.02 (1.01, 1.04)).

Period prevalence of number of ≥2 CVRFs by region

The prevalence was consistently higher in the osteoarthritis cohort compared with controls across regions, with the highest PRR in Yorkshire & The Humber, and East Midlands (1.18 (1.14 1.22)) and the lowest PRR in North East (1.11 (1.06, 1.15)).

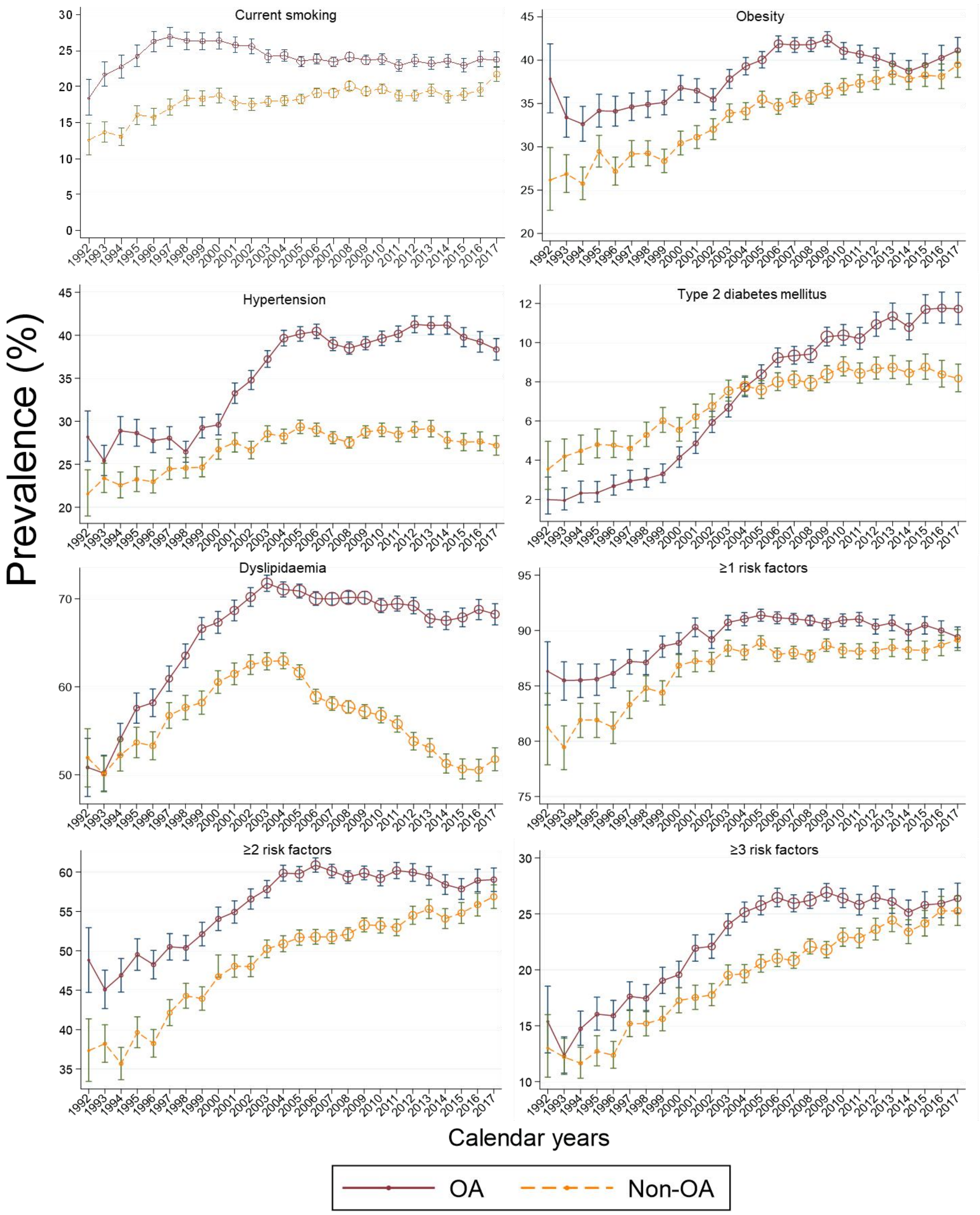
Period prevalence of number of ≥3 CVRFs by region

The prevalence was consistently higher in the osteoarthritis cohort compared with controls across regions, with the highest PRR in London (1.29 (1.23, 1.35)) and the lowest PRR in West Midlands and Scotland (1.13 (1.09, 1.18)).

2.3.5 Trends in the annual prevalence of modifiable CVRFs in consulters with and without osteoarthritis

The annual prevalence of each and the number of modifiable CVRFs increased between 1992-2017 in both the osteoarthritis and non-osteoarthritis cohorts (Figure 2.4). The time trends in the annual PRR between the two cohorts varied for each CVRF or different numbers of CVRFs (Appendix 2.7).

Figure 2.4. Trends in the prevalence of modifiable cardiovascular risk factors by OA status, 1992-2017. OA, osteoarthritis; the bubble size in each calendar year is determined by the size of the numerator population in the OA status group



Annual prevalence of current smoking

The annual prevalence was consistently higher in the osteoarthritis cohort compared with controls, with the PRR decreasing from 1.46 (1.15, 1.85) in 1992 to 1.09 (1.01, 1.18) in 2017 (Appendix 2.7.1).

Annual prevalence of obesity

The annual prevalence was consistently higher in the osteoarthritis cohort compared with controls between 1992-2012, with the PRR decreasing from 1.42 (1.16, 1.75) in 1992 to 1.07 (1.01, 1.12) in 2012, and became similar between the two cohorts afterwards until 2017 (1.04 (0.97, 1.11)) (Appendix 2.7.2).

Annual prevalence of hypertension

The annual prevalence was consistently higher in the osteoarthritis cohort compared with controls, with the PRR increasing from 1.31 (1.11, 1.54) in 1992 to 1.41 (1.34, 1.49) in 2017 (Appendix 2.7.3).

Annual prevalence of T2DM

The annual prevalence was consistently lower in the osteoarthritis cohort compared with controls between 1992-2003, with the PRR increasing from 0.56 (0.32, 0.99) in 1992 to 0.89 (0.80, 0.98) in 2003 (Appendix 2.7.3). The annual prevalence was similar between the two cohorts in 2004 (PRR: 0.99 (0.91, 1.08)), and became consistently higher in the osteoarthritis cohort afterwards, with the PRR increasing to 1.43 (1.28, 1.60) in 2017.

Annual prevalence of dyslipidaemia

The annual prevalence was similar between the two cohorts between 1992 (0.98 (0.89, 1.07)) to 1994 (1.03 (0.99, 1.09)), and became consistently higher in the osteoarthritis cohort afterwards, with the PRR increasing from 1.07 (1.03, 1.12) in 1995 to 1.32 (1.28, 1.36) in 2017 (Appendix 2.7.5).

Annual prevalence of number of ≥1 CVRFs

The annual prevalence was consistently higher in the osteoarthritis cohort compared with controls between 1992 (1.06 (1.01, 1.12)) to 2016 (1.02 (1.00, 1.03)) with a stable PRR by year (Appendix 2.7.6). The annual prevalence was similar between the two cohorts in 2017 (1.00 (0.99, 1.02)).

Annual prevalence of number of ≥2 CVRFs

The annual prevalence was consistently higher in the osteoarthritis cohort compared with controls, with the PRR decreasing from 1.31 (1.14, 1.49) in 1992 to 1.04 (1.00, 1.08) in 2017 (Appendix 2.7.7).

Annual prevalence of number of ≥3 CVRFs

The annual prevalence was consistently higher in the osteoarthritis cohort compared with controls between 1994 (PRR: 1.27 (1.08, 1.48)) to 2015 (1.07 (1.00, 1.14)), but was similar between the two cohorts in 1992-1993 or 2016-2017 (Appendix 2.7.8).

2.3.6 Estimates based on imputed data

A total of 49,839 (11.58%) individuals in the study population were not recorded for BMI in CPRD GOLD. The proportion of not recorded BMI was higher in the non-osteoarthritis (17.97%) than the osteoarthritis cohort (5.19%). A multiple imputation process using chained equations was applied to impute the BMI, considering osteoarthritis status, and other characteristics (e.g., age, sex, region, year of index consultation, current smoking, hypertension, and T2DM) in the dataset.

Imputed period prevalence of obesity, number of ≥1, ≥2, and ≥3 CVRFs was 28.39 (28.20, 28.58) %, 74.32 (74.13, 74.50) %, 42.12 (41.91, 42.33) %, and 17.12 (16.96, 17.28) %, respectively, in controls. These were lower compared with controls with complete data. Imputed period prevalence of obesity, number of ≥1, ≥2, and ≥3 CVRFs was 37.00 (36.80, 37.21) %, 88.59 (88.46, 88.73) %, 56.32 (56.11, 56.53) %, and 23.85 (23.67, 24.03) %, respectively, in the osteoarthritis cohort (Table 2.6). These were consistent with those based on complete data. Imputed PRRs confirmed the higher prevalence of these risk factors in the osteoarthritis cohort compared with controls (Table 2.6). Imputed period PRR of obesity, number of ≥1, ≥2, and ≥3 CVRFs was 1.30 (1.29, 1.31), 1.19 (1.19, 1.20), 1.34 (1.33, 1.35), and 1.39 (1.38, 1.41), respectively. These imputed PRRs were higher than those based on the complete data.

Table 2.5 Imputed period prevalence of obesity, and number ≥1, ≥2 and ≥3 modifiable CVRFs in OA and non-OA populations, 1992-2017

CVRF	Prevalence (95%CI)		Prevalence rate ratio (95%CI)
	OA	Non-OA	
Obesity	37.00 (36.80, 37.21)	28.39 (28.20, 28.58)	**1.30 (1.29, 1.31)**
Number of ≥1 CVRFs	88.59 (88.46, 88.73)	74.32 (74.13, 74.50)	**1.19 (1.19, 1.20)**
Number of ≥2 CVRFs	56.32 (56.11, 56.53)	42.12 (41.91, 42.33)	**1.34 (1.33, 1.35)**
Number of ≥3 CVRFs	23.85 (23.67, 24.03)	17.12 (16.96, 17.28)	**1.39 (1.38, 1.41)**

CVRF, cardiovascular risk factor; MI, multiple imputation; OA, osteoarthritis; 95%CI, 95% confidence interval; Estimates in **bold**, statistically significant

Subgroup analyses based on imputed data showed that the prevalence of obesity and the number of CVRFs were consistently higher in the osteoarthritis cohort compared with controls across age and sex groups (Figure 2.5), regions (Appendix 2.8), and index years (Figure 2.6).

Figure 2.5. Imputed period prevalence rate ratio (PRR) of obesity, and number ≥1, ≥2 and ≥3 modifiable CVRFs in osteoarthritis and non-osteoarthritis populations by age and sex group, 1992-2017

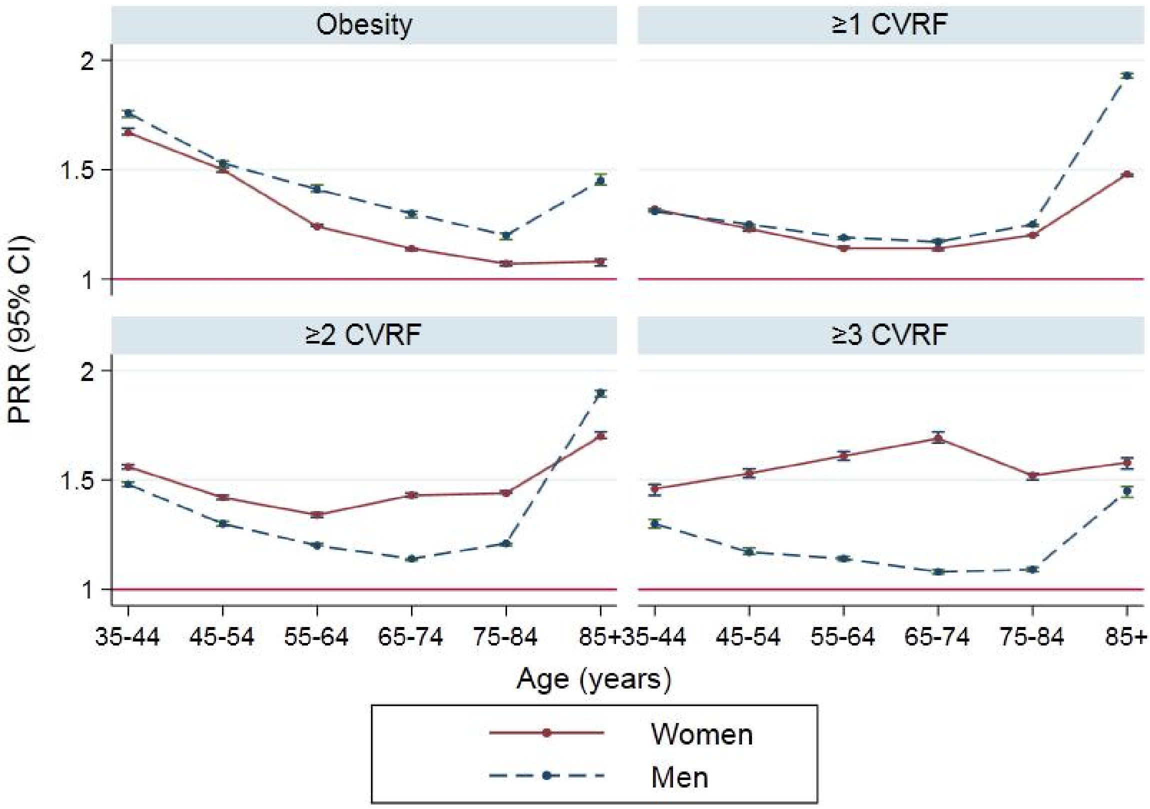
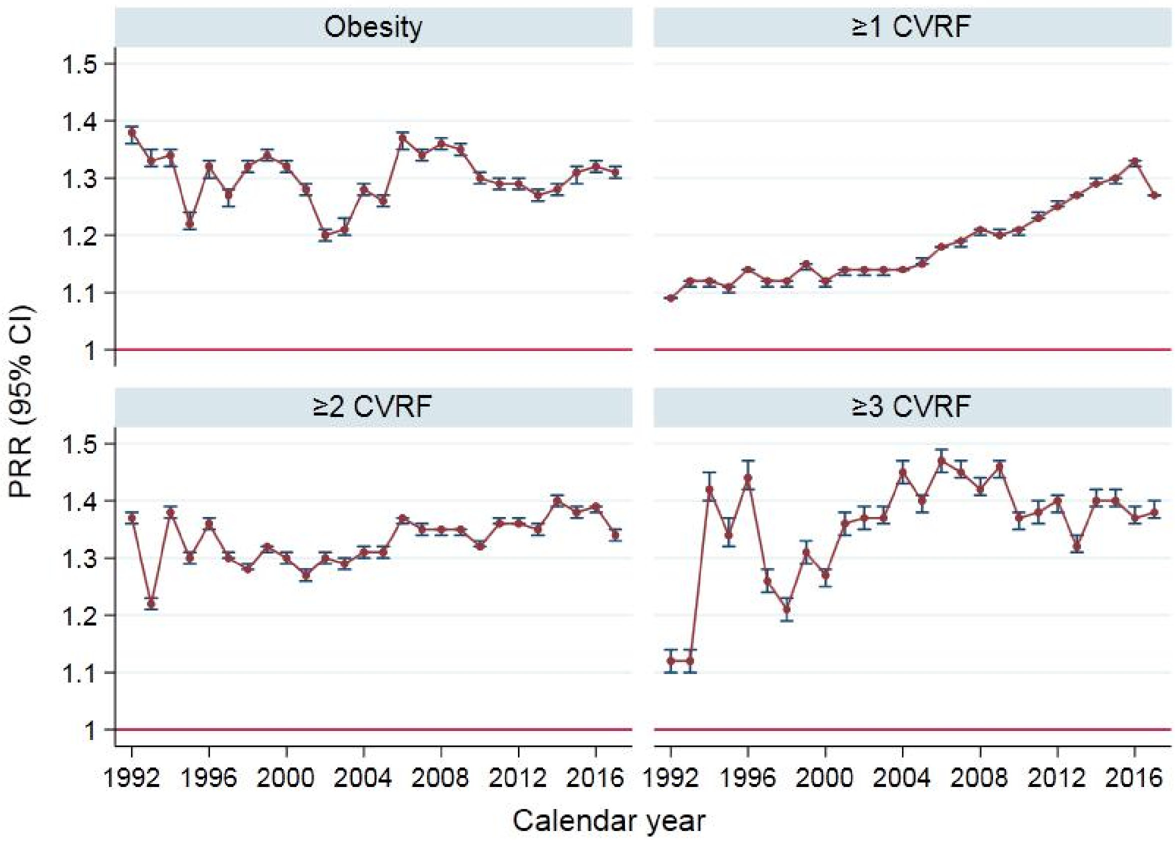


Figure 2.6. Imputed annual prevalence rate ratio (PRR) of obesity, and number of ≥1, ≥2 and ≥3 modifiable CVRFs in osteoarthritis and non-osteoarthritis populations in 1992-2017



Imputed period prevalence by age and sex

Imputed period prevalence of obesity by age and sex

For women, the prevalence was higher in the osteoarthritis cohort compared to controls overall (PRR: 1.25 (1.24, 1.27)) (Appendix 2.8.1). For men, the prevalence was also higher in the osteoarthritis cohort compared to controls overall (PRR: 1.41 (1.40, 1.42)).

Imputed period prevalence of number of ≥1 CVRFs by age and sex

For women, the prevalence was consistently higher in the osteoarthritis cohort compared to controls overall (PRR: 1.18 (1.18, 1.18)) (Appendix 2.8.2). For men, the prevalence was also higher in the osteoarthritis cohort compared to controls overall (PRR: 1.22 (1.21, 1.22)).

Imputed period prevalence of number of ≥2 CVRFs by age and sex

For women, the prevalence was higher in the osteoarthritis cohort compared to controls overall (PRR: 1.41 (1.4, 1.42)) (Appendix 2.8.3). For men, the prevalence was also higher in the osteoarthritis cohort compared to controls overall (PRR: 1.22 (1.21, 1.23)).

Imputed period prevalence of number of ⩾3 CVRFs by age and sex

For women, the prevalence was higher in the osteoarthritis cohort compared to controls overall (PRR: 1.60 (1.58, 1.62)). For men, the prevalence was also higher in the osteoarthritis cohort compared to controls overall (PRR: 1.13 (1.12, 1.14)).

Imputed period prevalence by region

Imputed period prevalence of obesity by region

The prevalence was consistently higher in the osteoarthritis cohort compared with controls across regions, with the highest PRR in South West (1.41 (1.40, 1.42)) and the lowest PRR in Northern Ireland (1.24 (1.23, 1.25)).

Imputed period prevalence of number of ≥ 1 CVRFs by region

The prevalence was consistently higher in the osteoarthritis cohort compared with controls across regions, with the highest PRR in South West (1.30 (1.30, 1.31)) and the lowest PRR in East Midlands (1.15 (1.15, 1.16)).

Imputed period prevalence of number of ≥2 CVRFs by region

The prevalence was consistently higher in the osteoarthritis cohort compared with controls across regions, with the highest PRR in South West (1.48 (1.47, 1.49)) and the lowest PRR in East Midlands (1.27 (1.26, 1.27)).

Imputed period prevalence of number of ≥3 CVRFs by region

The prevalence was consistently higher in the osteoarthritis cohort compared with controls across regions, with the highest PRR in South Central (1.61 (1.59, 1.63)) and the lowest PRR in East Midlands (1.24 (1.23, 1.26)).

Imputed annual prevalence

Imputed annual prevalence of obesity

The annual prevalence was consistently higher in the osteoarthritis cohort compared with controls, with the PRR slightly decreasing from 1.38 (1.36, 1.39) in 1992 to 1.31 (1.3, 1.32) in 2017 (Appendix 2.8.1).

Imputed annual prevalence of number of ≥ 1 CVRFs

The annual prevalence was consistently higher in the osteoarthritis cohort compared with controls, with the PRR increasing from 1.09 (1.09, 1.09) in 1992 to 1.27 (1.27, 1.27) in 2017 (Appendix 2.8.2).

Imputed annual prevalence of number of ≥2 CVRFs

The annual prevalence was consistently higher in the osteoarthritis cohort compared with controls, with the PRR slightly decreasing from 1.37 (1.36, 1.38) in 1992 to 1.34 (1.33, 1.35) in 2017 (Appendix 2.8.3).

Imputed annual prevalence of number of ≥3 CVRFs

The annual prevalence was consistently higher in the osteoarthritis cohort compared with controls, with the PRR increasing from 1.12 (1.10, 1.14) in 1992 to 1.38 (1.37, 1.40) in 2017 (Appendix 2.8.4).

Summary of results:

- A higher period (26-year) prevalence of smoking, obesity, hypertension, T2DM, dyslipidaemia, and number of ≥1, ≥2 and ≥3 modifiable CVRFs was higher in the osteoarthritis cohort compared to matched controls between 1992-2017.
- The period prevalence and PRR varied by age group, sex and geographical region.
- The annual prevalence of modifiable CVRFs was generally higher in the osteoarthritis cohort between 1992-2017.
- The annual PRR between the osteoarthritis and controls increased for hypertension, T2DM, dyslipidaemia, and number of ≥1 modifiable CVRFs between 1992-2017.
- The multiple imputation process was used to handle missing values of BMI, generating lower prevalence estimates of obesity, number of ≥1, ≥2 and ≥3 modifiable CVRFs in controls and larger PRRs between the osteoarthritis cohort and controls.

2.4 Discussion

2.4.1 Summary of findings

The analysis from this study which used primary care CPRD GOLD EHR data has indicated a higher period (26-year) prevalence of single and number of modifiable CVRFs in consulters with osteoarthritis aged 35 and over compared with age-, sex- and practice-matched controls without osteoarthritisc between 1992 and 2017. The period prevalence and PRR of single and number of modifiable CVRFs varied by sex, age, and geographical regions. For example, the prevalence of obesity increased in younger consulters with osteoarthritis and the highest PRR of obesity was observed in the youngest age group (35-44 years). The annual prevalence of single and number of modifiable CVRFs increased by years in both consulters with and without osteoarthritis, with a higher prevalence commonly observed in consulters with osteoarthritis. Notably, the annual PRR between consulters with and without osteoarthritis increased for hypertension, T2DM, dyslipidaemia, and number of ≥1 modifiable CVRFs in 1992-2017. Analyses following the multiple imputation showed that the highest PRR for obesity and number of ≥1 and ≥2 modifiable CVRFs between consulters with and without osteoarthritis consistently existed in the younger age group in both men and women.

2.4.2 Comparisons with other studies

Primary care EHR data have been used to estimate the prevalence of smoking status in osteoarthritis populations but comparing the prevalence between osteoarthritis and non-osteoarthritis populations has not been reported. Leyland and colleagues (2016) reported that the period prevalence of current smoking was 12.5% in consulters with knee osteoarthritis with a mean age of 68 years in a regional primary care database in Catalonia, Spain between 2006 and 2011. The estimate from this study at 24.07% is markedly higher. However, the two estimates were not comparable as a longer prevalence period (26-year vs. 6-year period) was used in this study compared with that in Leyland et al (2006)'s. The higher smoking prevalence in this study indicated that the osteoarthritis cohort might be more disadvantaged in socioeconomic status (SES) according to the recognised association between smoking and lower SES (Hiscock et al., 2012). Previous studies have not used similar methods as the current study to compare the smoking prevalence between primary care consulters with and without osteoarthritis. The current study was the first to date reporting a higher prevalence of smoking in consulters with osteoarthritis compared to age-, sex-, and practice-matched controls based on primary care EHRs.

The comparatively higher period prevalence of some modifiable CVRFs in osteoarthritis consulters in this study is consistent with what has been previously reported. Previous comparisons of the prevalence of obesity, hypertension, diabetes and dyslipidaemia between consulters with and without osteoarthritis derived from primary care EHRs consistently showed a higher prevalence in those with osteoarthritis (Prieto-Alhambra et al., 2014, Rahman et al., 2013, Nielen et al., 2012). These risk factors have been suggested to be shared risk factors for both osteoarthritis and CVD (Fernandes & Valdes, 2015). Inflammatory environment induced by obesity (a primary risk factor for knee and hip osteoarthritis), hypertension, changes in lipid profile and blood glucose levels associated with the pathogenesis of osteoarthritis and prescriptions for osteoarthritis (e.g., Nonsteroidal Anti-inflammatory Drugs (NSAIDs) for knee and hip osteoarthritis), hypertension, (Fernandes & Valdes, 2015, Le Clanche et al., 2016, Sowers & Karvonen-

Gutierrez, 2010). This might further explain the increased modifiable CVRFs in consulters with osteoarthritis. However, previous studies have not comprehensively reported the age-, sex- and geographical difference in the prevalence of CVRFs between consulters with and without osteoarthritis thus failing to identify subpopulations with the higher burden. The current study used comparable populations and was the first to identify subgroups of osteoarthritis consulters with the highest prevalence of each and number of CVRFs (e.g., women with middle ages) or the highest difference in the prevalence from those without osteoarthritis (e.g., men with elder ages). The geographical difference in the prevalence of modifiable CVRFs (e.g., higher in northern than southern English regions) was observed for the first time in consulters with osteoarthritis. This study was also the first to date using primary care EHRs to identify number of modifiable CVRFs to show a higher overall burden of CVRFs in consulters with osteoarthritis compared to those without.

There seemed to be no previous report of temporal trends of modifiable CVRFs in consulters with osteoarthritis using primary care EHRs. In general populations, trends in the prevalence of modifiable CVRFs such as obesity, diabetes and hypertension are generally increasing in the UK (Zghebi et al., 2017). The increased prevalence of modifiable CVRFs was also seen in consulters with and without osteoarthritis in the current study. The study was the first to date to report the difference in the prevalence of CVRFs between consulters with and without osteoarthritis and reported an increasing gap in hypertension, T2DM, dyslipidaemia, and number of ≥1 and ≥3 CVRFs. The transient increase in the annual prevalence of T2DM in consulters with osteoarthritis in 2004 found in this study is likely attributable to the QOF, an incentive scheme introduced in the same year to improve the identification of clinical conditions in primary care (QOF, 2019). The continually increased PRRs of T2DM between consulters with and without osteoarthritis throughout the study period bring up a concern that there might be a further increase in the burden of T2DM and a consequent increase in CVD risk in the UK population with osteoarthritis.

2.4.3 Interpretation and implication of the findings

The consistently existing highest gap in the prevalence of obesity in the youngest age group (35-44 years) between populations with and without osteoarthritis in both men and women is the main population-level health concern in terms of future health economic burden and healthy life expectancy relevant to increased CVD risk (Hecker et al., 2022). The findings are consistent with the increased prevalence of obesity in the young general population, in which low physical activity and unhealthy eating behaviours are more popular than in other age groups over the past decades (Dai et al., 2020). The higher prevalence of obesity in the young population with newly diagnosed osteoarthritis could be explained by the sharing biological pathway between obesity and osteoarthritis (Kluzek, Newton and Arden, 2015; Dickson et al., 2019; Thijssen et al., 2015). More intensive public health strategies like promoting healthy eating (Holmes, 2021), and lowering the accessibility of fast-food chains should be considered for the young population with early diagnosed osteoarthritis (Department of Health and Social Care, 2020).

Postmenopausal women have an increased CVD risk that is often due to hormonal factors (e.g., decreased cardioprotective effects of oestrogen) and accompanied by increased obesity, dyslipidaemia and hypertension (Maas and Appelman, 2010), all shared pathways with osteoarthritis (Kluzek, Newton and Arden, 2015; Dickson et al., 2019; Thijssen et al., 2015). However, the consistently existing higher gap in the prevalence of smoking and number of ≥3 CVRFs between populations with and without osteoarthritis across age groups in women compared with men implies that not only hormonal factors but also lifestyles should be a concern in women with osteoarthritis. Although the relationship between smoking and osteoarthritis has not yet been confirmed (Kong et al., 2017), the provision of stop-smoking services according to guidelines (NICE, 2021) and public health actions such as campaigns to promote smoking cessation (Department of Health, 2017), specially tailored strategies according to gender, should be considered for populations with osteoarthritis in terms of the known strong relationship between smoking and the development of CVD outcomes and mortality (Yusuf et al., 2020).

Health conditions such as hypertension and obesity are more prevalent in areas with socioeconomic deprivation and show a North-South divide, with a higher prevalence in the north of England (e.g., North East, North West, and Yorkshire & Humber) than in the south of England (e.g., South West, South East, and London) (Baker, 2019). The North-South divide was also observed in populations with osteoarthritis, with the prevalence of modifiable CVRFs tending to be higher in the north of England. Socioeconomic deprivation might increase not only CVRFs but also CVD events in populations with osteoarthritis through its negative effects on achieved education, income, health services access and resource availability (Pujades-Rodriguez et al., 2014). However, the findings from regional data used in this study might miss important variations in deprivation between smaller areas. For example, the North West of England includes not only more affluent areas but also less affluent rural areas which have varied populations (Baker, 2019). Further studies using data from a smaller-area level are required to help obtain a clearer picture of whether CVRFs are influenced by socioeconomic deprivation in populations with osteoarthritis.

2.4.4 Strengths and limitations

This is the first large-scale study to provide national prevalence estimates of modifiable CVRFs in a high-risk population, consulters with osteoarthritis, across the UK. The large sample size and long study period allowed the study of osteoarthritis populations in different age and sex groups, geographical regions and years. This enables an assessment of high-risk patient groups and may reflect on the effectiveness of regional CVD prevention strategies and the temporal effects of current clinical practice schemes. Moreover, the study controlled the potential confounding effects of age and sex with the use of matched osteoarthritis and non-osteoarthritis consulters.

The study findings had potential limitations. First, this study did not include some modifiable CVRFs such as physical inactivity, drinking and an unhealthy diet. However, this study covered five common modifiable risk factors with advantages in the completeness of recording and being managed in the primary care setting. This provides the basis for the assessment of healthcare needs for CVRF treatment. Second, there was a lack of validation of each CVRF in consulters with and without osteoarthritis specifically. No resource was available to check for misclassification and whether it is differential or not. Third, a common issue related to selection bias in EHR-based studies was also highly likely in the current study. The controls were those who consulted primary care for non-osteoarthritis reasons and might be less healthy than the general population. This might lead to an underestimated difference in the prevalence of CVRFs between consulters with osteoarthritis and controls. Fourth, the PRR reported here should not be used to indicate the causality between osteoarthritis and CVRFs as it can only tell the prevalence difference between consulters with and without osteoarthritis and there was no temporal sequence of osteoarthritis and CVRF in the current study. Although matching was used in the current study, there remained unmeasured confounders (e.g., genetics, lifestyles, environmental factors) that could explain the difference in the prevalence of CVRFs between consulters with osteoarthritis and controls. Finally, comparisons of prevalence estimates and PRRs between regions and years might be treated with caution due to the differences in various potential confounders (e.g., age and sex distribution, socio-economic deprivation, completeness of recording) that could influence the occurrence of CVRFs between regions and calendar years.

2.5 Conclusion

In conclusion, there was a consistently higher prevalence of individual and number of modifiable CVRFs in consulters with newly diagnosed osteoarthritis compared to those who have not consulted for osteoarthritis between 1992-2017. This difference between the two populations was commonly seen by age group, sex, or region. The increasing gap in the annual prevalence of hypertension, T2DM, dyslipidaemia and the number of CVRFs between the two populations was found for the first time. These estimates indicate that from a practical perspective, assessing and treating CVRFs in line with current guidelines are required in consulters for osteoarthritis. From a public health and primary care perspective, clinical effectiveness, cost-effectiveness, and acceptability of potential CVD preventive care strategies should be further addressed in the osteoarthritis population, especially osteoarthritis sub-populations with the highest CVRF prevalence. The regional difference in the prevalence of modifiable CVRFs suggests potential influences of local socioeconomic status on CVD risk in consulters for osteoarthritis. Future research to understand socioeconomic factors associated with CVD risk in osteoarthritis populations is warranted.

Chapter 3: Neighbourhood socioeconomic deprivation and the prevalence of modifiable CVRFs in primary care consulters with and without osteoarthritis

3.1 Introduction

The previous chapter provided evidence from primary care records in the UK that consulters with osteoarthritis had a persistent higher prevalence of modifiable CVRFs including current smoking, hypertension, diabetes, dyslipidaemia, obesity, and the number of risk factors than those without osteoarthritis. The variation in prevalence estimates of CVRFs by geographical region suggests that socioeconomic factors may explain some of the inequalities in the prevalence of CVRFs between consulters with and without osteoarthritis. Previous evidence from general populations has shown that neighbourhood socioeconomic deprivation is associated with an increased prevalence of CVRFs such as obesity and diabetes and its effects might be reversible (Brown, Becker & Antwi, 2016, Everson et al., 2002, Hiscock, Dobbie & Bauld, 2015, Leng et al., 2015, Pujades-Rodriguez et al., 2014). A case-control study in England and Wales has demonstrated that people with osteoarthritis with lower socioeconomic status (SES) (unskilled or partly skilled occupation groups) were more likely to have six or more clinical comorbidities including obesity than those with higher SES (professional and managerial groups) (mean difference=3.4%; 95% confidence interval (CI) 0.9 to 5.9) while the socioeconomic variation in clinical comorbidities was not marked among age- and sex-matched controls without osteoarthritis (Kadam, Jordan & Croft, 2004). Although both in the general population and osteoarthritis population, the socioeconomic inequalities in comorbidities were observed, it is not clear whether socioeconomic inequalities in the prevalence of CVRFs differ in the population with osteoarthritis compared with the population without osteoarthritis.

Since the 1970s local measures of deprivation in England have been calculated by the Department for Communities and Local Government and its predecessors. The latest version of the data extraction was the English Indices of Deprivation 2015 which update the 2010 Indices (Department for Communities and Local Government, 2015). English Indices of Deprivation 2015 focus on the national and sub-national patterns of multiple deprivations, which are based on 37 separate indicators, organised across seven distinct domains of deprivation which are combined, using appropriate weights, to calculate the Index of Multiple Deprivation 2015 (IMD 2015). The seven domains of deprivation include (1) income deprivation, (2) employment deprivation, (3) education, skills, and training deprivation, (4) health deprivation and disability, (5) crime, (6) barriers to housing and services, (7) living environment deprivation. IMD 2015 is an overall measure of multiple deprivations experienced by people living in an area and is calculated for every Lower layer Super Output Area (LSOA) (built from groups of contiguous Output Areas with clusters of adjacent unit postcodes), or neighbourhood, in England. Every such neighbourhood in England is ranked according to its level of deprivation relative to that of other areas.

With patients' consent, primary care electronic health records (EHRs) are linked to IMD 2015, which provides a unique opportunity to investigate the socioeconomic inequalities in health status or clinical outcomes (Herrett et al., 2015). Based on the primary EHRs IMD linkage, previous studies investigated the prevalence of several modifiable CVRFs by each decile/ quintile of IMD in the general population (Charlton et al., 2013, Pujades-Rodriguez et al., 2014), or incorporate IMD as a predictor in the prediction tool (e.g., QRISK3, ASSIGN) to predict the risk to develop CVD in the general population (Hippisley-Cox, Coupland & Brindle, 2017, Woodward et al., 2007). Few works using CPRD-IMD linked database have addressed the socioeconomic inequalities at the population level with measurements like slope index of inequality (SII) or relative index of inequality (RII) that are commonly used in public health evaluation (OHID, 2017). Some studies have measured the absolute and relative difference in multiple chronic conditions between the least and the most deprived group but without accounting for the size of the groups and the intermediate-deprived groups (Head et al., 2021).

This chapter describes a study that examines socioeconomic inequalities in the prevalence of modifiable CVRFs in consulters with and without osteoarthritis between 1992-2017 using large retrospective cohorts based on EHRs from a representative primary care EHR database, CPRD GOLD, linked with the patient-level English IMD 2015. The findings of this chapter will assist the understanding of whether socioeconomic inequalities in the prevalence of CVRFs differ between the population with and without osteoarthritis, which will help the following works on assessing the excess CVD risk in osteoarthritis and provide useful health information for public health practice, for example, if socioeconomic inequalities widen in the population with osteoarthritis, preventive strategies and integrated clinical care should be prioritised in the deprived population with osteoarthritis.

This work attempted to answer the following question:

- Do the socioeconomic inequalities in the prevalence of modifiable CVRFs differ between primary care consulters with and without osteoarthritis between 1992-2017?

3.2 Methods

3.2.1 Study design

The study used a retrospective incident osteoarthritis cohort aged 35 and over with linkage to English IMD 2015 data and a retrospective age-, sex-, practice-, and index year-matched non-osteoarthritis cohort derived from CPRD GOLD. CPRD GOLD is described in chapter 2. The data for this study were extracted from CPRD GOLD linked with English IMD 2015 data.

3.2.2 Case population with osteoarthritis

All individuals aged 35 and over who had an incident diagnosis of osteoarthritis between January 1992 and December 2017 with up-to-standard data and registration in CPRD GOLD for at least three years prior to the date of the incident diagnosis of osteoarthritis were eligible. Osteoarthritis was defined as a primary care consultation with a read code (e.g., N05..11) for diagnosed osteoarthritis (list of read codes for diagnosed osteoarthritis shown in Appendix 2.1). People with osteoarthritis who had a history of osteoarthritis diagnosis prior to the incident diagnosis of osteoarthritis were excluded. Individuals who transferred out or had a record of death prior to the incident diagnosis of osteoarthritis were excluded. People with osteoarthritis without a linkage to English IMD 2015 were also excluded. The date of the incident osteoarthritis consultation was the index date for inclusion in the study.

3.2.3 Control population without osteoarthritis

One control without osteoarthritis who had the linkage to English IMD 2015 was matched for each osteoarthritis individual based on age stratification (35-44, 45-54, 55-64, 65-74, 85 and over), sex, and practice by risk set sampling (identifying controls from a group of people who are at-risk at the index date of the case) (Borgan, Goldstein & Langholz, 1995). Controls were assigned an index date identical to that of matched people with osteoarthritis. Controls without osteoarthritis were defined as individuals aged 35 and over with at least one primary care consultation or clinical event (i.e., symptom, diagnosis, therapy, test, referral, immunisation) between January 1992 and December 2017 (to exclude 'ghost-patients'), with up-to-standard data and registration in CPRD GOLD for at least three years prior to the index consultation, and without a history of osteoarthritis diagnosis within three years prior to or after the index consultation. Controls without osteoarthritis who transferred out or had a record of death prior to the index consultation were excluded.

3.2.4 Measurement of socioeconomic deprivation

IMD score was calculated by the Department for Communities and Local Government departments for 32,884 Lower Super Output Areas (also called small neighbourhoods defined in England with an average population of 1,500 residents) based on seven domains of deprivation (outlined in the introduction). IMD 2015 was linked to patients' data in CPRD GOLD using the patient's postcode of residence. Deciles were calculated by ranking the 32,844 small neighbourhoods in England from the most deprived to the least deprived and dividing them into 10 equal groups. It is important to note that IMD deciles are a measure of relative deprivation to other areas and to recognise that not every individual in an area with the most deprived IMD decile will themselves be deprived or not affluent. The IMD score for a neighbourhood might change over the study period. However, census data have shown that using a fixed IMD decile allocation for small areas in England offered a stable ranking of areas (73% of England's population had not changed decile position; 12% of the population moved up and 15% moved down the ranking between 1991- 2001) (Bajekal et al., 2013).

3.2.5 Identification of CVRFs

Five modifiable CVRFs, including smoking status, obesity, hypertension, T2DM and dyslipidaemia, recorded within three years prior to the index consultation of each study participant were identified. Methods used to define single and number of these CVRFs are described in section 2.2.4 in chapter 2.

3.2.6 Measurement of socioeconomic inequalities

The study used SII and RII to quantify socioeconomic inequality in health in absolute and relative terms, respectively. Both are interpreted as the effect on the health of moving from the least to the most deprived group. They were measured using population-weighted and regression-based inequality measurements, accounting for the size of the groups and the intermediate deprived IMD groups (as described below).

Regress the prevalence on the midpoint of IMD categories, weighted by proportion in the population:

$$Prevalence = \beta_0 + \beta_1(IMD\ midpoint) + \varepsilon$$

– Slope Index of Inequality (SII) = β_1
– Relative Index of Inequality (RII) = 1 + (SII/ average of prevalence in the whole population IMD decile 1-10

Where:

$\beta_0$is the intercept of the regression line and the Y-axis
β_1 is the coefficient that relates to the midpoint of the range of the distribution of IMD;
ε is an error term.

SII is at the value zero when there is no inequality. Greater values indicate higher levels of inequality. Positive values indicate a higher concentration of a condition among the most deprived group and negative values indicate a higher concentration among the least deprived. RII is at the value one when there is no inequality. Further values from one indicate higher levels of inequality. Values larger than one indicate a concentration of a condition among the most deprived group and values smaller than one indicate a concentration among the least deprived. SIIs and RIIs were calculated using a standard analytical tool provided by England Office for Health Improvement and Disparities (OHID, 2017).

3.2.7 Statistical analyses

Analyses were performed using STATA/MP 14.2 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP). The period prevalence with 95% confidence intervals (CIs) of individual modifiable CVRFs and number of ≥1, ≥2, and ≥3 CVRFs were calculated for each deprivation decile in the osteoarthritis and non-osteoarthritis cohorts between 1992 and 2017. Complete case analyses for obesity and number of ≥1, ≥2 and ≥3 CVRFs were performed in subjects with BMI recorded within three years prior to the index consultation.

The SII and RII for each modifiable CVRF were also stratified by age groups (35-44, 45-54, 55-64, 65-74, 75-84, 85+), sex (male and female), region, and each calendar year of the index consultation (1992-2017) in this study.

To deal with the missing data on BMI (used to define obesity), multiple imputation process was used in this study. Although it could not be confirmed that values such as BMI in the current study were missing at random, multiple imputation was still selected to check whether the missingness changes the study results as there were no resources to trace people with missing values using EHRs. Chained equations were carried out to impute BMI using all other variables in the dataset, such as age, sex, region, index year of consultation, IMD, smoking status, and diabetes, as covariates. This generated 13 imputations based on the fraction of those without complete data among all subjects (Rubin, 1987). The results of analyses based on imputed data were compared with that of the complete case analysis.

Summary of study methods:

- The study used CPRD GOLD database linked with England patient-level index of multiple deprivation 2015 database.
- 1:1 Age-, sex-, practice- and index year-matched osteoarthritis and non-osteoarthritis cohorts were derived.
- Period prevalence of individual and multiple modifiable CVRFs by IMD decile in each cohort between 1992-2017 was estimated,
- Slope index of inequality (SII) and the relative index of inequality (RII) were used to measure socioeconomic inequalities in the prevalence of modifiable CVRFs between 1992-2017 in each cohort.
- Stratified SII and RII by age, sex, geographical region, and index year were estimated in each cohort.
- To handle the missing values, analyses were repeated based on imputed data.

3.3 Results

3.3.1 Characteristics of the study population

Between 1992 and 2017, 215,190 of 409,791 consulters with incident physician-diagnosed osteoarthritis and aged 35 and over from the CPRD GOLD were 1:1 matched with controls without osteoarthritis (as the samples used in chapter 2). Among them, 109,142 (50.72%) sets of cases and controls who give consent to their linkage to English IMD 2015 were included in this study (Figure 3.1).

Characteristics of osteoarthritis cases and controls without osteoarthritis in CPRD GOLD (included in the chapter 2 study) and those included in this study (CPRD GOLD linked IMD 2015) were presented in Table 3.1. Population characteristics like age and sex distribution were similar between the study population with and without IMD linkage. The final study population with IMD linkage included 109,142 sets of cases and controls whose characteristics were presented in Table 3.2. The mean age was 62 years, and the proportion of the female gender was 66% both for the whole study population with and without osteoarthritis. The distribution of socioeconomic deprivation levels (IMD deciles) was similar between populations with and without osteoarthritis, for example, the proportion of the least and most deprived deciles was 12.34% and 7.72%, respectively, in the population with osteoarthritis, and 12.55% and 7.43% in population without osteoarthritis.

Figure 3.1 Flow chart of the study subjects. OA, osteoarthritis; CPRD, Clinical Practice Research Datalink; IMD, Index of Multiple Deprivation; BMI, body mass index; N in the source of non-OA controls=507,352.

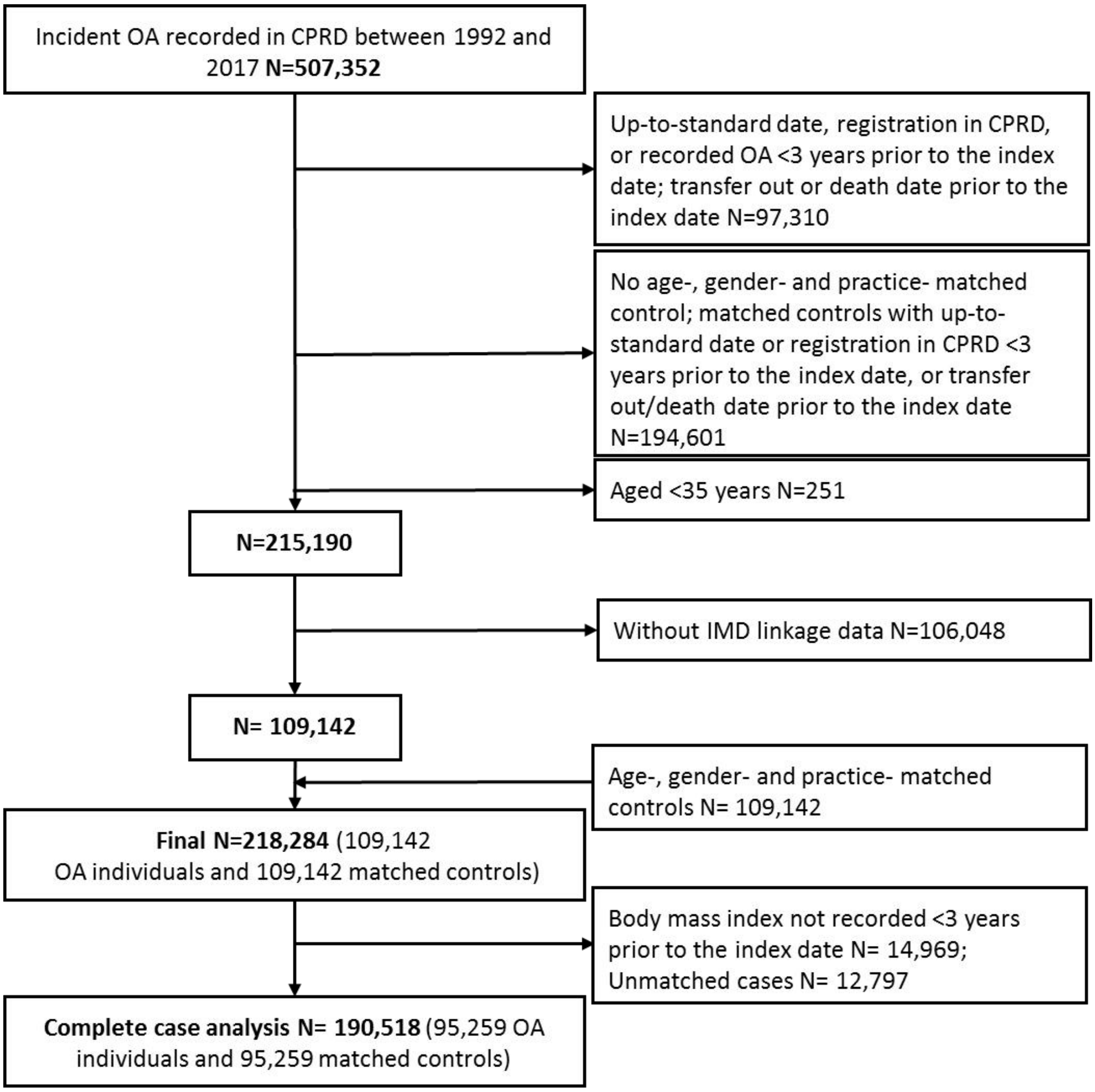


Table 3.1. Characteristics of incident OA consulters aged ≥35 in CPRD, 1992-2017

	OA	Non-OA	OA	Non-OA
No. patients	215190	215190	109142	109142
Age				
mean ± SD years	62.62 ± 11.53	62.41±11.87	62.65 ± 11.39	62.39± 11.60
35-44, n (%)	11360 (5.28)	11360 (5.28)	5614 (5.14)	5614 (5.14)
45-54, n (%)	43852 (20.38)	43852 (20.38)	21847 (20.02)	21847 (20.02)
55-64, n (%)	69988 (32.52)	69988 (32.52)	35992 (32.98)	35992 (32.98)
65-74, n (%)	53631 (24.92)	53631 (24.92)	27567 (25.26)	27567 (25.26)
75-84, n (%)	31030 (14.42)	31030 (14.42)	15890 (14.56)	15890 (14.56)
85+, n (%)	5329 (2.48)	5329 (2.48)	2232 (2.05)	2232 (2.05)
Sex, n (%)				
Female	139426 (64.79)	139426 (64.79)	72051 (66.02)	72051 (66.02)
Male	75764 (35.21)	75764 (35.21)	37091 (33.98)	37091 (33.98)
Region, n (%)				
North East	4593 (2.13)	4593 (2.13)	3427 (3.14)	3427 (3.14)
North West	27200 (12.64)	27205 (12.64)	19441 (17.81)	19441 (17.81)
Yorkshire & The Humber	9277 (4.31)	9275 (4.31)	6073 (5.56)	6073 (5.56)
East Midlands	8960 (4.16)	8957 (4.16)	4353 (3.99)	4353 (3.99)
West Midlands	22256 (10.34)	22250 (10.34)	15295 (14.01)	15295 (14.01)
East of England	18103 (8.41)	18101 (8.41)	12567 (11.51)	12567 (11.51)
South West	18251 (8.48)	18249 (8.48)	12616 (11.56)	12616 (11.56)
South Central	20656 (9.60)	20655 (9.60)	12289 (11.26)	12289 (11.26)
London	15763 (7.33)	15767 (7.33)	9836 (9.01)	9836 (9.01)
South East Coast	19290 (8.96)	19294 (8.97)	13245 (12.14)	13245 (12.14)
Northern Ireland	6430 (2.99)	6434 (2.99)	-	-
Scotland	20521 (9.54)	20519 (9.54)	-	-
Wales	23890 (11.10)	23891 (11.10)	-	-
Calendar year of index consultation, n (%)				
1992	905 (0.42)	905 (0.42)	448 (0.41)	448 (0.41)
1993	2362 (1.10)	2362 (1.10)	1374 (1.26)	1374 (1.26)

1994	2970 (1.38)	2970 (1.38)	1589 (1.46)	1589 (1.46)
1995	3248 (1.51)	3248 (1.51)	1697 (1.55)	1697 (1.55)
1996	3879 (1.80)	3879 (1.80)	2089 (1.91)	2089 (1.91)
1997	4522 (2.10)	4522 (2.10)	2460 (2.25)	2460 (2.25)
1998	5031 (2.34)	5031 (2.34)	2775 (2.54)	2775 (2.54)
1999	5478 (2.55)	5478 (2.55)	3143 (2.88)	3143 (2.88)
2000	5572 (2.59)	5572 (2.59)	3179 (2.91)	3179 (2.91)
2001	6074 (2.82)	6074 (2.82)	3473 (3.18)	3473 (3.18)
2002	7248 (3.37)	7248 (3.37)	4244 (3.89)	4244 (3.89)
2003	9449 (4.39)	9449 (4.39)	5552 (5.09)	5552 (5.09)
2004	11210 (5.21)	11210 (5.21)	6393 (5.86)	6393 (5.86)
2005	12952 (6.02)	12952 (6.02)	7216 (6.61)	7216 (6.61)
2006	13720 (6.38)	13720 (6.38)	7388 (6.77)	7388 (6.77)
2007	15946 (7.41)	15946 (7.41)	8290 (7.60)	8290 (7.60)
2008	18391 (8.55)	18391 (8.55)	9571 (8.77)	9571 (8.77)
2009	15698 (7.29)	15698 (7.29)	8150 (7.47)	8150 (7.47)
2010	12890 (5.99)	12890 (5.99)	6452 (5.91)	6452 (5.91)
2011	11314 (5.26)	11314 (5.26)	5456 (5.00)	5456 (5.00)
2012	9718 (4.52)	9718 (4.52)	4503 (4.13)	4503 (4.13)
2013	8738 (4.06)	8738 (4.06)	3820 (3.50)	3820 (3.50)
2014	8245 (3.83)	8245 (3.83)	3294 (3.02)	3294 (3.02)
2015	7470 (3.47)	7470 (3.47)	2788 (2.55)	2788 (2.55)
2016	6358 (2.95)	6358 (2.95)	2028 (1.86)	2028 (1.86)
2017	5802 (2.70)	5802 (2.70)	1770 (1.62)	1770 (1.62)

OA, osteoarthritis; SD, standard deviation

Table 3.2. Characteristics of the study population

		Overall		Complete case analysis	
OA status		OA	Non-OA	OA	Non-OA
No. patients		109142	109142	95259	95259
Age					
	mean ± SD years	62.65 ± 11.39	62.39± 11.60	62.48 ± 11.06	62.22± 11.27
	35-44, n (%)	5614 (5.14)	5614 (5.14)	4619 (4.85)	4619 (4.85)
	45-54, n (%)	21847 (20.02)	21847 (20.02)	18952 (19.9)	18952 (19.9)
	55-64, n (%)	35992 (32.98)	35992 (32.98)	32356 (33.97)	32356 (33.97)
	65-74, n (%)	27567 (25.26)	27567 (25.26)	24698 (25.93)	24698 (25.93)
	75-84, n (%)	15890 (14.56)	15890 (14.56)	13145 (13.80)	13145 (13.80)
	85+, n (%)	2232 (2.05)	2232 (2.05)	1489 (1.56)	1489 (1.56)
Sex, n (%)					
	Male	37091 (33.98)	37091 (33.98)	31074 (32.62)	31074 (32.62)
	Female	72051 (66.02)	72051 (66.02)	64185 (67.38)	64185 (67.38)
IMD decile					
	1	13448 (12.34)	13686 (12.55)	11847 (12.45)	12145 (12.76)
	2	12173 (11.17)	12706 (11.65)	10644 (11.18)	11157 (11.72)
	3	12195 (11.19)	12445 (11.41)	10640 (11.18)	10884 (11.43)
	4	12750 (11.7)	12650 (11.6)	11077 (11.64)	10935 (11.49)
	5	12606 (11.56)	12726 (11.67)	10905 (11.46)	11033 (11.59)
	6	10389 (9.53)	10344 (9.49)	9066 (9.53)	9040 (9.50)
	7	10042 (9.21)	9837 (9.02)	8766 (9.21)	8567 (9.00)
	8	8840 (8.11)	8672 (7.95)	7746 (8.14)	7611 (8.00)
	9	8162 (7.49)	7872 (7.22)	7189 (7.55)	6806 (7.15)
	10	8413 (7.72)	8100 (7.43)	7284 (7.65)	7009 (7.36)
Region, n (%)					
	North East	3427 (3.14)	3427 (3.14)	2891 (3.03)	2891 (3.03)
	North West	19441 (17.81)	19441 (17.81)	17095 (17.95)	17095 (17.95)

	Yorkshire & The Humber	6073 (5.56)	6073 (5.56)	5296 (5.56)	5296 (5.56)
	East Midlands	4353 (3.99)	4353 (3.99)	3823 (4.01)	3823 (4.01)
	West Midlands	15295 (14.01)	15295 (14.01)	13565 (14.24)	13565 (14.24)
	East of England	12567 (11.51)	12567 (11.51)	10751 (11.29)	10751 (11.29)
	South West	12616 (11.56)	12616 (11.56)	10967 (11.51)	10967 (11.51)
	South Central	12289 (11.26)	12289 (11.26)	10601 (11.13)	10601 (11.13)
	London	9836 (9.01)	9836 (9.01)	8655 (9.09)	8655 (9.09)
	South East Coast	13245 (12.14)	13245 (12.14)	11615 (12.19)	11615 (12.19)
By calendar year, n (%)					
	1992	448 (0.41)	448 (0.41)	315 (0.33)	315 (0.33)
	1993	1374 (1.26)	1374 (1.26)	971 (1.02)	971 (1.02)
	1994	1589 (1.46)	1589 (1.46)	1182 (1.24)	1182 (1.24)
	1995	1697 (1.55)	1697 (1.55)	1301 (1.37)	1301 (1.37)
	1996	2089 (1.91)	2089 (1.91)	1660 (1.74)	1660 (1.74)
	1997	2460 (2.25)	2460 (2.25)	2021 (2.12)	2021 (2.12)
	1998	2775 (2.54)	2775 (2.54)	2286 (2.40)	2286 (2.40)
	1999	3143 (2.88)	3143 (2.88)	2637 (2.77)	2637 (2.77)
	2000	3179 (2.91)	3179 (2.91)	2698 (2.83)	2698 (2.83)
	2001	3473 (3.18)	3473 (3.18)	2962 (3.11)	2962 (3.11)
	2002	4244 (3.89)	4244 (3.89)	3657 (3.84)	3657 (3.84)
	2003	5552 (5.09)	5552 (5.09)	4778 (5.02)	4778 (5.02)
	2004	6393 (5.86)	6393 (5.86)	5606 (5.89)	5606 (5.89)
	2005	7216 (6.61)	7216 (6.61)	6311 (6.63)	6311 (6.63)
	2006	7388 (6.77)	7388 (6.77)	6502 (6.83)	6502 (6.83)
	2007	8290 (7.60)	8290 (7.60)	7342 (7.71)	7342 (7.71)
	2008	9571 (8.77)	9571 (8.77)	8478 (8.90)	8478 (8.90)
	2009	8150 (7.47)	8150 (7.47)	7276 (7.64)	7276 (7.64)
	2010	6452 (5.91)	6452 (5.91)	5783 (6.07)	5783 (6.07)
	2011	5456 (5.00)	5456 (5.00)	4933 (5.18)	4933 (5.18)
	2012	4503 (4.13)	4503 (4.13)	4090 (4.29)	4090 (4.29)
	2013	3820 (3.50)	3820 (3.50)	3441 (3.61)	3441 (3.61)
	2014	3294 (3.02)	3294 (3.02)	2994 (3.14)	2994 (3.14)
	2015	2788 (2.55)	2788 (2.55)	2543 (2.67)	2543 (2.67)
	2016	2028 (1.86)	2028 (1.86)	1860 (1.95)	1860 (1.95)
	2017	1770 (1.62)	1770 (1.62)	1632 (1.71)	1632 (1.71)

87.28% of the overall study population had complete data on BMI, which yields a sample with 95,259 sets of cases and controls as the complete dataset. Characteristics of the population in the complete database were similar in terms of age, sex and the index of consultation year to those in the overall study population (Table 3.2).

3.3.2 Socioeconomic inequality in modifiable CVRFs in consulters with and without osteoarthritis

Socioeconomic inequalities in the prevalence of single CVRF in both populations were common and widened in those with osteoarthritis (Figure 3.1 & 3.3). The SII for the period prevalence of current smoking was 18.63 (95%CI: 17.75, 19.51) % cf. 15.83 (14.96, 16.65) %, for hypertension was 4.64 (3.64, 5.63) % cf. 3.80 (2.88, 4.72) %, for T2DM was 5.47 (4.91, 6.04) % cf. 4.09 (3.52, 4.67) %, and for obesity was 18.81 (17.74, 19.89) % cf. 15.68 (14.62, 16.73) % in the population with and without osteoarthritis, respectively. The RII for current smoking was 2.29 (2.19, 2.39) cf. 2.29 (2.18, 2.41), for hypertension was 1.13 (1.10, 1.16) cf. 1.13 (1.10, 1.17), for T2DM was 2.00 (1.85, 2.17) cf. 1.65 (1.53, 1.77), and for obesity was 1.65 (1.60, 1.70) cf. 1.60 (1.55, 1.66) in the population with and without osteoarthritis, respectively. Reversed socioeconomic inequalities for dyslipidaemia were observed in both populations and particularly widened in those without osteoarthritis, with -1.16 (-2.11, -0.19) % and -4.11 (-5.12, -3.12) of SII, 0.98 (0.97, 1.00) and 0.94 (0.92, 0.95) of RII in the population with and without osteoarthritis, respectively (Table 3.3).

The socioeconomic inequalities for number of CVRFs were also observed in both populations, and the inequality for number of ≥2 and ≥3 CVRFs widened in the population with osteoarthritis (Figure 3.1 & 3.3), as the SII for the prevalence of number of ≥1, ≥2, and ≥3 CVRFs was 5.69 (5.04, 6.34)%, 19.26 (18.18, 20.33)%, 15.96 (15.00, 16.93)% in the population with osteoarthritis, and 6.22 (5.46, 6.99)%, 15.41 (14.31, 16.54)% and 11.39 (10.48, 12.30)% in the population without osteoarthritis; RII was 1.06 (1.06, 1.07), 1.39 (1.37, 1.42), and 1.95 (1.86, 2.03) in the population with osteoarthritis, and 1.07 (1.07, 1.08), 1.37 (1.34, 1.40), and 1.79 (1.71, 1.88) in the population without osteoarthritis (Table 3.3).

Table 3.3. Measures of inequality in the period prevalence of modifiable CVRF in OA and non-OA samples, 1992-2017

Risk factors	OA status	Period prevalence (95%CI) by IMD decile										Slope index of inequality (95%CI) (%)	Relative index of inequality (95%CI)
		1 (Least deprived)	2	3	4	5	6	7	8	9	10 (Most deprived)		
Current smoking	OA	16.98 (16.35, 17.62)	19.22 (18.53, 19.93)	19.57 (18.86, 20.28)	21.4 (20.69, 22.12)	21.74 (21.02, 22.47)	24.18 (23.36, 25.01)	25.53 (24.68, 26.4)	29.67 (28.72, 30.64)	31.41 (30.41, 32.43)	37.19 (36.16, 38.24)	**18.63 (17.75, 19.51)**	**2.29 (2.19, 2.39)**
	Non-OA	14.49 (13.9, 15.09)	15.76 (15.13, 16.4)	16.87 (16.22, 17.54)	18.36 (17.68, 19.04)	19.16 (18.48, 19.85)	20.86 (20.08, 21.66)	22.38 (21.56, 23.22)	24.31 (23.41, 25.23)	26.83 (25.85, 27.82)	31.65 (30.64, 32.68)	**15.83 (14.96, 16.65)**	**2.29 (2.18, 2.41)**
Hypertension	OA	34.06 (33.26, 34.87)	36.18 (35.32, 37.04)	37.27 (36.41, 38.13)	37.04 (36.2, 37.88)	37.29 (36.45, 38.14)	37 (36.07, 37.94)	37.55 (36.6, 38.51)	39.82 (38.8, 40.85)	39.5 (38.44, 40.57)	38.3 (37.26, 39.35)	**4.64 (3.64, 5.63)**	**1.13 (1.10, 1.16)**
	Non-OA	28.37 (27.62, 29.14)	30.03 (29.23, 30.83)	30.34 (29.53, 31.16)	29.76 (28.97, 30.57)	29.04 (28.26, 29.84)	31.31 (30.42, 32.22)	31.15 (30.23, 32.07)	31.55 (30.57, 32.54)	32.51 (31.47, 33.56)	32.43 (31.41, 33.46)	**3.80 (2.88, 4.72)**	**1.13 (1.10, 1.17)**
Type 2 diabetes mellitus	OA	5.52 (5.14, 5.92)	6.92 (6.47, 7.38)	7.68 (7.21, 8.16)	7.33 (6.88, 7.79)	8.07 (7.6, 8.56)	8.23 (7.71, 8.77)	9.04 (8.49, 9.62)	9.97 (9.35, 10.61)	10.55 (9.89, 11.24)	11.27 (10.6, 11.96)	**5.47 (4.91, 6.04)**	**2.00 (1.85, 2.17)**
	Non-OA	6.38 (5.98, 6.8)	7.49 (7.04, 7.96)	7.96 (7.49, 8.44)	7.77 (7.31, 8.25)	7.57 (7.11, 8.04)	8.87 (8.32, 9.43)	9.19 (8.63, 9.78)	9.92 (9.3, 10.57)	10.38 (9.71, 11.07)	10.25 (9.59, 10.93)	**4.09 (3.52, 4.67)**	**1.65 (1.53, 1.77)**
Dyslipidaemia	OA	71.02 (70.25, 71.79)	70.11 (69.29, 70.93)	71.16 (70.35, 71.96)	69.44 (68.63, 70.23)	69.13 (68.31, 69.93)	69.8 (68.91, 70.69)	70.48 (69.58, 71.37)	69.66 (68.69, 70.62)	70.35 (69.35, 71.34)	69.38 (68.38, 70.36)	**-1.16 (-2.11, -0.19)**	0.98 (0.97, 1.00)

	Non-OA	66.68 (65.88, 67.47)	67.05 (66.23, 67.87)	65.97 (65.13, 66.8)	63.73 (62.89, 64.57)	64.47 (63.63, 65.3)	64.71 (63.78, 65.64)	64.29 (63.33, 65.24)	64.78 (63.77, 65.79)	62.82 (61.74, 63.89)	62.83 (61.76, 63.88)	**-4.11 (-5.12, -3.12)**	**0.94 (0.92, 0.95)**
Obesity	OA	29.1 (28.28, 29.92)	34.29 (33.39, 35.2)	35.86 (34.95, 36.78)	35.89 (35, 36.8)	36.92 (36.01, 37.83)	40.49 (39.48, 41.51)	41.96 (40.92, 43)	44.31 (43.2, 45.42)	46.7 (45.54, 47.86)	47.64 (46.49, 48.79)	**18.81 (17.74, 19.89)**	**1.65 (1.60, 1.70)**
	Non-OA	26.93 (26.15, 27.73)	29.38 (28.54, 30.24)	31.67 (30.8, 32.55)	32.19 (31.31, 33.08)	32.85 (31.97, 33.73)	35.12 (34.14, 36.12)	37.39 (36.36, 38.42)	38.84 (37.74, 39.94)	41.18 (40.01, 42.36)	41.49 (40.33, 42.65)	**15.68 (14.62, 16.73)**	**1.60 (1.55, 1.66)**
≥1 CVRF	OA	88.07 (87.48, 88.65)	89.12 (88.51, 89.71)	90.13 (89.55, 90.69)	89.47 (88.89, 90.04)	89.72 (89.14, 90.28)	90.45 (89.82, 91.05)	91.71 (91.11, 92.28)	92.59 (91.98, 93.16)	93.23 (92.62, 93.8)	93.71 (93.13, 94.26)	**5.69 (5.04, 6.34)**	**1.06 (1.06, 1.07)**
	Non-OA	83.32 (82.64, 83.98)	85.38 (84.71, 86.03)	85.65 (84.98, 86.3)	85.45 (84.78, 86.11)	85.43 (84.76, 86.09)	86.6 (85.88, 87.3)	87.37 (86.65, 88.07)	88.52 (87.78, 89.22)	88.97 (88.2, 89.7)	90.3 (89.58, 90.98)	**6.22 (5.46, 6.99)**	**1.07 (1.07, 1.08)**
≥2 CVRF	OA	49.43 (48.53, 50.33)	53.92 (52.97, 54.87)	56.38 (55.43, 57.33)	56.5 (55.57, 57.42)	56.55 (55.62, 57.49)	59.85 (58.83, 60.86)	61.58 (60.55, 62.6)	64.76 (63.68, 65.82)	66.43 (65.33, 67.53)	69.74 (68.67, 70.8)	**19.26 (18.18, 20.33)**	**1.39 (1.37, 1.42)**
	Non-OA	42.84 (41.96, 43.73)	46.29 (45.37, 47.22)	47.39 (46.45, 48.33)	48 (47.06, 48.94)	48.57 (47.64, 49.51)	51.19 (50.16, 52.23)	52.35 (51.29, 53.41)	54.43 (53.31, 55.56)	56.85 (55.66, 58.03)	58.65 (57.49, 59.81)	**15.41 (14.31, 16.54)**	**1.37 (1.34, 1.40)**
≥3 CVRF	OA	17.47 (16.79, 18.17)	21.21 (20.44, 22)	22.97 (22.17, 23.78)	22.45 (21.68, 23.24)	23.81 (23.01, 24.62)	25.49 (24.6, 26.4)	26.81 (25.88, 27.75)	30.33 (29.3, 31.36)	32.4 (31.32, 33.49)	33.66 (32.58, 34.76)	**15.96 (15.00, 16.93)**	**1.95 (1.86, 2.03)**
	Non-OA	15.68 (15.03, 16.34)	17.51 (16.81, 18.23)	18.43 (17.71, 19.17)	18.1 (17.38, 18.83)	18.83 (18.1, 19.57)	20.92 (20.08, 21.77)	22.45 (21.57, 23.35)	24 (23.05, 24.98)	25.17 (24.14, 26.22)	27.31 (26.27, 28.37)	**11.39 (10.48, 12.30)**	**1.79 (1.71, 1.88)**

CVRF, cardiovascular risk factor; OA, osteoarthritis; 95%CI, 95% confidence interval; Estimates in **bold**, statistically significant

Figure 3.2. Slope index of inequality in the period prevalence of modifiable CVRFs in OA and non-OA samples, 1992-2017. CVRF, cardiovascular risk factors; OA, osteoarthritis; T2DM, type 2 diabetes mellitus

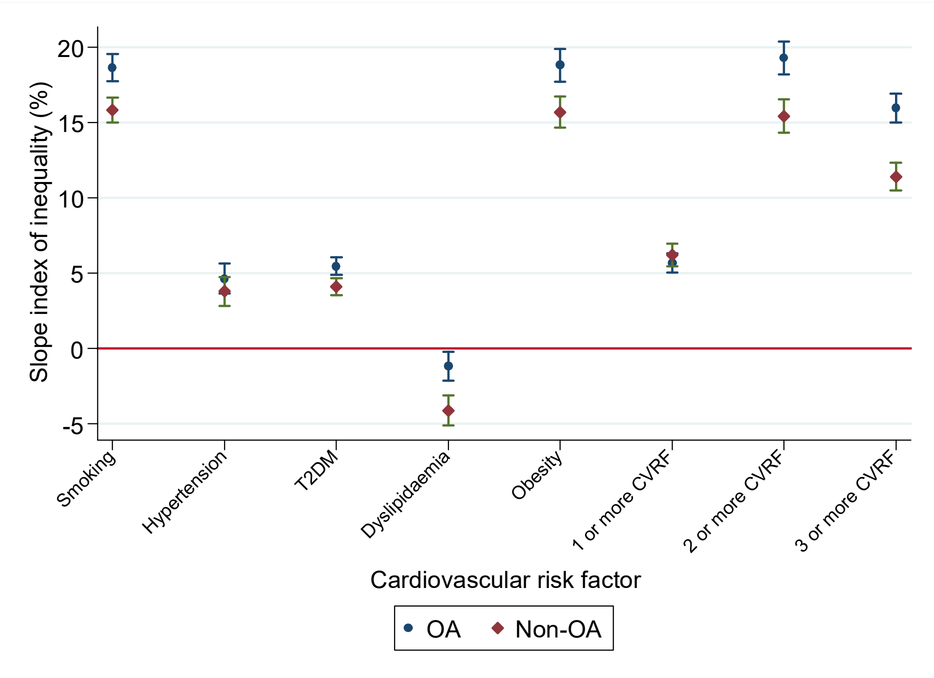
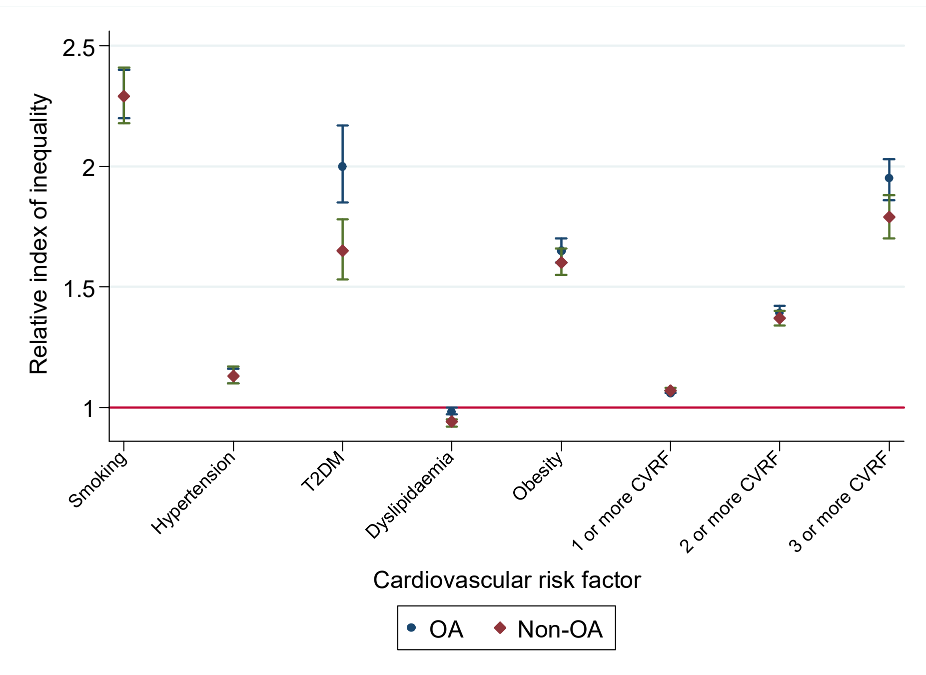


Figure 3.3. Relative index of inequality in the period prevalence of modifiable CVRFs in OA and non-OA samples, 1992-2017. CVRF, cardiovascular risk factor; OA, osteoarthritis; T2DM, type 2 diabetes mellitus



3.3.3 Socioeconomic inequality in modifiable CVRFs in consulters with and without osteoarthritis by age, gender, region and year

Inequality in single CVRF by age and gender subgroups

Socioeconomic inequalities in single CVRF were commonly observed in different age groups both in populations with and without osteoarthritis and widened in the population with osteoarthritis (Appendix 3.1.1-3.1.5). The highest socioeconomic inequality in current smoking, hypertension, T2DM, obesity and dyslipidaemia was found in the 35-44, 45-54, 55-64, 35-44, and 45-54 years old groups, respectively (Appendix 3.1.1-3.1.5).

Socioeconomic inequalities in single CVRF were found in both genders in both populations with and without osteoarthritis and generally widened in women with osteoarthritis (Appendix 3.1.1-3.1.5). An inverse inequality was observed for dyslipidaemia in both genders in both populations with and without osteoarthritis and widened in men without osteoarthritis (Appendix 3.1.8).

Inequality in single CVRF by region

Socioeconomic inequalities in single CVRF varied by English geographical region both in populations with and without osteoarthritis, and widened in the population with osteoarthritis, particularly in Northern regions (Appendix 3.1.1-3.1.5). For example, the SII for the prevalence of current smoking and dyslipidaemia was 20.87 (16.96, 24.61) % and 5.96 (1.8, 10.19) %, respectively, in Yorkshire and the Humber, and 10.76 (8.11, 13.36) % and -1.41 (-4.26, 1.44) % in South Central, within the population with osteoarthritis; 18.39 (14.69, 21.99) % and -1.61 (-5.88, 2.77) % in Yorkshire and the Humber, and 15.09 (11.83, 18.3) % and -2.68 (-5.74, 0.27) % in South Central, within the population without osteoarthritis. Correspondently, RII was 2.38 (2, 2.89) and 1.09 (1.03, 1.16) in Yorkshire and the Humber, and 1.66 (1.46, 1.9) and 0.98 (0.94, 1.02) in South Central, within the population with osteoarthritis; 2.60 (2.12, 3.26) and 0.97 (0.91, 1.04) in Yorkshire and the Humber, and 1.68 (1.46, 1.95) and 0.96 (0.92, 1.01) in South Central, within the population without osteoarthritis.

Inequality in single CVRF by year

Socioeconomic inequalities in single CVRF varied between 1992-2017 both in the population with and without osteoarthritis, especially increased in the population with osteoarthritis (Appendix 3.1.1-3.1.5). For example, the SII for the prevalence of current smoking, hypertension, and T2DM increased from 15.07 (0.71, 29.16) %, -1.51 (-16.02, 12.42) %, and 1.51 (-1.57, 4.6) % at the start of the study to 25.44 (18.39, 32.56) %, 5.76 (-2.48, 13.82) %, and 9.00 (3.55, 14.46) % in 2017, within the population with osteoarthritis; increased from 8.64 (-2.16, 19.11) %, -1.99 (-15.83, 11.97) %, and 2.42 (-1.9, 6.77) % at the start of the study to 23.18 (15.77, 30.48) %, 8.82 (0.91, 16.76) %, and 5.84 (0.74, 10.82) % in 2017, within the population without osteoarthritis. RII increased from 2.13 (1.02, 6.08), 0.95 (0.54, 1.63), and 2.05 (-14.29, 20.94) at the start of the study to 3.38 (2.32, 5.56), 1.17 (0.94, 1.46), and 2.30 (1.36, 4.52) in 2017 within the population with osteoarthritis; increased from 2.11 (0.86, 8.72), 0.91 (0.46, 1.78), and 1.70 (0.63, 6.37) at the start of the study to 2.77 (1.96, 4.2), 1.32 (1.03, 1.69), and 1.88 (1.07, 3.67) in 2017, within the population without osteoarthritis (Appendix 3.1.1-3.1.5).

Inequality in number of CVRFs by age and gender subgroups

Socioeconomic inequalities in the number of CVRFs were commonly observed in different age groups both in populations with and without osteoarthritis and widened in the population with osteoarthritis for number of ≥2 and ≥3 CVRFs (Appendix 3.1.6-3.1.8). The highest socioeconomic inequality for number of ≥1, ≥2, and ≥3 CVRFs was found in the 35-44, 45-54, and 55-64 years old groups, respectively, with 17.54 (13.83, 21.41) %, 26.71 (24.29, 29.12) %, and 19.15 (17.48, 20.85) % of SII, 1.24 (1.18, 1.30), 1.65 (1.57, 1.73) and 2.16 (2.02, 2.33) of RII in the population with osteoarthritis; 22.45 (18.01, 26.73), 19.95 (17.47, 22.4)% and 13.4 (11.83, 14.96) % of SII, 1.35 (1.27, 1.43), 1.55 (1.47, 1.64) and 1.93 (1.78, 2.10) of RII in the population without osteoarthritis (Appendix 3.1.6-3.1.8).

Socioeconomic inequalities in number of CVRFs were found in both genders in both populations with and without osteoarthritis and generally widened in women with osteoarthritis (Appendix 3.1.6-3.1.8). The SII for the prevalence of number of ≥1, ≥2, and ≥3 CVRFs was 4.89 (3.82, 6.02) %, 16.18 (14.39, 17.91) %, and 13.04 (11.53, 14.56) % in men and 5.75 (4.95, 6.53) %,19.53 (18.3, 20.77) % and 15.96 (14.89, 17.04) % in women, within the population with osteoarthritis; 1.26 (-0.05, 2.61) %, 7.43 (5.64, 9.19) % and 9.96 (8.45, 11.49) % in men and 5.55 (4.6, 6.5) %, 16.42 (15.16, 17.68) % and10.19 (9.26, 11.12) % in women, within the population without osteoarthritis. The RII for number of ≥1, ≥2, and ≥3 CVRFs was 1.06 (1.04, 1.07), 1.34 (1.29, 1.38) and 1.75 (1.63, 1.87) in men and 1.07 (1.06, 1.08), 1.42 (1.39, 1.45) and 2.03 (1.93, 2.14) in women, within the population with osteoarthritis; 1.02 (1, 1.03), 1.15 (1.11, 1.19) and 1.52 (1.42, 1.63) in men and 1.07 (1.06, 1.08), 1.46 (1.42, 1.51) and 1.95 (1.83, 2.09) in women, within the population without osteoarthritis.

Inequality in number of CVRFs by region

Socioeconomic inequalities in the number of CVRFs varied over English geographical regions both in populations with and without osteoarthritis, and widened in the population with osteoarthritis, particularly in Northern regions (Appendix 3.1.6-3.1.8). For example, the SII for the prevalence of number of ≥1, ≥2, and ≥3 CVRFs was 8.31 (4.7, 11.93)%, 32.30 (25.96, 38.47) % and 22.97 (17.34, 28.61) % respectively, in North East, and 4.52 (2.54, 6.41) %, 17.12 (13.87, 20.28) % and 14.51 (11.63, 17.43) % in South West, within the population with osteoarthritis; 9.71 (5.52, 13.84)%, 22.59 (16.11, 28.97) % and 11.37 (6.09, 16.9) % in North East, and 4.75 (2.55, 6.98) %, 12.66 (9.37, 15.93) % and 10.66 (7.89, 13.38) % in South West, within the population without osteoarthritis. Correspondently, RII was 1.09 (1.05, 1.14), 1.71 (1.53, 1.91) and 2.53 (1.98, 3.31) in North East, and 1.05 (1.03, 1.07), 1.34 (1.27, 1.42) and 1.83 (1.61, 2.08) in South West, within the population with osteoarthritis; 1.12 (1.06, 1.17), 1.54 (1.36, 1.75) and 1.71 (1.31, 2.24) in North East, and 1.06 (1.03, 1.08), 1.29 (1.21, 1.38) and 1.70 (1.48, 1.96) in South West, within the population without osteoarthritis.

Inequality in number of CVRFs by year

Socioeconomic inequalities in number of CVRFs increased between 1992-2017 both in populations with and without osteoarthritis, especially widened in the population with osteoarthritis (Appendix 3.1.6-3.1.8). The SII for the prevalence of number of ≥1, ≥2, and ≥3 CVRFs increased from 1.22 (-11.76, 14.12) %, 18.87 (-0.53, 38.24) % and 8.61 (-6.18, 23.25) %

in 1992 to 6.60 (1.32, 11.76) %, 28.24 (20.07, 36.59) % and 17.85 (10.19, 25.77) % in 2017, within the population with osteoarthritis; increased from 6.38 (-9.61, 22.45) %, 1.72 (-17.63, 21.04) % and 1.63 (-12.45, 15.39) % in 1992 to 7.32 (1.67, 13.04) %, 24.15 (15.5, 32.58) % and 16.75 (9.48, 24.17) % in 2017, within the population without osteoarthritis. Correspondently, RII increased from 1.01 (0.88, 1.18), 1.47 (0.99, 2.33) and 1.81 (0.61, 8.22) in 1992 to 1.08 (1.02, 1.14), 1.64 (1.41, 1.92) and 1.95 (1.45, 2.76) in 2017 within the population with osteoarthritis; increased from 1.08 (0.89, 1.32), 1.05 (0.61, 1.81) and 1.12 (0.37, 3.88) in 1992 to 1.09 (1.02, 1.16), 1.56 (1.33, 1.85) and 2.12 (1.5, 3.16) in 2017, within population without osteoarthritis (Appendix 3.1.6-3.1.8).

3.3.4 Estimates based on imputed data

The proportion of the study population without a record of BMI was 12.72%. A multiple imputation process was applied to impute the BMI, considering deprivation deciles, osteoarthritis status, and other characteristics (e.g., age, sex, year of index consultation, current smoking, hypertension, and T2DM). Measures of inequality for obesity, and number of (≥1, ≥2 and ≥3) CVRFs and subgroup analyses were then repeated using the imputed BMI and lipid data.

Results based on imputed data did not differ from that based on the complete data in earlier analyses. The imputed inequality measures also showed that inequalities were observed in both populations with and without osteoarthritis and widened in those with osteoarthritis (Table 3.4). The imputed SII for the prevalence of obesity, and number of ≥1, ≥2, and ≥3 CVRFs was 17.66 (16.68, 18.65) %, 5.46 (4.84, 6.10) %, 18.40 (17.39, 19.40) % and 14.96

(14.07, 15.83) % in the population with osteoarthritis; 13.62 (12.68, 14.56) %, 4.09 (3.33, 4.85) %,13.35 (12.31, 14.36) % and 10.09 (9.28, 10.91) % in the population without osteoarthritis. The imputed RII for obesity, and number of ≥1, ≥2, and ≥3 CVRFs was 1.64 (1.60, 1.69), 1.06 (1.06, 1.07), 1.39 (1.36, 1.41), and 1.93 (1.85, 2.01) in the population with osteoarthritis; 1.57 (1.52, 1.62), 1.05 (1.04, 1.06), 1.33 (1.30, 1.36), and 1.74 (1.66, 1.83) in the population without osteoarthritis. Subgroup analyses based on imputed data also generated similar results to those based on the complete data (Appendix 3.2).

Table 3.4. Imputed measures of socioeconomic inequalities in the period prevalence of modifiable CVRF in OA and non-OA samples, 1992-2017

Risk factors	OA status	Period prevalence (95%CI) by IMD decile										Slope index of inequality (95%CI) (%)	Relative index of inequality (95%CI)
		1 (Least deprived)	2	3	4	5	6	7	8	9	10 (Most deprived)		
Obesity	OA	27.85 (27.09, 28.61)	32.10 (31.27, 32.93)	33.74 (32.90, 34.58)	34.09 (33.26, 34.91)	35.06 (34.23, 35.89)	38.32 (37.39, 39.26)	39.77 (38.82, 40.73)	41.88 (40.85, 42.91)	44.47 (43.39, 45.55)	44.65 (43.58, 45.71)	**17.66 (16.68, 18.65)**	**1.64 (1.60, 1.69)**
	Non-OA	24.80 (24.07, 25.52)	26.97 (26.20, 27.75)	29.06 (28.26, 29.85)	29.01 (28.22, 29.80)	29.78 (28.99, 30.58)	32.14 (31.24, 33.04)	33.82 (32.88, 34.75)	35.66 (34.65, 36.67)	37.20 (36.13, 38.27)	37.11 (36.06, 38.16)	**13.62 (12.68, 14.56)**	**1.57 (1.52, 1.62)**
≥1 CVRF	OA	86.87 (86.29, 87.44)	87.66 (87.08, 88.25)	88.50 (87.93, 89.07)	88.15 (87.59, 88.71)	88.11 (87.55, 88.68)	89.02 (88.42, 89.62)	90.17 (89.58, 90.75)	90.97 (90.38, 91.57)	91.94 (91.35, 92.53)	92.10 (91.52, 92.67)	**5.46 (4.84, 6.10)**	**1.06 (1.06, 1.07)**
	Non-OA	81.16 (80.50, 81.81)	82.43 (81.77, 83.09)	82.78 (82.11, 83.44)	81.84 (81.16, 82.51)	82.01 (81.34, 82.68)	83.35 (82.63, 84.06)	83.75 (83.02, 84.48)	84.94 (84.19, 85.70)	84.76 (83.97, 85.56)	85.43 (84.66, 86.20)	**4.09 (3.33, 4.85)**	**1.05 (1.04, 1.06)**
≥2 CVRF	OA	48.12 (47.27, 48.96)	51.91 (51.02, 52.80)	54.07 (53.18, 54.95)	54.71 (53.85, 55.58)	54.63 (53.76, 55.50)	57.87 (56.92, 58.82)	59.44 (58.48, 60.40)	62.44 (61.43, 63.45)	64.61 (63.57, 65.65)	66.85 (65.84, 67.85)	**18.40 (17.39, 19.40)**	**1.39 (1.36, 1.41)**
	Non-OA	40.79 (39.97, 41.61)	43.66 (42.79, 44.52)	44.69 (43.81, 45.56)	44.88 (44.01, 45.75)	45.28 (44.42, 46.15)	48.22 (47.26, 49.18)	48.82 (47.84, 49.81)	51.20 (50.15, 52.25)	52.88 (51.78, 53.99)	54.10 (53.02, 55.19)	**13.35 (12.31, 14.36)**	**1.33 (1.30, 1.36)**
≥3 CVRF	OA	16.76 (16.13, 17.39)	20.22 (19.50, 20.93)	21.69 (20.95, 22.42)	21.32 (20.60, 22.03)	22.73 (22.00, 23.47)	24.41 (23.59, 25.24)	25.46 (24.60, 26.31)	28.84 (27.89, 29.78)	30.67 (29.67, 31.67)	31.80 (30.80, 32.79)	**14.96 (14.07, 15.83)**	**1.93 (1.85, 2.01)**
	Non-OA	14.57 (13.98, 15.17)	16.25 (15.61, 16.89)	17.25 (16.58, 17.91)	16.61 (15.96, 17.25)	17.34 (16.68, 18.00)	19.37 (18.61, 20.14)	20.61 (19.81, 21.41)	22.24 (21.36, 23.12)	22.98 (22.05, 23.91)	24.78 (23.84, 25.72)	**10.09 (9.28, 10.91)**	**1.74 (1.66, 1.83)**

CVRF, cardiovascular risk factor; OA, osteoarthritis; 95%CI, 95% confidence interval; Estimates in **bold**, statistically significant

3.4 Discussion

3.4.1 Summary of study findings

The results of this study indicate that the socioeconomic inequality in the prevalence of CVRFs is consistently more common in the population with osteoarthritis compared with those without osteoarthritis, especially in women, younger (35-64), and residents in Northern English regions. The socioeconomic inequality in the prevalence of CVRF increased between 1992-2017 in both populations with and without osteoarthritis and was consistently different between those with and without osteoarthritis.

3.4.2 Comparisons with other studies

No previous studies to date have quantitatively measured socioeconomic inequality in the prevalence of modifiable CVRFs among consulters with and without osteoarthritis between 1992-2017 using primary care EHRs in England. Instead of measuring the overall socio-economic inequalities, previous studies in the general population focused on the comparison of the prevalence of CVRF in the population from the most and the least deprived neighbourhood (Charafeddine et al., 2012, Ernstsen et al., 2012, Devaux & Sassi, 2011, Imkampe & Gullifordi, 2010, Kislaya et al., 2019). Although these comparisons consistently revealed a higher prevalence in the most deprived neighbourhood than the least deprived neighbourhood, the overall socio-economic inequalities might be estimated with bias by ignoring the weights of the estimations from the subpopulation from the neighbourhoods between the most and the least deprived neighbourhoods. The population health survey is the most popular way to investigate the socioeconomic gap in health indicators in the general population. For example, a longitudinal English GP survey reported both absolute and relative inequalities in the prevalence of obesity (SII=13.4% in women and 7.7% in men; RII=1.9 in women and 1.4 in men, controlling for age, sex, year of the survey, etc.) between the lowest and highest SES groups (defined by occupation class) between 1991 and 2007 (Devaux & Sassi, 2011). Restricted by the aim, the cost, and the potential low response rate, few longitudinal nationally representative population surveys have been routinely processed in the population with specific conditions (i.e., osteoarthritis). The current study provided an alternative method to longitudinally surveillance of the socioeconomic inequalities in the prevalence of CVRFs (or health indicators) in the population with specific conditions based on the routinely recorded primary care electronic health records which have been proved to be representative, efficient (in terms of cost and response rate), powerful and highly valid (Herrett et al., 2015).

Different from the overall population-level evaluation, some previous studies reported the relative measurement (i.e., odds ratio) of a single CVRF within the general population at a single time point (Larranaga et al., 2005, Tang et al., 2016, Wang & Beydoun, 2007). Similar to the findings of this research, these previous studies yielded a significantly higher likelihood of CVRFs in the most deprived population compared with the least deprived population. A meta-analysis of nine studies showed an association between lower SES and hypertension (pooled odds ratio= 1.88, 95% CI: 1.27-2.79), diabetes (1.90, 1.25-2.87), obesity (1.57, 0.95-2.59) and dyslipidaemia (3.68, 2.03-6.64) (Tang et al., 2016). The higher relative measurements of odds ratio compared with the RII could be explained by 1) the lack of weighting of the middle population whose SES is between the most and the least deprivation;

2) the different time coverage between period prevalence in this study and the one-time point measured prevalence from the surveys; 3) different validity of CVRFs information derived from survey data and EHR data. The study finding that no significant RII was observed in the people with osteoarthritis and a reverse RII observed in people without osteoarthritis for the prevalence of dyslipidaemia was different from previous studies. This surprising finding might be explained by the higher comorbidities in the deprived population which potentially trigger CVD management in primary care settings (for example, statin prescription for CVD management) (NICE, 2016).

Comparisons of socioeconomic inequality in the prevalence of CVRFs between the population with osteoarthritis and a comparable control population without osteoarthritis were seldom processed in prior studies. One prior study presented that the gap in high comorbidity counts (≥6 clinical conditions) was greater in primary care consulters with osteoarthritis (number of cases= 951 for low SES VS. 692 for high SES) compared with controls without osteoarthritis (565 VS. 552) with the use of survey data in England and Wales in 1991/1992 (Kadam, Jordan & Croft, 2004). A more recent study reported a greater gap in the onset of self-reported cognitive impairment in primary care consulters with osteoarthritis (43.3% for those with inadequate income VS. 29.7% for those with adequate income) than those without osteoarthritis (20.2% VS. 17.1%) (Wilkie, Kaur & Hayward, 2019). Both studies might suggest that socioeconomic inequalities in the prevalence of common health indicators are more common in the population with osteoarthritis than in those without osteoarthritis.

The specific subgroup analysis by age in the current study revealed the socioeconomic inequality gap in the number of CVRFs in the English population aged 35-64 years, and especially more common among those with osteoarthritis. This might suggest that the number of CVRFs is more common in younger deprived populations, especially the younger deprived population with newly diagnosed osteoarthritis. Considering the potential healthy life expectancy and future population-level health burden, strict CVD management might be considered in the primary care settings targeting the young, deprived population with newly diagnosed osteoarthritis.

As the first study to investigate the temporal trend of socioeconomic inequalities in the prevalence of single and number of CVRFs in the population with and without osteoarthritis in England over 1992-2017, the current study revealed that the socioeconomic inequalities in the prevalence of single and number of CVRF consistently exist both in the population with and without osteoarthritis and widened over the recent years in England over 1992-2017, with the inequality consistently more common in the population with osteoarthritis than the population without osteoarthritis. This is consistent with recent findings of the increased prevalence of CVRFs in people living in more deprived areas in England over the past decades (Nowakowska et al., 2019). As CVRFs and other comorbidities are more likely to be clustered in the population with osteoarthritis, these joint findings would partly explain the more common socioeconomic inequalities in CVRFs observed in the population with osteoarthritis over recent years.

3.4.3 Strengths and limitations

This study is the first to quantify the socioeconomic inequality in CVRFs among consulters for osteoarthritis and to provide comparisons of the inequality between consulters with and without osteoarthritis over two decades based on the nationally representative primary care EHRs. The study suggested that routinely collected data in England from a large primary care database could be a good source to longitudinally monitor socioeconomic inequality for routinely recorded health indicators either in the general population or the population with specific conditions with efficiency and validity. The measurements of absolute and relative socioeconomic inequalities were made using the toolbox recently developed by OHID (PHE, 2018b, Speybroeck et al., 2012), which makes the estimations comparable to national estimations in terms of methodology.

Several limitations should be addressed when interpreting the findings of this study. First, the SES measured as IMD decile provides overall socioeconomic information at the neighbourhood level which are not exact individual-level socioeconomic measurements like occupation, income, and education. Second, there would be some unmeasured confounders that might have an impact on socioeconomic inequalities in the prevalence of CVRFS. Third, coding quality might vary over primary care settings within socioeconomic neighbourhoods, which might be relevant to underdiagnoses or under-recording bias. Finally, a common concern for using primary care records is misclassification however other studies suggest that this may be minimal with consistent prevalence estimates in modifiable CVRFs between CPRD GOLD and other data resources such as population surveys and secondary care databases (Bhaskaran et al., 2013, Booth, Prevost & Gulliford, 2013, Herrett et al., 2013).

3.5 Conclusions

In conclusion, socioeconomic inequalities in the prevalence of modifiable CVRFs were very common in populations with and without osteoarthritis between 1992-2017 in England and widened in the population with osteoarthritis, especially for smoking, T2DM, obesity, and number of CVRFs. In the younger population with osteoarthritis, the increased socioeconomic inequalities in the prevalence of modifiable CVRFs suggests that the early onset of number of CVRFs in the young, deprived population could be a concern for health policymakers in terms of future loss of healthy life expectancy, and health burden due to the disability. Clinical effectiveness, cost-effectiveness, and acceptability of potential preventive care strategies such as CVRF screening should be further addressed before their application in the osteoarthritis population, especially osteoarthritis sub-populations living in the most deprived areas.

Chapter 4: Management of risk of cardiovascular disease in primary care consulters with and without osteoarthritis

4.1 Introduction

The analyses described in the previous chapters have identified that consulters to primary care in the UK for osteoarthritis had a higher prevalence of modifiable CVRFs and socioeconomic deprivation partly explains this. Understanding the assessment of CVD risk based on CVRFs and subsequent risk management may also identify reasons for poorer CVD outcomes for consulters with osteoarthritis and ways to reduce this. It would be helpful to understand the management status of modifiable CVRFs in osteoarthritis and non-osteoarthritis consulters and whether the management of CVD risk is in line with current clinical guidelines.

Clinical prediction models use multiple predictors to estimate the absolute probability or risk that a certain outcome is present or will occur within a specific time period in individuals (Riley et al., 2016). The predicted risks generated by the models and the given thresholds enable the stratification of individuals into different levels of risk. Therefore, clinical prediction models can be used to guide clinical management such as additional testing or following treatment based on the stratified risk group of an individual. Clinical prediction models have been developed for CVD risk assessment in general populations using both modifiable and non-modifiable risk factors as predictors (Damen et al., 2019). Some of these models, such as the Framingham (D'Agostino et al., 2008), ASSIGN (Woodward et al., 2007) and QRISK risk equations (Hippisley-Cox, Coupland & Brindle, 2017) have been recommended by clinical guidelines as the first step of the CVD primary prevention strategy which is assessing the 10-year CVD risk of individuals to guide the following treatment (NICE, 2016).

Pharmacological treatments such as statins are widely recommended as part of the strategy for CVD primary prevention following the risk assessment by the national guidelines (NICE, 2016, Stone, et al., 2014) and there is evidence to suggest that statins are effective in people with osteoarthritis (Sheng et al., 2012). The provision of CVD prevention has been reported to be poor in people with other comorbidities such as rheumatoid arthritis (Castañeda et al., 2020, Schmidt et al., 2018), however little is known in people with osteoarthritis. There is a need to evaluate the management of at-risk individuals for CVD primary prevention in practice and to establish where intervention is needed to improve outcomes for people with osteoarthritis.

In this chapter, the prevalence of having intermediate and high CVD risk predicted by the sex-specific Framingham risk score was estimated in at-risk osteoarthritis and matched non-osteoarthritis consulters who have not consulted for CVD and the prevalence of prescribed pharmacological management recommended by guidelines will be compared between osteoarthritis and non-osteoarthritis consulters with intermediate and high predicted CVD risk.

The analysis described in this chapter aims to answer the following question:

- Do the routine pharmacological treatments for the prevention of future CVD provided in primary care settings differ between high/intermediate predicted-CVD-risk consulters with and without osteoarthritis?

4.2 Methods

4.2.1 Data setting

Data from CPRD GOLD (as described in chapter 2) was used for this analysis.

4.2.2 Osteoarthritis cohort

All individuals aged 35 and over who had an incident diagnosis of osteoarthritis between January 1992 and December 2017 were identified by the methods described in chapter 2 (section 2.2.2). Those with a record of prevalent CVD within three years prior to the osteoarthritis index date were excluded from the current study. CVD was defined as a primary care consultation with a read code for diagnosed IHD, HF, PAD, and cerebrovascular disease (the list of read codes for diagnosed CVD is shown in Appendix 4.1-4.4).

4.2.3 Non-osteoarthritis cohort

Controls were identified in the ways described in chapter 2 (2.2.2). Those with a record of prevalent CVD within three years prior to the index date were excluded.

4.2.4 Cardiovascular risk assessment

The 10-year predicted risk of CVD for each study participant was calculated using the sex-specific Framingham equation published in 2008 (D'Agostino et al., 2008). Although prediction tools (QRISK2, ASSIGN) have been developed based on the UK population, their algorithms or baseline survivals were not available to date (Hippisley-Cox, Coupland & Brindle, 2017, Woodward et al., 2007). Framingham risk score was selected as its published risk prediction method (D'Agostino et al., 2008) and it is a widely used risk assessment tool to guide clinical practice in primary CVD prevention. Moreover, it has been shown to correlate with other CVD risk prediction tools (QRISK2, ASSIGN) used in UK primary care (van Staa et al., 2014). It is based on predictors (age, sex, SBP, hypertension treatment, total and HDL cholesterol, diabetes, and current smoking status) that can easily be measured in clinical settings (D'Agostino et al., 2008). The steps for calculating the 10-year CVD risk for each study participant were as the following:

Define predictors: age=age(years) at the index date; SBP=the latest record of SBP within three years prior to the index date; TC= the latest record of total cholesterol within three years prior to the index date; HDL= the latest record of HDL-cholesterol within three years prior to the index date; hypertension treatment=yes if an individual had at least one record of antihypertensive drug use within three years prior to the index date (else=no); smoking=1 if an individual had a record of current smoking prior to the index date (else=0); diabetes=1 if an individual had a record of T2DM within three years prior to the index date (else=0).

1. Define each individual's Framingham score: $\sum_{i=1}^{p} X_i \beta_i$($X_i$ is the value of the ith predictor if binary or the log-transformed value if continuous;β_i is the estimated regression coefficient; p is the number of predictors) = log(age)*2.32888 + log(TC)*1.20904 + log(HDL)*(-0.70833) + log(SBP)*2.76157 + (smoking)*0.52873 + (diabetes)*0.69154 if the individual is a women without hypertension treatment; = log(age)*2.32888 + log(TC)*1.20904 + log(HDL)*(-0.70833) + log(SBP)*2.82263 + (smoking)*0.52873 + (diabetes)*0.69154 if the individual is a women with hypertension treatment; = log(age)*3.06117 + log(TC)*1.12370 + log(HDL)*(-0.93263) + log(SBP)*1.93303 + (smoking)*0.65451 + (diabetes)*0.57367 if the individual is a men without hypertension treatment; = log(age)*3.06117 + log(TC)*1.12370 + log(HDL)*(-0.93263) + log(SBP)*1.99881 + (smoking)*0.65451 + (diabetes)*0.57367 if

the individual is a men with hypertension treatment

2. Define average Framingham score: $\sum_{i=1}^{p} \overline{X}_i\beta_i$ ($\overline{X}_i$ is the log-transformed value of the mean of the ith predictor if continuous or is the proportion of the predictor if binary) = log(mean age)*2.32888 + log(mean TC)*1.20904 + log(mean HDL)*(-0.70833) + log(mean SBP)*2.76157 + (proportion of smoking)*0.52873 + (proportion of diabetes)*0.69154 if the individual is a women without hypertension treatment; = log(mean age)*2.32888 + log(mean TC)*1.20904 + log(mean HDL)*(-0.70833) + log(mean SBP)*2.82263 + (proportion of smoking)*0.52873 + (proportion of diabetes)*0.69154 if the individual is a women with hypertension treatment; = log(mean age)*3.06117 + log(mean TC)*1.12370 + log(mean HDL)*(-0.93263) + log(mean SBP)*1.93303 + (proportion of smoking)*0.65451 + (proportion of diabetes)*0.57367 if the individual is a men without hypertension treatment; = log(mean age)*3.06117 + log(mean TC)*1.12370 + log(mean HDL)*(-0.93263) + log(mean SBP)*1.99881 + (proportion of smoking)*0.65451 + (proportion of diabetes)*0.57367 if the individual is a men with hypertension treatment

3. Define each individual's 10-year CVD risk: $\hat{p} = 1 - S_0(10)^{\exp(\sum_{i=1}^{p} X_i\beta_i - \sum_{i=1}^{p} \overline{X}_i\beta_i)}$, where $S_0(10)$ is baseline survival at 10 years ($S_0(10)$=0.95012 if the individual is a woman; = 0.88936 if the individual is a man)

4.2.5 Pharmacological treatments for individuals at risk of CVD

The study obtained data from CPRD GOLD on pharmacological treatments (statins, antihypertensive and antidiabetic treatments) that are recommended as part of the strategy for CVD primary prevention in general practices (NICE, 2016). Consulters were defined as being prescribed a pharmacological treatment if they had any code of stains, antihypertensive drugs, and antidiabetic drugs included by the British National Formulary (BNF) within three years prior to the date of the index consultation. The BNF code lists were shown in Appendix 4.1.

4.2.6 Statistical analyses

Analyses were performed using STATA/MP 14.2 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP).

Two CVD risk categories, the high- and intermediate-risk, were used in this study. A high-risk category was defined as a predicted 10-year CVD risk ≥20% based on the Framingham study (D'Agostino et al., 2008) that suggests the use of this threshold for statins, and it is also used in primary care in Scotland (NICE, 2016). The intermediate-risk category was defined as a predicted risk ≥10% based on the NICE guidelines that recommend the use of this threshold for statins prescription in primary care in UK countries other than Scotland (NICE, 2016). The prevalence of having predicted high or intermediate CVD risk was estimated for the osteoarthritis and non-osteoarthritis cohorts.

The relative difference of the above prevalence between osteoarthritis and non-arthritis cohorts was measured by the PRR by Poisson regression models (described in section 2.2.7). As the sex-specific Framingham risk score used here does not include obesity that is associated with both osteoarthritis and CVD risk, PRR was also stratified by this potential confounder/effect modifier: obesity status (obesity, non-obesity, BMI not recorded). Moreover, obese individuals are targets recommended by the current guidelines for osteoarthritis care (NICE, 2020a) and might be more likely to be diagnosed with other risk factors than non-obese individuals. The stratified analyses by obesity status would help to answer whether the predicted CVD risk based on other risk factors differs between obese and non-obese consulters.

The prevalence was estimated for:

- being prescribed statins among consulters with a predicted 10-year CVD risk of ≥20% or ≥10% in the osteoarthritis and non-osteoarthritis cohorts.
- being prescribed antihypertensive treatment among consulters with 1) ≥20% or ≥10% predicted CVD risk; 2) and diagnosed hypertension recorded within three years prior to the index consultation, was estimated in the osteoarthritis and non-osteoarthritis cohort.
- being prescribed antidiabetic treatments among consulters with 1) ≥20% or ≥10% predicted CVD risk; 2) diagnosed type 2 diabetes recorded within three years prior to the index consultation, was also estimated in the osteoarthritis and non-osteoarthritis cohort.

The relative difference for the above prevalence of management status was also summarised between osteoarthritis and non-osteoarthritis cohorts using PRR. Restricted by the small size of the subpopulation, stratified analyses for pharmacological treatments were performed by sex but not by obesity status.

The complete case analyses used a denominator restricted to matched people with and without osteoarthritis who had a full record of SBP, total blood cholesterol, and HDL cholesterol. Although it could not be confirmed that values such as SBP, total blood cholesterol, HDL-cholesterol, and BMI in the current study were missing at random, multiple imputation was still selected to check whether the missingness changes the study results as there were no resources to trace people with missing values using EHRs. Chained equations were carried out using recorded SBP, total blood cholesterol, HDL-cholesterol, and BMI as outcomes and all other variables in the dataset, such as age, sex, region, index year of consultation, smoking status, and diabetes, as covariates. This generated 29 imputations based on the fraction of those without complete data among all subjects (Rubin, 1987). The comparison of the prevalence of high/intermediate-risk individuals and the prevalence of pharmacological treatments among those with a high/intermediate risk between osteoarthritis and non-osteoarthritis cohorts were then repeated using data imputed by the model described above within a multiple imputation framework (Rubin, 1987).

Summary of the study methods:

- The study used CPRD GOLD data linked with the patient-level IMD databases in the UK.
- 1:1 age-, sex-, practice- and index year-matched osteoarthritis and non-osteoarthritis cohorts without prevalent CVD were derived.
- Used the sex-specific Framingham risk score to predict the 10-year CVD risk for each cohort member
- Estimated the period prevalence of having high (≥20%) or intermediate (≥10%) predicted CVD risk in each cohort between 1992-2017
- Used Poisson models to obtain the prevalence rate ratio to measure the relative difference in the prevalence of having high (≥20%) or intermediate (≥10%) predicted risk between osteoarthritis and non-osteoarthritis consulters
- Secondary analyses obtained the prevalence rate ratio of having statins, antihypertensive treatment, and antidiabetic treatment among consulters having high or intermediate CVD risk in osteoarthritis and non-osteoarthritis cohorts
- To handle the missing values, analyses were repeated based on imputed data.

4.3 Results

4.3.1 Characteristics of the study population

215,190 consulters with osteoarthritis newly diagnosed between 1992-2017 and their 1:1 age-, sex- and practice-matched control without osteoarthritis were identified from the CPRD GOLD (Figure 4.1). Among them, 110,027 sets of the matched case and control without any recorded CVD within three years prior to the index consultation were included in this study. Their demographic characteristics are shown in Table 4.1. The median age of osteoarthritis and non-osteoarthritis cohorts was 61 years. The highest and lowest proportion of age-group in the study population was the 55-64 years old group (32.91%) and the 85 years and over old group (2.37%). The proportion of women in each cohort was 64.96%. The two cohorts were also similar in distribution by geographical region and year of the index consultation. The osteoarthritis cohort (37.01%) had a higher prevalence of obesity than the non-osteoarthritis cohort (28.23%). At least one SBP, TC and HDL-cholesterol measurement was recorded within three years prior to the index consultation for 110,027 (53.58%) osteoarthritis consulters and 110,027 matched non-osteoarthritis consulters. These individuals were included in the complete case analysis. Table 4.1 also shows the demographic characteristics of participants included in the complete case analysis in comparison to the overall population in the study. These two populations were similar in terms of age distribution, region and the index of consultation year.

Figure 4.1 Flow chart of the study subjects. OA, osteoarthritis; CPRD, Clinical Practice Research Datalink; CVD, cardiovascular disease; HDL, high-density lipoprotein. N in the source of non-OA controls=507,352.

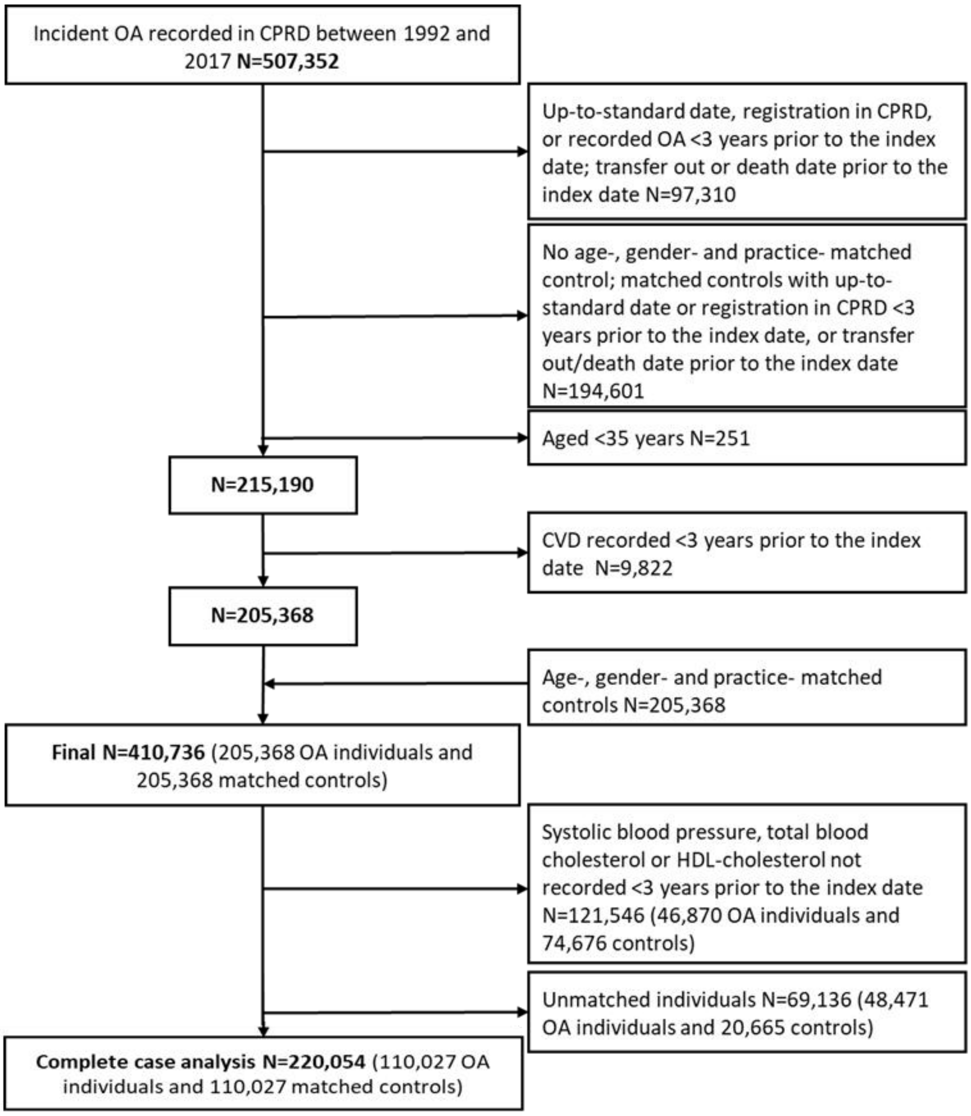


Table 4.1. Characteristics of OA and non-OA cohorts included in the study and the complete case analysis for predicted 10-year CVD risk

Characteristics	Total study population		Complete case analysis	
	OA	Non-OA	OA	Non-OA
No. individuals	205368	205368	110027	110027
Age				
Median (IQR) years	61 (54-71)	61 (54-70)	62 (56-70)	62 (56-70)
35-44, n (%)	11296 (5.50)	11296 (5.50)	3287 (2.99)	3287 (2.99)
45-54, n (%)	43052 (20.96)	43052 (20.96)	19653 (17.86)	19653 (17.86)
55-64, n (%)	67585 (32.91)	67583 (32.91)	40010 (36.36)	40010 (36.36)
65-74, n (%)	50224 (24.46)	50222 (24.45)	30939 (28.12)	30939 (28.12)
75-84, n (%)	28345 (13.80)	28347 (13.80)	14749 (13.40)	14749 (13.40)
85+, n (%)	4866 (2.37)	4868 (2.37)	1389 (1.26)	1389 (1.26)
Sex, n (%)				
Men	71957 (35.04)	71957 (35.04)	37366 (33.96)	37366 (33.96)
Women	133411 (64.96)	133411 (64.96)	72661 (66.04)	72661 (66.04)
Total blood cholesterol recorded < 3 years prior to the index date				
Median (IQR) mmol/l	5.40 (4.60-6.20)	5.40 (4.60-6.20)	5.40 (4.60-6.20)	5.40 (4.60-6.20)

Not recorded, n (%)	31558 (15.37)	59724 (29.08)	-	-
HDL-cholesterol recorded < 3 years prior to the index date				
Median (IQR) mmol/l	1.40 (1.20-1.70)	1.45 (1.20-1.78)	1.41 (1.20-1.72)	1.45 (1.20-1.78)
Not recorded, n (%)	44043 (21.45)	71145 (34.64)	-	-
SBP recorded < 3 years prior to the index date				
Median (IQR) mm Hg	138 (125-148)	137 (124-148)	138 (126-148)	138 (126-148)
Not recorded, n (%)	1237 (0.60)	25529 (12.43)	-	-
Hypertension recorded < 3 years prior to the index date, n (%)	13789 (6.71)	7710 (3.75)	8341 (7.58)	5596 (5.09)
Prescribed antihypertensive drugs and hypertension recorded < 3 years prior to the index date, n (%)	11393 (5.55)	6534 (3.18)	7011 (6.37)	4829 (4.39)
Type 2 diabetes mellitus recorded < 3 years prior to the index date, n (%)	4453 (2.17)	2612 (1.27)	2924 (2.66)	2118 (1.92)
Current smoking, n (%)	49542 (24.12)	38383 (18.69)	24652 (22.41)	21213 (19.28)
Obesity status, n (%)				
Obesity (BMI≥30kg/m^2)	76015 (37.01)	57978 (28.23)	44354 (40.31)	40907 (37.18)
Non-obesity (BMI<30kg/m^2)	118853 (57.87)	110024 (53.57)	62774 (57.05)	65311 (59.36)
BMI not recorded	10500 (5.11)	37366 (18.19)	2899 (2.63)	3809 (3.46)
Region, n (%)				
North East	4359 (2.12)	4359 (2.12)	2595 (2.36)	2595 (2.36)
North West	25756	25761	15885	15887

	(12.54)	(12.54)	(14.44)	(14.44)
Yorkshire & The Humber	8714 (4.24)	8712 (4.24)	3442 (3.13)	3440 (3.13)
East Midlands	8475 (4.13)	8472 (4.13)	2530 (2.30)	2529 (2.30)
West Midlands	21247 (10.35)	21241 (10.34)	12395 (11.27)	12394 (11.26)
East of England	17308 (8.43)	17306 (8.43)	7983 (7.26)	7982 (7.25)
South West	17459 (8.50)	17458 (8.50)	7285 (6.62)	7283 (6.62)
South Central	19883 (9.68)	19882 (9.68)	10191 (9.26)	10190 (9.26)
London	15091 (7.35)	15095 (7.35)	8650 (7.86)	8654 (7.87)
South East Coast	18519 (9.02)	18523 (9.02)	10988 (9.99)	10990 (9.99)
Northern Ireland	6148 (2.99)	6151 (3.00)	3904 (3.55)	3905 (3.55)
Scotland	19581 (9.53)	19579 (9.53)	10814 (9.83)	10811 (9.83)
Wales	22828 (11.12)	22829 (11.12)	13365 (12.15)	13367 (12.15)
Calendar year of index consultation, n (%)				
1992-1994	5645 (2.75)	5645 (2.75)	1482 (1.35)	1482 (1.35)
1995-1997	10760 (5.24)	10760 (5.24)	3450 (3.14)	3450 (3.14)
1998-2000	15131 (7.37)	15131 (7.37)	5998 (5.45)	5998 (5.45)
2001-2003	21404 (10.42)	21404 (10.42)	10543 (9.58)	10543 (9.58)

2004-2006	36021 (17.54)	36021 (17.54)	20561 (18.69)	20561 (18.69)
2007-2009	48243 (23.49)	48243 (23.49)	28450 (25.86)	28450 (25.86)
2010-2012	32765 (15.95)	32765 (15.95)	19571 (17.79)	19571 (17.79)
2013-2015	23621 (11.5)	23621 (11.5)	13535 (12.3)	13535 (12.3)
2016-2017	11778 (5.74)	11778 (5.74)	6437 (5.85)	6437 (5.85)

OA, osteoarthritis; CVD, cardiovascular disease; HDL, high-density lipoprotein; IQR, interquartile range; SBP, systolic blood pressure

4.3.2 Prevalence of individuals with a high or intermediate predicted 10-year risk for cardiovascular disease

The prevalence of having intermediate predicted 10-year CVD risk was 30.70 (95%CI: 30.43, 30.98) %, and 28.98 (28.71, 29.25) %) in osteoarthritis and non-osteoarthritis consulters, with 1.06 (1.04, 1.08) of PRR. The prevalence of having a high predicted 10-year CVD risk was 6.97 (95%CI: 6.82, 7.12) %, and 6.87 (6.72, 7.02) % in osteoarthritis and non-osteoarthritis consulters, with 1.01 (0.98, 1.05) of PRR.

Women with osteoarthritis had a significantly higher prevalence of having high and intermediated predicted 10-year CVD risk than women without osteoarthritis (Table 4.2). However, there was no significant difference in the prevalence of having high and intermediate predicted 10-year CVD risk between men with and without osteoarthritis (Table 4.2).

Table 4.2. Prevalence of individuals with a predicted 10-year CVD risk ≥20%/≥10% in OA and non-OA cohorts by sex, 1992-2017

Predicted 10-year CVD risk	OA			Non-OA			Prevalence rate ratio (95%CI)
	D	N	Prevalence (%) (95%CI)	D	N	Prevalence (%) (95%CI)	
Total							
≥20%	110027	7668	6.97 (6.82, 7.12)	110027	7557	6.87 (6.72, 7.02)	1.01 (0.98, 1.05)
≥10%	110027	33781	30.70 (30.43, 30.98)	110027	31885	28.98 (28.71, 29.25)	**1.06 (1.04, 1.08)**
Women							
≥20%	72661	1367	1.88 (1.78, 1.98)	72661	1050	1.45 (1.36, 1.53)	**1.30 (1.20, 1.41)**
≥10%	72661	11580	15.94 (15.67, 16.21)	72661	9961	13.71 (13.46, 13.96)	**1.16 (1.13, 1.19)**
Men							
≥20%	37366	6301	16.86 (16.48, 17.25)	37366	6507	17.41 (17.03, 17.8)	0.97 (0.94, 1.00)
≥10%	37366	22201	59.41 (58.92, 59.91)	37366	21924	58.67 (58.17, 59.17)	1.01 (0.99, 1.03)

CVD, cardiovascular disease; 95%CI, 95% confidence interval; OA, osteoarthritis; D, denominator; N, numerator; Estimates in **bold**, statistically significant

4.3.3 Prevalence of individuals with a high or intermediate predicted 10-year risk for cardiovascular disease by obesity

Stratified analyses by obesity status showed a slightly higher prevalence of having a high predicted 10-year CVD risk in the non-obese consulters with osteoarthritis than non-obese controls (PRR: 1.05 (95%CI: 1.01, 1.10)). No significant difference in the prevalence of having a high predicted risk between obese osteoarthritis consulters and obese controls (PRR: 0.98 (0.93, 1.03) (Table 4.3). Both obese and non-obese consulters with osteoarthritis had a slightly higher prevalence of having intermediate predicted risk, compared with their counterpart without osteoarthritis (Table 4.3).

Table 4.3. Prevalence of individuals with a predicted 10-year CVD risk ≥20%/≥10% in OA and non-OA cohorts by obesity status, 1992-2017

Obesity status	OA			Non-OA			Prevalence rate ratio (95%CI)
	D	N	Proportion (95%CI)	D	N	Proportion (95%CI)	
≥20%							
Obesity	44354	3003	6.77 (6.54, 7.01)	40907	2832	6.92 (6.68, 7.17)	0.98 (0.93, 1.03)
Non-obesity	62774	4424	7.05 (6.85, 7.25)	65311	4364	6.68 (6.49, 6.88)	**1.05 (1.01, 1.10)**
BMI not recorded	2899	241	8.31 (7.33, 9.38)	3809	361	9.48 (8.57, 10.45)	0.88 (0.75, 1.03)
≥10%							
Obesity	44354	13594	30.65 (30.22, 31.08)	40907	12124	29.64 (29.20, 30.08)	**1.03 (1.01, 1.06)**
Non-obesity	62774	19138	30.49 (30.13, 30.85)	65311	18411	28.19 (27.84, 28.54)	**1.08 (1.06, 1.10)**
BMI not recorded	2899	1049	36.18 (34.43, 37.96)	3809	1350	35.44 (33.92, 36.99)	1.02 (0.94, 1.11)

CVD, cardiovascular disease; OA, osteoarthritis; 95%CI, 95% confidence interval; D, denominator; N, numerator; Estimates in **bold**, statistically significant

4.3.4 Prevalence of individuals being prescribed pharmacological treatments among individuals with a high or intermediate predicted 10-year risk for cardiovascular disease

The study included 2024 pairs of matched osteoarthritis and non-osteoarthritis consulters who had a high predicted 10-year CVD risk, and 18,728 pairs of matched osteoarthritis consulters and non-osteoarthritis consulters who had an intermediate predicted 10-year CVD risk. The difference in the prevalence of being prescribed statins was not significant between matched osteoarthritis (35.97 (95%CI: 33.87, 38.1) %) and non-osteoarthritis cohorts (36.02 (33.92, 38.15) %) with high predicted risk; PRR 1.00 (0.90, 1.11). There was also no difference observed in men or women (Table 4.4). Among those who had intermediate risk, the prevalence was slightly higher in the osteoarthritis (37.05 (36.36, 37.75) %) than non-osteoarthritis cohort (35.26 (34.58, 35.95) %); PRR 1.05 (1.02, 1.09).

Among consulters with hypertension and high or intermediate predicted CVD risk the prevalence of being prescribed antihypertensive treatment was significantly higher in osteoarthritis than in non-osteoarthritis cohorts overall and in men but not significant in women, as the PRR was 1.12 (1.00, 1.25), 1.11 (1.00, 1.24), and 1.28 (0.69, 2.37) for high predicted risk, 1.14 (1.09, 1.18), 1.14 (1.09, 1.19) and 1.10 (0.99, 1.22) for intermediate predicted risk, respectively (Table 4.5).

Among consulters with T2DM as well as high predicted CVD risk, there was no significant difference in the prevalence of prescribed antidiabetic treatments between osteoarthritis and non-osteoarthritis cohorts (Table 4.6). For those with T2DM and intermediate predicted risk, the prevalence of being prescribed antidiabetic treatment was higher in the osteoarthritis (50.96 (40.97, 60.90) %) than non-osteoarthritis cohort (43.27 (33.59, 53.35) %); PRR was 1.21 (1.04, 1.41) whilst the PRR in women was 1.43 (0.82, 2.50), due to low numbers, the higher rate was not significant.

Table 4.4. Prevalence of individuals being prescribed statins among matched OA and non-OA cohorts with a high or intermediate predicted 10-year CVD risk, 1992-2017

Sex	OA			Non-OA			Prevalence rate ratio (95%CI)
	D	N	Prevalence (%) (95%CI)	D	N	Prevalence (%) (95%CI)	
High (≥20%)							
Total	2024	728	35.97 (33.87, 38.1)	2024	729	36.02 (33.92, 38.15)	1.00 (0.90, 1.11)
*Women	74	14	18.92 (10.75, 29.7)	74	14	18.92 (10.75, 29.7)	1.00 (0.48, 2.10)
Men	1950	714	36.62 (34.47, 38.8)	1950	715	36.67 (34.52, 38.85)	1.00 (0.90, 1.11)
Intermediate (≥10%)							
Total	18728	6939	37.05 (36.36, 37.75)	18728	6604	35.26 (34.58, 35.95)	**1.05 (1.02, 1.09)**
Women	3120	700	22.44 (20.98, 23.94)	3120	625	20.03 (18.64, 21.48)	**1.12 (1.01, 1.25)**
Men	15608	6239	39.97 (39.2, 40.75)	15608	5979	38.31 (37.54, 39.08)	**1.04 (1.01, 1.08)**

CVD, cardiovascular disease; 95%CI, 95% confidence interval; OA, osteoarthritis; D, denominator; N, numerator; Estimates in **bold**, statistically significant; *There are very few women in the analyses.

Table 4.5. Prevalence of individuals being prescribed antihypertensive treatments among hypertensive OA and non-OA individuals with a high/intermediate predicted 10-year CVD risk, 1992-2017

Sex	OA			Non-OA			Prevalence rate ratio (95%CI)
	D	N	Prevalence (%) (95%CI)	D	N	Prevalence (%) (95%CI)	
high (≥20%)							
Total	804	691	85.95 (83.35, 88.27)	804	618	76.87 (73.79, 79.74)	**1.12 (1.00, 1.25)**
*Women	32	23	71.88 (53.25, 86.25)	32	18	56.25 (37.66, 73.64)	1.28 (0.69, 2.37)
Men	772	668	86.53 (83.92, 88.86)	772	600	77.72 (74.62, 80.61)	**1.11 (1.00, 1.24)**
intermediate (≥10%)							
Total	5914	5170	87.42 (86.55, 88.25)	5914	4547	76.89 (75.79, 77.95)	**1.14 (1.09, 1.18)**
Women	958	747	77.97 (75.21, 80.56)	958	678	70.77 (67.78, 73.64)	1.10 (0.99, 1.22)
Men	4956	4423	89.25 (88.35, 90.09)	4956	3869	78.07 (76.89, 79.21)	**1.14 (1.09, 1.19)**

CVD, cardiovascular disease; 95%CI, 95% confidence interval; OA, osteoarthritis; D, denominator; N, numerator; Estimates in **bold**, statistically significant; *There are very few women in the analyses.

Table 4.6. Prevalence of individuals being prescribed antidiabetic treatment among people with and without OA who had diabetes and a high/intermediate predicted 10-year CVD risk, 1992-2017

Sex	OA			Non-OA			Prevalence rate ratio (95%CI)
	D	N	Prevalence (%) (95%CI)	D	N	Prevalence (%) (95%CI)	
High (≥20%)							
Total	104	53	50.96 (40.97, 60.90)	104	45	43.27 (33.59, 53.35)	1.18 (0.79, 1.75)
*Women	3	2	66.67 (9.43, 99.16)	3	0	0.00 (0.00, 70.76) #	-
Men	101	51	50.50 (40.36, 60.60)	101	45	44.55 (34.66, 54.78)	1.13 (0.76, 1.69)
Intermediate (≥10%)							
Total	614	363	59.12 (55.11, 63.04)	614	300	48.86 (44.84, 52.89)	**1.21 (1.04, 1.41)**
Women	64	30	46.88 (34.28, 59.77)	64	21	32.81 (21.59, 45.69)	1.43 (0.82, 2.50)
Men	550	333	60.55 (56.32, 64.65)	550	279	50.73 (46.46, 54.98)	**1.19 (1.02, 1.40)**

CVD, cardiovascular disease; 95%CI, 95% confidence interval; OA, osteoarthritis; D, denominator; N, numerator; Estimates in **bold**, statistically significant; #one-sided; *There are very few women in the analyses.

4.3.5 Estimates based on imputed data

A total of 118,425 (28.83%) individuals in the study population were not recorded for SBP, TC, HDL, or BMI in the CPRD GOLD. These data were more likely to be under-recorded in the non-osteoarthritis (35.40%) than the osteoarthritis cohort (22.27%) (Table 4.7). Therefore, multiple imputations were processed for SBP, TC, HDL, and BMI, using osteoarthritis status, and other characteristics (e.g., age, sex, region, year of index consultation, current smoking, and T2DM) in the dataset as predictors. The above-described analyses were repeated based on the imputed datasets.

Table 4.7. Incompleteness of data included in the study

Variables	OA (n=205368)	Non-OA (n=205368)	Total (n=410736)
SBP, n (%)	1237 (0.60)	25529 (12.43)	26766 (6.52)
Total cholesterol, n (%)	32008 (15.59)	60131 (29.28)	92139 (22.43)
HDL- cholesterol, n (%)	44138 (21.49)	71236 (34.69)	115374 (28.09)
Body mass index, n (%)	10500 (5.11)	37366 (18.19)	47866 (11.65)
SBP/ total cholesterol/ HDL-cholesterol/ body mass index, n (%)	45732 (22.27)	72693 (35.40)	118425 (28.83)

OA, osteoarthritis; SBP, systolic blood pressure

For the prevalence of individuals with high or intermediate predicted CVD risk, estimates from imputed datasets were generally lower than those from the complete case analyses. However, higher prevalences were still observed in the osteoarthritis consulters compared with non-osteoarthritis consulters. The PRR estimations were generally higher than those based on complete data (Table 4.8). For women, imputed estimations also revealed a higher prevalence of high or intermediate predicted risk in osteoarthritis than the non-osteoarthritis cohort (Table 4.8). However, for men, different from estimations from the complete dataset, imputed estimations suggested a significantly higher prevalence in men with osteoarthritis than men without osteoarthritis (Table 4.8).

Table 4.8. Imputed prevalence of individuals with ≥20% and ≥10% predicted 10-year CVD risk in OA and non-OA cohorts by sex, 1992-2017

Predicted 10-year CVD risk	OA		Non-OA		Prevalence rate ratio (95%CI)
	D	Prevalence (%) (95%CI)	D	Prevalence (%) (95%CI)	
Total					
≥20%	205368	5.69 (5.59, 5.79)	205368	4.37 (4.28, 4.46)	**1.30 (1.27, 1.34)**
≥10%	205368	27.56 (26.73, 28.39)	205368	23.07 (22.28, 23.87)	**1.30 (1.28, 1.32)**
Women					
≥20%	133411	1.51 (1.45, 1.58)	133411	1.04 (0.99, 1.10)	**1.45 (1.35, 1.55)**
≥10%	133411	13.92 (13.04, 14.80)	133411	11.75 (10.92, 12.58)	**1.29 (1.26, 1.32)**
Men					
≥20%	71957	13.42 (13.17, 13.67)	71957	10.54 (10.31, 10.76)	**1.27 (1.24, 1.31)**
≥10%	71957	42.94 (41.60, 44.28)	71957	36.13 (34.80, 37.45)	**1.30 (1.28, 1.33)**

CVD, cardiovascular disease; 95%CI, 95% confidence interval; OA, osteoarthritis; D, denominator; Estimates in **bold**, statistically significant

Stratified analyses for the prevalence of having high or intermediate predicted CVD risk from the imputed datasets presented generally high prevalence in the osteoarthritis cohort across strata compared with estimations from complete data. The imputation estimations stratified by obesity status showed a higher prevalence of having high predicted CVD risk in the non-obese osteoarthritis cohort, compared with the non-obese controls, but the difference in the prevalence was not significant between the obese case and control group (Appendix 4.2). The higher imputed prevalence of having intermediate predicted CVD risk was observed in the osteoarthritis cohort compared with the non-osteoarthritis cohort, irrespective of obese status (Appendix 4.3).

Consistent with estimations from the complete data, the imputed estimations did not reveal a significant difference in the prevalence of being prescribed statins between matched osteoarthritis and non-osteoarthritis cohorts (Table 4.9). Prevalence of being prescribed antihypertensive treatment and antidiabetic treatment in those with high and intermediate predicted CVD risk in osteoarthritis and non-osteoarthritis cohorts were similar to the above estimations from the complete data (4.11 & 4.12).

Table 4.9. Imputed prevalence of individuals having statins among OA and non-OA individuals with high/intermediate predicted 10-year CVD risk, 1992-2017

Sex	OA		Non-OA		Prevalence rate ratio (95%CI)
	D	Prevalence (%) (95%CI)	D	Prevalence (%) (95%CI)	
High (≥20%)					
Total	1996	35.98 (33.88, 38.09)	1996	35.97 (33.87, 38.08)	1.00 (0.90, 1.11)
*Women	72	19.17 (9.98, 28.36)	72	19.17 (9.98, 28.36)	1.00 (0.45, 1.55)
Men	1924	36.62 (34.47, 38.77)	1924	36.61 (34.46, 38.76)	1.00 (0.90, 1.11)
Intermediate (≥10%)					
Total	18581	37.03 (36.34, 37.73)	18581	35.26 (34.57, 35.94)	**1.05 (1.02, 1.09)**
Women	3081	22.36 (20.89, 23.83)	3081	19.99 (18.58, 21.41)	1.12 (1.00, 1.25)
Men	15500	39.95 (39.18, 40.72)	15500	38.29 (37.52, 39.05)	**1.04 (1.01, 1.08)**

CVD, cardiovascular disease; 95%CI, 95% confidence interval; OA, osteoarthritis; D, denominator; N, numerator; Estimates in **bold**, statistically significant; *There are very few women in the analyses.

Table 4.10. Imputed prevalence of individuals having antihypertensive treatment among hypertensive OA and non-OA individuals with high/intermediate predicted 10-year CVD risk, 1992-2017

Sex	OA		Non-OA		Prevalence rate ratio (95%CI)
	D	Prevalence (%) (95%CI)	D	Prevalence (%) (95%CI)	
High (≥20%)					
Total	792	85.66 (83.21, 88.1)	792	76.66 (73.72, 79.61)	1.12 (1.00, 1.25)
*Women	31	71.04 (54.36, 87.71)	31	54.94 (36.65, 73.24)	1.31 (0.68, 2.52)
Men	761	86.25 (83.8, 88.7)	761	77.55 (74.58, 80.52)	1.11 (1.00, 1.24)
Intermediate (≥10%)					
Total	5865	87.31 (86.46, 88.17)	5865	76.85 (75.77, 77.93)	**1.14 (1.09, 1.18)**
Women	947	77.82 (75.18, 80.47)	947	70.54 (67.63, 73.45)	1.10 (0.99, 1.23)
Men	4918	89.14 (88.27, 90.01)	4918	78.06 (76.9, 79.22)	**1.14 (1.09, 1.19)**

CVD, cardiovascular disease; 95%CI, 95% confidence interval; OA, osteoarthritis; D, denominator; N, numerator; Estimates in **bold**, statistically significant; *There are very few women in the analyses.

Table 4.11. Imputed prevalence of individuals having antidiabetic treatment among people with and without OA who had diabetes and a high/intermediate predicted 10-year CVD risk, 1992-2017

Sex	OA		Non-OA		Prevalence rate ratio (95%CI)
	D	Prevalence (%) (95%CI)	D	Prevalence (%) (95%CI)	
High (≥20%)					
Total	102	50.00 (40.18, 59.82)	102	43.14 (33.41, 52.87)	1.17 (0.76, 1.78)
*Women	2	50.00 (1.26, 98.74)	2	0.00 (0.00, 84.19) *	-
Men	100	50.00 (40.08, 59.92)	100	44.00 (34.15, 53.85)	1.14 (0.74, 1.75)
Intermediate (≥10%)					
Total	608	59.05 (55.13, 62.96)	608	48.85 (44.87, 52.83)	**1.21 (1.04, 1.41)**
Women	63	46.03 (33.47, 58.59)	63	31.75 (20.02, 43.48)	1.44 (0.80, 2.60)
Men	545	60.55 (56.44, 64.66)	545	50.83 (46.62, 55.03)	**1.19 (1.02, 1.40)**

CVD, cardiovascular disease; 95%CI, 95% confidence interval; OA, osteoarthritis; D, denominator; N, numerator; (*) one-sided and 97.5% confidence interval; Estimates in **bold**, statistically significant; *There are very few women in the analyses.

4.4 Discussion

4.4.1 Summary of study findings

Overall, the prevalence of having intermediate predicted CVD risk (predicted CVD risk >10%) and high predicted CVD risk (predicted CVD risk >20%) was significantly higher in primary care consulters with newly diagnosed osteoarthritis compared with their controls without osteoarthritis. This relationship consistently occurred for women and men, obese and non-obese groups. However, the higher prevalence of high predicted risk in osteoarthritis was not observed in those with complete data. The prevalence of being prescribed statins was similar in the osteoarthritis and non-osteoarthritis cohorts when CVD risk was predicted high and higher in the osteoarthritis consulters when CVD risk was intermediate. Antihypertensive treatments and antidiabetic treatments were prescribed more often to osteoarthritis consulters with diagnosed hypertension and diabetes, comparing non-osteoarthritis consulters with hypertension and diabetes, both in intermediate and high predicted risk groups.

4.4.2 Comparisons with other studies

Whilst consulters with osteoarthritis have been previously shown to have a higher prevalence of modifiable CVRFs than those without osteoarthritis, few studies have addressed the predicted risk in this specific population and further compared the CVD risk with a comparative group without osteoarthritis. One study with a restricted sample size (64 participants with osteoarthritis) performed the risk evaluation over a decade ago illustrates that both men (8.3% cf. 3%) and women (7.5% cf. 0%) with osteoarthritis had a higher proportion of high 10-year CHD risk (≥30% predicted by the Joint British Societies risk calculator) compared to the UK national statistics in 2000 (Erb et al., 2004). This contrasts with the findings from a review that reported an increased CVD risk in both women and men with osteoarthritis than in those without (Hall et al., 2016). In the current study, both a higher prevalence of intermediate predicted CVD risk (≥10%) and a higher prevalence of high predicted CVD risk (≥20%) were significant in osteoarthritis consulters compared with non-osteoarthritis consulters. The different prediction tools, different cut-offs to define the high-risk group, and the difference in the comparable groups (non-osteoarthritis population or general population) should be considered in the comparison, which made the comparisons between research findings difficult.

To date, this study is the first to attempt to describe the extent that interventions are prescribed for CVD risk factors in osteoarthritis consulters and compare this in non-osteoarthritis consulters. A few studies have looked at statins prescribed for CVD primary prevention in general populations. A study using primary care data from the UK THIN (The Health Improvement Network) database found that 35% of consulters aged 40 years and over who had a high recorded 10-year CVD risk (≥20% predicted by QRISK2 risk score) were initiated on statins between 2012-2015 (Finnikin et al., 2017). The current study used different methods (prevalent instead of incident cases using statins) but generated a similar proportion of statins prescriptions among consulters with a high predicted risk (≥20% predicted by Framingham risk score) (35.97% in consulters with osteoarthritis and 36.00% in those without osteoarthritis) compared to the THIN study. However, the proportion of statins prescription in another high-risk patient group, hypertension patients aged 30-75 who had a ≥20% predicted CVD risk, was as high as 97%, according to the UK Quality and

Outcomes Framework (QOF) data in 2019 (QOF, 2019). This suggests that a large proportion of the osteoarthritis population might have missed opportunities for CVD preventive treatments, and this might result in a high risk of poor CVD outcomes. Statins prescribed similarly between osteoarthritis and non-osteoarthritis consulters with high predicted CVD risk, and differently between osteoarthritis and non-osteoarthritis consulters with intermediate predicted CVD risk, which might reflect that the Framingham risk score might not perform well in predicting top high CVD risk group and the underestimated absolute risk make the high-risk group less representative. The US general population used to develop the Framingham risk score was different in risk factor distribution than the osteoarthritis population, which has more prevalent CVRFs (D'Agostino et al., 2008). Moreover, the higher prevalence of high predicted risk in osteoarthritis was not observed in those with complete data. Missing values might affect the performance of the Framingham risk score in predicting very high risk. Further validation of the model performance in people with osteoarthritis is warranted.

4.4.3 Strengths and limitations

This is the first large UK representative matched cohort extracted from long-term longitudinal primary care records. Previous studies have demonstrated the national representativeness and validity of data for morbidities in the database used general population in this study (Booth, Prevost & Gulliford, 2013), Herrett et al., 2013). All variables and outcomes were defined by established code lists validated in previous studies (Herrett et al., 2013). This study used two cut-offs to define high and intermediate predicted CVD risk, both of which would be used in routine clinical practices (NICE, 2016).

One limitation of this study was the use of the Framingham risk score for risk assessment as the brevity of this tool has limited the inclusion of factors that are associated with CVD and limits its' performance (Collins & Altman, 2009, van Staa et al., 2014). For example, the Framingham risk score does not include obesity. This might result in an underestimated difference in the risk between consulters with and without osteoarthritis in the current study as obesity is more common in osteoarthritis (Jiang et al., 2012, Reyes et al., 2015). As obese individuals are targets recommended by the current guidelines for osteoarthritis care (NICE, 2020a), they might be more likely to be diagnosed with other risk factors than non-obese individuals. However, stratified analyses were undertaken in the current study and the prevalence of high/intermediate predicted risk in consulters with osteoarthritis was not affected by obesity status. Another limitation of Framingham regards issues of prediction accuracy in external populations. A study comparing the performance of Framingham and QRISK2 equations in the UK primary care population reported that QRISK2 had improved discrimination (how well the prediction model differentiates between individuals who have the outcome and those who do not) and calibration (how closely the predicted risk agrees with the observed risk) over Framingham risk score (Collins & Altman, 2009). The study also showed different performance of the Framingham equation between men and women; the tool had better discrimination in women (D statistic: 1.41 (95% CI: 1.39 to 1.44)) than men (1.33 (1.31 to 1.34)) and overestimated the 10-year CVD risk by 25% in men compared to only 4% in women in the UK. Moreover, the current study showed that a higher prevalence of high predicted risk in osteoarthritis was observed in imputed data but not in those with complete data of CVRFs. Missing values might affect the performance of the Framingham risk score in predicting high risk. Thus, the performance of the Framingham risk score in identifying high-risk individuals with osteoarthritis requires further investigation in EHRs where missingness is common. However, the tool QRISK2 is not available in this study in terms of the code list of predictors and baseline hazard function.

The study used the recording of prescriptions in CPRD GOLD that is currently automatic and therefore complete, though one limitation was that it cannot be ascertained whether prescriptions were subsequently dispensed at a pharmacy or taken by the patient, which is a common limitation in the pharmaceutical studies based on EHRs. The actual prevalence of taking pharmacological treatments was less likely to be measured which might lead to potentially underestimated prevalence in the current study. It is also important to note that pharmacological treatments only represent part of the care for people at risk of CVD. Research is required to evaluate other aspects of CVD prevention, such as the proportion of receiving CVRF assessment, lifestyle modification, and treatment adherence, to help to establish ways to reduce risk in people with osteoarthritis.

4.5 Conclusion

The consulters with osteoarthritis newly diagnosed between 1992-2017 in the UK primary care settings were more likely to have both an intermediate predicted 10-year CVD risk (≥10%) and a high predicted risk (≥20%) compared with the non-osteoarthritis consulters. Statins were more likely to be prescribed to osteoarthritis consulters with intermediate predicted CVD risk compared with non-osteoarthritis consulters. For patients with high predicted risk, the extent of the prescription of statins was similar between osteoarthritis and non-osteoarthritis consulters. Considering only one-third of osteoarthritis consulters at high predicted risk had statins prescriptions, there might be a gap between the actual and expected CVD management among this population. Considering the potential CVD outcomes due to less management, it might need to be highlighted to explore potential barriers to optimum care for osteoarthritis who are at high risk of CVD. As CVRFs were more prevalent in people with osteoarthritis and missingness was likely to affect the predicted risk, the currently used Framingham risk score needs to be validated further in the osteoarthritis and non-osteoarthritis cohorts in EHRs to accurately map the population in the real prevention need and help understand the real excess CVD risk due to osteoarthritis.

Chapter 5: Assess the performance in predicting the risk of cardiovascular disease in primary care consulters with and without osteoarthritis based on the Framingham risk score

5.1 Introduction

Previous evidence has shown that osteoarthritis is associated with a higher CVD risk regardless of sex. Similarly, chapter 4 found that consulters with osteoarthritis had a higher prevalence of high 10-year CVD risk predicted by the Framingham risk score compared to matched controls in the UK primary care EHRs. However, the relationship was observed in imputed data but not in complete data of CVRFs, implying a potentially underestimated risk in consulters with osteoarthritis using the Framingham risk score. It is unknown whether the Framingham risk score, a prediction tool derived from a US general population, is appropriate to identify osteoarthritis consulters who are truly in need of CVD prevention in UK primary care. The potential CVD outcomes in consulters with osteoarthritis might be due to the less management of CVD risk. Moreover, the Framingham risk score might perform differently over specific populations (e.g., underpredict the risk in men with osteoarthritis or overpredict in those without osteoarthritis). Consequently, CVD risk management is less likely to be provided in primary care consulters for osteoarthritis if their CVD risk is not accurately identified.

Framingham risk score has been extensively studied for the general population and has been recommended to guide practice by providing preventative interventions (e.g., prescribing statins) for individuals with a high predicted CVD risk (Collins & Altman, 2009, D'Agostino et al., 2008). However, the Framingham risk score does not always accurately predict risk. For example, the sex-specific Framingham risk score has been reported to overestimate the 10-year CVD risk in the UK primary care population (by 4% in women, by 25% in men and by 18% overall) (Collins & Altman, 2009). Moreover, in the population with a specific condition like osteoarthritis, little information is available to date about the performance of the Framingham risk score in predicting CVD risk.

Patients with osteoarthritis were observed to have a high risk of CVD (Hall et al., 2016), which is supported by the findings from Chapter two as primary care consulters for osteoarthritis had a higher prevalence of routinely recorded CVRFs (current smoking, hypertension, T2DM, dyslipidaemia and obesity) than age-, sex- and practice-matched non-OA controls. These risk factors are also key predictors incorporated in the Framingham risk score (D'Agostino et al., 2008). As the distribution of predictors is different between people with and without osteoarthritis, the accuracy of predicting CVD risk using the risk score in the osteoarthritis population requires further investigation to inform the management of high-risk individuals.

Therefore, in the population with osteoarthritis, it would be useful to understand the prediction accuracy of the Framingham risk score, a well-established CVD risk prediction tool, in terms of model discrimination and calibration. The main objective of this chapter is to evaluate the performance of the Framingham risk score in primary care consulters for osteoarthritis.

This chapter attempted to answer the following question:

- Does the commonly applied CVD risk tool in the general population, the Framingham risk score, perform well in terms of discrimination and calibration in consulters with and without osteoarthritis?

5.2 Methods

5.2.1 Data setting

Data from CPRD GOLD (as described in chapter 2) was used for this analysis. Patient-level data linkages to national cause-specific death registrations (death registration from the Office of National Statistics (ONS)) are available for this study to capture fatal CVD events.

5.2.2 Matched cohort

Eligible members in the case group were those with newly diagnosed osteoarthritis recorded in CPRD GOLD between 1 January 1992 and 31 December 2017 and without any record of osteoarthritis within three years prior to index consultation (date of incident diagnosis of osteoarthritis of the case) and aged 35 years and over by index consultation. Eligible members in the control group were 1:1 age-, sex-, and practice-matched individuals without osteoarthritis by index date selected by the risk-set sampling method. Either case or matched control in the same risk set with any CVD event recorded in CPRD GOLD or ONS within three years prior to index consultation were excluded.

5.2.3 Predictors

Predictors (age, sex, SBP, hypertension treatment, total and HDL cholesterol, diabetes, and current smoking status) included in the sex-specific Framingham risk score were extracted from the primary care data in CPRD GOLD and the predicted 10-year CVD risk was calculated for each study participant. Details of the definition of predictors and the calculation of 10-

year CVD risk predicted by the Framingham risk score are described in section 4.2.4.

5.2.4 Outcome

The earliest CVD event (IHD, HF, cerebrovascular disease, PAD, and CVD deaths) recorded either in primary care records or cause-specific death registration from ONS during the follow-up after index consultation was defined as an incident CVD event (Read codes and ICD codes used to define CVD are presented in Appendix 5.1). The censor date was all participants were followed from the date of the index consultation until the first date among the date of the incident CVD, date of death, date transferred out, or 31 December 2017.

5.2.5 Statistical analyses

The sex-specific Framingham risk score is a Cox proportional-hazards regression model developed in a United States population (D'Agostino et al., 2008). The published formula for the predicted 10-year CVD risk is $\hat{p} = 1 - S_0(10)^{\exp(LP)}$, where $S_0(10)$ is baseline survival at 10 years ($S_0(10)$=0.95012 if the individual is a woman; = 0.88936 if the individual is a man) and LP is the linear predictor (the weighted sum of the predictors in the model with the regression coefficients as the weights) (details seen in section 4.2.4).

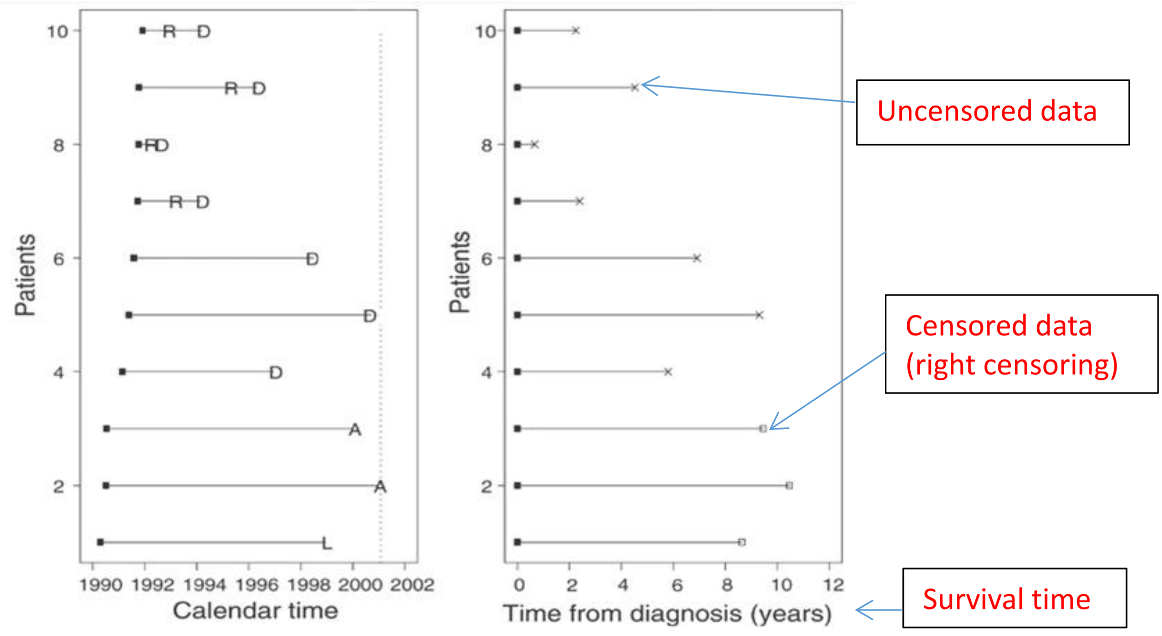
<u>Survival analysis</u>

The observed outcome under assessment in this chapter was the time to an incident CVD event within 10 years after the index date. Instead of simply assessing whether the event occurred in an individual, the time to event can be used to define the risk of the event if not all events have occurred in study subjects during the follow-up (Clark et al., 2003). However, when the outcome of a study is the time to event, several problems can occur. In this study, for example, some individuals were lost to follow-up (e.g., transferred out from the CPRD practice), and thus their true time to event was unknown. Moreover, the times were not likely to follow a normal distribution. A special method called survival analysis has been developed to study time to event if such problems occurred (Clark et al., 2003) and are described below.

Survival time and censoring

Survival analysis involves the definition of survival time, which is the time from a fixed point until an event of interest (e.g., death) occurred (Cox & Oakes, 2018). The individual observation may start and finish at different times. An individual's survival time is measured from their time of entry into the study until they experience the event of interest (Figure 6.1) (Clark et al., 2003). Figure 5.1 presents how patient profiles in calendar time are converted to time to event.

Figure 5.1 Representation of 10 individuals with staggered entry and follow-up over 12 years in survival analysis for ovarian cancer (adapted from Clark et al., 2003). R=relapse, D=death from ovarian cancer, A=attended last clinic visit, L=loss to follow-up.



For a subset of the study group, the survival time is unknown; some will develop the event beyond the end of the follow-up period, some will be lost to follow-up, and for some, the occurrence of another event makes it hard for them to be further followed up. This situation is called "censoring". It should be uninformative, meaning individuals who are censored should have the same prospects of survival as those who continue to be followed. (Clark et al., 2003). For example, if those under observation are more likely to be followed than those who are censored, the remaining study population would be made up of healthier people, the estimated risk of events would be lower, and survival rates would be overestimated (Szklo & Nieto, 2014). The type of censoring in which an individual's event (assuming it were to occur) is beyond the end of the observation period is called "right censoring" (Fox & Weisberg, 2002). Left censoring can also occur when the length of survival time is unknown (Fox & Weisberg, 2002); an event was observed, but it is impossible to determine when it started. Interval censoring can occur when both right and left censoring happen at the same time, that is, individuals leave and re-enter a study during the follow-up (Fox & Weisberg, 2002). In this situation, only individuals whose survival condition was known by the end of the follow-up were included in the analysis.

In this study survival time of each participant was calculated in days from the date of the index consultation to the first date among the date of the incident CVD event, date of non-CVD death, date transferred out, and 31 December 2017. The censor date for those who were free of CVD events or have survived was 31 December 2017 as the CPRD GOLD data applied for the current study was available until the end of 2017.

Analysing hazard probabilities

Survival or hazard probabilities are typically used to describe and analyse survival data. The survival probability is the probability that a person will survive from a start point to a specific time in the future (Clark et al., 2003). The Kaplan-Meier method (also called the product-limit method) allows survival probabilities to be estimated from the survival times of both uncensored and censored subjects (Kaplan & Meier, 1958). Since events are assumed to occur independently, the survival probability from the time of one event to the time of the next can be multiplied to obtain the cumulative survival probability (S(t)). This can be examined visually with the Kaplan-Meier curve, which presents the survival probability over survival time. The Kaplan-Meier curve is shown as a step function; that is, the estimated probability changes only when an event occurs and remains constant until the time of the next event. (Clark et al., 2003).

The Kaplan-Meier method can not provide an estimate of the effect size and can not easily adjust for the effects of other factors such as potential confounders (Bradburn et al., 2003). Instead, a statistical model can be used to give the effect size of a single continuous predictor or adjust for the effects of covariates (Bradburn et al., 2003), the most commonly used of which is the Cox proportional hazard model (Cox, 1972) which uses the hazard function (h(t)) (Fox & Weisberg, 2002). The hazard function is defined as the instantaneous rate of the event of interest at a survival time point t (Fox & Weisberg, 2002). There is a clearly defined relationship between the cumulative survival probability (S(t)) and the hazard function (h(t)) given by the formula:

$$\mathrm{h(t)} = -\frac{d}{dt}[logS(\mathrm{t})]$$

** $\frac{d}{dt}$=differentiation (change in the slope over time).*

The cumulative hazard H(t) is defined as the integral of the hazard, or the area under the hazard function between times 0 and t. The relationship between S(t) and H(t) is given by the formula:

$$\mathrm{H(t)} = -\mathrm{logS(t)}$$

The Cox proportional hazard model (Cox, 1972) is a regression model which describes the relationship between an event and a set of covariates expressed by the hazard function (Bradburn et al., 2003). Within Cox's model, the hazard function is estimated nonparametrically, so survival times are not assumed to follow a particular distribution. The formula for the Cox model is:

$$\mathrm{h(t)} = h_0(t)\exp\{b_1x_1 + b_2x_2 + \ldots + b_px_p\}$$

Where h(t) = the hazard function, (x_1, x_2, …, x_p) = set of covariates, (b_1, b_2, …b_p) = size of coefficients, $h_0(t)$ the baseline hazard.

<u>Assessing predictive performance of the Framingham risk score</u>

The predictive performance of the Framingham risk score was quantified in terms of calibration and discrimination. Calibration reflects the extent to which the predicted and observed risks agree, whereas discrimination is the ability to distinguish high-risk from low-risk individuals (Debray et al., 2015). The calibration slope was used to evaluate the calibration value by fitting a Cox model to the study population with no predictors other than the LP assessed by Framingham models (Royston & Altman, 2013). A calibration slope (the coefficient of LP) value = 1 occurs when predicted risks are appropriately scaled to each other over the entire range of predicted risk, and a value > 1 occurs when the model is underfitting (e.g., predicted risks are systematically too low or too high) and a value < 1 occurs when the model is overfitting (e.g., predicted risks are too low for low observed risks and too high for high observed risks). The visual inspection of the calibration was conducted using a calibration plot, in which tenths of predicted risk were plotted against observed risk and a 45° line indicates perfect calibration (Royston & Altman, 2013). The observed risk for 10-year CVD by tenths of the predicted risk was calculated using Kaplan-Meier estimates (Royston & Altman, 2013). The formula is as below:

Observed 10-year CVD risk = 1 – survival probability at 10 year = 1 – number of individuals surviving at 10 year/number of individuals at risk at 10 year (individuals who have died from non-CVD causes or transferred out were considered as censored and were not included in the denominator)

The predicted/observed risk ratio was obtained using the mean value of 10-year risk assessed by Framingham risk score divided by observed 10-year CVD risk in each tenth of predicted risk.

Miscalibration can be interpreted as reflecting a need for methods to improve the model's accuracy in the validation population (Debray et al., 2015). Using overestimated risks implies overtreatment and using underestimated risks implies undertreatment in the population, thus, miscalibration might have a serious impact on population health (Mishra et al., 2022). The Framingham model would then be recalibrated by re-estimating its baseline survival in the study population (D'Agostino et al., 2008, Debray et al., 2015). The predicted risk would be re-calculated based on re-estimated baseline survival and calibration plots would be re-made once the recalibration was needed.

Harrell's concordance (C) statistic was used for evaluating the discriminative value of the Framingham risk score by computing the concordance probability after fitting a Cox model to the study population with no covariates other than the LP assessed by Framingham models (Harrell et al., 1982). It represents the probability that an individual with a shorter time to event receives a higher predicted risk than an individual with a longer time to event or without the event. A C-statistic for binary outcomes can range from 0.5 to 1; a value = 1 indicates the prediction model is good at determining a high-risk individual to have the event earlier than a low-risk individual, and a value of 0.5 represents no discrimination.

Complete case analyses were restricted to samples with a full record of SBP, total blood cholesterol, and HDL cholesterol. Although it could not be confirmed that values such as BMI in the current study were missing at random, multiple imputation was still selected to check whether the missingness changes the study results as there were no resources to trace people with missing values using EHRs. The details of the multiple imputation process are included in chapter 4 section 4.2.6. The evaluation of the performance of the Framingham risk score was then repeated using data imputed by the model described above within a multiple imputation framework (using 40 imputations) (Rubin, 1987). These estimates were compared to the complete case analysis.

Summary of the study methods:

- The population-based cohort was derived from CPRD GOLD data with linked death registration data from the national cause-specific death registration.
- Newly diagnosed osteoarthritis case was 1:1 matched with control without osteoarthritis on age, sex, practice and index year.
- The individual 10-year risk of CVD was predicted by sex-specific Framingham risk score.
- Kaplan-Meier method was used to estimate the observed risk of 10-year CVD events (IHD, HF, cerebrovascular disease, PAD, and CVD deaths) by tenths of predicted risk in each cohort
- Rates ratio for predicted risk with observed risk as a reference to estimate the accuracy of predicted risk.
- Calibration slope was used to measure the model calibration of the Framingham risk score
- Harrell's concordance (C) statistic was used to measure the model discrimination of the Framingham risk score
- Stratified analyses were performed by sex
- Final estimation was derived from the imputed dataset with chained equation

5.3 Results

5.3.1 Characteristics of the study population

205,368 primary care consulters for osteoarthritis aged ≥35 years without prevalent CVD (median age 61 years, 64.96% women) who were followed for a median of 8.26 (IQR: 4.31-11.90) years and 205,368 age group-, sex-, and practice-matched controls without osteoarthritis with a similar follow-up duration (8.00 (3.96-11.74) years) between 1992-2017 (Table 4.1). The median total cholesterol, HDL cholesterol and systolic blood pressure were 5.4 (IQR 4.6 to 6.2) mmol/L, 1.40 (1.20 to 1.70) mmHg, and 138 (125 to 148) mmHg in the osteoarthritis group, and 5.4 (4.6 to 6.2) mmol/L, 1.45 (1.20 to 1.78) mmol/L, 137 (124 to 148) mmHg in the control group, respectively. The prevalence of hypertension, T2DM, current smoking, and obesity was 6.71%, 2.17%, 24.12%, and 37.01% in the osteoarthritis group, and 3.75%, 1.27%, 18.09%, and 28.25% in the control group, respectively. A total of 110,027 (53.58%) osteoarthritis consulters and 110,027 matched non-osteoarthritis consulters had at least one SBP, TC and HDL-cholesterol measurement recorded within three years prior to the index consultation and were included in the complete case analysis. Table 4.1 shows the characteristics of participants included in the complete case analysis with a comparison to the overall population in the study. These two populations were similar in terms of age and sex distribution, and the length of follow-up (8.32 (4.54- 11.75) years in the osteoarthritis and 8.35 (4.41- 11.98) years in the non-osteoarthritis cohort). The overall osteoarthritis consulters and those with complete data had similar observed 10-year event rates (10.27 (95%CI: 10.10, 10.45) cf. 10.12 (9.96, 10.28)), while non-osteoarthritis participants (10.07 (9.88, 10.27) cf. 8.55 (8.40, 8.70)) with complete data had a higher observed 10-year CVD risk compared with the overall non-osteoarthritis participants. The previous chapter has shown that the osteoarthritis and non-osteoarthritis cohorts with complete data were similar in age and sex distribution (Table 4.1) as well as other the distribution of other predictors.

5.3.2 Calibration and discrimination of Framingham risk score in consulters with and without osteoarthritis

Table 5.1 shows calibration and discrimination measurements for Framingham risk score in osteoarthritis and non-osteoarthritis cohorts with complete data by sex. The calibration slope was similar between the osteoarthritis and non-osteoarthritis cohorts by overall and sex. The calibration slope for women was higher than for men in both osteoarthritis and non-osteoarthritis cohorts. The values of the slope were significantly under 1 for both cohort and sex, indicating the overall under-prediction for the Framingham risk score among study participants within complete data. A similar Harrell's C-statistic was observed between the osteoarthritis and non-osteoarthritis cohorts by overall and sex (Table 5.1). The C-statistics were under 0.7 and were lower than that of the original development population (0.76 (95%CI: 0.75, 0.78) in men to 0.79 (0.77, 0.81) in women) (D'Agostino et al., 2008), indicating restricted discrimination of Framingham risk score in both the osteoarthritis and non-osteoarthritis cohorts.

Table 5.1. Calibration and discrimination statistics of Framingham risk score for predicting 10-year risk of cardiovascular disease in OA and non-OA cohorts aged ≥35 years with complete data

Statistics	Overall		Men		Women	
	OA	Non-OA	OA	Non-OA	OA	Non-OA
Calibration slope	0.74 (0.71, 0.76)	0.72 (0.69, 0.75)	0.60 (0.56, 0.64)	0.59 (0.54, 0.63)	0.83 (0.80, 0.86)	0.79 (0.76, 0.82)
Harrell's C	0.64 (0.63, 0.64)	0.65 (0.64, 0.65)	0.62 (0.61, 0.63)	0.63 (0.62, 0.64)	0.65 (0.64, 0.65)	0.66 (0.65, 0.66)

OA, osteoarthritis; Harrell's C, Harrell's concordance (C) statistic

Table 5.2 summarizes the mean of observed and predicted 10-year risk of CVD by overall, sex, and decile of predicted risk, both in osteoarthritis and non-osteoarthritis cohorts. Figure 5.1 visually presents the agreement between the predicted and the observed risk. The osteoarthritis and non-osteoarthritis consulters showed similar levels of overall agreement between observed and mean risk predicted (predicted/observed rates ratio: 0.86 cf. 0.85), in men (1.12 cf.1.10) and women (0.68 cf. 0.67) and across decile of predicted risk (Table 5.2). Among all consulters with osteoarthritis, the Framingham risk score overestimated the CVD risk in those within the 10th decile risk group, whereas consistently underestimated the risk in the 1st to 8th decile risk group (Table 5.2). Among men with osteoarthritis, the Framingham risk score overestimated the CVD risk within the 8th – 10th decile risk groups and underestimated the risk in the 1st – 3rd decile risk groups. Among women with osteoarthritis, the CVD risk was consistently underestimated in each decile risk group.

Similar to results for those with osteoarthritis, among consulters without osteoarthritis, the risk score overestimated the CVD risk in those within the highest (10th decile) risk group, whereas consistently underestimated the risk in lower (1st to 9th decile) risk groups (Figure 5.1). This was also seen in men without osteoarthritis (Table 5.2); the risk score overestimated the CVD risk within the 9th and 10th decile risk groups and underestimated the risk in the 1st and 3rd decile risk groups. Among women without osteoarthritis, the CVD risk was consistently underestimated in each decile risk group.

Table 5.2. Mean predicted and observed 10-year cardiovascular risk in OA and non-OA cohorts aged ≥35 years with complete data across tenths of predicted risk

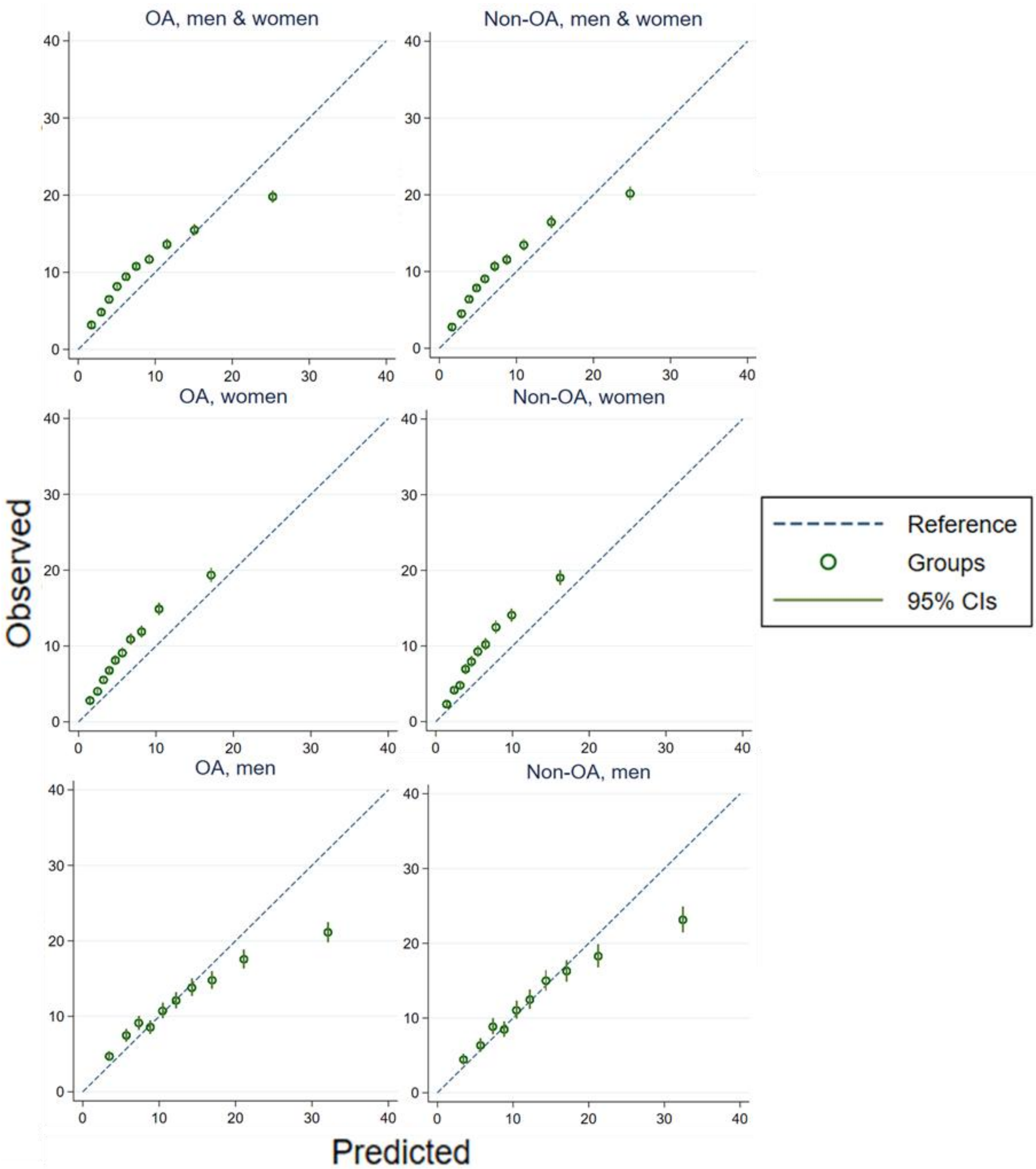
Tenths of risk		OA			Non-OA		
		Predicted (%) (95%CI)	Observed (%) (95%CI)	Ratio	Predicted (%) (95%CI)	Observed (%) (95%CI)	Ratio
Overall	All	8.86 (8.82, 8.89)	10.27 (10.10, 10.45)	**0.86 (0.84, 0.88)**	8.52 (8.49, 8.56)	10.07 (9.88, 10.27)	**0.85 (0.83, 0.87)**
	1	1.73 (1.72, 1.74)	3.16 (2.86, 3.50)	**0.55 (0.47, 0.63)**	1.64 (1.63, 1.65)	2.77 (2.46, 3.12)	**0.59 (0.50, 0.70)**
	2	2.98 (2.97, 2.98)	4.82 (4.44, 5.23)	**0.62 (0.55, 0.69)**	2.87 (2.86, 2.87)	4.51 (4.12, 4.95)	**0.64 (0.56, 0.72)**
	3	4.00 (4.00, 4.01)	6.49 (6.05, 6.97)	**0.62 (0.56, 0.68)**	3.84 (3.84, 3.85)	6.39 (5.91, 6.9)	**0.60 (0.54, 0.67)**
	4	5.04 (5.04, 5.05)	8.16 (7.67, 8.69)	**0.62 (0.57, 0.67)**	4.82 (4.82, 4.83)	7.85 (7.32, 8.41)	**0.61 (0.56, 0.68)**
	5	6.19 (6.19, 6.2)	9.43 (8.90, 9.98)	**0.66 (0.61, 0.71)**	5.9 (5.89, 5.91)	9.03 (8.47, 9.64)	**0.65 (0.60, 0.71)**
	6	7.53 (7.52, 7.54)	10.77 (10.21, 11.36)	**0.70 (0.65, 0.75)**	7.17 (7.17, 7.18)	10.68 (10.07, 11.33)	**0.67 (0.62, 0.73)**
	7	9.22 (9.21, 9.23)	11.66 (11.07, 12.28)	**0.79 (0.74, 0.84)**	8.75 (8.75, 8.76)	11.55 (10.92, 12.22)	**0.76 (0.70, 0.81)**
	8	11.51 (11.50, 11.53)	13.62 (12.99, 14.27)	**0.85 (0.80, 0.90)**	10.96 (10.94, 10.97)	13.45 (12.76, 14.18)	**0.82 (0.76, 0.87)**
	9	15.09 (15.07, 15.12)	15.47 (14.81, 16.17)	0.98 (0.93, 1.03)	14.52 (14.5, 14.55)	16.44 (15.67, 17.25)	**0.88 (0.84, 0.94)**
	10	25.26 (25.14, 25.38)	19.80 (19.06, 20.57)	**1.28 (1.23, 1.33)**	24.76 (24.62, 24.89)	20.17 (19.3, 21.07)	**1.23 (1.17, 1.28)**
Men	All	13.23 (13.16, 13.30)	11.86 (11.55, 12.19)	1.12 (0.63, 1.90)	13.31 (13.23, 13.39)	12.15 (11.77, 12.54)	**1.10 (1.06, 1.13)**
	1	3.47 (3.45, 3.50)	4.69 (4.10, 5.36)	**0.74 (0.62, 0.89)**	3.46 (3.43, 3.48)	4.45 (3.79, 5.22)	**0.78 (0.63, 0.96)**
	2	5.70 (5.68, 5.71)	7.47 (6.69, 8.34)	**0.76 (0.66,**	5.7 (5.68, 5.71)	6.34 (5.51, 7.28)	0.90 (0.76,

				0.88)			1.06)
	3	7.32 (7.31, 7.33)	9.12 (8.25, 10.07)	**0.80 (0.71, 0.91)**	7.32 (7.31, 7.33)	8.85 (7.88, 9.93)	**0.83 (0.72, 0.95)**
	4	8.85 (8.84, 8.86)	8.55 (7.70, 9.47)	1.04 (0.92, 1.17)	8.83 (8.81, 8.84)	8.45 (7.48, 9.54)	1.05 (0.91, 1.20)
	5	10.44 (10.43, 10.46)	10.72 (9.76, 11.76)	0.97 (0.88, 1.08)	10.44 (10.43, 10.46)	11.04 (9.92, 12.28)	0.95 (0.84, 1.07)
	6	12.20 (12.19, 12.22)	12.09 (11.07, 13.19)	1.01 (0.91, 1.11)	12.22 (12.21, 12.24)	12.47 (11.25, 13.80)	0.98 (0.88, 1.10)
	7	14.26 (14.25, 14.28)	13.80 (12.72, 14.95)	1.03 (0.95, 1.13)	14.35 (14.32, 14.37)	14.99 (13.68, 16.41)	0.96 (0.87, 1.06)
	8	16.93 (16.90, 16.95)	14.77 (13.67, 15.96)	**1.15 (1.05, 1.25)**	17.09 (17.06, 17.11)	16.28 (14.93, 17.73)	1.05 (0.96, 1.15)
	9	21.09 (21.05, 21.13)	17.56 (16.37, 18.82)	**1.20 (1.11, 1.29)**	21.27 (21.22, 21.31)	18.27 (16.81, 19.83)	**1.16 (1.07, 1.27)**
	10	32.08 (31.87, 32.29)	21.13 (19.87, 22.46)	**1.52 (1.43, 1.62)**	32.44 (32.20, 32.67)	23.14 (21.52, 24.87)	**1.40 (1.31, 1.50)**
Women	All	6.39 (6.36, 6.42)	9.42 (9.21, 9.63)	**0.68 (0.66, 0.70)**	6.14 (6.11, 6.17)	9.14 (8.92, 9.37)	**0.67 (0.65, 0.69)**
	1	1.47 (1.46, 1.48)	2.81 (2.46, 3.22)	**0.52 (0.43, 0.64)**	1.41 (1.40, 1.42)	2.31 (1.97, 2.71)	**0.61 (0.49, 0.76)**
	2	2.45 (2.45, 2.46)	4.02 (3.60, 4.50)	**0.61 (0.52, 0.71)**	2.39 (2.39, 2.40)	4.16 (3.70, 4.69)	**0.58 (0.49, 0.68)**
	3	3.22 (3.21, 3.22)	5.53 (5.02, 6.08)	**0.58 (0.51, 0.67)**	3.15 (3.15, 3.16)	4.80 (4.30, 5.35)	**0.66 (0.57, 0.76)**
	4	3.97 (3.97, 3.97)	6.78 (6.21, 7.4)	**0.59 (0.52, 0.66)**	3.88 (3.87, 3.88)	6.95 (6.35, 7.6)	**0.56 (0.49, 0.64)**
	5	4.76 (4.75, 4.76)	8.11 (7.49, 8.77)	**0.59 (0.53, 0.65)**	4.63 (4.63, 4.64)	7.93 (7.28, 8.62)	**0.58 (0.52, 0.66)**
	6	5.65 (5.64, 5.65)	9.08 (8.44, 9.77)	**0.62 (0.56, 0.69)**	5.48 (5.47, 5.48)	9.27 (8.57, 10.01)	**0.59 (0.53, 0.66)**
	7	6.72 (6.71,	10.87	**0.62**	6.49 (6.49,	10.21 (9.48,	**0.64**

	6.72)	(10.18, 11.62)	**(0.56, 0.68)**	6.50)	10.98)	**(0.58, 0.70)**
8	8.14 (8.13, 8.15)	11.89 (11.17, 12.66)	**0.69 (0.63, 0.74)**	7.84 (7.83, 7.84)	12.49 (11.70, 13.33)	**0.63 (0.57, 0.69)**
9	10.38 (10.37, 10.40)	14.87 (14.08, 15.7)	**0.70 (0.65, 0.75)**	9.89 (9.88, 9.91)	14.08 (13.25, 14.95)	**0.70 (0.65, 0.76)**
10	17.12 (17.01, 17.22)	19.36 (18.49, 20.26)	**0.89 (0.84, 0.94)**	16.20 (16.09, 16.31)	19.03 (18.09, 20.01)	**0.85 (0.80, 0.91)**

OA, osteoarthritis; estimates in **bold,** statistically significant

Figure 5.2. Predicted versus observed 10-year risk (%) of cardiovascular disease by tenths of predicted risk in OA and non-OA cohorts aged ≥35 years in complete data



5.3.3 Recalibration of Framingham risk score in consulters with and without osteoarthritis

The calibration slopes presented above reflect a restricted calibration of Framingham models in the study participants with complete data. To improve the model calibration, recalibration was attempted by re-estimating the models' baseline survivals in the study participants and re-calculating the predicted risk based on the re-estimated baseline survivals (men: 0.8999; women: 0.9255) and re-making the calibration plots.

Table 5.3 summarizes the mean value of re-estimated predicted risk and observed 10-year CVD risk by decile of predicted risk and sex in osteoarthritis and non-osteoarthritis cohorts and Figure 5.2 visually presents the agreement between the re-estimated predicted and observed risk. Recalibrated Framingham risk score provided improved the overall agreement but the variety in the agreement across risk groups still existed. The overall predicted/observed rates ratios (ranged 0.99-1.01) in Table 5.3 indicate that the re-estimated predicted risk highly agreed with the observed 10-year CVD risk in both osteoarthritis and non-osteoarthritis consulters in both men and women. Calibration plots based on the re-estimated predicted risk showed the overfitting of recalibrated Framingham risk score (the observed CVD risk was overestimated in higher tenths of re-estimated predicted risk and was underestimated in lower-risk groups) regardless of the osteoarthritis status or sex (Figure 5.2).

Table 5.3. Re-estimated predicted and observed 10-year cardiovascular risk in OA and non-OA cohorts aged ≥35 years across tenths of predicted risk in the complete data

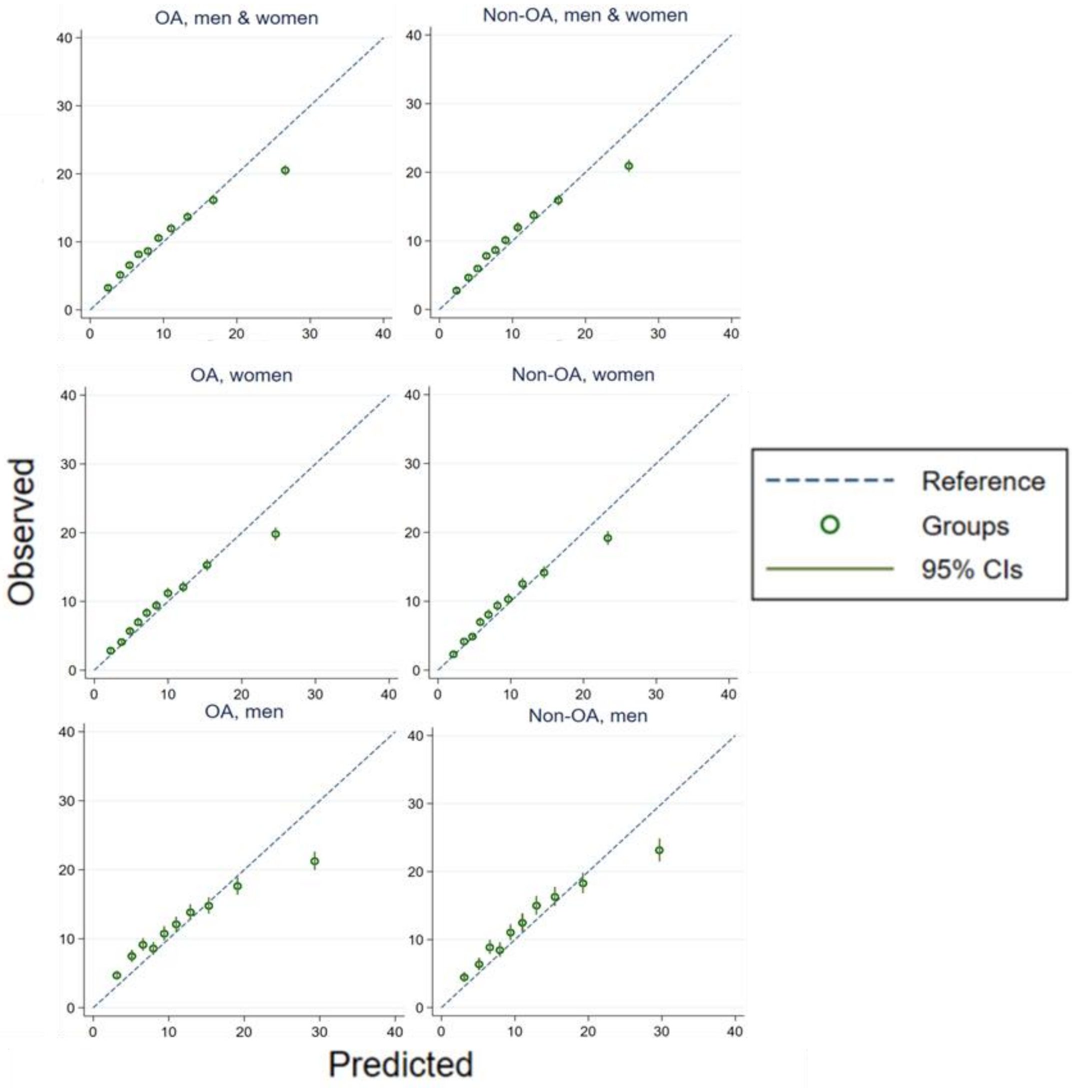
Tenths of risk		OA			Non-OA		
		Predicted (%) (95%CI)	Observed (%) (95%CI)	Ratio	Predicted (%) (95%CI)	Observed (%) (95%CI)	Ratio
Men & Women	All	10.34 (10.30, 10.37)	10.27 (10.10, 10.45)	1.01 (0.99, 1.03)	10.05 (10.01, 10.09)	10.07 (9.88, 10.27)	1.00 (0.98, 1.02)
	1	2.44 (2.43, 2.45)	3.16 (2.86, 3.50)	**0.77 (0.68, 0.88)**	2.34 (2.33, 2.35)	2.77 (2.46, 3.12)	0.84 (0.73, 0.98)
	2	4.08 (4.08, 4.09)	4.82 (4.44, 5.23)	**0.85 (0.76, 0.94)**	3.98 (3.98, 3.99)	4.51 (4.12, 4.95)	0.88 (0.79, 0.99)
	3	5.36 (5.35, 5.36)	6.49 (6.05, 6.97)	**0.83 (0.76, 0.90)**	5.23 (5.23, 5.24)	6.39 (5.91, 6.9)	0.82 (0.74, 0.90)
	4	6.59 (6.58, 6.60)	8.16 (7.67, 8.69)	**0.81 (0.75, 0.87)**	6.42 (6.42, 6.43)	7.85 (7.32, 8.41)	0.82 (0.75, 0.89)
	5	7.87 (7.87, 7.88)	9.43 (8.90, 9.98)	**0.84 (0.78, 0.90)**	7.66 (7.65, 7.66)	9.03 (8.47, 9.64)	0.85 (0.78, 0.92)
	6	9.31 (9.31, 9.32)	10.77 (10.21, 11.36)	**0.86 (0.81, 0.92)**	9.05 (9.04, 9.05)	10.68 (10.07, 11.33)	0.85 (0.79, 0.91)
	7	11.03 (11.02, 11.04)	11.66 (11.07, 12.28)	0.95 (0.89, 1.01)	10.73 (10.72, 10.73)	11.55 (10.92, 12.22)	0.93 (0.87, 0.99)
	8	13.29 (13.28, 13.3)	13.62 (12.99, 14.27)	0.98 (0.92, 1.03)	12.91 (12.90, 12.92)	13.45 (12.76, 14.18)	0.96 (0.90, 1.02)
	9	16.78 (16.76, 16.81)	15.47 (14.81, 16.17)	**1.09 (1.03, 1.14)**	16.28 (16.25, 16.3)	16.44 (15.67, 17.25)	0.99 (0.94, 1.05)
	10	26.6 (26.49, 26.72)	19.80 (19.06, 20.57)	**1.34 (1.29, 1.40)**	25.93 (25.80, 26.05)	20.17 (19.3, 21.07)	1.29 (1.23, 1.34)
Men	All	11.98 (11.91, 12.04)	11.86 (11.55, 12.19)	1.01 (0.98, 1.04)	12.05 (11.97, 12.12)	12.15 (11.77, 12.54)	0.99 (0.96, 1.03)
	1	3.12 (3.09, 3.14)	4.69 (4.10, 5.36)	**0.67 (0.55, 0.80)**	3.10 (3.08, 3.13)	4.45 (3.79, 5.22)	0.70 (0.56, 0.87)
	2	5.12 (5.10,	7.47 (6.69,	**0.69**	5.12 (5.10,	6.34 (5.51,	0.81

		5.13)	8.34)	**(0.59, 0.79)**	5.13)	7.28)	(0.68, 0.96)
	3	6.58 (6.57, 6.59)	9.12 (8.25, 10.07)	**0.72 (0.64, 0.82)**	6.58 (6.57, 6.59)	8.85 (7.88, 9.93)	0.74 (0.64, 0.86)
	4	7.96 (7.95, 7.97)	8.55 (7.70, 9.47)	0.93 (0.82, 1.05)	7.94 (7.93, 7.95)	8.45 (7.48, 9.54)	0.94 (0.82, 1.08)
	5	9.40 (9.39, 9.42)	10.72 (9.76, 11.76)	**0.88 (0.79, 0.98)**	9.40 (9.39, 9.42)	11.04 (9.92, 12.28)	0.85 (0.75, 0.97)
	6	11.00 (10.98, 11.01)	12.09 (11.07, 13.19)	0.91 (0.82, 1.01)	11.02 (11.00, 11.03)	12.47 (11.25, 13.80)	0.88 (0.79, 0.99)
	7	12.87 (12.86, 12.89)	13.80 (12.72, 14.95)	0.93 (0.85, 1.02)	12.95 (12.93, 12.96)	14.99 (13.68, 16.41)	0.86 (0.78, 0.96)
	8	15.30 (15.27, 15.32)	14.77 (13.67, 15.96)	1.04 (0.95, 1.13)	15.44 (15.42, 15.47)	16.28 (14.93, 17.73)	0.95 (0.86, 1.04)
	9	19.11 (19.07, 19.14)	17.56 (16.37, 18.82)	**1.09 (1.01, 1.18)**	19.27 (19.23, 19.31)	18.27 (16.81, 19.83)	1.06 (0.97, 1.15)
	10	29.32 (29.13, 29.52)	21.13 (19.87, 22.46)	**1.39 (1.30, 1.48)**	29.66 (29.43, 29.88)	23.14 (21.52, 24.87)	1.28 (1.20, 1.38)
Women	All	9.41 (9.37, 9.45)	9.42 (9.21, 9.63)	1.00 (0.97, 1.03)	9.06 (9.01, 9.10)	9.14 (8.92, 9.37)	0.99 (0.96, 1.02)
	1	2.22 (2.21, 2.23)	2.81 (2.46, 3.22)	**0.79 (0.67, 0.94)**	2.13 (2.11, 2.14)	2.31 (1.97, 2.71)	0.92 (0.76, 1.12)
	2	3.69 (3.68, 3.69)	4.02 (3.60, 4.50)	**0.92 (0.80, 1.06)**	3.60 (3.59, 3.61)	4.16 (3.70, 4.69)	0.87 (0.75, 1.00)
	3	4.83 (4.82, 4.83)	5.53 (5.02, 6.08)	**0.87 (0.78, 0.98)**	4.73 (4.73, 4.74)	4.80 (4.30, 5.35)	0.99 (0.86, 1.13)
	4	5.94 (5.94, 5.95)	6.78 (6.21, 7.40)	**0.88 (0.79, 0.97)**	5.81 (5.80, 5.81)	6.95 (6.35, 7.6)	**0.84 (0.75, 0.94)**
	5	7.11 (7.10, 7.12)	8.11 (7.49, 8.77)	**0.88 (0.80, 0.97)**	6.93 (6.92, 6.94)	7.93 (7.28, 8.62)	**0.88 (0.79, 0.97)**
	6	8.42 (8.41, 8.43)	9.08 (8.44, 9.77)	0.93 (0.85, 1.01)	8.17 (8.16, 8.18)	9.27 (8.57, 10.01)	**0.88 (0.80, 0.97)**

7	9.98 (9.97, 9.99)	10.87 (10.18, 11.62)	0.92 (0.85, 1.00)	9.66 (9.65, 9.67)	10.21 (9.48, 10.98)	0.95 (0.87, 1.03)
8	12.05 (12.04, 12.07)	11.89 (11.17, 12.66)	1.01 (0.94, 1.09)	11.61 (11.60, 11.63)	12.49 (11.70, 13.33)	0.93 (0.86, 1.01)
9	15.28 (15.26, 15.31)	14.87 (14.08, 15.70)	1.03 (0.96, 1.10)	14.58 (14.56, 14.61)	14.08 (13.25, 14.95)	1.04 (0.96, 1.11)
10	24.59 (24.45, 24.73)	19.36 (18.49, 20.26)	**1.27 (1.21, 1.34)**	23.34 (23.19, 23.48)	19.03 (18.09, 20.01)	**1.23 (1.16, 1.3)**

OA, osteoarthritis; estimates in **bold,** statistically significant

Figure 5.3. Re-estimated predicted versus observed 10-year risk (%) of cardiovascular disease by tenths of predicted risk in OA and non-OA cohorts aged ≥35 years in complete data



5.3.4 Imputed calibration and discrimination statistics of Framingham risk score in consulters with and without osteoarthritis

A total of 118,425 (28.83%) of the study participants were not recorded for continuous variables such as SBP, TC, and HDL in the CPRD GOLD and a multiple imputation process using linear regression models was applied to impute such data using osteoarthritis status, and other characteristics (e.g., age, sex, region, year of index consultation, current smoking, and T2DM) in the dataset as predictors.

Table 5.4 shows imputed calibration and discrimination statistics for Framingham risk score in osteoarthritis and non-osteoarthritis cohorts by sex. These statistics were consistent with those based on complete data, indicating restricted calibration and discrimination of Framingham risk score in both osteoarthritis and non-osteoarthritis in both sexes.

Table 5.4. Imputed calibration and discrimination statistics of Framingham risk score for predicting 10-year risk of cardiovascular disease in OA and non-OA cohorts aged ≥35 years

Statistics	Overall		Men		Women	
	OA	Non-OA	OA	Non-OA	OA	Non-OA
Calibration slope	0.74 (0.71, 0.76)	0.72 (0.69, 0.75)	0.60 (0.56, 0.64)	0.59 (0.54, 0.64)	0.83 (0.80, 0.86)	0.79 (0.76, 0.82)
Harrell's C	0.64 (0.63, 0.64)	0.65 (0.64, 0.65)	0.62 (0.61, 0.63)	0.63 (0.62, 0.64)	0.65 (0.64, 0.65)	0.66 (0.65, 0.66)

OA, osteoarthritis; Harrell's C, Harrell's concordance statistic

Predicted/observed ratios estimated from the imputed datasets were different between osteoarthritis and non-osteoarthritis cohorts (Table 5.5). Overall, the Framingham risk score underestimated the observed 10-year CVD risk by 13% (0.87 of ratio) in the osteoarthritis and by only 1% (0.99) in the non-osteoarthritis cohort (Table 5.5). For women, the observed risk was underestimated by 33% (0.67 of ratio) in osteoarthritis and by 25% (0.75 of ratio) in the non-osteoarthritis cohort. In men, the overall agreement estimated from the imputed datasets found the overpredicted risk of CVD in osteoarthritis (predicted/observed ratio: 1.17) and non-osteoarthritis consulters (1.41). Overpredicted CVD risks were also found in the 8^{th} – 10^{th} risk decile group and underpredicted risks were found in the 1^{st} -3^{rd} decile risk groups in the osteoarthritis population; overpredicted CVD risks were also found in the highest (9^{th} – 10^{th} decile) risk groups and underpredicted risks were found in the lowest (1^{st} decile) risk groups in the non-osteoarthritis population (Table 5.5).

Calibration plots based on imputed data confirmed the varying levels of agreement across risk groups, indicating the overall restricted calibration of the Framingham risk score, especially among consulters with osteoarthritis (Figure 5.3).

Table 5.5. Predicted and observed 10-year cardiovascular risk in OA and non-OA cohorts aged ≥35 years across tenths of predicted risk in imputed data

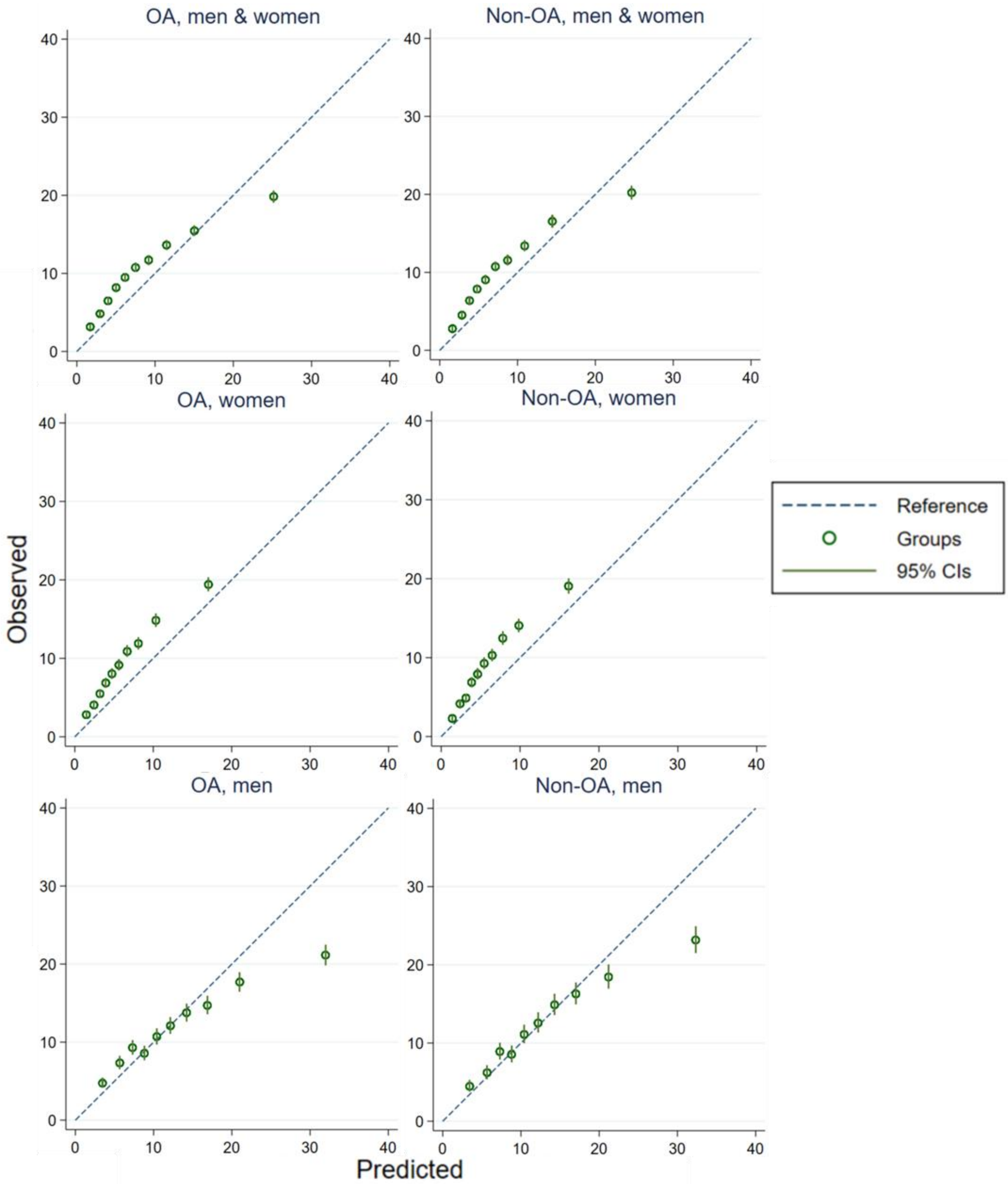
Tenths of risk		OA			Non-OA		
		Predicted (%) (95%CI)	Observed (%) (95%CI)	Ratio	Predicted (%) (95%CI)	Observed (%) (95%CI)	Ratio
Men & Women	All	8.82 (8.79, 8.86)	10.12 (9.96, 10.28)	**0.87 (0.85, 0.89)**	8.49 (8.46, 8.53)	8.55 (8.40, 8.70)	0.99 (0.97, 1.02)
	1	1.72 (1.71, 1.73)	3.16 (2.85, 3.49)	**0.54 (0.47, 0.63)**	1.64 (1.63, 1.64)	2.78 (2.47, 3.13)	**0.59 (0.50, 0.70)**
	2	2.96 (2.96, 2.97)	4.83 (4.45, 5.24)	**0.61 (0.55, 0.69)**	2.86 (2.85, 2.86)	4.50 (4.11, 4.93)	**0.64 (0.56, 0.72)**
	3	3.99 (3.98, 3.99)	6.49 (6.04, 6.96)	**0.61 (0.56, 0.68)**	3.83 (3.82, 3.83)	6.38 (5.91, 6.89)	**0.60 (0.54, 0.67)**
	4	5.02 (5.01, 5.02)	8.18 (7.68, 8.70)	**0.61 (0.56, 0.67)**	4.80 (4.80, 4.81)	7.85 (7.32, 8.42)	**0.61 (0.56, 0.67)**
	5	6.16 (6.16, 6.17)	9.47 (8.94, 10.03)	**0.65 (0.60, 0.70)**	5.88 (5.87, 5.88)	9.04 (8.47, 9.64)	**0.65 (0.60, 0.71)**
	6	7.50 (7.49, 7.50)	10.75 (10.19, 11.34)	**0.70 (0.65, 0.75)**	7.15 (7.14, 7.15)	10.73 (10.12, 11.39)	**0.67 (0.62, 0.72)**
	7	9.18 (9.17, 9.19)	11.71 (11.12, 12.33)	**0.78 (0.74, 0.84)**	8.72 (8.71, 8.73)	11.52 (10.88, 12.19)	**0.76 (0.70, 0.81)**
	8	11.47 (11.45, 11.48)	13.6 (12.97, 14.26)	**0.84 (0.80, 0.89)**	10.91 (10.90, 10.93)	13.38 (12.69, 14.11)	**0.82 (0.76, 0.87)**
	9	15.04 (15.01, 15.06)	15.43 (14.76, 16.12)	0.97 (0.93, 1.03)	14.47 (14.45, 14.49)	16.51 (15.74, 17.32)	**0.88 (0.83, 0.93)**
	10	25.17 (25.05, 25.29)	19.79 (19.05, 20.56)	**1.27 (1.22, 1.33)**	24.67 (24.54, 24.81)	20.17 (19.30, 21.07)	**1.22 (1.17, 1.28)**
Men	All	13.19 (13.12, 13.25)	11.29 (11.01, 11.57)	**1.17 (0.66, 2.02)**	13.26 (13.19, 13.34)	9.38 (9.11, 9.66)	**1.41 (1.36, 1.47)**
	1	3.46 (3.44, 3.48)	4.74 (4.15, 5.41)	**0.73 (0.61, 0.87)**	3.45 (3.42, 3.47)	4.46 (3.81, 5.23)	**0.77 (0.63, 0.95)**
	2	5.68 (5.66,	7.33 (6.56,	**0.77**	5.68 (5.66,	6.21 (5.40,	0.91

		5.69)	8.19)	**(0.67, 0.89)**	5.69)	7.15)	(0.78, 1.08)
	3	7.30 (7.28, 7.31)	9.28 (8.40, 10.24)	**0.79 (0.70, 0.89)**	7.29 (7.28, 7.31)	8.90 (7.93, 9.99)	0.82 (0.71, 0.94)
	4	8.81 (8.80, 8.82)	8.56 (7.72, 9.49)	1.03 (0.91, 1.16)	8.79 (8.78, 8.81)	8.49 (7.52, 9.59)	1.04 (0.90, 1.19)
	5	10.40 (10.39, 10.42)	10.66 (9.70, 11.71)	0.98 (0.88, 1.09)	10.41 (10.39, 10.42)	11.10 (9.98, 12.34)	0.94 (0.83, 1.06)
	6	12.15 (12.14, 12.17)	12.08 (11.07, 13.18)	1.01 (0.91, 1.11)	12.18 (12.16, 12.2)	12.48 (11.27, 13.82)	0.98 (0.87, 1.09)
	7	14.21 (14.19, 14.23)	13.75 (12.68, 14.91)	1.03 (0.95, 1.13)	14.29 (14.27, 14.31)	14.86 (13.55, 16.28)	0.96 (0.87, 1.06)
	8	16.86 (16.84, 16.89)	14.69 (13.59, 15.87)	**1.15 (1.06, 1.25)**	17.02 (17.00, 17.05)	16.25 (14.91, 17.7)	1.05 (0.95, 1.15)
	9	21.01 (20.97, 21.05)	17.67 (16.48, 18.93)	**1.19 (1.10, 1.28)**	21.19 (21.15, 21.24)	18.44 (16.98, 20.01)	**1.15 (1.06, 1.25)**
	10	31.97 (31.76, 32.17)	21.14 (19.88, 22.47)	**1.51 (1.42, 1.61)**	32.33 (32.09, 32.57)	23.08 (21.45, 24.8)	**1.40 (1.31, 1.50)**
Women	All	6.36 (6.33, 6.39)	9.51 (9.32, 9.70)	**0.67 (0.65, 0.69)**	6.11 (6.08, 6.14)	8.14 (7.97, 8.32)	**0.75 (0.73, 0.78)**
	1	1.47 (1.46, 1.47)	2.81 (2.46, 3.22)	**0.52 (0.43, 0.64)**	1.41 (1.40, 1.41)	2.29 (1.95, 2.69)	**0.62 (0.49, 0.77)**
	2	2.44 (2.44, 2.45)	4.06 (3.63, 4.54)	**0.60 (0.52, 0.70)**	2.38 (2.38, 2.39)	4.15 (3.69, 4.68)	**0.57 (0.49, 0.68)**
	3	3.20 (3.20, 3.21)	5.49 (4.98, 6.04)	**0.58 (0.51, 0.67)**	3.14 (3.14, 3.15)	4.87 (4.37, 5.43)	**0.64 (0.56, 0.75)**
	4	3.95 (3.95, 3.96)	6.87 (6.29, 7.49)	**0.57 (0.51, 0.65)**	3.86 (3.86, 3.87)	6.87 (6.28, 7.52)	**0.56 (0.49, 0.64)**
	5	4.74 (4.73, 4.74)	8.03 (7.42, 8.69)	**0.59 (0.53, 0.66)**	4.62 (4.61, 4.62)	7.91 (7.27, 8.61)	**0.58 (0.52, 0.66)**
	6	5.62 (5.62, 5.63)	9.13 (8.49, 9.82)	**0.62 (0.56, 0.68)**	5.45 (5.45, 5.46)	9.27 (8.57, 10.01)	**0.59 (0.53, 0.66)**

7	6.68 (6.68, 6.69)	10.88 (10.18, 11.62)	**0.61 (0.56, 0.67)**	6.47 (6.46, 6.48)	10.29 (9.57, 11.07)	**0.63 (0.57, 0.70)**
8	8.10 (8.09, 8.11)	11.89 (11.17, 12.66)	**0.68 (0.63, 0.74)**	7.80 (7.80, 7.81)	12.43 (11.64, 13.26)	**0.63 (0.57, 0.69)**
9	10.34 (10.32, 10.35)	14.83 (14.04, 15.66)	**0.70 (0.65, 0.75)**	9.86 (9.84, 9.87)	14.07 (13.25, 14.94)	**0.70 (0.65, 0.76)**
10	17.05 (16.94, 17.15)	19.35 (18.48, 20.25)	**0.88 (0.83, 0.93)**	16.14 (16.03, 16.25)	19.04 (18.09, 20.02)	**0.85 (0.80, 0.90)**

OA, osteoarthritis; estimates in **bold,** statistically significant

Figure 5.4. Predicted versus observed 10-year risk (%) of cardiovascular disease by tenths of predicted risk in OA and non-OA cohorts aged ≥35 years in imputed data



To improve the calibration of the Framingham risk score, recalibration was also attempted within imputed datasets. After the recalibration, predicted/observed rates ratios showed improved calibration of Framingham risk score in osteoarthritis than non-osteoarthritis consulters overall (1.01 cf. 1.16), in men (1.06 cf. 1.29) and women (0.97 cf. 1.10) but the variety still existed in the agreement across decile risk groups (Table 5.6). Osteoarthritis consulters had a more extremely varied agreement across risk groups; the level of overprediction in high-risk groups and underprediction in lower-risk groups was greater compared to non-osteoarthritis consulters regardless of sex (Table 5.6). After the recalibration, calibration plots based on imputed data also revealed the overall restricted calibration of the Framingham risk score, especially among consulters with osteoarthritis (Figure 5.4).

Table 5.6. Re-estimated predicted and observed 10-year cardiovascular risk in OA and non-OA cohorts aged ≥35 years across tenths of predicted risk in imputed data

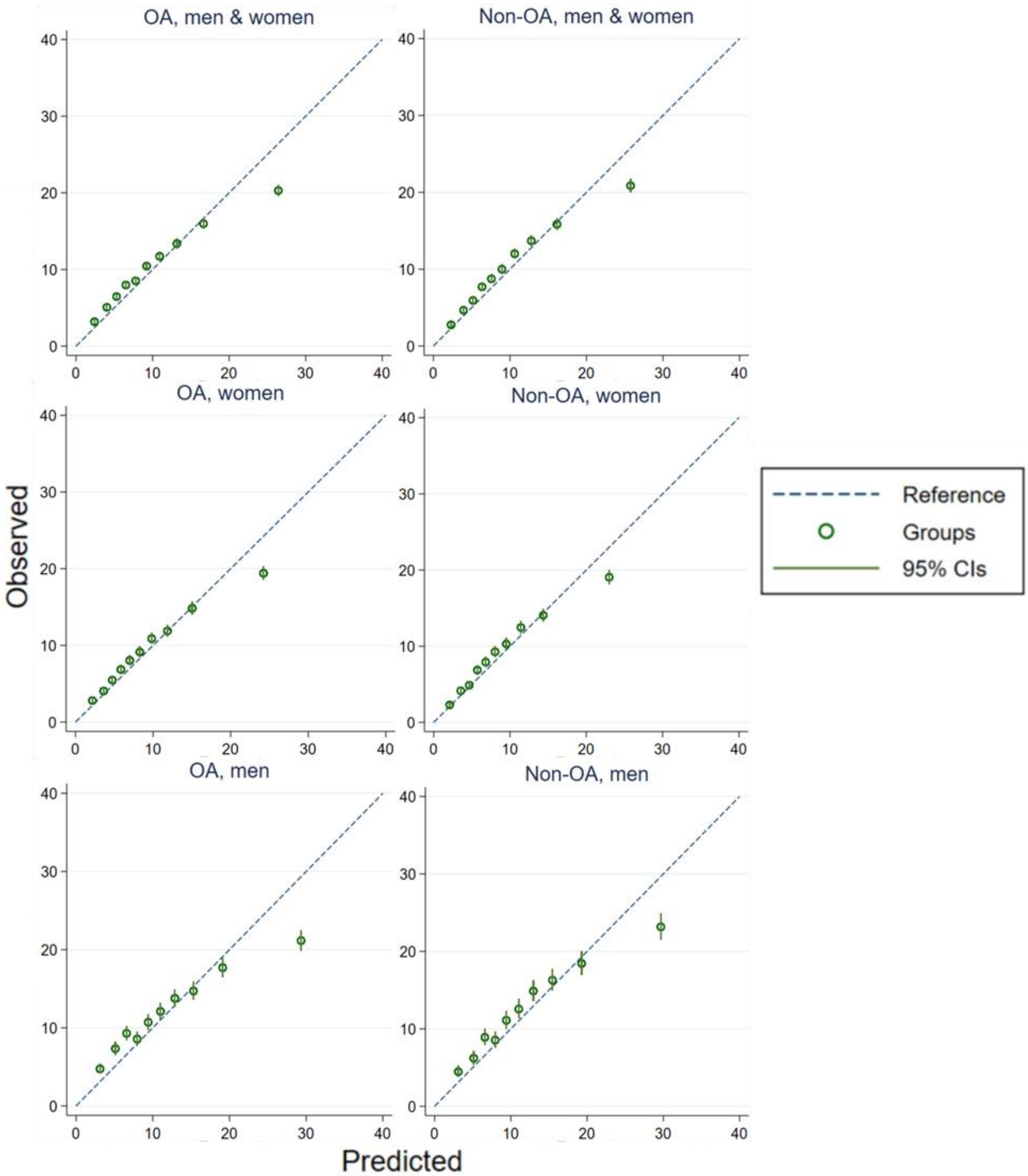
Tenths of risk		OA			Non-OA		
		Predicted (%) (95%CI)	Observed (%) (95%CI)	Ratio	Predicted (%) (95%CI)	Observed (%) (95%CI)	Ratio
Men & Women	All	10.24 (10.21, 10.28)	10.12 (9.96, 10.28)	1.01 (0.99, 1.03)	9.96 (9.92, 10.00)	8.55 (8.40, 8.70)	**1.16 (1.14, 1.19)**
	1	2.41 (2.40, 2.42)	3.20 (2.89, 3.53)	**0.75 (0.66, 0.86)**	2.31 (2.30, 2.32)	2.77 (2.46, 3.12)	**0.83 (0.72, 0.97)**
	2	4.03 (4.03, 4.04)	5.07 (4.68, 5.49)	**0.79 (0.72, 0.88)**	3.93 (3.93, 3.94)	4.65 (4.25, 5.09)	**0.85 (0.76, 0.95)**
	3	5.30 (5.29, 5.30)	6.47 (6.03, 6.95)	**0.82 (0.75, 0.89)**	5.17 (5.16, 5.18)	5.94 (5.47, 6.43)	**0.87 (0.79, 0.96)**
	4	6.52 (6.51, 6.52)	7.98 (7.48, 8.50)	**0.82 (0.76, 0.88)**	6.35 (6.34, 6.35)	7.70 (7.17, 8.26)	**0.82 (0.76, 0.90)**
	5	7.79 (7.78, 7.79)	8.52 (8.01, 9.05)	**0.91 (0.85, 0.99)**	7.57 (7.57, 7.58)	8.73 (8.17, 9.33)	**0.87 (0.80, 0.94)**
	6	9.22 (9.21, 9.23)	10.42 (9.86, 11.02)	**0.88 (0.83, 0.95)**	8.95 (8.95, 8.96)	9.99 (9.39, 10.63)	**0.90 (0.83, 0.97)**
	7	10.93 (10.92, 10.94)	11.71 (11.12, 12.33)	**0.93 (0.88, 0.99)**	10.62 (10.61, 10.63)	11.97 (11.31, 12.67)	**0.89 (0.83, 0.95)**
	8	13.17 (13.16, 13.18)	13.37 (12.74, 14.02)	0.99 (0.93, 1.04)	12.79 (12.78, 12.81)	13.66 (12.97, 14.39)	0.94 (0.88, 1.00)
	9	16.65 (16.63, 16.67)	15.94 (15.27, 16.64)	1.04 (0.99, 1.1)	16.14 (16.12, 16.16)	15.81 (15.08, 16.58)	1.02 (0.97, 1.08)
	10	26.42 (26.31, 26.54)	20.27 (19.54, 21.02)	**1.30 (1.25, 1.36)**	25.77 (25.64, 25.89)	20.83 (19.98, 21.71)	**1.24 (1.18, 1.29)**
Men	All	11.98 (11.92, 12.05)	11.29 (11.01, 11.57)	**1.06 (0.59, 1.87)**	12.06 (11.98, 12.13)	9.38 (9.11, 9.66)	**1.29 (1.24, 1.34)**
	1	3.12 (3.10, 3.14)	4.74 (4.15, 5.41)	**0.66 (0.55, 0.79)**	3.11 (3.08, 3.13)	4.46 (3.81, 5.23)	**0.70 (0.56, 0.86)**
	2	5.12 (5.11, 5.13)	7.33 (6.56, 8.19)	**0.70 (0.61,**	5.12 (5.11, 5.14)	6.21 (5.40, 7.15)	**0.82 (0.70,**

				0.81)			**0.98)**
	3	6.59 (6.58, 6.60)	9.28 (8.40, 10.24)	**0.71 (0.63, 0.81)**	6.59 (6.57, 6.60)	8.90 (7.93, 9.99)	**0.74 (0.64, 0.86)**
	4	7.96 (7.95, 7.97)	8.56 (7.72, 9.49)	0.93 (0.82, 1.05)	7.95 (7.94, 7.96)	8.49 (7.52, 9.59)	0.94 (0.81, 1.08)
	5	9.41 (9.40, 9.42)	10.66 (9.70, 11.71)	**0.88 (0.79, 0.99)**	9.41 (9.40, 9.43)	11.10 (9.98, 12.34)	**0.85 (0.75, 0.96)**
	6	11.00 (10.99, 11.01)	12.08 (11.07, 13.18)	0.91 (0.82, 1.01)	11.03 (11.01, 11.04)	12.48 (11.27, 13.82)	**0.88 (0.79, 0.99)**
	7	12.88 (12.86, 12.89)	13.75 (12.68, 14.91)	0.94 (0.85, 1.03)	12.96 (12.94, 12.97)	14.85 (13.54, 16.27)	**0.87 (0.79, 0.97)**
	8	15.30 (15.28, 15.33)	14.69 (13.59, 15.87)	1.04 (0.96, 1.14)	15.45 (15.43, 15.48)	16.26 (14.92, 17.71)	0.95 (0.86, 1.05)
	9	19.12 (19.08, 19.15)	17.67 (16.48, 18.93)	1.08 (1.00, 1.17)	19.28 (19.24, 19.33)	18.44 (16.98, 20.01)	1.05 (0.96, 1.14)
	10	29.33 (29.14, 29.53)	21.14 (19.88, 22.47)	**1.39 (1.30, 1.48)**	29.68 (29.45, 29.90)	23.08 (21.45, 24.8)	**1.29 (1.20, 1.38)**
Women	All	9.26 (9.22, 9.30)	9.51 (9.32, 9.70)	0.97 (0.95, 1.00)	8.92 (8.88, 8.96)	8.14 (7.97, 8.32)	**1.10 (1.06, 1.13)**
	1	2.18 (2.17, 2.19)	2.81 (2.46, 3.22)	**0.78 (0.65, 0.92)**	2.09 (2.08, 2.10)	2.29 (1.95, 2.69)	0.91 (0.75, 1.11)
	2	3.62 (3.62, 3.63)	4.06 (3.63, 4.54)	0.89 (0.78, 1.03)	3.54 (3.53, 3.55)	4.15 (3.69, 4.68)	**0.85 (0.74, 0.99)**
	3	4.75 (4.74, 4.75)	5.49 (4.98, 6.04)	**0.87 (0.77, 0.98)**	4.66 (4.65, 4.66)	4.87 (4.37, 5.43)	0.96 (0.84, 1.09)
	4	5.85 (5.84, 5.85)	6.87 (6.29, 7.49)	**0.85 (0.77, 0.95)**	5.71 (5.71, 5.72)	6.87 (6.28, 7.52)	**0.83 (0.74, 0.93)**
	5	6.99 (6.99, 7.00)	8.03 (7.42, 8.69)	**0.87 (0.79, 0.96)**	6.82 (6.81, 6.82)	7.91 (7.27, 8.61)	**0.86 (0.78, 0.96)**
	6	8.28 (8.28, 8.29)	9.13 (8.49, 9.83)	**0.91 (0.83, 0.99)**	8.04 (8.03, 8.05)	9.27 (8.57, 10.01)	**0.87 (0.79, 0.96)**
	7	9.82 (9.81,	10.88	**0.90**	9.51 (9.50,	10.29 (9.57,	0.92

	9.83)	(10.18, 11.62)	**(0.83, 0.98)**	9.52)	11.07)	(0.85, 1.01)
8	11.86 (11.84, 11.87)	11.90 (11.17, 12.66)	1.00 (0.93, 1.07)	11.43 (11.42, 11.45)	12.43 (11.64, 13.27)	0.92 (0.85, 1.00)
9	15.04 (15.02, 15.06)	14.83 (14.04, 15.66)	1.01 (0.95, 1.08)	14.36 (14.34, 14.38)	14.07 (13.24, 14.94)	1.02 (0.95, 1.10)
10	24.24 (24.1, 24.38)	19.35 (18.48, 20.25)	**1.25 (1.19, 1.32)**	23.00 (22.86, 23.15)	19.04 (18.10, 20.02)	**1.21 (1.14, 1.28)**

OA, osteoarthritis; estimates in **bold,** statistically significant

Figure 5.5. Re-estimated predicted versus observed 10-year risk (%) of cardiovascular disease by tenths of predicted risk in OA and non-OA cohorts aged ≥35 years in imputed data



5.4 Discussion

5.4.1 Summary of study findings

This study showed restricted and similar performance of the Framingham risk score, in terms of calibration and discrimination, in the UK primary care consulters for osteoarthritis and non-osteoarthritis consulters. Among consulters with osteoarthritis, the Framingham risk score underpredicted the 10-year CVD risk by 14% overall and 32% in women and overpredicted the risk by 12% in men. Among consulters without osteoarthritis, a similar prediction was observed. Recalibration by updating baseline survivals was also attempted to improve the calibration of the risk score, which yielded the improved overall agreement between predicted and observed risk, but the calibration was still restricted because the risk was overpredicted in higher-risk groups and underpredicted in lower-risk groups. Calibration and discrimination were measured, and re-calibration was attempted in the imputed datasets. The overall predicted/observed risk ratio improved in consulters without osteoarthritis but not in consulters with osteoarthritis, as good agreement between predicted and observed risk was still not observed in consulters with osteoarthritis, especially those within the highest or lowest risk group. Discrimination and calibration slope was still restricted in both consulters with and without osteoarthritis after recalibration in imputed data.

5.4.2 Comparisons with other studies

Irrespective of numerous studies to validate the Framingham risk score in general populations (Damen et al., 2019) and other populations with specific conditions, such as those with diabetes (McEwan et al., 2004), CKD (Weiner et al., 2007), and rheumatoid arthritis (Arts et al., 2015), validating Framingham risk score in osteoarthritis by testing its model discrimination and calibration has not been previously implemented. In external general populations, the Framingham risk score generally overpredicts the CVD risk in the highest risk group and underpredicts the risk in the lowest risk group, and even overpredicts the overall risk (Damen et al., 2019). A validation study using the primary care EHRs from the UK (THIN database) reported that the sex-specific Framingham risk score overpredicted the overall 10-year CVD risk (by 18% in men and by 4% in women) but discriminated well (C statistics: 0.75 in men and 0.77 in women) in general practice consulters (Collins & Altman, 2009). In contrast to studies in general populations, previous studies of the performance of Framingham risk score in subpopulations with specific conditions have tended to show lower discrimination and to underestimate CVD risk in those with comorbidities (McEwan et al., 2004, Weiner et al., 2007, Arts et al., 2015). This is similar to the findings of the current study, especially in the overall consulters for osteoarthritis, and female consulters with osteoarthritis. Considering the wide application of the Framingham risk score to assist the clinical decision on timing, dose, and type of risk-lowering medications, its restricted predictive capacities in consulters for osteoarthritis may fail to provide timely preventive interventions or tailored management schemes and as a result the potential poorer CVD outcomes and health burdens in this specific population.

This study also revealed that the agreement between predicted and observed CVD risk differed between men and women with osteoarthritis. For example, the Framingham risk score consistently underpredicted the risk in women with osteoarthritis but overpredicted the risk in men with osteoarthritis overall and those in a higher risk decile. This sex-specific differentiation in the overall agreement might be explained by the marked difference in CVD risk between men and women with osteoarthritis. This is evidenced by the higher CVD event rate at 10 years (11.86 (95%CI: 11.55, 12.19) % cf. 9.42 (9.21, 9.63) %) in men than in women with osteoarthritis. Chapter 3 also reported a higher prevalence of current smoking (25.70 (25.47, 26.09) % cf. 23.14 (22.92, 23.36) %) and T2DM (10.71 (10.49, 10.94) % cf. 7.20 (7.07, 7.34) %) in men than women among consulters for osteoarthritis. The overprediction in men with higher predicted risk might be explained by that individuals with high risk are more likely to receive risk-reducing treatments during follow-up, resulting in a lower event rate (Damen et al., 2019). Underprediction is likely to lead to missing opportunities for risk-reducing treatments and consequently a high event rate. The attempt to solve the miscalibration was made by recalibration in the current study. However, the recalibrated model still consistently underpredicted the risk in most risk decile groups (1-7 tenths of risk) both in men and women with osteoarthritis and overpredicted the risk in those within the highest risk decile group.

The restricted performance of both the original and recalibrated Framingham model among consulters for osteoarthritis might be explained by the differential effects and types of CVD predictors from the original population. Although no previous CVD risk prediction models focused only on osteoarthritis, specific Framingham predictors such as age, sex, and T2DM are related to both osteoarthritis and CVD (Fernandes & Valdes, 2015, Louati et al., 2015), and therefore, the association between these predictors and CVD risk in terms of regression coefficients might be different from those in the general population. In addition to Framingham predictors, many osteoarthritis-related factors, such as obesity, inflammation, use of pain-relief drugs, and physical inactivity, may plan an important role in the excess CVD events in consulters for osteoarthritis, as their strong association with the development of

CVD in general populations (Fernandes & Valdes, 2015). Other CVD risk prediction tools with additional predictors, such as the QRISK3 (includes obesity) (Hippisley-Cox, Coupland & Brindle, 2017), have been developed and recommended for use in UK primary care by clinical guidelines (NICE, 2016). The older version of QRISK2 has been reported to calibrate better and discriminate similarly compared to the sex-specific Framingham risk score in the UK primary care consulters (Collins & Altman, 2009). Some existing CVD risk scores, like QRISK3, were not applied in the current study due to the unavailable code list to define predictors and baseline hazard for risk estimation. Future studies to validate the QRiSK3 in the osteoarthritis and non-osteoarthritis population are warranted. ASSIGN score emulated from the Framingham score with incorporation of Scotland Index of Multiple Deprivation (similar neighbourhood socioeconomic inequalities measurements as Index of Multiple Deprivation, family history of CHD/stroke, daily amount of cigarettes consumption has been proved to serve the Scottish general population very well in terms of the prediction 10-year risk of CVD. However, due to the lack of validated code lists for family history of CHD/Stroke and daily cigarette consumption in English primary care, the current study could not apply the ASSIGN score to estimate the CVD risk in osteoarthritis and non- osteoarthritis population. Future studies with those predictors to estimate the CVD risk using ASSIGN scores in osteoarthritis and non-osteoarthritis population are also warranted.

5.4.3 Strengths and limitations

This is the first large UK representative matched cohort extracted from long-term longitudinal primary care records with national linkages to validate the model performance of Framingham risk score in the osteoarthritis and comparative non-osteoarthritis populations.

Previous studies have demonstrated the national representativeness and good coverage of the databases used in the current study. Both variables and outcomes were defined by established code lists validated in previous studies. There are some limitations of the current study. First, as described above, assessments of other CVD risk prediction tools, such as the QRISK3, used in UK primary care were not performed in this study. A prediction tool used in Scottish primary care, the ASSIGN (Woodward et al., 2007), was also not included in the study, because the linkage to the Scottish Index of Multiple Deprivation is used as a predictor in the ASSIGN and is not available in the current CPRD GOLD. Second, the missing percentage of predictors was relatively high (40% in the worst scenario). Although the imputation was attempted, the agreement between predicted and observed risk was not improved in those with osteoarthritis. Future studies with low missingness to validate the score are warranted.

5.5 Conclusion

Good model performance in terms of model calibration and discrimination for sex-specific Framingham risk score to predict the 10-year CVD risk in primary care consulters for osteoarthritis aged 35 and over was not observed in this current study derived from UK primary care records linked with national cause-specific death registration. Framingham risk score underpredicted the 10-year CVD risk in primary care consulters for osteoarthritis aged 35 and over, especially in those who were women. Recalibration and application of the score in the imputed dataset also could not improve the performance of the score. The current findings suggest in the population with osteoarthritis clinical decisions aided by this score might fail to provide timely preventive interventions or tailored intensive management schemes and as a result potentially poorer CVD outcomes and health burdens in this specific population. Future validation works in the osteoarthritis population with access to predictors and algorithms of other CVD prediction tools, such as the QRISK3 and ASSIGN are warranted. A new specific risk score to predict the CVD risk in the osteoarthritis population is also warranted.

Chapter 6: Excess risk of cardiovascular disease for newly diagnosed osteoarthritis in primary care in England

6.1 Introduction

Findings in previous chapters (Chapters 3-4) identified a persistently high prevalence of modifiable CVRFs and suboptimal CVD risk-reducing prescriptions among UK primary care consulters with newly diagnosed osteoarthritis over the past two decades. It is necessary to accurately estimate the magnitude of excess risk of CVD for having newly diagnosed osteoarthritis in a primary care setting to understand the excess potential health burden of CVD outcomes.

The relative risk of CVD in people with osteoarthritis compared with those without osteoarthritis has been outlined in previous chapters. For example, a meta-analysis of 15 studies reported an increased risk of CVD in people with osteoarthritis compared to matched controls without osteoarthritis (pooled RR: 1.69, 95% CI 1.13 to 2.53) (Hall et al., 2016). Recent longitudinal studies also reported an association between hand, knee, or hip osteoarthritis and an increased CVD risk (Haugen et al., 2015, Kendzerska et al., 2017). However, the interpretation of studies to date has been limited by inadequate control for the effects of confounders such as coexisting traditional risk factors. Other studies controlled some potential confounders but had short follow-ups (Haugen et al., 2015, Kendzerska et al., 2017). Importantly, few previous studies have addressed the excess risk of CVD due to newly diagnosed osteoarthritis in primary care settings. Several studies using primary care EHRs have reported associations between predictors (blood pressure, T2DM, smoking, socioeconomic deprivation) other than osteoarthritis and the incidence of CVD (Pujades-

Rodriguez et al., 2014, Pujades-Rodriguez et al., 2015, Rapsomaniki et al., 2014, Shah et al., 2015). This has shown sufficient data validity in primary care EHRs to provide a useful indication of disease associations in research.

In Chapter 5, the sex-specific Framingham risk score could not accurately predict the risk of 10-year CVD in terms of model discrimination and calibration in people with osteoarthritis from the primary care setting. Thus, this risk score does not give robust estimates of the excess CVD risk in people with osteoarthritis, and other validated methods are needed for estimation. In this chapter, data from nationally representative primary care records linked to the English national socioeconomic deprivation database was used to identify a cohort incorporating consulters with newly diagnosed osteoarthritis recorded between 1992-2017, and their age-, sex- and practice-matched controls who did not consult for osteoarthritis. The adjusted excess risk of CVD events recorded both in primary care and death registration from the Office of National Statistics (ONS) was estimated for the osteoarthritis and non-osteoarthritis cohorts, controlling for (i) demographics, period effects, and recording variance between practices and (ii) adjustment for lifestyle risk factors, clinical measurements, modifiable CVRFs, pharmacological treatments, and socioeconomic status.

This chapter addresses the following question:

- Is there a long-term absolute risk difference of CVD between at-risk populations with and without newly diagnosed osteoarthritis recorded in the UK primary care settings between 1992-2017?

6.2 Method

6.2.1 Data setting

Data from CPRD GOLD (as described in chapter 2) was used for this analysis. Patient-level data linkages to death registrations (death registration from the Office of National Statistics (ONS)) and deprivation measures (area-level socioeconomic status from the English index of multiple deprivation (IMD)) were also used in this study.

6.2.2 Matched cohort

Eligible members in the case group were those with newly diagnosed osteoarthritis recorded in CPRD GOLD between 1 January 1992 and 31 December 2017 and without any record of osteoarthritis within three years prior to index consultation (date of incident diagnosis of osteoarthritis of the case) and aged 35 years and over by index consultation. Eligible members in the control group were 1:1 age-, sex-, and practice-matched individuals without osteoarthritis by index date selected by the risk-set sampling method. Either case or matched control in the same risk set without English IMD 2015 linkage or with any CVD event recorded in CPRD GOLD or ONS within 3 years prior to the index consultation was excluded from the matched cohort.

6.2.3 Covariables

Demographical variables (sex and age by index date), geographical region, lifestyle variables (like current smoking status), modifiable CVRFs (hypertension and T2DM), body measurement (body mass index (BMI), systolic blood pressure), lipid profile (triglyceride, total cholesterol, LDL cholesterol) were extracted from CPRD GOLD primary care records within 3 years prior to the index consultation. The most recent records to the index date were used for those with multiple records. Socio-economic status indicators were extracted from deciles of the area-level IMD in 2015 England.

6.2.4 Outcome

The earliest CVD event (IHD, HF, cerebrovascular disease, PAD, and CVD deaths) recorded either in primary care records or death registration from ONS during the follow-up after index consultation was defined as an incident CVD event. All participants were followed from the date of the index consultation until the first date among the date of the incident CVD, date of death, date transferred out, or 31 December 2017.

6.2.5 Statistical analysis

Analyses were performed using STATA/MP 14.2 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP). Two-sided $P<0.05$ was set as the statistical significance level. Categorical variables were presented as numbers and percentages; continuous variables were presented as medians and interquartile ranges (IQR). The study used survival analysis methods (as described in chapter 5 section 5.2.5) to obtain the hazard function of CVD in the osteoarthritis and non-osteoarthritis cohorts.

Although it is not always needed to account for matching in analysis, an analysis that does account for the matching may provide a strength in some studies: a matched-pair analysis only needs data from matched pairs in which one or both presented the event (Cummings, McKnight, and Greenland, 2003). In the current study, controls without osteoarthritis were selected based on the matching variables (age, gender, practice, and index consultation year) of the osteoarthritis cases. Consequently, the selected controls might not represent the entire population from which the osteoarthritis cases were derived. The potential selection bias it generated could be prevented in the analysis conditional on the values of the matching variables, controls would then be more representative of the source population (Cummings, McKnight, and Greenland, 2003). To account for the potential bias due to matching, a frailty model ('conditional Cox proportional hazard model') was applied to estimate the excess risk of CVD related to having newly diagnosed osteoarthritis. The model details were presented below:

$$\mu(t, Z, X) = Z\mu_0(t)\exp\,(\beta^T X)$$

where $\mu_0(t)$is the baseline hazard function, β is the vector of regression coefficients, X is the vector of observed covariates, and Z is the frailty variable. The frailty variable Z is a random variable varying over the population which lowers ($Z<1$) or increases ($Z>1$) the individual risk (here, it is the matching pair). 'Frailty' is the failure to control for unmeasured differences between individuals. It corresponds to the notions of liability or susceptibility in different settings (dos Santos, Davies and Francis, 1995). The parameters included in the final model were selected by backward elimination ($P<0.01$). Marginal estimations of the risk difference from the final models were used to estimate the excess risk (attributable risk fraction, %) as below.

$$f^{(i)}(W_j, \theta) = exp\left\{(W_j^{(i)} - W_j)\beta\right\}$$

Where $i \in \{0, 1\}$ W_j indicates the covariate vector. β denotes the column vector containing the sub-vector of the parameter vector θ containing the coefficients corresponding to the covariates of the z vector.

Matching, adjustment in the multivariate model, and stratification were used to control the effects of potential confounders on the association between osteoarthritis and CVD (Kestenbaum, 2009). Demographic variables including age and sex were matching variables. Consultation year and practice were also matching variables for addressing period effects and recording variance, respectively. Lifestyle risk factors (current smoking status), clinical measurement (systolic blood pressure, total cholesterol, and LDL cholesterol), modifiable CVRFs (hypertension), pharmacological treatment (statins, antihypertensive drugs, and antidiabetic drugs) and socioeconomic status (English IMD deciles) were adjusted for in the model. Stratified analyses of adjusted excess risk were conducted based on sex, age group, English IMD deciles and geographical regions.

Multiple imputation is appropriate for handling missing data when missing at random is assumed; the proportions of missing data are above 5% and below 40% (Jakobsen et al., 2017). Although it could not be confirmed that the continuous variables such as systolic blood pressure in the current study were missing at random, multiple imputation was still selected to check whether the missingness changes the study results as there were no resources to trace people with missing values using EHRs. The missing percentage continuous variables ranged from 5-39% of all matched cohort members. Based on a worst-case scenario of 39% of participants with one or more missing covariates, 39 imputed datasets were created using multiple imputation with chained equations (Rubin, 1987). Final model estimations were derived from the imputed datasets.

6.3 Results

6.3.1 Characteristics of the matched cohort

103,740 incident osteoarthritis cases were diagnosed between 1992-2017 and their 1:1 age-, sex-, and practice-matched controls were incorporated into the matched cohort. The characteristic of cohort members was presented in Table 6.1. 66.2% of the cohort members (either case or control group) were female gender. The proportion of age-group 35-44, 45-54, 55-64, 65-74, 75-84, and 85+ years in the cohort (either case or control group) was 5.36%, 20.63%, 33.47%, 24.78%, 13.85%, and 1.91%, respectively. 3.13%, 17.61%, 5.51%, 3.96%, 14.00%, 11.57%, 11.57%, 11.37%, 9.06%, and 12.21% of cohort members (either case or cohort group) resident in North East, North West, Yorkshire & The Humber, East Midlands, West Midlands, East of England, South West, South Central, London and South East Coast, respectively. The proportion of the least and the most deprived group was 12.43% and 7.63% in the case group, and 12.62% and 7.34% in the control group, respectively. The prevalence of current smoking, hypertension and type 2 diabetes was 23.79%, 36.50%, and 8.02% in the case group, and 20.23%, 29.84%, and 8.19% in the control group, respectively. The median body mass index, systolic blood pressure, total cholesterol, LDL cholesterol, HDL cholesterol, and triglyceride were 28.2 kg/m2, 138 mmHg, 5.4 mmol/L, 3.2 mmol/L, 1.41 mmol/L, and 1.40 mmol/L in the case group. The median follow-up was 7.92 (IQR: 4.35-11.60) years and 6.28 (2.86-10.48) years in the case and the control group. The rates of incident CVD events were 8.63% and 7.75% in the case and the control group.

Table 6.1 Characteristics of study participants

	OA cohort	Non-OA cohort
No. patients	103,740	103,740
CVD, n (%)	8,953 (8.63)	8,036 (7.75)
Follow-up, median (IQR) years	7.92 (4.35-11.60)	6.28 (2.86-10.48)
Female, n (%)	68,756 (66.2)	68,756 (66.2)
Age, n (%)		
35-44 years	5,565 (5.36)	5,565 (5.36)
45-54 years	21,398 (20.63)	21,398 (20.63)
55-64 years	34,723 (33.47)	34,723 (33.47)
65-74 years	25,706 (24.78)	25,706 (24.78)
75-84 years	14,371 (13.85)	14,371 (13.85)
85+ years	1,977 (1.91)	1,977 (1.91)
Region, n (%)		
North East	3,250 (3.13)	3,250 (3.13)
North West	18,272 (17.61)	18,272 (17.61)
Yorkshire & The Humber	5,711 (5.51)	5,711 (5.51)
East Midlands	4,106 (3.96)	4,106 (3.96)
West Midlands	14,527 (14.00)	14,527 (14.00)
East of England	11,998 (11.57)	11,998 (11.57)
South West	12,007 (11.57)	12,007 (11.57)
South Central	11,799 (11.37)	11,799 (11.37)
London	9,404 (9.06)	9,404 (9.06)
South East Coast	12,666 (12.21)	12,666 (12.21)
10-level of Index of Multiple Deprivation, n (%)		
1(Least Deprivation)	12,892 (12.43)	13,092 (12.62)
2	11,605 (11.19)	12,153 (11.71)
3	11,641 (11.22)	11,864 (11.44)
4	12,158 (11.72)	12,036 (11.60)
5	11,993 (11.56)	12,130 (11.69)

6	9,885 (9.53)	9,861 (9.51)
7	9,558 (9.21)	9,340 (9.00)
8	8,346 (8.05)	8,211 (7.91)
9	7,751 (7.47)	7,438 (7.17)
10(Most Deprivation)	7,911 (7.63)	7,615 (7.34)
Current smoker, n (%)	24,680 (23.79)	20,984 (20.23)
Hypertension, n (%)	37,861 (36.50)	30,961 (29.84)
Type 2 diabetes mellitus, n (%)	8,315 (8.02)	8,498 (8.19)
Body mass index, kg/m2	28.2 (25.0–- 32.2)	27.6 (24.5-31.4)
Systolic blood pressure, median (IQR) mmHg	138 (126-149)	137 (125- 148)
Total cholesterol, median (IQR) mmol/L	5.40 (4.70- 6.20)	5.40 (4.70-6.20)
Low-density lipoprotein cholesterol, median (IQR) mmol/L	3.20 (2.50-4.00)	3.10 (2.50- 4.00)
High-density lipoprotein cholesterol, median (IQR) mmol/L	1.41 (1.20-1.72)	1.47 (1.20-1.80)
Triglyceride, median (IQR) mmol/L	1.40 (1.00-1.93)	1.30 (0.90-1.80)
Antihypertensive treatment, n (%)	48,848 (47.05)	39,122 (37.68)
Statins, n (%)	22,113 (21.30)	19,454 (18.74)
Antidiabetic treatment, n (%)	5,590 (5.38)	4,786 (4.61)

OA, osteoarthritis; CVD, cardiovascular disease; IQR, interquartile range

6.3.2 Parameters estimated from the final frailty model

Osteoarthritis, current smoking status, IMD levels (least deprived decile as reference), systolic blood pressure, LDL cholesterol, triglyceride, hypertension, prescription of antihypertensive medication, prescription of statins, and prescription of diabetes medication were included in the final Frailty model (Table 6.2). The adjusted HR for other CVRFs and pharmacological treatments are presented in Table 6.2. Compared with the least deprived decile, the adjusted HR ranged from 1.22 (1.04 to 1.44) to 1.55 (1.27 to 1.90) for IMD levels 2-10, respectively. With 1 unit increase in systolic blood pressure (1 mmHg increase), LDL cholesterol (1 mmol/L increase), and triglyceride (1 mmol/L increase), the adjusted HR was 1.003 (1.001 to 1.005), 1.16 (1.12 to 1.20), and 1.07 (1.02 to 1.12), respectively.

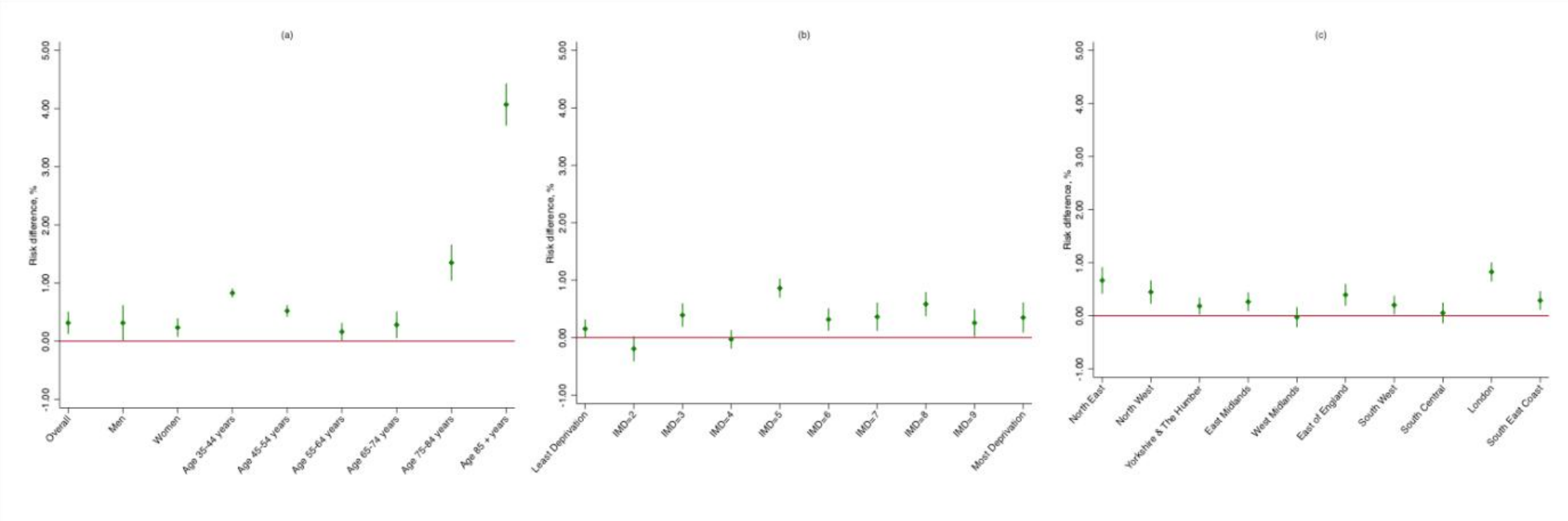
Table 6.2 Multivariate adjusted hazard ratios for parameters included in the frailty model

Parameters	Adjusted hazard ratio (95%CI)
Osteoarthritis, yes vs no	1.07 (1.02 to 1.13)
Current smoking, yes vs no	1.20 (1.15 to 1.26)
10-level of index of multiple deprivation	
1(least deprivation)	Reference
2	1.22 (1.04 to 1.44)
3	1.12 (0.96 to 1.31)
4	1.15 (0.98 to 1.35)
5	1.10 (0.93 to 1.30)
6	1.34 (1.12 to 1.59)
7	1.07 (0.89 to 1.27)
8	1.24 (1.04 to 1.49)
9	1.46 (1.20 to 1.77)
10(most deprivation)	1.55 (1.27 to 1.90)
Systolic blood pressure, 1 mmHg increase	1.003 (1.001 to 1.005)
Low-density lipoprotein cholesterol, 1 mmol/L increase	1.16 (1.12 to 1.20)
Triglyceride, 1 mmol/L increase	1.07 (1.02 to 1.12)
Hypertension, yes vs no	1.08 (1.00 to 1.18)
Being prescribed antihypertensive treatment, yes vs no	0.82 (0.75 to 0.90)
Being prescribed statins, yes vs no	0.86 (0.79 to 0.95)
Being prescribed antidiabetic treatment, yes vs no	0.70 (0.61 to 0.81)

6.3.3 Adjusted excess risk of CVD for osteoarthritis

The overall adjusted excess risk of CVD for osteoarthritis was 0.31 (0.12 to 0.51) % (Figure 6.1 – (a)). The adjusted excess risk was higher for men (0.31 (0.01 to 0.62) %) than for women (0.23 (0.07 to 0.39) %). The adjusted excess risk was higher in the youngest (0.83 (0.75 to 0.91) % for 35-44 years) as well as the oldest age groups (1.35 (1.04 to 1.66) % for 75-84, and 4.07 (3.71 to 4.43) % for 85 + years) (Figure 6.1 – (a)). The adjusted excess risk was higher in more deprived deciles (0.86 (0.69 to 1.03) %, 0.32 (0.12 to 0.51) %, 0.36 (0.12 to 0.61) %, 0.58 (0.37 to 0.79) %, 0.26 (0.02 to 0.50) %, and 0.35 (0.09 to 0.61) % for IMD 5-10, respectively) (Figure 6.1 – (b)). The adjusted excess risk was consistent across regions except for West Midlands and South Central (Figure 6.1 – (c)).

Figure 6.1. Adjusted risk difference for cardiovascular diseases between osteoarthritis and non-osteoarthritis consulters



6.4 Discussion

6.4.1 Main findings

In this large, matched cohort study using national representative primary care EHRs and multiple linkages, a small but significant excess risk (attributable risk fraction) of CVD, 0.31 (0.12 to 0.51) %, was identified for osteoarthritis, with controlled effects of age, sex, practice, period effect, and adjustment of smoking status, socio-economic status, systolic blood pressure, LDL cholesterol, triglyceride, hypertension, antihypertensive treatment, statins, and anti-diabetes treatment. The higher excess risk was observed in men, the youngest and the oldest age groups, more deprived groups, and northern regions.

6.4.2 Comparations with previous studies

The relative risk of CVD between the osteoarthritis case group and controls without osteoarthritis had been investigated in the previous large-scale population-based cohort studies that yielded inconsistent findings. For example, with osteoarthritis compared to controls without osteoarthritis, a study revealed a higher risk of CVD mortality in older women (Barbour et al., 2015) and the Progetto Veneto Anziano Study Cohort revealed a higher incidence of CVD in elderly men and women (Veronese et al., 2016). In contrast, in the Framingham Study having symptomatic hand osteoarthritis was found to be associated with the incidence of coronary heart disease, but not found for radiographic hand osteoarthritis or overall CVD (Haugen et al., 2015). In the elder population from the Rotterdam cohort study, having osteoarthritis was not shown to be associated with increased CVD incidence (Hoeven et al., 2015). In the current study, a population included osteoarthritis cases and controls with age 35 years and over, younger than the previous study cohorts, and increased risk of incident CVD was found to be associated with osteoarthritis in comparison to well-matched non-osteoarthritis population controls. Importantly, the significant excess risk of CVD due to newly diagnosed osteoarthritis was firstly estimated in this study by ruling out confounding effects from primary care routinely recorded demographical variables, lifestyle variables, modifiable CVRF, clinical measurements, pharmacological treatments, and socioeconomic deprivation that have not been fully addressed in the previous population-based cohort studies reporting higher relative risk of CVD in osteoarthritis (Barbour et al., 2015, Veronese et al., 2016). Such potential confounders have been reported to influence both osteoarthritis and CVD and might cause a spurious association if not controlled (Hall et al. 2016, O'Neill et al., 2018).

6.4.3 Novel findings

Consistent with the higher risk of CVD in men and the elder age group observed in the general population, the more concerning finding of this study is the higher excess risk of CVD due to osteoarthritis in the population aged 35-44 years in which either osteoarthritis or CVD is not common. Osteoarthritis in younger adults with osteoarthritis has been related to joint injuries (Snoeker et al., 2020), however, less evidence has shown the relationship between osteoarthritis with long-term metabolic risk factors or CVD in younger populations. Chapter 2 showed a higher prevalence of obesity in consulters with osteoarthritis aged 35-44 years might partly explain the high excess risk of CVD as the strong effects of obesity on the development of CVD (Bastien et al., 2014). Although confounders routinely recorded in primary care were controlled or adjusted for, missing confounders such as physical activity and pain-related NSAIDs could have potential impacts on the findings (Tikkanen, Gustafsson and Ingelsson, 2018; Schmidt et al., 2011; Pepine and Gurbel, 2017).

6.4.4 Implications

The excess risk of CVD was small considering the significantly higher prevalence of modifiable CVRFs as shown in chapter 2. Prevalent CVD cases were not excluded from the chapter 2 population, and this might result in a population more prevalent with CVRFs compared to the current population who had no recorded CVD prior to the index date. Once the CVD cases were excluded, the baseline prevalence of modifiable CVRFs in cohorts with and without osteoarthritis was similar (e.g., smoking prevalence was 23.79% cf. 20.23% in Table 6.1). Although small, the excess CVD risk in people with osteoarthritis was significant even with control and adjustment for routinely recorded CVRFs and other confounders. This highlights the need to assess the cost-effectiveness of tailored care of CVRFs among osteoarthritis consulters in primary care settings. The clinical effectiveness, cost-effectiveness, and acceptability of many preventive approaches, such as offering routine blood pressure monitoring and lipids tests, improving the usage of risk-reducing treatments (e.g. antihypertensive drugs, antidiabetic drugs, and statins), and promoting population-level public health strategies should be addressed for the osteoarthritis population, especially those who are youngest and oldest and living in more deprived areas (Elizabeth et al., 2020; Chareonrungrueangchai et al., 2020; Ciumărnean et al., 2021).

6.4.5 Mechanism of excess risk due to osteoarthritis

It is well-known that osteoarthritis and CVD share common risk factors, suggesting a possible role of the common aetiology pathways such as ageing, and metabolic and hormone processes (Loeser, Collins and Diekman, 2016). Increasingly, emerging evidence supports the role of metabolic processes, specifically systematic inflammation due to inflammatory cytokines and adipokines released from adipose tissue (Courties et al., 2015) on atherosclerosis, which has been established as the main cause of the development of many types of CVD. In another metabolic pathway, increased levels of LDL trigger the acceleration of atherosclerosis and the cumulation of LDL within synovial lining cells in the joint lead to synovial activation and osteophyte formation in osteoarthritis (de Munter et al., 2016).

Like other common non-communicable diseases, both CVD and osteoarthritis have been partly explained by ageing processes. Because the accumulation of advanced glycation end products in the collagen pathway interacts with the increasing mechanical profiles of tissue by ageing, the risk for progression to osteoarthritis, hypertension and atherosclerosis is increased (Courties et al., 2015). It's also likely that the rapid ageing process increases pro-inflammatory processes and modifies the internal immune system via toll-like receptors to escalate the systematic inflammation involved in the progress of osteoarthritis (Shalhoub et al., 2011). Moreover, toll-like receptors interact with LDL levels, as LDL levels increased to diminish the protection of HDL and make toll-like receptors less expressed. This leads to weakened adjustment to collagen tissue, change in fat metabolism, and production of pro-inflammatory cytokines (Bay-Jensen et al., 2013).

Other indirect pathways have been proposed and include less physical activity and pain-related analgesic use, which are commonly observed in osteoarthritis and would lead to CVD. For example, those with walking disabilities were reported to have an increased risk of CVD or death (Nüesch et al., 2011; Hawker et al., 2014). However, the Rotterdam study revealed that either in osteoarthritis or non-osteoarthritis, the risk of CVD attributable to disability was negligible (Hoeven et al., 2015).

In contrast to population studies, inflammatory markers, pain severity, disability, and physical activity are not routinely recorded in primary care records, and the causal association between these markers and CVD is out of the scope of this study. In the current study, the levels of LDL were slightly higher in the case group and the LDL remained in the final model as a significant predictor, which is consistent with the mechanism triggered by LDL.

6.4.6 Strengths and limitations

This is the first large, matched cohort extracted from a long-term longitudinal primary care database in England with national linkages to estimate the excess risk of incident CVD events for osteoarthritis with a long follow-up. Previous studies have demonstrated the national representativeness of the primary care database and good coverage of its linkage databases. Variables and outcomes were defined by established code lists that have been validated in previous studies. There are some limitations of the current study. First, the residual effect on the study findings caused by systematic inflammatory factors and less physical activities could not be further tested as this information was not available in the study data. Second, some analgesics related to the CVD risk, such as NSAIDs, were not adjusted for in the current study, as these are commonly available in pharmacies and are therefore not fully recorded in the primary care system, which could introduce potential information bias. Third, all variables were measured at baseline, but some could be time-varying, for example, BMI. A common challenge of research using EHRs was modelling repeated measures (Goldstein et al., 2017). In the current study, 39% of participants had at least one covariable missing at baseline. Repeated measures would generate more significant missingness that could have compromised the quality of this study even with the use of statistical methods (Jakobsen et al., 2017). The time-varying effects of these variables could not be tested due to no access to the data and the expected high volume of missingness of the variables over time.

6.4.7 Conclusion

There was a small but significant overall excess risk of CVD for osteoarthritis after adjustment for demographics, period effects, variation of primary care coding over practices, and adjustment of CVD-related lifestyle risk factors, comorbidities, body measurements, clinical measurements and clinical treatments routinely recorded in primary care settings. The adjusted excess risk was highest in males, populations living in deprived areas, and the youngest and oldest populations of the cohort. Clinical effectiveness, cost-effectiveness, and acceptability of potential CVD preventive care strategies should be further addressed before their application in the osteoarthritis population, especially those with the youngest and oldest age and deprived socioeconomic status, to help avoid the future burden and mortality caused by CVD and reduce the health inequalities. Further external validation studies with more CVD-and OA-related variables like inflammatory factors, physical activity, and diet are warranted in the future.

7.1 Chapter introduction

This chapter summarises and discusses all findings from this thesis. This is followed by the strengths and limitations of the thesis, and the implications of these findings for primary care and public health are outlined with suggestions for further investigations and future research.

The overall aim of this thesis was to investigate whether primary care consulters with osteoarthritis, compared to consulters without osteoarthritis, have a higher prevalence of modifiable cardiovascular risk factors (CVRFs) and poorer management (which eventually leads to a higher risk of CVD). The methods used in this thesis included a systematic review and five retrospective cohort studies, in which samples were derived from a large nationally representative primary care electronic health record (EHR) database, the CPRD GOLD. The research questions explored were:

1. In studies using primary care EHRs, is the prevalence of routinely recorded CVRFs among consulters with osteoarthritis different to those without osteoarthritis?
2. Does the prevalence of routinely recorded modifiable CVRFs (smoking, hypertension, obesity, dyslipidaemia, and type 2 diabetes mellitus (T2DM)) differ between consulters with and without osteoarthritis in the UK primary care settings between 1992-2017?
3. Do the socioeconomic inequalities in the prevalence of modifiable CVRFs differ between primary care consulters with and without osteoarthritis between 1992-2017?
4. Do the routine pharmacological treatments for the prevention of future CVD

provided in primary care settings differ between high/intermediate predicted-CVD-risk consulters with and without osteoarthritis?

5. Does the commonly applied CVD risk tool in the general population, the Framingham risk score, perform well in terms of discrimination and calibration in consulters with and without osteoarthritis?
6. Is there a long-term absolute risk difference of CVD between at-risk populations with and without newly diagnosed osteoarthritis recorded in the UK primary care settings between 1992-2017?

7.2 Discussion of thesis findings

This section will discuss the thesis findings in order of the above research questions; focusing first on the review results and followed by the study findings, which will be discussed in comparison with wider health literature throughout.

7.2.1 Research question 1: In studies using primary care EHRs, is the prevalence of routinely recorded CVRFs among consulters with osteoarthritis different to those without osteoarthritis

The systematic review summarised evidence from studies that have used primary care EHRs to estimate the prevalence of CVRFs in people with osteoarthritis and compared this to those without osteoarthritis. Studies using primary care EHRs showed a higher prevalence of hypertension, obesity, dyslipidaemia and T2DM in consulters with osteoarthritis than those without. This review did not identify any studies that compared the prevalence estimates of smoking or chronic kidney disease between consulters with and without osteoarthritis. Only one study reported an association between osteoarthritis and increased CVRFs which controlled for age and gender. The robustness of these findings remains unclear due to the small number of reviewed studies, heterogeneous populations studied, disease definitions used, and the lack of adjustment for confounders.

Comparison of study results was limited by the difference in population characteristics. It was also not clear whether variations in age and gender distribution between osteoarthritis populations affected the reported prevalence estimates of CVRFs from the evidence base identified by this systematic review. However, older age and female gender may confound the observed association between osteoarthritis and modifiable CVRFs. The risk of CVD events, as well as risk factors including dyslipidaemia, hypertension and diabetes, is higher in older age groups (Corella & Ordovás, 2014). Thus, an older population is likely to include more cases of CVRFs compared to a younger population. This might contribute to the findings which illustrated a smaller association between osteoarthritis and CVRFs observed from age- and gender-matched populations with and without osteoarthritis (Rahman et al., 2013), compared to that from unmatched populations (Nielen et al., 2012, Prieto-Alhambra et al., 2014). Moreover, the review did not identify any studies using data from a national database of UK primary care. This suggests that further studies using large-scale and high-quality representative primary care EHRs are required to estimate the occurrence of CVRFs in people with osteoarthritis in the UK. To obtain comparable estimates, such studies should consider using similar methods, including age- and gender-subgroup analyses and comparable methods of identifying risk factors and conditions.

7.2.2 Research question 2: Does the prevalence of routinely recorded modifiable CVRFs differ between consulters with and without osteoarthritis in the UK primary care settings between 1992-2017?

To address this question, a matched retrospective cohort including 430,380 consulters aged 35 years and over (215,190 incident osteoarthritis cases and 1:1 age-, sex-, practice- and index year-matched controls without osteoarthritis by risk-set sampling) was derived from the UK primary care database, CPRD GOLD, between 1992 and 2017. Both annual and period (1992-2017)prevalence of each of the five modifiable CVRFs (current smoking, T2DM, hypertension, obesity and dyslipidaemia) and the number of (≥1, ≥2, ≥3) those risk factors were estimated between 1992-2017. The prevalence rate ratio (PRR) between osteoarthritis and non-osteoarthritis cohorts was estimated using a Poisson regression model. Subgroup analyses by age and sex group, geographical regions, and index year were conducted for both prevalence estimates and PRRs.

The estimations for the matched retrospective cohort showed a higher period prevalence of single and number of modifiable CVRFs in consulters with osteoarthritis compared with matched controls without osteoarthritis between 1992 and 2017. The prevalence of single and number of modifiable CVRFs varied by sex, age, and geographical regions, with a higher prevalence commonly observed in consulters with osteoarthritis compared with those without. The annual prevalence of single and number of modifiable CVRFs increased by years in both consulters with and without osteoarthritis, with a higher prevalence commonly observed in consulters with osteoarthritis. Notably, the gap between consulters with and without osteoarthritis in the annual prevalence of hypertension, T2DM, dyslipidaemia, and the number of ≥1 and ≥3 modifiable CVRFs widened over time between 1992-2017. The largest gap in the prevalence of obesity in younger age groups (e.g., 35-44 years) was consistently found between consulters with and without osteoarthritis.

These estimates indicate that more intensive practical actions to assess and treat CVRFs are required in consulters for osteoarthritis. From a public health perspective, the provision of preventive interventions should focus on osteoarthritis populations, considering the difference in the burden of CVRFs across sub-patient groups. The regional difference in the prevalence of modifiable CVRFs suggests potential influences of local socioeconomic status on CVD risk in consulters for osteoarthritis. Future research to understand socioeconomic factors associated with CVD risk in osteoarthritis populations is warranted.

7.2.3 Research question 3: Do the socioeconomic inequalities in the prevalence of modifiable CVRFs differ between primary care consulters with and without osteoarthritis between 1992-2017?

Chapter 2 showed that both the prevalence and PRR of modifiable CVRFs varied over geographical regions, which might be explained by socioeconomic factors (that are associated with CVRFs) and by the difference in inequalities between consulters with and without osteoarthritis. A small number of studies have addressed whether socioeconomic inequalities (both absolute and relative difference) in modifiable CVRFs differ between populations with and without osteoarthritis in primary care settings. To address this question, 109,142 osteoarthritis cases newly diagnosed between 1992-2017 and aged 35 years and over, and their 1:1 age-, sex-, practice- and index year-matched non-osteoarthritis individual controls were extracted from the CPRD GOLD linked with the 2015 English Index of Multiple Deprivation (IMD) database. The population-weighted, regression-based measurements: slope index of inequality (SII) and relative index of inequality (RII) are two officially used indicators of socioeconomic inequalities by the Office for Health Improvement and Disparities (OHID) in the UK. SII and RII in the prevalence of each modifiable CVRF and number of risk factors (≥1, ≥2, ≥3) were estimated by the weighted linear regression method for the population with and without osteoarthritis.

This study revealed that socioeconomic inequalities in the prevalence of modifiable CVRFs were very common in populations with and without osteoarthritis between 1992-2017 in England, and widened during this time in the population with osteoarthritis, especially for smoking, T2DM, obesity and the number of CVRFs. In the young population with osteoarthritis, the increased socioeconomic inequalities in the prevalence of modifiable CVRFs suggests the early onset of the number of CVRFs in the deprived population with osteoarthritis could be a concern for health policymakers in terms of future loss of healthy life expectancy, and health burden due to the disability and comorbidity. More research on the cost-effectiveness of preventative strategies and tailored care strategies targeting this specific deprived population is required.

7.2.4 Research question 4: Do the routine pharmacological treatments for the prevention of future CVD provided in primary care settings differ between high/intermediate predicted-CVD-risk consulters with and without osteoarthritis?

Current guidelines such as the NICE guidelines for CVD primary prevention recommend the use of formalised clinical prediction tools to assess 10-year CVD risk and to guide pharmacological treatments for individuals at risk. Linked to this, understanding the extent to which medication is prescribed when CVRFs exist among osteoarthritis consulters with high CVD risk, and whether the management is different from their matched controls without osteoarthritis, indicates whether further strategies are required to reduce CVD risk.

To address this research question, a matched retrospective cohort including 205,368 cases aged 35 years and over newly consulted osteoarthritis in primary care between 1992-2017 and 1:1 age-, sex-, practice-and index year-matched controls without osteoarthritis were firstly identified from the CPRD GOLD. Individuals with a high/intermediate 10-year CVD risk estimated by a clinical prediction model, the sex-specific Framingham risk score, were then identified. Finally, the prevalence of being prescribed pharmacological treatment for CVD primary prevention among those at a high/intermediate predicted risk in consulters for osteoarthritis was compared with those without osteoarthritis.

Overall, a significantly higher prevalence of intermediate risk (predicted CVD risk ≥10%) and high risk (predicted CVD risk≥20%) were estimated among primary care consulters with osteoarthritis between 1992-2017 compared with their controls without osteoarthritis. Higher prevalence in consulters with osteoarthritis was observed in both sex groups and across obesity status. The extent of the prescription of statins was similar between the osteoarthritis and non-osteoarthritis cohorts with high predicted CVD risk. However, statins were prescribed more often to osteoarthritis consulters with intermediate predicted risk compared with the controls without osteoarthritis. Antihypertensive treatments and antidiabetic treatments were prescribed more often to osteoarthritis consulters with diagnosed hypertension and diabetes, compared to non-osteoarthritis consulters with hypertension and diabetes, both in intermediate and high predicted risk groups.

To date, this study is the first to estimate the extent of the provision of interventions for identified CVRFs in osteoarthritis consulters and compares this to non-osteoarthritis consulters. A few studies have looked at statins prescribed for CVD primary prevention in general populations. A study using primary care data from the UK THIN (The Health Improvement Network) database showed that 35% of consulters aged 40 years and over who had a high recorded 10-year CVD risk (≥20% predicted by QRISK2 risk score) were initiated on statins between 2012-2015 (Finnikin et al., 2017). The current study used different methods (prevalent instead of incident cases using statins) but generated a similar proportion of statins prescriptions among consulters with a high predicted risk (≥20% predicted by Framingham risk score) (35.97% in consulters with osteoarthritis and

36.00% in those without osteoarthritis) compared to the THIN study. However, the proportion of statins prescription in another high-risk patient group, hypertension patients aged 30-75 who had a ≥20% predicted CVD risk, was as high as 97%, according to the UK Quality and Outcomes Framework (QOF) data in 2019 (QOF, 2019). This suggests that a proportion of consulters with osteoarthritis might be undertreated for the management of CVRFs, which may result in poor CVD outcomes. Complete data showed a similar prevalence of high predicted risk between osteoarthritis and non-osteoarthritis consulters, but the imputed data showed a higher prevalence in osteoarthritis with osteoarthritis. This might suggest that the Framingham risk score might not perform well in predicting the top high CVD risk group, and the potentially underestimated absolute risk makes the high-risk group less representative. Further validation of the performance of the model predicting CVD risk in the osteoarthritis cohort is warranted.

7.2.5 Research question 5: Does the commonly applied CVD risk tool in the general population, the Framingham risk score, perform well in terms of discrimination and calibration in consulters with and without osteoarthritis?

Although the Framingham risk score is well-studied in general populations, whether this tool can accurately predict CVD risk in osteoarthritis populations is currently unknown, especially since the distribution of predictors differs between the osteoarthritis population and the general population. Moreover, all predictors from the primary care EHRs are not originally collected for research purposes. This would also bring uncertainty to the model performance in the current study. In contrast, each predictor was measured with a standardised method in the model development cohort from the Framingham

Heart Study (D'Agostino et al., 2008). This chapter evaluated the performance of the Framingham risk score in predicting the 10-year risk of CVD among consulters for osteoarthritis based on a population-based cohort study with predictors derived from primary care EHRs and events extracted from primary care EHRs linked with national cause-specific death registration data. To address this question, a matched population-based cohort included 205,368 incident osteoarthritis cases aged 35 years and over between 1992-2017 and 1:1 age-, sex-, practice-and index year-matched controls without osteoarthritis. Cases and controls with prevalent CVD records were ruled out. The incident diagnosis of CVD events (ischaemic heart disease (IHD), heart failure (HF), cerebrovascular disease, peripheral artery disease (PAD), and CVD deaths) was recorded in CPRD GOLD or linked to national cause-specific death registration data. The observed risk of 10-year CVD events was estimated by the Kaplan-Meier method. Discrimination (Harrell's concordance (C) statistic), calibration (calibration slope) statistics and expected/observed risk ratio were used to examine the performance of Framingham risk score in osteoarthritis and non-osteoarthritis cohorts overall and by sex.

The restricted model performance of the Framingham risk score in terms of calibration (slope: 0.74 cf. 0.72) and discrimination (C statistic: 0.64 cf. 0.65) was revealed in both consulters with and without osteoarthritis. Among consulters with osteoarthritis, the Framingham risk score underpredicted the 10-year CVD risk by 14% overall and 32% in women and overpredicted the risk by 12% in men. Among consulters without osteoarthritis, similar performance was observed. Recalibration by updating baseline survivals was also attempted, which yielded an improved overall agreement between predicted and observed risk but a restricted calibration as the overprediction in higher-risk groups and underprediction in lower-risk groups. Calibration and discrimination were measured, and re-calibration was attempted in the imputed datasets. The agreement of predicted and observed risk improved in consulters without osteoarthritis but the overall risk was still underestimated by the risk score in those with osteoarthritis. Improved calibration and discrimination were not observed in consulters with or without osteoarthritis.

The current findings suggest that in the population with osteoarthritis, clinical decisions aided by this score might fail to provide timely preventive interventions or tailored intensive management schemes resulting in potentially poorer CVD outcomes and health burdens in this specific population. Future validation work in the osteoarthritis population with access to predictors and algorithms of other CVD prediction tools, such as the QRISK3 and ASSIGN is warranted. A new specific risk score to predict the CVD risk in the osteoarthritis population is also warranted.

7.2.6 Research question 6: Is there a long-term absolute risk difference of CVD between at-risk populations with and without newly diagnosed osteoarthritis recorded in the UK primary care settings between 1992-2017?

Accurate estimation of long-term (>10 years) risk difference between consulters with and without osteoarthritis would be helpful to understand the health burden on population-level and provide evidence for future effective interventions and reduce the development of CVD events in the UK primary care consulters with osteoarthritis, a population with long-existing poor CVRF profile. Based on the previous literature search, few studies have estimated the long-term absolute risk difference between consulters with and with osteoarthritis with adjustment of routinely recorded confounders using the national representative primary care EHRs.

To address this question, a 1:1 age-, sex-, practice-and index year-matched retrospective cohort incorporating 103,740 aged 35 years consulters with incident osteoarthritis diagnosed between 1992-2017 in English primary settings and their matched controls without osteoarthritis were selected by risk-set sampling method. Both cases and their controls were at risk of CVD by index date (the osteoarthritis diagnosis date) and with linkage to the English IMD 2015 database. Incident CVD events ((IHD, HF, cerebrovascular disease, PAD, and CVD deaths)) were extracted from both primary care records and death registration of Office National Statistics (ONS) for deaths that are mainly due to CVD. The frailty Cox regression model (`conditional Cox regression model') showed that the adjusted absolute difference in CVD risk between English consulters with and without osteoarthritis was significant after adjustment for current smoking, IMD deciles, systolic blood pressure (SBP), low-density lipoprotein (LDL) cholesterol, triglyceride, hypertension, being prescribed treatments.

A significant excess risk (attributable risk fraction) of CVD, 0.31 (0.12 to 0.51) %, was identified for osteoarthritis. Results were controlled for age, sex, practice, period effect, and adjustment of smoking status, socioeconomic status, SBP, LDL cholesterol, triglyceride, hypertension, antihypertensive treatment, statins, and anti-diabetes treatment. The highest excess risk was observed in men, the youngest and oldest age groups, deprived groups, and northern regions.

The excess risk of CVD in chapter 6 was small considering the significantly higher prevalence of modifiable CVRFs as shown in chapter 2. Prevalent CVD cases were not excluded from the chapter 2 population, and this might result in a population more prevalent with CVRFs compared to the chapter 6 population who had no recorded CVD prior to the index date. Once the CVD cases were removed, the difference in the prevalence of modifiable CVRFs between cohorts with and without osteoarthritis was small (e.g., smoking prevalence was 23.79% cf. 20.23% in Table 6.1). Although small, the significant excess CVD risk consistently highlighted the need to study the cost-effective of tailored care at the individual level and the population-level public health care strategies in the osteoarthritis population, especially those with the youngest and oldest age and deprived socioeconomic status, to help avoid the future health burden caused by CVD and reduce the health inequalities. Future external validation studies with more CVD-related variables like inflammatory factors, physical activity, and diet are warranted.

7.3 Strengths and limitations

7.3.1 Strengths

Data size and representativeness

All cohorts used in this thesis were derived from CRPD GOLD, which is the national primary care EHR dataset. The cohort size (>400K for Chapters 2, 4, and 5; >200K for

Chapters 3 and 6) provided statistical power for overall and most stratified analyses in each chapter. Previous studies have demonstrated the national representativeness and good coverage of demographic data for the CPRD GOLD population (Herrett et al., 2015). Although no previous study has reported the representativeness of the incident osteoarthritis samples derived from the CPRD GOLD, the current study population was likely to be representative of consulters for osteoarthritis as the distribution of age and gender was similar to that of a previous primary care population with osteoarthritis (Arthritis Research UK, 2013).

Data quality

Data validity regarding information bias is a common concern in research using EHRs as data are not collected for research purposes or in a standardized way (Goldstein et al., 2017). To maintain the validity of the proposed exposures and outcomes, linked national data were used in this thesis. For example, in chapter 3, linkage to the English IMD 2015 database was used to map the consulters and their matched controls' socioeconomic status. To improve the validity of outcomes, for example, CVD, national death registration was linked to the cohort in Chapters 4, 5 and 6, to define the CVD events alongside the CVD information recorded in the primary care records. The list of codes that defines the exposure, outcome, and covariates used in each cohort was well-established and validated in previously published studies (Yu et al., 2018).

Study design and analysis methods

Efforts to control confounding effects were made in the current thesis, including matching, adjustment in a multivariate model, and stratification. In each analysis chapter, demographic variables including age and sex were matched. Consultation year and practice were also matched variables for addressing period effects and recording variance, respectively. In chapter 6, lifestyle risk factors (current smoking status), clinical measurement (systolic blood pressure, total cholesterol, and LDL cholesterol), modifiable CVRFs (hypertension), pharmacological treatment (statins, antihypertensive drugs, and antidiabetic drugs) and socioeconomic status (English IMD deciles) were adjusted in the multivariate model. Stratified analyses based on sex, age group, obesity, English IMD deciles or geographical regions were also conducted. The measurements of absolute and relative socioeconomic inequalities were made by the toolbox recently developed by OHID (2017), which makes the estimations comparable to national estimations in terms of methodology. This regression-based tool uses information from all socioeconomic groups and avoids the extreme estimate by calculating the difference only between the highest and the lowest socioeconomic status. The latter method ignores the health condition of a large sample of the population (Speybroeck et al., 2012). The current thesis was interested in quantifying the amount of inequality across an entire socioeconomic group category. Thus, the regression-based tool was more appropriate. There were missing values in the CPRD GOLD, and it was not confirmed whether values were missing completely at random. Therefore, complete case analyses were not enough to confirm the study findings. Multiple imputation can be used to handle missing values, but missing at random is assumed (Jakobsen et al., 2017). Although this assumption was not tested by the current thesis due to limited resources to trace participants with missing data, the multiple imputations with chained equations were still applied in the main analysis to estimate the effects of missing values on the study findings and generally yielded similar estimations as those from the complete case analyses.

7.3.2 Limitations

Chance

Although the overall cohort size was large, multiple subgroups were used for stratification, resulting in a small sample size in some groups. For example, Chapter 4 identified a small number of women (N=64) with both T2DM and a high predicted CVD risk that would not allow a robust prevalence estimate of the antidiabetic prescriptions in this group or a prevalence difference between consulters with and without osteoarthritis to be detected. Small sample sizes decrease the power of statistical analysis, decreasing the ability to detect differences. A larger sample size of such a subgroup might generate different study findings as the increasing sample size would be more likely to identify the small difference between groups (Mascha & Vetter, 2018).

Unmeasured covariables/confounders

Some risk factors, such as nonsteroidal anti-inflammatory drugs (NSAIDs) use and physical activity, are important contributors to the development of CVD (Fernandes, & Valdes, 2015). NSAIDs are among the most frequently prescribed (58.9% of all) treatment for osteoarthritis to control joint pain (Kingsbury et al., 2013). These drugs have shown renal side effects like sodium retention, leading to hallmarks of CVD including arterial hypertension, atherosclerotic events and consequently an increased CVD risk in people with osteoarthritis (Wehling et al., 2014). People with severe osteoarthritis generally find regular exercise painful, uncomfortable, challenging and inconvenient (Campbell et al., 2012). This implies that a reduction in exposure to physical activity in people with osteoarthritis could eventually increase the CVD risk (Nuesch et al., 2011). However, these factors are not or not well recorded in primary care settings (e.g., NSAIDs are over-the-counter and physical activity is not routinely measured in primary care). In chapter 2, for example, these unmeasured confounders might have an impact on the association between osteoarthritis and measured CVRFs. In chapter 6, there might be unmeasured confounders that might alter the absolute difference in CVD risk between consulters with and without osteoarthritis. Such potential confounders that influence both osteoarthritis and CVD might cause a spurious association in the current study (Fernandes, & Valdes, 2015**,** Hall et al. 2016, O'Neill et al., 2018).

Selection bias

A common issue related to selection bias in EHR-based studies may also be present in studies conducted as part of the current thesis. The controls without osteoarthritis were those who have consulted primary care for other health-related reasons and might not represent a healthy general population. This might lead to an overestimated prevalence of CVRFs or CVD risk in controls and an underestimated difference between consulters with osteoarthritis and controls. Thus, the prevalence rate ratios or hazard ratios reported in the thesis should not be used to indicate the causality between osteoarthritis and CVRFs or CVD as they can only tell the potential relationship. However, in chapters 4, 5, and 6 consulters with prevalent CVD were excluded, remaining a population that was healthier in terms of CVD and related conditions. This might help to reduce the selection bias related to the selection of controls with existing health conditions.

Misclassification bias

Although the lists of codes that were used to define the case, exposure, and outcomes were from existing well-established code lists, there is still potential for misclassification bias. For example, recording osteoarthritis in primary care EHRs might have a lower sensitivity due to not every osteoarthritis individual having the diagnosis (Yu et al., 2018). If more severe osteoarthritis cases were more likely to be diagnosed, there might be an overestimation of the prevalence of modifiable CVRFs and CVD risk in the osteoarthritis cohort as multiple comorbidities are common among more severe cases. Consequently, there might be an overestimate of the prevalence difference in modifiable CVRFs (chapter 2), or the CVD risk difference between consulters with and without osteoarthritis (chapter 6). There was a lack of validation of each CVRF in consulters with and without osteoarthritis specifically in previous chapters and no resource was available to check for misclassification and whether it is differential or not in the current thesis. For pharmacological treatments records in EHRs, it is not feasible to understand or exactly measure whether treatments were taken or not at the patient level, which could partly explain that similar statin prescription and differentiated actual CVD risk between the consulters with osteoarthritis and without osteoarthritis among the high predicted CVD risk group.

The socioeconomic measurement using the IMD decile provides overall socioeconomic information at the neighbourhood level which is not an individual-level socioeconomic measurement like occupation, income, and education. It means some individuals' true socioeconomic status might be misclassified due to their residential neighbourhood. Although individual-level socioeconomic status such as occupation could be used to identify the socioeconomic difference in CVD risk in the osteoarthritis population (Kadam, Jordan & Croft, 2004), it was not available in current analyses as it was not recorded in a standardised way in the CPRD GOLD, and no resource was available to deal with large amount data at the individual level. However, evidence has supported that individual socioeconomic status was not likely to affect the association between area-level deprivation and CVD outcome (Ramsay et al., 2015). Thus, the linkage to the area-level socioeconomic dataset, the English IMD, was not only a more convenient way to assign the socioeconomic status value for the large sample in the thesis analyses but also an appropriate method to assess the socioeconomic difference in CVD risk.

Although the Framingham risk score is used worldwide, the newly developed CVD risk score, QRISK3, has better discrimination and calibration in the UK population registered in primary care settings (Hippisley-Cox, Coupland & Brindle, 2017). However, the tool QRISK was not available in this project in terms of the code list of predictors and baseline hazard functions. As a risk score is used to guide risk stratification and the following treatment for risk reduction, an overprediction of the risk will result in overtreatment and an underprediction will result in undertreatment in the population (Damen et al., 2019). Chapter 5 in the current thesis found an underprediction of 10-year CVD risk in people with osteoarthritis with the use of the Framingham risk score, especially those who were in the lower risk group and those who were women. Thus, chapter 4 might not have identified a population who were truly at a high/intermediate risk using the risk score and might not provide a robust estimate of the prevalence of risk-reduction prescriptions among those with a high/intermediate risk in the following analyses. Using the QRISK that is developed for the UK population might provide a different performance in predicting the CVD risk in the osteoarthritis population but, to date, no evidence is available to support it.

7.4 Implications for future studies

7.4.1 Replication in other cohorts

Although this is the first time that a study compares: 1) the prevalence of modifiable CVRFs, 2) the socioeconomic inequalities in modifiable CVRFs, and 3) the pharmaceutical management of CVRFs, in cohorts with and without osteoarthritis over two decades using the EHRs in UK primary care settings, it would be prudent to compare these in other settings and populations, in particular within cohorts that incorporate the unmeasured confounders in this project (physical activity and diet information).In the UK, BioBank could provide suitable data for this. Moreover, in future replication studies, selection of controls to be more representative of the general population, as well as more sources to identify osteoarthritis cases (e.g., more data linkage, using texts to define the case), are required to prevent potential selection bias.

7.4.2 Development and external validation of CVD risk prediction score

If the code lists of predictors and baseline hazard of the QRISK3 score are available, it would still be worth implementing an external validation study to assess the model discrimination and calibration of predicting 10-year CVD risk in the cohort with osteoarthritis. If the 10-year CVD risk is still underestimated in the cohort with osteoarthritis, it might be helpful to derive and validate a risk prediction score among patients with osteoarthritis in the UK primary care settings.

7.4.3 Evaluate new pharmaceutical treatments and their preventive effect

It has been five years since the last collection of cohort data used in this project. There have been several pharmaceutical treatments that have been widely used in UK primary care over this period of time. For example, Sodium-glucose Cotransporter-2 Inhibitors have been commonly prescribed to patients with T2DM (NICE, 2022). Glucagon-like peptide-1 has been used for patients with T2DM or with a body mass index over 35 kg/m^2. It would be helpful to widen the findings from this project by investigating whether these new pharmaceutical treatments have been equally provided to patients with and without osteoarthritis; and whether new treatments could alter the course of CVD in the cohort with osteoarthritis.

7.4.5 The interaction of ethnicity disparity and socioeconomic inequalities

In chapter 3, the socioeconomic inequalities in modifiable CVRFs between consulters with and without osteoarthritis have been investigated. It is unclear what the role of ethnicity is in these associations as other studies have revealed the significant ethnic disparity in the prevalence of CVRFs. It might be helpful to understand the distribution of CVRFs, relevant treatments, and the potential future CVD risk in consulters with osteoarthritis of different ethnicities. Moreover, it would be more helpful to ascertain whether there is an interaction between ethnicity disparity and socioeconomic inequalities in the distribution of CVRFs, relevant treatments, and the potential future CVD risk in consulters with osteoarthritis.

7.5 Implications for reducing CVD risk in people with osteoarthritis

7.5.1 For health professionals

There are several direct implications of this thesis for primary care practice. Primary care professionals should be vigilant to modifiable CVRFs (e.g., smoking, obesity, T2DM, hypertension and dyslipidaemia) that frequently coexist in consulters for osteoarthritis across different age and sex groups (as shown in Chapter 2). Practitioners should consider checking modifiable CVRFs and assessing the 10-year CVD risk of their consulters following the diagnosis of osteoarthritis immediately and formulate appropriate care plans for those at risk. Practitioners should be prepared to face the challenges of managing multiple risk factors combined with treatment for osteoarthritis symptoms, as one in four consulters with osteoarthritis were found to have at least three modifiable CVRFs and there are currently no clear recommendations from national guidelines for the optimal managing strategy for conditions. Whilst the routine risk factor screening of all consulters for osteoarthritis is currently not available, active case identification of groups most at risk is a realistic option to identify those most in need of interventions. For example, screening for CVRFs could focus on consulters with osteoarthritis living in more deprived areas (Chapter 3). The low rate (one-third) of statins treatment for CVD primary prevention as shown in Chapter 4 implies potential suboptimal management of consulters with osteoarthritis who were considered eligible for the treatment. Given the effectiveness of statins in preventing CVD events, ensuring the provision of such treatment to eligible consulters and increasing the awareness of the excess CVD risk in osteoarthritis might be key to improving outcomes in consulters with osteoarthritis. The underestimated risk using the sex-specific Framingham risk score (Chapter 5) was likely to result in missed opportunities to receive CVD risk prevention in consulters with osteoarthritis. Although the Framingham risk score is no longer recommended for CVD primary prevention by the national guidelines in the UK (NICE, 2016), professionals should be aware of the potential underpredicted CVD risk in consulters with osteoarthritis using prediction tools with unknown performance in the osteoarthritis population. Considering the significant excess CVD risk in osteoarthritis even after adjusting multiple CVRFs and other confounders (Chapter 6), professionals should also manage osteoarthritis itself to control the potential effects of osteoarthritis-related mechanisms, such as joint inflammation and NSAIDs use, on CVD risk.

7.5.2 For consulters with osteoarthritis

CVD risk assessment and counselling should be taken as soon as possible after the diagnosis of osteoarthritis, to detect and treat coexisting modifiable CVRFs, and to manage the potential side effects of osteoarthritis treatments (e.g., NSAIDs) that may adversely affect cardiovascular health. Consulters with osteoarthritis should follow the general lifestyle advice in the NICE guidelines for CVD prevention to minimise the effects of modifiable CVRFs on the development of CVD (NICE, 2016). In brief, these include smoking cessation, avoiding overweight or obesity, adopting a healthy diet, limiting alcohol consumption, increasing physical activity and avoiding sedentary behaviours.

7.5.3 For public health

According to Arthritis Research UK, the leading authority on arthritis in the UK, the size of the osteoarthritis population consulting the UK primary care between 2004-2010 was estimated to be 8.75 million based on a sample representative of the UK population (Arthritis Research UK, 2013). Given that the osteoarthritis population included in this thesis had similar age and sex distribution to that from the Arthritis Research UK statistics, there could be millions of consulters for osteoarthritis with at least one coexisting modifiable cardiovascular risk factor, using the prevalence estimate (90.15%) provided in this chapter 2. The consistently higher annual prevalence of having at least one modifiable CVRF in consulters between 1992-2017 implies that planning of strategies and interventions was needed to reduce the size of the population with osteoarthritis suffering from these risk factors. The higher prevalence of obesity in the young population with osteoarthritis indicates that more suitable public health strategies like promoting healthy eating (Holmes, 2021), and lowering the accessibility of fast-food chains should be considered for the young population with early diagnosed osteoarthritis (Department of Health and Social Care, 2020). The consistently higher prevalence of smoking in women with osteoarthritis across age groups indicates that cost-effectiveness of public health actions such as campaigns to promote smoking cessation (Department of Health, 2017) should be further addressed for women with osteoarthritis in terms of the known strong relationship between smoking and the development of CVD outcomes and mortality (Yusuf et al., 2020).

SIIs and RIIs provided in Chapter 3 confirmed the potential of socioeconomic inequality in modifiable CVRFs among consulters with osteoarthritis using data on deprivation at the small area level. Clinical effectiveness, cost-effectiveness, and acceptability of risk factor screening/prevention programmes and campaigns should be addressed in people with osteoarthritis living in more deprived areas to reduce inequalities. Chapter 3 also provided comprehensive subgroup analyses based on age, sex, region, and calendar year that would help to identify the target group most in need of interventions.

The study findings also revealed that there could be a large proportion (30.70 %) of the osteoarthritis population with a ≥10% predicted 10-year CVD risk that is eligible for statins treatment for CVD primary prevention in the UK. An indicator of CVD primary prevention is currently included in the Quality Outcome Framework (QOF), which gives incentives for GPs to prescribe statins but this is only for other patient groups such as those with newly diagnosed hypertension or T2DM with a predicted risk ≥20% (QOF, 2019) and has resulted in increased statins prescribing (Alabbadi et al., 2010). Given the suboptimal (only one-third) provision of statins treatment in consulters with osteoarthritis eligible for primary prevention found in Chapter 4, it might be beneficial for stakeholders to consider incentives for managing osteoarthritis populations that aim to reduce CVD risk.

7.6 Conclusion

The evidence presented in this thesis has illustrated that the prevalence of modifiable CVRFs remained persistently higher among consulters with osteoarthritis compared with matched controls without osteoarthritis in UK primary care between 1992-2017. The prevalence was also consistently higher in the female gender, working age group, and northern English regions. Socioeconomic inequalities in the prevalence of modifiable CVRFs were very common in populations with and without osteoarthritis between 1992-2017 in England and widened in the population with osteoarthritis. Among the patients with intermediate or high predicted CVD risk as detected by the existing Framingham score, a similar proportion of routine pharmaceutical treatments were provided to patients with and without osteoarthritis. However, the validation of the Framingham score suggested the overall poor discrimination and calibration, especially in the higher-risk groups in the population with osteoarthritis, which indicates that the CVD risk of this subpopulation with osteoarthritis has been underestimated. Significant excess risk of CVD was observed in the population with osteoarthritis compared with a matched control population, and further increased excess risk was further observed in the male gender, working-age population and the deprived population.

The findings in this thesis consistently suggested that clinical effectiveness, cost-effectiveness, and acceptability of potential CVD preventive care strategies should be further addressed before their application in the osteoarthritis population. Future research is necessary to inform ways to accurately assess CVD risk (for example, development and validation of CVD risk score specifically in the population with osteoarthritis) and effectively reduce the risk in consulters with osteoarthritis. Additionally, health policymakers, health professionals, and osteoarthritis patients should work collaboratively to develop, advocate for, and implement changes that increase the uptake of CVD risk assessment and counselling as soon as the condition is diagnosed.

In the younger working-age population with osteoarthritis, increasing socioeconomic inequalities in the prevalence of modifiable CVRFs suggests that the early onset of multiple CVRFs in the younger working-age deprived population should be a cause for concern for health policymakers in terms of future loss of healthy life expectancy, and health burden due to the disability. More studies of the cost-effectiveness of CVD preventative strategies and tailored care strategies (for example reducing the inequality access to health services) targeting this specific group should be considered.

Ultimately, policy changes that address barriers to preventive care and engagement in health promotion programs in deprived groups are necessary to reduce the risk of CVD and improve health equity across the osteoarthritis population.

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Appendices

Chapter 1 appendices (search strategies)

Medline

Medline (OvidSP) (Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) 1946 to Present)

# ▲	Searches	Results
1	exp Osteoarthritis/	59146
2	osteoarthr$.tw.	63154
3	OA.tw.	30117
4	(degenerative adj (arthritis or joint or joints)).tw.	4077
5	arthrosis.tw.	5341
6	(knee$ adj3 (pain or painful)).tw.	9902
7	(hip$ adj3 (pain or painful)).tw.	5695
8	(hand$ adj3 (pain or painful)).tw.	2167
9	(joint$ adj3 (pain or painful)).tw.	11083
10	(finger$ adj3 (pain or painful)).tw.	563
11	(thumb$ adj3 (pain or painful)).tw.	232
12	(shoulder$ adj3 (pain or painful)).tw.	8446
13	((foot or feet) adj3 (pain or painful)).tw.	2431
14	(ankle$ adj3 (pain or painful)).tw.	1700
15	or/1-14	131128
16	exp Cardiovascular Diseases/	2335244
17	exp Risk/	1127304

18	16 and 17	289332
19	((cardiovascular$ or cardio-vascular$ or CVD or CV or coronary or CHD or "heart disease$" or cerebrovascular$ or "heart failure$" or HF or stroke$ or isch?emia$ or "heart decompensation$" or "myocardial infarct$" or MI or angina) adj3 risk).tw.	169671
20	18 or 19	376784
21	Smoking/	147978
22	Tobacco/	30832
23	(Tobacco$ or smoking or smoke$ or cigarette$ or cigar$).tw.	312928
24	exp Dyslipidemias/	78314
25	dyslipid?emia$.tw.	28415
26	Dyslipoprotein?emia$.tw.	1053
27	(hyperlipid?emia$ or hyper-lipid?emia$).tw.	24873
28	(hyperlipoprotein?emia$ or hyper-lipoprotein?emia$).tw.	4617
29	(hypercholesterol?emi$ or hyper-cholesterol?emi$).tw.	33569
30	(hypertriglycerid?emia$ or hyper-triglycerid?emi$).tw.	12195
31	((elevat$ or high$ or increas$) adj3 (cholesterol or TC or "low-density lipoprotein" or LDL or LDL-C or triglyceride$ or TG)).tw.	94199
32	((reduc$ or low$ or decreas$) adj3 ("high density lipoprotein" or HDL or HDL-C)).tw.	25528
33	exp Hypolipidemic Agents/	135396
34	exp Hydroxymethylglutaryl-CoA Reductase Inhibitors/	38446
35	(antilipid$ or anti-lipid$).tw.	1019
36	("Hydroxymethylglutaryl-CoA Reductase Inhibit$" or "HMG-COA reductase inhibit$" or Statin$).tw.	41238
37	exp Diabetes Mellitus/	406475

38	exp Diabetes Complications/	127957
39	Blood Glucose/	161057
40	Hemoglobin A, Glycosylated/	32335
41	Metabolic Syndrome X/	28152
42	(diabete$ or diabetic$ or DM or T1D or T1DM or T2D or T2DM).tw.	594797
43	"metabolic syndrome$".tw.	44190
44	((elevat$ or high$ or increas$) adj3 ("blood glucose" or "blood sugar" or HbA1c)).tw.	13933
45	exp Agents, Hypoglycemic/	243069
46	exp Sulfonylurea Compounds/	19669
47	exp Biguanides/	24611
48	Sodium-Glucose Transporter 2/	1215
49	alpha-Glucosidases/	4280
50	Glucagon-Like Peptide 1/	7162
51	Thiazolidinediones/	11504
52	exp Amylin Receptor Agonists/	2370
53	(antidiabet$ or anti-diabet$).tw.	19800
54	insulin.tw.	344630
55	("Sodium glucose co-transporter 2" or "Sodium glucose transporter 2").tw.	617
56	"Sulfonylurea Compound$".tw.	162
57	Biguanide$.tw.	2762

58	"alpha-glucosidase inhibit$".tw.	2386
59	"glucagon-like peptide-1".tw.	9141
60	thiazolidinedione$.tw.	5615
61	"amylin analog$".tw.	126
62	exp Obesity/	194190
63	Body Mass Index/	116269
64	exp Body weight/	443524
65	exp Body Fat Distribution/	12548
66	weight gain/	30032
67	exp Waist Circumference/	8953
68	Waist-Hip Ratio/	3891
69	exp Adipose Tissue/	93303
70	(adipos$ or obes$).tw.	325661
71	("body mass ind$" or "body mass" or BMI).tw.	238144
72	"weight gain".tw.	56507
73	("waist circumference$" or "waist-hip ratio").tw.	26038
74	(fat or "body fat distribution" or "fat overload syndrom$").tw.	238815
75	(overeat$ or over-eat$ or overfeed$ or over-feed$).tw.	4558
76	exp Renal insufficiency, chronic/	107782
77	((endstage or end stage or established or chronic or progressive) adj1 (renal or kidney) adj1 (failure or disease$ or insufficien$)).tw.	102344

78	exp Dialysis/	24800
79	Dialysis.tw.	102483
80	(ESKD or ESRD or ESRF).tw.	16137
81	(CKD or CKF or CKI or CRD or CRF or CRI).tw.	43443
82	(h?emodialysis or h?emofiltration or h?emodiafiltration).tw.	76582
83	(predialysis or pre-dialysis).tw.	4752
84	exp Hypertension/	254214
85	hypertens$.tw.	410380
86	((elevat$ or high$ or increas$) adj3 BP).tw.	13444
87	((elevat$ or high$ or increas$) adj3 systolic).tw.	16938
88	((elevat$ or high$ or increas$) adj3 SBP).tw.	4135
89	((elevat$ or high$ or increas$) adj3 diastolic).tw.	11390
90	((elevat$ or high$ or increas$) adj3 DBP).tw.	1921
91	((elevat$ or high$ or increas$) adj3 "blood pressur$").tw.	58314
92	exp Antihypertensive Agents/	261323
93	(antihypertensi$ or anti-hypertensi$).tw.	51666
94	exp Angiotensin-Converting Enzyme Inhibitors/	44534
95	exp Angiotensin Receptor Antagonists/	21999
96	exp Adrenergic beta-Antagonists/	87697
97	exp Adrenergic Antagonists/	129240

98	exp Thiazides/	16235
99	exp sodium chloride symporter inhibitors/	15023
100	exp sodium potassium chloride symporter inhibitors/	14464
101	exp Diuretics/	82650
102	(angiotensin adj3 (receptor antagon$ or receptor block$)).tw.	13410
103	ARB$.tw.	74918
104	(beta adj3 (adrenergic$ or antagonist$ or block$ or receptor$)).tw.	116815
105	(alpha adj3 (adrenergic$ or antagonist$ or block$ or receptor$)).tw.	86798
106	((angiotensin or adrenergic$) adj3 antagonist$).tw.	12282
107	Thiazide$.tw.	5695
108	diuretic$.tw.	38089
109	"angiotensin converting enzyme inhibit$".tw.	20161
110	(ACE adj2 inhibit$).tw.	19937
111	ACEI$.tw.	4103
112	exp Calcium Channel Blockers/	84626
113	(calcium adj3 (antagonist$ or block$ or inhibit$)).tw.	46752
114	CCB$.tw.	3548
115	or/20-114	3399659
116	Epidemiologic Studies/	8123
117	exp Case-Control Studies/	974962

118	exp Cohort Studies/	1866550
119	Cross-Sectional Studies/	276227
120	epidemiolog$.tw.	345569
121	("case control$" or case-control$).tw.	117613
122	Cohort$.tw.	483149
123	("cross sectional" or cross-sectional).tw.	285022
124	("follow up" or follow-up).tw.	880153
125	longitudinal.tw.	215212
126	retrospective$.tw.	623877
127	prospective$.tw.	641537
128	(observ$ adj3 (study or studies)).tw.	158019
129	or/116-128	3663284
130	15 and 115 and 129	6822
131	exp animals/ not humans/	4743200
132	130 not 131	6751

Embase

Embase (OvidSP) (Embase 1974 to 2017 November 21)

# ▲	Searches	Results
1	exp Osteoarthritis/	110807
2	osteoarthr$.tw.	81887
3	OA.tw.	42860

4	(degenerative adj (arthritis or joint or joints)).tw.	4990
5	arthrosis.tw.	6697
6	(knee$ adj3 (pain or painful)).tw.	13009
7	(hip$ adj3 (pain or painful)).tw.	7288
8	(hand$ adj3 (pain or painful)).tw.	3093
9	(joint$ adj3 (pain or painful)).tw.	16227
10	(finger$ adj3 (pain or painful)).tw.	777
11	(thumb$ adj3 (pain or painful)).tw.	265
12	(shoulder$ adj3 (pain or painful)).tw.	10495
13	((foot or feet) adj3 (pain or painful)).tw.	3253
14	(ankle$ adj3 (pain or painful)).tw.	2090
15	or/1-14	186351
16	exp cardiovascular disease/	3701881
17	exp risk/	2095152
18	((cardiovascular$ or cardio-vascular$ or CVD or CV or coronary or CHD or "heart disease$" or cerebrovascular$ or "heart failure$" or HF or stroke$ or isch?emia$ or "heart decompensation$" or "myocardial infarct$" or MI or angina) adj3 risk$).tw.	247201
19	16 and 17	652107
20	18 or 19	730124
21	exp hypertension/	639635
22	hypertens$.tw.	559072
23	((elevat$ or high$ or increas$) adj3 "blood pressur$").tw.	74057

24	((elevat$ or high$ or increas$) adj3 BP).tw.	19590
25	((elevat$ or high$ or increas$) adj3 SBP).tw.	6608
26	((elevat$ or high$ or increas$) adj3 systolic).tw.	22998
27	((elevat$ or high$ or increas$) adj3 diastolic).tw.	14733
28	((elevat$ or high$ or increas$) adj3 DBP).tw.	2728
29	exp antihypertensive agent/	651358
30	(antihypertensi$ or anti-hypertensi$).tw.	70134
31	exp dipeptidyl carboxypeptidase inhibitor/	160235
32	"angiotensin converting enzyme inhibit$".tw.	23485
33	(ACE adj2 inhibit$).tw.	27636
34	exp angiotensin receptor antagonist/	80023
35	(angiotensin adj3 (receptor antagon$ or receptor block$)).tw.	18369
36	ARB$.tw.	79575
37	exp adrenergic receptor blocking agent/	379522
38	(beta adj3 (adrenergic$ or antagonist$ or block$ or receptor$)).tw.	129733
39	(alpha adj3 (adrenergic$ or antagonist$ or block$ or receptor$)).tw.	80771
40	((angiotensin or adrenergic$) adj3 antagonist$).tw.	14411
41	exp thiazide diuretic agent/	52549
42	exp diuretic agent/	334484
43	diuretic$.tw.	49765
44	Thiazide$.tw.	6834

45	ACEI$.tw.	7600
46	exp calcium channel blocking agent/	209245
47	(calcium adj3 (antagonist$ or block$ or inhibit$)).tw.	53852
48	CCB$.tw.	4743
49	exp smoking/ or exp "smoking and smoking related phenomena"/	308581
50	exp "tobacco use"/	297401
51	(Tobacco$ or smoking or smoke$ or cigarette$ or cigar$).tw.	399750
52	exp obesity/	431042
53	exp body mass/	320309
54	exp body weight/	570913
55	exp adipose tissue/	146127
56	exp waist circumference/ or exp waist hip ratio/	48795
57	(adipos$ or obes$).tw.	435606
58	("body mass ind$" or "body mass" or BMI).tw.	374321
59	"weight gain".tw.	71516
60	("waist circumference$" or "waist-hip ratio").tw.	39079
61	(fat or "body fat distribution" or "fat overload syndrom$").tw.	292250
62	(overeat$ or over-eat$ or overfeed$ or over-feed$).tw.	5594
63	exp diabetes mellitus/	817923
64	exp glucose blood level/	223332

65	exp hemoglobin A1c/	80687
66	(diabete$ or diabetic$ or DM or T1D or T1DM or T2D or T2DM).tw.	813654
67	("blood glucose" or "blood sugar" or "hemoglobin A1c" or HbA1c or "metabolic syndrome$").tw.	211859
68	exp antidiabetic agent/	440814
69	(antidiabet$ or anti-diabet$).tw.	31093
70	insulin.tw.	426056
71	("Sodium glucose co-transporter 2" or "Sodium glucose transporter 2").tw.	1010
72	"Sulfonylurea Compound$".tw.	129
73	Biguanide$.tw.	3475
74	alpha-Glucosidase/	6965
75	exp glucagon like peptide/	22777
76	"glucagon-like peptide-1".tw.	11805
77	exp thiazole derivative/	106525
78	thiazolidinedione$.tw.	7142
79	exp amylin receptor agonist/	4981
80	"amylin analog$".tw.	149
81	"alpha-glucosidase inhibit$".tw.	3084
82	exp "disorders of lipid and lipoprotein metabolism"/	311987
83	dyslipid?emia$.tw.	46190
84	dyslipoprotein?emia$.tw.	1223
85	(hyperlipid?emia$ or hyper-lipid?emia$).tw.	37145

86	(hyperlipoprotein?emia$ or hyper-lipoprotein?emia$).tw.	5430
87	(hypercholesterol?emi$ or hyper-cholesterol?emi$).tw.	43342
88	(hypertriglycerid?emia$ or hyper-triglycerid?emi$).tw.	16004
89	((elevat$ or high$ or increas$) adj3 (cholesterol or TC or "low-density lipoprotein" or LDL or LDL-C or triglyceride$ or TG)).tw.	116698
90	((reduc$ or low$ or decreas$) adj3 ("high density lipoprotein" or HDL or HDL-C)).tw.	33847
91	exp antilipemic agent/	266290
92	(antilipid$ or anti-lipid$).tw.	1568
93	("Hydroxymethylglutaryl-CoA Reductase Inhibit$" or "HMG-COA reductase inhibit$" or Statin$).tw.	61269
94	exp kidney disease/	825754
95	exp renal replacement therapy/	170392
96	Dialysis.tw.	130891
97	(h?emodialysis or h?emofiltration or h?emodiafiltration).tw.	98988
98	(predialysis or pre-dialysis).tw.	6316
99	(CKD or CKF or CKI or CRD or CRF or CRI).tw.	62980
100	(ESKD or ESRD or ESRF).tw.	23630
101	((endstage or "end stage" or end-stage or established or chronic or progressive) adj1 (renal or kidney) adj1 (failure or disease$ or insufficien$)).tw.	136363
102	exp dialysis/	60001
103	or/20-102	5390603
104	exp case control study/	140269
105	exp cohort analysis/	338988

106	exp cross-sectional study/	241697
107	exp epidemiology/	2838957
108	exp longitudinal study/	108647
109	exp retrospective study/	603842
110	exp prospective study/	420667
111	exp follow up/	1245356
112	epidemiolog$.tw.	413783
113	("case control$" or case-control$).tw.	139749
114	Cohort$.tw.	725558
115	("cross sectional" or cross-sectional).tw.	342854
116	("follow up" or follow-up).tw.	1230986
117	longitudinal.tw.	259279
118	retrospective$.tw.	927980
119	prospective$.tw.	873631
120	(observ$ adj3 (study or studies)).tw.	220059
121	exp observational study/	131703
122	or/104-121	5928601
123	15 and 103 and 122	17253
124	exp animal/ not human/	4927989
125	123 not 124	17037

126	limit 125 to embase	9662

PsycINFO

PsycINFO (OvidSP) (PsycINFO 1806 to November Week 2 2017)		
# ▲	Searches	Results
1	osteoarthr$.tw.	1670
2	OA.tw.	1023
3	(degenerative adj (arthritis or joint or joints)).tw.	53
4	arthrosis.tw.	45
5	(knee$ adj3 (pain or painful)).tw.	402
6	(hip$ adj3 (pain or painful)).tw.	183
7	(hand$ adj3 (pain or painful)).tw.	401
8	(joint$ adj3 (pain or painful)).tw.	728
9	(finger$ adj3 (pain or painful)).tw.	103
10	(thumb$ adj3 (pain or painful)).tw.	12
11	(shoulder$ adj3 (pain or painful)).tw.	538
12	((foot or feet) adj3 (pain or painful)).tw.	175
13	(ankle$ adj3 (pain or painful)).tw.	41
14	exp ARTHRITIS/	3807
15	or/1-14	7147
16	exp Cardiovascular Disorders/	56047
17	exp risk factors/	68300
18	16 and 17	6578

19	((cardiovascular$ or cardio-vascular$ or CVD or CV or coronary or CHD or "heart disease$" or cerebrovascular$ or "heart failure$" or HF or stroke$ or isch?emia$ or "heart decompensation$" or "myocardial infarct$" or MI or angina) adj3 risk).tw.	11086
20	18 or 19	13948
21	exp HYPERTENSION/	6631
22	hypertens$.tw.	16133
23	((elevat$ or high$ or increas$) adj3 "blood pressur$").tw.	4242
24	((elevat$ or high$ or increas$) adj3 BP).tw.	1345
25	((elevat$ or high$ or increas$) adj3 systolic).tw.	1058
26	((elevat$ or high$ or increas$) adj3 SBP).tw.	325
27	((elevat$ or high$ or increas$) adj3 diastolic).tw.	537
28	((elevat$ or high$ or increas$) adj3 DBP).tw.	184
29	exp Antihypertensive Drugs/	4855
30	(antihypertensi$ or anti-hypertensi$).tw.	1500
31	"angiotensin converting enzyme inhibit$".tw.	327
32	(ACE adj2 inhibit$).tw.	247
33	ACEI$.tw.	116
34	(angiotensin adj3 (receptor antagon$ or receptor block$)).tw.	255
35	ARB$.tw.	13410
36	((angiotensin or adrenergic$) adj3 antagonist$).tw.	802
37	(beta adj3 (adrenergic$ or antagonist$ or block$ or receptor$)).tw.	4327
38	(alpha adj3 (adrenergic$ or antagonist$ or block$ or receptor$)).tw.	3916

39	exp adrenergic blocking drugs/	3704
40	exp diuretics/	3053
41	diuretic$.tw.	784
42	Thiazide$.tw.	87
43	exp channel blockers/	1053
44	(calcium adj3 (antagonist$ or block$ or inhibit$)).tw.	1659
45	CCB$.tw.	345
46	exp TOBACCO SMOKING/	28483
47	(Tobacco$ or smoking or smoke$ or cigarette$ or cigar$).tw.	58421
48	(adipos$ or obes$).tw.	36576
49	("body mass ind$" or "body mass" or BMI).tw.	24993
50	"weight gain".tw.	9284
51	("waist circumference$" or "waist-hip ratio").tw.	2374
52	(fat or "body fat distribution" or "fat overload syndrom$").tw.	12377
53	(overeat$ or over-eat$ or overfeed$ or over-feed$).tw.	2386
54	obesity/	21471
55	body mass index/	4634
56	body fat/	1583
57	exp Body Weight/	46832
58	dyslipid?emia$.tw.	1193

59	dyslipoprotein?emia$.tw.	2
60	(hyperlipid?emia$ or hyper-lipid?emia$).tw.	974
61	(hyperlipoprotein?emia$ or hyper-lipoprotein?emia$).tw.	9
62	(hypercholesterol?emi$ or hyper-cholesterol?emi$).tw.	793
63	(hypertriglycerid?emia$ or hyper-triglycerid?emi$).tw.	226
64	((elevat$ or high$ or increas$) adj3 (cholesterol or TC or "low-density lipoprotein" or LDL or LDL-C or triglyceride$ or TG)).tw.	3219
65	((reduc$ or low$ or decreas$) adj3 ("high density lipoprotein" or HDL or HDL-C)).tw.	848
66	(antilipid$ or anti-lipid$).tw.	19
67	("Hydroxymethylglutaryl-CoA Reductase Inhibit$" or "HMG-COA reductase inhibit$" or Statin$).tw.	4863
68	exp lipid metabolism disorders/	230
69	statins/	634
70	(diabete$ or diabetic$ or DM or T1D or T1DM or T2D or T2DM).tw.	28829
71	("blood glucose" or "blood sugar" or "hemoglobin A1c" or HbA1c or "metabolic syndrome$").tw.	7855
72	(antidiabet$ or anti-diabet$).tw.	410
73	insulin.tw.	10098
74	("Sodium glucose co-transporter 2" or "Sodium glucose transporter 2").tw.	4
75	"Sulfonylurea Compound$".tw.	1
76	Biguanide$.tw.	52
77	"glucagon-like peptide-1".tw.	385
78	thiazolidinedione$.tw.	75

79	"amylin analog$".tw.	8
80	"alpha-glucosidase inhibit$".tw.	8
81	exp diabetes/	15490
82	metabolic syndrome/	1828
83	hemoglobin/	630
84	insulin/	3388
85	Dialysis.tw.	1970
86	(h?emodialysis or h?emofiltration or h?emodiafiltration).tw.	1448
87	(predialysis or pre-dialysis).tw.	73
88	(CKD or CKF or CKI or CRD or CRF or CRI).tw.	3527
89	(ESKD or ESRD or ESRF).tw.	425
90	((endstage or "end stage" or end-stage or established or chronic or progressive) adj1 (renal or kidney) adj1 (failure or disease$ or insufficien$)).tw.	1962
91	kidney diseases/	1909
92	exp dialysis/	1689
93	or/20-92	224558
94	epidemiolog$.tw.	47442
95	Cohort$.tw.	63204
96	("follow up" or follow-up).tw.	103616
97	longitudinal.tw.	98066
98	retrospective$.tw.	37149
99	prospective$.tw.	59383

100	(observ$ adj3 (study or studies)).tw.	19471
101	epidemiology/	46037
102	cohort analysis/	1239
103	exp longitudinal studies/	15873
104	retrospective studies/	385
105	((case$ adj3 control$) or (case$ adj3 comparison$) or case-comparison or "control group$").tw.	85781
106	("cross section$" or cross-section$ or "prevalence study").tw.	65268
107	or/94-106	483377
108	15 and 93 and 107	288

Cochrane library

Cochrane library (23 November 2017)

ID	Search	Results
#1	MeSH descriptor: [Osteoarthritis] explode all trees	4636
#2	osteoarthr*:ti,ab	7604
#3	OA:ti,ab	3021
#4	arthrosis:ti,ab	220
#5	degenerative next (arthritis or joint or joints):ti,ab	169
#6	knee* near/3 (pain or painful):ti,ab	2138
#7	hip* near/3 (pain or painful):ti,ab	469
#8	hand* near/3 (pain or painful):ti,ab	410
#9	joint* near/3 (pain or painful):ti,ab	1650
#10	finger* near/3 (pain or painful):ti,ab	77
#11	thumb* near/3 (pain or painful):ti,ab	22
#12	shoulder* near/3 (pain or painful):ti,ab	1553
#13	(foot or feet) near/3 (pain or painful):ti,ab	261
#14	ankle* near/3 (pain or painful):ti,ab	151
#15	#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14	13753
#16	MeSH descriptor: [Cardiovascular Diseases] explode all trees	89274
#17	MeSH descriptor: [Risk] explode all trees	38820
#18	(cardiovascular or cardio-vascular* or CVD or CV or coronary or CHD or "heart disease*" or cerebrovascular* or "heart failure*" or HF or stroke* or ischem* or ischaem* or "heart decompensation*" or "myocardial infarct*" or MI or angina) near/3 risk:ti,ab	19100
#19	#16 and #17	14052
#20	#18 or #19	28213

#21	MeSH descriptor: [Tobacco Use] explode all trees	6418
#22	MeSH descriptor: [Smoke] explode all trees	375
#23	MeSH descriptor: [Tobacco] explode all trees	166
#24	Tobacco* or smoking or smoke* or cigarette* or cigar*:ti,ab	26917
#25	MeSH descriptor: [Hypertension] explode all trees	15798
#26	hypertens*:ti,ab	38054
#27	(elevat* or high* or increas*) near/3 blood pressur*:ti,ab	7198
#28	(elevat* or high* or increas*) near/3 BP:ti,ab	1759
#29	(elevat* or high* or increas*) near/3 systolic:ti,ab	2220
#30	(elevat* or high* or increas*) near/3 SBP:ti,ab	646
#31	(elevat* or high* or increas*) near/3 diastolic:ti,ab	1152
#32	(elevat* or high* or increas*) near/3 DBP:ti,ab	255
#33	MeSH descriptor: [Antihypertensive Agents] explode all trees	7778
#34	antihypertensi* or anti-hypertensi*:ti,ab	16868
#35	angiotensin converting enzyme near/3 inhibit*:ti,ab	5174
#36	ACE near/3 inhibit*:ti,ab	3362
#37	ACEI*:ti,ab	856
#38	MeSH descriptor: [Angiotensin-Converting Enzyme Inhibitors] explode all trees	3984
#39	MeSH descriptor: [Angiotensin Receptor Antagonists] explode all trees	2023
#40	angiotensin near/3 (receptor next antagon* or receptor next block*):ti,ab	2517
#41	ARB*:ti,ab	2813
#42	MeSH descriptor: [Adrenergic Antagonists] explode all trees	5650
#43	beta near/3 (adrenergic* or antagonist* or block* or receptor*):ti,ab	10520
#44	alpha near/3 (adrenergic* or antagonist* or block* or receptor*):ti,ab	3713
#45	MeSH descriptor: [Calcium Channel Blockers] explode all trees	2888
#46	calcium near/3 (antagonist* or block* or inhibit*):ti,ab	5084
#47	CCB*:ti,ab	557
#48	MeSH descriptor: [Thiazides] explode all trees	2363
#49	Thiazide*:ti,ab	944
#50	MeSH descriptor: [Diuretics] explode all trees	2799
#51	diuretic*:ti,ab	5185
#52	MeSH descriptor: [Sodium Chloride Symporter Inhibitors] explode all trees	394
#53	MeSH descriptor: [Sodium Potassium Chloride Symporter Inhibitors] explode all trees	49
#54	Chloride Symporter Inhibit*:ti,ab	86
#55	MeSH descriptor: [Obesity] explode all trees	10649
#56	MeSH descriptor: [Body Mass Index] explode all trees	8781
#57	MeSH descriptor: [Body Fat Distribution] explode all trees	704
#58	MeSH descriptor: [Body Weight] explode all trees	21386
#59	MeSH descriptor: [Waist Circumference] explode all trees	837
#60	MeSH descriptor: [Waist-Hip Ratio] explode all trees	237
#61	MeSH descriptor: [Adipose Tissue] explode all trees	2153
#62	adipos* or obes*:ti,ab	23130
#63	body mass ind* or "body mass" or BMI:ti,ab	39073
#64	weight gain:ti,ab	6028
#65	“waist circumference*” or "waist-hip ratio":ti,ab	4792
#66	fat or "body fat distribution" or "fat overload syndrom*":ti,ab	21379
#67	overeat* or over-eat* or overfeed* or over-feed*:ti,ab	438
#68	MeSH descriptor: [Dyslipidemias] explode all trees	5716

#69	dyslipidemia* or dyslipidaemia*:ti,ab	3187
#70	Dyslipoproteinemia* or Dyslipoproteinaemia*:ti,ab	42
#71	hyperlipidemia* or hyperlipidaemia* or hyper-lipidemia* or hyper-lipidaemia*:ti,ab	4518
#72	hyperlipoproteinemia* or hyperlipoproteinaemia* or hyper-lipoproteinemia* or hyper-lipoproteinaemia*:ti,ab	943
#73	hypercholesterolemi* or hypercholesterolaemi* or hyper-cholesterolemi* or hyper-cholesterolaemi*:ti,ab	6222
#74	hypertriglyceridemia* or hypertriglyceridaemia* or hyper-triglyceridemi* or hyper-triglyceridaemi*:ti,ab	1510
#75	(elevat* or high* or increas*) near/3 (cholesterol or TC or low-density lipoprotein or LDL or LDL-C or triglyceride* or TG):ti,ab	10290
#76	(reduc* or low* or decreas*) near/3 (high density lipoprotein or HDL or HDL-C):ti,ab	2682
#77	MeSH descriptor: [Hypolipidemic Agents] explode all trees	6563
#78	MeSH descriptor: [Hydroxymethylglutaryl-CoA Reductase Inhibitors] explode all trees	3441
#79	antilipid* or anti-lipid*:ti,ab	64
#80	Hydroxymethylglutaryl-CoA Reductase Inhibit* or HMG-COA reductase inhibit* or Statin*:ti,ab	7679
#81	MeSH descriptor: [Diabetes Mellitus] explode all trees	21042
#82	MeSH descriptor: [Blood Glucose] explode all trees	14114
#83	MeSH descriptor: [Hemoglobin A, Glycosylated] explode all trees	4968
#84	MeSH descriptor: [Metabolic Syndrome X] explode all trees	1422
#85	diabete* or diabetic* or DM or T1D or T1DM or T2D or T2DM:ti,ab	77769
#86	metabolic syndrome*:ti,ab	4458
#87	(elevat* or high* or increas*) near/3 (blood glucose or blood sugar or HbA1c):ti,ab	1357
#88	MeSH descriptor: [Hypoglycemic Agents] explode all trees	7067
#89	MeSH descriptor: [Sulfonylurea Compounds] explode all trees	1501
#90	MeSH descriptor: [Biguanides] explode all trees	4118
#91	MeSH descriptor: [Sodium-Glucose Transporter 2] explode all trees	150
#92	MeSH descriptor: [alpha-Glucosidases] explode all trees	36
#93	MeSH descriptor: [Glucagon-Like Peptide 1] explode all trees	867
#94	MeSH descriptor: [Thiazolidinediones] explode all trees	1329
#95	antidiabet* or anti-diabet*:ti,ab	3526
#96	insulin:ti,ab	27185
#97	Sodium glucose co-transporter 2 or Sodium glucose transporter 2:ti,ab	368
#98	sulfonylurea compound*:ti,ab	24
#99	Biguanide*:ti,ab	223
#100	alpha-glucosidase inhibit*:ti,ab	310
#101	glucagon-like peptide-1:ti,ab	1398
#102	thiazolidinedione*:ti,ab	548
#103	amylin analog*:ti,ab	48
#104	MeSH descriptor: [Renal Insufficiency, Chronic] explode all trees	4751
#105	MeSH descriptor: [Dialysis] explode all trees	237
#106	(endstage or end stage or established or chronic or progressive) near/2 (renal or kidney) near/2 (failure or disease* or insufficien*):ti,ab	7410
#107	ESKD or ESRD or ESRF:ti,ab	1394
#108	CKD or CKF or CKI or CRD or CRF or CRI:ti,ab	74951
#109	Dialysis:ti,ab	7062
#110	hemodialysis or haemodialysis or hemofiltration or haemofiltration or hemodiafiltration or haemodiafiltration:ti,ab	8559
#111	predialysis or pre-dialysis:ti,ab	714
#112	#20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or	312376

	#45 or #46 or #47 or #48 or #49 or #50 or #51 or #52 or #53 or #54 or #55 or #56 or #57 or #58 or #59 or #60 or #61 or #62 or #63 or #64 or #65 or #66 or #67 or #68 or #69 or #70 or #71 or #72 or #73 or #74 or #75 or #76 or #77 or #78 or #79 or #80 or #81 or #82 or #83 or #84 or #85 or #86 or #87 or #88 or #89 or #90 or #91 or #92 or #93 or #94 or #95 or #96 or #97 or #98 or #99 or #100 or #101 or #102 or #103 or #104 or #105 or #106 or #107 or #108 or #109 or #110 or #111	
#113	MeSH descriptor: [Epidemiologic Studies] explode all trees	145156
#114	epidemiolog*:ti,ab	7415
#115	case control* or case-control*:ti,ab	54168
#116	Cohort*:ti,ab	34092
#117	cross sectional or cross-sectional:ti,ab	13199
#118	follow up or follow-up:ti,ab	177248
#119	longitudinal:ti,ab	10374
#120	retrospective*:ti,ab	19002
#121	prospective*:ti,ab	137572
#122	observ* near/3 (study or studies):ti,ab	14144
#123	#113 or #114 or #115 or #116 or #117 or #118 or #119 or #120 or #121 or #122	378048
#124	#15 and #112 and #123	1233

PubMed

PubMed (24 November 2017)		
Search	Query	Items found
#129	#127 NOT #128	2522
#128	Search ("Animals"[Mesh]) NOT "Humans"[Mesh]	4392580
#127	#15 AND #111 AND #122	2567
#122	Search #112 or (#113 or #114 or #115 or #116 or #117 or #118 or #119 or #120 or #121)[Title/Abstract]	3291599
#121	Search (observe or observation or observational) AND (study or studies)	319999
#120	Search prospective*	726068
#119	Search retrospective*	839902
#118	Search longitudinal	245006
#117	Search "follow up" or follow-up	1129851
#116	Search "cross sectional" or "cross-sectional"	362626
#115	Search Cohort*	517484
#114	Search ("case control*" or "case-control*")	275537
#113	Search epidemiolog*	1786618
#112	Search "Epidemiologic Studies"[Mesh]	2076898
#111	Search #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45 or #46 or #47 or #48 or #49 or #50 or #51 or #52 or #53 or #54 or #55 or #56 or #57 or #58 or #59 or #60 or #61 or #62 or #63 or #64 or #65 or #66 or #67 or #68 or #69 or #70 or #71 or #72 or #73 or #74 or #75 or #76 or #77 or #78 or #79 or #80 or #81 or #82 or #83 or #84 or #85 or #86 or #87 or #88 or #89 or #90 or #91 or #92 or #93 or #94 or #95 or #96 or #97 or #98 or #99 or #100 or #101 or #102 or #103 or #104 or #105 or #106 or #107 or #108 or #109 or #110	2414821
#110	Search predialysis or pre-dialysis	4481
#109	Search hemodialysis or haemodialysis or hemofiltration or haemofiltration or hemodiafiltration or haemodiafiltration	142618
#108	Search Dialysis	168069
#107	Search CKD or CKF or CKI or CRD or CRF or CRI	43763
#106	Search (ESKD or ESRD or ESRF)	104868

#105	Search ((endstage or end stage or established or chronic or progressive) and (renal or kidney) and (failure or disease* or insufficien*))	198627
#104	Search "Renal Replacement Therapy"[Mesh]	186793
#103	Search "Renal Insufficiency, Chronic"[Mesh]	99348
#102	Search amylin analog*	120
#101	Search "Amylin Receptor Agonists"[Mesh]	12
#100	Search "glucagon-like peptide-1"	10688
#99	Search thiazolidinedione*	12786
#98	Search alpha-glucosidase inhibit*	2248
#97	Search Biguanide*	4579
#96	Search sulfonylurea compound*	5697
#95	Search "Sodium glucose co-transporter 2" or "Sodium glucose transporter 2"	1392
#94	Search insulin	372628
#93	Search (antidiabet* or anti-diabet*)	20656
#92	Search (elevat* or high* or increas*) and ("blood glucose" or "blood sugar" or HbA1c)	122018
#91	Search metabolic syndrome*	46415
#90	Search (diabete* or diabetic* or DM or T1D or T1DM or T2D or T2DM)	664863
#89	Search "Thiazolidinediones"[Mesh]	10672
#88	Search "Glucagon-Like Peptide 1"[Mesh]	6786
#87	Search "alpha-Glucosidases"[Mesh]	3893
#86	Search "Sodium-Glucose Transporter 2"[Mesh]	1044
#85	Search "Biguanides"[Mesh]	22572
#84	Search "Sulfonylurea Compounds"[Mesh]	18184
#83	Search "Hypoglycemic Agents"[Mesh]	57637
#82	Search "Diabetes Complications"[Mesh]	118148
#81	Search "Blood Glucose"[Mesh]	147634
#80	Search "Diabetes Mellitus"[Mesh]	371483
#79	Search (Hydroxymethylglutaryl-CoA Reductase Inhibit* or HMG-COA reductase inhibit* or Statin*)	53023
#78	Search (antilipid* or anti-lipid*)	976
#77	Search ((reduc* or low* or decreas*) and (high density lipoprotein or HDL or HDL-C))	76692
#76	Search ((elevat* or high* or increas*) and (cholesterol or TC or "low-density lipoprotein" or LDL or LDL-C or triglyceride* or TG))	268965
#75	Search (hypertriglyceridemia* or hypertriglyceridaemia* or hyper-triglyceridemi* or hyper-triglyceridaemi*)	13398
#74	Search (hypercholesterolemi* or hypercholesterolaemi* or hyper-cholesterolemi* or hyper-cholesterolaemi*)	43167
#73	Search (hyperlipoproteinemia* or hyperlipoproteinaemia* or hyper-lipoproteinemia* or hyper-lipoproteinaemia*)	12081
#72	Search hyperlipidemia* or hyperlipidaemia* or hyper-lipidemia* or hyper-lipidaemia*	41120
#71	Search (Dyslipoproteinemia* or Dyslipoproteinaemia*)	1005
#70	Search (dyslipidemia* or dyslipidaemia*)	30312
#69	Search "Hydroxymethylglutaryl-CoA Reductase Inhibitors"[Mesh]	25665
#68	Search "Hypolipidemic Agents"[Mesh]	50161
#67	Search "Dyslipidemias"[Mesh]	72657
#66	Search (overeat* or over-eat* or overfeed* or over-feed*)	4164
#65	Search (fat or "body fat distribution" or (fat overload and (syndrome or syndromes)))	230687
#64	Search ("waist circumference*" or "waist-hip ratio")	26845
#63	Search "weight gain"	65298

#62	Search (body mass ind* or "body mass" or BMI)	249576
#61	Search (adipos* or obes*)	391511
#60	Search "Adipose Tissue"[Mesh]	85412
#59	Search "Waist-Hip Ratio"[Mesh]	3531
#58	Search "Waist Circumference"[Mesh]	7836
#57	Search "Body Weight"[Mesh]	408717
#56	Search "Body Fat Distribution"[Mesh]	10800
#55	Search "Body Mass Index"[Mesh]	104622
#54	Search "Obesity"[Mesh]	177697
#53	Search Chloride Symporter AND (Inhibitor OR inhibitors)	4669
#52	Search diuretic*	94705
#51	Search Thiazide*	5221
#50	Search CCB*	4881
#49	Search calcium AND (antagonist* OR blocker OR blockers OR inhibitor OR inhibitors)	146425
#48	Search ARB*	9605
#47	Search angiotensin and receptor AND ((antagonist OR antagonists) OR (blocker OR blockers))	29939
#46	Search alpha AND (adrenergic* OR antagonist* OR blocker OR blockers OR receptor*)	326704
#45	Search beta AND (adrenergic* OR antagonist* OR blocker OR blockers OR receptor*)	311455
#44	Search (adrenergic* AND (antagonist* OR blocker OR blockers OR receptor*))	115990
#43	Search ACEI*	3962
#42	Search ACE AND (inhibitor OR inhibitors)	19882
#41	Search ACE AND (inhibitor OR inhibitors)	19882
#40	Search "angiotensin converting enzyme" AND (inhibitor OR inhibitors)	42514
#39	Search "Sodium Potassium Chloride Symporter Inhibitors"[Mesh]	818
#38	Search "Sodium Chloride Symporter Inhibitors"[Mesh]	2892
#37	Search "Diuretics"[Mesh]	33197
#36	Search "Thiazides"[Mesh]	14990
#35	Search "Calcium Channel Blockers"[Mesh]	35425
#34	Search "Adrenergic Antagonists"[Mesh]	53804
#33	Search "Angiotensin Receptor Antagonists"[Mesh]	15515
#32	Search "Angiotensin-Converting Enzyme Inhibitors"[Mesh]	30512
#31	Search "Antihypertensive Agents"[Mesh]	60122
#30	Search (elevat* OR high* OR increas*) AND DBP	10001
#29	Search (elevat* OR high* OR increas*) AND diastolic	83357
#28	Search (elevat* OR high* OR increas*) AND SBP	13912
#27	Search (elevat* OR high* OR increas*) AND systolic	109105
#26	Search (elevat* OR high* OR increas*) AND ("blood pressure" OR "blood pressures")	247917
#25	Search hypertens*[Title/Abstract]	386567
#24	Search "Hypertension"[Mesh]	235391
#23	Search Tobacco* OR smoking OR smoke* OR cigarette* OR cigar*	333672
#22	Search "Tobacco"[Mesh]	27748
#21	Search "Tobacco Use"[Mesh]	136738
#20	#18 OR #19	263369
#19	Search (cardiovascular OR cardio-vascular* OR CVD OR CV OR coronary OR CHD OR "heart disease*" OR cerebrovascular* OR "heart failure*" OR HF OR stroke* OR ischem* OR ischaem* OR "heart decompensation*" OR "myocardial infarct*" OR MI OR angina) AND risk	603916

#18	#16 AND #17	263369
#17	Search "Risk"[Mesh]	1025412
#16	Search "Cardiovascular Diseases"[Mesh]	2147171
#15	Search #1 or #2 or #3 or (#4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14)[Title/Abstract]	89622
#14	Search ankle* AND (pain OR painful)	10808
#13	Search (foot OR feet) AND (pain OR painful)	17120
#12	Search shoulder* AND (pain OR painful)	20013
#11	Search thumb* AND (pain OR painful)	1908
#10	Search finger* AND (pain OR painful)	6383
#9	Search joint* AND (pain OR painful)	69824
#8	Search hand* AND (pain OR painful)	23771
#7	Search arthrosis[Title/Abstract]	5067
#6	Search hip* AND (pain OR painful)	19061
#5	Search knee* AND (pain OR painful)	29142
#4	Search degenerative AND (arthritis OR joint OR joints)	13018
#3	Search OA[Title/Abstract]	27153
#2	Search osteoarthr*[Title/Abstract]	58938
#1	Search osteoarthritis[MeSH Terms]	53429

CINAHL

CINAHL Plus with Full Text (EBSCO) (24 November 2017)

Search ID#	Search Terms	Actions
S108	S15 AND S96 AND S107	View Results (2,434)
S107	S97 OR S98 OR S99 OR S100 OR S101 OR S102 OR S103 OR S104 OR S105 OR S106	View Results (869,985)
S106	TI (observ* N3 (study or studies)) OR AB (observ* N3 (study or studies)*)	View Results (41,372)
S105	TI prospective* OR AB prospective*	View Results (140,999)
S104	TI retrospective* OR AB retrospective*	View Results (121,529)
S103	TI longitudinal OR AB longitudinal	View Results (56,415)
S102	TI ("follow up" or follow-up) OR AB ("follow up" or follow-up)	View Results (162,374)
S101	TI ("cross sectional" or cross-sectional) OR AB ("cross sectional" or cross-sectional)	View Results (87,637)
S100	TI Cohort* OR AB Cohort*	View Results (131,383)
S99	TI ("case control*" or case-control*) OR AB ("case control*" or case-control*)	View Results (23,424)
S98	TI epidemiolog* OR AB epidemiolog*	View Results (53,533)
S97	(MH "Nonexperimental Studies+")	View Results (542,829)
S96	S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 OR S49 OR S50 OR S51 OR S52 OR S53 OR S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61 OR S62 OR S63 OR S64 OR S65 OR S66 OR S67 OR S68 OR S69 OR S70 OR S71 OR S72 OR S73 OR S74 OR S75 OR S76 OR S77 OR S78 OR S79 OR S80 OR S81 OR S82 OR S83 OR S84 OR S85 OR S86 OR S87 OR S88 OR S89 OR S90 OR S91 OR S92 OR S93 OR S94 OR S95	View Results (596,272)

S95	TI (predialysis or pre-dialysis) OR AB (predialysis or pre-dialysis)	View Results (737)
S94	TI (hemodialysis or haemodialysis or hemofiltration or haemofiltration or hemodiafiltration or haemodiafiltration) OR AB (hemodialysis or haemodialysis or hemofiltration or haemofiltration or hemodiafiltration or haemodiafiltration)	View Results (11,466)
S93	TI Dialysis OR AB Dialysis	View Results (13,515)
S92	TI (CKD or CKF or CKI or CRD or CRF or CRI) OR AB (CKD or CKF or CKI or CRD or CRF or CRI)	View Results (8,393)
S91	TI (ESKD or ESRD or ESRF) OR AB (ESKD or ESRD or ESRF)	View Results (3,139)
S90	TI ((endstage or end stage or established or chronic or progressive) N2 (renal or kidney) N2 (failure or disease* or insufficien*)) OR AB ((endstage or end stage or established or chronic or progressive) N2 (renal or kidney) N2 (failure or disease* or insufficien*))	View Results (18,757)
S89	(MH "Dialysis+")	View Results (17,935)
S88	(MH "Renal Insufficiency, Chronic+")	View Results (19,743)
S87	TI "amylin analog*" OR AB "amylin analog*"	View Results (29)
S86	TI thiazolidinedione* OR AB thiazolidinedione*	View Results (952)
S85	TI "glucagon-like peptide-1" OR AB "glucagon-like peptide-1"	View Results (1,472)
S84	TI alpha-glucosidase inhibit* OR AB alpha-glucosidase inhibit*	View Results (207)
S83	TI Biguanide* OR AB Biguanide*	View Results (250)
S82	TI "sulfonylurea compound*" OR AB "sulfonylurea compound*"	View Results (3)
S81	TI ("Sodium glucose co-transporter 2" or "Sodium glucose transporter 2") OR AB ("Sodium glucose co-transporter 2" or "Sodium glucose transporter 2")	View Results (146)
S80	TI insulin OR AB insulin	View Results (39,850)
S79	TI (antidiabet* or anti-diabet*) OR AB (antidiabet* or anti-diabet*:)	View Results (3,529)
S78	(MH "Hypoglycemic Agents+")	View Results (35,989)
S77	TI ((elevat* or high* or increas*) N3 (blood glucose or blood sugar or HbA1c)) OR AB ((elevat* or high* or increas*) N3 (blood glucose or blood sugar or HbA1c))	View Results (3,458)
S76	TI "metabolic syndrome*" OR AB "metabolic syndrome*"	View Results (10,663)
S75	TI (diabete* or diabetic* or DM or T1D or T1DM or T2D or T2DM) OR AB (diabete* or diabetic* or DM or T1D or T1DM or T2D or T2DM)	View Results (139,703)
S74	(MH "Metabolic Syndrome X+")	View Results (10,726)
S73	(MM "Hemoglobin A, Glycosylated")	View Results (2,794)
S72	(MM "Blood Glucose")	View Results (8,219)
S71	(MH "Diabetes Mellitus+")	View Results (120,130)
S70	TI (Hydroxymethylglutaryl-CoA Reductase Inhibit* or HMG-COA reductase inhibit* or Statin*) OR AB (Hydroxymethylglutaryl-CoA Reductase Inhibit* or HMG-COA reductase inhibit* or Statin*)	View Results (10,844)
S69	TI (antilipid* or anti-lipid*) OR AB (antilipid* or anti-lipid*)	View Results (99)
S68	(MH "Antilipemic Agents+")	View Results (16,360)
S67	TI ((reduc* or low* or decreas*) N3 ("high density lipoprotein" or HDL or HDL-C)) AND ((reduc* or low* or decreas*) N3 ("high density lipoprotein" or HDL or HDL-C))	View Results (322)
S66	TI ((elevat* or high* or increas*) N3 (cholesterol or "low-density lipoprotein" or LDL or LDL-C or triglyceride* or TG)) AND ((elevat* or high* or increas*) N3 (cholesterol or "low-density lipoprotein" or LDL or LDL-C or triglyceride* or TG))	View Results (1,453)
S65	TI (hypertriglyceridemia* or hypertriglyceridaemia* or hyper-triglyceridemi* or hyper-triglyceridaemi*) OR AB (hypertriglyceridemia* or hypertriglyceridaemia* or hyper-triglyceridemi* or hyper-triglyceridaemi*)	View Results (1,360)
S64	TI (hypercholesterolemi* or hypercholesterolaemi* or hyper-cholesterolemi* or hyper-cholesterolaemi*) OR AB (hypercholesterolemi* or hypercholesterolaemi*	View Results (4,045)

	or hyper-cholesterolemi* or hyper-cholesterolaemi*)	
S63	TI (hyperlipoproteinemia* or hyperlipoproteinaemia* or hyper-lipoproteinemia* or hyper-lipoproteinaemia*) OR AB (hyperlipoproteinemia* or hyperlipoproteinaemia* or hyper-lipoproteinemia* or hyper-lipoproteinaemia*)	View Results (76)
S62	TI (hyperlipidemia* or hyperlipidaemia* or hyper-lipidemia* or hyper-lipidaemia*) OR AB (hyperlipidemia* or hyperlipidaemia* or hyper-lipidemia* or hyper-lipidaemia*)	View Results (3,550)
S61	TI (Dyslipoproteinemia* or Dyslipoproteinaemia*) OR AB (Dyslipoproteinemia* or Dyslipoproteinaemia*)	View Results (31)
S60	TI (dyslipidemia* or dyslipidaemia*) OR AB (dyslipidemia* or dyslipidaemia*)	View Results (5,265)
S59	(MH "Hyperlipidemia+")	View Results (15,419)
S58	TI (overeat* or over-eat* or overfeed* or over-feed*) OR AB (overeat* or over-eat* or overfeed* or over-feed*)	View Results (1,194)
S57	TI (fat or "body fat distribution" or "fat overload syndrom*") OR AB (fat or "body fat distribution" or "fat overload syndrom*")	View Results (36,875)
S56	TI (“waist circumference*” or "waist-hip ratio") OR AB (“waist circumference*” or "waist-hip ratio")	View Results (7,079)
S55	TI weight gain OR AB weight gain	View Results (11,073)
S54	TI (body mass ind* or "body mass" or BMI) OR AB (body mass ind* or "body mass" or BMI)	View Results (60,319)
S53	TI (adipos* or obes*) OR AB (adipos* or obes*)	View Results (74,840)
S52	(MH "Adipose Tissue+")	View Results (13,147)
S51	(MM "Adipose Tissue Distribution")	View Results (2,234)
S50	(MM "Body Mass Index") OR (MH "Body Weight+") OR (MM "Waist Circumference") OR (MM "Waist-Hip Ratio")	View Results (113,422)
S49	(MH "Obesity+")	View Results (72,743)
S48	TI diuretic* OR AB diuretic*	View Results (3,997)
S47	TI Thiazide* OR AB Thiazide*	View Results (719)
S46	TI CCB* OR AB CCB*	View Results (482)
S45	TI (calcium N3 (antagonist* or block* or inhibit*) OR AB (calcium N3 (antagonist* or block* or inhibit*)	View Results (3,062)
S44	TI (alpha N3 (adrenergic* or antagonist* or block* or receptor*)) OR AB (alpha N3 (adrenergic* or antagonist* or block* or receptor*))	View Results (3,197)
S43	TI (beta N3 (adrenergic* or antagonist* or block* or receptor*)) OR AB (beta N3 (adrenergic* or antagonist* or block* or receptor*))	View Results (6,606)
S42	TI ARB* OR AB ARB*	View Results (5,378)
S41	TI (angiotensin N2 receptor N3 (antagon* or block*)) OR AB (angiotensin N2 receptor N3 (antagon* or block*))	View Results (2,696)
S40	TI ACEI* OR AB ACEI*	View Results (697)
S39	TI ACE N3 inhibit* OR AB ACE N3 inhibit*	View Results (2,460)
S38	TI "angiotensin converting enzyme" N3 inhibit* OR AB "angiotensin converting enzyme" N3 inhibit*	View Results (3,708)
S37	TI (antihypertensi* or anti-hypertensi*) OR AB (antihypertensi* or anti-hypertensi*)	View Results (7,440)
S36	(MH "Diuretics+")	View Results (7,227)
S35	(MH "Calcium Channel Blockers+")	View Results (5,488)
S34	(MH "Adrenergic Alpha-Antagonists+")	View Results (1,701)
S33	(MH "Adrenergic Beta-Antagonists+")	View Results (8,771)
S32	(MH "Antihypertensive Agents+")	View Results (24,866)
S31	TI ((elevat* or high* or increas*) N3 DBP) OR AB ((elevat* or high* or increas*) N3 DBP)	View Results (436)
S30	TI ((elevat* or high* or increas*) N3 diastolic) OR AB ((elevat* or high* or increas*) N3 diastolic)	View Results (1,994)

S29	TI ((elevat* or high* or increas*) N3 SBP) OR AB ((elevat* or high* or increas*) N3 SBP)	View Results (1,070)
S28	TI ((elevat* or high* or increas*) N3 systolic) OR AB ((elevat* or high* or increas*) N3 systolic)	View Results (3,026)
S27	TI ((elevat* or high* or increas*) N3 BP) OR AB ((elevat* or high* or increas*) N3 BP)	View Results (2,462)
S26	TI ((elevat* or high* or increas*) N3 "blood pressur*") OR AB ((elevat* or high* or increas*) N3 "blood pressur*")	View Results (9,503)
S25	TI hypertens* OR AB hypertens*	View Results (58,945)
S24	(MH "Hypertension+")	View Results (55,264)
S23	TI (Tobacco* or smoking or smoke* or cigarette* or cigar*) OR AB (Tobacco* or smoking or smoke* or cigarette* or cigar*)	View Results (76,828)
S22	(MH "Tobacco+")	View Results (7,184)
S21	(MM "Smoking")	View Results (25,454)
S20	S18 OR S19	View Results (81,570)
S19	TI ((cardiovascular or cardio-vascular* or CVD or CV or coronary or CHD or "heart disease*" or cerebrovascular* or "heart failure*" or HF or stroke* or ischem* or ischaem* or "heart decompensation*" or "myocardial infarct*" or MI or angina) N3 risk) OR AB ((cardiovascular or cardio-vascular* or CVD or CV or coronary or CHD or "heart disease*" or cerebrovascular* or "heart failure*" or HF or stroke* or ischem* or ischaem* or "heart decompensation*" or "myocardial infarct*" or MI or angina) N3 ...	View Results (48,783)
S18	S16 AND S17	View Results (48,468)
S17	(MH "Risk Factors+")	View Results (150,265)
S16	(MH "Cardiovascular Diseases+")	View Results (427,907)
S15	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14	View Results (42,514)
S14	TI (((foot or feet) N3 (pain or painful))) OR AB (((foot or feet) N3 (pain or painful)))	View Results (1,248)
S13	TI ((ankle* N3 (pain or painful))) OR AB ((ankle* N3 (pain or painful)))	View Results (789)
S12	TI ((shoulder* N3 (pain or painful))) OR AB ((shoulder* N3 (pain or painful)))	View Results (3,595)
S11	TI ((thumb* N3 (pain or painful))) OR AB ((thumb* N3 (pain or painful)))	View Results (86)
S10	TI ((finger* N3 (pain or painful))) OR AB ((finger* N3 (pain or painful)))	View Results (171)
S9	TI ((hand* N3 (pain or painful))) OR AB ((joint* N3 (pain or painful)))	View Results (3,386)
S8	TI ((hand* N3 (pain or painful))) OR AB ((hand* N3 (pain or painful)))	View Results (1,047)
S7	TI ((hip* N3 (pain or painful))) OR AB ((hip* N3 (pain or painful)))	View Results (2,338)
S6	TI ((knee* N3 (pain or painful))) OR AB ((knee* N3 (pain or painful)))	View Results (4,779)
S5	TI ((degenerative N3 (arthritis or joint or joints))) OR AB ((degenerative N3 (arthritis or joint or joints)))	View Results (915)
S4	TI arthrosis OR AB arthrosis	View Results (611)
S3	TI OA OR AB OA	View Results (7,272)
S2	TI osteoarthr* OR AB osteoarthr*	View Results (19,992)
S1	(MH "Osteoarthritis+")	View Results (20,736)

AMED

AMED (EBSCO) 27 November 2017

Search ID#	Search terms	Actions

S106	S15 AND S104 AND S105	View Results (159)
S105	S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 OR S49 OR S50 OR S51 OR S52 OR S53 OR S54 OR S55 OR S56 OR S57 OR S58 OR S59 OR S60 OR S61 OR S62 OR S63 OR S64 OR S65 OR S66 OR S67 OR S68 OR S69 OR S70 OR S71 OR S72 OR S73 OR S74 OR S75 OR S76 OR S77 OR S78 OR S79 OR S80 OR S81 OR S82 OR S83 OR S84 OR S85 OR S86 OR S87 OR S88 OR S89 OR S90 OR S91	View Results (14,307)
S104	S92 OR S93 OR S94 OR S95 OR S96 OR S97 OR S98 OR S99 OR S100 OR S101 OR S102 OR S103	View Results (25,841)
S103	(DE "CASE CONTROL STUDIES")	View Results (3)
S102	(DE "COHORT STUDIES")	View Results (2)
S101	TI (observ* N3 (study or studies)) OR AB (observ* N3 (study or studies)*)	View Results (1,681)
S100	TI prospective* OR AB prospective*	View Results (6,262)
S99	TI retrospective* OR AB retrospective*	View Results (4,059)
S98	TI longitudinal OR AB longitudinal	View Results (2,861)
S97	TI ("follow up" or follow-up) OR AB ("follow up" or follow-up)	View Results (8,442)
S96	TI ("cross sectional" or cross-sectional) OR AB ("cross sectional" or cross-sectional)	View Results (4,138)
S95	TI Cohort* OR AB Cohort*	View Results (3,751)
S94	TI ("case control*" or case-control*) OR AB ("case control*" or case-control*)	View Results (667)
S93	TI epidemiolog* OR AB epidemiolog*	View Results (1,542)
S92	(DE "EPIDEMIOLOGY")	View Results (225)
S91	TI (predialysis or pre-dialysis) OR AB (predialysis or pre-dialysis)	View Results (6)
S90	TI (hemodialysis or haemodialysis or hemofiltration or haemofiltration or hemodiafiltration or haemodiafiltration) OR AB (hemodialysis or haemodialysis or hemofiltration or haemofiltration or hemodiafiltration or haemodiafiltration)	View Results (138)
S89	TI Dialysis OR AB Dialysis	View Results (212)
S88	TI (CKD or CKF or CKI or CRD or CRF or CRI) OR AB (CKD or CKF or CKI or CRD or CRF or CRI)	View Results (126)
S87	TI (ESKD or ESRD or ESRF) OR AB (ESKD or ESRD or ESRF)	View Results (52)
S86	TI ((endstage or end stage or established or chronic or progressive) N2 (renal or kidney) N2 (failure or disease* or insufficien*)) OR AB ((endstage or end stage or established or chronic or progressive) N2 (renal or kidney) N2 (failure or disease* or insufficien*))	View Results (263)
S85	(DE "KIDNEY TRANSPLANTATION")	View Results (9)
S84	(DE "KIDNEY FAILURE CHRONIC")	View Results (149)
S83	TI "amylin analog*" OR AB "amylin analog*"	View Results (2)
S82	TI thiazolidinedione* OR AB thiazolidinedione*	View Results (2)
S81	TI "glucagon-like peptide-1" OR AB "glucagon-like peptide-1"	View Results (10)
S80	TI alpha-glucosidase inhibit* OR AB alpha-glucosidase inhibit*	View Results (54)
S79	TI Biguanide* OR AB Biguanide*	View Results (4)
S78	TI "sulfonylurea compound*" OR AB "sulfonylurea compound*"	View Results (0)
S77	TI ("Sodium glucose co-transporter 2" or "Sodium glucose transporter 2") OR AB ("Sodium glucose co-transporter 2" or "Sodium glucose transporter 2")	View Results (42)
S76	TI insulin OR AB insulin	View Results (963)
S75	TI (antidiabet* or anti-diabet*) OR AB (antidiabet* or anti-diabet*:)	View Results (409)
S74	(DE "HYPOGLYCEMIC AGENTS")	View Results (570)
S73	TI ((elevat* or high* or increas*) N3 (blood glucose or blood sugar or HbA1c)) OR AB ((elevat* or high* or increas*) N3 (blood glucose or blood sugar or HbA1c))	View Results (119)
S72	TI "metabolic syndrome*" OR AB "metabolic syndrome*"	View Results (165)

S71	TI (diabete* or diabetic* or DM or T1D or T1DM or T2D or T2DM) OR AB (diabete* or diabetic* or DM or T1D or T1DM or T2D or T2DM)	View Results (4,184)
S70	(DE "BLOOD GLUCOSE")	View Results (357)
S69	(DE "DIABETES MELLITUS") OR (DE "DIABETES MELLITUS TYPE 1") OR (DE "DIABETES MELLITUS TYPE 2")	View Results (2,494)
S68	TI (Hydroxymethylglutaryl-CoA Reductase Inhibit* or HMG-COA reductase inhibit* or Statin*) OR AB (Hydroxymethylglutaryl-CoA Reductase Inhibit* or HMG-COA reductase inhibit* or Statin*)	View Results (136)
S67	TI (antilipid* or anti-lipid*) OR AB (antilipid* or anti-lipid*)	View Results (34)
S66	(DE "ANTILIPEMIC AGENTS")	View Results (154)
S65	TI ((reduc* or low* or decreas*) N3 ("high density lipoprotein" or HDL or HDL-C)) AND ((reduc* or low* or decreas*) N3 ("high density lipoprotein" or HDL or HDL-C))	View Results (4)
S64	TI ((elevat* or high* or increas*) N3 (cholesterol or "low-density lipoprotein" or LDL or LDL-C or triglyceride* or TG)) AND ((elevat* or high* or increas*) N3 (cholesterol or "low-density lipoprotein" or LDL or LDL-C or triglyceride* or TG))	View Results (41)
S63	TI (hypertriglyceridemia* or hypertriglyceridaemia* or hyper-triglyceridemi* or hyper-triglyceridaemi*) OR AB (hypertriglyceridemia* or hypertriglyceridaemia* or hyper-triglyceridemi* or hyper-triglyceridaemi*)	View Results (23)
S62	TI (hypercholesterolemi* or hypercholesterolaemi* or hyper-cholesterolemi* or hyper-cholesterolaemi*) OR AB (hypercholesterolemi* or hypercholesterolaemi* or hyper-cholesterolemi* or hyper-cholesterolaemi*)	View Results (140)
S61	TI (hyperlipoproteinemia* or hyperlipoproteinaemia* or hyper-lipoproteinemia* or hyper-lipoproteinaemia*) OR AB (hyperlipoproteinemia* or hyperlipoproteinaemia* or hyper-lipoproteinemia* or hyper-lipoproteinaemia*)	View Results (11)
S60	TI (hyperlipidemia* or hyperlipidaemia* or hyper-lipidemia* or hyper-lipidaemia*) OR AB (hyperlipidemia* or hyperlipidaemia* or hyper-lipidemia* or hyper-lipidaemia*)	View Results (159)
S59	TI (Dyslipoproteinemia* or Dyslipoproteinaemia*) OR AB (Dyslipoproteinemia* or Dyslipoproteinaemia*)	View Results (6)
S58	TI (dyslipidemia* or dyslipidaemia*) OR AB (dyslipidemia* or dyslipidaemia*)	View Results (95)
S57	(DE "DYSLIPIDEMIAS") OR (DE "HYPERLIPIDEMIA")	View Results (174)
S56	TI (overeat* or over-eat* or overfeed* or over-feed*) OR AB (overeat* or over-eat* or overfeed* or over-feed*)	View Results (20)
S55	TI (fat or "body fat distribution" or "fat overload syndrom*") OR AB (fat or "body fat distribution" or "fat overload syndrom*")	View Results (1,354)
S54	TI (“waist circumference*” or "waist-hip ratio") OR AB (“waist circumference*” or "waist-hip ratio")	View Results (112)
S53	TI weight gain OR AB weight gain	View Results (272)
S52	TI (body mass ind* or "body mass" or BMI) OR AB (body mass ind* or "body mass" or BMI)	View Results (2,022)
S51	TI (adipos* or obes*) OR AB (adipos* or obes*)	View Results (1,772)
S50	(DE "ADIPOSE TISSUE")	View Results (151)
S49	MM ("Adipose Tissue Distribution")	View Results (252)
S48	(DE "BODY MASS INDEX") OR (DE "BODY WEIGHT")	View Results (696)
S47	(DE "OBESITY")	View Results (1,401)
S46	TI diuretic* OR AB diuretic*	View Results (204)
S45	TI Thiazide* OR AB Thiazide*	View Results (6)
S44	TI CCB* OR AB CCB*	View Results (12)
S43	TI (calcium N3 (antagonist* or block* or inhibit*) OR AB (calcium N3 (antagonist* or block* or inhibit*)	View Results (127)
S42	TI (alpha N3 (adrenergic* or antagonist* or block* or receptor*)) OR AB (alpha N3 (adrenergic* or antagonist* or block* or receptor*))	View Results (136)
S41	TI (beta N3 (adrenergic* or antagonist* or block* or receptor*)) OR AB (beta N3 (adrenergic* or antagonist* or block* or receptor*))	View Results (170)
S40	TI ARB* OR AB ARB*	View Results (504)

S39	TI (angiotensin N2 receptor N3 (antagon* or block*)) OR AB (angiotensin N2 receptor N3 (antagon* or block*))	View Results (13)
S38	TI ACEI* OR AB ACEI*	View Results (7)
S37	TI ACE N3 inhibit* OR AB ACE N3 inhibit*	View Results (51)
S36	TI "angiotensin converting enzyme" N3 inhibit* OR AB "angiotensin converting enzyme" N3 inhibit*	View Results (62)
S35	TI (antihypertensi* or anti-hypertensi*) OR AB (antihypertensi* or anti-hypertensi*)	View Results (233)
S34	(DE "DIURETICS")	View Results (113)
S33	(DE "CALCIUM CHANNEL BLOCKERS")	View Results (31)
S32	(DE "ADRENERGIC BETA RECEPTOR BLOCKADERS")	View Results (37)
S31	(DE "ANTIHYPERTENSIVE AGENTS")	View Results (185)
S30	TI ((elevat* or high* or increas*) N3 DBP) OR AB ((elevat* or high* or increas*) N3 DBP)	View Results (10)
S29	TI ((elevat* or high* or increas*) N3 diastolic) OR AB ((elevat* or high* or increas*) N3 diastolic)	View Results (55)
S28	TI ((elevat* or high* or increas*) N3 SBP) OR AB ((elevat* or high* or increas*) N3 SBP)	View Results (24)
S27	TI ((elevat* or high* or increas*) N3 systolic) OR AB ((elevat* or high* or increas*) N3 systolic)	View Results (51)
S26	TI ((elevat* or high* or increas*) N3 BP) OR AB ((elevat* or high* or increas*) N3 BP)	View Results (51)
S25	TI ((elevat* or high* or increas*) N3 "blood pressur*") OR AB ((elevat* or high* or increas*) N3 "blood pressur*")	View Results (278)
S24	TI hypertens* OR AB hypertens*	View Results (1,283)
S23	(DE "HYPERTENSION")	View Results (928)
S22	TI (Tobacco* or smoking or smoke* or cigarette* or cigar*) OR AB (Tobacco* or smoking or smoke* or cigarette* or cigar*)	View Results (1,244)
S21	(DE "SMOKING")	View Results (325)
S20	S18 OR S19	View Results (884)
S19	TI ((cardiovascular or cardio-vascular* or CVD or CV or coronary or CHD or "heart disease*" or cerebrovascular* or "heart failure*" or HF or stroke* or ischem* or ischaem* or "heart decompensation*" or "myocardial infarct*" or MI or angina) N3 risk) OR AB ((cardiovascular or cardio-vascular* or CVD or CV or coronary or CHD or "heart disease*" or cerebrovascular* or "heart failure*" or HF or stroke* or ischem* or ischaem* or "heart decompensation*" or "myocardial infarct*" or MI or angina) N3 ...	View Results (884)
S18	S16 AND S17	View Results (8)
S17	(DE "RISK") OR (DE "RISK FACTORS")	View Results (221)
S16	(DE "CARDIOVASCULAR DIS")	View Results (1,137)
S15	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14	View Results (5,802)
S14	TI (((foot or feet) N3 (pain or painful))) OR AB (((foot or feet) N3 (pain or painful)))	View Results (408)
S13	TI ((ankle* N3 (pain or painful))) OR AB ((ankle* N3 (pain or painful)))	View Results (280)
S12	TI ((shoulder* N3 (pain or painful))) OR AB ((shoulder* N3 (pain or painful)))	View Results (927)
S11	TI ((thumb* N3 (pain or painful))) OR AB ((thumb* N3 (pain or painful)))	View Results (17)
S10	TI ((finger* N3 (pain or painful))) OR AB ((finger* N3 (pain or painful)))	View Results (27)
S9	TI ((hand* N3 (pain or painful))) OR AB ((joint* N3 (pain or painful)))	View Results (586)
S8	TI ((hand* N3 (pain or painful))) OR AB ((hand* N3 (pain or painful)))	View Results (167)
S7	TI ((hip* N3 (pain or painful))) OR AB ((hip* N3 (pain or painful)))	View Results (269)
S6	TI ((knee* N3 (pain or painful))) OR AB ((knee* N3 (pain or painful)))	View Results (751)
S5	TI ((degenerative N3 (arthritis or joint or joints))) OR AB ((degenerative N3 (arthritis or joint or joints)))	View Results (193)
S4	TI arthrosis OR AB arthrosis	View Results (164)
S3	TI OA OR AB OA	View Results (686)

S2	TI osteoarthr* OR AB osteoarthr*	View Results (2,655)
S1	(DE"Osteoarthritis")	View Results (1,358)

Web of Science

Web of science (27 November 2017)		
Set	Results	Search terms
#81	5,760	#80 AND #70 AND #14
# 80	2,898,733	#79 OR #78 OR #77 OR #76 OR #75 OR #74 OR #73 OR #72 OR #71
# 79	202,541	ts=(observ* near/3 (study or studies))
# 78	583,495	ts=prospective*
# 77	504,037	ts=retrospective*
# 76	342,149	ts=longitudinal
# 75	860,642	ts=("follow up" or follow-up)
# 74	280,006	ts=("cross sectional" or cross-sectional)
# 73	500,937	ts=Cohort*
# 72	105,205	ts=("case control*" or case-control*)
# 71	422,798	ts=epidemiolog*
# 70	3,200,399	#69 OR #68 OR #67 OR #66 OR #65 OR #64 OR #63 OR #62 OR #61 OR #60 OR #59 OR #58 OR #57 OR #56 OR #55 OR #54 OR #53 OR #52 OR #51 OR #50 OR #49 OR #48 OR #47 OR #46 OR #45 OR #44 OR #43 OR #42 OR #41 OR #40 OR #39 OR #38 OR #37 OR #36 OR #35 OR #34 OR #33 OR #32 OR #31 OR #30 OR #29 OR #28 OR #27 OR #26 OR #25 OR #24 OR #23 OR #22 OR #21 OR #20 OR #19 OR #18 OR #17 OR #16 OR #15
# 69	193,974	ts=((cardiovascular or cardio-vascular* or CVD or CV or coronary or CHD or "heart disease*" or cerebrovascular* or "heart failure*" or HF or stroke* or ischem* or ischaem* or "heart decompensation*" or "myocardial infarct*" or MI or angina) near/3 risk)
# 68	4,418	ts=(predialysis or pre-dialysis)
# 67	94,182	ts=(hemodialysis or haemodialysis or hemofiltration or haemofiltration or hemodiafiltration or haemodiafiltration)
# 66	104,211	ts=Dialysis
# 65	46,897	ts=(CKD or CKF or CKI or CRD or CRF or CRI)
# 64	16,642	ts=(ESKD or ESRD or ESRF)
# 63	110,240	ts=((endstage or "end stage" or established or chronic or progressive) near/2 (renal or kidney) near/2 (failure or disease* or insufficien*))
# 62	175	ts="amylin analog*"
# 61	7,040	ts=thiazolidinedione*
# 60	13,228	ts="glucagon-like peptide-1"
# 59	3,228	ts="alpha-glucosidase inhibit*"
# 58	2,690	ts=Biguanide*
# 57	148	ts="sulfonylurea compound*"
# 56	599	ts=("Sodium glucose co-transporter 2" or "Sodium glucose transporter 2")
# 55	420,505	ts=insulin
# 54	21,198	ts=(antidiabet* or anti-diabet*)
# 53	10,921	ts=((elevat* or high* or increas*) near/3 ("blood glucose" or "blood sugar" or HbA1c))
# 52	80,225	ts="metabolic syndrome*"
# 51	691,573	ts=(diabete* or diabetic* or DM or T1D or T1DM or T2D or T2DM)
# 50	50,725	ts=("Hydroxymethylglutaryl-CoA Reductase Inhibit*" or "HMG-COA reductase inhibit*" or Statin*)
# 49	977	ts=(antilipid* or anti-lipid*)
# 48	23,655	ts=((reduc* or low* or decreas*) near/3 ("high density lipoprotein" or HDL or HDL-C))
# 47	103,658	ts=((elevat* or high* or increas*) near/3 (cholesterol or TC or "low-density lipoprotein" or LDL

		or LDL-C or triglyceride* or TG))
# 46	11,955	ts=(hypertriglyceridemia* or hypertriglyceridaemia* or hyper-triglyceridemi* or hyper-triglyceridaemi*)
# 45	43,107	ts=(hypercholesterolemi* or hypercholesterolaemi* or hyper-cholesterolemi* or hyper-cholesterolaemi*)
# 44	4,072	ts=(hyperlipoproteinemia* or hyperlipoproteinaemia* or hyper-lipoproteinemia* or hyper-lipoproteinaemia*)
# 43	24,383	ts=(hyperlipidemia* or hyperlipidaemia* or hyper-lipidemia* or hyper-lipidaemia*)
# 42	855	ts=(Dyslipoproteinemia* or Dyslipoproteinaemia*)
# 41	27,670	ts=(dyslipidemia* or dyslipidaemia*)
# 40	4,536	ts=(overeat* or over-eat* or overfeed* or over-feed*)
# 39	303,488	ts=(fat or "body fat distribution" or "fat overload syndrom*")
# 38	24,595	ts=(“waist circumference*” or "waist-hip ratio")
# 37	68,025	ts="weight gain"
# 36	277,825	ts=(body mass ind* or "body mass" or BMI)
# 35	401,349	ts=(obes* or adipos*)
# 34	7	ts="Chloride Symporter Inhibit*"
# 33	27,357	ts=diuretic*
# 32	4,377	ts=Thiazide*
# 31	3,744	ts=CCB*
# 30	47,428	ts=(calcium near/3 (antagonist* or block* or inhibit*))
# 29	117,429	ts=(alpha near/3 (adrenergic* or antagonist* or block* or receptor*))
# 28	140,625	ts=(beta near/3 (adrenergic* or antagonist* or block* or receptor*))
# 27	323,439	ts=ARB*
# 26	14,323	ts=(angiotensin near/2 receptor near/3 (antagon* or block*))
# 25	3,568	ts=ACEI*
# 24	21,436	ts=(ACE near/3 inhibit*)
# 23	24,518	ts=("angiotensin converting enzyme" near/3 inhibit*)
# 22	47,076	ts=(antihypertensi* or anti-hypertensi*)
# 21	2,046	ts=((elevat* OR high* OR increas*) near/3 DBP)
# 20	3,641	ts=((elevat* or high* or increas*) near/3 SBP)
# 19	15,049	ts=((elevat* or high* or increas*) near/3 systolic)
# 18	14,514	ts=((elevat* or high* or increas*) near/3 BP)
# 17	48,432	ts=((elevat* or high* or increas*) near/3 "blood pressur*")
# 16	441,701	ts=hypertens*
# 15	360,278	ts=(Tobacco* or smoking or smoke* or cigarette* or cigar*)
# 14	127,588	#13 OR #12 OR #11 OR #10 OR #9 OR #8 OR #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1
# 13	2,335	ts=((foot or feet) near/3 (pain or painful))
# 12	1,404	ts=(ankle* near/3 (pain or painful))
# 11	8,181	ts=(shoulder* near/3 (pain or painful))
# 10	201	ts=(thumb* NEAR/3 (pain OR painful))
# 9	555	ts=(finger* NEAR/3 (pain OR painful))
# 8	10,230	ts=(joint* NEAR/3 (pain OR painful))
# 7	2,409	ts=(hand* NEAR/3 (pain OR painful))
# 6	4,767	ts=(hip NEAR/3 (pain OR painful))
# 5	9,724	ts=(knee NEAR/3 (pain OR painful))
# 4	4,493	ts=(degenerative NEAR/3 (joint OR joints OR arthritis))
# 3	3,302	ts=arthrosis
# 2	33,328	ts=OA

# 1	77,640	ts=osteoarthr*

Chapter 2 appendices

Appendix 2.1. Code list for osteoarthritis diagnosis

Read code	Read term
N05..11	Osteoarthritis
N05z211	Elbow osteoarthritis NOS
N05z400	Osteoarthritis NOS, of the hand
N05z611	Knee osteoarthritis NOS
N053512	Hip osteoarthritis NOS
N053611	Patellofemoral osteoarthritis
N05z712	Foot osteoarthritis NOS
N05z.11	Joint degeneration
N05z412	Thumb osteoarthritis NOS
N05z511	Hip osteoarthritis NOS
N05zB00	Osteoarthritis NOS, of acromioclavicular joint

N05zL00	Osteoarthritis NOS, of knee
N05..00	Osteoarthritis and allied disorders
N05z100	Osteoarthritis NOS, of shoulder region
N05zA00	Osteoarthritis NOS, of sternoclavicular joint
N050111	Heberdens' nodes
N050.00	Generalised osteoarthritis - OA
N053700	Localised osteoarthritis, unspecified, of the ankle and foot
N05z411	Finger osteoarthritis NOS
N05z713	Toe osteoarthritis NOS
N05z500	Osteoarthritis NOS, pelvic region/thigh
N05z.00	Osteoarthritis NOS
N05z900	Osteoarthritis NOS, of shoulder
N05zJ00	Osteoarthritis NOS, of hip
N05zS00	Osteoarthritis NOS, of 1st MTP joint
N05zF00	Osteoarthritis NOS, of MCP joint
N05zN00	Osteoarthritis NOS, of ankle
N05zT00	Osteoarthritis NOS, of lesser MTP joint
N05zE00	Osteoarthritis NOS, of wrist
N05zH00	Osteoarthritis NOS, of DIP joint of finger
N05zG00	Osteoarthritis NOS, of PIP joint of finger
N050500	Secondary multiple arthrosis
N05z800	Osteoarthritis NOS, other specified site
N05z600	Osteoarthritis NOS, of the lower leg
N05z311	Wrist osteoarthritis NOS
N053100	Localised osteoarthritis, unspecified, of shoulder region
N05z700	Osteoarthritis NOS, of ankle and foot
N051500	Localised, primary osteoarthritis of the pelvic region/thigh
N053400	Localised osteoarthritis, unspecified, of the hand
N053800	Localised osteoarthritis, unspecified, of other spec site
N051F00	Localised, primary osteoarthritis of elbow
N05zC00	Osteoarthritis NOS, of elbow
N051800	Localised, primary osteoarthritis of other specified site
N053500	Localised osteoarthritis, unspecified, pelvic region/thigh
N051z00	Localised, primary osteoarthritis NOS
N051600	Localised, primary osteoarthritis of the lower leg
N053900	Arthrosis of first carpometacarpal joint, unspecified
N051400	Localised, primary osteoarthritis of the hand
N054.00	Oligoarticular osteoarthritis, unspecified
N052400	Localised, secondary osteoarthritis of the hand
N050400	Primary generalized osteoarthrosis
N050200	Generalised osteoarthritis of multiple sites
N051100	Localised, primary osteoarthritis of the shoulder region
N051B00	Primary gonarthrosis, bilateral
N05z300	Osteoarthritis NOS, of the forearm
N051200	Localised, primary osteoarthritis of the upper arm
N051900	Primary coxarthrosis, bilateral

N052A00	Post-traumatic gonarthrosis, bilateral
N050700	Heberden's nodes with arthropathy
N051D00	Localised, primary osteoarthritis of the wrist
N051700	Localised, primary osteoarthritis of the ankle and foot
N051A00	Coxarthrosis resulting from dysplasia, bilateral
N05zU00	Osteoarthritis NOS, of IP joint of toe
N05zz00	Osteoarthritis NOS
N051E00	Localised, primary osteoarthritis of toe
N053z00	Localised osteoarthritis, unspecified, NOS
N051.00	Localised, primary osteoarthritis
N052800	Localised, secondary osteoarthritis of other specified site
N052600	Localised, secondary osteoarthritis of the lower leg
N052100	Localised, secondary osteoarthritis of the shoulder region
N05zK00	Osteoarthritis NOS, of sacro-iliac joint
N052700	Localised, secondary osteoarthritis of the ankle and foot
N053.00	Localised osteoarthritis, unspecified
N053600	Localised osteoarthritis, unspecified, of the lower leg
N051300	Localised, primary osteoarthritis of the forearm
N050z00	Generalised osteoarthritis NOS
N05z000	Osteoarthritis NOS, of unspecified site
N050112	Bouchards' nodes
N051C00	Primary arthrosis of first carpometacarpal joints, bilateral
N050100	Generalised osteoarthritis of the hand
N050300	Bouchard's nodes with arthropathy
N050600	Erosive osteoarthrosis
N050000	Generalised osteoarthritis of unspecified site
N05zP00	Osteoarthritis NOS, of subtalar joint
N052200	Localised, secondary osteoarthritis of the upper arm
N054600	Oligoarticular osteoarthritis, unspecified, of lower leg
N054800	Oligoarticular osteoarthritis, unspecified, other spec sites
N052.00	Localised, secondary osteoarthritis
N052500	Localised, secondary osteoarthritis of pelvic region/thigh
N052300	Localised, secondary osteoarthritis of the forearm
N054000	Oligoarticular osteoarthritis, unspec, of unspecified sites
N053000	Localised osteoarthritis, unspecified, of unspecified site
N052C00	Post-traumatic gonarthrosis, unilateral
N05z200	Osteoarthritis NOS, of the upper arm
N054100	Oligoarticular osteoarthritis, unspecified, of shoulder
N05z711	Ankle osteoarthritis NOS
N053511	Otto's pelvis
N054z00	Osteoarthritis of more than one site, unspecified, NOS
N051000	Localised, primary osteoarthritis of unspecified site
N05zR00	Osteoarthritis NOS, of other tarsal joint
N05zQ00	Osteoarthritis NOS, of talonavicular joint
N054900	Oligoarticular osteoarthritis, unspecified, multiple sites
N052z00	Localised, secondary osteoarthritis NOS

N054400	Oligoarticular osteoarthritis, unspecified, of hand
N053200	Localised osteoarthritis, unspecified, of the upper arm
N052B00	Post-traumatic arthrosis of first carpometacarpal jt bilat
N053300	Localised osteoarthritis, unspecified, of the forearm
N052900	Post-traumatic coxarthrosis, bilateral
N05zD00	Osteoarthritis NOS, of distal radio-ulnar joint
N054500	Oligoarticular osteoarthritis, unspecified, of pelvis/thigh
N052000	Localised, secondary osteoarthritis of unspecified site
N05zM00	Osteoarthritis NOS, of tibio-fibular joint
N054700	Oligoarticular osteoarthritis, unspecified, of ankle/foot
N054200	Oligoarticular osteoarthritis, unspecified, of upper arm
N052511	Coxae malum senilis
N051G00	Osteoarthritis of spinal facet joint

Appendix 2.2. Code list for smoking status

Read code	Read term
137..	Tobacco consumption
1371	Never smoked tobacco
1372	Trivial smoker - < 1 cig/day
1373	Light smoker - 1-9 cigs/day
1374	Moderate smoker - 10-19 cigs/d
1375	Heavy smoker - 20-39 cigs/day
1376	Very heavy smoker - 40+cigs/d
1377	Ex-trivial smoker (<1/day)
1378	Ex-light smoker (1-9/day)
1379	Ex-moderate smoker (10-19/day)
137A.	Ex-heavy smoker (20-39/day)
137B.	Ex-very heavy smoker (40+/day)
137C.	Keeps trying to stop smoking
137D.	Admitted tobacco cons untrue ?
137E.	Tobacco consumption unknown
137F.	Ex-smoker - amount unknown
137G.	Trying to give up smoking
137H.	Pipe smoker
137I.	Passive smoker
137I0	Exposed to tobacco smoke at home
137J.	Cigar smoker
137K.	Stopped smoking
137K0	Recently stopped smoking
137L.	Current non-smoker
137M.	Rolls own cigarettes
137N.	Ex pipe smoker
137O.	Ex cigar smoker
137P.	Cigarette smoker
137Q.	Smoking started
137R.	Current smoker

137S.	Ex smoker
137T.	Date ceased smoking
137U.	Not a passive smoker
137V.	Smoking reduced
137W.	Chews tobacco
137X.	Cigarette consumption
137Y.	Cigar consumption
137Z.	Tobacco consumption NOS
137a.	Pipe tobacco consumption
137b.	Ready to stop smoking
137c.	Thinking about stopping smoking
137d.	Not interested in stopping smoking
137e.	Smoking restarted
137f.	Reason for restarting smoking
137g.	Cigarette pack-years
137h.	Minutes from waking to first tobacco consumption
137i.	Ex-tobacco chewer
137j.	Ex-cigarette smoker
137k.	Refusal to give smoking status
137l.	Ex roll-up cigarette smoker
137m.	Failed attempt to stop smoking
137n.	Total time smoked
137o.	Waterpipe tobacco consumption
13WF.	Family smoking history
13WF1	Father smokes
13WF2	Mother smokes
13WF3	Both parents smoke
13WF4	Passive smoking risk
13WK.	No smokers in the household
13WR.	Mother does not smoke
H3101	Smokers' cough
SM7y2	Smoke inhalation
177..	Smoke inhalation
13p..	Smoking cessation milestones
13p0.	Negotiated date for cessation of smoking
13p1.	Smoking status at 4 weeks
13p2.	Smoking status between 4 and 52 weeks
13p3.	Smoking status at 52 weeks
13p4.	Smoking free weeks
13p5.	Smoking cessation programme start date
13p50	Practice based smoking cessation programme start date
13p6.	Carbon monoxide reading at 4 weeks
13p7.	Smoking status at 12 weeks
13p8.	Lost to smoking cessation follow-up
6791	Health ed. - smoking
67910	Health education - parental smoking

745H.	Smoking cessation therapy
745H0	Nicotine replacement therapy using nicotine patches
745H1	Nicotine replacement therapy using nicotine gum
745H2	Nicotine replacement therapy using nicotine inhalator
745H3	Nicotine replacement therapy using nicotine lozenges
745H4	Smoking cessation drug therapy
745Hy	Other specified smoking cessation therapy
745Hz	Smoking cessation therapy NOS
ZV4D7	[V]Exposure to tobacco smoke
9OO..	Stop smoking monitoring admin.
9OO1.	Attends stop smoking monitor.
9OO2.	Refuses stop smoking monitor
9OO3.	Stop smoking monitor default
9OO4.	Stop smoking monitor 1st lettr
9OO5.	Stop smoking monitor 2nd lettr
9OO6.	Stop smoking monitor 3rd lettr
9OO7.	Stop smoking monitor verb.inv.
9OO8.	Stop smoking monitor phone inv
9OO9.	Stop smoking monitoring delete
9OOA.	Stop smoking monitor.chck done
9OOB.	Stop smoking invitation short message service text message
9OOB0	Stop smoking invitation first short message service text message
9OOB1	Stop smoking invitation second short message service text message
9OOB2	Stop smoking invitation third short message service text message
9OOZ.	Stop smoking monitor admin.NOS
1782	Asthma trigger - tobacco smoke
8HTK.	Referral to stop-smoking clinic
8CAL.	Smoking cessation advice
8CdB.	Stop smoking service opportunity signposted
8I6H.	Smoking review not indicated
8IAj.	Smoking cessation advice declined
8HBM.	Stop smoking face to face follow-up
8HBP.	Smoking cessation 12 week follow-up
8IEK.	Smoking cessation programme declined
8IEM.	Smoking cessation drug therapy declined
8IEo.	Referral to smoking cessation service declined
8HkQ.	Referral to NHS stop smoking service
8T08.	Referral to smoking cessation service
8H7i.	Referral to smoking cessation advisor
9N2k.	Seen by smoking cessation advisor
67H1.	Lifestyle advice regarding smoking
67H6.	Brief intervention for smoking cessation
9kf1.	Referred for chronic obstructive pulmonary disease structured smoking assessment
9kf2.	Chronic obstructive pulmonary disease structured smoking assessment declined
9N4M.	DNA - Did not attend smoking cessation clinic
9NS02	Referral for smoking cessation service offered

9hG..	Exception reporting: smoking quality indicators
9hG0.	Excepted from smoking quality indicators: Patient unsuitable
9hG1.	Excepted from smoking quality indicators: Informed dissent
9NdW.	Consent given for smoking cessation data sharing
9NdZ.	Declined consent for smoking cessation data sharing
9kc..	Smoking cessation - enhanced services administration
9kc0.	Smoking cessation monitoring template completed - enhanced services administration
9Ndf.	Consent given for follow-up by smoking cessation team
9ko..	Current smoker annual review - enhanced services administration
9Ndg.	Declined consent for follow-up by smoking cessation team
9km..	Ex-smoker annual review - enhanced services administration
9kn..	Non-smoker annual review - enhanced services administration
9NdY.	Declined consent for follow-up evaluation after smoking cessation intervention
9NdV.	Consent given for follow-up evaluation after smoking cessation intervention
13cA.	Smokes drugs

Appendix 2.3 Code list for diagnosed hypertension

Read code	Read term
G2...00	Hypertensive disease
G20..00	Essential hypertension
G200.00	Malignant essential hypertension
G201.00	Benign essential hypertension
G20..11	High blood pressure
G202.00	Systolic hypertension
G203.00	Diastolic hypertension
G20z.00	Essential hypertension NOS
G20z.11	Hypertension NOS
G24..00	Secondary hypertension
G240.00	Secondary malignant hypertension
G240000	Secondary malignant renovascular hypertension
G240z00	Secondary malignant hypertension NOS
G241.00	Secondary benign hypertension
G241000	Secondary benign renovascular hypertension
G241z00	Secondary benign hypertension NOS
G244.00	Hypertension secondary to endocrine disorders
G24z.00	Secondary hypertension NOS
G24z000	Secondary renovascular hypertension NOS
G24z100	Hypertension secondary to drug
G24zz00	Secondary hypertension NOS

G2y..00	Other specified hypertensive disease
G2z..00	Hypertensive disease NOS
Gyu2.00	[X]Hypertensive diseases
Gyu2000	[X]Other secondary hypertension

Appendix 2.4 Code list for type 2 diabetes

Read code	Read terms
66Ao.00	Diabetes type 2 review
66At100	Type II diabetic dietary review
66At111	Type 2 diabetic dietary review
C100112	Non-insulin dependent diabetes mellitus
C109.00	Non-insulin dependent diabetes mellitus
C109000	Non-insulin-dependent diabetes mellitus with renal comps
C109011	Type II diabetes mellitus with renal complications
C109012	Type 2 diabetes mellitus with renal complications
C109100	Non-insulin-dependent diabetes mellitus with ophthalm comps
C109.11	NIDDM - Non-insulin dependent diabetes mellitus
C109111	Type II diabetes mellitus with ophthalmic complications
C109112	Type 2 diabetes mellitus with ophthalmic complications
C109.12	Type 2 diabetes mellitus
C109.13	Type II diabetes mellitus
C109200	Non-insulin-dependent diabetes mellitus with neuro comps
C109211	Type II diabetes mellitus with neurological complications
C109212	Type 2 diabetes mellitus with neurological complications
C109300	Non-insulin-dependent diabetes mellitus with multiple comps
C109400	Non-insulin dependent diabetes mellitus with ulcer
C109411	Type II diabetes mellitus with ulcer
C109412	Type 2 diabetes mellitus with ulcer
C109500	Non-insulin dependent diabetes mellitus with gangrene
C109511	Type II diabetes mellitus with gangrene
C109512	Type 2 diabetes mellitus with gangrene
C109600	Non-insulin-dependent diabetes mellitus with retinopathy
C109611	Type II diabetes mellitus with retinopathy
C109612	Type 2 diabetes mellitus with retinopathy
C109700	Non-insulin dependent diabetes mellitus - poor control

C109711	Type II diabetes mellitus - poor control
C109712	Type 2 diabetes mellitus - poor control
C109900	Non-insulin-dependent diabetes mellitus without complication
C109A00	Non-insulin dependent diabetes mellitus with mononeuropathy
C109A11	Type II diabetes mellitus with mononeuropathy
C109B00	Non-insulin dependent diabetes mellitus with polyneuropathy
C109B11	Type II diabetes mellitus with polyneuropathy
C109C00	Non-insulin dependent diabetes mellitus with nephropathy
C109C11	Type II diabetes mellitus with nephropathy
C109C12	Type 2 diabetes mellitus with nephropathy
C109D00	Non-insulin dependent diabetes mellitus with hypoglyca coma
C109D11	Type II diabetes mellitus with hypoglycaemic coma
C109D12	Type 2 diabetes mellitus with hypoglycaemic coma
C109E00	Non-insulin depend diabetes mellitus with diabetic cataract
C109E11	Type II diabetes mellitus with diabetic cataract
C109E12	Type 2 diabetes mellitus with diabetic cataract
C109F11	Type II diabetes mellitus with peripheral angiopathy
C109F12	Type 2 diabetes mellitus with peripheral angiopathy
C109G00	Non-insulin dependent diabetes mellitus with arthropathy
C109G11	Type II diabetes mellitus with arthropathy
C109G12	Type 2 diabetes mellitus with arthropathy
C109H11	Type II diabetes mellitus with neuropathic arthropathy
C109H12	Type 2 diabetes mellitus with neuropathic arthropathy
C109J00	Insulin treated Type 2 diabetes mellitus
C109J11	Insulin treated non-insulin dependent diabetes mellitus
C109J12	Insulin treated Type II diabetes mellitus
C109K00	Hyperosmolar non-ketotic state in type 2 diabetes mellitus
C10D.00	Diabetes mellitus autosomal dominant type 2
C10F.00	Type 2 diabetes mellitus
C10F000	Type 2 diabetes mellitus with renal complications
C10F011	Type II diabetes mellitus with renal complications
C10F100	Type 2 diabetes mellitus with ophthalmic complications
C10F.11	Type II diabetes mellitus
C10F111	Type II diabetes mellitus with ophthalmic complications
C10F200	Type 2 diabetes mellitus with neurological complications

C10F211	Type II diabetes mellitus with neurological complications
C10F300	Type 2 diabetes mellitus with multiple complications
C10F311	Type II diabetes mellitus with multiple complications
C10F400	Type 2 diabetes mellitus with ulcer
C10F411	Type II diabetes mellitus with ulcer
C10F500	Type 2 diabetes mellitus with gangrene
C10F511	Type II diabetes mellitus with gangrene
C10F600	Type 2 diabetes mellitus with retinopathy
C10F611	Type II diabetes mellitus with retinopathy
C10F700	Type 2 diabetes mellitus - poor control
C10F711	Type II diabetes mellitus - poor control
C10F900	Type 2 diabetes mellitus without complication
C10F911	Type II diabetes mellitus without complication
C10FA00	Type 2 diabetes mellitus with mononeuropathy
C10FA11	Type II diabetes mellitus with mononeuropathy
C10FB00	Type 2 diabetes mellitus with polyneuropathy
C10FB11	Type II diabetes mellitus with polyneuropathy
C10FC00	Type 2 diabetes mellitus with nephropathy
C10FC11	Type II diabetes mellitus with nephropathy
C10FD00	Type 2 diabetes mellitus with hypoglycaemic coma
C10FD11	Type II diabetes mellitus with hypoglycaemic coma
C10FE00	Type 2 diabetes mellitus with diabetic cataract
C10FE11	Type II diabetes mellitus with diabetic cataract
C10FF00	Type 2 diabetes mellitus with peripheral angiopathy
C10FG00	Type 2 diabetes mellitus with arthropathy
C10FG11	Type II diabetes mellitus with arthropathy
C10FH00	Type 2 diabetes mellitus with neuropathic arthropathy
C10FJ00	Insulin treated Type 2 diabetes mellitus
C10FJ11	Insulin treated Type II diabetes mellitus
C10FK00	Hyperosmolar non-ketotic state in type 2 diabetes mellitus
C10FL00	Type 2 diabetes mellitus with persistent proteinuria
C10FL11	Type II diabetes mellitus with persistent proteinuria
C10FM00	Type 2 diabetes mellitus with persistent microalbuminuria
C10FM11	Type II diabetes mellitus with persistent microalbuminuria
C10FN00	Type 2 diabetes mellitus with ketoacidosis

C10FP00	Type 2 diabetes mellitus with ketoacidotic coma
C10FQ00	Type 2 diabetes mellitus with exudative maculopathy
C10FR00	Type 2 diabetes mellitus with gastroparesis
ZC2CA00	Dietary advice for type II diabetes

Appendix 2.5. Period prevalence of modifiable cardiovascular risk factors in osteoarthritis and non-osteoarthritis cohorts by age group and gender.

Appendix 2.5.1. Period prevalence of current smoking in OA and non-OA populations by age and gender, 1992-2017

Gender/ Age group (years)	OA			Non-OA			Prevalence rate ratio (95%CI)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Women	139426	32266	23.14 (22.92, 23.36)	139426	21374	15.33 (15.14, 15.52)	1.51 (1.49, 1.53)
35-44	6350	2181	34.35 (33.18, 35.53)	6350	1763	27.76 (26.66, 28.88)	1.24 (1.17, 1.30)
45-54	27625	8414	30.46 (29.92, 31.00)	27625	6418	23.23 (22.74, 23.74)	1.31 (1.27, 1.35)
55-64	43624	10821	24.81 (24.40,	43624	6968	15.97 (15.63,	1.55 (1.51, 1.60)

			25.21)			16.32)	
65-74	35376	6975	19.72 (19.30, 20.14)	35376	3916	11.07 (10.74, 11.40)	1.78 (1.72, 1.85)
75-84	22176	3392	15.30 (14.82, 15.78)	22176	2030	9.15 (08.78, 09.54)	1.67 (1.59, 1.76)
85+	4275	483	11.30 (10.36, 12.29)	4275	279	6.53 (05.80, 07.31)	1.73 (1.50, 1.99)
Men	75764	19533	25.70 (25.47, 26.09)	75764	18791	24.80 (24.49, 25.11)	1.04 (1.02, 1.06)
35-44	5010	1756	35.05 (33.73, 36.39)	5010	1572	31.38 (30.09, 32.68)	1.12 (1.06, 1.18)
45-54	16227	5207	32.09 (31.37, 32.81)	16227	4614	28.43 (27.74, 29.14)	1.13 (1.09, 1.17)
55-64	26364	7035	26.68 (26.15, 27.22)	26364	7006	26.57 (26.04, 27.11)	1.00 (0.98, 1.03)
65-74	18255	3866	21.18 (20.59, 21.78)	18255	4034	22.10 (21.50, 22.71)	0.96 (0.92, 1.00)
75-84	8854	1545	17.45 (16.66, 18.26)	8854	1476	16.67 (15.90, 17.46)	1.05 (0.98, 1.12)
85+	1054	124	11.76 (09.88, 13.86)	1054	89	8.44 (06.84, 10.29)	1.39 (1.08, 1.80)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.5.2. Period prevalence of obesity in OA and matched non-OA individuals by age group and gender, 1992-2017

Gender/ Age group (years)	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Women	112876	44963	39.83 (39.55, 40.12)	112876	40038	35.47 (35.19 35.75)	1.12 (1.11, 1.14)
35-44	4880	2295	47.03 (45.62, 48.44)	4880	1640	33.61 (32.28, 34.95)	1.40 (1.33, 1.47)
45-54	22440	10241	45.64 (44.98, 46.29)	22440	7769	34.62 (34.00, 35.25)	1.32 (1.29, 1.35)
55-64	36996	15400	41.63 (41.12, 42.13)	36996	13723	37.09 (36.60, 37.59)	1.12 (1.10, 1.14)
65-74	29879	11615	38.87 (38.32, 39.43)	29879	11092	37.12 (36.57, 37.67)	1.05 (1.03, 1.07)
75-84	16625	5032	30.27 (29.57, 30.97)	16625	5308	31.93 (31.22, 32.64)	0.95 (0.92, 0.98)
85+	2056	380	18.48 (16.83, 20.23)	2056	506	24.61 (22.76, 26.53)	0.75 (0.67, 0.85)
Men	55424	21466	38.73 (38.32,	55424	18,536	33.44 (33.05,	1.16 (1.14, 1.18)

			39.14)			33.84)	
35-44	3229	1305	40.41 (38.72, 42.13)	3229	955	29.58 (28.01, 31.18)	1.37 (1.28, 1.46)
45-54	11441	4922	43.02 (42.11, 43.93)	11441	3940	34.44 (33.57, 35.32)	1.25 (1.21, 1.29)
55-64	20182	8573	42.48 (41.80, 43.16)	20182	7224	35.79 (35.13, 36.46)	1.19 (1.16, 1.22)
65-74	13970	5005	35.83 (35.03, 36.63)	13970	4647	33.26 (32.48, 34.05)	1.08 (1.04, 1.11)
75-84	6162	594	25.87 (24.78, 26.98)	6162	1685	27.35 (26.23, 28.48)	0.95 (0.89, 1.00)
85+	440	67	15.23 (12.00, 18.93)	440	85	19.32 (15.73, 23.32)	0.79 (0.59, 1.06)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.5.3. Period prevalence of hypertension in OA and matched non-OA individuals by age group and gender, 1992-2017

Gender/ Age group (years)	OA			Non-OA			prevalence rate ratio (95%CI)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Women	139426	52599	37.73 (37.47, 37.98)	139426	33450	23.99 (23.77, 24.22)	1.57 (1.55, 1.59)
35-44	6350	552	8.69 (08.01, 09.41)	6350	632	9.95 (09.24, 10.72)	0.87 (0.78, 0.97)
45-54	27625	5310	19.22 (18.76, 19.69)	27625	4444	16.09 (15.66, 16.53)	1.19 (1.15, 1.24)
55-64	43624	14029	32.16 (31.72, 32.60)	43624	9431	21.62 (21.23, 22.01)	1.49 (1.45, 1.52)
65-74	35376	16840	47.60 (47.08, 48.12)	35376	9506	26.87 (26.41, 27.34)	1.77 (1.74, 1.81)
75-84	22176	13230	59.66 (59.01, 60.31)	22176	7949	35.85 (35.21, 36.48)	1.66 (1.63, 1.70)
85+	4275	2638	61.71 (60.23, 63.17)	4275	1488	34.81 (33.38, 36.26)	1.77 (1.69, 1.86)
Men	75764	27990	36.94 (36.60, 37.29)	75764	26103	34.45 (34.11, 34.79)	1.07 (1.06, 1.09)

35-44	5010	444	8.86 (08.09, 09.68)	5010	552	11.02 (10.16, 11.92)	0.80 (0.71, 0.91)
45-54	16227	3412	21.03 (20.40, 21.66)	16227	3564	21.96 (21.33, 22.61)	0.96 (0.92, 1.00)
55-64	26364	9685	36.74 (36.15, 37.32)	26364	9221	34.98 (34.40, 35.55)	1.05 (1.03, 1.07)
65-74	18255	8922	48.87 (48.15, 49.60)	18255	8293	45.43 (44.70, 46.15)	1.08 (1.05, 1.10)
75-84	8854	4909	55.44 (54.40, 56.48)	8854	4155	46.93 (45.88, 47.97)	1.18 (1.15, 1.22)
85+	1054	618	58.63 (55.59, 61.63)	1054	318	30.17 (27.41, 33.04)	1.94 (1.75, 2.16)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.5.4. Period prevalence of type 2 diabetes mellitus in OA and non-OA individuals by age and gender, 2012-2017

Gender/ Age group (years)	OA			Non-OA			Prevalence rate ratio (95%CI)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Women	139426	10043	7.20 (07.07, 07.34)	139426	7871	5.65 (05.52, 05.77)	1.28 (1.24, 1.31)
35-44	6350	156	2.46 (02.09, 02.87)	6350	169	2.66 (02.28, 03.09)	0.92 (0.74, 1.14)
45-54	27625	1160	4.20 (03.97, 04.44)	27625	1042	3.77 (03.55, 04.00)	1.11 (1.03, 1.21)
55-64	43624	2732	6.26 (06.04, 06.49)	43624	2232	5.12 (04.91, 05.33)	1.22 (1.16, 1.29)
65-74	35376	3283	9.28 (08.98, 09.59)	35376	2455	6.94 (06.68, 07.21)	1.34 (1.27, 1.41)
75-84	22176	2343	10.57 (10.16, 10.98)	22176	1728	7.79 (07.44, 08.15)	1.36 (1.28, 1.44)
85+	4275	369	8.63 (07.81, 09.51)	4275	245	5.73 (05.05, 06.47)	1.51 (1.29, 1.76)
Men	75764	8117	10.71 (10.49, 10.94)	75764	8498	11.22 (10.99, 11.44)	0.96 (0.93, 0.98)
35-44	5010	143	2.85 (02.41, 03.35)	5010	160	3.19 (02.72, 03.72)	0.89 (0.72, 1.12)

45-54	16227	960	5.92 (05.56, 06.29)	16227	1170	7.21 (06.82, 07.62)	0.82 (0.76, 0.89)
55-64	26364	2874	10.90 (10.53, 11.28)	26364	2979	11.30 (10.92, 11.69)	0.96 (0.92, 1.01)
65-74	18255	2591	14.19 (13.69, 14.71)	18255	2809	15.39 (14.87, 15.92)	0.92 (0.88, 0.97)
75-84	8854	1416	15.99 (15.23, 16.77)	8854	1283	14.49 (13.76, 15.24)	1.10 (1.03, 1.18)
85+	1054	133	12.62 (10.67, 14.78)	1054	97	9.20 (07.53, 11.11)	1.37 (1.07, 1.76)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.5.5. Period prevalence of dyslipidaemia in OA and matched non-OA individuals by age group and gender

Gender/ Age group (years)	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Women	139426	96546	69.25 (69.00, 69.49)	139426	83583	59.95 (59.69, 60.21)	1.16 (1.15, 1.16)
35-44	6350	3308	52.09 (50.86, 53.33)	6350	2227	35.07 (33.90, 36.26)	1.49 (1.43, 1.55)
45-54	27625	18525	67.06 (66.50, 67.61)	27625	14658	53.06 (52.47, 53.65)	1.26 (1.25, 1.28)
55-64	43624	32841	75.28 (74.87, 75.69)	43624	29284	67.13 (66.69, 67.57)	1.12 (1.11, 1.13)
65-74	35376	25892	73.19 (72.73, 73.65)	35376	23675	66.92 (66.43, 67.41)	1.09 (1.08, 1.10)
75-84	22176	13863	62.51 (61.87, 63.15)	22176	12304	55.48 (54.83, 56.14)	1.13 (1.11, 1.14)
85+	4275	2117	49.52 (48.01, 51.03)	4275	1435	33.57 (32.15, 35.01)	1.48 (1.40, 1.55)
Men	75764	50442	66.58 (66.24, 66.91)	75764	39351	51.94 (51.58, 5230)	1.28 (1.27, 1.29)
35-44	5010	2938	58.64 (57.26, 60.01)	5010	1974	39.40 (38.04, 40.77)	1.49 (1.43, 1.55)
45-54	16227	11385	70.16 (69.45, 70.86)	16227	8496	52.36 (51.59, 53.13)	1.34 (1.32, 1.36)

55-64	26364	19091	72.41 (71.87, 72.95)	26364	15449	58.60 (58.00, 59.19)	1.24 (1.22, 1.25)
65-74	18255	11859	64.96 (64.27, 65.66)	18255	9664	52.94 (52.21, 53.67)	1.23 (1.21, 1.25)
75-84	8854	4708	53.17 (52.13, 54.22)	8854	3564	40.25 (39.23, 41.28)	1.32 (1.28, 1.36)
85+	1054	461	43.74 (40.72, 46.79)	1054	204	19.35 (17.01, 21.87)	2.26 (1.96, 2.60)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.5.6. Period prevalence of ≥1 modifiable cardiovascular risk factors in OA and matched non-OA populations by age group and gender, 1992-2017

Gender/ Age group (years)	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Women	112876	101945	90.32 (90.14, 90.49)	112876	97396	86.29 (86.08, 86.49)	1.05 (1.04, 1.05)
35-44	4880	3936	80.66 (79.52, 81.76)	4880	3717	76.17 (74.95, 77.36)	1.06 (1.04, 1.08)
45-54	22440	19607	87.38 (86.93, 87.81)	22440	18636	83.05 (82.55, 83.54)	1.05 (1.04, 1.06)
55-64	36996	33833	91.45 (91.16, 91.73)	36996	32757	88.54 (88.21, 88.86)	1.03 (1.03, 1.04)
65-74	29879	27612	92.41 (92.11, 92.71)	29879	26422	88.43 (88.06, 88.79)	1.05 (1.04, 1.05)
75-84	16625	15165	91.22 (90.78, 91.64)	16625	14151	85.12 (84.57, 85.66)	1.07 (1.06, 1.08)
85+	2056	1792	87.16 (85.64, 88.58)	2056	1713	83.32 (81.63, 84.90)	1.05 (1.02, 1.07)
Men	55424	49781	89.82 (89.56, 90.07)	55424	49755	89.77 (89.52, 90.02)	1.00 (1.00, 1.00)
35-44	3229	2698	83.56 (82.23, 84.82)	3229	2639	81.73 (80.35, 83.05)	1.02 (1.00, 1.05)
45-54	11441	10168	88.87 (88.28, 89.44)	11441	10078	88.09 (87.48, 88.67)	1.01 (1.00, 1.02)

55-64	20182	18495	91.64 (91.25, 92.02)	20182	18429	91.31 (90.92, 91.70)	1.00 (1.00, 1.01)
65-74	13970	12670	90.69 (90.20, 91.17)	13970	12751	91.27 (90.79, 91.74)	0.99 (0.99, 1.00)
75-84	6162	5394	87.54 (86.69, 88.35)	6162	5485	89.01 (88.21, 89.78)	0.98 (0.97, 1.00)
85+	440	356	80.91 (76.92, 84.48)	440	373	84.77 (81.07, 88.00)	0.95 (0.90, 1.01)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.5.7. Period prevalence of ≥2 modifiable cardiovascular risk factors in OA and matched non-OA populations by age group and gender, 1992-2017

Gender/ Age group (years)	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Women	112876	65419	57.96 (57.67, 58.24)	112876	52729	46.71 (46.42, 47.01)	1.24 (1.23, 1.25)
35-44	4880	2140	43.85 (42.45, 45.26)	4880	1838	37.66 (36.30, 39.04)	1.16 (1.11, 1.22)
45-54	22440	11780	52.50 (51.84, 53.15)	22440	9934	44.27 (43.62, 44.92)	1.19 (1.16, 1.21)
55-64	36996	21451	57.98 (57.48, 58.49)	36996	17764	48.02 (47.51, 48.53)	1.21 (1.19, 1.22)
65-74	29879	18648	62.41 (61.86, 62.96)	29879	14208	47.55 (46.98, 48.12)	1.31 (1.29, 1.33)
75-84	16625	10312	62.03 (61.28, 62.77)	16625	7990	48.06 (47.30, 48.82)	1.29 (1.27, 1.32)
85+	2056	1088	52.92 (50.73, 55.09)	2056	995	48.39 (46.21, 50.58)	1.09 (1.03, 1.16)
Men	55424	32008	57.75 (57.34, 58.16)	55424	32895	59.35 (58.94, 59.76)	0.97 (0.96, 0.98)
35-44	3229	1441	44.63 (42.90, 46.36)	3229	1384	42.86 (41.15, 44.59)	1.04 (0.99, 1.10)
45-54	11441	6314	55.19 (54.27, 56.10)	11441	6204	54.23 (53.31, 55.14)	1.02 (0.99, 1.04)

55-64	20182	12265	60.77 (60.09, 61.45)	20182	12508	61.98 (61.30, 62.65)	0.98 (0.97, 1.00)
65-74	13970	8399	60.12 (59.30, 60.94)	13970	8939	63.99 (63.18, 64.78)	0.94 (0.92, 0.96)
75-84	6162	3399	55.16 (53.91, 56.41)	6162	3628	58.88 (57.64, 60.11)	0.94 (0.91, 0.97)
85+	440	190	43.18 (38.50, 47.96)	440	232	52.73 (47.94, 57.47)	0.82 (0.71, 0.94)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.5.8. Period prevalence of ≥3 modifiable cardiovascular risk factors in OA and matched non-OA populations by age group and gender, 1992-2017

Gender/ Age group (years)	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Women	112876	27302	24.19 (23.94, 24.44)	112876	19549	17.32 (17.10, 17.54)	1.40 (1.37, 1.42)
35-44	4880	656	13.44 (12.50, 14.43)	4880	607	12.44 (11.53, 13.40)	1.08 (0.97, 1.20)
45-54	22440	4481	19.97 (19.45, 20.50)	22440	3537	15.76 (15.29, 16.25)	1.27 (1.22, 1.32)
55-64	36996	9181	24.82 (24.38, 25.26)	36996	6374	17.23 (16.85, 17.62)	1.44 (1.40, 1.48)
65-74	29879	8423	28.19 (27.68, 28.70)	29879	5470	18.31 (17.87, 18.75)	1.54 (1.49, 1.59)
75-84	16625	4217	25.37 (24.71, 26.03)	16625	3202	19.26 (18.66, 19.87)	1.32 (1.26, 1.37)
85+	2056	344	16.73 (15.14, 18.42)	2056	359	17.46 (15.84, 19.17)	0.96 (0.84, 1.10)
Men	55424	13693	24.71 (24.35, 25.07)	55424	15185	27.40 (27.03, 27.77)	0.90 (0.88, 0.92)
35-44	3229	453	14.03 (12.85, 15.28)	3229	473	14.65 (13.45, 15.92)	0.96 (0.85, 1.08)
45-54	11441	2460	21.50 (20.75, 22.27)	11441	2698	23.58 (22.81, 24.37)	0.91 (0.87, 0.96)

55-64	20182	5574	27.62 (27.00, 28.24)	20182	6007	29.76 (29.13, 30.40)	0.93 (0.90, 0.96)
65-74	13970	3838	27.47 (26.73, 28.22)	13970	4315	30.89 (30.12, 31.66)	0.89 (0.86, 0.92)
75-84	6162	1309	21.24 (20.23, 22.29)	6162	1597	25.92 (24.83, 27.03)	0.82 (0.77, 0.87)
85+	440	59	13.41 (10.37, 16.95)	440	95	21.59 (17.83, 25.73	0.62 (0.46, 0.84)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.6 Period prevalence of modifiable cardiovascular risk factors in osteoarthritis and non-osteoarthritis populations by region

Appendix 2.6.1. Period prevalence of current smoking in OA and non-OA populations by region, 1992-2017

Region	OA			Non-OA			Prevalence rate ratio (95%CI)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	215190	51799	24.07 (23.89, 24.25)	215190	40165	18.66 (18.50, 18.83)	1.29 (1.27, 1.31)
North East	4593	1221	26.58 (25.31, 27.89)	4593	950	20.68 (19.52, 21.88)	1.29 (1.18, 1.40)
North West	27200	7253	26.67 (26.14, 27.20)	27205	5919	21.76 (21.27, 22.25)	1.23 (1.18, 1.27)
Yorkshire & The Humber	9277	2545	27.43 (26.53, 28.35)	9275	1880	20.27 (19.46, 21.10)	1.35 (1.28, 1.44)
East Midlands	8960	2451	27.35 (26.43, 28.29)	8957	1879	20.98 (20.14, 21.84)	1.30 (1.23, 1.38)
West Midlands	22256	5472	24.59 (24.02, 25.16)	22250	4357	19.58 (19.06, 20.11)	1.26 (1.21, 1.31)
East of England	18103	4193	23.16 (22.55,	18101	3239	17.89 (17.34,	1.29 (1.24, 1.36)

			23.78)			18.46)	
South West	18251	4452	24.39 (23.77, 25.02)	18249	3056	16.75 (16.21, 17.30)	1.46 (1.39, 1.53)
South Central	20656	4342	21.02 (20.47, 21.58)	20655	3178	15.39 (14.90, 15.89)	1.37 (1.31, 1.43)
London	15763	3665	23.25 (22.59, 23.92)	15767	2639	16.74 (16.16, 17.33)	1.39 (1.32, 1.46)
South East Coast	19290	3741	19.39 (18.84, 19.96)	19294	2824	14.64 (14.14, 15.14)	1.32 (1.26, 1.39)
Northern Ireland	6430	1595	24.81 (23.75, 25.88)	6434	1297	20.16 (19.18, 21.16)	1.23 (1.14, 1.32)
Scotland	20521	5289	25.77 (25.18, 26.38)	20519	4559	22.22 (21.65, 22.79)	1.16 (1.11, 1.21)
Wales	23890	5580	23.36 (22.82, 23.90)	23891	4388	18.37 (17.88, 18.86)	1.27 (1.22, 1.32)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.6.2. Period prevalence of obesity in OA and matched non-OA individuals by region in 1992-2017

Region	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	168300	66429	39.47 (39.24, 39.70)	168300	58574	34.80 (34.58, 35.03)	1.13 (1.12, 1.15)
North East	3616	1438	39.77 (38.17, 41.38)	3616	1232	34.07 (32.53, 35.64)	1.16 (1.08, 1.26)
North West	21930	8620	39.31 (38.66, 39.96)	21935	7649	34.87 (34.24, 35.51)	1.13 (1.09, 1.16)
Yorkshire & The Humber	7168	2668	37.22 (36.10, 38.35)	7166	2233	31.16 (30.09, 32.25)	1.19 (1.13, 1.26)
East Midlands	7118	2717	38.17 (37.04, 39.31)	7115	2352	33.06 (31.96, 34.16)	1.15 (1.09, 1.22)
West Midlands	18248	7203	39.47 (38.76, 40.19)	18242	6421	35.20 (34.51, 35.90)	1.12 (1.08, 1.16)
East of England	13825	4842	35.02 (34.23, 35.83)	13826	4297	31.08 (30.31, 31.86)	1.13 (1.08, 1.17)
South West	12996	5041	38.79 (37.95, 39.63)	12993	4429	34.09 (33.27, 34.91)	1.14 (1.09, 1.18)
South Central	15207	5683	37.37 (36.60, 38.15)	15205	5000	32.88 (32.14, 33.64)	1.14 (1.09, 1.18)
London	12184	4710	38.66 (37.79, 39.53)	12187	4117	33.78 (32.94, 34.63)	1.14 (1.10, 1.19)
South East Coast	15100	5563	36.84 (36.07, 37.62)	15103	4865	32.21 (31.47, 32.96)	1.14 (1.10, 1.19)
Northern Ireland	5271	2162	41.02 (39.68, 42.36)	5275	1975	37.44 (36.13, 38.76)	1.10 (1.03, 1.16)

Scotland	16763	7406	44.18 (43.43, 44.94)	16761	6575	39.23 (38.49, 39.97)	1.13 (1.09, 1.16)
Wales	18874	8376	44.38 (43.67, 45.09)	18876	7429	39.36 (38.66, 40.06)	1.13 (1.09, 1.16)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.6.3. Period prevalence of hypertension in OA and matched non-OA individuals by region, 1992-2017

Region	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	215190	80589	37.45 (37.25, 37.66)	215190	59553	27.67 (27.49, 27.86)	1.35 (1.34, 1.37)
North East	4593	1564	34.05 (32.68, 35.44)	4593	1253	27.28 (26.00, 28.59)	1.25 (1.17, 1.33)
North West	27200	9883	36.33 (35.76, 36.91)	27205	7913	29.09 (28.55, 29.63)	1.25 (1.22, 1.28)
Yorkshire & The Humber	9277	3087	33.28 (32.28, 34.25)	9275	2295	24.74 (23.87, 25.64)	1.34 (1.28, 1.41)
East Midlands	8960	3091	34.50 (33.51, 35.49)	8957	2422	27.04 (26.12, 27.97)	1.28 (1.22, 1.33)
West Midlands	22256	8252	37.08 (36.44, 37.72)	22250	6585	29.60 (29.00, 30.20)	1.25 (1.22, 1.29)
East of England	18103	6392	35.31 (34.61, 36.01)	18101	4748	26.23 (25.59, 26.88)	1.35 (1.30, 1.39)
South West	18251	6939	38.02 (37.31, 38.73)	18249	4502	24.67 (24.05, 25.30)	1.54 (1.49, 1.59)
South Central	20656	7875	38.12 (37.46, 38.79)	20655	5034	24.37 (23.79, 24.96)	1.56 (1.52, 1.61)
London	15763	6226	39.50 (38.73, 40.27)	15767	4206	26.68 (25.99 27.37)	1.48 (1.43, 1.53)
South East Coast	19290	7355	38.13 (37.44, 38.82)	19294	5222	27.07 (26.44, 27.70)	1.41 (1.37, 1.45)
Northern Ireland	6430	2385	37.09 (35.91, 38.29)	6434	1800	27.98 (26.88, 29.09)	1.33 (1.26, 1.39)
Scotland	20521	7776	37.89 (37.23, 38.56)	20519	6213	30.28 (29.65, 30.91)	1.25 (1.22, 1.29)

Wales	23890	9764	40.87 (40.25, 41.50)	23891	7360	30.81 (30.22, 31.40)	1.33 (1.29, 1.36)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.6.4. Period prevalence of type 2 diabetes mellitus in OA and matched non-OA individuals by region, 1992-2017

Region	OA			Non-OA			Prevalence rate ratio (95%CI)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	215190	18160	8.44 (08.32, 08.56	215190	16369	7.61 (07.50, 07.72)	1.11 (1.09, 1.13)
North East	4593	296	6.44 (05.75, 07.19)	4593	296	6.44 (05.75, 07.19)	1.00 (0.85, 1.17)
North West	27200	2292	8.43 (08.10, 08.76)	27205	2208	8.12 (07.79, 08.45)	1.04 (0.98, 1.10)
Yorkshire & The Humber	9277	559	6.03 (05.55, 06.53)	9275	540	5.82 (05.35, 06.32)	1.03 (0.92, 1.16)
East Midlands	8960	645	7.20 (06.67, 07.75)	8957	624	6.97 (06.45, 07.51)	1.03 (0.93, 1.15)
West Midlands	22256	1792	8.05 (07.70, 08.42)	22250	1766	7.94 (07.59, 08.30)	1.01 (0.95, 1.08)
East of England	18103	1285	7.10 (06.73, 07.48)	18101	1167	6.45 (06.09, 06.81)	1.10 (1.02, 1.19)
South West	18251	1567	8.59 (08.18, 09.00)	18249	1275	6.99 (06.62, 07.37)	1.23 (1.14, 1.32)
South Central	20656	1658	8.03 (07.66, 08.41)	20655	1315	6.37 (06.04, 06.71)	1.26 (1.17, 1.36)
London	15763	1630	10.34 (09.87, 10.83)	15767	1329	8.43 (08.00, 08.87)	1.23 (1.14, 1.32)
South East Coast	19290	1669	8.65 (08.26, 09.06)	19294	1372	7.11 (06.75, 07.48)	1.22 (1.13, 1.31)
Northern Ireland	6430	521	8.10 (07.45, 08.80)	6434	511	7.94 (07.29, 08.63)	1.02 (0.90, 1.15)
Scotland	20521	1818	8.86 (08.47, 09.26)	20519	1789	8.72 (08.34, 09.11)	1.02 (0.95, 1.08)
Wales	23890	2428	10.16 (09.78, 10.55)	23891	2177	9.11 (08.75, 09.48)	1.12 (1.05, 1.18)

OA, osteoarthritis; D, denominator; N, numerator

Appendix 2.6.5. Period prevalence of dyslipidaemia in OA and matched non-OA individuals by region, 1992-2017

Region	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	215190	146988	68.31 (68.11, 68.50)	215190	122934	57.13 (56.92, 57.34)	1.20 (1.19, 1.20)
North East	4593	3392	73.85 (72.55, 75.12)	4593	2857	62.20 (60.78, 63.61)	1.19 (1.15, 1.22)
North West	27200	19264	70.82 (70.28, 71.36)	27205	16621	61.10 (60.51, 61.68)	1.16 (1.15, 1.17)
Yorkshire & The Humber	9277	5907	63.67 (62.69, 64.65)	9275	5016	54.08 (53.06, 55.10)	1.18 (1.15, 1.21)
East Midlands	8960	5068	56.56 (55.53, 57.59)	8957	4717	52.66 (51.62, 53.70)	1.07 (1.05, 1.10)
West Midlands	22256	15487	69.59 (68.98, 70.19)	22250	13285	59.71 (59.06, 60.35)	1.17 (1.15, 1.18)
East of England	18103	12172	67.24 (66.55, 67.92)	18101	9919	54.80 (54.07, 55.53)	1.23 (1.21, 1.25)
South West	18251	12299	67.39 (66.70, 68.07)	18249	9565	52.41 (51.69, 53.14)	1.29 (1.26, 1.31)
South Central	20656	14375	69.59 (68.96, 70.22)	20655	11321	54.81 (54.13, 55.49)	1.27 (1.25, 1.29)
London	15763	10835	68.74 (68.01, 69.46)	15767	8938	56.69 (55.91, 57.46)	1.21 (1.19, 1.23)
South East Coast	19290	13269	68.79 (68.13, 69.44)	19294	11108	57.57 (56.87, 58.27)	1.19 (1.18, 1.21)
Northern Ireland	6430	4484	69.74 (68.60, 70.86)	6434	3919	60.91 (59.71, 62.11)	1.14 (1.12, 1.17)
Scotland	20521	13601	66.28 (65.63, 66.93)	20519	11475	55.92 (55.24, 56.60)	1.19 (1.17, 1.20)
Wales	23890	16835	70.47 (69.89, 71.05)	23891	14193	59.41 (58.78, 60.03)	1.19 (1.17, 1.20)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.6.6. Period prevalence of risk factors ≥1 in OA and matched non-OA populations by region, 1992-2017

Region	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	168300	151726	90.15 (90.01, 90.29)	168300	147151	87.43 (87.27, 87.59)	1.03 (1.03, 1.03)
North East	3616	3321	91.84 (90.90, 92.71)	3616	3249	89.85 (88.82, 90.82)	1.02 (1.01, 1.04)
North West	21930	20117	91.73 (91.36, 92.09)	21935	19600	89.35 (88.94, 89.76)	1.03 (1.02, 1.03)
Yorkshire & The Humber	7168	6323	88.21 (87.44, 88.95)	7166	6049	84.41 (83.55, 85.25)	1.05 (1.03, 1.06)
East Midlands	7118	6190	86.96 (86.16, 87.74)	7115	5904	82.98 (82.09, 83.85)	1.05 (1.03, 1.06)
West Midlands	18248	16579	90.85 (90.43, 91.27)	18242	16131	88.43 (87.95, 88.89)	1.03 (1.02, 1.03)
East of England	13825	12153	87.91 (87.35, 88.45)	13826	11834	85.59 (85.00, 86.17)	1.03 (1.02, 1.04)
South West	12996	11696	90.00 (89.47, 90.51)	12993	11343	87.30 (86.72, 87.87)	1.03 (1.02, 1.04)
South Central	15207	13648	89.75 (89.26, 90.23)	15205	13149	86.48 (85.92, 87.02)	1.04 (1.03, 1.05)
London	12184	11089	91.01 (90.49, 91.51)	12187	10681	87.64 (87.05, 88.22)	1.04 (1.03, 1.05)
South East Coast	15100	13437	88.99 (88.48, 89.48)	15103	13064	86.50 (85.94, 87.04)	1.03 (1.02, 1.04)
Northern Ireland	5271	4796	90.99 (90.18, 91.75)	5275	4658	88.30 (87.41, 89.16)	1.03 (1.02, 1.04)
Scotland	16763	15090	90.02 (89.56, 90.47)	16761	14664	87.49 (86.98, 87.99)	1.03 (1.02, 1.04)
Wales	18874	17287	91.59 (91.19, 91.98)	18876	16825	89.13 (88.68, 89.57	1.03 (1.02, 1.03)

OA, osteoarthritis; D, denominator; N, numerator

Appendix 2.6.7. Prevalence of risk factors ≥2 in OA and matched non-OA populations by region, 1992-2017

Region	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	168300	97427	57.89 (57.65, 58.12)	168300	85624	50.88 (50.64, 51.11)	1.14 (1.13, 1.14)
North East	3616	2137	59.10 (57.48, 60.71)	3616	1931	53.40 (51.76, 55.04)	1.11 (1.06, 1.15)
North West	21930	13134	59.89 (59.24, 60.54)	21935	11712	53.39 (52.73, 54.06)	1.12 (1.10, 1.14)
Yorkshire & The Humber	7168	3872	54.02 (52.86, 55.18)	7166	3292	45.94 (44.78, 47.10)	1.18 (1.14 1.22)
East Midlands	7118	3848	54.06 (52.89, 55.22)	7115	3262	45.85 (44.68, 47.01)	1.18 (1.14, 1.22)
West Midlands	18248	10550	57.81 (57.09, 58.53)	18242	9505	52.11 (51.38, 52.83)	1.11 (1.09, 1.13)
East of England	13825	7471	54.04 (53.20, 54.87)	13826	6563	47.47 (46.63, 48.30)	1.14 (1.11, 1.17)
South West	12996	7495	57.67 (56.82, 58.52)	12993	6443	49.59 (48.72, 50.45)	1.16 (1.14, 1.20)
South Central	15207	8539	56.15 (55.36, 56.94)	15205	7291	47.95 (47.15, 48.75)	1.17 (1.15, 1.20)
London	12184	7116	58.40 (57.52, 59.28)	12187	6122	50.23 (49.34, 51.13)	1.16 (1.14, 1.19)
South East Coast	15100	8276	54.81 (54.01, 55.60)	15103	7219	47.80 (47.00, 48.60)	1.15 (1.12, 1.17)
Northern Ireland	5271	3154	59.84 (58.50, 61.16)	5275	2789	52.87 (51.51, 54.23)	1.13 (1.09, 1.17)
Scotland	16763	10050	59.95 (59.21, 60.70)	16761	9003	53.71 (52.96, 54.47)	1.12 (1.10, 1.14)
Wales	18874	11785	62.44 (61.74, 63.13)	18876	10492	55.58 (54.87, 56.29)	1.12 (1.10, 1.14)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.6.8. Prevalence of risk factors ≥3 in OA and matched non-OA individuals by region in 1992-2017

Region	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	168300	40995	24.36 (24.15, 24.56)	168300	34734	20.64 (20.45, 20.83)	1.18 (1.17, 1.20)
North East	3616	872	24.12 (22.73, 25.54)	3616	745	20.60 (19.29, 21.96)	1.17 (1.07, 1.28)
North West	21930	5500	25.08 (24.51, 25.66)	21935	4769	21.74 (21.20, 22.29)	1.15 (1.12, 1.19)
Yorkshire & The Humber	7168	1574	21.96 (21.00, 22.94)	7166	1262	17.61 (16.74, 18.51)	1.25 (1.17, 1.33)
East Midlands	7118	1553	21.82 (20.86, 22.8)	7115	1291	18.14 (17.26, 19.06)	1.20 (1.13, 1.28)
West Midlands	18248	4379	24.00 (23.38, 24.62)	18242	3865	21.19 (20.60, 21.79)	1.13 (1.09, 1.18)
East of England	13825	2917	21.10 (20.42, 21.79)	13826	2563	18.54 (17.89, 19.2)	1.14 (1.09, 1.19)
South West	12996	3108	23.92 (23.18, 24.66)	12993	2606	20.06 (19.37, 20.76)	1.19 (1.14, 1.25)
South Central	15207	3464	22.78 (22.11, 23.45)	15205	2764	18.18 (17.57, 18.8)	1.25 (1.20, 1.31)
London	12184	3090	25.36 (24.59, 26.14)	12187	2395	19.65 (18.95, 20.37)	1.29 (1.23, 1.35)
South East Coast	15100	3402	22.53 (21.87, 23.2)	15103	2749	18.20 (17.59, 18.83)	1.24 (1.18, 1.29)
Northern Ireland	5271	1340	25.42 (24.25, 26.62)	5275	1163	22.05 (20.93, 23.19)	1.15 (1.08, 1.24)
Scotland	16763	4456	26.58 (25.91, 27.26)	16761	3926	23.42 (22.78, 24.07)	1.13 (1.09, 1.18)
Wales	18874	5340	28.29 (27.65, 28.94	18876	4636	24.56 (23.95, 25.18)	1.15 (1.11, 1.19)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.7 Trends in the prevalence of modifiable cardiovascular risk factors in osteoarthritis and non-osteoarthritis populations 1992-2017

Appendix 2.7.1. Prevalence of current smoking in OA and non-OA populations by calendar year, 1992-2017

Calendar year	OA			Non-OA			Prevalence rate ratio (95%CI)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	215190	51799	24.07 (23.89, 24.25)	215190	40165	18.66 (18.50, 18.83)	1.29 (1.27, 1.31)
1992	905	166	18.34 (15.87, 21.02)	905	114	12.60 (10.50, 14.94)	1.46 (1.15, 1.85)
1993	2362	512	21.68 (20.03, 23.39)	2362	323	13.67 (12.31, 15.13)	1.59 (1.38, 1.82)
1994	2970	675	22.73 (21.23, 24.28)	2970	387	13.03 (11.84, 14.29)	1.74 (1.54, 1.98)
1995	3248	787	24.23 (22.77, 25.74)	3248	522	16.07 (14.82, 17.38)	1.51 (1.35, 1.68)
1996	3879	1019	26.27 (24.89, 27.69)	3879	611	15.75 (14.62, 16.94)	1.67 (1.51, 1.84)
1997	4522	1218	26.93 (25.65, 28.25)	4522	773	17.09 (16.01, 18.22)	1.58 (1.44, 1.72)
1998	5031	1326	26.36 (25.14, 27.60)	5031	926	18.41 (17.34, 19.50)	1.43 (1.32, 1.56)
1999	5478	1441	26.31 (25.14, 27.49)	5478	1003	18.31 (17.29, 19.36)	1.44 (1.33, 1.56)
2000	5572	1473	26.44 (25.28, 27.61)	5572	1044	18.74 (17.72, 19.79)	1.41 (1.30, 1.53)
2001	6074	1566	25.78 (24.69, 26.90)	6074	1076	17.71 (16.76, 18.70)	1.46 (1.35, 1.57)
2002	7248	1854	25.58 (24.58, 26.60)	7248	1272	17.55 (16.68, 18.45)	1.46 (1.36, 1.57)
2003	9449	2285	24.18 (23.32, 25.06)	9449	1692	17.91 (17.14, 18.69)	1.35 (1.27, 1.44)
2004	11210	2729	24.34 (23.55, 25.15)	11210	2025	18.06 (17.36, 18.79)	1.35 (1.27, 1.43)
2005	12952	3046	23.52 (22.79, 24.26)	12952	2363	18.24 (17.58, 18.92)	1.29 (1.22, 1.36)
2006	13720	3277	23.88 (23.17, 24.61)	13720	2622	19.11 (18.46, 19.78)	1.25 (1.19, 1.32)
2007	15946	3737	23.44 (22.78, 24.10)	15946	3048	19.11 (18.51, 19.73)	1.23 (1.17, 1.29)

2008	18391	4435	24.12 (23.50, 24.74)	18391	3690	20.06 (19.49, 20.65)	1.20 (1.15, 1.26)
2009	15698	3711	23.64 (22.98, 24.31)	15698	3037	19.35 (18.73, 19.97)	1.22 (1.16, 1.28)
2010	12890	3067	23.79 (23.06, 24.54)	12890	2533	19.65 (18.97, 20.35)	1.21 (1.15, 1.28)
2011	11314	2597	22.95 (22.18, 23.74)	11314	2122	18.76 (18.04, 19.49)	1.22 (1.16, 1.30)
2012	9718	2293	23.60 (22.75, 24.45)	9718	1826	18.79 (18.02, 19.58)	1.26 (1.18, 1.34)
2013	8738	2030	23.23 (22.35, 24.13)	8738	1704	19.50 (18.67, 20.35)	1.19 (1.12, 1.27)
2014	8245	1944	23.58 (22.67, 24.51)	8245	1534	18.61 (17.77, 19.46)	1.27 (1.19, 1.36)
2015	7470	1716	22.97 (22.02, 23.94)	7470	1415	18.94 (18.06, 19.85)	1.21 (1.13, 1.30)
2016	6358	1517	23.86 (22.82, 24.93)	6358	1243	19.55 (18.58, 20.55)	1.22 (1.13, 1.32)
2017	5802	1378	23.75 (22.66, 24.87)	5802	1260	21.72 (20.66, 22.80)	1.09 (1.01, 1.18)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.7.2. Prevalence of obesity in OA and matched non-OA populations by calendar year, 1992-2017

Calendar year	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	168300	66429	39.47 (39.24, 39.70)	168300	58574	34.80 (34.58, 35.03)	1.13 (1.12, 1.15)
1992	592	224	37.84 (33.92, 41.88)	592	155	26.18 (22.68, 29.92)	1.42 (1.16, 1.75)
1993	1641	548	33.39 (31.11, 35.73)	1641	441	26.87 (24.74, 29.09)	1.24 (1.10, 1.41)
1994	2139	698	32.63 (30.65, 34.67)	2139	551	25.76 (23.92, 27.67)	1.27 (1.13, 1.42)
1995	2439	833	34.15 (32.27, 36.07)	2439	719	29.48 (27.67, 31.33)	1.16 (1.05, 1.28)
1996	2970	1013	34.11 (32.40, 35.84)	2970	807	27.17 (25.58, 28.81)	1.26 (1.14, 1.38)
1997	3502	1212	34.61 (33.03, 36.21)	3502	1022	29.18 (27.68, 30.72)	1.19 (1.09, 1.29)
1998	3881	1354	34.89 (33.39, 36.41)	3881	1135	29.25 (27.82, 30.70)	1.19 (1.10, 1.29)
1999	4357	1530	35.12 (33.70, 36.55)	4357	1236	28.37 (27.03, 29.73)	1.24 (1.15, 1.33)
2000	4417	1626	36.81 (35.39, 38.25)	4417	1344	30.43 (29.07, 31.81)	1.21 (1.13, 1.30)
2001	4830	1762	36.48 (35.12, 37.86)	4830	1503	31.12 (29.81, 32.45)	1.17 (1.09, 1.26)
2002	5850	2075	35.47 (34.24, 36.71)	5850	1874	32.03 (30.84, 33.25)	1.11 (1.04, 1.18)
2003	7693	2910	37.83 (36.74, 38.92)	7693	2606	33.87 (32.82, 34.95)	1.12 (1.06, 1.18)
2004	9170	3604	39.30 (38.30, 40.31)	9170	3129	34.12 (33.15, 35.10)	1.15 (1.10, 1.21)
2005	10471	4193	40.04 (39.10, 40.99)	10471	3716	35.49 (34.57, 36.41)	1.13 (1.08, 1.18)
2006	11085	4642	41.88 (40.96, 42.80)	11085	3841	34.65 (33.76, 35.54)	1.21 (1.16, 1.26)
2007	12765	5329	41.75 (40.89, 42.61)	12765	4526	35.46 (34.63, 36.29)	1.18 (1.13, 1.23)

2008	14573	6090	41.79 (40.99, 42.60)	14573	5202	35.70 (34.92, 36.48)	1.17 (1.13, 1.21)
2009	12470	5290	42.42 (41.55, 43.29)	12470	4548	36.47 (35.63, 37.32)	1.16 (1.12, 1.21)
2010	10216	4196	41.07 (40.12, 42.03)	10216	3772	36.92 (35.99, 37.87)	1.11 (1.06, 1.16)
2011	8838	3597	40.70 (39.67, 41.73)	8838	3298	37.32 (36.31, 38.33)	1.09 (1.04, 1.14)
2012	7457	3003	40.27 (39.16, 41.39)	7457	2812	37.71 (36.61, 38.82)	1.07 (1.01, 1.12)
2013	6546	2590	39.57 (38.38, 40.76)	6546	2514	38.41 (37.22, 39.60)	1.03 (0.98, 1.09)
2014	6110	2366	38.72 (37.50, 39.96)	6110	2311	37.82 (36.61, 39.05)	1.02 (0.97, 1.08)
2015	5458	2152	39.43 (38.13, 40.74)	5458	2088	38.26 (36.96, 39.56)	1.03 (0.97, 1.09)
2016	4575	1842	40.26 (38.84, 41.70)	4575	1744	38.12 (36.71, 39.55)	1.06 (0.99, 1.13)
2017	4255	1750	41.13 (39.64, 42.62)	4255	1680	39.48 (38.01, 40.97)	1.04 (0.97, 1.11)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.7.3. Prevalence of hypertension in OA and matched non-OA populations by calendar year, 1992-2017

Calendar year	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	215190	80589	37.45 (37.25, 37.66)	215190	59553	27.67 (27.49, 27.86)	1.35 (1.34, 1.37)
1992	905	255	28.18 (25.27, 31.23)	905	195	21.55 (18.91, 24.37)	1.31 (1.11, 1.54)
1993	2362	600	25.40 (23.66, 27.21)	2362	552	23.37 (21.68, 25.13)	1.09 (0.98, 1.20)
1994	2970	858	28.89 (27.26, 30.56)	2970	670	22.56 (21.07, 24.11)	1.28 (1.17, 1.40)
1995	3248	930	28.63 (27.08, 30.22)	3248	755	23.25 (21.80, 24.74)	1.23 (1.13, 1.34)
1996	3879	1076	27.74 (26.33, 29.18)	3879	891	22.97 (21.65, 24.33)	1.21 (1.12, 1.30)
1997	4522	1268	28.04 (26.73, 29.37)	4522	1106	24.46 (23.21, 25.74)	1.15 (1.07, 1.23)
1998	5031	1330	26.44 (25.22, 27.68)	5031	1236	24.57 (23.38, 25.78)	1.08 (1.01, 1.15)
1999	5478	1602	29.24 (28.04, 30.47)	5478	1351	24.66 (23.53, 25.83)	1.19 (1.11, 1.26)
2000	5572	1649	29.59 (28.40, 30.81)	5572	1489	26.72 (25.56, 27.91)	1.11 (1.04, 1.18)
2001	6074	2020	33.26 (32.07, 34.46)	6074	1672	27.53 (26.41, 28.67)	1.21 (1.14, 1.28)
2002	7248	2521	34.78 (33.68, 35.89)	7248	1930	26.63 (25.61, 27.66)	1.31 (1.24, 1.37)
2003	9449	3518	37.23 (36.26, 38.22)	9449	2697	28.54 (27.63, 29.47)	1.30 (1.25, 1.36)
2004	11210	4446	39.66 (38.75, 40.57)	11210	3166	28.24 (27.41, 29.09)	1.40 (1.35, 1.46)
2005	12952	5200	40.15 (39.30, 41.00)	12952	3801	29.35 (28.56, 30.14)	1.37 (1.32, 1.42)
2006	13720	5550	40.45 (39.63, 41.28)	13720	3981	29.02 (28.26, 29.78)	1.39 (1.35, 1.44)
2007	15946	6214	38.97 (38.21, 39.73)	15946	4479	28.09 (27.39, 28.79)	1.39 (1.34, 1.43)

2008	18391	7079	38.49 (37.79, 39.20)	18391	5061	27.52 (26.87, 28.17)	1.40 (1.36, 1.44)
2009	15698	6132	39.06 (38.30, 39.83)	15698	4513	28.75 (28.04, 29.46)	1.36 (1.32, 1.40)
2010	12890	5108	39.63 (38.78, 40.48)	12890	3737	28.99 (28.21, 29.78)	1.37 (1.32, 1.41)
2011	11314	4544	40.16 (39.26, 41.07)	11314	3219	28.45 (27.62, 29.29)	1.41 (1.36, 1.46)
2012	9718	4010	41.26 (40.28, 42.25)	9718	2821	29.03 (28.13, 29.94)	1.42 (1.37, 1.48)
2013	8738	3594	41.13 (40.10, 42.17)	8738	2545	29.13 (28.17, 30.09)	1.41 (1.36, 1.47)
2014	8245	3395	41.18 (40.11, 42.25)	8245	2292	27.80 (26.83, 28.78)	1.48 (1.42, 1.55)
2015	7470	2971	39.77 (38.66, 40.89)	7470	2059	27.56 (26.55, 28.59)	1.44 (1.38, 1.51)
2016	6358	2494	39.23 (38.02, 40.44)	6358	1758	27.65 (26.55, 28.77)	1.42 (1.35, 1.49)
2017	5802	2225	38.35 (37.10, 39.61)	5802	1577	27.18 (26.04, 28.34)	1.41 (1.34, 1.49)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.7.3. Prevalence of type 2 diabetes mellitus in OA and matched non-OA populations by calendar year, 1992-2017

Calendar year	OA			Non-OA			Prevalence rate ratio (95%CI)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	215190	18160	8.44 (08.32, 08.56	215190	16369	7.61 (07.50, 07.72)	1.11 (1.09, 1.13)
1992	905	18	1.99 (01.18, 03.13)	905	32	3.54 (02.43, 04.96)	0.56 (0.32, 0.99)
1993	2362	46	1.95 (01.43, 02.59)	2362	99	4.19 (03.42, 05.08)	0.46 (0.33, 0.66)
1994	2970	69	2.32 (01.81, 02.93)	2970	133	4.48 (03.76, 05.28)	0.52 (0.39, 0.69)
1995	3248	76	2.34 (01.85, 02.92)	3248	156	4.80 (04.09, 05.60)	0.49 (0.37, 0.64)
1996	3879	104	2.68 (02.20, 03.24)	3879	185	4.77 (04.12, 05.49)	0.56 (0.44, 0.71)
1997	4522	133	2.94 (02.47, 03.48)	4522	208	4.60 (04.01, 05.25)	0.64 (0.52, 0.79)
1998	5031	154	3.06 (02.60, 03.58)	5031	266	5.29 (04.69, 05.94)	0.58 (0.48, 0.70)
1999	5478	181	3.30 (02.85, 03.81)	5478	330	6.02 (05.41, 06.69)	0.55 (0.46, 0.65)
2000	5572	230	4.13 (03.62, 04.68)	5572	309	5.55 (04.96, 06.18)	0.74 (0.63, 0.88)
2001	6074	295	4.86 (04.33, 05.43)	6074	378	6.22 (05.63, 06.86)	0.78 (0.67, 0.90)
2002	7248	430	5.93 (05.40, 06.50)	7248	491	6.77 (06.21, 07.38)	0.88 (0.77, 0.99)
2003	9449	632	6.69 (06.19, 07.21)	9449	712	7.54 (07.01, 08.09)	0.89 (0.80, 0.98)
2004	11210	865	7.72 (07.23, 08.23)	11210	873	7.79 (07.30, 08.30)	0.99 (0.91, 1.08)
2005	12952	1085	8.38 (07.91, 08.87)	12952	983	7.59 (07.14, 08.06)	1.10 (1.02, 1.20)
2006	13720	1267	9.23 (08.76, 09.73)	13720	1097	8.00 (07.55, 08.46)	1.15 (1.07, 1.25)
2007	15946	1490	9.34 (08.90, 09.81)	15946	1295	8.12 (07.70, 08.56)	1.15 (1.07, 1.24)
2008	18391	1730	9.41 (08.99,	18391	1456	7.92 (07.53,	1.19 (1.11, 1.27)

			09.84)			08.32)	
2009	15698	1617	10.30 (09.83, 10.79)	15698	1316	8.38 (07.95, 08.83)	1.23 (1.15, 1.32)
2010	12890	1338	10.38 (09.86, 10.92)	12890	1131	8.77 (08.29, 09.28)	1.18 (1.10, 1.28)
2011	11314	1155	10.21 (09.66, 10.78)	11314	954	8.43 (07.93, 08.96)	1.21 (1.12, 1.31)
2012	9718	1062	10.93 (10.31, 11.57)	9718	844	8.68 (08.13, 09.26)	1.26 (1.15, 1.37)
2013	8738	991	11.34 (10.68, 12.02)	8738	763	8.73 (08.15, 09.34)	1.30 (1.19, 1.42)
2014	8245	890	10.79 (10.13, 11.48)	8245	697	8.45 (07.86, 09.07)	1.28 (1.16, 1.40)
2015	7470	874	11.70 (10.98, 12.45)	7470	654	8.76 (08.12, 09.42)	1.34 (1.21, 1.47)
2016	6358	748	11.76 (10.98, 12.58)	6358	533	8.38 (07.71, 09.09)	1.40 (1.26, 1.56)
2017	5802	680	11.72 (10.90, 12.58)	5802	474	8.17 (07.48, 08.90)	1.43 (1.28, 1.60)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.7.5. Prevalence of dyslipidaemia in OA and matched non-OA populations by calendar year, 1992-2017

Calendar year	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	215190	146988	68.31 (68.11, 68.50)	215190	122934	57.13 (56.92, 57.34)	1.20 (1.19, 1.20)
1992	905	460	50.83 (47.52, 54.13)	905	470	51.93 (48.62, 55.23)	0.98 (0.89, 1.07)
1993	2362	1185	50.17 (48.13, 52.21)	2362	1183	50.08 (48.05, 52.12)	1.00 (0.95, 1.06)
1994	2970	1605	54.04 (52.23, 55.84)	2970	1551	52.22 (50.41, 54.03)	1.03 (0.99, 1.09)
1995	3248	1870	57.57 (55.85, 59.28)	3248	1743	53.66 (51.93, 55.39)	1.07 (1.03, 1.12)
1996	3879	2257	58.19 (56.61, 59.74)	3879	2067	53.29 (51.70, 54.87)	1.09 (1.05, 1.14)
1997	4522	2755	60.92 (59.48, 62.35)	4522	2566	56.74 (55.29, 58.20)	1.07 (1.04, 1.11)
1998	5031	3196	63.53 (62.18, 64.86)	5031	2900	57.64 (56.26, 59.01)	1.10 (1.07, 1.14)
1999	5478	3649	66.61 (65.35, 67.86)	5478	3188	58.20 (56.88, 59.51)	1.14 (1.11, 1.18)
2000	5572	3751	67.32 (66.07, 68.55)	5572	3373	60.53 (59.24, 61.82)	1.11 (1.08, 1.14)
2001	6074	4171	68.67 (67.49, 69.84)	6074	3733	61.46 (60.22, 62.69)	1.12 (1.09, 1.15)
2002	7248	5088	70.20 (69.13, 71.25)	7248	4531	62.51 (61.39, 63.63)	1.12 (1.10, 1.15)
2003	9449	6781	71.76 (70.84, 72.67)	9449	5942	62.88 (61.90, 63.86)	1.14 (1.12, 1.16)
2004	11210	7966	71.06 (70.21, 71.90)	11210	7057	62.95 (62.05, 63.85)	1.13 (1.11, 1.15)
2005	12952	9180	70.88 (70.09, 71.66)	12952	7985	61.65 (60.81, 62.49)	1.15 (1.13, 1.17)
2006	13720	9607	70.02 (69.25, 70.79)	13720	8078	58.88 (58.05, 59.70)	1.19 (1.17, 1.21)
2007	15946	11158	69.97 (69.26, 70.68)	15946	9263	58.09 (57.32, 58.86)	1.20 (1.18, 1.22)
2008	18391	12904	70.16 (69.50, 70.83)	18391	10611	57.70 (56.98, 58.41)	1.22 (1.20, 1.24)
2009	15698	11007	70.12 (69.39,	15698	8976	57.18 (56.40,	1.23 (1.21, 1.25)

			70.83)			57.96)	
2010	12890	8924	69.23 (68.43, 70.03)	12890	7315	56.75 (55.89, 57.61)	1.22 (1.20, 1.24)
2011	11314	7857	69.44 (68.59, 70.29)	11314	6309	55.76 (54.84, 56.68)	1.25 (1.22, 1.27)
2012	9718	6727	69.22 (68.29, 70.14)	9718	5229	53.81 (52.81, 54.80)	1.29 (1.26, 1.32)
2013	8738	5921	67.76 (66.77, 68.74)	8738	4637	53.07 (52.01, 54.12)	1.28 (1.25, 1.31)
2014	8245	5566	67.51 (66.48, 68.52)	8245	4228	51.28 (50.19, 52.36)	1.32 (1.28, 1.35)
2015	7470	5071	67.88 (66.81, 68.94)	7470	3784	50.66 (49.52, 51.80)	1.34 (1.30, 1.38)
2016	6358	4373	68.78 (67.62, 69.92)	6358	3212	50.52 (49.28, 51.76)	1.36 (1.32, 1.40)
2017	5802	3959	68.24 (67.02, 69.43)	5802	3003	51.76 (50.46, 53.05)	1.32 (1.28, 1.36)

OA, osteoarthritis; D, denominator; N, numerator

Appendix 2.7.6. Prevalence of risk factors ≥1 in OA and matched non-OA populations by calendar year, 1992-2017

Calendar year	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	168300	151726	90.15 (90.01, 90.29)	168300	147151	87.43 (87.27, 87.59)	1.03 (1.03, 1.03)
1992	592	511	86.32 (83.28, 88.98)	592	481	81.25 (77.87, 84.32)	1.06 (1.01, 1.12)
1993	1641	1403	85.50 (83.70, 87.17)	1641	1304	79.46 (77.43, 81.39)	1.08 (1.04, 1.11)
1994	2139	1829	85.51 (83.94, 86.97)	2139	1695	81.92 (80.33, 83.43)	1.08 (1.05, 1.11)
1995	2439	2088	85.61 (84.15, 86.98)	2439	1998	81.92 (80.33, 83.43)	1.05 (1.02, 1.07)
1996	2970	2558	86.13 (84.83, 87.35)	2970	2413	81.25 (79.79, 82.64)	1.06 (1.04, 1.08)
1997	3502	3054	87.21 (86.06, 88.30)	3502	2918	83.32 (82.05, 84.54)	1.05 (1.03, 1.07)
1998	3881	3381	87.12 (86.02, 88.16)	3881	3291	84.80 (83.63, 85.91)	1.03 (1.01, 1.05)
1999	4357	3859	88.57 (87.59, 89.50)	4357	3677	84.39 (83.28, 85.46)	1.05 (1.03, 1.07)
2000	4417	3926	88.88 (87.92, 89.80)	4417	3836	86.85 (85.81, 87.83)	1.02 (1.01, 1.04)
2001	4830	4362	90.31 (89.44, 91.13)	4830	4214	87.25 (86.27, 88.17)	1.04 (1.02, 1.05)
2002	5850	5218	89.20 (88.37, 89.98)	5850	5100	87.18 (86.30, 88.03)	1.02 (1.01, 1.04)
2003	7693	6980	90.73 (90.06, 91.37)	7693	6802	88.42 (87.68, 89.12)	1.03 (1.02, 1.04)
2004	9170	8349	91.05 (90.44, 91.62)	9170	8073	88.04 (87.36, 88.69)	1.03 (1.02, 1.04)
2005	10471	9570	91.40 (90.84, 91.93)	10471	9312	88.93 (88.31, 89.53)	1.03 (1.02, 1.04)
2006	11085	10105	91.16 (90.62, 91.68)	11085	9736	87.83 (87.21, 88.43)	1.04 (1.03, 1.05)
2007	12765	11624	91.06 (90.55, 91.55)	12765	11236	88.02 (87.45, 88.58)	1.03 (1.03, 1.04)
2008	14573	13249	90.91 (90.44, 91.38)	14573	12781	87.70 (87.16, 88.23)	1.04 (1.03, 1.04)
2009	12470	11295	90.58 (90.05, 91.08)	12470	11059	88.68 (88.12, 89.24)	1.02 (1.01, 1.03)
2010	10216	9291	90.95 (90.37,	10216	9011	88.20 (87.56,	1.03 (1.02, 1.04)

			91.50)			88.82)	
2011	8838	8046	91.04 (90.42, 91.63)	8838	7789	88.13 (87.44, 88.80)	1.03 (1.02, 1.04)
2012	7457	6739	90.37 (89.68, 91.03)	7457	6577	88.20 (87.45, 88.92)	1.02 (1.01, 1.04)
2013	6546	5937	90.70 (89.97, 91.39)	6546	5790	88.45 (87.65, 89.22)	1.03 (1.01, 1.04)
2014	6110	5490	89.85 (89.07, 90.60)	6110	5393	88.27 (87.43, 89.06)	1.02 (1.01, 1.03)
2015	5458	4939	90.49 (89.68, 91.26)	5458	4814	88.20 (87.32, 89.05)	1.03 (1.01, 1.04)
2016	4575	4118	90.01 (89.11, 90.87)	4575	4057	88.68 (87.72, 89.58)	1.02 (1.00, 1.03)
2017	4255	3805	89.42 (88.46, 90.33)	4255	3794	89.17 (88.19, 90.08)	1.00 (0.99, 1.02)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.7.7. Prevalence of risk factors ≥2 in OA and matched non-OA populations by calendar year, 1992-2017

Calendar year	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	168300	97427	57.89 (57.65, 58.12)	168300	85624	50.88 (50.64, 51.11)	1.14 (1.13, 1.14)
1992	592	289	48.82 (44.72, 52.93)	592	221	37.33 (33.42, 41.37)	1.31 (1.14, 1.49)
1993	1641	740	45.09 (42.67, 47.54)	1641	627	38.21 (35.85, 40.61)	1.18 (1.09, 1.28)
1994	2139	1003	46.89 (44.76, 49.03)	2139	763	35.67 (33.64, 37.74)	1.31 (1.22, 1.41)
1995	2439	1208	49.53 (47.53, 51.53)	2439	967	39.65 (37.70, 41.62)	1.25 (1.17, 1.33)
1996	2970	1433	48.25 (46.44, 50.06)	2970	1136	38.25 (36.50, 40.02)	1.26 (1.19, 1.34)
1997	3502	1769	50.51 (48.84, 52.18)	3502	1476	42.15 (40.50, 43.80)	1.20 (1.14, 1.26)
1998	3881	1955	50.37 (48.79, 51.96)	3881	1719	44.29 (42.72, 45.87)	1.14 (1.08, 1.19)
1999	4357	2271	52.12 (50.63, 53.62)	4357	1914	43.93 (42.45, 45.42)	1.19 (1.14, 1.24)
2000	4417	2388	54.06 (52.58, 55.54)	4417	2064	46.73 (46.64, 49.47)	1.16 (1.11, 1.21)
2001	4830	2653	54.93 (53.51, 56.34)	4830	2321	48.05 (46.64, 49.47)	1.14 (1.10, 1.19)
2002	5850	3310	56.58 (55.30, 57.86)	5850	2808	48.00 (46.71, 49.29)	1.18 (1.14, 1.22)
2003	7693	4449	57.83 (56.72, 58.94)	7693	3866	50.25 (49.13, 51.38)	1.15 (1.12, 1.19)
2004	9170	5489	59.86 (58.85, 60.86)	9170	4667	50.89 (49.87, 51.92)	1.18 (1.15, 1.21)
2005	10471	6258	59.77 (58.82, 60.71)	10471	5412	51.69 (50.72, 52.65)	1.16 (1.13, 1.18)
2006	11085	6749	60.88 (59.97, 61.79)	11085	5739	51.77 (50.84, 52.71)	1.18 (1.15, 1.20)
2007	12765	7675	60.13 (59.27, 60.98)	12765	6609	51.77 (50.90, 52.64)	1.16 (1.14, 1.19)
2008	14573	8650	59.36 (58.55, 60.16)	14573	7595	52.12 (51.30, 52.93)	1.14 (1.12, 1.16)
2009	12470	7468	59.89 (59.02, 60.75)	12470	6645	53.29 (52.41, 54.17)	1.12 (1.10, 1.15)
2010	10216	6048	59.20 (58.24, 60.16)	10216	5437	53.22 (52.25, 54.19)	1.11 (1.09, 1.14)
2011	8838	5320	60.19 (59.17,	8838	4680	52.95 (51.91,	1.14 (1.11, 1.16)

			61.22)			54.00)	
2012	7457	4471	59.96 (58.83, 61.07)	7457	4065	54.51 (53.37, 55.65)	1.10 (1.07, 1.13)
2013	6546	3896	59.52 (58.32, 60.71)	6546	3621	55.32 (54.10, 56.53)	1.08 (1.04, 1.11)
2014	6110	3569	58.41 (57.16, 59.65)	6110	3305	54.09 (52.83, 55.35)	1.08 (1.06, 1.11)
2015	5458	3158	57.86 (56.54, 59.17)	5458	2991	54.80 (53.47, 56.13)	1.06 (1.02, 1.09)
2016	4575	2696	58.93 (57.49, 60.36)	4575	2556	55.87 (54.42, 57.31)	1.05 (1.02, 1.09)
2017	4255	2512	59.04 (57.54, 60.52)	4255	2420	56.87 (55.37, 58.37)	1.04 (1.00, 1.08)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.7.8. Prevalence of risk factors ≥3 in OA and matched non-OA populations by calendar year, 1992-2017

Calendar year	OA			Non-OA			Prevalence rate ratio (95%)
	D	N	Prevalence (95%CI)	D	N	Prevalence (95%CI)	
Total	168300	40995	24.36 (24.15, 24.56)	168300	34734	20.64 (20.45, 20.83)	1.18 (1.17, 1.20)
1992	592	91	15.37 (12.56, 18.53)	592	77	13.01 (10.40, 15.99)	1.18 (0.89, 1.57)
1993	1641	202	12.31 (10.76, 14.00)	1641	200	12.19 (10.64, 13.87)	1.01 (0.84, 1.21)
1994	2139	315	14.73 (13.25, 16.30)	2139	249	11.64 (10.31, 13.08)	1.27 (1.08, 1.48)
1995	2439	391	16.03 (14.60, 17.55)	2439	310	12.71 (11.41, 14.10)	1.26 (1.10, 1.45)
1996	2970	472	15.89 (14.59, 17.26)	2970	367	12.36 (11.19, 13.59)	1.29 (1.13, 1.46)
1997	3502	617	17.62 (16.37, 18.92)	3502	532	15.19 (14.02, 16.42)	1.16 (1.04, 1.29)
1998	3881	677	17.44 (16.26, 18.68)	3881	590	15.20 (14.09, 16.37)	1.15 (1.04, 1.27)
1999	4357	829	19.03 (17.87, 20.22)	4357	680	15.61 (14.54, 16.72)	1.22 (1.11, 1.34)
2000	4417	864	19.56 (18.40, 20.76)	4417	762	17.25 (16.15, 18.40)	1.13 (1.04, 1.24)
2001	4830	1059	21.93 (20.77, 23.12)	4830	846	17.52 (16.45, 18.62)	1.25 (1.15, 1.36)
2002	5850	1292	22.09 (21.03, 23.17)	5850	1039	17.76 (16.79, 18.76)	1.24 (1.16, 1.34)
2003	7693	1849	24.03 (23.08, 25.01)	7693	1502	19.52 (18.64, 20.43)	1.23 (1.16, 1.31)
2004	9170	2306	25.15 (24.26, 26.05)	9170	1801	19.64 (18.83, 20.47)	1.28 (1.21, 1.35)
2005	10471	2696	25.75 (24.91, 26.6)	10471	2153	20.56 (19.79, 21.35)	1.25 (1.19, 1.32)
2006	11085	2933	26.46 (25.64, 27.29)	11085	2332	21.04 (20.28, 21.81)	1.26 (1.20, 1.32)
2007	12765	3311	25.94 (25.18, 26.71)	12765	2659	20.83 (20.13, 21.55)	1.25 (1.19, 1.30)
2008	14573	3819	26.21 (25.49, 26.93)	14573	3218	22.08 (21.41, 22.76)	1.19 (1.14, 1.24)
2009	12470	3358	26.93 (26.15, 27.72)	12470	2718	21.80 (21.07, 22.53)	1.24 (1.18, 1.29)
2010	10216	2698	26.41 (25.56, 27.28)	10216	2341	22.92 (22.10, 23.74)	1.15 (1.10, 1.21)
2011	8838	2281	25.81 (24.90, 26.73)	8838	2018	22.83 (21.96, 23.72)	1.13 (1.07, 1.19)
2012	7457	1974	26.47 (25.47,	7457	1762	23.63 (22.67,	1.12 (1.06, 1.18)

			27.49)			24.61)	
2013	6546	1709	26.11 (25.05, 27.19)	6546	1600	24.44 (23.41, 25.50)	1.07 (1.01, 1.13)
2014	6110	1535	25.12 (24.04, 26.23)	6110	1429	23.39 (22.33, 24.47)	1.07 (1.01, 1.14)
2015	5458	1408	25.80 (24.64, 26.98)	5458	1318	24.15 (23.02, 25.31)	1.07 (1.00, 1.14)
2016	4575	1186	25.92 (24.66, 27.22)	4575	1156	25.27 (24.01, 26.55)	1.03 (0.96, 1.10)
2017	4255	1123	26.39 (25.07, 27.74)	4255	1075	25.26 (23.96, 26.60)	1.04 (0.97, 1.12)
OA, osteoarthritis; D, denominator; N, numerator							

Appendix 2.8 Imputed period prevalence of obesity, and number of ≥1, ≥2 and ≥3 modifiable cardiovascular risk factors in osteoarthritis and non-osteoarthritis populations by subgroups 1992-2017

Appendix 2.8.1. Imputed period prevalence of obesity in OA and matched non-OA individuals by subgroups, 1992-2017

Subgroups	Prevalence (95%CI)		Prevalence rate ratio (95%CI)
	OA	Non-OA	
Gender, age group (years)			
Women, all	37.46 (37.20, 37.71)	29.86 (29.62, 30.1)	1.25 (1.24, 1.27)
35-44	44.99 (43.77, 46.22)	26.87 (25.78, 27.96)	1.67 (1.66, 1.69)
45-54	43.61 (43.02, 44.19)	29.11 (28.57, 29.64)	1.50 (1.49, 1.51)
55-64	40.31 (39.85, 40.77)	32.38 (31.94, 32.82)	1.24 (1.24, 1.25)
65-74	36.95 (36.45, 37.46)	32.54 (32.05, 33.03)	1.14 (1.13, 1.14)
75-84	27.27 (26.69, 27.86)	25.59 (25.01, 26.16)	1.07 (1.06, 1.08)
85+	14.46 (13.41, 15.52)	13.45 (12.43, 14.47)	1.08 (1.06, 1.09)
Men, all	36.17 (35.83, 36.51)	25.69 (25.38, 26)	1.41 (1.40, 1.42)
35-44	36.45 (35.11, 37.78)	20.76 (19.64, 21.88)	1.76 (1.74, 1.77)
45-54	39.71 (38.96, 40.46)	26.03 (25.36, 26.71)	1.53 (1.51, 1.54)
55-64	40.37 (39.78, 40.97)	28.54 (27.99, 29.08)	1.41 (1.40, 1.43)
65-74	34.31 (33.62, 35.00)	26.47 (25.83, 27.11)	1.30 (1.28, 1.31)
75-84	23.68 (22.80, 24.57)	19.79 (18.96, 20.62)	1.20 (1.18, 1.21)
85+	12.25 (10.27, 14.24)	8.44 (6.76, 10.12)	1.45 (1.43, 1.48)
Region			
North East	37.19 (35.79, 38.59)	28.09 (26.79, 29.39)	1.32 (1.31, 1.34)
North West	36.94 (36.36, 37.51)	29.32 (28.78, 29.86)	1.26 (1.25, 1.27)
Yorkshire & The Humber	34.59 (33.62, 35.56)	25.36 (24.47, 26.24)	1.36 (1.35, 1.38)
East Midlands	35.08 (34.09, 36.07)	27.69 (26.76, 28.61)	1.27 (1.26, 1.28)
West Midlands	37.27 (36.64, 37.91)	29.92 (29.32, 30.53)	1.25 (1.24, 1.26)
East of England	32.90 (32.22, 33.59)	25.01 (24.38, 25.64)	1.32 (1.30, 1.33)

	South West	35.91 (35.22, 36.61)	25.49 (24.86, 26.12)	1.41 (1.40, 1.42)
	South Central	35.09 (34.44, 35.74)	25.38 (24.79, 25.98)	1.38 (1.37, 1.40)
	London	36.56 (35.81, 37.31)	27.31 (26.61, 28.01)	1.34 (1.33, 1.35)
	South East Coast	34.56 (33.88, 35.23)	26.19 (25.57, 26.81)	1.32 (1.31, 1.33)
	Northern Ireland	39.17 (37.97, 40.36)	31.52 (30.38, 32.66)	1.24 (1.23, 1.25)
	Scotland	41.63 (40.96, 42.31)	33.23 (32.58, 33.87)	1.25 (1.24, 1.26)
	Wales	41.76 (41.14, 42.39)	32.27 (31.68, 32.86)	1.29 (1.28, 1.30)
Calendar year				
	1992	27.73 (24.81, 30.66)	20.11 (17.5, 22.73)	1.38 (1.36, 1.39)
	1993	27.90 (26.09, 29.71)	20.96 (19.31, 22.6)	1.33 (1.32, 1.35)
	1994	27.90 (26.29, 29.52)	20.84 (19.38, 22.3)	1.34 (1.32, 1.35)
	1995	29.37 (27.80, 30.94)	23.98 (22.52, 25.45)	1.22 (1.21, 1.24)
	1996	30.14 (28.69, 31.58)	22.87 (21.54, 24.19)	1.32 (1.3, 1.33)
	1997	30.87 (29.53, 32.22)	24.39 (23.14, 25.64)	1.27 (1.25, 1.28)
	1998	31.39 (30.11, 32.67)	23.81 (22.64, 24.99)	1.32 (1.31, 1.33)
	1999	32.11 (30.87, 33.35)	23.93 (22.8, 25.06)	1.34 (1.33, 1.35)
	2000	33.82 (32.58, 35.06)	25.59 (24.45, 26.74)	1.32 (1.31, 1.33)
	2001	33.5 (32.32, 34.69)	26.23 (25.12, 27.33)	1.28 (1.27, 1.29)
	2002	32.86 (31.78, 33.95)	27.32 (26.29, 28.34)	1.2 (1.19, 1.21)
	2003	35.07 (34.10, 36.03)	28.87 (27.96, 29.78)	1.21 (1.2, 1.23)
	2004	37.27 (36.37, 38.16)	29.19 (28.35, 30.03)	1.28 (1.27, 1.29)
	2005	37.82 (36.99, 38.66)	30.03 (29.24, 30.82)	1.26 (1.25, 1.27)
	2006	39.58 (38.76, 40.40)	28.98 (28.22, 29.74)	1.37 (1.35, 1.38)
	2007	39.52 (38.76, 40.27)	29.54 (28.83, 30.25)	1.34 (1.33, 1.35)
	2008	39.81 (39.10, 40.52)	29.34 (28.68, 30)	1.36 (1.35, 1.37)
	2009	40.3 (39.53, 41.07)	29.93 (29.22, 30.65)	1.35 (1.34, 1.36)
	2010	39.13 (38.28, 39.97)	30.16 (29.37, 30.96)	1.3 (1.29, 1.31)
	2011	38.66 (37.76, 39.56)	29.95 (29.11, 30.8)	1.29 (1.28, 1.3)
	2012	38.33 (37.36, 39.30)	29.79 (28.88, 30.7)	1.29 (1.28, 1.3)
	2013	37.83 (36.82, 38.85)	29.74 (28.79, 30.7)	1.27 (1.26, 1.28)
	2014	37.04 (36.00, 38.08)	28.99 (28.01, 29.97)	1.28 (1.27, 1.29)
	2015	37.55 (36.45, 38.65)	28.77 (27.74, 29.8)	1.31 (1.29, 1.32)
	2016	37.53 (36.34, 38.72)	28.36 (27.25, 29.47)	1.32 (1.31, 1.33)
	2017	39.12 (37.87, 40.38)	29.92 (28.74, 31.10)	1.31 (1.3, 1.32)

MI, multiple imputation; OA, osteoarthritis; 95%CI, 95% confidence interval; D, denominator; N, numerator

Appendix 2.8.2. Imputed period prevalence of number of ≥1 modifiable cardiovascular risk factors in OA and matched non-OA individuals by subgroups, 1992-2017

Subgroups	Prevalence (95%CI)		Prevalence rate ratio (95%CI)
	OA	Non-OA	
Gender/ age group (years)			
Women, all	88.65 (88.48, 88.81)	75.14 (74.91, 75.37)	1.18 (1.18, 1.18)
35-44	79.8 (78.81, 80.78)	60.65 (59.44, 61.85)	1.32 (1.31, 1.32)
45-54	86.37 (85.97, 86.78)	70.3 (69.76, 70.83)	1.23 (1.22, 1.23)
55-64	90.37 (90.1, 90.65)	79.09 (78.71, 79.47)	1.14 (1.14, 1.15)
65-74	91.27 (90.97, 91.56)	80.22 (79.8, 80.63)	1.14 (1.13, 1.14)
75-84	88.13 (87.71, 88.56)	73.52 (72.94, 74.1)	1.20 (1.20, 1.20)
85+	79.88 (78.68, 81.09)	54.13 (52.63, 55.62)	1.48 (1.47, 1.48)
Men, all	88.49 (88.26, 88.72)	72.8 (72.48, 73.12)	1.22 (1.21, 1.22)
35-44	80.82 (79.73, 81.91)	61.64 (60.29, 62.98)	1.31 (1.31, 1.32)
45-54	87.8 (87.29, 88.3)	70.35 (69.64, 71.05)	1.25 (1.24, 1.25)
55-64	90.84 (90.5, 91.19)	76.53 (76.02, 77.04)	1.19 (1.18, 1.19)
65-74	89.47 (89.03, 89.92)	76.31 (75.7, 76.93)	1.17 (1.17, 1.18)
75-84	86.07 (85.35, 86.8)	69 (68.03, 69.96)	1.25 (1.24, 1.25)
85+	79.89 (77.46, 82.31)	41.37 (38.39, 44.34)	1.93 (1.92, 1.94)
Region			
North East	89.98 (89.12, 90.85)	77.81 (76.61, 79.02)	1.16 (1.15, 1.16)
North West	90.29 (89.93, 90.64)	78.83 (78.34, 79.31)	1.15 (1.14, 1.15)
Yorkshire & The Humber	85.28 (84.55, 86.00)	72.41 (71.50, 73.32)	1.18 (1.17, 1.18)
East Midlands	83.78 (83.02, 84.55)	72.77 (71.85, 73.69)	1.15 (1.15, 1.16)
West Midlands	89.81 (89.41, 90.20)	77.84 (77.30, 78.39)	1.15 (1.15, 1.16)
East of England	86.24 (85.74, 86.74)	71.70 (71.04, 72.35)	1.20 (1.20, 1.21)
South West	88.26 (87.80, 88.73)	67.86 (67.18, 68.53)	1.30 (1.30, 1.31)
South Central	88.26 (87.83, 88.70)	69.68 (69.06, 70.31)	1.27 (1.26, 1.27)
London	89.56 (89.09, 90.04)	73.2 (72.51, 73.89)	1.22 (1.22, 1.23)

South East Coast	87.91 (87.45, 88.37)	73.27 (72.64, 73.89)	1.20 (1.20, 1.20)
Northern Ireland	90.00 (89.27, 90.73)	77.67 (76.65, 78.68)	1.16 (1.16, 1.16)
Scotland	88.54 (88.10, 88.97)	76.69 (76.12, 77.27)	1.15 (1.15, 1.16)
Wales	90.25 (89.87, 90.62)	76.11 (75.57, 76.65)	1.19 (1.18, 1.19)
Calendar year			
1992	75.91 (73.12, 78.70)	69.61 (66.61, 72.61)	1.09 (1.09, 1.09)
1993	77.1 (75.4, 78.79)	68.97 (67.1, 70.83)	1.12 (1.11, 1.12)
1994	79.26 (77.8, 80.72)	70.84 (69.21, 72.48)	1.12 (1.11, 1.12)
1995	81.25 (79.91, 82.59)	73.31 (71.78, 74.83)	1.11 (1.1, 1.11)
1996	82.6 (81.41, 83.79)	72.39 (70.98, 73.8)	1.14 (1.14, 1.14)
1997	83.15 (82.06, 84.24)	74.48 (73.21, 75.75)	1.12 (1.11, 1.12)
1998	83.7 (82.68, 84.72)	74.98 (73.78, 76.17)	1.12 (1.11, 1.12)
1999	86.24 (85.32, 87.15)	75.17 (74.03, 76.32)	1.15 (1.14, 1.15)
2000	86.06 (85.15, 86.97)	77.12 (76.01, 78.22)	1.12 (1.11, 1.12)
2001	87.54 (86.71, 88.37)	77.1 (76.04, 78.16)	1.14 (1.13, 1.14)
2002	88.01 (87.26, 88.76)	77.5 (76.54, 78.46)	1.14 (1.13, 1.14)
2003	89.17 (88.55, 89.8)	78.46 (77.63, 79.29)	1.14 (1.13, 1.14)
2004	89.46 (88.9, 90.03)	78.36 (77.6, 79.12)	1.14 (1.14, 1.14)
2005	90.12 (89.6, 90.63)	78.11 (77.4, 78.82)	1.15 (1.15, 1.16)
2006	90.35 (89.86, 90.84)	76.57 (75.87, 77.28)	1.18 (1.18, 1.18)
2007	89.82 (89.35, 90.29)	75.59 (74.93, 76.26)	1.19 (1.18, 1.19)
2008	90.18 (89.75, 90.61)	74.66 (74.03, 75.28)	1.21 (1.2, 1.21)
2009	89.78 (89.31, 90.26)	74.62 (73.94, 75.3)	1.20 (1.2, 1.21)
2010	89.81 (89.29, 90.34)	74.32 (73.57, 75.08)	1.21 (1.2, 1.21)
2011	89.94 (89.39, 90.5)	72.99 (72.17, 73.81)	1.23 (1.23, 1.24)
2012	90.05 (89.45, 90.64)	71.96 (71.07, 72.85)	1.25 (1.25, 1.26)
2013	89.71 (89.07, 90.35)	70.67 (69.71, 71.62)	1.27 (1.27, 1.27)
2014	89.34 (88.67, 90.01)	69.21 (68.21, 70.2)	1.29 (1.29, 1.3)
2015	89.24 (88.53, 89.94)	68.82 (67.77, 69.87)	1.3 (1.29, 1.3)
2016	89.43 (88.67, 90.19)	67.32 (66.16, 68.47)	1.33 (1.32, 1.33)
2017	89.00 (88.20, 89.81)	70.03 (68.85, 71.21)	1.27 (1.27, 1.27)

MI, multiple imputation; OA, osteoarthritis; 95%CI, 95% confidence interval; D, denominator; N, numerator

Appendix 2.8.3. Imputed period prevalence of number of ≥2 modifiable cardiovascular risk factors in OA and matched non-OA individuals by subgroups, 1992-2017

Subgroups		Prevalence (95%CI)		Prevalence rate ratio (95%CI)
		OA	Non-OA	
Gender/ age group (years)				
	Women, all	56.42 (56.16, 56.68)	40.03 (39.77, 40.29)	1.41 (1.4, 1.42)
	35-44	44.94 (43.72, 46.17)	28.8 (27.69, 29.92)	1.56 (1.55, 1.57)
	45-54	52.3 (51.72, 52.89)	36.93 (36.36, 37.5)	1.42 (1.41, 1.43)
	55-64	57.26 (56.79, 57.72)	42.74 (42.27, 43.2)	1.34 (1.33, 1.35)
	65-74	60.75 (60.24, 61.26)	42.51 (42, 43.03)	1.43 (1.42, 1.44)
	75-84	57.89 (57.24, 58.54)	40.09 (39.44, 40.73)	1.44 (1.44, 1.45)
	85+	48.02 (46.53, 49.52)	28.21 (26.86, 29.56)	1.7 (1.69, 1.72)
	Men, all	56.13 (55.77, 56.48)	45.96 (45.61, 46.32)	1.22 (1.21, 1.23)
	35-44	43.97 (42.6, 45.35)	29.72 (28.45, 30.99)	1.48 (1.47, 1.49)
	45-54	53.55 (52.79, 54.32)	41.16 (40.4, 41.92)	1.3 (1.29, 1.31)
	55-64	59.79 (59.2, 60.38)	49.65 (49.05, 50.26)	1.2 (1.2, 1.21)
	65-74	58.7 (57.98, 59.41)	51.66 (50.93, 52.38)	1.14 (1.13, 1.14)
	75-84	53.08 (52.04, 54.12)	44 (42.97, 45.04)	1.21 (1.2, 1.21)
	85+	42.98 (39.99, 45.97)	22.68 (20.14, 25.21)	1.9 (1.88, 1.91)
Region				
	North East	57.85 (56.42, 59.28)	44.26 (42.83, 45.70)	1.31 (1.30, 1.31)
	North West	57.93 (57.34, 58.51)	45.55 (44.96, 46.14)	1.27 (1.26, 1.28)
	Yorkshire & The Humber	52.65 (51.63, 53.66)	38.21 (37.22, 39.2)	1.38 (1.37, 1.39)
	East Midlands	50.78 (49.75, 51.82)	40.11 (39.10, 41.13)	1.27 (1.26, 1.27)
	West Midlands	56.68 (56.03, 57.33)	44.55 (43.90, 45.2)	1.27 (1.26, 1.28)
	East of England	52.67 (51.94, 53.40)	38.79 (38.08, 39.50)	1.36 (1.35, 1.37)
	South West	56.11 (55.39, 56.83)	37.85 (37.15, 38.56)	1.48 (1.47, 1.49)
	South Central	55.15 (54.47, 55.83)	37.84 (37.17, 38.50)	1.46 (1.45, 1.47)
	London	57.22 (56.44, 57.99)	41.05 (40.29, 41.82)	1.39 (1.39, 1.40)
	South East Coast	53.89 (53.18, 54.59)	39.47 (38.78, 40.16)	1.37 (1.36, 1.37)
	Northern Ireland	57.88 (56.68, 59.09)	45.48 (44.26, 46.69)	1.27 (1.27, 1.28)

	Scotland	58.04 (57.36, 58.71)	45.77 (45.09, 46.45)	1.27 (1.26, 1.28)
	Wales	60.75 (60.13, 61.36)	46.08 (45.44, 46.71)	1.32 (1.31, 1.33)
Calendar year				
	1992	38.34 (35.17, 41.51)	27.96 (25.03, 30.88)	1.37 (1.36, 1.38)
	1993	37.38 (35.43, 39.34)	30.74 (28.87, 32.6)	1.22 (1.21, 1.23)
	1994	41.11 (39.34, 42.88)	29.8 (28.15, 31.44)	1.38 (1.37, 1.39)
	1995	44.43 (42.72, 46.14)	34.27 (32.63, 35.9)	1.3 (1.29, 1.31)
	1996	44.68 (43.11, 46.24)	32.87 (31.39, 34.35)	1.36 (1.35, 1.37)
	1997	47.24 (45.78, 48.69)	36.2 (34.8, 37.6)	1.3 (1.3, 1.31)
	1998	47.35 (45.97, 48.73)	36.85 (35.52, 38.18)	1.28 (1.28, 1.29)
	1999	49.67 (48.35, 51)	37.75 (36.47, 39.04)	1.32 (1.31, 1.32)
	2000	51.72 (50.41, 53.04)	39.79 (38.5, 41.07)	1.3 (1.29, 1.31)
	2001	52.98 (51.72, 54.24)	41.7 (40.46, 42.94)	1.27 (1.26, 1.28)
	2002	54.47 (53.32, 55.62)	42 (40.86, 43.13)	1.3 (1.29, 1.31)
	2003	56.69 (55.69, 57.69)	43.89 (42.89, 44.89)	1.29 (1.28, 1.3)
	2004	58.38 (57.46, 59.29)	44.49 (43.57, 45.41)	1.31 (1.3, 1.32)
	2005	58.85 (58, 59.7)	44.91 (44.06, 45.77)	1.31 (1.3, 1.32)
	2006	59.67 (58.85, 60.49)	43.71 (42.88, 44.54)	1.37 (1.36, 1.37)
	2007	58.82 (58.05, 59.58)	43.55 (42.78, 44.32)	1.35 (1.34, 1.36)
	2008	58.47 (57.76, 59.19)	43.47 (42.76, 44.19)	1.35 (1.34, 1.35)
	2009	59.08 (58.31, 59.85)	43.87 (43.09, 44.64)	1.35 (1.34, 1.35)
	2010	58.73 (57.88, 59.58)	44.34 (43.49, 45.2)	1.32 (1.32, 1.33)
	2011	58.88 (57.98, 59.79)	43.19 (42.27, 44.1)	1.36 (1.36, 1.37)
	2012	59.17 (58.19, 60.15)	43.38 (42.4, 44.37)	1.36 (1.36, 1.37)
	2013	58.29 (57.25, 59.32)	43.21 (42.17, 44.25)	1.35 (1.34, 1.36)
	2014	58 (56.93, 59.06)	41.42 (40.36, 42.48)	1.4 (1.39, 1.41)
	2015	57.1 (55.97, 58.22)	41.31 (40.2, 42.43)	1.38 (1.37, 1.39)
	2016	57.83 (56.62, 59.05)	41.73 (40.51, 42.94)	1.39 (1.38, 1.39)
	2017	57.84 (56.57, 59.11)	43.23 (41.95, 44.50)	1.34 (1.33, 1.35)
MI, multiple imputation; OA, osteoarthritis; 95%CI, 95% confidence interval; D, denominator; N, numerator				

Appendix 2.8.4. Imputed period prevalence of number of ≥3 modifiable cardiovascular risk factors in OA and matched non-OA individuals by subgroups, 1992-2017

Subgroups	Prevalence (95%CI)		Prevalence rate ratio (95%CI)
	OA	Non-OA	
Gender/ age group (years)			
Women, all	23.68 (23.45, 23.9)	14.81 (14.62, 14.99)	1.6 (1.58, 1.62)
35-44	14.94 (14.07, 15.82)	10.25 (9.51, 11)	1.46 (1.43, 1.48)
45-54	20.96 (20.48, 21.44)	13.67 (13.27, 14.08)	1.53 (1.51, 1.55)
55-64	24.65 (24.25, 25.06)	15.29 (14.95, 15.63)	1.61 (1.59, 1.63)
65-74	27.31 (26.84, 27.77)	16.11 (15.73, 16.49)	1.69 (1.67, 1.72)
75-84	23.49 (22.93, 24.05)	15.5 (15.03, 15.98)	1.52 (1.50, 1.53)
85+	15.17 (14.09, 16.24)	9.61 (8.73, 10.5)	1.58 (1.55, 1.60)
Men, all	24.18 (23.88, 24.49)	21.37 (21.08, 21.67)	1.13 (1.12, 1.14)
35-44	14.35 (13.38, 15.32)	11.02 (10.15, 11.89)	1.30 (1.28, 1.32)
45-54	21.35 (20.72, 21.98)	18.19 (17.59, 18.78)	1.17 (1.16, 1.19)
55-64	27.48 (26.94, 28.02)	24.14 (23.63, 24.66)	1.14 (1.13, 1.15)
65-74	26.93 (26.29, 27.57)	24.89 (24.26, 25.51)	1.08 (1.07, 1.09)
75-84	20.7 (19.86, 21.54)	19.01 (18.19, 19.83)	1.09 (1.08, 1.10)
85+	13.72 (11.64, 15.8)	9.49 (7.72, 11.26)	1.45 (1.42, 1.47)
Region			
North East	24.25 (23.01, 25.49)	17.57 (16.47, 18.67)	1.38 (1.36, 1.40)
North West	24.24 (23.73, 24.75)	18.57 (18.11, 19.04)	1.30 (1.29, 1.32)
Yorkshire & The Humber	21.39 (20.55, 22.22)	14.89 (14.16, 15.61)	1.44 (1.42, 1.46)
East Midlands	20.25 (19.41, 21.08)	16.29 (15.52, 17.05)	1.24 (1.23, 1.26)
West Midlands	23.86 (23.30, 24.42)	18.21 (17.7, 18.71)	1.31 (1.30, 1.33)
East of England	21.18 (20.58, 21.77)	15.02 (14.50, 15.54)	1.41 (1.39, 1.43)
South West	23.35 (22.73, 23.96)	15.32 (14.79, 15.84)	1.52 (1.51, 1.54)
South Central	22.62 (22.05, 23.19)	14.07 (13.60, 14.54)	1.61 (1.59, 1.63)
London	24.82 (24.15, 25.5)	16.10 (15.53, 16.68)	1.54 (1.52, 1.56)
South East Coast	21.97 (21.39, 22.56)	15.06 (14.56, 15.57)	1.46 (1.44, 1.48)
Northern Ireland	24.41 (23.36, 25.46)	18.82 (17.87, 19.78)	1.30 (1.28, 1.31)
Scotland	26.37 (25.76, 26.97)	20.24 (19.69, 20.79)	1.30 (1.29, 1.32)

	Wales	27.70 (27.13, 28.27)	20.34 (19.83, 20.85)	1.36 (1.35, 1.38)
Calendar year				
	1992	11.27 (9.21, 13.33)	10.06 (8.09, 12.02)	1.12 (1.1, 1.14)
	1993	11.13 (9.87, 12.40)	9.91 (8.70, 11.11)	1.12 (1.1, 1.14)
	1994	13.36 (12.14, 14.59)	9.39 (8.34, 10.44)	1.42 (1.4, 1.45)
	1995	14.32 (13.11, 15.52)	10.65 (9.59, 11.71)	1.34 (1.32, 1.37)
	1996	14.95 (13.83, 16.07)	10.36 (9.4, 11.32)	1.44 (1.42, 1.47)
	1997	16.17 (15.1, 17.25)	12.8 (11.83, 13.78)	1.26 (1.24, 1.28)
	1998	16.41 (15.38, 17.43)	13.56 (12.61, 14.5)	1.21 (1.19, 1.23)
	1999	17.85 (16.84, 18.87)	13.62 (12.71, 14.53)	1.31 (1.29, 1.33)
	2000	19.37 (18.33, 20.41)	15.29 (14.35, 16.24)	1.27 (1.25, 1.28)
	2001	20.94 (19.92, 21.96)	15.38 (14.47, 16.28)	1.36 (1.34, 1.38)
	2002	21.45 (20.51, 22.4)	15.69 (14.85, 16.52)	1.37 (1.35, 1.39)
	2003	23.52 (22.67, 24.38)	17.13 (16.37, 17.89)	1.37 (1.36, 1.39)
	2004	25.17 (24.36, 25.97)	17.35 (16.65, 18.05)	1.45 (1.43, 1.47)
	2005	24.94 (24.19, 25.68)	17.84 (17.18, 18.5)	1.4 (1.38, 1.41)
	2006	26.05 (25.32, 26.79)	17.74 (17.1, 18.38)	1.47 (1.45, 1.49)
	2007	25.49 (24.81, 26.16)	17.53 (16.94, 18.12)	1.45 (1.44, 1.47)
	2008	25.92 (25.29, 26.55)	18.22 (17.66, 18.77)	1.42 (1.41, 1.44)
	2009	26.83 (26.13, 27.52)	18.44 (17.83, 19.04)	1.46 (1.44, 1.47)
	2010	25.87 (25.11, 26.62)	18.9 (18.22, 19.57)	1.37 (1.35, 1.38)
	2011	25.64 (24.83, 26.44)	18.57 (17.85, 19.29)	1.38 (1.36, 1.4)
	2012	26.16 (25.28, 27.03)	18.74 (17.96, 19.51)	1.4 (1.38, 1.41)
	2013	25.79 (24.87, 26.71)	19.47 (18.64, 20.3)	1.32 (1.31, 1.34)
	2014	25.28 (24.34, 26.21)	18.02 (17.19, 18.85)	1.4 (1.39, 1.42)
	2015	25.52 (24.53, 26.5)	18.19 (17.32, 19.07)	1.4 (1.39, 1.42)
	2016	25.79 (24.72, 26.87)	18.81 (17.85, 19.77)	1.37 (1.36, 1.39)
	2017	26.42 (25.29, 27.56)	19.13 (18.12, 20.14)	1.38 (1.37, 1.4)

MI, multiple imputation; OA, osteoarthritis; 95%CI, 95% confidence interval; D, denominator; N, numerator

Chapter 3 appendices

Appendix 3.1. Subgroup analyses for the inequality in the prevalence of modifiable cardiovascular risk factors in samples with and without osteoarthritis

Appendix 3.1.1. Inequality in the prevalence of current smoking in OA and non-OA samples by subgroups, 1992-2017

OA status	Subgroup	Period prevalence by IMD decile (%) (95%CI)										Slope index of inequality (95%CI)(%)	Relative index of inequality (95%CI)
		1 (Least deprived)	2	3	4	5	6	7	8	9	10(Most deprived)		
OA	1992	12.5 (2.66, 32.36)	23.26 (11.76, 38.63)	13.51 (4.54, 28.77)	18.46 (9.92, 30.03)	19.51 (8.82, 34.87)	17.14 (6.56, 33.65)	14.58 (6.07, 27.76)	20.37 (10.63, 33.53)	27.5 (14.6, 43.89)	33.9 (22.08, 47.39)	15.07 (0.71, 29.16)	2.13 (1.02, 6.08)
Non-OA	1992	4.17 (0.11, 21.12)	2.78 (0.07, 14.53)	9.8 (3.26, 21.41)	11.11 (4.59, 21.56)	15.22 (6.34, 28.87)	22 (11.53, 35.96)	6.38 (1.34, 17.54)	21.74 (10.95, 36.36)	9.52 (1.17, 30.38)	11.11 (4.59, 21.56)	8.64 (-2.16, 19.11)	2.11 (0.86, 8.72)
OA	1993	16 (10.06, 23.62)	15.31 (8.83, 23.99)	15.63 (9.81, 23.09)	21.28 (15.66, 27.83)	16.67 (11.54, 22.93)	18.93 (13.33, 25.67)	20.57 (14.23, 28.18)	24.14 (16.68, 32.96)	25.56 (16.94, 35.84)	32.85 (25.07, 41.38)	14.7 (6.8, 22.4)	2.11 (1.41, 3.48)
Non-OA	1993	8.7 (4.25, 15.41)	12.5 (7.17, 19.78)	8.66 (4.4, 14.97)	11.79 (7.78, 16.91)	18.75 (13.27, 25.31)	13.48 (8.31, 20.24)	8.96 (4.71, 15.12)	10.81 (5.71, 18.12)	18.56 (11.38, 27.73)	20.14 (13.82, 27.78)	7.96 (1.35, 14.54)	1.85 (1.1, 3.43)
OA	1994	12.99 (8.12, 19.34)	26.12 (18.92, 34.41)	22.45 (15.98, 30.06)	20 (14.92, 25.9)	20.9 (15.17, 27.64)	18.65 (13.42, 24.88)	21.68 (15.23, 29.34)	24.14 (16.68, 32.96)	34.92 (26.65, 43.92)	28.49 (22.01, 35.7)	11.99 (4.45, 19.44)	1.72 (1.21, 2.54)
Non-OA	1994	5.29 (2.45, 9.81)	12.14 (7.24, 18.73)	13.13 (8.31, 19.36)	12.44 (8.43, 17.48)	8.98 (5.11, 14.38)	13.21 (8.37, 19.48)	12.98 (7.74, 19.96)	17.8 (11.37, 25.91)	15.33 (9.75, 22.47)	23.08 (17.17, 29.89)	13.12 (6.82, 19.23)	2.93 (1.71, 6.22)
OA	1995	12.57 (7.96, 18.58)	23.26 (16.27, 31.51)	20.39 (14.3, 27.68)	18.39 (13.53, 24.1)	19.02 (13.89, 25.08)	23.47 (17.72, 30.04)	28.85 (21.88, 36.63)	26.15 (18.84, 34.58)	29.79 (22.38, 38.06)	27.92 (21.78, 34.74)	15.22 (8.05, 22.42)	2.01 (1.45, 2.94)

Non-OA	1995	8.38 (4.66, 13.67)	14.38 (9.13, 21.14)	11.11 (6.82, 16.81)	11.56 (7.47, 16.84)	13.24 (8.91, 18.67)	13.71 (8.99, 19.72)	21.08 (15.15, 28.08)	16.44 (10.83, 23.46)	23.58 (16.39, 32.07)	18.18 (13.07, 24.27)	12.07 (5.85, 18.17)	2.37 (1.51, 4.14)
OA	1996	15.97 (11.55, 21.25)	17.5 (12.5, 23.49)	18.75 (13.02, 25.67)	18.5 (13.92, 23.84)	20.26 (15.23, 26.09)	27.6 (21.82, 34)	26.6 (20.66, 33.24)	25.71 (19.42, 32.85)	30.9 (24.2, 38.25)	40.77 (34.4, 47.38)	23.97 (17.29, 30.63)	2.96 (2.12, 4.38)
Non-OA	1996	11.48 (7.76, 16.16)	11.86 (7.67, 17.26)	11.3 (7.04, 16.91)	12.16 (8.41, 16.81)	13.56 (9.46, 18.6)	13.6 (9.43, 18.74)	15.42 (10.73, 21.17)	11.63 (7.25, 17.39)	15.13 (9.84, 21.83)	23.48 (18.16, 29.5)	9.08 (3.48, 14.54)	1.96 (1.28, 3.19)
OA	1997	22.5 (18.04, 27.48)	18.33 (13.74, 23.68)	15.79 (11.31, 21.18)	20.49 (15.95, 25.67)	25.17 (20.34, 30.5)	23.14 (17.98, 28.97)	25.62 (20.24, 31.61)	32.95 (26.07, 40.43)	25.47 (18.94, 32.92)	38.82 (32.81, 45.1)	17.27 (11.13, 23.46)	2.09 (1.57, 2.87)
Non-OA	1997	13.38 (9.81, 17.65)	14.45 (10.38, 19.37)	11.97 (8.1, 16.83)	13.99 (10.23, 18.5)	11.87 (8.54, 15.93)	14.17 (10.13, 19.08)	17.76 (12.88, 23.55)	17.65 (12.23, 24.22)	17.5 (11.95, 24.29)	25.1 (19.78, 31.04)	9.58 (4.3, 14.84)	1.9 (1.32, 2.89)
OA	1998	17.01 (13.15, 21.48)	21.97 (17.13, 27.45)	17.44 (13.19, 22.39)	23.48 (19.11, 28.31)	25.45 (20.86, 30.48)	25.6 (20.7, 31)	25.69 (20.03, 32.02)	28.89 (23.06, 35.29)	29.76 (23.59, 36.52)	33.21 (27.63, 39.16)	16.04 (10.35, 21.65)	1.98 (1.54, 2.6)
Non-OA	1998	12.92 (9.62, 16.86)	12.32 (8.74, 16.72)	15.83 (11.61, 20.86)	14.59 (10.96, 18.87)	16.52 (12.76, 20.87)	18.15 (13.82, 23.16)	17.52 (13.21, 22.55)	19.21 (14.32, 24.92)	20.13 (14.19, 27.21)	26.38 (21.07, 32.25)	11.89 (6.7, 17.04)	2.08 (1.5, 2.97)
OA	1999	19.66 (15.66, 24.18)	20.96 (16.72, 25.72)	18.3 (14.2, 23)	24.35 (19.91, 29.23)	23.81 (19.6, 28.43)	23.45 (18.83, 28.6)	25.09 (20.08, 30.65)	31.76 (26.1, 37.86)	34.2 (28.55, 40.21)	35.05 (29.57, 40.84)	17.35 (11.99, 22.82)	2.05 (1.63, 2.64)
Non-OA	1999	14.24 (10.69, 18.44)	11.66 (8.38, 15.65)	16.06 (12.27, 20.48)	17.32 (13.54, 21.64)	17.68 (13.97, 21.9)	18.61 (14.48, 23.34)	20.95 (16.45, 26.03)	18.85 (14.15, 24.33)	21.43 (16.53, 27.02)	22.79 (18.12, 28.02)	10.3 (5.49, 15.11)	1.82 (1.36, 2.45)
OA	2000	20 (16.02, 24.48)	16.13 (12.21, 20.71)	20.17 (16.1, 24.75)	28.04 (23.57, 32.86)	22.7 (18.65, 27.18)	26.18 (21.09, 31.8)	28.01 (22.85, 33.65)	30.57 (25.08, 36.5)	36.17 (30.02, 42.67)	37.82 (32.42, 43.46)	20.58 (15.07, 26.07)	2.31 (1.81, 3)

Non-OA	2000	12.29 (9.04, 16.19)	15.18 (11.51, 19.47)	13.7 (10.34, 17.66)	14.86 (11.51, 18.75)	15.27 (11.86, 19.21)	23.33 (18.66, 28.54)	22.98 (17.9, 28.73)	26.52 (21.29, 32.27)	19.92 (15.11, 25.46)	24.91 (19.86, 30.52)	14.7 (9.95, 19.44)	2.36 (1.75, 3.31)
OA	2001	20.49 (16.47, 25)	22.34 (18.27, 26.83)	20.93 (16.75, 25.62)	21.77 (17.91, 26.04)	27.43 (23.17, 32.01)	24.76 (20.13, 29.88)	25.55 (20.84, 30.73)	29.18 (23.93, 34.88)	24.55 (19.6, 30.05)	34.69 (29.66, 39.99)	11.85 (6.69, 17.1)	1.62 (1.31, 2.03)
Non-OA	2001	14.32 (10.98, 18.23)	11.55 (8.42, 15.34)	16.85 (13.17, 21.07)	17.59 (14.05, 21.6)	18.43 (14.9, 22.41)	16.34 (12.68, 20.57)	17.8 (13.7, 22.53)	17.62 (13.2, 22.8)	21.3 (16.63, 26.6)	27.27 (22.29, 32.72)	10.55 (5.88, 15.13)	1.85 (1.41, 2.52)
OA	2002	19.57 (16.08, 23.45)	24.44 (20.54, 28.69)	20.18 (16.57, 24.18)	20.79 (17.33, 24.6)	23.21 (19.6, 27.15)	23.97 (19.81, 28.54)	30.83 (26.4, 35.53)	25.39 (21.12, 30.04)	28.84 (23.93, 34.15)	36.89 (31.8, 42.2)	13.79 (9.02, 18.43)	1.77 (1.45, 2.19)
Non-OA	2002	12.32 (9.53, 15.57)	12.78 (9.83, 16.24)	12.96 (10.12, 16.24)	15.67 (12.61, 19.15)	19.14 (15.73, 22.92)	19.25 (15.5, 23.46)	19.95 (16.17, 24.17)	20.67 (16.59, 25.24)	21.64 (17.15, 26.69)	27.64 (23.02, 32.63)	14.8 (10.72, 18.97)	2.44 (1.88, 3.29)
OA	2003	16.89 (14.15, 19.92)	18.77 (15.8, 22.03)	21.49 (18.21, 25.07)	21.72 (18.74, 24.94)	20.36 (17.23, 23.78)	28.46 (24.65, 32.52)	23.87 (20.22, 27.82)	29.04 (24.78, 33.6)	29.38 (24.99, 34.08)	34.88 (30.59, 39.37)	16.85 (12.88, 20.92)	2.1 (1.75, 2.57)
Non-OA	2003	11.21 (8.93, 13.83)	14.93 (12.3, 17.88)	18.47 (15.42, 21.85)	15.44 (12.81, 18.38)	16.98 (14.15, 20.11)	21.26 (17.83, 25.03)	19.39 (16, 23.16)	21.95 (18.17, 26.1)	21.91 (17.94, 26.31)	28.07 (23.88, 32.57)	13.74 (10.15, 17.38)	2.21 (1.77, 2.83)
OA	2004	18.4 (15.64, 21.42)	20.41 (17.54, 23.52)	19.18 (16.35, 22.28)	24.71 (21.7, 27.91)	22.12 (19.22, 25.23)	25.57 (22.17, 29.2)	26.46 (22.92, 30.24)	27.82 (23.99, 31.91)	28.97 (25.02, 33.18)	37.37 (33.02, 41.87)	15.72 (11.94, 19.52)	1.95 (1.66, 2.32)
Non-OA	2004	15.45 (12.95, 18.21)	14.63 (12.11, 17.44)	17.64 (14.98, 20.55)	18.57 (15.9, 21.47)	20.81 (17.84, 24.03)	17.83 (14.95, 21.01)	20.35 (17.12, 23.89)	24.21 (20.53, 28.19)	23.42 (19.56, 27.65)	28.44 (24.61, 32.51)	12.13 (8.62, 15.56)	1.9 (1.57, 2.32)
OA	2005	18.3 (15.78, 21.03)	20.02 (17.37, 22.89)	19.3 (16.63, 22.21)	20.58 (17.93, 23.44)	22.04 (19.27, 25)	22.66 (19.57, 25.99)	23.25 (20.1, 26.63)	28.45 (24.9, 32.22)	29.79 (26.04, 33.75)	34.85 (30.6, 39.3)	14.47 (10.98, 17.92)	1.92 (1.63, 2.28)

Non-OA	2005	14.61 (12.34, 17.11)	15.26 (12.96, 17.8)	13.61 (11.28, 16.22)	19.54 (16.89, 22.41)	17.69 (15.22, 20.37)	19.3 (16.35, 22.53)	22.96 (19.81, 26.36)	23.33 (20, 26.93)	23.84 (20.29, 27.67)	28.54 (24.6, 32.75)	13.77 (10.46, 17.03)	2.13 (1.77, 2.61)
OA	2006	17.54 (15.02, 20.29)	17.88 (15.38, 20.59)	18.65 (16.09, 21.42)	20.55 (17.91, 23.4)	22.65 (19.85, 25.63)	22.19 (19.24, 25.36)	26.3 (23.1, 29.7)	28.3 (24.85, 31.96)	33.07 (29.02, 37.33)	34.91 (30.76, 39.24)	17.86 (14.42, 21.27)	2.25 (1.91, 2.71)
Non-OA	2006	14.76 (12.47, 17.3)	16.94 (14.58, 19.51)	16.95 (14.46, 19.67)	18.5 (16.03, 21.18)	16.95 (14.6, 19.51)	23.64 (20.46, 27.06)	23.62 (20.45, 27.02)	25.46 (22.02, 29.14)	25.24 (21.59, 29.16)	32.13 (27.81, 36.69)	14.96 (11.65, 18.3)	2.17 (1.8, 2.62)
OA	2007	18.08 (15.72, 20.64)	16.68 (14.36, 19.22)	19.49 (16.99, 22.17)	21.22 (18.68, 23.94)	19.09 (16.69, 21.68)	24.65 (21.67, 27.82)	24.9 (21.92, 28.08)	29.71 (26.35, 33.25)	31.5 (27.91, 35.27)	38.26 (34.22, 42.42)	18.95 (15.69, 22.2)	2.38 (2.02, 2.83)
Non-OA	2007	16.68 (14.52, 19.03)	15.73 (13.53, 18.14)	17.22 (14.85, 19.79)	19.05 (16.57, 21.73)	19.69 (17.24, 22.33)	23.62 (20.72, 26.73)	21.45 (18.58, 24.54)	22.9 (19.78, 26.25)	28.6 (24.85, 32.58)	35.9 (31.96, 39.99)	15.91 (12.75, 19.12)	2.22 (1.87, 2.66)
OA	2008	16.54 (14.46, 18.79)	21.12 (18.77, 23.63)	20.18 (17.87, 22.64)	20.77 (18.4, 23.31)	20.94 (18.51, 23.53)	25.43 (22.65, 28.37)	24.17 (21.42, 27.1)	31.38 (28.06, 34.83)	33.33 (29.89, 36.91)	41.61 (37.95, 45.34)	20.64 (17.59, 23.69)	2.47 (2.13, 2.9)
Non-OA	2008	14.67 (12.73, 16.79)	15.84 (13.78, 18.08)	17.89 (15.71, 20.25)	22.11 (19.66, 24.71)	19.86 (17.56, 22.31)	24.25 (21.49, 27.18)	25.7 (22.8, 28.77)	27.25 (24.1, 30.57)	32.07 (28.59, 35.71)	36.36 (32.69, 40.16)	20.76 (17.78, 23.74)	2.75 (2.34, 3.29)
OA	2009	16.7 (14.49, 19.1)	17.26 (14.84, 19.91)	18.77 (16.38, 21.34)	21.76 (19.17, 24.54)	20.92 (18.35, 23.68)	22.21 (19.19, 25.45)	25.16 (22.12, 28.4)	30.65 (27.19, 34.29)	32.03 (28.27, 35.97)	39.87 (35.95, 43.89)	20.98 (17.62, 24.23)	2.63 (2.22, 3.17)
Non-OA	2009	15.85 (13.63, 18.29)	16.92 (14.62, 19.43)	19.09 (16.77, 21.59)	18.83 (16.4, 21.45)	21.36 (18.72, 24.2)	22.01 (19.05, 25.2)	24.4 (21.35, 27.64)	24.36 (21.05, 27.92)	32.3 (28.61, 36.16)	38.48 (34.44, 42.63)	18.96 (15.77, 22.15)	2.5 (2.1, 3)
OA	2010	15.57 (13.14, 18.26)	17.34 (14.64, 20.32)	18.41 (15.79, 21.26)	21.96 (19.02, 25.14)	24.22 (21.17, 27.48)	24.15 (20.74, 27.82)	27.63 (24.11, 31.37)	35.48 (31.27, 39.87)	32.31 (28.3, 36.52)	39.27 (34.67, 44.02)	23.78 (20.15, 27.49)	2.93 (2.43, 3.63)

Non-OA	2010	14.85 (12.51, 17.45)	18.17 (15.5, 21.09)	18.89 (16.29, 21.72)	18.77 (16, 21.79)	21.05 (18.21, 24.13)	20.1 (16.94, 23.56)	25.09 (21.53, 28.92)	26.96 (23.11, 31.09)	31.06 (26.83, 35.54)	42.46 (37.74, 47.28)	20.54 (16.88, 24.23)	2.72 (2.24, 3.38)
OA	2011	16.15 (13.45, 19.15)	16.15 (13.41, 19.21)	19.82 (16.87, 23.04)	19.5 (16.52, 22.77)	20.4 (17.25, 23.84)	24.76 (21.09, 28.71)	27.35 (23.49, 31.47)	30.5 (26.02, 35.27)	34.38 (29.82, 39.16)	37.1 (32.17, 42.23)	21.97 (17.87, 25.99)	2.8 (2.27, 3.55)
Non-OA	2011	15.09 (12.57, 17.9)	16.64 (13.88, 19.7)	19.48 (16.52, 22.72)	18 (15.09, 21.2)	21.95 (18.71, 25.46)	21.03 (17.55, 24.85)	25.9 (22.12, 29.96)	30.58 (26.17, 35.28)	31.51 (27, 36.3)	36.18 (31.06, 41.53)	20.23 (16.29, 24.16)	2.68 (2.18, 3.4)
OA	2012	13.89 (11.27, 16.87)	19.49 (16.28, 23.04)	21.86 (18.47, 25.55)	19.8 (16.39, 23.57)	21.03 (17.62, 24.78)	24.53 (20.53, 28.89)	21.98 (17.88, 26.53)	25.07 (20.57, 30.01)	31.31 (26.21, 36.77)	42.47 (36.8, 48.3)	19.34 (14.92, 23.74)	2.49 (1.99, 3.2)
Non-OA	2012	15.93 (13.07, 19.14)	15.12 (12.26, 18.36)	16.45 (13.39, 19.89)	20.91 (17.29, 24.89)	22.95 (19.29, 26.94)	22.05 (18.26, 26.21)	27.01 (22.64, 31.74)	28.95 (24.61, 33.6)	30.09 (25.25, 35.28)	33.56 (28.17, 39.3)	19.8 (15.46, 24.15)	2.62 (2.08, 3.4)
OA	2013	14.18 (11.34, 17.42)	17.58 (14.06, 21.56)	19.35 (15.84, 23.26)	21.59 (17.67, 25.93)	21.21 (17.44, 25.39)	24.01 (19.8, 28.64)	28.65 (24.01, 33.65)	30.7 (25.76, 35.99)	34.55 (28.63, 40.86)	35.8 (29.94, 41.99)	22.53 (17.68, 27.27)	2.88 (2.23, 3.87)
Non-OA	2013	14.58 (11.68, 17.89)	18.74 (15.27, 22.61)	20.47 (16.89, 24.44)	23.26 (19.29, 27.62)	23 (19.09, 27.3)	21.61 (17.47, 26.22)	22.69 (18.31, 27.55)	30.55 (25.47, 35.99)	32.01 (26.57, 37.85)	43.33 (36.97, 49.86)	21.18 (16.43, 25.91)	2.65 (2.1, 3.48)
OA	2014	16.37 (13.05, 20.13)	20.75 (16.74, 25.24)	20.86 (16.85, 25.33)	18.72 (14.97, 22.95)	18.8 (15.01, 23.08)	27.83 (23.04, 33.03)	22.89 (18.13, 28.22)	35.71 (29.96, 41.79)	36.55 (30.56, 42.86)	41.87 (35, 48.98)	22.94 (17.72, 28.27)	2.79 (2.15, 3.78)
Non-OA	2014	16.11 (12.82, 19.85)	19.53 (15.89, 23.6)	19.26 (15.53, 23.44)	21.19 (17.05, 25.82)	20.11 (16.18, 24.51)	25.08 (20.33, 30.32)	27.69 (22.76, 33.06)	27.45 (22.07, 33.37)	29.56 (23.37, 36.35)	38.35 (31.68, 45.36)	18.02 (12.98, 23.2)	2.29 (1.78, 3.04)
OA	2015	15.35 (12.17, 18.99)	21.07 (16.72, 25.97)	19.08 (14.82, 23.95)	20.13 (15.73, 25.14)	20.76 (16.58, 25.45)	21.46 (16.37, 27.29)	24.89 (19.52, 30.9)	28.5 (22.56, 35.06)	30.05 (23.68, 37.05)	37.17 (30.31, 44.45)	17.76 (12.22, 23.35)	2.31 (1.75, 3.17)

Non-OA	2015	14.01 (10.81, 17.73)	14.72 (11.06, 19.04)	16.67 (12.81, 21.13)	18.59 (14.43, 23.36)	24.44 (19.76, 29.6)	25.09 (20.11, 30.6)	25.11 (19.65, 31.22)	27.92 (21.78, 34.74)	36.82 (30.43, 43.56)	38.1 (30.72, 45.89)	25.2 (19.69, 30.84)	3.59 (2.59, 5.34)
OA	2016	15.94 (12.24, 20.24)	20.15 (15.51, 25.46)	23.71 (18.39, 29.71)	17.88 (12.56, 24.29)	22.87 (17.53, 28.95)	21.64 (15.72, 28.57)	27.68 (21.24, 34.9)	32.08 (24.9, 39.93)	26 (19.19, 33.79)	33.33 (25.09, 42.4)	15.81 (9.22, 22.3)	2.06 (1.5, 2.91)
Non-OA	2016	17.88 (14.05, 22.25)	20.22 (15.57, 25.55)	18.06 (13.17, 23.85)	27.22 (20.87, 34.34)	26.5 (20.96, 32.64)	25.52 (18.65, 33.42)	21.76 (16.16, 28.26)	29.61 (22.48, 37.54)	35.76 (28.46, 43.58)	43.22 (34.13, 52.66)	20.43 (13.73, 27.22)	2.4 (1.75, 3.45)
OA	2017	14.2 (10.62, 18.43)	18.58 (13.98, 23.93)	18.84 (13.75, 24.84)	26.01 (19.65, 33.22)	21.89 (16.38, 28.25)	22.22 (15.3, 30.49)	26.06 (19.06, 34.08)	34.75 (26.94, 43.22)	34.86 (25.99, 44.58)	45.98 (35.23, 57)	25.44 (18.39, 32.56)	3.38 (2.32, 5.56)
Non-OA	2017	17.09 (13.33, 21.4)	21.3 (16.63, 26.6)	16.4 (11.42, 22.47)	29.53 (22.35, 37.55)	19.9 (14.48, 26.27)	29.01 (21.41, 37.58)	28.77 (21.58, 36.83)	37.27 (28.24, 47.01)	35.48 (27.1, 44.58)	40.63 (30.71, 51.13)	23.18 (15.77, 30.48)	2.77 (1.96, 4.2)
OA	Age 35-44 years	26.75 (23.12, 30.63)	24.29 (20.7, 28.17)	22.12 (18.68, 25.87)	29.07 (25.39, 32.95)	32.75 (28.92, 36.76)	31.82 (27.94, 35.89)	32.66 (28.73, 36.78)	42.63 (38.26, 47.09)	43.59 (39.47, 47.77)	47.27 (43.41, 51.16)	26.64 (22.28, 31.03)	2.32 (1.99, 2.73)
Non-OA	Age 35-44 years	24.32 (21.02, 27.87)	25.75 (22.2, 29.56)	25.7 (22.27, 29.37)	24.58 (21.18, 28.24)	32.52 (28.82, 36.39)	34.48 (30.29, 38.86)	36.3 (32.23, 40.51)	36.53 (32.21, 41.02)	42.69 (38.37, 47.1)	48.06 (43.89, 52.26)	25.71 (21.45, 30.17)	2.29 (1.97, 2.69)
OA	Age 45-54 years	20.29 (18.79, 21.85)	23.6 (21.86, 25.42)	23.6 (21.85, 25.42)	27.81 (26.03, 29.64)	27.74 (25.93, 29.6)	30.16 (28.2, 32.17)	33.01 (31, 35.08)	37.3 (35.09, 39.54)	40.53 (38.26, 42.82)	46.98 (44.76, 49.2)	26.39 (24.26, 28.51)	2.54 (2.33, 2.77)
Non-OA	Age 45-54 years	18.28 (16.87, 19.75)	20.8 (19.22, 22.45)	21.95 (20.29, 23.69)	24.45 (22.77, 26.19)	26.79 (25.05, 28.59)	29.6 (27.65, 31.61)	31.29 (29.23, 33.42)	33.65 (31.45, 35.91)	37.63 (35.31, 40.01)	42.03 (39.72, 44.36)	24.22 (22.15, 26.34)	2.57 (2.35, 2.83)
OA	Age 55-64 years	17.55 (16.47, 18.69)	19.93 (18.71, 21.19)	21.2 (19.94, 22.5)	22.93 (21.69, 24.21)	23.35 (22.08, 24.66)	26.04 (24.58, 27.54)	27.4 (25.88, 28.96)	32.44 (30.7, 34.21)	33.65 (31.82, 35.51)	40.31 (38.43, 42.21)	20.71 (19.13, 22.27)	2.39 (2.22, 2.58)

Non-OA	Age 55-64 years	15.09 (14.07, 16.14)	16.66 (15.56, 17.81)	17.08 (15.93, 18.27)	21.04 (19.83, 22.29)	19.87 (18.69, 21.1)	21.98 (20.59, 23.41)	23.68 (22.23, 25.19)	25.76 (24.14, 27.44)	27.79 (26.02, 29.62)	33.84 (31.99, 35.72)	16.59 (15.1, 18.06)	2.29 (2.11, 2.49)
OA	Age 65-74 years	15.14 (13.96, 16.38)	17.53 (16.23, 18.89)	17.47 (16.18, 18.82)	18.08 (16.77, 19.45)	17.89 (16.6, 19.24)	20.42 (18.88, 22.02)	21.46 (19.85, 23.14)	24.27 (22.51, 26.11)	25.2 (23.26, 27.2)	30.21 (28.14, 32.33)	12.67 (10.96, 14.37)	1.93 (1.76, 2.12)
Non-OA	Age 65-74 years	11.44 (10.4, 12.55)	12.98 (11.84, 14.18)	14.11 (12.93, 15.35)	13.84 (12.66, 15.1)	14.72 (13.52, 15.98)	15.56 (14.2, 17.01)	17.28 (15.8, 18.85)	19.39 (17.74, 21.12)	20.56 (18.79, 22.42)	24.7 (22.83, 26.65)	11.49 (9.98, 13.03)	2.15 (1.93, 2.41)
OA	Age 75-84 years	12.14 (10.69, 13.71)	14.42 (12.84, 16.11)	15.51 (13.91, 17.22)	14.82 (13.26, 16.5)	15.56 (13.95, 17.28)	16.83 (14.97, 18.83)	16.99 (15.09, 19.01)	18.56 (16.48, 20.79)	18.85 (16.62, 21.25)	21.41 (19.03, 23.95)	7.72 (5.72, 9.74)	1.63 (1.43, 1.87)
Non-OA	Age 75-84 years	9.78 (8.46, 11.23)	9.9 (8.57, 11.36)	13.32 (11.81, 14.93)	11.06 (9.66, 12.58)	11.96 (10.52, 13.52)	12.56 (10.96, 14.32)	13.29 (11.62, 15.11)	14.66 (12.78, 16.69)	14.73 (12.74, 16.9)	16.79 (14.61, 19.16)	6.14 (4.27, 7.98)	1.65 (1.42, 1.94)
OA	Age 85+ years	9.88 (6.5, 14.24)	15.19 (11.12, 20.03)	11.07 (7.7, 15.27)	8.49 (5.4, 12.58)	11.31 (7.82, 15.67)	12.84 (8.71, 18.03)	10.33 (6.59, 15.22)	17.79 (12.25, 24.54)	11.46 (6.94, 17.51)	9.92 (5.39, 16.37)	0.9 (-4.05, 5.73)	1.08 (0.7, 1.68)
Non-OA	Age 85+ years	12.45 (8.56, 17.29)	6.51 (3.84, 10.22)	8.63 (5.61, 12.57)	8.54 (5.55, 12.44)	11.54 (8.08, 15.82)	11.85 (7.82, 16.99)	8.59 (5.08, 13.39)	8.25 (4.79, 13.05)	9.38 (4.94, 15.8)	10 (5.71, 15.96)	0.12 (-4.41, 4.66)	1.01 (0.62, 1.68)
OA	Men	19.7 (18.56, 20.87)	20.78 (19.56, 22.03)	20.39 (19.18, 21.64)	24.14 (22.87, 25.44)	23.73 (22.47, 25.03)	26.28 (24.83, 27.76)	28.57 (27.04, 30.13)	32.4 (30.72, 34.11)	33.84 (32.05, 35.67)	41.44 (39.61, 43.29)	20.05 (18.48, 21.61)	2.25 (2.1, 2.43)
Non-OA	Men	20.19 (19.04, 21.38)	21.82 (20.6, 23.08)	23.52 (22.25, 24.82)	25.85 (24.55, 27.18)	27.37 (26.03, 28.74)	29.69 (28.19, 31.22)	31.85 (30.26, 33.47)	33.53 (31.81, 35.28)	34.48 (32.7, 36.3)	42.64 (40.78, 44.5)	20.7 (19.11, 22.33)	2.18 (2.04, 2.33)
OA	Women	15.55 (14.8, 16.33)	18.4 (17.55, 19.27)	19.13 (18.28, 20.01)	19.98 (19.13, 20.85)	20.69 (19.83, 21.58)	23.1 (22.11, 24.12)	24.02 (23, 25.06)	28.28 (27.13, 29.46)	30.23 (29.02, 31.46)	35.06 (33.81, 36.33)	17.98 (16.94, 19.05)	2.33 (2.2, 2.46)

Non-OA	Women	11.59 (10.94, 12.26)	12.57 (11.87, 13.31)	13.4 (12.67, 14.16)	14.44 (13.69, 15.21)	15.1 (14.34, 15.88)	16.26 (15.39, 17.16)	17.61 (16.69, 18.55)	19.7 (18.68, 20.75)	22.77 (21.63, 23.94)	25.95 (24.77, 27.15)	13.35 (12.39, 14.33)	2.41 (2.24, 2.59)
OA	East Midlands	25.2 (19.98, 31)	24.4 (20.7, 28.41)	25.58 (21.53, 29.95)	27.3 (23.73, 31.1)	32.82 (27.72, 38.23)	28.53 (23.74, 33.71)	31.97 (28.42, 35.68)	31.12 (26.94, 35.54)	35.62 (31.57, 39.83)	34.88 (29.08, 41.04)	12.36 (7.57, 17.17)	1.52 (1.29, 1.8)
Non-OA	East Midlands	22.4 (17.39, 28.08)	21.31 (17.81, 25.16)	22.09 (18.52, 25.99)	26.02 (22.45, 29.84)	27.76 (22.76, 33.21)	25 (20.49, 29.96)	27.51 (24.02, 31.21)	23.93 (20.03, 28.18)	26.09 (22.6, 29.82)	24.79 (19.49, 30.73)	4.45 (-0.1, 8.86)	1.2 (1, 1.45)
OA	East of England	19.33 (17.7, 21.03)	20.36 (18.48, 22.35)	20 (17.85, 22.28)	22.99 (21.01, 25.05)	22.65 (20.51, 24.89)	25.1 (22.89, 27.42)	25.73 (23.37, 28.2)	27.41 (24.07, 30.94)	29.98 (25.72, 34.51)	30.91 (25.87, 36.32)	10.39 (7.72, 13)	1.59 (1.41, 1.79)
Non-OA	East of England	16.45 (14.93, 18.05)	17.17 (15.41, 19.05)	17.39 (15.39, 19.53)	18.18 (16.38, 20.09)	20.76 (18.73, 22.9)	24.21 (21.99, 26.55)	23.09 (20.75, 25.56)	23.05 (19.91, 26.44)	22.29 (18.64, 26.28)	26.95 (22.07, 32.27)	9.83 (7.4, 12.32)	1.66 (1.45, 1.9)
OA	London	15.87 (13.21, 18.82)	17.96 (15.54, 20.58)	21.13 (18.37, 24.1)	19.79 (17.51, 22.23)	21.73 (19.5, 24.09)	25.02 (22.47, 27.71)	22.59 (20.29, 25.03)	27.59 (25.02, 30.27)	29.24 (26.58, 32)	33.16 (28.52, 38.07)	14.34 (11.41, 17.3)	1.9 (1.66, 2.19)
Non-OA	London	16.05 (13.42, 18.97)	15.7 (13.44, 18.17)	17.88 (15.28, 20.73)	17.76 (15.6, 20.08)	16.24 (14.26, 18.37)	16.37 (14.22, 18.72)	17.76 (15.67, 20)	20.7 (18.38, 23.18)	24.02 (21.55, 26.63)	27.84 (23.33, 32.71)	8.57 (5.74, 11.34)	1.6 (1.37, 1.88)
OA	North East	12.46 (9.09, 16.52)	17.47 (13.13, 22.55)	19.41 (13.75, 26.17)	15.12 (10.98, 20.08)	18.39 (12.93, 24.96)	22.47 (17.99, 27.48)	25.32 (20.62, 30.49)	28.97 (24.74, 33.48)	32.68 (26.99, 38.79)	40.02 (36.81, 43.3)	33.5 (28.43, 38.67)	4.38 (3.29, 6.22)
Non-OA	North East	11.9 (8.64, 15.86)	11.8 (8.7, 15.51)	18.44 (13.04, 24.9)	16.2 (11.55, 21.81)	22.04 (16.31, 28.69)	19.35 (15.11, 24.2)	18.82 (14.46, 23.83)	19.87 (16.27, 23.87)	30.45 (24.73, 36.66)	36.41 (33.16, 39.75)	29.61 (24.61, 34.59)	4.74 (3.41, 7.29)
OA	North West	16.07 (14.15, 18.15)	18.29 (16.55, 20.13)	19.57 (17.92, 21.3)	22.07 (20.07, 24.18)	20.86 (19.03, 22.78)	22.91 (20.93, 24.99)	26.24 (24.21, 28.36)	32.47 (30.34, 34.66)	32.16 (30.2, 34.18)	37.78 (36.05, 39.53)	24.3 (22.18, 26.5)	2.76 (2.49, 3.08)

Non-OA	North West	14.1 (12.33, 16.03)	15.25 (13.7, 16.91)	18.11 (16.52, 19.78)	18.46 (16.62, 20.41)	18.94 (17.14, 20.84)	21.83 (19.87, 23.89)	24.01 (22.06, 26.04)	27.8 (25.73, 29.95)	28.32 (26.37, 30.33)	33.17 (31.49, 34.88)	21.49 (19.46, 23.57)	2.78 (2.49, 3.13)
OA	South Central	18.66 (17.37, 20.01)	19.78 (17.87, 21.8)	21.4 (19.15, 23.79)	20.15 (18.05, 22.36)	21.6 (19.35, 23.99)	24.55 (21.97, 27.27)	22.09 (19.5, 24.86)	26.27 (23.11, 29.62)	36.11 (31.75, 40.65)	35.54 (28.28, 43.33)	10.76 (8.11, 13.36)	1.66 (1.46, 1.9)
Non-OA	South Central	15.22 (14.04, 16.45)	17.21 (15.42, 19.11)	18.84 (16.65, 21.18)	19.53 (17.48, 21.7)	19.19 (17.04, 21.48)	17.5 (15.3, 19.87)	21.43 (18.8, 24.24)	24.93 (21.74, 28.33)	25.5 (21.52, 29.81)	27.86 (20.62, 36.06)	9.38 (6.99, 11.83)	1.68 (1.46, 1.95)
OA	South East Coast	13.73 (12.27, 15.29)	16.41 (14.9, 18.01)	16.94 (15.33, 18.64)	17.82 (16.08, 19.66)	19.03 (17.07, 21.12)	23.24 (20.71, 25.91)	23.05 (20.09, 26.22)	26.88 (24.01, 29.9)	28.37 (25.05, 31.87)	36.45 (29.83, 43.48)	14.94 (12.51, 17.34)	2.28 (1.98, 2.65)
Non-OA	South East Coast	12.13 (10.76, 13.61)	13.18 (11.84, 14.61)	13.01 (11.56, 14.57)	15.47 (13.83, 17.23)	19.06 (17.1, 21.15)	20.08 (17.68, 22.65)	21.12 (18.21, 24.27)	22.81 (20.14, 25.65)	25.2 (21.87, 28.75)	31.35 (24.74, 38.57)	14.27 (12.03, 16.54)	2.53 (2.15, 3.03)
OA	South West	17.67 (15.13, 20.43)	20.62 (18.47, 22.91)	19.96 (17.91, 22.13)	22.42 (20.13, 24.84)	21.34 (19.67, 23.07)	23.27 (21.13, 25.51)	25.6 (23.11, 28.22)	31.6 (28.88, 34.42)	31.78 (28.85, 34.82)	35.57 (32.23, 39.02)	15.9 (13.17, 18.55)	1.98 (1.75, 2.25)
Non-OA	South West	14.66 (12.33, 17.24)	16.03 (14.09, 18.13)	17.89 (15.98, 19.92)	18.45 (16.33, 20.73)	17.72 (16.19, 19.32)	20.05 (18.03, 22.2)	21.2 (18.85, 23.69)	23.92 (21.47, 26.51)	27.99 (25.04, 31.08)	30.93 (27.66, 34.34)	13.4 (10.9, 15.86)	2 (1.75, 2.32)
OA	West Midlands	15.62 (14.01, 17.33)	21.03 (18.88, 23.32)	18.37 (16.72, 20.11)	22.81 (20.83, 24.89)	22.35 (20.43, 24.35)	22.66 (20.43, 25.01)	26.54 (24.16, 29.03)	30.88 (28.13, 33.74)	29.98 (27.29, 32.78)	37.59 (35.29, 39.92)	20.83 (18.48, 23.29)	2.51 (2.24, 2.84)
Non-OA	West Midlands	13.24 (11.74, 14.84)	16.56 (14.7, 18.57)	15.51 (14, 17.12)	19.57 (17.68, 21.58)	19.71 (17.88, 21.64)	21.72 (19.51, 24.06)	23.47 (21.2, 25.85)	26.79 (24.11, 29.6)	29.51 (26.78, 32.35)	30.02 (27.81, 32.31)	18.74 (16.44, 21)	2.64 (2.32, 3.04)
OA	Yorkshire & The Humber	14.67 (11.39, 18.48)	19.12 (15.32, 23.4)	20.55 (17.23, 24.19)	21.91 (19.71, 24.24)	23.63 (20.55, 26.93)	28.87 (25.35, 32.59)	28.4 (24.81, 32.21)	29.52 (25.28, 34.04)	31.39 (26.93, 36.12)	38.59 (34.74, 42.54)	20.87 (16.96, 24.61)	2.38 (2, 2.89)

Non-OA	Yorkshire & The Humber	11.16 (8.35, 14.53)	14.32 (10.95, 18.27)	16.26 (13.43, 19.42)	17.07 (15.02, 19.26)	20.51 (17.81, 23.42)	24.29 (21.01, 27.82)	25.04 (21.53, 28.82)	23.61 (19.61, 28)	25.82 (21.42, 30.61)	31.2 (27.43, 35.15)	18.39 (14.69, 21.99)	2.6 (2.12, 3.26)

IMD, Indices of multiple deprivation; 95%CI, 95% confidence interval; OA, osteoarthritis

Appendix 3.1.2. Inequality in the prevalence of hypertension in OA and non-OA samples by subgroups, 1992-2017

OA status	Subgroup	Period prevalence by IMD decile (%) (95%CI)										Slope index of inequality (95%CI)(%)	Relative index of inequality (95%CI)
		1 (Least deprived)	2	3	4	5	6	7	8	9	10(Most deprived)		
OA	1992	25 (9.77, 46.71)	23.26 (11.76, 38.63)	16.22 (6.19, 32.01)	29.23 (18.6, 41.83)	39.02 (24.2, 55.5)	31.43 (16.85, 49.29)	37.5 (23.95, 52.65)	18.52 (9.25, 31.43)	35 (20.63, 51.68)	16.95 (8.44, 28.97)	-1.51 (-16.02, 12.42)	0.95 (0.54, 1.63)
Non-OA	1992	12.5 (2.66, 32.36)	27.78 (14.2, 45.19)	27.45 (15.89, 41.74)	15.87 (7.88, 27.26)	26.09 (14.27, 41.13)	20 (10.03, 33.72)	21.28 (10.7, 35.66)	32.61 (19.53, 48.02)	19.05 (5.45, 41.91)	15.87 (7.88, 27.26)	-1.99 (-15.83, 11.97)	0.91 (0.46, 1.78)
OA	1993	24 (16.82, 32.46)	27.55 (19.01, 37.5)	21.88 (15.05, 30.04)	27.66 (21.4, 34.64)	21.67 (15.88, 28.41)	27.22 (20.67, 34.59)	28.37 (21.1, 36.57)	30.17 (22, 39.39)	32.22 (22.75, 42.9)	26.28 (19.13, 34.48)	5.63 (-3.04, 14.27)	1.24 (0.9, 1.73)
Non-OA	1993	19.13 (12.39, 27.52)	25 (17.55, 33.73)	21.26 (14.5, 29.4)	20.28 (15.09, 26.33)	22.16 (16.26, 29.02)	27.66 (20.47, 35.82)	23.13 (16.29, 31.2)	25.23 (17.46, 34.35)	27.84 (19.21, 37.86)	20.86 (14.44, 28.57)	3.96 (-3.9, 11.99)	1.19 (0.83, 1.71)
OA	1994	27.92 (21, 35.71)	29.1 (21.58, 37.57)	29.25 (22.05, 37.31)	23.64 (18.19, 29.81)	26.55 (20.21, 33.7)	25.91 (19.88, 32.69)	34.97 (27.19, 43.38)	26.72 (18.93, 35.74)	38.89 (30.34, 47.98)	27.93 (21.5, 35.12)	4.95 (-2.82, 13.02)	1.19 (0.9, 1.59)
Non-OA	1994	22.35 (16.33, 29.37)	23.57 (16.81, 31.48)	23.75 (17.39, 31.11)	25.33 (19.79, 31.54)	23.95 (17.7, 31.16)	23.9 (17.5, 31.3)	18.32 (12.11, 26.02)	19.49 (12.78, 27.8)	26.28 (19.13, 34.48)	28.02 (21.63, 35.14)	2.06 (-5.47, 9.88)	1.09 (0.79, 1.51)
OA	1995	19.16 (13.49, 25.96)	31.01 (23.16, 39.75)	23.03 (16.59, 30.54)	30.04 (24.11, 36.52)	24.39 (18.68, 30.86)	30.1 (23.77, 37.05)	32.05 (24.81, 39.99)	33.85 (25.78, 42.66)	34.04 (26.28, 42.49)	35.53 (28.86, 42.65)	14.17 (6.56, 21.8)	1.64 (1.25, 2.21)
Non-OA	1995	20.36 (14.53, 27.27)	22.6 (16.1, 30.25)	21.64 (15.72, 28.57)	23.62 (17.9, 30.14)	19.12 (13.96, 25.19)	28.57 (22.01, 35.88)	26.51 (19.97, 33.9)	24.66 (17.91, 32.47)	21.95 (14.99, 30.31)	20.71 (15.29, 27.02)	2.05 (-4.98, 9.21)	1.09 (0.8, 1.51)

OA	1996	22.69 (17.53, 28.54)	27.5 (21.44, 34.24)	25.62 (19.06, 33.12)	27.56 (22.16, 33.49)	30.4 (24.48, 36.83)	33.03 (26.87, 39.66)	25.12 (19.31, 31.67)	27.43 (20.97, 34.67)	30.9 (24.2, 38.25)	28.76 (23.03, 35.03)	5.19 (-1.7, 12.02)	1.21 (0.94, 1.56)
Non-OA	1996	22.54 (17.46, 28.31)	24.74 (18.84, 31.43)	23.16 (17.16, 30.08)	22.35 (17.39, 27.97)	23.73 (18.45, 29.68)	19.74 (14.78, 25.5)	23.88 (18.16, 30.39)	18.02 (12.59, 24.6)	24.34 (17.75, 31.96)	30.43 (24.56, 36.82)	2.99 (-3.8, 9.68)	1.14 (0.85, 1.53)
OA	1997	20.31 (16.04, 25.14)	31.08 (25.41, 37.2)	28.51 (22.74, 34.84)	29.33 (24.09, 35.01)	25.5 (20.65, 30.85)	33.06 (27.16, 39.37)	35.54 (29.51, 41.92)	27.84 (21.36, 35.08)	34.78 (27.46, 42.68)	30.2 (24.62, 36.23)	9.44 (3.13, 15.75)	1.39 (1.11, 1.75)
Non-OA	1997	23.89 (19.28, 28.99)	27.34 (21.98, 33.24)	25.21 (19.78, 31.28)	22.87 (18.18, 28.11)	23.44 (18.9, 28.47)	30.71 (25.09, 36.78)	22.9 (17.45, 29.12)	28.24 (21.61, 35.64)	30.63 (23.59, 38.39)	25.1 (19.78, 31.04)	3.01 (-3.25, 9.17)	1.12 (0.88, 1.43)
OA	1998	24.48 (19.97, 29.45)	26.14 (20.94, 31.88)	24.56 (19.64, 30.02)	26.96 (22.34, 31.97)	27.84 (23.1, 32.98)	28.33 (23.24, 33.86)	25.23 (19.61, 31.54)	29.78 (23.88, 36.21)	30.73 (24.49, 37.54)	29.89 (24.5, 35.72)	6.07 (0.13, 11.92)	1.25 (1.01, 1.56)
Non-OA	1998	21.63 (17.46, 26.27)	28.17 (23.01, 33.79)	24.71 (19.58, 30.43)	24.01 (19.5, 29)	25.8 (21.26, 30.75)	25.62 (20.62, 31.15)	28.47 (23.2, 34.21)	27.07 (21.43, 33.32)	26.42 (19.75, 33.98)	26.77 (21.43, 32.66)	4.19 (-1.61, 10.07)	1.18 (0.94, 1.49)
OA	1999	26.69 (22.16, 31.6)	25.15 (20.59, 30.16)	25.55 (20.84, 30.73)	29.28 (24.53, 34.39)	30.16 (25.57, 35.06)	29.97 (24.9, 35.43)	33.45 (27.9, 39.37)	32.16 (26.47, 38.27)	29.74 (24.34, 35.59)	32.3 (26.96, 38.01)	7.87 (2.3, 13.53)	1.31 (1.08, 1.61)
Non-OA	1999	24.04 (19.57, 28.96)	23.31 (18.83, 28.29)	29.7 (24.82, 34.95)	25.7 (21.25, 30.55)	22.16 (18.08, 26.69)	25.87 (21.13, 31.06)	22.3 (17.68, 27.47)	27.46 (21.96, 33.52)	26.59 (21.24, 32.5)	31.29 (26.03, 36.93)	3.75 (-1.76, 9.38)	1.16 (0.93, 1.44)
OA	2000	28.49 (23.92, 33.42)	26.77 (21.93, 32.07)	29.83 (25.1, 34.91)	28.57 (24.07, 33.41)	31.89 (27.3, 36.75)	32 (26.53, 37.87)	29.08 (23.85, 34.76)	37.74 (31.88, 43.87)	33.19 (27.2, 39.61)	30.77 (25.69, 36.22)	6.27 (0.46, 12.09)	1.23 (1.02, 1.49)
Non-OA	2000	26.86 (22.28, 31.83)	26.19 (21.57, 31.24)	27.12 (22.63, 32)	25.44 (21.23, 30.02)	24.43 (20.26, 28.99)	31 (25.81, 36.57)	25 (19.74, 30.87)	33.33 (27.67, 39.37)	29.27 (23.66, 35.38)	29.74 (24.34, 35.59)	4.74 (-0.9, 10.23)	1.19 (0.97, 1.46)

OA	2001	31.15 (26.44, 36.17)	32.21 (27.56, 37.13)	34.01 (29.02, 39.28)	38.52 (33.83, 43.37)	36.41 (31.75, 41.26)	37.3 (31.98, 42.87)	31.55 (26.47, 36.97)	38.79 (33.06, 44.76)	35.38 (29.75, 41.32)	35.57 (30.5, 40.89)	4.12 (-1.51, 9.82)	1.12 (0.96, 1.32)
Non-OA	2001	29.43 (24.91, 34.26)	24.23 (19.86, 29.03)	27.45 (22.95, 32.31)	28.43 (24.14, 33.04)	29.95 (25.68, 34.5)	31.02 (26.29, 36.08)	28.16 (23.21, 33.53)	26.82 (21.54, 32.63)	31.41 (25.99, 37.23)	31.31 (26.08, 36.92)	3.81 (-1.58, 9.23)	1.14 (0.95, 1.38)
OA	2002	34.68 (30.38, 39.18)	35.56 (31.13, 40.17)	30.16 (25.95, 34.62)	34.26 (30.12, 38.58)	37.1 (32.87, 41.49)	38.4 (33.54, 43.44)	34.22 (29.65, 39.03)	34.97 (30.22, 39.96)	32.6 (27.48, 38.05)	41.21 (35.98, 46.59)	3.73 (-1.48, 8.82)	1.11 (0.96, 1.29)
Non-OA	2002	23 (19.33, 27)	25.78 (21.79, 30.11)	28.34 (24.4, 32.54)	27.38 (23.53, 31.5)	27.57 (23.64, 31.78)	26.5 (22.24, 31.11)	30.54 (26.09, 35.28)	28.21 (23.61, 33.18)	35.41 (30.04, 41.06)	33.33 (28.42, 38.53)	9.42 (4.55, 14.15)	1.4 (1.18, 1.68)
OA	2003	32.31 (28.8, 35.96)	36.91 (33.14, 40.8)	38.65 (34.66, 42.76)	34.56 (31.06, 38.19)	39.74 (35.83, 43.75)	36.43 (32.32, 40.7)	36.29 (32.1, 40.65)	39.11 (34.45, 43.92)	40 (35.19, 44.95)	39.11 (34.69, 43.67)	5.46 (0.87, 9.93)	1.16 (1.02, 1.31)
Non-OA	2003	27.14 (23.82, 30.65)	32.13 (28.58, 35.83)	26.95 (23.41, 30.72)	33.38 (29.84, 37.07)	31.31 (27.74, 35.05)	28.54 (24.7, 32.63)	32.53 (28.41, 36.85)	30.77 (26.49, 35.3)	30.73 (26.22, 35.53)	35.96 (31.43, 40.69)	4.76 (0.44, 9.05)	1.17 (1.01, 1.34)
OA	2004	35.27 (31.78, 38.88)	38.63 (35.08, 42.27)	38.65 (35.04, 42.34)	38.29 (34.85, 41.82)	38.74 (35.27, 42.3)	39.32 (35.45, 43.3)	40.38 (36.36, 44.49)	42.8 (38.48, 47.21)	45.47 (41.03, 49.97)	42.8 (38.32, 47.37)	8.12 (3.94, 12.29)	1.23 (1.11, 1.37)
Non-OA	2004	30.89 (27.63, 34.3)	29.11 (25.8, 32.61)	29.05 (25.83, 32.43)	26.63 (23.56, 29.88)	27.31 (24.02, 30.8)	30.7 (27.16, 34.42)	33.33 (29.47, 37.37)	30.16 (26.18, 34.37)	33.56 (29.18, 38.16)	31.87 (27.9, 36.05)	3.44 (-0.76, 7.45)	1.12 (0.98, 1.29)
OA	2005	38.2 (34.96, 41.53)	36.59 (33.32, 39.95)	38.61 (35.22, 42.07)	36.51 (33.29, 39.83)	40 (36.66, 43.41)	41.23 (37.51, 45.02)	41.43 (37.67, 45.26)	42.43 (38.47, 46.47)	43.79 (39.65, 48)	40.25 (35.84, 44.78)	6.39 (2.4, 10.46)	1.18 (1.06, 1.3)
Non-OA	2005	30.12 (27.11, 33.27)	31.54 (28.5, 34.7)	30.81 (27.58, 34.18)	31.48 (28.33, 34.77)	29.82 (26.81, 32.96)	31.46 (27.92, 35.16)	28.25 (24.85, 31.84)	32 (28.28, 35.9)	34.26 (30.25, 38.45)	34.82 (30.62, 39.2)	2.59 (-1.24, 6.36)	1.09 (0.96, 1.23)

OA	2006	36.87 (33.6, 40.24)	38.18 (34.93, 41.5)	40.79 (37.48, 44.17)	41.22 (37.92, 44.59)	39.69 (36.36, 43.09)	40.6 (37.03, 44.24)	40.51 (36.87, 44.22)	44.32 (40.44, 48.26)	42.8 (38.48, 47.21)	43 (38.64, 47.44)	6.14 (2.19, 10.12)	1.16 (1.05, 1.28)
Non-OA	2006	27.57 (24.61, 30.67)	31.61 (28.62, 34.71)	31.13 (28, 34.4)	34.03 (30.95, 37.22)	29.85 (26.94, 32.89)	32.38 (28.83, 36.09)	33.03 (29.48, 36.74)	30.62 (26.95, 34.47)	34.27 (30.24, 38.49)	33.93 (29.54, 38.54)	4.18 (0.39, 8.03)	1.14 (1.01, 1.29)
OA	2007	35.24 (32.24, 38.32)	35.28 (32.23, 38.43)	42.08 (38.89, 45.32)	36.54 (33.5, 39.67)	39.19 (36.14, 42.31)	35.76 (32.4, 39.23)	39.9 (36.46, 43.42)	41.14 (37.47, 44.89)	39.97 (36.14, 43.89)	39.15 (35.09, 43.32)	4.35 (0.57, 8.04)	1.12 (1.02, 1.24)
Non-OA	2007	30.16 (27.44, 32.98)	30.06 (27.23, 33.01)	29.09 (26.2, 32.12)	30.57 (27.62, 33.65)	28.72 (25.89, 31.67)	31.5 (28.29, 34.85)	30.66 (27.39, 34.07)	33.09 (29.55, 36.77)	31.51 (27.64, 35.58)	35.2 (31.28, 39.28)	3.9 (0.34, 7.39)	1.14 (1.01, 1.27)
OA	2008	33.76 (31.05, 36.55)	36.99 (34.16, 39.89)	39.29 (36.42, 42.21)	39.89 (36.96, 42.87)	39.87 (36.88, 42.91)	39.18 (36.01, 42.41)	38.74 (35.56, 42)	41.12 (37.57, 44.74)	39.03 (35.45, 42.7)	38.36 (34.77, 42.06)	4.51 (1.08, 7.96)	1.12 (1.03, 1.23)
Non-OA	2008	28.44 (25.92, 31.07)	26.67 (24.14, 29.32)	31.05 (28.37, 33.83)	28.45 (25.77, 31.26)	28.94 (26.3, 31.69)	31.89 (28.86, 35.04)	31.19 (28.1, 34.41)	32.14 (28.82, 35.6)	31.34 (27.88, 34.96)	35.15 (31.51, 38.93)	6.13 (2.91, 9.37)	1.23 (1.1, 1.37)
OA	2009	36.45 (33.53, 39.45)	38.57 (35.36, 41.85)	40.06 (36.99, 43.19)	39.92 (36.77, 43.12)	36.27 (33.17, 39.45)	37.06 (33.49, 40.74)	37.09 (33.65, 40.63)	43.45 (39.67, 47.3)	41.74 (37.71, 45.85)	40.53 (36.59, 44.55)	3.58 (-0.14, 7.3)	1.1 (1, 1.21)
Non-OA	2009	27.24 (24.48, 30.13)	31.18 (28.28, 34.19)	29.49 (26.75, 32.34)	31.28 (28.35, 34.32)	32.89 (29.81, 36.07)	32.74 (29.33, 36.28)	32.04 (28.7, 35.52)	33.44 (29.76, 37.28)	33.28 (29.56, 37.16)	33.69 (29.79, 37.75)	6.01 (2.54, 9.58)	1.21 (1.08, 1.36)
OA	2010	37.08 (33.74, 40.52)	38.88 (35.29, 42.56)	40.42 (37.01, 43.91)	41.06 (37.48, 44.72)	40.6 (37.03, 44.24)	38.95 (34.98, 43.02)	38.82 (34.92, 42.82)	42.94 (38.54, 47.43)	41.15 (36.89, 45.52)	41.78 (37.12, 46.56)	3.72 (-0.58, 8.11)	1.1 (0.99, 1.22)
Non-OA	2010	29.94 (26.85, 33.17)	31.5 (28.22, 34.93)	33.09 (29.9, 36.41)	31.1 (27.75, 34.59)	30.92 (27.65, 34.34)	33.28 (29.49, 37.23)	33.39 (29.47, 37.49)	34.41 (30.23, 38.77)	35.24 (30.85, 39.83)	31.09 (26.75, 35.7)	3.38 (-0.79, 7.46)	1.11 (0.98, 1.26)

OA	2011	38.67 (34.98, 42.46)	41.38 (37.57, 45.28)	38.75 (35.04, 42.55)	41.33 (37.5, 45.24)	39.97 (36.03, 44)	40.04 (35.79, 44.41)	40.72 (36.38, 45.16)	43 (38.09, 48.01)	39.66 (34.93, 44.54)	45.97 (40.82, 51.18)	3.69 (-0.96, 8.31)	1.1 (0.98, 1.23)
Non-OA	2011	29.36 (26.07, 32.81)	32.22 (28.67, 35.94)	34.86 (31.21, 38.64)	31.46 (27.87, 35.21)	28.71 (25.14, 32.5)	32.94 (28.84, 37.23)	36.25 (32.04, 40.63)	35.19 (30.58, 40.02)	38.46 (33.69, 43.41)	35.88 (30.78, 41.23)	6.78 (2.4, 11.26)	1.23 (1.07, 1.41)
OA	2012	35.86 (32.08, 39.78)	38.45 (34.38, 42.64)	40.07 (35.95, 44.31)	39.6 (35.29, 44.04)	41.49 (37.23, 45.85)	39.25 (34.6, 44.06)	42.9 (37.81, 48.09)	43.15 (37.84, 48.58)	40.58 (35.09, 46.24)	44.48 (38.76, 50.31)	7.22 (2.18, 12.21)	1.2 (1.06, 1.36)
Non-OA	2012	36.44 (32.55, 40.47)	31.14 (27.33, 35.15)	33.65 (29.63, 37.85)	34.27 (29.95, 38.78)	34.02 (29.82, 38.41)	36.59 (32.08, 41.28)	34.03 (29.3, 39)	32.6 (28.09, 37.37)	34.51 (29.46, 39.84)	36.3 (30.78, 42.11)	0.67 (-4.29, 5.54)	1.02 (0.88, 1.18)
OA	2013	40.67 (36.48, 44.97)	35.63 (31.05, 40.41)	41.96 (37.4, 46.61)	44.91 (39.99, 49.92)	40.79 (36.1, 45.61)	36.94 (32.07, 42.02)	40.73 (35.58, 46.03)	45.59 (40.12, 51.15)	39.84 (33.67, 46.25)	39.3 (33.29, 45.56)	1.57 (-3.94, 7.25)	1.04 (0.91, 1.19)
Non-OA	2013	32.01 (28.04, 36.17)	34.42 (30.08, 38.97)	35.99 (31.62, 40.54)	31.65 (27.21, 36.36)	34.04 (29.55, 38.75)	35.73 (30.79, 40.92)	38.21 (32.98, 43.65)	41.16 (35.63, 46.85)	37.05 (31.36, 43.02)	34.58 (28.58, 40.97)	5.87 (0.43, 11.33)	1.18 (1.01, 1.38)
OA	2014	35.65 (31.2, 40.29)	40.97 (35.92, 46.16)	39.57 (34.58, 44.73)	44.1 (39.11, 49.19)	41.51 (36.53, 46.63)	40.06 (34.71, 45.6)	40.49 (34.73, 46.45)	40.98 (35.01, 47.15)	41.77 (35.57, 48.16)	38.42 (31.7, 45.49)	2.95 (-2.93, 8.85)	1.08 (0.93, 1.25)
Non-OA	2014	27.96 (23.85, 32.37)	37.21 (32.63, 41.97)	36.05 (31.37, 40.94)	35.88 (30.87, 41.12)	31.22 (26.58, 36.15)	36.16 (30.78, 41.81)	34.53 (29.22, 40.14)	34.9 (29.06, 41.1)	32.02 (25.66, 38.91)	31.55 (25.27, 38.38)	1.25 (-4.42, 7.06)	1.04 (0.87, 1.23)
OA	2015	36.4 (31.98, 41.01)	38.99 (33.6, 44.59)	35.53 (30.15, 41.19)	41.61 (35.95, 47.44)	40.35 (35.11, 45.76)	40.77 (34.4, 47.38)	36.71 (30.56, 43.19)	37.85 (31.33, 44.71)	47.67 (40.45, 54.96)	41.88 (34.8, 49.22)	6.22 (-0.26, 12.8)	1.17 (0.99, 1.39)
Non-OA	2015	31.4 (26.96, 36.11)	33.44 (28.33, 38.84)	31.82 (26.82, 37.14)	33.97 (28.73, 39.52)	33.76 (28.52, 39.31)	39.78 (34, 45.79)	37.23 (30.98, 43.81)	32.99 (26.48, 40.03)	31.36 (25.29, 37.94)	34.52 (27.37, 42.24)	3.56 (-2.7, 9.65)	1.11 (0.92, 1.35)

OA	2016	32.46 (27.55, 37.68)	41.04 (35.1, 47.19)	39.66 (33.31, 46.26)	34.64 (27.7, 42.1)	43.05 (36.46, 49.83)	32.75 (25.78, 40.33)	35.03 (28.02, 42.54)	38.36 (30.77, 46.4)	46 (37.84, 54.32)	45.53 (36.53, 54.75)	7.69 (0.03, 15.01)	1.22 (1.01, 1.5)
Non-OA	2016	31.84 (27.05, 36.94)	32.96 (27.35, 38.95)	38.43 (31.91, 45.27)	33.33 (26.5, 40.73)	29.91 (24.12, 36.22)	35.17 (27.43, 43.53)	35.75 (29, 42.95)	39.47 (31.65, 47.72)	36.36 (29.03, 44.2)	35.59 (27, 44.93)	4.94 (-2.61, 12.31)	1.15 (0.93, 1.44)
OA	2017	35.05 (29.91, 40.45)	37.15 (31.18, 43.43)	40.58 (33.83, 47.61)	36.42 (29.25, 44.06)	30.35 (24.08, 37.21)	37.3 (28.85, 46.36)	45.07 (36.72, 53.64)	41.13 (32.92, 49.73)	41.28 (31.94, 51.12)	39.08 (28.79, 50.13)	5.76 (-2.48, 13.82)	1.17 (0.94, 1.46)
Non-OA	2017	26.61 (22.1, 31.52)	34.66 (29.06, 40.58)	31.75 (25.18, 38.9)	34.23 (26.66, 42.44)	29.84 (23.45, 36.87)	31.3 (23.48, 39.98)	38.36 (30.44, 46.76)	30.91 (22.45, 40.43)	36.29 (27.85, 45.4)	38.54 (28.78, 49.03)	8.82 (0.91, 16.76)	1.32 (1.03, 1.69)
OA	Age 35-44 years	5.39 (3.66, 7.6)	6.78 (4.79, 9.26)	7.43 (5.36, 9.99)	5.19 (3.53, 7.33)	8.01 (5.93, 10.54)	10.91 (8.43, 13.82)	9.72 (7.37, 12.53)	8.96 (6.61, 11.81)	9.49 (7.21, 12.2)	14.55 (11.94, 17.47)	8.06 (5.38, 10.77)	2.71 (1.89, 4.15)
Non-OA	Age 35-44 years	8.9 (6.8, 11.41)	10.58 (8.17, 13.41)	12.36 (9.84, 15.24)	11.2 (8.79, 14.01)	10.78 (8.44, 13.52)	13.59 (10.69, 16.94)	11.11 (8.59, 14.07)	13.36 (10.44, 16.74)	15.01 (12.03, 18.4)	15.14 (12.29, 18.36)	5.75 (2.7, 8.88)	1.62 (1.25, 2.14)
OA	Age 45-54 years	14.71 (13.4, 16.1)	17.48 (15.93, 19.12)	18.94 (17.34, 20.63)	19.1 (17.55, 20.72)	19.66 (18.07, 21.33)	19.17 (17.51, 20.92)	21.79 (20.04, 23.62)	21.91 (20.04, 23.86)	23.17 (21.25, 25.17)	23.92 (22.06, 25.86)	8.96 (7.1, 10.84)	1.59 (1.44, 1.76)
Non-OA	Age 45-54 years	18.1 (16.7, 19.57)	18.67 (17.16, 20.26)	19.38 (17.8, 21.05)	19.26 (17.73, 20.87)	18.39 (16.88, 19.98)	20.64 (18.92, 22.44)	19.88 (18.11, 21.73)	21.44 (19.54, 23.42)	23.48 (21.46, 25.58)	23.32 (21.37, 25.36)	5.32 (3.42, 7.2)	1.31 (1.19, 1.44)
OA	Age 55-64 years	29.74 (28.42, 31.08)	31.46 (30.03, 32.91)	32.39 (30.94, 33.87)	33.1 (31.7, 34.53)	31.8 (30.39, 33.22)	34.24 (32.66, 35.86)	34.19 (32.56, 35.84)	37.03 (35.23, 38.85)	38.68 (36.79, 40.6)	38.11 (36.25, 39.99)	8.71 (6.96, 10.39)	1.3 (1.23, 1.37)
Non-OA	Age 55-64 years	26.29 (25.04, 27.58)	27.49 (26.16, 28.84)	27.54 (26.17, 28.94)	27.93 (26.59, 29.29)	27.18 (25.85, 28.54)	30.31 (28.76, 31.89)	29.41 (27.84, 31.02)	30.29 (28.58, 32.04)	29.89 (28.07, 31.75)	32.88 (31.05, 34.76)	5.48 (3.8, 7.08)	1.21 (1.14, 1.29)

OA	Age 65-74 years	44.76 (43.09, 46.44)	46.98 (45.24, 48.72)	47 (45.27, 48.73)	47.22 (45.49, 48.96)	49.31 (47.59, 51.02)	46.93 (45, 48.88)	48.16 (46.16, 50.16)	50.96 (48.87, 53.05)	50.71 (48.44, 52.97)	49.29 (47.01, 51.56)	5.27 (3.22, 7.33)	1.12 (1.07, 1.17)
Non-OA	Age 65-74 years	33.04 (31.48, 34.64)	36.44 (34.78, 38.12)	36.29 (34.64, 37.97)	35.23 (33.56, 36.93)	34.27 (32.63, 35.93)	37.6 (35.74, 39.48)	37.2 (35.28, 39.16)	35.96 (33.93, 38.02)	39.08 (36.91, 41.28)	38.05 (35.92, 40.21)	4.12 (2.11, 6.12)	1.12 (1.06, 1.18)
OA	Age 75-84 years	58.68 (56.4, 60.93)	56.2 (53.9, 58.49)	58.15 (55.89, 60.39)	57.83 (55.58, 60.06)	56.42 (54.14, 58.68)	57.88 (55.33, 60.4)	57.67 (55.09, 60.22)	61.48 (58.77, 64.15)	60.44 (57.53, 63.3)	57.63 (54.66, 60.57)	1.98 (-0.66, 4.65)	1.03 (0.99, 1.08)
Non-OA	Age 75-84 years	44.11 (41.82, 46.41)	43.08 (40.8, 45.39)	43.08 (40.83, 45.35)	42.22 (39.96, 44.51)	42.56 (40.3, 44.85)	41.17 (38.71, 43.67)	44.64 (42.12, 47.19)	45.04 (42.32, 47.78)	46.34 (43.44, 49.26)	42.58 (39.6, 45.59)	1.14 (-1.63, 3.82)	1.03 (0.97, 1.09)
OA	Age 85+ years	57.31 (50.96, 63.49)	55.56 (49.41, 61.58)	55.71 (49.78, 61.52)	61.39 (55.16, 67.35)	57.66 (51.57, 63.59)	57.34 (50.48, 63.99)	55.87 (48.92, 62.65)	61.96 (54.04, 69.44)	63.69 (55.65, 71.21)	57.25 (48.32, 65.85)	4.09 (-3.25, 11.39)	1.07 (0.95, 1.22)
Non-OA	Age 85+ years	53.11 (46.6, 59.55)	51.34 (45.1, 57.55)	46.4 (40.43, 52.46)	47.33 (41.37, 53.35)	40.21 (34.48, 46.14)	43.6 (36.81, 50.58)	46.46 (39.36, 53.67)	46.39 (39.22, 53.68)	44.53 (35.75, 53.57)	50 (41.74, 58.26)	-6.42 (-13.79, 1.1)	0.87 (0.74, 1.03)
OA	Men	34.09 (32.72, 35.48)	36.28 (34.82, 37.75)	37.42 (35.96, 38.91)	36.44 (35, 37.89)	36.21 (34.77, 37.66)	35.36 (33.78, 36.96)	35.4 (33.78, 37.05)	38.43 (36.68, 40.2)	37.73 (35.89, 39.6)	35.99 (34.21, 37.8)	1.77 (0.04, 3.48)	1.05 (1, 1.1)
Non-OA	Men	39.25 (37.84, 40.68)	40.19 (38.73, 41.66)	39.15 (37.69, 40.64)	39.02 (37.57, 40.49)	38.42 (36.94, 39.91)	39.55 (37.94, 41.19)	38.58 (36.91, 40.26)	39.65 (37.86, 41.46)	39.39 (37.55, 41.25)	39.57 (37.74, 41.42)	-0.22 (-2, 1.53)	0.99 (0.95, 1.04)
OA	Women	34.05 (33.06, 35.05)	36.13 (35.07, 37.19)	37.19 (36.13, 38.26)	37.35 (36.31, 38.39)	37.86 (36.81, 38.91)	37.84 (36.69, 39)	38.62 (37.45, 39.8)	40.53 (39.27, 41.8)	40.36 (39.06, 41.67)	39.45 (38.17, 40.75)	6.06 (4.84, 7.34)	1.18 (1.14, 1.21)
Non-OA	Women	22.83 (21.97, 23.71)	24.69 (23.77, 25.63)	25.73 (24.79, 26.7)	24.92 (23.99, 25.87)	24.41 (23.5, 25.34)	27.01 (25.96, 28.08)	27.4 (26.32, 28.5)	27.5 (26.35, 28.67)	28.85 (27.62, 30.11)	28.72 (27.51, 29.96)	5.9 (4.76, 7.03)	1.26 (1.2, 1.31)

OA	East Midlands	28.74 (23.26, 34.73)	36.4 (32.17, 40.79)	37.33 (32.76, 42.07)	38.74 (34.77, 42.82)	38.39 (33.06, 43.94)	33.33 (28.29, 38.68)	35.76 (32.1, 39.55)	37.12 (32.72, 41.69)	39.15 (35, 43.41)	38.76 (32.78, 45)	3.93 (-1.07, 9.06)	1.11 (0.97, 1.28)
Non-OA	East Midlands	30 (24.39, 36.09)	25.7 (21.93, 29.76)	27.51 (23.63, 31.66)	29.73 (25.99, 33.69)	28.76 (23.7, 34.25)	27.65 (22.96, 32.73)	29.61 (26.04, 33.38)	28.22 (24.07, 32.66)	31.14 (27.44, 35.04)	34.3 (28.34, 40.65)	4.74 (-0.05, 9.79)	1.18 (1, 1.39)
OA	East of England	32.04 (30.11, 34.03)	36.04 (33.76, 38.37)	34.52 (31.93, 37.18)	34.89 (32.63, 37.2)	37.19 (34.69, 39.74)	35.27 (32.8, 37.8)	37.13 (34.5, 39.83)	37.93 (34.25, 41.71)	37.76 (33.19, 42.49)	36.28 (30.98, 41.84)	5.12 (2.16, 8.06)	1.16 (1.06, 1.26)
Non-OA	East of England	28.78 (26.9, 30.7)	28.31 (26.18, 30.51)	32.09 (29.59, 34.66)	29.08 (26.94, 31.29)	27.3 (25.06, 29.64)	32.43 (29.98, 34.95)	31.14 (28.55, 33.83)	30.84 (27.35, 34.49)	31.67 (27.53, 36.04)	29.87 (24.81, 35.32)	2.77 (-0.09, 5.68)	1.1 (1, 1.21)
OA	London	36.97 (33.35, 40.7)	38.71 (35.57, 41.93)	40.54 (37.15, 44)	40.55 (37.68, 43.46)	39.17 (36.49, 41.91)	38.36 (35.46, 41.33)	41.86 (39.09, 44.67)	42.56 (39.68, 45.48)	41.79 (38.88, 44.75)	45.92 (40.9, 50.99)	5.33 (1.91, 8.76)	1.14 (1.05, 1.24)
Non-OA	London	28.84 (25.51, 32.34)	29.5 (26.62, 32.52)	30.35 (27.17, 33.68)	30.43 (27.79, 33.17)	29.35 (26.87, 31.93)	31.36 (28.6, 34.22)	28.01 (25.52, 30.6)	30.93 (28.24, 33.7)	32.47 (29.74, 35.3)	30.27 (25.63, 35.23)	1.95 (-1.27, 5.13)	1.07 (0.96, 1.19)
OA	North East	24.92 (20.34, 29.96)	32.71 (27.14, 38.67)	28.82 (22.15, 36.26)	35.66 (29.82, 41.84)	33.91 (26.92, 41.46)	41.14 (35.66, 46.79)	34.18 (28.96, 39.69)	35.4 (30.91, 40.1)	34.63 (28.83, 40.79)	35.37 (32.24, 38.59)	7.02 (1.42, 12.58)	1.23 (1.04, 1.45)
Non-OA	North East	24.7 (20.18, 29.67)	33.78 (28.99, 38.83)	26.82 (20.48, 33.94)	33.33 (27.08, 40.05)	30.11 (23.61, 37.25)	34.84 (29.54, 40.43)	29.62 (24.4, 35.26)	29.02 (24.85, 33.46)	25.93 (20.53, 31.92)	29.43 (26.38, 32.63)	-0.91 (-6.34, 4.55)	0.97 (0.81, 1.16)
OA	North West	31.77 (29.29, 34.34)	36.58 (34.38, 38.82)	36.52 (34.49, 38.58)	37.69 (35.32, 40.11)	36.06 (33.88, 38.3)	36.47 (34.17, 38.82)	35.69 (33.45, 37.97)	38.79 (36.56, 41.05)	38.9 (36.84, 40.99)	38.2 (36.47, 39.96)	4.35 (1.91, 6.75)	1.13 (1.05, 1.2)
Non-OA	North West	27.72 (25.4, 30.12)	31.76 (29.71, 33.85)	30.6 (28.68, 32.57)	29.52 (27.34, 31.78)	29.59 (27.48, 31.78)	33.67 (31.41, 35.99)	34.93 (32.74, 37.18)	31.57 (29.41, 33.79)	32.99 (30.95, 35.08)	33.4 (31.72, 35.11)	4.78 (2.39, 7.08)	1.16 (1.08, 1.25)

OA	South Central	34.98 (33.38, 36.61)	36.44 (34.1, 38.82)	37.09 (34.4, 39.84)	36.95 (34.39, 39.56)	42.24 (39.48, 45.03)	36.68 (33.75, 39.68)	40.73 (37.6, 43.93)	42.13 (38.52, 45.81)	37.61 (33.2, 42.17)	40.36 (32.83, 48.24)	6.95 (3.89, 10.03)	1.2 (1.11, 1.31)
Non-OA	South Central	27.57 (26.09, 29.09)	28.46 (26.3, 30.7)	28.34 (25.8, 31)	31.9 (29.46, 34.42)	28.26 (25.79, 30.84)	24.21 (21.71, 26.85)	28.02 (25.12, 31.06)	30.14 (26.74, 33.72)	28.64 (24.49, 33.07)	34.29 (26.48, 42.77)	0.92 (-1.95, 3.75)	1.03 (0.94, 1.14)
OA	South East Coast	35.1 (33.04, 37.21)	37.02 (35.02, 39.06)	38.45 (36.33, 40.61)	41.84 (39.55, 44.15)	37.47 (35, 39.98)	38.19 (35.24, 41.21)	38.01 (34.54, 41.58)	42.92 (39.67, 46.22)	43.41 (39.7, 47.18)	41.38 (34.53, 48.49)	6.53 (3.59, 9.48)	1.18 (1.1, 1.28)
Non-OA	South East Coast	28.54 (26.61, 30.53)	31.22 (29.36, 33.13)	31.37 (29.33, 33.46)	30.05 (27.94, 32.23)	32.44 (30.07, 34.88)	32.92 (30.06, 35.87)	32.37 (28.99, 35.9)	32.76 (29.74, 35.89)	34.59 (30.9, 38.42)	31.89 (25.25, 39.13)	4.56 (1.8, 7.4)	1.16 (1.06, 1.27)
OA	South West	36.18 (32.91, 39.55)	36.39 (33.79, 39.05)	38.45 (35.91, 41.03)	36.53 (33.85, 39.28)	37.7 (35.71, 39.72)	38.78 (36.28, 41.32)	38.62 (35.81, 41.49)	39.03 (36.16, 41.96)	40.48 (37.36, 43.65)	38.86 (35.45, 42.36)	3.48 (0.47, 6.38)	1.1 (1.01, 1.19)
Non-OA	South West	26.58 (23.62, 29.71)	32.22 (29.7, 34.82)	31.38 (29.04, 33.8)	30.46 (27.91, 33.1)	28.41 (26.59, 30.29)	29.91 (27.57, 32.33)	32.72 (29.99, 35.53)	31.22 (28.54, 34.01)	33.79 (30.66, 37.02)	32.63 (29.31, 36.09)	2.99 (0.06, 5.84)	1.1 (1, 1.21)
OA	West Midlands	35.73 (33.57, 37.93)	34.73 (32.18, 37.35)	38.53 (36.42, 40.67)	35.28 (33, 37.61)	34.31 (32.1, 36.56)	36.18 (33.59, 38.83)	35 (32.41, 37.66)	43.07 (40.09, 46.09)	39.4 (36.51, 42.35)	39.62 (37.3, 41.97)	4.52 (1.82, 7.26)	1.13 (1.05, 1.22)
Non-OA	West Midlands	29.73 (27.68, 31.84)	29.79 (27.46, 32.2)	29.76 (27.82, 31.75)	31.95 (29.7, 34.27)	28.8 (26.7, 30.97)	35.53 (32.93, 38.2)	31.64 (29.14, 34.23)	35.49 (32.57, 38.5)	34.77 (31.91, 37.72)	34.23 (31.93, 36.58)	6.38 (3.75, 8.95)	1.22 (1.13, 1.33)
OA	Yorkshire & The Humber	33.5 (28.93, 38.3)	29.2 (24.71, 34.01)	32.66 (28.73, 36.78)	31.78 (29.28, 34.36)	34.74 (31.24, 38.37)	36.04 (32.28, 39.94)	36.64 (32.76, 40.65)	30.89 (26.59, 35.46)	35.28 (30.66, 40.11)	33.12 (29.43, 36.97)	3.2 (-1.09, 7.37)	1.1 (0.97, 1.25)
Non-OA	Yorkshire & The Humber	32.79 (28.37, 37.45)	24.67 (20.4, 29.34)	28.94 (25.39, 32.7)	23.44 (21.12, 25.89)	27.74 (24.72, 30.93)	27.12 (23.7, 30.74)	27.51 (23.87, 31.39)	31.33 (26.89, 36.03)	29.08 (24.49, 34.01)	28.08 (24.44, 31.94)	1.5 (-2.48, 5.67)	1.06 (0.91, 1.23)

IMD, Indices of multiple deprivation; 95%CI, 95% confidence interval; OA, osteoarthritis

Appendix 3.1.3. Inequality in the prevalence of type 2 diabetes mellitus in OA and non-OA samples by subgroups, 1992-2017

OA status	Subgroup	Period prevalence by IMD decile (%) (95%CI)										Slope index of inequality (95%CI)(%)	Relative index of inequality (95%CI)
		1 (Least deprived)	2	3	4	5	6	7	8	9	10(Most deprived)		
OA	1992	0 (0, 0)	2.33 (0.06, 12.29)	0 (0, 0)	1.54 (0.04, 8.28)	0 (0, 0)	5.71 (0.7, 19.16)	0 (0, 0)	0 (0, 0)	5 (0.61, 16.92)	3.39 (0.41, 11.71)	-	-
Non-OA	1992	0 (0, 0)	2.78 (0.07, 14.53)	3.92 (0.48, 13.46)	6.35 (1.76, 15.47)	4.35 (0.53, 14.84)	6 (1.25, 16.55)	4.26 (0.52, 14.54)	0 (0, 0)	4.76 (0.12, 23.82)	7.94 (2.63, 17.56)	-	-
OA	1993	0.8 (0.02, 4.38)	2.04 (0.25, 7.18)	1.56 (0.19, 5.53)	2.13 (0.58, 5.36)	2.22 (0.61, 5.59)	2.96 (0.97, 6.77)	2.13 (0.44, 6.09)	2.59 (0.54, 7.37)	3.33 (0.69, 9.43)	2.19 (0.45, 6.27)	1.51 (-1.57, 4.6)	2.05 (-14.29, 20.94)
Non-OA	1993	2.61 (0.54, 7.43)	4.17 (1.37, 9.46)	2.36 (0.49, 6.75)	6.6 (3.66, 10.83)	3.98 (1.61, 8.02)	4.96 (2.02, 9.96)	4.48 (1.66, 9.49)	3.6 (0.99, 8.97)	7.22 (2.95, 14.3)	5.76 (2.52, 11.03)	2.42 (-1.9, 6.77)	1.7 (0.63, 6.37)
OA	1994	3.25 (1.06, 7.41)	0.75 (0.02, 4.09)	0.68 (0.02, 3.73)	2.27 (0.74, 5.22)	1.69 (0.35, 4.87)	1.55 (0.32, 4.48)	1.4 (0.17, 4.96)	2.59 (0.54, 7.37)	1.59 (0.19, 5.62)	2.79 (0.91, 6.4)	0.45 (-2.53, 3.4)	1.27 (-0.17, 10.17)
Non-OA	1994	4.12 (1.67, 8.3)	5.71 (2.5, 10.95)	4.37 (1.78, 8.81)	2.67 (0.98, 5.71)	2.99 (0.98, 6.85)	3.77 (1.4, 8.03)	3.05 (0.84, 7.63)	5.93 (2.42, 11.84)	8.76 (4.61, 14.8)	6.59 (3.45, 11.23)	3.05 (-1.3, 7.23)	1.97 (0.75, 8.73)
OA	1995	0.6 (0.02, 3.29)	3.1 (0.85, 7.75)	1.32 (0.16, 4.67)	0.45 (0.01, 2.47)	1.46 (0.3, 4.22)	2.55 (0.83, 5.85)	1.92 (0.4, 5.52)	1.54 (0.19, 5.45)	4.26 (1.58, 9.03)	2.54 (0.83, 5.82)	2.09 (-0.7, 4.74)	3.49 (-34.69, 37.31)
Non-OA	1995	4.19 (1.7, 8.45)	4.11 (1.52, 8.73)	4.68 (2.04, 9.01)	3.52 (1.43, 7.11)	2.94 (1.09, 6.29)	6.86 (3.59, 11.67)	4.82 (2.1, 9.27)	5.48 (2.4, 10.51)	8.13 (3.97, 14.44)	6.06 (3.17, 10.35)	3.2 (-0.78, 7.34)	1.95 (0.83, 6.55)
OA	1996	2.1 (0.69, 4.83)	3 (1.11, 6.42)	0.63 (0.02, 3.43)	1.18 (0.24, 3.41)	3.96 (1.83, 7.39)	3.17 (1.28, 6.42)	4.43 (2.05, 8.25)	1.14 (0.14, 4.07)	2.25 (0.62, 5.65)	2.58 (0.95, 5.52)	0.76 (-1.76, 3.32)	1.36 (0.43, 5.06)
Non-	1996	6.97 (4.11,	6.7 (3.62,	1.13 (0.14,	6.27 (3.63,	6.36 (3.6,	3.51 (1.53,	5.97 (3.12,	5.23 (2.42,	2.63 (0.72,	2.17 (0.71, 5)	-3.53 (-6.95, -0.1)	0.47 (0.16,

OA		10.92)	11.19)	4.02)	9.99)	10.27)	6.8)	10.2)	9.7)	6.6)			0.97)
OA	1997	1.25 (0.34, 3.17)	3.19 (1.39, 6.18)	3.07 (1.24, 6.22)	5.3 (3, 8.59)	4.36 (2.34, 7.34)	2.48 (0.92, 5.32)	2.07 (0.67, 4.76)	2.27 (0.62, 5.72)	1.86 (0.39, 5.35)	5.49 (3.03, 9.04)	1.32 (-1.27, 3.87)	1.52 (0.65, 4.19)
Non-OA	1997	3.82 (1.99, 6.58)	4.69 (2.45, 8.04)	4.27 (2.07, 7.72)	6.48 (3.95, 9.94)	4.37 (2.41, 7.23)	5.51 (3.05, 9.08)	4.21 (1.94, 7.83)	5.88 (2.86, 10.55)	6.25 (3.04, 11.19)	4.12 (1.99, 7.44)	0.86 (-2.24, 3.94)	1.19 (0.62, 2.38)
OA	1998	1.49 (0.49, 3.45)	2.27 (0.84, 4.88)	1.78 (0.58, 4.1)	4.06 (2.24, 6.71)	4.19 (2.31, 6.93)	3.75 (1.89, 6.62)	2.75 (1.02, 5.89)	2.67 (0.98, 5.71)	3.41 (1.38, 6.91)	3.69 (1.78, 6.68)	1.89 (-0.42, 4.2)	1.9 (0.87, 5.73)
Non-OA	1998	5.34 (3.24, 8.21)	4.93 (2.72, 8.13)	5.02 (2.7, 8.43)	4.86 (2.8, 7.78)	4.64 (2.67, 7.42)	4.98 (2.75, 8.22)	4.74 (2.55, 7.98)	7.86 (4.72, 12.14)	6.92 (3.5, 12.04)	8.27 (5.19, 12.36)	2.79 (-0.49, 6.13)	1.66 (0.91, 3.57)
OA	1999	1.69 (0.62, 3.63)	1.8 (0.66, 3.87)	2.84 (1.31, 5.32)	2.32 (1.01, 4.52)	3.44 (1.84, 5.81)	4.23 (2.27, 7.13)	4.73 (2.54, 7.95)	4.31 (2.17, 7.59)	4.09 (2.06, 7.2)	4.47 (2.4, 7.52)	3.51 (1.18, 5.87)	3.28 (1.41, 14.4)
Non-OA	1999	7.12 (4.62, 10.41)	7.06 (4.52, 10.4)	6.97 (4.47, 10.27)	6.15 (3.89, 9.16)	5.01 (3.04, 7.72)	7.26 (4.65, 10.69)	6.08 (3.64, 9.44)	9.43 (6.07, 13.81)	2.78 (1.12, 5.64)	5.1 (2.88, 8.28)	-1.92 (-4.99, 1.26)	0.74 (0.43, 1.21)
OA	2000	3.84 (2.11, 6.35)	3.87 (2.02, 6.66)	2.27 (0.99, 4.43)	3.97 (2.24, 6.46)	4.34 (2.55, 6.85)	5.09 (2.81, 8.39)	3.19 (1.47, 5.97)	4.15 (2.09, 7.31)	4.68 (2.36, 8.22)	6.41 (3.96, 9.73)	2.22 (-0.48, 4.87)	1.73 (0.89, 3.98)
Non-OA	2000	4.29 (2.42, 6.97)	5.36 (3.21, 8.33)	4.38 (2.53, 7.02)	4.28 (2.51, 6.77)	6.87 (4.58, 9.84)	8 (5.19, 11.67)	2.82 (1.14, 5.73)	9.47 (6.22, 13.66)	9.76 (6.35, 14.17)	6.69 (4.01, 10.37)	4.45 (1.43, 7.64)	2.17 (1.26, 4.3)
OA	2001	4.37 (2.52, 7)	4.42 (2.59, 6.98)	5.23 (3.13, 8.14)	4.07 (2.39, 6.43)	5.1 (3.18, 7.69)	6.27 (3.87, 9.52)	5.05 (2.91, 8.07)	4.98 (2.75, 8.22)	5.42 (3.06, 8.77)	7 (4.53, 10.23)	2.11 (-0.61, 4.86)	1.52 (0.87, 2.81)
Non-OA	2001	5.47 (3.42, 8.24)	4.23 (2.38, 6.87)	8.97 (6.25, 12.36)	7.23 (4.93, 10.16)	7.14 (4.9, 9.99)	6.37 (4.08, 9.41)	7.77 (5.04, 11.34)	4.98 (2.68, 8.37)	6.86 (4.18, 10.5)	10.1 (6.92, 14.11)	2.41 (-0.68, 5.51)	1.42 (0.91, 2.32)
OA	2002	5.11 (3.3, 7.5)	3.11 (1.71, 5.16)	6.43 (4.35, 9.1)	6.14 (4.21, 8.6)	6.55 (4.55, 9.07)	5.93 (3.79, 8.76)	5.34 (3.38, 7.97)	5.44 (3.4, 8.2)	7.21 (4.63, 10.62)	10.37 (7.37, 14.07)	3.7 (0.98, 6.4)	1.88 (1.19, 3.24)
Non-OA	2002	4.52 (2.85, 6.76)	5.83 (3.84, 8.43)	6.28 (4.3, 8.79)	5.16 (3.4, 7.47)	7.61 (5.42, 10.34)	8 (5.54, 11.11)	7.14 (4.84, 10.1)	7.26 (4.8, 10.46)	10.49 (7.29, 14.49)	9.4 (6.56, 12.95)	5.06 (2.32, 7.88)	2.15 (1.4, 3.57)
OA	2003	4.11 (2.75,	5.99 (4.28,	6.41 (4.55,	6.06 (4.42,	7.55 (5.58,	7.21 (5.15,	7.69 (5.53,	6.09 (4.02,	9.14 (6.51,	8.46 (6.11,	4 (1.63, 6.4)	1.85 (1.28,

		5.89)	8.13)	8.73)	8.08)	9.95)	9.76)	10.37)	8.79)	12.37)	11.34)		2.76)
Non-OA	2003	6.34 (4.63, 8.45)	6.94 (5.12, 9.15)	5.42 (3.74, 7.57)	8.24 (6.28, 10.56)	9.19 (7.07, 11.69)	10.34 (7.87, 13.28)	8.89 (6.53, 11.75)	9.73 (7.13, 12.88)	8.82 (6.22, 12.05)	11.37 (8.53, 14.75)	5.11 (2.51, 7.67)	1.89 (1.36, 2.71)
OA	2004	4.98 (3.51, 6.83)	5.48 (3.94, 7.39)	7.05 (5.28, 9.19)	5.69 (4.17, 7.57)	7.46 (5.7, 9.56)	8.41 (6.35, 10.89)	9.11 (6.9, 11.74)	10.31 (7.82, 13.27)	11.67 (8.98, 14.82)	9.6 (7.12, 12.6)	6.63 (4.29, 9.04)	2.53 (1.78, 3.86)
Non-OA	2004	6.94 (5.24, 8.98)	7.45 (5.63, 9.64)	7.03 (5.31, 9.09)	7.68 (5.91, 9.78)	6.5 (4.78, 8.6)	7.6 (5.67, 9.92)	9.47 (7.2, 12.18)	10.12 (7.63, 13.09)	10.59 (7.88, 13.83)	11.45 (8.85, 14.49)	4.54 (1.99, 7.07)	1.76 (1.28, 2.48)
OA	2005	5.87 (4.4, 7.64)	7.27 (5.61, 9.24)	6.97 (5.31, 8.96)	7.91 (6.19, 9.92)	9.1 (7.24, 11.26)	7.46 (5.6, 9.69)	8.94 (6.89, 11.36)	9.54 (7.32, 12.16)	9.57 (7.27, 12.31)	14.73 (11.69, 18.21)	5.82 (3.47, 8.21)	2.06 (1.53, 2.91)
Non-OA	2005	5.55 (4.13, 7.27)	7.86 (6.18, 9.82)	7.06 (5.36, 9.09)	7.72 (6, 9.75)	6.8 (5.23, 8.67)	7.75 (5.83, 10.07)	8.01 (6.05, 10.34)	6.83 (4.95, 9.16)	12.1 (9.47, 15.17)	12.55 (9.76, 15.8)	4.7 (2.38, 6.95)	1.85 (1.37, 2.58)
OA	2006	4.77 (3.43, 6.44)	6.92 (5.32, 8.82)	6.88 (5.28, 8.78)	9.82 (7.92, 11.99)	8.46 (6.67, 10.55)	10.01 (7.94, 12.41)	11.11 (8.9, 13.65)	12.13 (9.71, 14.91)	10.31 (7.82, 13.27)	14.4 (11.46, 17.76)	8.36 (6.02, 10.74)	2.7 (2, 3.78)
Non-OA	2006	5.88 (4.41, 7.66)	8.09 (6.42, 10.04)	8.05 (6.3, 10.11)	8.04 (6.35, 10)	7.68 (6.05, 9.57)	9.94 (7.77, 12.47)	8.37 (6.38, 10.73)	9.98 (7.71, 12.66)	10.17 (7.73, 13.06)	9.21 (6.69, 12.29)	3.49 (1.25, 5.73)	1.53 (1.16, 2.05)
OA	2007	5.72 (4.35, 7.36)	7.33 (5.75, 9.19)	10.92 (8.99, 13.1)	8.07 (6.43, 9.98)	8.99 (7.28, 10.95)	8.56 (6.69, 10.74)	10.04 (8.03, 12.35)	12.14 (9.82, 14.79)	12.38 (9.93, 15.19)	14.41 (11.61, 17.59)	6.92 (4.67, 9.23)	2.15 (1.66, 2.88)
Non-OA	2007	6.6 (5.2, 8.24)	8.12 (6.5, 9.99)	8.34 (6.65, 10.3)	9.58 (7.76, 11.66)	8.72 (7.02, 10.67)	9.38 (7.45, 11.61)	9.61 (7.6, 11.93)	11.37 (9.08, 14.01)	10.38 (7.96, 13.24)	10.68 (8.27, 13.51)	4.24 (2.04, 6.43)	1.61 (1.26, 2.11)
OA	2008	5.54 (4.3, 7.01)	8.65 (7.07, 10.44)	8.98 (7.37, 10.8)	9.38 (7.71, 11.26)	10.8 (8.99, 12.84)	10.06 (8.2, 12.19)	10.6 (8.67, 12.79)	12.02 (9.77, 14.56)	13.06 (10.68, 15.74)	11.28 (9.05, 13.85)	6.3 (4.21, 8.41)	1.96 (1.56, 2.51)

Non-OA	2008	5.69 (4.45, 7.14)	7.27 (5.84, 8.93)	8.95 (7.35, 10.76)	6.9 (5.46, 8.59)	6.95 (5.53, 8.59)	9.86 (7.99, 11.99)	10.63 (8.65, 12.89)	9.52 (7.53, 11.84)	13.27 (10.82, 16.03)	12.12 (9.73, 14.86)	6.55 (4.5, 8.6)	2.21 (1.7, 2.96)
OA	2009	7.92 (6.36, 9.72)	8.74 (6.97, 10.79)	10.09 (8.29, 12.14)	9.66 (7.85, 11.73)	10.09 (8.23, 12.2)	9.05 (7.04, 11.41)	11.27 (9.12, 13.73)	13.84 (11.32, 16.68)	12.27 (9.72, 15.2)	14.99 (12.25, 18.08)	6.21 (3.78, 8.67)	1.84 (1.45, 2.41)
Non-OA	2009	7.32 (5.77, 9.13)	8.92 (7.21, 10.89)	8.6 (6.98, 10.46)	9 (7.26, 10.99)	8.84 (7.06, 10.89)	9.08 (7.09, 11.41)	11.13 (8.96, 13.6)	10.35 (8.08, 13)	10.93 (8.57, 13.67)	10.28 (7.9, 13.09)	3.39 (1.08, 5.68)	1.45 (1.13, 1.87)
OA	2010	7.05 (5.38, 9.03)	8.11 (6.22, 10.36)	9.45 (7.52, 11.69)	8.19 (6.3, 10.41)	10.28 (8.19, 12.7)	12.59 (10.01, 15.54)	11.68 (9.23, 14.5)	11.69 (9, 14.85)	12.88 (10.13, 16.07)	16.67 (13.3, 20.49)	8.14 (5.45, 10.85)	2.29 (1.73, 3.17)
Non-OA	2010	7.66 (5.95, 9.68)	8.63 (6.74, 10.85)	9.39 (7.49, 11.58)	9.73 (7.67, 12.11)	8.95 (7.01, 11.21)	8.95 (6.78, 11.55)	10.65 (8.21, 13.52)	13.08 (10.24, 16.36)	11.45 (8.67, 14.75)	10.9 (8.12, 14.24)	4.1 (1.48, 6.76)	1.54 (1.17, 2.07)
OA	2011	6.96 (5.16, 9.15)	7.08 (5.23, 9.33)	8.2 (6.23, 10.54)	10.68 (8.41, 13.32)	8.79 (6.65, 11.34)	9.86 (7.43, 12.77)	11.98 (9.26, 15.15)	11.75 (8.76, 15.32)	12.98 (9.9, 16.6)	14.78 (11.34, 18.81)	7.65 (4.75, 10.58)	2.27 (1.64, 3.26)
Non-OA	2011	5.62 (4.07, 7.55)	7.72 (5.8, 10.02)	10.81 (8.54, 13.44)	6.57 (4.78, 8.78)	9.24 (7.06, 11.83)	9.92 (7.45, 12.87)	12.15 (9.42, 15.33)	10.44 (7.66, 13.8)	13.4 (10.23, 17.12)	12.94 (9.56, 16.98)	7.12 (4.35, 9.9)	2.22 (1.6, 3.19)
OA	2012	5.82 (4.11, 7.96)	11.37 (8.85, 14.31)	10.93 (8.44, 13.84)	6 (4.08, 8.45)	10.9 (8.36, 13.89)	12.38 (9.42, 15.88)	12.87 (9.64, 16.7)	14.29 (10.76, 18.44)	13.1 (9.57, 17.35)	14.38 (10.61, 18.88)	7.68 (4.38, 10.92)	2.12 (1.53, 3.1)
Non-OA	2012	7.46 (5.47, 9.88)	8.01 (5.9, 10.57)	8.88 (6.6, 11.64)	8.62 (6.23, 11.55)	10.86 (8.24, 13.96)	12.5 (9.56, 15.96)	11.17 (8.2, 14.75)	13.63 (10.46, 17.33)	11.5 (8.31, 15.39)	13.01 (9.38, 17.42)	6.73 (3.64, 9.88)	1.98 (1.43, 2.87)
OA	2013	9.89 (7.49, 12.73)	7.84 (5.46, 10.83)	11.3 (8.56, 14.56)	10.67 (7.83, 14.1)	8.39 (5.95, 11.43)	7.39 (4.97, 10.5)	12.92 (9.62, 16.86)	13.98 (10.42, 18.21)	18.29 (13.67, 23.7)	21.01 (16.2, 26.51)	8.95 (5.09, 12.8)	2.29 (1.58, 3.55)

Non-OA	2013	8.33 (6.12, 11.03)	8.5 (6.11, 11.43)	10.56 (7.92, 13.72)	12.47 (9.46, 16.03)	8.69 (6.19, 11.77)	11.36 (8.27, 15.09)	13.43 (9.97, 17.56)	12.22 (8.79, 16.38)	9.35 (6.2, 13.4)	12.5 (8.59, 17.36)	3.9 (0.49, 7.36)	1.46 (1.04, 2.08)
OA	2014	7.17 (4.96, 9.98)	9.97 (7.12, 13.48)	8.56 (5.93, 11.86)	10 (7.21, 13.42)	10.44 (7.57, 13.95)	11.31 (8.09, 15.26)	12.32 (8.74, 16.72)	14.29 (10.31, 19.08)	13.65 (9.65, 18.56)	17.24 (12.31, 23.15)	8.49 (4.57, 12.39)	2.27 (1.54, 3.59)
Non-OA	2014	7.61 (5.32, 10.47)	8.14 (5.73, 11.14)	9.63 (6.94, 12.93)	12.15 (8.93, 16.01)	7.67 (5.2, 10.83)	13.36 (9.76, 17.68)	12.05 (8.63, 16.23)	13.73 (9.75, 18.57)	16.75 (11.89, 22.61)	15.05 (10.46, 20.68)	8.57 (4.59, 12.54)	2.3 (1.55, 3.66)
OA	2015	6.36 (4.3, 9.01)	11.01 (7.79, 14.97)	6.91 (4.33, 10.37)	12.08 (8.61, 16.33)	9.94 (6.98, 13.61)	12.02 (8.14, 16.9)	13.92 (9.78, 19)	17.29 (12.48, 23.04)	21.76 (16.16, 28.26)	16.75 (11.75, 22.82)	13.22 (8.84, 17.61)	3.58 (2.23, 6.97)
Non-OA	2015	8.45 (5.96, 11.56)	9.51 (6.55, 13.23)	11.82 (8.54, 15.8)	8.97 (6.05, 12.71)	8.36 (5.53, 12.01)	12.19 (8.59, 16.61)	14.72 (10.41, 19.96)	14.21 (9.66, 19.88)	14.55 (10.17, 19.91)	13.1 (8.39, 19.15)	6.49 (2.32, 10.82)	1.83 (1.22, 2.86)
OA	2016	6.96 (4.51, 10.17)	9.33 (6.13, 13.46)	10.34 (6.74, 15)	8.94 (5.2, 14.11)	12.11 (8.13, 17.13)	13.45 (8.72, 19.5)	7.91 (4.39, 12.91)	15.72 (10.44, 22.33)	18 (12.21, 25.1)	15.45 (9.56, 23.07)	9.62 (4.67, 14.66)	2.54 (1.54, 4.83)
Non-OA	2016	7.82 (5.26, 11.11)	10.11 (6.77, 14.37)	8.33 (5.01, 12.85)	9.44 (5.6, 14.69)	8.55 (5.3, 12.89)	10.34 (5.91, 16.49)	12.44 (8.13, 17.94)	17.76 (12.04, 24.78)	10.3 (6.12, 15.98)	17.8 (11.37, 25.91)	7.8 (2.76, 12.99)	2.17 (1.3, 4.12)
OA	2017	7.55 (4.95, 10.95)	9.88 (6.5, 14.24)	14.01 (9.59, 19.5)	9.25 (5.38, 14.58)	8.96 (5.39, 13.78)	10.32 (5.61, 17)	14.79 (9.39, 21.71)	14.89 (9.46, 21.86)	15.6 (9.36, 23.79)	19.54 (11.81, 29.43)	9 (3.55, 14.46)	2.3 (1.36, 4.52)
Non-OA	2017	7.56 (5.04, 10.81)	7.58 (4.75, 11.36)	12.17 (7.87, 17.7)	7.38 (3.74, 12.83)	8.9 (5.27, 13.87)	9.16 (4.82, 15.45)	10.27 (5.87, 16.38)	14.55 (8.55, 22.54)	8.06 (3.94, 14.33)	17.71 (10.67, 26.83)	5.84 (0.74, 10.82)	1.88 (1.07, 3.67)
OA	Age 35-44 years	0.9 (0.29, 2.08)	0.94 (0.31, 2.18)	1.67 (0.77, 3.15)	2.42 (1.33, 4.03)	2.26 (1.21, 3.84)	2 (1, 3.55)	3.49 (2.11, 5.39)	4.58 (2.93, 6.8)	3.34 (2.02, 5.17)	4.55 (3.09, 6.43)	4.09 (2.51, 5.67)	7.86 (-47.66, 75.14)

Non-OA	Age 35-44 years	1.11 (0.45, 2.28)	2.29 (1.23, 3.89)	3.13 (1.89, 4.85)	2.34 (1.29, 3.9)	2.78 (1.63, 4.41)	4.67 (2.98, 6.92)	4.07 (2.57, 6.1)	2.92 (1.61, 4.86)	5.46 (3.66, 7.79)	5.11 (3.45, 7.25)	3.97 (2.26, 5.66)	3.99 (2.07, 12.23)
OA	Age 45-54 years	2.57 (2.01, 3.23)	3.98 (3.21, 4.87)	3.72 (2.97, 4.59)	4.25 (3.48, 5.13)	4.96 (4.11, 5.92)	4.04 (3.24, 4.98)	5.88 (4.91, 6.97)	5.76 (4.74, 6.92)	6.19 (5.13, 7.39)	7.45 (6.34, 8.7)	4.47 (3.46, 5.49)	2.78 (2.16, 3.69)
Non-OA	Age 45-54 years	3.57 (2.92, 4.32)	5.34 (4.49, 6.3)	5.09 (4.24, 6.06)	4.3 (3.54, 5.18)	5.34 (4.49, 6.31)	5.51 (4.57, 6.57)	6.69 (5.62, 7.9)	7.81 (6.6, 9.16)	9.32 (7.97, 10.81)	7.32 (6.16, 8.64)	4.79 (3.67, 5.93)	2.42 (1.94, 3.09)
OA	Age 55-64 years	4.87 (4.27, 5.54)	6.19 (5.47, 6.98)	6.86 (6.09, 7.69)	6.54 (5.82, 7.31)	7.43 (6.66, 8.26)	8.09 (7.2, 9.05)	9.35 (8.37, 10.39)	9.8 (8.72, 10.96)	11.48 (10.27, 12.77)	12.23 (11.01, 13.55)	7.19 (6.2, 8.21)	2.69 (2.31, 3.17)
Non-OA	Age 55-64 years	6.09 (5.43, 6.82)	6.81 (6.08, 7.61)	6.58 (5.84, 7.39)	7.98 (7.19, 8.83)	7.09 (6.34, 7.9)	8.81 (7.87, 9.82)	8.76 (7.81, 9.79)	10 (8.91, 11.18)	9.69 (8.54, 10.93)	11.62 (10.4, 12.94)	5.1 (4.08, 6.12)	1.93 (1.69, 2.23)
OA	Age 65-74 years	7.35 (6.51, 8.28)	9 (8.03, 10.04)	9.98 (8.97, 11.07)	9.83 (8.82, 10.9)	10.32 (9.3, 11.41)	10.69 (9.53, 11.94)	10.87 (9.67, 12.18)	13.19 (11.81, 14.66)	13.8 (12.28, 15.43)	14.71 (13.14, 16.38)	6.7 (5.41, 8.01)	1.93 (1.69, 2.21)
Non-OA	Age 65-74 years	8.11 (7.22, 9.07)	9.19 (8.21, 10.23)	10.19 (9.17, 11.28)	9.23 (8.24, 10.3)	9.58 (8.58, 10.64)	11.83 (10.62, 13.13)	12.51 (11.22, 13.89)	11.85 (10.51, 13.28)	12.5 (11.07, 14.05)	11.7 (10.33, 13.19)	4.66 (3.42, 5.92)	1.58 (1.39, 1.8)
OA	Age 75-84 years	9.13 (7.86, 10.54)	10.12 (8.78, 11.59)	11.72 (10.3, 13.25)	10.16 (8.84, 11.61)	11.13 (9.75, 12.65)	12.41 (10.78, 14.19)	11.99 (10.36, 13.76)	13.23 (11.43, 15.19)	13.57 (11.63, 15.7)	13.64 (11.67, 15.8)	4.57 (2.82, 6.33)	1.5 (1.28, 1.77)
Non-OA	Age 75-84 years	9.07 (7.8, 10.48)	10.06 (8.72, 11.53)	12.2 (10.76, 13.76)	11.11 (9.71, 12.63)	9.54 (8.24, 10.96)	10.05 (8.6, 11.66)	10.12 (8.64, 11.75)	12.44 (10.7, 14.35)	12.23 (10.4, 14.25)	11.97 (10.09, 14.05)	2.08 (0.35, 3.8)	1.21 (1.04, 1.42)
OA	Age 85+ years	7.91 (4.9, 11.94)	7.41 (4.58, 11.21)	8.3 (5.39, 12.1)	8.11 (5.09, 12.13)	8.39 (5.4, 12.33)	8.72 (5.33, 13.28)	8.45 (5.09, 13.03)	7.36 (3.86, 12.51)	10.83 (6.44, 16.77)	13.74 (8.35, 20.84)	3.24 (-1.12, 7.65)	1.46 (0.86, 2.61)
Non-OA	Age 85+ years	13.28 (9.26, 18.22)	11.49 (7.89, 16)	7.55 (4.74, 11.32)	8.54 (5.55, 12.44)	8.39 (5.45, 12.23)	7.11 (4.03, 11.45)	6.57 (3.54, 10.97)	6.7 (3.62, 11.19)	7.81 (3.81, 13.9)	9.33 (5.2, 15.16)	-5.18 (-9.82, -0.62)	0.54 (0.28, 0.94)

OA	Men	7.75 (6.99, 8.56)	9.23 (8.37, 10.14)	10.17 (9.27, 11.13)	9.59 (8.73, 10.5)	10.74 (9.84, 11.7)	10.39 (9.4, 11.44)	11.21 (10.16, 12.33)	12.4 (11.23, 13.63)	11.18 (10.01, 12.44)	13.99 (12.73, 15.33)	5.05 (3.95, 6.15)	1.64 (1.47, 1.84)
Non-OA	Men	10.53 (9.66, 11.45)	10.89 (9.98, 11.85)	12.68 (11.7, 13.72)	12.5 (11.53, 13.52)	12.21 (11.24, 13.24)	13.22 (12.12, 14.38)	13.03 (11.9, 14.23)	14.57 (13.3, 15.91)	16.05 (14.69, 17.48)	13.86 (12.6, 15.21)	4.63 (3.4, 5.85)	1.45 (1.31, 1.59)
OA	Women	4.36 (3.94, 4.81)	5.69 (5.19, 6.22)	6.36 (5.84, 6.92)	6.15 (5.65, 6.69)	6.67 (6.14, 7.23)	7.12 (6.53, 7.76)	7.96 (7.33, 8.64)	8.73 (8.02, 9.48)	10.24 (9.45, 11.07)	9.9 (9.13, 10.72)	5.77 (5.11, 6.45)	2.39 (2.14, 2.67)
Non-OA	Women	4.27 (3.86, 4.7)	5.71 (5.22, 6.23)	5.48 (5, 6)	5.3 (4.83, 5.8)	5.27 (4.81, 5.77)	6.59 (6.01, 7.21)	7.25 (6.63, 7.91)	7.59 (6.92, 8.31)	7.37 (6.67, 8.12)	8.37 (7.64, 9.14)	3.83 (3.19, 4.46)	1.92 (1.72, 2.15)
OA	East Midlands	5.51 (3.05, 9.08)	9.6 (7.16, 12.53)	7.37 (5.1, 10.25)	8.7 (6.55, 11.28)	5.57 (3.34, 8.66)	8.41 (5.66, 11.92)	7.73 (5.81, 10.04)	7.94 (5.65, 10.78)	7.98 (5.83, 10.6)	10.47 (7.01, 14.86)	0.87 (-2.07, 3.92)	1.11 (0.76, 1.65)
Non-OA	East Midlands	4.4 (2.22, 7.74)	7.17 (5.07, 9.79)	6.02 (4.1, 8.49)	8.32 (6.18, 10.91)	6.35 (3.87, 9.75)	10.59 (7.53, 14.36)	7.28 (5.36, 9.62)	9.03 (6.53, 12.09)	8.75 (6.61, 11.32)	10.74 (7.14, 15.34)	3.93 (1.05, 6.84)	1.67 (1.14, 2.53)
OA	East of England	4.36 (3.55, 5.29)	5.91 (4.84, 7.13)	5.95 (4.72, 7.38)	6.65 (5.52, 7.94)	8.17 (6.81, 9.71)	7.47 (6.17, 8.95)	7.63 (6.24, 9.21)	10.07 (7.91, 12.6)	13.73 (10.64, 17.32)	12.62 (9.17, 16.78)	6.57 (4.94, 8.26)	2.76 (2.1, 3.77)
Non-OA	East of England	5.42 (4.52, 6.45)	5.86 (4.79, 7.08)	8.36 (6.93, 9.97)	7.46 (6.26, 8.81)	6.41 (5.22, 7.77)	8.29 (6.89, 9.85)	8.22 (6.74, 9.9)	9.73 (7.59, 12.23)	12.08 (9.3, 15.34)	8.44 (5.59, 12.12)	4.45 (2.79, 6.12)	1.87 (1.47, 2.42)
OA	London	5.53 (3.94, 7.51)	7.74 (6.11, 9.65)	10.32 (8.31, 12.62)	9.59 (7.94, 11.45)	10.75 (9.11, 12.57)	11.13 (9.32, 13.15)	11.58 (9.85, 13.5)	10.79 (9.06, 12.73)	12.38 (10.5, 14.45)	13.01 (9.84, 16.75)	5.51 (3.4, 7.65)	1.73 (1.4, 2.17)
Non-OA	London	8.52 (6.57, 10.83)	7.59 (5.98, 9.46)	8.69 (6.82, 10.87)	9.91 (8.25, 11.78)	8.67 (7.18, 10.34)	11.29 (9.46, 13.32)	9.52 (7.95, 11.3)	12.86 (10.97, 14.95)	11.39 (9.59, 13.39)	13.78 (10.44, 17.72)	4.96 (2.83, 7.06)	1.65 (1.32, 2.08)
OA	North East	3.34 (1.68, 5.9)	3.72 (1.8, 6.73)	6.47 (3.27, 11.28)	2.71 (1.1, 5.51)	5.17 (2.39, 9.59)	6.01 (3.66, 9.23)	7.28 (4.67, 10.72)	6.44 (4.32, 9.17)	6.23 (3.6, 9.91)	9.76 (7.9, 11.88)	7.53 (4.5, 10.66)	3.77 (2.13, 9.61)

Non-OA	North East	5.36 (3.21, 8.33)	8.04 (5.49, 11.28)	5.59 (2.71, 10.03)	5.56 (2.9, 9.5)	5.38 (2.61, 9.66)	7.1 (4.5, 10.55)	6.27 (3.76, 9.73)	6.25 (4.19, 8.91)	8.23 (5.1, 12.43)	8.16 (6.4, 10.21)	2.44 (-0.65, 5.69)	1.43 (0.9, 2.38)
OA	North West	5.21 (4.08, 6.53)	6.76 (5.66, 8.01)	8.04 (6.93, 9.26)	7.5 (6.26, 8.9)	7.39 (6.24, 8.67)	7.64 (6.42, 9.01)	9.39 (8.07, 10.85)	8.91 (7.65, 10.31)	9.69 (8.48, 11.01)	12.7 (11.54, 13.94)	6.55 (5.14, 8.01)	2.21 (1.84, 2.7)
Non-OA	North West	7.12 (5.84, 8.59)	7.9 (6.75, 9.18)	9.23 (8.06, 10.52)	8.66 (7.35, 10.11)	8.23 (6.99, 9.61)	8.67 (7.37, 10.12)	9.82 (8.49, 11.29)	9.57 (8.24, 11.03)	11.11 (9.78, 12.56)	10.9 (9.81, 12.07)	3.85 (2.42, 5.31)	1.52 (1.3, 1.8)
OA	South Central	6.41 (5.61, 7.28)	7.16 (5.96, 8.52)	8.69 (7.18, 10.39)	7.05 (5.76, 8.54)	8.64 (7.14, 10.34)	8.4 (6.8, 10.25)	10.79 (8.89, 12.93)	12.31 (10.02, 14.92)	11.54 (8.79, 14.79)	12.05 (7.52, 17.99)	5.69 (3.86, 7.51)	2.07 (1.63, 2.7)
Non-OA	South Central	6.02 (5.25, 6.86)	7.04 (5.86, 8.38)	6.98 (5.6, 8.58)	9.08 (7.63, 10.71)	8.2 (6.74, 9.86)	7.71 (6.2, 9.44)	9.89 (8.03, 12.02)	8.84 (6.83, 11.21)	7.38 (5.14, 10.21)	11.43 (6.68, 17.9)	3.81 (2.15, 5.5)	1.68 (1.33, 2.15)
OA	South East Coast	6.28 (5.27, 7.42)	7 (5.98, 8.14)	8.32 (7.16, 9.61)	8.52 (7.28, 9.91)	8.65 (7.27, 10.19)	8.76 (7.12, 10.64)	9.93 (7.89, 12.29)	11.5 (9.5, 13.77)	13.18 (10.76, 15.92)	15.76 (11.04, 21.52)	6.1 (4.34, 7.84)	2.11 (1.7, 2.66)
Non-OA	South East Coast	6 (5.01, 7.1)	7.69 (6.65, 8.84)	7.87 (6.72, 9.14)	6.79 (5.67, 8.05)	8.03 (6.7, 9.52)	8.98 (7.31, 10.88)	10.29 (8.18, 12.73)	9.95 (8.09, 12.06)	10.49 (8.22, 13.12)	14.59 (9.84, 20.52)	4.4 (2.69, 6.08)	1.76 (1.41, 2.23)
OA	South West	5.89 (4.39, 7.71)	8.64 (7.18, 10.29)	8.05 (6.69, 9.59)	8.06 (6.61, 9.72)	7.11 (6.09, 8.24)	8.23 (6.88, 9.76)	7.33 (5.89, 8.98)	10.92 (9.15, 12.9)	10.66 (8.79, 12.78)	10.13 (8.11, 12.44)	3.12 (1.35, 4.92)	1.46 (1.17, 1.84)
Non-OA	South West	6.08 (4.56, 7.92)	9.27 (7.76, 10.97)	8.78 (7.39, 10.32)	8.06 (6.6, 9.71)	7.1 (6.09, 8.22)	8.28 (6.92, 9.81)	9.85 (8.18, 11.73)	10.47 (8.75, 12.39)	10.92 (8.94, 13.17)	10.62 (8.52, 13.02)	3.15 (1.34, 4.98)	1.44 (1.17, 1.78)
OA	West Midlands	5.01 (4.07, 6.09)	6.14 (4.91, 7.56)	6.37 (5.35, 7.51)	6.21 (5.1, 7.46)	8.53 (7.28, 9.93)	7.48 (6.12, 9.03)	8.62 (7.15, 10.27)	10.51 (8.74, 12.5)	10.14 (8.43, 12.08)	10.73 (9.31, 12.29)	6.45 (4.94, 7.98)	2.42 (1.94, 3.09)
Non-OA	West Midlands	7.88 (6.71, 9.18)	8.18 (6.83, 9.7)	7.12 (6.07, 8.3)	7.44 (6.22, 8.82)	7.51 (6.33, 8.84)	9.44 (7.91, 11.16)	9.01 (7.52, 10.68)	10.15 (8.38,	9.68 (7.97, 11.62)	9.93 (8.52, 11.48)	2.92 (1.32, 4.5)	1.42 (1.17, 1.74)

									12.16)				
OA	Yorkshire & The Humber	5.13 (3.21, 7.74)	4.13 (2.38, 6.63)	6.24 (4.36, 8.61)	5.72 (4.54, 7.11)	6.33 (4.65, 8.38)	7.97 (5.98, 10.38)	8.57 (6.45, 11.12)	6.86 (4.68, 9.66)	8.03 (5.59, 11.09)	6.27 (4.5, 8.47)	2.85 (0.6, 5.08)	1.56 (1.1, 2.25)
Non-OA	Yorkshire & The Humber	6.05 (3.99, 8.73)	4.24 (2.44, 6.8)	6.83 (4.97, 9.12)	5.26 (4.09, 6.65)	7.12 (5.46, 9.08)	8.46 (6.42, 10.9)	8.64 (6.46, 11.26)	8.19 (5.74, 11.26)	9.24 (6.48, 12.67)	7.11 (5.15, 9.52)	3.65 (1.28, 5.95)	1.71 (1.21, 2.51)
IMD, Indices of multiple deprivation; 95%CI, 95% confidence interval; OA, osteoarthritis													

Appendix 3.1.4. Inequality in the prevalence of dyslipidaemia in OA and non-OA samples by subgroups, 1992-2017

OA	Subgroup	Period prevalence by IMD decile (%) (95%CI)	Slope index of	Relative index of

status		1 (Least deprived)	2	3	4	5	6	7	8	9	10(Most deprived)	inequality (95%CI)(%)	inequality (95%CI)
OA	1992	62.5 (40.59, 81.2)	55.81 (39.88, 70.92)	67.57 (50.21, 81.99)	53.85 (41.03, 66.3)	43.9 (28.47, 60.25)	45.71 (28.83, 63.35)	50 (35.23, 64.77)	40.74 (27.57, 54.97)	45 (29.26, 61.51)	66.1 (52.61, 77.92)	-6.38 (-22.95, 10.25)	0.89 (0.65, 1.2)
Non-OA	1992	79.17 (57.85, 92.87)	55.56 (38.1, 72.06)	50.98 (36.6, 65.25)	50.79 (37.89, 63.62)	56.52 (41.11, 71.07)	52 (37.42, 66.34)	61.7 (46.38, 75.49)	50 (34.9, 65.1)	52.38 (29.78, 74.29)	66.67 (53.66, 78.05)	2.83 (-13.63, 18.83)	1.05 (0.79, 1.41)
OA	1993	55.2 (46.05, 64.1)	51.02 (40.72, 61.26)	42.19 (33.51, 51.23)	58.51 (51.11, 65.63)	50 (42.47, 57.53)	57.4 (49.57, 64.96)	54.61 (46.02, 63.01)	46.55 (37.24, 56.05)	51.11 (40.35, 61.8)	49.64 (40.99, 58.3)	-1.67 (-11.16, 7.35)	0.97 (0.8, 1.16)
Non-OA	1993	60.87 (51.33, 69.84)	50.83 (41.55, 60.07)	60.63 (51.57, 69.18)	56.13 (49.17, 62.92)	46.59 (39.05, 54.25)	58.16 (49.56, 66.4)	48.51 (39.79, 57.29)	50.45 (40.8, 60.08)	50.52 (40.17, 60.83)	46.76 (38.26, 55.41)	-11.36 (-20.87, -1.98)	0.81 (0.67, 0.97)
OA	1994	53.25 (45.05, 61.32)	63.43 (54.68, 71.58)	65.31 (57.02, 72.96)	54.55 (47.72, 61.25)	57.06 (49.42, 64.46)	55.96 (48.65, 63.08)	62.24 (53.75, 70.2)	50.86 (41.42, 60.26)	49.21 (40.19, 58.26)	50.28 (42.72, 57.82)	-9.48 (-18.31, -0.7)	0.84 (0.72, 0.98)
Non-OA	1994	66.47 (58.84, 73.52)	54.29 (45.66, 62.72)	60 (51.97, 67.65)	53.33 (46.59, 59.99)	56.29 (48.41, 63.94)	55.35 (47.27, 63.22)	52.67 (43.77, 61.45)	54.24 (44.82, 63.44)	51.09 (42.42, 59.73)	50.55 (43.05, 58.03)	-12.28 (-21.12, -3.35)	0.8 (0.69, 0.93)
OA	1995	64.07 (56.3, 71.34)	62.79 (53.84, 71.14)	56.58 (48.31, 64.59)	56.5 (49.72, 63.11)	60.98 (53.93, 67.69)	62.24 (55.06, 69.05)	64.1 (56.04, 71.62)	62.31 (53.39, 70.65)	58.16 (49.56, 66.4)	60.41 (53.21, 67.29)	0.03 (-8.26, 8.33)	1 (0.87, 1.15)
Non-OA	1995	60.48 (52.63, 67.95)	58.9 (50.47, 66.97)	62.57 (54.86, 69.84)	57.79 (50.6, 64.74)	57.35 (50.26, 64.23)	57.71 (50.03, 65.13)	53.01 (45.12, 60.79)	56.85 (48.4, 65.01)	65.04 (55.92, 73.42)	48.99 (41.84, 56.17)	-7.95 (-16.29, 0.47)	0.87 (0.75, 1.01)
OA	1996	61.76 (55.27, 67.97)	55 (47.82, 62.02)	61.88 (53.87, 69.43)	60.63 (54.33, 66.68)	55.51 (48.79, 62.08)	62.44 (55.7, 68.85)	60.59 (53.51, 67.36)	60.57 (52.92, 67.86)	65.73 (58.26, 72.67)	51.07 (44.46, 57.66)	-2.3 (-9.98, 5.08)	0.96 (0.84, 1.09)

Non-OA	1996	60.25 (53.81, 66.43)	61.86 (54.62, 68.72)	57.06 (49.42, 64.46)	56.86 (50.54, 63.03)	52.97 (46.38, 59.47)	57.46 (50.76, 63.96)	50.75 (43.62, 57.85)	61.05 (53.33, 68.38)	50 (41.79, 58.21)	52.17 (45.51, 58.78)	-8.96 (-16.41, -1.45)	0.85 (0.74, 0.97)
OA	1997	64.06 (58.54, 69.32)	64.14 (57.87, 70.08)	68.42 (61.96, 74.4)	59.01 (53.03, 64.8)	59.73 (53.92, 65.35)	64.46 (58.08, 70.49)	65.7 (59.35, 71.66)	65.34 (57.81, 72.34)	60.87 (52.88, 68.45)	68.63 (62.54, 74.27)	2.15 (-4.46, 8.71)	1.03 (0.93, 1.15)
Non-OA	1997	66.88 (61.37, 72.06)	66.02 (59.86, 71.8)	64.53 (58.03, 70.65)	57.34 (51.45, 63.07)	60 (54.4, 65.41)	57.09 (50.75, 63.26)	57.48 (50.55, 64.19)	61.76 (54.01, 69.1)	66.87 (59.01, 74.1)	58.44 (51.96, 64.7)	-7.27 (-14.09, -0.63)	0.89 (0.79, 0.99)
OA	1998	68.96 (63.7, 73.87)	66.29 (60.24, 71.97)	66.19 (60.33, 71.7)	68.99 (63.81, 73.83)	64.07 (58.67, 69.22)	63.48 (57.68, 69)	66.97 (60.3, 73.18)	67.56 (61.01, 73.63)	69.76 (62.97, 75.96)	64.94 (58.94, 70.62)	-1.7 (-7.91, 4.53)	0.97 (0.89, 1.07)
Non-OA	1998	67.13 (61.99, 71.99)	64.44 (58.57, 70)	60.23 (53.99, 66.24)	63.83 (58.38, 69.03)	64.93 (59.64, 69.96)	64.06 (58.14, 69.67)	62.04 (56.01, 67.81)	62.88 (56.27, 69.15)	61.01 (52.96, 68.63)	60.24 (53.93, 66.3)	-4.86 (-11.32, 1.45)	0.93 (0.84, 1.03)
OA	1999	76.4 (71.64, 80.72)	66.47 (61.13, 71.51)	68.14 (62.7, 73.23)	70.72 (65.61, 75.47)	65.08 (60.04, 69.88)	68.08 (62.54, 73.26)	64.36 (58.39, 70.02)	69.8 (63.77, 75.38)	69.52 (63.64, 74.96)	71.48 (65.92, 76.59)	-2.83 (-8.49, 2.78)	0.96 (0.88, 1.04)
Non-OA	1999	64.99 (59.63, 70.07)	68.71 (63.37, 73.71)	64.24 (58.81, 69.42)	61.73 (56.48, 66.79)	65.7 (60.68, 70.47)	60.25 (54.63, 65.68)	60.14 (54.31, 65.76)	63.11 (56.73, 69.18)	57.14 (50.78, 63.34)	57.82 (51.95, 63.53)	-9.53 (-15.48, -3.49)	0.86 (0.78, 0.95)
OA	2000	69.86 (64.87, 74.53)	72.58 (67.25, 77.47)	71.59 (66.57, 76.25)	69.58 (64.67, 74.18)	67.35 (62.46, 71.97)	71.64 (65.91, 76.89)	68.79 (63.03, 74.16)	67.92 (61.94, 73.5)	64.26 (57.77, 70.38)	71.79 (66.45, 76.72)	-2.98 (-8.6, 2.67)	0.96 (0.88, 1.04)
Non-OA	2000	71.14 (66.09, 75.84)	70.54 (65.35, 75.36)	67.4 (62.32, 72.18)	61.71 (56.73, 66.52)	63.61 (58.64, 68.38)	68 (62.4, 73.24)	64.11 (57.8, 70.08)	64.39 (58.29, 70.17)	63.41 (57.06, 69.44)	68.03 (62.09, 73.56)	-5.39 (-11.18, 0.4)	0.92 (0.84, 1.01)
OA	2001	72.4 (67.52, 76.92)	71.95 (67.17, 76.38)	71.51 (66.43, 76.22)	70.33 (65.7, 74.68)	68.69 (63.97, 73.14)	71.79 (66.5, 76.66)	71.29 (65.97, 76.21)	70.82 (65.12, 76.07)	73.65 (68.04, 78.74)	70.85 (65.72, 75.6)	-0.3 (-5.62, 5)	1 (0.92, 1.07)

Non-OA	2001	72.66 (67.9, 77.05)	65.63 (60.44, 70.57)	67.39 (62.34, 72.16)	64.34 (59.52, 68.95)	66.82 (62.17, 71.24)	67.87 (62.78, 72.66)	64.08 (58.45, 69.43)	67.05 (60.99, 72.72)	64.26 (58.31, 69.9)	64.98 (59.26, 70.4)	-4.95 (-10.52, 0.66)	0.93 (0.85, 1.01)
OA	2002	73.4 (69.16, 77.35)	71.78 (67.37, 75.89)	70.73 (66.3, 74.89)	72.08 (67.95, 75.95)	70.83 (66.65, 74.77)	72.16 (67.42, 76.57)	74.27 (69.76, 78.43)	70.73 (65.91, 75.22)	73.04 (67.81, 77.83)	71.47 (66.4, 76.16)	-0.12 (-4.82, 4.7)	1 (0.93, 1.07)
Non-OA	2002	70.02 (65.74, 74.06)	71.52 (67.09, 75.67)	70.24 (66, 74.24)	64.09 (59.73, 68.28)	62.55 (58.08, 66.87)	66.5 (61.64, 71.11)	70.44 (65.74, 74.84)	65.64 (60.47, 70.55)	66.56 (60.96, 71.83)	68.38 (63.23, 73.21)	-3.59 (-8.65, 1.29)	0.95 (0.88, 1.02)
OA	2003	73.27 (69.78, 76.56)	72.56 (68.9, 76)	75.22 (71.48, 78.69)	71.51 (68.03, 74.81)	70.94 (67.15, 74.52)	74 (70.04, 77.7)	71.2 (67.05, 75.11)	73.77 (69.33, 77.88)	72.84 (68.23, 77.11)	75.26 (71.12, 79.09)	0.52 (-3.57, 4.7)	1.01 (0.95, 1.07)
Non-OA	2003	70.06 (66.46, 73.49)	69.68 (66.03, 73.16)	65.25 (61.26, 69.1)	67.21 (63.53, 70.73)	69.47 (65.75, 73.01)	67.24 (63.03, 71.26)	69.29 (65.02, 73.33)	71.04 (66.57, 75.23)	65.74 (60.84, 70.4)	65.2 (60.49, 69.69)	-2.09 (-6.41, 2.17)	0.97 (0.91, 1.04)
OA	2004	69.99 (66.5, 73.31)	73.7 (70.34, 76.86)	76.87 (73.59, 79.93)	72.57 (69.28, 75.69)	72.12 (68.79, 75.27)	71.52 (67.78, 75.05)	72.34 (68.51, 75.94)	69.65 (65.47, 73.6)	75.05 (71, 78.8)	72.65 (68.42, 76.6)	-0.37 (-4.18, 3.53)	0.99 (0.94, 1.05)
Non-OA	2004	68.06 (64.63, 71.36)	71.17 (67.68, 74.47)	67.64 (64.17, 70.97)	65.17 (61.72, 68.52)	71.1 (67.56, 74.45)	68.84 (65.11, 72.4)	68.42 (64.43, 72.22)	69.25 (65.01, 73.25)	64.64 (59.99, 69.09)	63.36 (59.07, 67.49)	-3.44 (-7.52, 0.75)	0.95 (0.89, 1.01)
OA	2005	69.85 (66.68, 72.89)	71.39 (68.21, 74.43)	71.98 (68.73, 75.06)	70.23 (67.05, 73.27)	74.49 (71.39, 77.42)	75.29 (71.88, 78.48)	71.83 (68.26, 75.21)	69.74 (65.91, 73.37)	74.11 (70.29, 77.68)	72.2 (67.97, 76.16)	2.58 (-1.14, 6.27)	1.04 (0.98, 1.09)
Non-OA	2005	69.2 (66.03, 72.23)	70.82 (67.71, 73.79)	69.19 (65.82, 72.42)	68.64 (65.36, 71.78)	68.59 (65.42, 71.65)	68.39 (64.68, 71.93)	67.52 (63.81, 71.08)	66.17 (62.22, 69.95)	65.55 (61.36, 69.57)	65.38 (61.01, 69.58)	-5.01 (-8.78, -1.16)	0.93 (0.88, 0.98)
OA	2006	74.34 (71.24, 77.27)	71.97 (68.85, 74.94)	71.33 (68.17, 74.34)	70.32 (67.16, 73.35)	71.04 (67.84, 74.09)	74.02 (70.7, 77.15)	72.15 (68.7, 75.42)	72.01 (68.36, 75.45)	68.87 (64.67, 72.85)	70.02 (65.82, 73.98)	-2.48 (-6.16, 1.16)	0.97 (0.92, 1.02)

Non-OA	2006	65.17 (61.89, 68.34)	64.83 (61.66, 67.91)	65.02 (61.67, 68.27)	66.63 (63.46, 69.69)	62.26 (59.07, 65.37)	65.81 (62.07, 69.42)	66.82 (63.11, 70.38)	66.72 (62.8, 70.48)	65.54 (61.32, 69.58)	63.82 (59.16, 68.29)	0.55 (-3.31, 4.4)	1.01 (0.95, 1.07)
OA	2007	72.52 (69.61, 75.3)	71.52 (68.52, 74.39)	71.95 (68.95, 74.81)	71.84 (68.89, 74.66)	71.92 (69.01, 74.7)	70.37 (67.04, 73.55)	71.54 (68.24, 74.67)	70.29 (66.75, 73.65)	71.32 (67.64, 74.8)	71.53 (67.6, 75.23)	-1.42 (-4.9, 2.05)	0.98 (0.94, 1.03)
Non-OA	2007	64.34 (61.42, 67.19)	66.13 (63.1, 69.07)	69.3 (66.24, 72.25)	62.76 (59.56, 65.87)	63.08 (59.96, 66.11)	64.5 (61.07, 67.82)	63.95 (60.42, 67.37)	65.58 (61.87, 69.16)	60.29 (56.06, 64.41)	63.05 (58.94, 67.02)	-3.48 (-7.14, 0.1)	0.95 (0.9, 1)
OA	2008	72.21 (69.55, 74.76)	71.75 (69.01, 74.37)	72.27 (69.55, 74.87)	70.31 (67.5, 73.02)	71.13 (68.28, 73.86)	72.29 (69.29, 75.16)	73.84 (70.85, 76.68)	70.36 (66.95, 73.61)	72.5 (69.08, 75.73)	72.21 (68.76, 75.48)	0.37 (-2.79, 3.55)	1.01 (0.96, 1.05)
Non-OA	2008	64.47 (61.7, 67.17)	68.05 (65.28, 70.74)	68.6 (65.81, 71.28)	65.02 (62.08, 67.88)	62.42 (59.52, 65.26)	65.12 (61.91, 68.23)	64.37 (61.06, 67.58)	64.55 (61.02, 67.96)	60.79 (57.02, 64.46)	65.3 (61.53, 68.93)	-3.8 (-7.23, -0.49)	0.94 (0.9, 0.99)
OA	2009	72.23 (69.41, 74.93)	71.64 (68.55, 74.58)	69.53 (66.55, 72.38)	71.13 (68.12, 74)	72.1 (69.1, 74.96)	71 (67.51, 74.33)	72.61 (69.29, 75.75)	73.21 (69.69, 76.53)	70.36 (66.48, 74.03)	71 (67.22, 74.59)	0.25 (-3.24, 3.74)	1 (0.96, 1.05)
Non-OA	2009	67.38 (64.35, 70.3)	66.46 (63.4, 69.42)	64.56 (61.59, 67.44)	62.97 (59.82, 66.04)	66.33 (63.13, 69.43)	65.2 (61.61, 68.66)	64.61 (61.06, 68.05)	62.9 (58.99, 66.69)	62.81 (58.84, 66.64)	62.77 (58.63, 66.77)	-4.15 (-7.8, -0.54)	0.94 (0.89, 0.99)
OA	2010	70.09 (66.8, 73.23)	68.67 (65.13, 72.06)	72.01 (68.77, 75.09)	71.62 (68.21, 74.86)	69.28 (65.82, 72.59)	69.73 (65.84, 73.42)	73.36 (69.65, 76.83)	71.37 (67.17, 75.31)	73.27 (69.24, 77.03)	68.26 (63.68, 72.6)	1.5 (-2.38, 5.47)	1.02 (0.97, 1.08)
Non-OA	2010	64.79 (61.44, 68.03)	64.97 (61.47, 68.35)	65.46 (62.12, 68.7)	64.66 (61.07, 68.13)	65.13 (61.62, 68.52)	65.03 (61.04, 68.88)	64.98 (60.85, 68.96)	63.18 (58.77, 67.43)	65.2 (60.62, 69.58)	65.66 (60.97, 70.14)	-0.17 (-4.2, 3.92)	1 (0.94, 1.06)
OA	2011	72.89 (69.37, 76.21)	68.92 (65.21, 72.47)	71.83 (68.26, 75.21)	68.58 (64.84, 72.14)	70.15 (66.32, 73.78)	68.28 (64.07, 72.27)	72.06 (67.9, 75.94)	74.25 (69.67, 78.47)	71.88 (67.29, 76.15)	72.58 (67.74, 77.05)	1.37 (-2.93, 5.56)	1.02 (0.96, 1.08)

Non-OA	2011	65.57 (61.99, 69.02)	68.53 (64.84, 72.06)	66.97 (63.23, 70.56)	64.63 (60.79, 68.34)	67.49 (63.6, 71.21)	60.91 (56.5, 65.2)	62.75 (58.35, 66.99)	66.5 (61.72, 71.05)	63.28 (58.36, 67.99)	67.65 (62.39, 72.59)	-2.85 (-7.31, 1.65)	0.96 (0.89, 1.03)
OA	2012	73.18 (69.51, 76.64)	71.66 (67.71, 75.38)	73.41 (69.5, 77.06)	69.8 (65.57, 73.8)	72.66 (68.62, 76.44)	71.5 (66.96, 75.73)	69.17 (64.21, 73.82)	69.39 (64.21, 74.22)	67.73 (62.24, 72.88)	68.9 (63.31, 74.1)	-5.02 (-9.71, -0.26)	0.93 (0.87, 1)
Non-OA	2012	66.27 (62.3, 70.08)	67.44 (63.39, 71.3)	64.65 (60.41, 68.73)	62.28 (57.7, 66.71)	63.73 (59.29, 68)	65.23 (60.57, 69.68)	68.31 (63.41, 72.93)	59.37 (54.44, 64.15)	63.13 (57.75, 68.28)	59.59 (53.72, 65.27)	-5.54 (-10.48, -0.59)	0.92 (0.85, 0.99)
OA	2013	68.84 (64.73, 72.74)	67.93 (63.24, 72.37)	71.3 (66.93, 75.4)	70.97 (66.27, 75.36)	66.9 (62.23, 71.34)	66.49 (61.49, 71.23)	70.79 (65.76, 75.46)	67.17 (61.81, 72.22)	69.92 (63.77, 75.58)	65.76 (59.61, 71.54)	-1.88 (-7.09, 3.39)	0.97 (0.9, 1.05)
Non-OA	2013	66.1 (61.88, 70.13)	67.32 (62.82, 71.6)	62.72 (58.14, 67.13)	67.39 (62.66, 71.87)	65.96 (61.25, 70.45)	63.43 (58.23, 68.41)	64.78 (59.4, 69.89)	62.7 (57.06, 68.09)	63.67 (57.71, 69.33)	61.67 (55.19, 67.85)	-4.08 (-9.33, 1.27)	0.94 (0.86, 1.02)
OA	2014	69.51 (65, 73.75)	69.81 (64.86, 74.44)	70.59 (65.69, 75.16)	68.72 (63.86, 73.29)	66.84 (61.88, 71.54)	67.28 (61.9, 72.34)	66.55 (60.73, 72.01)	68.05 (62.08, 73.61)	70.68 (64.6, 76.26)	68.97 (62.11, 75.26)	-1.83 (-7.55, 3.64)	0.97 (0.9, 1.06)
Non-OA	2014	67.11 (62.54, 71.46)	64.19 (59.45, 68.72)	62.96 (58.06, 67.68)	61.3 (56.01, 66.4)	66.14 (61.12, 70.9)	64.17 (58.53, 69.54)	66.78 (61.2, 72.02)	66.67 (60.52, 72.42)	65.02 (58.04, 71.57)	67.96 (61.12, 74.28)	1.71 (-3.89, 7.4)	1.03 (0.94, 1.12)
OA	2015	69.96 (65.52, 74.13)	66.04 (60.54, 71.23)	69.41 (63.89, 74.54)	67.79 (62.15, 73.06)	68.13 (62.9, 73.04)	69.53 (63.18, 75.37)	68.35 (62.02, 74.22)	72.9 (66.42, 78.73)	72.02 (65.12, 78.23)	69.11 (62.03, 75.58)	2.43 (-3.7, 8.41)	1.04 (0.95, 1.13)
Non-OA	2015	66.18 (61.4, 70.73)	62.27 (56.76, 67.55)	67.58 (62.23, 72.6)	61.54 (55.89, 66.96)	63.02 (57.39, 68.4)	67.74 (61.91, 73.19)	58.44 (51.8, 64.87)	68.02 (61.02, 74.47)	62.27 (55.51, 68.7)	65.48 (57.76, 72.63)	-1.43 (-7.71, 4.78)	0.98 (0.88, 1.08)
OA	2016	74.2 (69.25, 78.74)	72.39 (66.62, 77.65)	71.98 (65.73, 77.66)	69.27 (61.96, 75.94)	67.26 (60.68, 73.38)	70.18 (62.72, 76.92)	71.75 (64.51, 78.25)	73.58 (66.02, 80.25)	74.67 (66.93, 81.41)	78.05 (69.69, 85.01)	0.88 (-6.06, 7.73)	1.01 (0.92, 1.11)

Non-OA	2016	68.99 (63.92, 73.75)	68.16 (62.21, 73.71)	66.2 (59.47, 72.48)	62.22 (54.71, 69.33)	61.97 (55.41, 68.21)	61.38 (52.94, 69.34)	62.69 (55.46, 69.53)	68.42 (60.4, 75.71)	65.45 (57.67, 72.67)	67.8 (58.57, 76.1)	-4.19 (-11.65, 3.07)	0.94 (0.84, 1.05)
OA	2017	73.41 (68.31, 78.1)	70.75 (64.73, 76.28)	80.19 (74.1, 85.4)	75.72 (68.63, 81.91)	70.65 (63.83, 76.84)	60.32 (51.22, 68.92)	69.72 (61.45, 77.14)	73.76 (65.69, 80.8)	73.39 (64.07, 81.4)	73.56 (63.02, 82.45)	-3.38 (-10.95, 4.16)	0.95 (0.86, 1.06)
Non-OA	2017	67.51 (62.38, 72.34)	71.84 (66.15, 77.06)	61.9 (54.57, 68.86)	66.44 (58.26, 73.96)	67.02 (59.86, 73.63)	70.23 (61.62, 77.9)	65.07 (56.75, 72.76)	73.64 (64.38, 81.58)	59.68 (50.49, 68.39)	64.58 (54.16, 74.08)	-3.5 (-11.2, 4.47)	0.95 (0.84, 1.07)
OA	Age 35-44 years	58.35 (54.13, 62.48)	54.61 (50.27, 58.91)	57.25 (52.95, 61.47)	55.54 (51.38, 59.64)	56.27 (52.1, 60.38)	58.91 (54.67, 63.05)	60.37 (56.12, 64.5)	55.58 (51.11, 59.98)	60.81 (56.66, 64.84)	59.09 (55.23, 62.87)	3.68 (-0.86, 8.22)	1.07 (0.98, 1.15)
Non-OA	Age 35-44 years	41.65 (37.77, 45.62)	42.15 (38.05, 46.34)	44.15 (40.16, 48.2)	39.46 (35.52, 43.51)	41.5 (37.57, 45.52)	46.25 (41.78, 50.76)	43.52 (39.29, 47.82)	46.56 (42.02, 51.14)	44.64 (40.28, 49.06)	48.77 (44.58, 52.96)	6.61 (1.98, 11.22)	1.16 (1.05, 1.29)
OA	Age 45-54 years	68.64 (66.86, 70.37)	68.48 (66.51, 70.41)	70.26 (68.32, 72.15)	70.17 (68.31, 71.99)	70.43 (68.53, 72.27)	69.03 (67, 71)	70.04 (68.03, 72)	71.04 (68.92, 73.1)	72.23 (70.12, 74.28)	72.05 (70.02, 74.02)	3.47 (1.38, 5.57)	1.05 (1.02, 1.08)
Non-OA	Age 45-54 years	60.48 (58.65, 62.29)	62.61 (60.68, 64.52)	61.06 (59.05, 63.04)	59.71 (57.75, 61.65)	60.6 (58.64, 62.54)	58.43 (56.28, 60.55)	60.35 (58.13, 62.55)	61.31 (59, 63.59)	59.74 (57.34, 62.1)	60.9 (58.59, 63.18)	-1.13 (-3.4, 1.17)	0.98 (0.95, 1.02)
OA	Age 55-64 years	76.53 (75.28, 77.75)	76.11 (74.77, 77.41)	77.7 (76.37, 78.98)	75.67 (74.36, 76.94)	74.62 (73.28, 75.92)	75.3 (73.82, 76.73)	76.35 (74.86, 77.79)	76.1 (74.48, 77.68)	77.05 (75.37, 78.67)	76.41 (74.74, 78.02)	-0.36 (-1.92, 1.17)	1 (0.98, 1.02)
Non-OA	Age 55-64 years	72.66 (71.36, 73.93)	72.56 (71.2, 73.89)	72.19 (70.78, 73.56)	70.63 (69.24, 71.99)	70.72 (69.33, 72.08)	71.74 (70.18, 73.25)	71.36 (69.77, 72.92)	72.03 (70.31, 73.7)	68.88 (67, 70.72)	70.96 (69.15, 72.73)	-2.31 (-3.94, -0.69)	0.97 (0.95, 0.99)
OA	Age 65-74 years	73.8 (72.3, 75.26)	72.07 (70.49, 73.62)	73.28 (71.72, 74.8)	71.04 (69.45, 72.6)	71.94 (70.37, 73.46)	72.13 (70.36, 73.85)	72.2 (70.38, 73.97)	71.43 (69.51, 73.3)	71.25 (69.16, 73.27)	69.53 (67.4, 71.6)	-2.81 (-4.66, -0.93)	0.96 (0.94, 0.99)

Non-OA	Age 65-74 years	72.55 (71.02, 74.03)	73.43 (71.87, 74.94)	71.11 (69.53, 72.66)	68.59 (66.93, 70.21)	67.92 (66.28, 69.52)	69.6 (67.8, 71.35)	69.26 (67.38, 71.09)	67.61 (65.59, 69.58)	67.86 (65.74, 69.92)	64.69 (62.56, 66.78)	-7.38 (-9.3, -5.49)	0.9 (0.88, 0.92)
OA	Age 75-84 years	62.49 (60.25, 64.7)	61.48 (59.21, 63.71)	61.79 (59.56, 63.99)	58.83 (56.58, 61.05)	57.7 (55.43, 59.95)	62.51 (59.99, 64.97)	62.53 (59.99, 65.02)	59.09 (56.35, 61.78)	58.68 (55.75, 61.56)	57.63 (54.66, 60.57)	-3.36 (-5.97, -0.7)	0.95 (0.91, 0.99)
Non-OA	Age 75-84 years	61.22 (58.95, 63.45)	59.54 (57.25, 61.8)	59.68 (57.43, 61.91)	55.88 (53.58, 58.16)	59.64 (57.37, 61.89)	58.7 (56.2, 61.16)	57.01 (54.47, 59.52)	59.39 (56.67, 62.06)	56.24 (53.34, 59.12)	53.53 (50.5, 56.54)	-4.93 (-7.65, -2.24)	0.92 (0.88, 0.96)
OA	Age 85+ years	49.41 (43.09, 55.74)	58.89 (52.76, 64.82)	51.21 (45.29, 57.11)	47.1 (40.9, 53.38)	44.53 (38.55, 50.62)	40.37 (33.8, 47.2)	45.07 (38.26, 52.02)	46.63 (38.79, 54.59)	47.13 (39.13, 55.25)	36.64 (28.4, 45.5)	-13.98 (-21.38, -6.76)	0.74 (0.63, 0.87)
Non-OA	Age 85+ years	46.06 (39.64, 52.57)	45.98 (39.82, 52.23)	46.04 (40.07, 52.1)	42.7 (36.85, 48.72)	45.45 (39.58, 51.42)	41.23 (34.52, 48.2)	38.38 (31.58, 45.54)	43.3 (36.22, 50.59)	42.97 (34.26, 52.01)	44 (35.91, 52.33)	-5.03 (-12.53, 2.27)	0.89 (0.75, 1.06)
OA	Men	69.33 (67.98, 70.66)	69.03 (67.61, 70.42)	69.18 (67.75, 70.57)	67.36 (65.94, 68.75)	67.98 (66.56, 69.37)	68.22 (66.65, 69.75)	69.24 (67.65, 70.81)	66.77 (65.04, 68.46)	68.62 (66.83, 70.38)	68.67 (66.92, 70.38)	-1.12 (-2.79, 0.53)	0.98 (0.96, 1.01)
Non-OA	Men	64.06 (62.66, 65.45)	62.37 (60.92, 63.81)	62.13 (60.66, 63.59)	59.78 (58.31, 61.25)	60.2 (58.71, 61.69)	58.64 (57, 60.27)	58.27 (56.57, 59.96)	58.58 (56.76, 60.39)	56.39 (54.51, 58.27)	56.25 (54.37, 58.1)	-8.21 (-9.99, -6.49)	0.87 (0.85, 0.9)
OA	Women	71.91 (70.96, 72.84)	70.69 (69.68, 71.69)	72.2 (71.21, 73.18)	70.51 (69.52, 71.49)	69.73 (68.72, 70.72)	70.62 (69.53, 71.69)	71.1 (70, 72.18)	71.14 (69.96, 72.29)	71.19 (69.97, 72.39)	69.74 (68.51, 70.94)	-1.24 (-2.38, -0.07)	0.98 (0.97, 1)
Non-OA	Women	68.02 (67.04, 68.97)	69.51 (68.51, 70.5)	67.98 (66.95, 68.99)	65.8 (64.76, 66.82)	66.57 (65.56, 67.57)	67.88 (66.76, 68.99)	67.32 (66.17, 68.46)	67.88 (66.66, 69.09)	66.23 (64.91, 67.52)	66.25 (64.96, 67.52)	-2.03 (-3.24, -0.85)	0.97 (0.95, 0.99)
OA	East Midlands	68.5 (62.4, 74.17)	67.8 (63.51, 71.88)	71.2 (66.69, 75.42)	67.92 (63.97, 71.68)	63.78 (58.27, 69.03)	64.26 (58.86, 69.41)	65.76 (62, 69.38)	62.23 (57.66, 66.65)	66.05 (61.88, 70.04)	56.59 (50.3, 62.72)	-8.48 (-13.57, -3.41)	0.88 (0.81, 0.95)

Non-OA	East Midlands	62.4 (56.08, 68.43)	64.14 (59.77, 68.34)	63.65 (59.26, 67.89)	59.12 (54.93, 63.2)	53.51 (47.68, 59.27)	62.06 (56.67, 67.24)	59.22 (55.23, 63.13)	53.05 (48.28, 57.77)	58.59 (54.51, 62.58)	56.61 (50.11, 62.95)	-8.23 (-13.46, -3.08)	0.87 (0.8, 0.95)
OA	East of England	70.52 (68.57, 72.41)	69.69 (67.45, 71.86)	70.97 (68.41, 73.43)	70.01 (67.78, 72.17)	67.24 (64.76, 69.66)	67.63 (65.15, 70.04)	68.34 (65.73, 70.86)	67.41 (63.73, 70.93)	67.51 (62.89, 71.88)	67.82 (62.37, 72.94)	-3.88 (-6.73, -0.94)	0.95 (0.91, 0.98)
Non-OA	East of England	64.23 (62.2, 66.22)	63.77 (61.44, 66.06)	62.24 (59.58, 64.84)	61.89 (59.54, 64.19)	61.95 (59.44, 64.42)	61.57 (58.97, 64.13)	62.78 (59.99, 65.5)	63.77 (60, 67.42)	64.58 (60.12, 68.86)	60.71 (55.02, 66.2)	-1.77 (-4.8, 1.2)	0.97 (0.93, 1.02)
OA	London	69.29 (65.69, 72.72)	71.83 (68.82, 74.7)	75.68 (72.58, 78.59)	71.59 (68.87, 74.2)	69.08 (66.47, 71.6)	70.29 (67.47, 72.99)	69.96 (67.32, 72.51)	70.67 (67.94, 73.29)	73.9 (71.22, 76.46)	72.7 (68.01, 77.06)	0.54 (-2.64, 3.74)	1.01 (0.96, 1.05)
Non-OA	London	66.9 (63.29, 70.37)	68.28 (65.22, 71.24)	69.27 (65.93, 72.47)	64.91 (62.09, 67.66)	66.9 (64.25, 69.48)	66.88 (63.99, 69.69)	64.49 (61.75, 67.16)	66.17 (63.33, 68.92)	62.28 (59.37, 65.12)	55.41 (50.18, 60.54)	-6.79 (-10.09, -3.53)	0.9 (0.86, 0.95)
OA	North East	73.25 (68.12, 77.96)	74.72 (69.09, 79.8)	70.59 (63.13, 77.32)	75.58 (69.87, 80.7)	75.86 (68.81, 82.02)	77.53 (72.52, 82.01)	73.1 (67.85, 77.91)	73.1 (68.67, 77.22)	70.43 (64.44, 75.94)	74.5 (71.52, 77.32)	-0.38 (-5.74, 4.87)	0.99 (0.93, 1.07)
Non-OA	North East	71.13 (65.96, 75.92)	70.24 (65.32, 74.84)	64.8 (57.33, 71.78)	63.89 (57.1, 70.3)	61.83 (54.43, 68.84)	76.77 (71.67, 81.36)	67.6 (61.85, 72.98)	68.75 (64.23, 73.02)	60.49 (54.04, 66.68)	66.55 (63.26, 69.72)	-4.61 (-10.14, 0.96)	0.93 (0.86, 1.02)
OA	North West	73.36 (70.91, 75.71)	75.7 (73.68, 77.64)	74.18 (72.29, 76.01)	74.52 (72.32, 76.63)	73.53 (71.46, 75.53)	74.36 (72.21, 76.43)	73.47 (71.35, 75.52)	70.99 (68.86, 73.05)	72.77 (70.85, 74.64)	70.58 (68.93, 72.2)	-4.54 (-6.76, -2.34)	0.94 (0.91, 0.97)
Non-OA	North West	66.29 (63.76, 68.75)	71.26 (69.22, 73.25)	69.76 (67.8, 71.67)	68.91 (66.63, 71.13)	70.07 (67.88, 72.19)	68.3 (66.01, 70.53)	66 (63.77, 68.19)	66.74 (64.5, 68.93)	64.45 (62.33, 66.54)	64.88 (63.15, 66.58)	-6.12 (-8.42, -3.74)	0.91 (0.88, 0.94)
OA	South Central	71.8 (70.26, 73.31)	66.87 (64.53, 69.15)	70.07 (67.44, 72.61)	67.2 (64.65, 69.68)	66.8 (64.11, 69.41)	71.25 (68.4, 73.98)	71.83 (68.86, 74.67)	73.6 (70.24, 76.76)	66.03 (61.54, 70.31)	67.47 (59.78, 74.53)	-1.41 (-4.26, 1.44)	0.98 (0.94, 1.02)

Non-OA	South Central	66.7 (65.1, 68.26)	60.95 (58.56, 63.31)	61.65 (58.82, 64.42)	62.8 (60.21, 65.34)	65.53 (62.82, 68.15)	63.37 (60.45, 66.22)	64.29 (61.08, 67.4)	64.64 (60.94, 68.21)	61.3 (56.61, 65.84)	65.71 (57.23, 73.52)	-2.68 (-5.74, 0.27)	0.96 (0.92, 1.01)
OA	South East Coast	69.91 (67.88, 71.89)	69.94 (67.99, 71.83)	70.8 (68.77, 72.77)	67.57 (65.36, 69.73)	70.04 (67.64, 72.36)	68.67 (65.76, 71.46)	70.2 (66.8, 73.44)	68.92 (65.79, 71.92)	71.2 (67.69, 74.54)	65.02 (58.04, 71.57)	-0.98 (-3.76, 1.81)	0.99 (0.95, 1.03)
Non-OA	South East Coast	67 (64.94, 69.02)	68.44 (66.53, 70.31)	66.82 (64.7, 68.89)	62.6 (60.32, 64.85)	66.56 (64.1, 68.95)	62.93 (59.91, 65.88)	62.69 (59.06, 66.21)	64.97 (61.8, 68.05)	61.66 (57.76, 65.45)	62.16 (54.75, 69.17)	-5.88 (-8.7, -3)	0.91 (0.87, 0.95)
OA	South West	69.35 (66.09, 72.47)	66.64 (64.02, 69.18)	68.77 (66.29, 71.17)	67.34 (64.65, 69.95)	66.01 (64.03, 67.95)	66.26 (63.78, 68.68)	68.62 (65.86, 71.28)	70.46 (67.68, 73.12)	67.39 (64.33, 70.34)	67.59 (64.21, 70.85)	0.44 (-2.42, 3.32)	1.01 (0.96, 1.05)
Non-OA	South West	68.18 (64.91, 71.32)	68.62 (66.03, 71.12)	65.03 (62.56, 67.44)	63.66 (60.91, 66.34)	61.1 (59.09, 63.09)	62.97 (60.44, 65.45)	65.17 (62.32, 67.94)	67.11 (64.29, 69.83)	64.16 (60.89, 67.34)	62.78 (59.24, 66.22)	-3.18 (-6.07, -0.35)	0.95 (0.91, 1)
OA	West Midlands	71.45 (69.36, 73.48)	71.78 (69.28, 74.18)	70.21 (68.19, 72.18)	69.44 (67.19, 71.63)	71.76 (69.6, 73.84)	70.24 (67.7, 72.69)	71.08 (68.53, 73.53)	67.44 (64.55, 70.24)	68.57 (65.74, 71.3)	67.05 (64.78, 69.27)	-4.14 (-6.74, -1.56)	0.94 (0.91, 0.98)
Non-OA	West Midlands	69.17 (67.04, 71.24)	67.83 (65.37, 70.21)	66.92 (64.87, 68.91)	65.37 (63.01, 67.67)	64.71 (62.43, 66.94)	65.54 (62.89, 68.12)	64.35 (61.69, 66.93)	61.9 (58.86, 64.87)	62.78 (59.8, 65.69)	60.66 (58.25, 63.03)	-8.58 (-11.28, -5.97)	0.88 (0.84, 0.91)
OA	Yorkshire & The Humber	69.19 (64.47, 73.64)	61.76 (56.71, 66.62)	66.61 (62.47, 70.56)	66.94 (64.34, 69.47)	67.93 (64.36, 71.35)	67.62 (63.8, 71.28)	71.76 (67.96, 75.35)	67.73 (63.13, 72.1)	71.78 (67.16, 76.08)	70.74 (66.99, 74.29)	5.96 (1.8, 10.19)	1.09 (1.03, 1.16)
Non-OA	Yorkshire & The Humber	63.72 (58.98, 68.27)	67.11 (62.11, 71.83)	63.09 (59.14, 66.91)	60.93 (58.16, 63.64)	61.4 (57.99, 64.73)	61.6 (57.7, 65.39)	65.61 (61.54, 69.52)	63.13 (58.29, 67.79)	62.23 (57.06, 67.2)	60.83 (56.72, 64.84)	-1.61 (-5.88, 2.77)	0.97 (0.91, 1.04)
IMD, Indices of multiple deprivation; 95%CI, 95% confidence interval; CVD, cardiovascular disease; OA, osteoarthritis													

Appendix 3.1.5. Inequality in the prevalence of obesity in OA and non-OA samples by subgroups, 1992-2017

OA	Subgroup	Period prevalence by IMD decile (%) (95%CI)	Slope index of	Relative index of

status		1 (Least deprived)	2	3	4	5	6	7	8	9	10(Most deprived)	inequality (95%CI)(%)	inequality (95%CI)
OA	1992	22.22 (6.41, 47.64)	32.26 (16.68, 51.37)	32.26 (16.68, 51.37)	36.73 (23.42, 51.71)	36 (17.97, 57.48)	26.09 (10.23, 48.41)	40.63 (23.7, 59.36)	34.38 (18.57, 53.19)	54.84 (36.03, 72.68)	54.76 (38.67, 70.15)	27.73 (8.8, 46.93)	2.12 (1.25, 4.32)
Non-OA	1992	16.67 (3.58, 41.42)	13.04 (2.78, 33.59)	28.57 (14.64, 46.3)	31.58 (17.5, 48.65)	28.95 (15.42, 45.9)	24.14 (10.3, 43.54)	17.24 (5.85, 35.77)	18.42 (7.74, 34.33)	38.46 (13.86, 68.42)	33.33 (21.09, 47.47)	9.18 (-8.14, 26.97)	1.43 (0.71, 3.21)
OA	1993	26.88 (18.21, 37.08)	38.24 (26.71, 50.82)	36.71 (26.14, 48.31)	34.56 (26.62, 43.19)	29.6 (21.77, 38.42)	33.33 (24.78, 42.77)	34.65 (25.46, 44.77)	29.41 (20.02, 40.29)	30.88 (20.24, 43.26)	37.62 (28.18, 47.82)	1.58 (-8.89, 12.39)	1.05 (0.75, 1.46)
Non-OA	1993	20.73 (12.57, 31.11)	28 (18.24, 39.56)	20.43 (12.77, 30.05)	23.64 (17.38, 30.86)	28.93 (21.05, 37.87)	26.47 (18.22, 36.13)	34.09 (24.32, 44.97)	32 (21.69, 43.78)	30.99 (20.54, 43.08)	29.29 (20.57, 39.29)	11.29 (1.06, 21.62)	1.53 (1.04, 2.3)
OA	1994	31.13 (22.49, 40.86)	35.71 (26.29, 46.03)	28.21 (20.28, 37.27)	30.29 (23.58, 37.67)	36.84 (28.65, 45.64)	25.36 (18.35, 33.47)	38.39 (29.36, 48.06)	26.83 (17.64, 37.76)	37.35 (26.97, 48.66)	33.33 (25.54, 41.86)	2.43 (-7.23, 12.19)	1.08 (0.8, 1.47)
Non-OA	1994	20.47 (13.83, 28.54)	18.52 (11.69, 27.14)	16.67 (10.49, 24.56)	17.9 (12.33, 24.69)	23.53 (16.24, 32.18)	36.07 (27.57, 45.25)	31 (22.13, 41.03)	36.36 (26.37, 47.31)	34.62 (25.55, 44.58)	26.52 (19.21, 34.9)	18.79 (9.92, 27.76)	2.17 (1.48, 3.41)
OA	1995	22.56 (15.77, 30.61)	28.87 (20.11, 38.95)	35.58 (26.43, 45.57)	26.01 (19.65, 33.22)	27.63 (20.7, 35.46)	33.79 (26.15, 42.11)	28.79 (21.24, 37.31)	43.3 (33.27, 53.75)	36.94 (27.97, 46.62)	33.97 (26.59, 41.98)	12.43 (3.37, 21.5)	1.5 (1.11, 2.05)
Non-OA	1995	16.54 (10.67, 23.97)	21.1 (13.87, 29.96)	34.59 (26.56, 43.32)	23.68 (17.17, 31.25)	30.52 (23.36, 38.44)	24.22 (17.09, 32.58)	26.36 (18.99, 34.84)	35.92 (26.7, 45.97)	39.62 (30.25, 49.59)	28.1 (21.14, 35.93)	12.85 (4.17, 21.38)	1.6 (1.16, 2.28)
OA	1996	24.61 (18.68, 31.35)	31.01 (23.9, 38.85)	29.84 (21.96, 38.71)	30 (23.89, 36.69)	34.1 (27.08, 41.68)	38.07 (30.87, 45.68)	38.41 (30.94, 46.32)	40.15 (31.87, 48.86)	36.69 (28.68, 45.28)	34.04 (27.3, 41.29)	12.68 (4.63, 20.77)	1.47 (1.15, 1.9)

Non-OA	1996	19.31 (14.1, 25.43)	29.73 (22.5, 37.79)	22.54 (15.95, 30.3)	24.37 (18.54, 30.97)	23.68 (17.83, 30.38)	26.52 (20.25, 33.58)	28.48 (21.74, 36.02)	34.31 (26.41, 42.9)	28.21 (20.28, 37.27)	25.41 (19.25, 32.41)	7.57 (0.03, 15.15)	1.34 (1, 1.81)
OA	1997	22.61 (17.68, 28.17)	35.53 (28.86, 42.65)	33.69 (26.96, 40.95)	26.2 (20.63, 32.4)	32.8 (27.02, 39)	30.58 (24.37, 37.36)	38.42 (31.7, 45.49)	40.14 (32.01, 48.69)	32.58 (24.68, 41.27)	42.65 (35.89, 49.63)	15.34 (8.03, 22.54)	1.61 (1.28, 2.05)
Non-OA	1997	20.23 (15.5, 25.67)	26.27 (20.54, 32.65)	27.57 (21.27, 34.6)	27.82 (22.34, 33.84)	29.89 (24.4, 35.84)	32.04 (25.72, 38.88)	32.75 (25.78, 40.33)	30.14 (22.83, 38.27)	37.69 (29.35, 46.61)	32.83 (26.34, 39.84)	13.83 (6.82, 20.81)	1.62 (1.26, 2.12)
OA	1998	22.86 (18.07, 28.23)	30.36 (24.41, 36.83)	31.44 (25.49, 37.89)	33.33 (27.88, 39.13)	29.41 (24.06, 35.21)	35.27 (29.24, 41.66)	38.2 (31.03, 45.77)	40.96 (33.86, 48.35)	41.72 (34.06, 49.69)	40.99 (34.46, 47.77)	18.72 (11.88, 25.67)	1.77 (1.43, 2.22)
Non-OA	1998	20.98 (16.55, 25.99)	26.92 (21.35, 33.09)	21.66 (16.37, 27.74)	37.45 (31.63, 43.56)	26.57 (21.55, 32.09)	26.99 (21.32, 33.28)	35.4 (29.17, 42.01)	29.26 (22.86, 36.32)	30.25 (22.17, 39.35)	35.19 (28.83, 41.95)	11.92 (5.5, 18.58)	1.52 (1.2, 1.95)
OA	1999	30.48 (25.44, 35.88)	31.52 (26.08, 37.36)	29.89 (24.5, 35.72)	31.49 (26.17, 37.19)	32.24 (27.01, 37.81)	39.68 (33.6, 46.01)	39.01 (32.57, 45.75)	37.33 (31, 44.01)	44.74 (38.17, 51.44)	37.92 (31.75, 44.38)	13.59 (7.18, 20.13)	1.48 (1.22, 1.81)
Non-OA	1999	24.16 (19.41, 29.43)	20.94 (16.3, 26.21)	23.86 (19.03, 29.24)	28.09 (23.07, 33.56)	25.57 (20.77, 30.86)	27.76 (22.43, 33.59)	30.61 (24.9, 36.8)	31.25 (25.02, 38.02)	35.58 (29.08, 42.49)	32.37 (26.5, 38.67)	12.94 (6.76, 19.02)	1.61 (1.28, 2.06)
OA	2000	28.48 (23.62, 33.74)	30.68 (25.17, 36.63)	38.38 (32.83, 44.18)	34.05 (28.92, 39.47)	32.02 (27.03, 37.35)	36.36 (30.15, 42.93)	40.17 (33.9, 46.68)	38.32 (31.77, 45.19)	45.1 (38.14, 52.2)	44.06 (37.94, 50.31)	15.38 (8.93, 21.86)	1.54 (1.28, 1.86)
Non-OA	2000	23.9 (19.32, 28.98)	32.62 (27.18, 38.43)	26.06 (21.24, 31.35)	25.89 (21.29, 30.93)	25.91 (21.26, 31.01)	30.92 (25.37, 36.9)	31.46 (25.28, 38.15)	34.22 (28.05, 40.82)	34.67 (28.08, 41.73)	37.9 (31.45, 44.68)	11.38 (5.12, 17.46)	1.48 (1.19, 1.85)
OA	2001	25.7 (21.02, 30.83)	31.14 (26.21, 36.4)	37.63 (32.01, 43.51)	37.26 (32.28, 42.44)	35.59 (30.5, 40.93)	36.2 (30.56, 42.14)	45.39 (39.35, 51.52)	40.35 (33.93, 47.03)	42.26 (35.92, 48.79)	41.26 (35.5, 47.21)	15.93 (9.87, 22.08)	1.55 (1.31, 1.85)

Non-OA	2001	25.36 (20.87, 30.28)	24.26 (19.56, 29.47)	27.44 (22.61, 32.71)	30.42 (25.68, 35.5)	29.97 (25.33, 34.94)	34.64 (29.32, 40.26)	29.84 (24.33, 35.83)	37.05 (30.72, 43.74)	40.71 (34.24, 47.42)	42.4 (36.2, 48.79)	18.19 (12.25, 24.07)	1.81 (1.48, 2.25)
OA	2002	26.9 (22.72, 31.42)	30.15 (25.63, 34.99)	31.27 (26.68, 36.14)	31.32 (26.97, 35.93)	38.39 (33.8, 43.14)	37.05 (31.84, 42.49)	37.36 (32.26, 42.67)	38.37 (33.1, 43.84)	41.01 (35.17, 47.04)	43.96 (38.24, 49.8)	16.88 (11.49, 22.24)	1.63 (1.39, 1.94)
Non-OA	2002	26.36 (22.3, 30.74)	29.33 (24.77, 34.23)	31.98 (27.54, 36.68)	29.09 (24.89, 33.58)	32.13 (27.65, 36.86)	32.02 (27.2, 37.14)	34.87 (29.86, 40.14)	34.64 (29.32, 40.26)	44.62 (38.47, 50.88)	36.82 (31.32, 42.6)	13.05 (7.58, 18.61)	1.5 (1.27, 1.8)
OA	2003	27.08 (23.56, 30.82)	32.72 (28.77, 36.85)	34.07 (29.91, 38.43)	36.12 (32.3, 40.08)	37.84 (33.64, 42.17)	36.24 (31.83, 40.83)	41.48 (36.87, 46.21)	41.42 (36.33, 46.65)	45.09 (39.76, 50.5)	50 (44.95, 55.05)	20.38 (15.68, 25.14)	1.75 (1.52, 2.03)
Non-OA	2003	28.98 (25.37, 32.8)	30.49 (26.74, 34.43)	28.21 (24.33, 32.34)	31.6 (27.82, 35.57)	33.09 (29.16, 37.21)	36.11 (31.69, 40.7)	35.1 (30.61, 39.8)	37.91 (33.1, 42.91)	36.36 (31.17, 41.81)	46.22 (40.96, 51.54)	14.47 (9.73, 19.33)	1.55 (1.34, 1.8)
OA	2004	28.99 (25.53, 32.64)	32.4 (28.8, 36.17)	33.01 (29.29, 36.89)	34.75 (31.18, 38.46)	34.39 (30.85, 38.07)	40.79 (36.58, 45.1)	43.78 (39.37, 48.26)	44.37 (39.69, 49.13)	51.38 (46.57, 56.18)	50.36 (45.42, 55.3)	23.64 (19.15, 28.11)	1.9 (1.67, 2.17)
Non-OA	2004	29.35 (25.99, 32.89)	27.35 (23.87, 31.04)	30.97 (27.46, 34.64)	30.19 (26.76, 33.8)	29.84 (26.26, 33.61)	35.37 (31.45, 39.43)	37.88 (33.6, 42.29)	37.95 (33.4, 42.67)	37.5 (32.59, 42.61)	42.6 (37.92, 47.37)	14.41 (10.08, 18.77)	1.56 (1.36, 1.79)
OA	2005	33.82 (30.44, 37.33)	34.19 (30.77, 37.73)	34.91 (31.42, 38.52)	35.78 (32.34, 39.33)	39.36 (35.79, 43.03)	42.74 (38.71, 46.83)	44.33 (40.25, 48.47)	45.05 (40.77, 49.37)	47.06 (42.66, 51.5)	51.1 (46.14, 56.04)	18.5 (14.29, 22.73)	1.61 (1.43, 1.8)
Non-OA	2005	28.09 (24.94, 31.41)	30.11 (26.94, 33.43)	32.36 (28.86, 36.01)	32.63 (29.18, 36.22)	34.93 (31.57, 38.41)	34.14 (30.28, 38.16)	36.22 (32.33, 40.26)	37.31 (33.14, 41.62)	48.21 (43.63, 52.81)	41.63 (36.86, 46.52)	16 (11.75, 20.11)	1.6 (1.41, 1.82)
OA	2006	30.07 (26.75, 33.55)	34.19 (30.85, 37.65)	39.53 (35.96, 43.19)	37.89 (34.43, 41.45)	41.22 (37.64, 44.86)	44.13 (40.31, 48)	42.93 (39.02, 46.9)	49.38 (45.2, 53.57)	45.8 (41.13, 50.51)	50.44 (45.75, 55.12)	19.83 (15.59, 24.03)	1.64 (1.48, 1.85)

Non-OA	2006	28.26 (25.11, 31.57)	30.54 (27.39, 33.84)	32.29 (28.93, 35.8)	33.63 (30.34, 37.04)	35.19 (31.89, 38.6)	34.13 (30.29, 38.14)	37.01 (33.1, 41.05)	37.01 (32.91, 41.26)	41.25 (36.73, 45.89)	38.61 (33.84, 43.55)	11.87 (7.86, 15.95)	1.42 (1.26, 1.61)
OA	2007	29.46 (26.44, 32.61)	35.98 (32.71, 39.35)	40.38 (37.05, 43.77)	40.89 (37.52, 44.33)	37.17 (33.93, 40.49)	39.74 (36.1, 43.47)	42.35 (38.65, 46.11)	46.89 (42.93, 50.88)	50.79 (46.6, 54.98)	50.6 (46.14, 55.04)	19.04 (15.1, 22.94)	1.62 (1.46, 1.8)
Non-OA	2007	27.16 (24.39, 30.07)	27.71 (24.8, 30.77)	32.36 (29.17, 35.68)	33.58 (30.35, 36.92)	33.95 (30.79, 37.23)	35.7 (32.16, 39.37)	37.56 (33.9, 41.32)	38.71 (34.76, 42.78)	42.68 (38.2, 47.25)	44.79 (40.45, 49.19)	17.83 (14.08, 21.59)	1.7 (1.51, 1.93)
OA	2008	30.59 (27.81, 33.48)	37.98 (34.95, 41.07)	37.64 (34.61, 40.74)	37.47 (34.37, 40.65)	39.3 (36.11, 42.55)	44.43 (41.01, 47.89)	42.93 (39.48, 46.43)	46.82 (43.01, 50.66)	48.54 (44.63, 52.46)	47.84 (43.86, 51.84)	17.83 (14.11, 21.49)	1.57 (1.43, 1.73)
Non-OA	2008	24.82 (22.28, 27.49)	28.14 (25.41, 31)	35.74 (32.78, 38.79)	33.08 (30.07, 36.2)	32.56 (29.64, 35.58)	33.71 (30.44, 37.1)	39.18 (35.67, 42.77)	42.22 (38.46, 46.05)	41.33 (37.36, 45.39)	45.47 (41.42, 49.57)	19.3 (15.8, 22.86)	1.78 (1.59, 2)
OA	2009	29.41 (26.51, 32.43)	35.82 (32.44, 39.29)	34.88 (31.74, 38.12)	39.52 (36.2, 42.92)	41.33 (37.92, 44.8)	42.33 (38.43, 46.31)	42.69 (38.97, 46.48)	48.72 (44.73, 52.72)	51.7 (47.35, 56.03)	53.25 (48.93, 57.52)	23.97 (20.05, 27.89)	1.84 (1.66, 2.04)
Non-OA	2009	29.18 (26.17, 32.33)	31.68 (28.6, 34.89)	31.23 (28.27, 34.31)	35.76 (32.54, 39.09)	35.79 (32.49, 39.2)	40.38 (36.55, 44.3)	38.09 (34.42, 41.86)	39.47 (35.44, 43.62)	39.34 (35.21, 43.58)	43.98 (39.61, 48.43)	14.41 (10.49, 18.25)	1.51 (1.34, 1.69)
OA	2010	29.76 (26.44, 33.25)	34.76 (31.05, 38.61)	36.89 (33.32, 40.58)	35.42 (31.75, 39.22)	35.94 (32.29, 39.72)	43.97 (39.73, 48.28)	42.86 (38.64, 47.16)	47.76 (43.04, 52.51)	45.74 (41.22, 50.31)	52.99 (47.98, 57.95)	21.25 (16.91, 25.56)	1.74 (1.54, 1.97)
Non-OA	2010	27.62 (24.46, 30.97)	29.96 (26.56, 33.52)	34.1 (30.69, 37.63)	34.4 (30.76, 38.19)	30.4 (26.94, 34.04)	36.93 (32.8, 41.21)	41.94 (37.5, 46.48)	42.64 (38.04, 47.33)	43.73 (38.85, 48.71)	41.67 (36.76, 46.7)	17.25 (12.78, 21.64)	1.65 (1.45, 1.89)
OA	2011	31.59 (27.92, 35.44)	36.22 (32.33, 40.26)	38.24 (34.37, 42.22)	36.27 (32.35, 40.33)	37.61 (33.53, 41.83)	44.04 (39.5, 48.66)	43.08 (38.44, 47.81)	43.84 (38.68, 49.1)	44.56 (39.47, 49.74)	54.03 (48.53, 59.46)	17.68 (12.8, 22.46)	1.57 (1.38, 1.79)

Non-OA	2011	29.88 (26.4, 33.54)	29.24 (25.62, 33.08)	35.5 (31.67, 39.48)	34.85 (30.94, 38.92)	33.94 (29.97, 38.09)	37.98 (33.56, 42.56)	44.39 (39.72, 49.14)	43.54 (38.48, 48.69)	43.99 (38.83, 49.24)	47.06 (41.36, 52.82)	19.09 (14.33, 23.76)	1.7 (1.48, 1.96)
OA	2012	29.93 (26.15, 33.92)	37.63 (33.35, 42.05)	34.26 (30.12, 38.6)	31.08 (26.8, 35.61)	34.95 (30.66, 39.42)	42.03 (37.11, 47.06)	43.06 (37.78, 48.47)	43.27 (37.7, 48.97)	48.24 (42.3, 54.22)	49.45 (43.4, 55.52)	18.72 (13.44, 24.1)	1.65 (1.43, 1.93)
Non-OA	2012	27.36 (23.64, 31.32)	30.24 (26.26, 34.44)	30.63 (26.53, 34.96)	33.01 (28.52, 37.75)	34.84 (30.4, 39.49)	40.59 (35.79, 45.52)	40 (34.9, 45.26)	38.71 (33.73, 43.87)	45.48 (39.74, 51.32)	46.15 (39.98, 52.42)	20.03 (14.86, 25.16)	1.79 (1.53, 2.1)
OA	2013	29.51 (25.43, 33.86)	32.28 (27.58, 37.25)	35.68 (31.05, 40.52)	39.12 (34.07, 44.35)	36.76 (31.96, 41.77)	43.71 (38.32, 49.22)	41.38 (35.92, 47)	44.12 (38.47, 49.88)	49.57 (42.96, 56.19)	51.28 (44.68, 57.85)	21.7 (15.93, 27.4)	1.77 (1.51, 2.08)
Non-OA	2013	29.98 (25.85, 34.36)	33.25 (28.77, 37.98)	33.49 (28.98, 38.24)	36.02 (31.14, 41.13)	41.21 (36.22, 46.33)	39.37 (33.99, 44.96)	40.8 (35.18, 46.61)	46.48 (40.57, 52.47)	40.61 (34.6, 46.84)	49.77 (42.93, 56.62)	18.23 (12.54, 23.99)	1.63 (1.39, 1.93)
OA	2014	28.28 (23.9, 33)	30.86 (25.97, 36.09)	33.04 (28.1, 38.28)	38.98 (33.87, 44.28)	34.86 (29.87, 40.1)	35.67 (30.25, 41.37)	38.74 (32.7, 45.04)	49.39 (42.96, 55.83)	53.33 (46.59, 59.99)	43.62 (36.41, 51.02)	21.9 (15.79, 27.99)	1.83 (1.53, 2.2)
Non-OA	2014	27.51 (23.13, 32.23)	33.5 (28.89, 38.36)	31.23 (26.51, 36.26)	33.12 (27.94, 38.63)	39.43 (34.27, 44.76)	42.05 (36.23, 48.04)	41.79 (35.94, 47.8)	41.7 (35.33, 48.29)	46.41 (38.98, 53.96)	49.74 (42.52, 56.97)	21.48 (15.41, 27.53)	1.81 (1.52, 2.18)
OA	2015	26.27 (22.09, 30.78)	36.39 (30.89, 42.18)	36.69 (31.01, 42.65)	36.9 (31.14, 42.95)	39.16 (33.68, 44.85)	42.52 (35.81, 49.45)	46.67 (39.77, 53.66)	41.75 (34.73, 49.03)	49.73 (42.27, 57.2)	53.76 (46.03, 61.35)	24.94 (18.32, 31.65)	1.94 (1.61, 2.35)
Non-OA	2015	30.16 (25.57, 35.06)	35.84 (30.34, 41.62)	38.67 (33.13, 44.43)	30.45 (25.2, 36.11)	38.71 (32.96, 44.7)	35.5 (29.7, 41.62)	42.29 (35.37, 49.44)	45.9 (38.53, 53.41)	45.85 (38.89, 52.94)	49.02 (40.86, 57.22)	17.05 (10.37, 23.67)	1.58 (1.31, 1.92)
OA	2016	30.67 (25.61, 36.11)	35.86 (29.76, 42.33)	34.8 (28.29, 41.77)	36.26 (29.06, 43.94)	40.3 (33.46, 47.43)	40.25 (32.56, 48.31)	41.82 (34.2, 49.74)	45.27 (37.08, 53.65)	50.34 (41.93, 58.75)	50.86 (41.42, 60.26)	20.82 (13.06, 28.82)	1.73 (1.4, 2.16)

Non-OA	2016	26.52 (21.83, 31.65)	26.72 (21.31, 32.7)	39.49 (32.58, 46.72)	36.42 (29.01, 44.33)	33.33 (26.9, 40.25)	41.04 (32.63, 49.87)	41.57 (34.25, 49.18)	51.05 (42.56, 59.49)	47.44 (39.4, 55.58)	50.44 (40.88, 59.98)	27.65 (19.93, 35.41)	2.19 (1.74, 2.83)
OA	2017	29.94 (24.92, 35.33)	32.2 (26.29, 38.57)	40.51 (33.56, 47.76)	39.13 (31.55, 47.12)	35.47 (28.33, 43.11)	52.54 (43.15, 61.81)	50 (41.18, 58.82)	47.62 (38.65, 56.7)	50 (39.73, 60.27)	52.5 (41.02, 63.79)	26.08 (17.73, 34.44)	1.97 (1.56, 2.51)
Non-OA	2017	28.32 (23.58, 33.44)	34.62 (28.85, 40.74)	38.29 (31.05, 45.92)	44.12 (35.62, 52.88)	34.88 (27.79, 42.51)	35 (26.52, 44.24)	44.09 (35.3, 53.17)	43 (33.14, 53.29)	43.75 (34.39, 53.44)	50.55 (39.86, 61.2)	19.11 (10.44, 27.57)	1.69 (1.34, 2.19)
OA	Age 35-44 years	32.16 (27.88, 36.67)	35.91 (31.42, 40.59)	38.43 (33.95, 43.06)	41.23 (36.75, 45.81)	41.29 (36.78, 45.92)	45.91 (41.18, 50.69)	48.96 (44.16, 53.78)	45.19 (40.34, 50.11)	53.55 (49.04, 58.02)	52.78 (48.47, 57.06)	22.88 (17.93, 27.96)	1.71 (1.51, 1.94)
Non-OA	Age 35-44 years	24.81 (21.15, 28.75)	25 (21.12, 29.2)	28.43 (24.55, 32.56)	28.96 (24.94, 33.24)	33.13 (28.98, 37.48)	31.74 (27.18, 36.57)	33.11 (28.76, 37.69)	37.28 (32.51, 42.24)	36.53 (31.96, 41.3)	39.92 (35.51, 44.45)	16.68 (12.04, 21.46)	1.71 (1.46, 2.03)
OA	Age 45-54 years	33.67 (31.77, 35.61)	39.72 (37.52, 41.95)	42.89 (40.68, 45.13)	39.7 (37.59, 41.84)	42.86 (40.68, 45.05)	46.04 (43.73, 48.36)	45.35 (43.04, 47.68)	49.11 (46.67, 51.57)	53.26 (50.79, 55.72)	52.95 (50.57, 55.33)	19.58 (17.1, 22.01)	1.57 (1.48, 1.67)
Non-OA	Age 45-54 years	26.06 (24.35, 27.83)	31.31 (29.36, 33.31)	32.13 (30.09, 34.23)	33.07 (31.09, 35.1)	33.44 (31.44, 35.5)	34.64 (32.45, 36.88)	36.7 (34.37, 39.08)	37.06 (34.65, 39.52)	41.25 (38.71, 43.84)	40.81 (38.33, 43.32)	14.52 (12.15, 16.81)	1.54 (1.44, 1.66)
OA	Age 55-64 years	30.11 (28.71, 31.53)	35.4 (33.85, 36.97)	38.57 (36.97, 40.19)	38.98 (37.44, 40.53)	39.47 (37.9, 41.06)	42.72 (40.97, 44.48)	45.42 (43.62, 47.23)	46.9 (44.94, 48.87)	48.73 (46.68, 50.79)	50.31 (48.29, 52.34)	20.34 (18.53, 22.22)	1.67 (1.59, 1.75)
Non-OA	Age 55-64 years	28 (26.65, 29.37)	31.29 (29.83, 32.77)	33.18 (31.65, 34.73)	34.13 (32.63, 35.66)	34.17 (32.67, 35.7)	36.34 (34.62, 38.08)	39.74 (37.95, 41.55)	41.63 (39.69, 43.59)	43.41 (41.31, 45.54)	44.64 (42.59, 46.7)	17.09 (15.27, 18.93)	1.63 (1.55, 1.72)
OA	Age 65-74 years	28.18 (26.61, 29.8)	34.97 (33.23, 36.74)	33.96 (32.24, 35.71)	35.39 (33.64, 37.16)	35.56 (33.83, 37.31)	38.4 (36.41, 40.42)	40.05 (38, 42.13)	44.52 (42.33, 46.72)	45.01 (42.62, 47.41)	44.58 (42.19, 47)	16.76 (14.61, 18.88)	1.59 (1.49, 1.68)

Non-OA	Age 65-74 years	27.21 (25.66, 28.81)	28.7 (27.06, 30.37)	32.04 (30.35, 33.76)	32.62 (30.88, 34.39)	34.53 (32.81, 36.29)	36.81 (34.86, 38.79)	39.28 (37.22, 41.37)	40.07 (37.88, 42.3)	43.28 (40.93, 45.64)	42.36 (40.04, 44.7)	17.82 (15.76, 19.95)	1.69 (1.59, 1.81)
OA	Age 75-84 years	22.4 (20.37, 24.54)	25.7 (23.53, 27.96)	26.68 (24.5, 28.95)	24.83 (22.71, 27.03)	26.34 (24.15, 28.62)	31.03 (28.48, 33.67)	31.74 (29.11, 34.47)	32.2 (29.38, 35.11)	33.16 (30.16, 36.26)	35.24 (32.07, 38.51)	12.66 (9.89, 15.39)	1.58 (1.43, 1.75)
Non-OA	Age 75-84 years	26.49 (24.33, 28.74)	25.15 (22.99, 27.4)	28.61 (26.39, 30.91)	27.69 (25.43, 30.03)	26.56 (24.35, 28.88)	32.23 (29.69, 34.85)	32.55 (29.99, 35.2)	34.68 (31.85, 37.59)	35.84 (32.78, 39)	34.13 (30.91, 37.47)	11.12 (8.37, 13.87)	1.46 (1.33, 1.61)
OA	Age 85+ years	11.93 (7.54, 17.66)	13.68 (9.14, 19.4)	12.63 (8.34, 18.07)	13.84 (8.88, 20.2)	19.02 (13.62, 25.45)	22.6 (16.1, 30.25)	20.28 (14.02, 27.81)	21.15 (13.76, 30.26)	19.64 (12.74, 28.22)	16 (8.55, 26.28)	10.54 (3.61, 17.13)	1.93 (1.25, 3.2)
Non-OA	Age 85+ years	18.45 (12.9, 25.16)	23.33 (17.36, 30.2)	26.18 (20.1, 33.01)	19.89 (14.34, 26.46)	22.63 (16.89, 29.25)	23.24 (16.57, 31.06)	24.43 (17.35, 32.7)	26.98 (19.47, 35.62)	23.86 (15.42, 34.14)	31.87 (22.49, 42.47)	7.09 (-0.79, 15.13)	1.35 (0.96, 1.95)
OA	Men	29.81 (28.38, 31.27)	34.37 (32.81, 35.96)	35.1 (33.51, 36.7)	34.75 (33.2, 36.32)	36.46 (34.88, 38.05)	39.63 (37.85, 41.42)	39.56 (37.74, 41.41)	43.12 (41.17, 45.09)	43.95 (41.89, 46.02)	44.6 (42.57, 46.64)	15.24 (13.36, 17.14)	1.51 (1.44, 1.6)
Non-OA	Men	27.71 (26.32, 29.13)	28.58 (27.12, 30.06)	31.51 (30, 33.06)	31.48 (29.97, 33.02)	31.92 (30.37, 33.49)	32.86 (31.17, 34.58)	36.39 (34.58, 38.23)	34.79 (32.9, 36.71)	38.25 (36.23, 40.31)	36.62 (34.65, 38.63)	10.74 (8.94, 12.58)	1.4 (1.32, 1.48)
OA	Women	28.74 (27.75, 29.75)	34.25 (33.15, 35.37)	36.24 (35.13, 37.37)	36.46 (35.36, 37.57)	37.15 (36.04, 38.27)	40.91 (39.67, 42.15)	43.07 (41.81, 44.34)	44.87 (43.52, 46.23)	47.96 (46.56, 49.37)	49.07 (47.67, 50.47)	20.49 (19.18, 21.82)	1.71 (1.65, 1.78)
Non-OA	Women	26.56 (25.6, 27.53)	29.78 (28.74, 30.83)	31.75 (30.68, 32.83)	32.54 (31.47, 33.63)	33.28 (32.22, 34.36)	36.23 (35.02, 37.45)	37.85 (36.61, 39.11)	40.76 (39.42, 42.12)	42.61 (41.18, 44.06)	43.85 (42.43, 45.28)	18.04 (16.74, 19.3)	1.71 (1.64, 1.78)
OA	East Midlands	31.1 (24.89, 37.85)	37.15 (32.56, 41.92)	37.01 (32.15, 42.07)	39.35 (35.13, 43.69)	38.6 (32.91, 44.52)	42.57 (36.87, 48.42)	39.26 (35.32, 43.31)	38.5 (33.63, 43.55)	46.18 (41.74, 50.68)	48.65 (41.91, 55.43)	11.53 (5.93, 17.16)	1.34 (1.16, 1.54)

Non-OA	East Midlands	24.43 (18.92, 30.65)	30.07 (25.81, 34.6)	30.16 (25.91, 34.68)	32.49 (28.31, 36.9)	36.15 (30.31, 42.32)	33.99 (28.69, 39.59)	35.78 (31.8, 39.91)	41.05 (36.06, 46.18)	40.99 (36.75, 45.32)	42.18 (35.43, 49.15)	16.6 (11.34, 22.01)	1.62 (1.38, 1.92)
OA	East of England	24.81 (22.92, 26.78)	33.36 (30.96, 35.82)	35.3 (32.52, 38.16)	33.92 (31.51, 36.4)	35.35 (32.61, 38.16)	41.29 (38.52, 44.1)	38.77 (35.86, 41.74)	39.56 (35.46, 43.79)	45.14 (40.07, 50.29)	44.27 (38.05, 50.62)	18.12 (14.97, 21.22)	1.71 (1.55, 1.88)
Non-OA	East of England	25.24 (23.35, 27.2)	28.62 (26.33, 30.99)	31.73 (29.05, 34.52)	31.53 (29.16, 33.98)	30.55 (28, 33.19)	34.83 (32.11, 37.62)	36.4 (33.47, 39.4)	36.55 (32.47, 40.77)	40.97 (36.06, 46.01)	36.51 (30.56, 42.78)	13.74 (10.7, 16.82)	1.56 (1.4, 1.73)
OA	London	27 (23.55, 30.66)	32.27 (29.13, 35.54)	34.72 (31.3, 38.27)	32.21 (29.33, 35.19)	37.15 (34.29, 40.08)	39.22 (36.07, 42.45)	45.99 (42.95, 49.04)	43.19 (40.13, 46.3)	47.54 (44.37, 50.73)	57.35 (51.96, 62.61)	23.66 (20.04, 27.31)	1.87 (1.69, 2.07)
Non-OA	London	28.46 (25.02, 32.1)	27.22 (24.28, 30.31)	31.06 (27.66, 34.62)	28.99 (26.24, 31.85)	33.67 (30.87, 36.55)	35.59 (32.51, 38.76)	37.13 (34.22, 40.12)	37.44 (34.44, 40.51)	41.74 (38.63, 44.91)	42.25 (36.85, 47.79)	16.08 (12.45, 19.58)	1.62 (1.45, 1.8)
OA	North East	23.99 (19.03, 29.52)	36.44 (30.15, 43.1)	37.24 (29.36, 45.65)	35.16 (28.85, 41.88)	38.36 (30.44, 46.76)	39.13 (33.34, 45.16)	44.87 (38.75, 51.1)	44.17 (39.04, 49.41)	47.11 (40.44, 53.86)	45.41 (41.8, 49.05)	19.85 (13.6, 26.11)	1.65 (1.41, 1.95)
Non-OA	North East	24.28 (19.34, 29.78)	30.28 (25.27, 35.67)	36.84 (29.17, 45.04)	31.44 (24.98, 38.48)	25.16 (18.54, 32.75)	34.55 (28.94, 40.49)	32.63 (26.69, 39.01)	37.63 (32.69, 42.77)	40.63 (33.61, 47.93)	43.06 (39.4, 46.76)	19.91 (13.84, 26.18)	1.79 (1.48, 2.18)
OA	North West	28.55 (25.99, 31.21)	35.28 (32.97, 37.64)	35.12 (33.01, 37.28)	36.86 (34.36, 39.41)	38.21 (35.84, 40.63)	41.79 (39.3, 44.3)	40.52 (38.06, 43.02)	46.08 (43.63, 48.55)	45.83 (43.55, 48.12)	47.21 (45.28, 49.14)	18.59 (16.05, 21.2)	1.6 (1.5, 1.71)
Non-OA	North West	27.1 (24.64, 29.66)	32.09 (29.92, 34.32)	32.49 (30.44, 34.6)	34.42 (31.99, 36.91)	36.52 (34.16, 38.94)	36.25 (33.84, 38.72)	38.5 (36.09, 40.94)	36.32 (33.93, 38.76)	39.62 (37.29, 41.97)	41.17 (39.27, 43.1)	12.78 (10.28, 15.27)	1.43 (1.33, 1.54)
OA	South Central	30.59 (28.94, 32.27)	35.99 (33.46, 38.59)	39.4 (36.4, 42.46)	38.63 (35.82, 41.49)	38.3 (35.39, 41.27)	43.8 (40.57, 47.08)	44.05 (40.66, 47.48)	45.82 (41.93, 49.75)	47.39 (42.43, 52.4)	54.61 (46.02, 63.01)	19.43 (16.16, 22.69)	1.69 (1.54, 1.85)

Non-OA	South Central	28.56 (26.97, 30.2)	29.07 (26.71, 31.52)	30.52 (27.68, 33.47)	33.85 (31.13, 36.65)	32.91 (30.13, 35.78)	36.86 (33.79, 40.01)	38.7 (35.27, 42.21)	40 (36.09, 44.01)	43.99 (39, 49.07)	45 (35.91, 54.35)	15.09 (11.83, 18.3)	1.6 (1.44, 1.77)
OA	South East Coast	29.18 (27.09, 31.33)	34.1 (32, 36.25)	36.81 (34.55, 39.1)	37.63 (35.21, 40.09)	37.69 (35.06, 40.37)	38.73 (35.56, 41.98)	42.15 (38.38, 46)	45.92 (42.44, 49.42)	46.99 (43.05, 50.97)	52.2 (44.68, 59.64)	17.18 (14.09, 20.22)	1.6 (1.46, 1.75)
Non-OA	South East Coast	25.16 (23.2, 27.21)	29.22 (27.28, 31.23)	30.16 (27.99, 32.39)	33.44 (31.08, 35.87)	34.61 (32.03, 37.26)	36.59 (33.47, 39.79)	38.28 (34.5, 42.17)	39.3 (35.95, 42.72)	43.26 (39.15, 47.43)	43.13 (35.33, 51.18)	17.4 (14.42, 20.42)	1.73 (1.57, 1.91)
OA	South West	31.57 (28.23, 35.06)	33.57 (30.83, 36.4)	33.74 (31.09, 36.47)	36.66 (33.77, 39.63)	36.52 (34.39, 38.69)	39.13 (36.43, 41.88)	41.76 (38.72, 44.84)	45.51 (42.36, 48.69)	46.74 (43.36, 50.14)	49.36 (45.59, 53.13)	17.64 (14.43, 20.84)	1.59 (1.46, 1.74)
Non-OA	South West	27.07 (23.89, 30.44)	29.33 (26.71, 32.07)	32.77 (30.23, 35.39)	34.89 (32.03, 37.83)	31.48 (29.45, 33.57)	34.29 (31.66, 37)	37.75 (34.75, 40.82)	39.49 (36.47, 42.57)	41.31 (37.82, 44.87)	42.47 (38.65, 46.35)	13.79 (10.7, 16.94)	1.5 (1.37, 1.65)
OA	West Midlands	32.19 (29.96, 34.5)	33.86 (31.18, 36.62)	35.4 (33.18, 37.67)	35.25 (32.83, 37.73)	36.76 (34.37, 39.19)	39.05 (36.22, 41.93)	41.99 (39.15, 44.88)	45.16 (42.03, 48.32)	46.36 (43.19, 49.55)	45.51 (43, 48.04)	16.42 (13.58, 19.25)	1.54 (1.43, 1.67)
Non-OA	West Midlands	27.5 (25.4, 29.68)	29.74 (27.27, 32.3)	32.2 (30.09, 34.36)	30.64 (28.27, 33.08)	33.46 (31.12, 35.87)	33.45 (30.71, 36.28)	37.14 (34.35, 39.98)	43.18 (39.98, 46.42)	42.35 (39.16, 45.59)	41.1 (38.57, 43.67)	16.47 (13.71, 19.24)	1.63 (1.5, 1.79)
OA	Yorkshire & The Humber	28.46 (23.91, 33.35)	31.78 (26.88, 36.99)	36.76 (32.42, 41.27)	34.01 (31.25, 36.86)	32.76 (29.11, 36.56)	40.36 (36.23, 44.6)	43 (38.67, 47.4)	41.24 (36.18, 46.44)	50.4 (45.2, 55.61)	48.23 (43.93, 52.55)	19.86 (15.19, 24.48)	1.7 (1.5, 1.94)
Non-OA	Yorkshire & The Humber	28.68 (24.23, 33.47)	23.37 (18.96, 28.26)	31.55 (27.66, 35.65)	28.95 (26.27, 31.76)	27.05 (23.83, 30.45)	32.61 (28.71, 36.7)	37.19 (32.87, 41.67)	39.83 (34.73, 45.1)	38.04 (32.74, 43.55)	41.07 (36.74, 45.51)	15.21 (10.7, 19.77)	1.62 (1.4, 1.88)
IMD, Indices of multiple deprivation; 95%CI, 95% confidence interval; OA, osteoarthritis													

Appendix 3.1.6. Inequality in the prevalence of number of ≥1 modifiable CVRF in OA and non-OA samples by subgroups, 1992-2017

OA status	Subgroup	Period prevalence by IMD decile (%) (95%CI)										Slope index of inequality (95%CI)(%)	Relative index of inequality (95%CI)
		1 (Least deprived)	2	3	4	5	6	7	8	9	10(Most deprived)		
OA	1992	94.44 (72.71, 99.86)	87.1 (70.17, 96.37)	87.1 (70.17, 96.37)	89.8 (77.77, 96.6)	84 (63.92, 95.46)	73.91 (51.59, 89.77)	93.75 (79.19, 99.23)	81.25 (63.56, 92.79)	90.32 (74.25, 97.96)	92.86 (80.52, 98.5)	1.22 (-11.76, 14.12)	1.01 (0.88, 1.18)
Non-OA	1992	77.78 (52.36, 93.59)	78.26 (56.3, 92.54)	77.14 (59.86, 89.58)	84.21 (68.75, 93.98)	81.58 (65.67, 92.26)	86.21 (68.34, 96.11)	75.86 (56.46, 89.7)	76.32 (59.76, 88.56)	84.62 (54.55, 98.08)	87.04 (75.1, 94.63)	6.38 (-9.61, 22.45)	1.08 (0.89, 1.32)
OA	1993	87.1 (78.55, 93.15)	83.82 (72.9, 91.64)	81.01 (70.62, 88.97)	86.03 (79.05, 91.37)	84 (76.38, 89.94)	89.47 (82.33, 94.44)	89.11 (81.35, 94.44)	82.35 (72.57, 89.77)	86.76 (76.36, 93.77)	87.13 (79, 92.96)	2.58 (-5.62, 10.77)	1.03 (0.94, 1.13)
Non-OA	1993	81.71 (71.63, 89.38)	81.33 (70.67, 89.4)	81.72 (72.35, 88.98)	80.61 (73.74, 86.34)	80.17 (71.94, 86.86)	83.33 (74.66, 89.98)	77.27 (67.11, 85.53)	81.33 (70.67, 89.4)	78.87 (67.56, 87.67)	82.83 (73.94, 89.67)	-0.65 (-9.54, 8.42)	0.99 (0.89, 1.11)
OA	1994	82.08 (73.43, 88.85)	94.9 (88.49, 98.32)	86.32 (78.74, 91.98)	85.14 (78.99, 90.06)	89.47 (82.97, 94.12)	84.06 (76.86, 89.73)	90.18 (83.11, 94.99)	76.83 (66.2, 85.44)	85.54 (76.11, 92.3)	81.88 (74.43, 87.92)	-5.52 (-13.13, 1.83)	0.94 (0.86, 1.02)
Non-OA	1994	85.83 (78.53, 91.38)	78.7 (69.78, 86)	80.83 (72.64, 87.44)	75.93 (68.59, 82.29)	83.19 (75.24, 89.42)	81.97 (73.98, 88.34)	76 (66.43, 83.98)	82.95 (73.45, 90.13)	87.5 (79.57, 93.17)	78.79 (70.82, 85.42)	-0.11 (-8.13, 7.97)	1 (0.91, 1.1)
OA	1995	81.2 (73.52, 87.45)	85.57 (76.97, 91.88)	85.58 (77.33, 91.7)	83.24 (76.82, 88.48)	86.84 (80.41, 91.77)	87.59 (81.09, 92.47)	87.88 (81.06, 92.91)	87.63 (79.39, 93.44)	87.39 (79.74, 92.93)	88.46 (82.38, 93.02)	6.62 (-0.32, 13.53)	1.08 (0.99, 1.17)
Non-OA	1995	76.69 (68.58, 83.58)	78.9 (70.04, 86.13)	80.45 (72.68, 86.81)	80.26 (73.04, 86.27)	79.87 (72.66, 85.89)	82.81 (75.14, 88.9)	81.4 (73.59, 87.7)	85.44 (77.12, 91.61)	90.57 (83.33, 95.38)	81.7 (74.65, 87.48)	8.59 (0.95, 16.26)	1.11 (1.01, 1.22)

OA	1996	79.58 (73.16, 85.06)	75.32 (67.84, 81.82)	82.26 (74.38, 88.53)	84.76 (79.17, 89.34)	82.66 (76.18, 87.98)	88.64 (83, 92.92)	88.41 (82.5, 92.88)	86.86 (80.03, 92.02)	89.93 (83.68, 94.38)	88.83 (83.43, 92.95)	13.48 (7.15, 19.84)	1.17 (1.09, 1.27)
Non-OA	1996	81.19 (75.11, 86.33)	83.78 (76.84, 89.33)	73.24 (65.17, 80.32)	76.14 (69.57, 81.91)	78.42 (71.89, 84.05)	79.56 (72.94, 85.18)	77.58 (70.44, 83.69)	86.13 (79.19, 91.44)	79.49 (71.03, 86.39)	85.64 (79.66, 90.4)	4.74 (-1.91, 11.4)	1.06 (0.98, 1.15)
OA	1997	82.38 (77.2, 86.8)	84.77 (78.98, 89.48)	86.63 (80.9, 91.16)	81.66 (76.03, 86.45)	84 (78.86, 88.32)	87.86 (82.61, 91.99)	89.66 (84.62, 93.48)	90.14 (84.01, 94.5)	89.39 (82.85, 94.08)	91.47 (86.85, 94.87)	9.85 (4.5, 15.32)	1.12 (1.05, 1.19)
Non-OA	1997	81.71 (76.43, 86.24)	84.79 (79.31, 89.29)	85.95 (80.09, 90.61)	79.84 (74.3, 84.65)	78.93 (73.47, 83.71)	81.55 (75.57, 86.6)	83.63 (77.21, 88.84)	82.19 (75.01, 88.02)	86.15 (79, 91.58)	85.86 (80.21, 90.39)	1.99 (-3.94, 7.71)	1.02 (0.95, 1.1)
OA	1998	83.93 (79.09, 88.03)	84.82 (79.44, 89.25)	83.41 (77.94, 87.98)	88.77 (84.52, 92.19)	86.4 (81.74, 90.24)	81.74 (76.28, 86.41)	87.64 (81.89, 92.09)	93.09 (88.47, 96.27)	94.48 (89.78, 97.44)	89.64 (84.86, 93.32)	8.42 (3.41, 13.28)	1.1 (1.04, 1.17)
Non-OA	1998	83.93 (79.32, 87.87)	78.63 (72.82, 83.7)	79.26 (73.25, 84.45)	83.15 (78.11, 87.43)	83.92 (79.14, 87.98)	86.28 (81.1, 90.49)	85.4 (80.11, 89.73)	87.23 (81.6, 91.65)	85.71 (78.12, 91.45)	90.28 (85.52, 93.88)	8.86 (3.58, 14.07)	1.11 (1.04, 1.18)
OA	1999	90.16 (86.32, 93.21)	84.42 (79.59, 88.49)	84.5 (79.63, 88.6)	89.62 (85.51, 92.89)	84.87 (80.34, 88.7)	86.9 (82.1, 90.81)	89.24 (84.41, 92.98)	93.78 (89.78, 96.56)	91.23 (86.78, 94.56)	93.33 (89.4, 96.14)	6.57 (2.46, 10.7)	1.08 (1.03, 1.13)
Non-OA	1999	82.21 (77.39, 86.38)	83.39 (78.48, 87.58)	83.16 (78.3, 87.31)	81.61 (76.74, 85.83)	83.93 (79.32, 87.87)	81.75 (76.54, 86.23)	82.45 (77.1, 87)	82.21 (76.32, 87.16)	82.69 (76.85, 87.57)	84.65 (79.46, 88.95)	0.7 (-4.51, 5.97)	1.01 (0.95, 1.08)
OA	2000	85.45 (81.12, 89.11)	87.88 (83.32, 91.56)	88.55 (84.37, 91.94)	88.34 (84.35, 91.62)	87.92 (83.91, 91.22)	88.74 (83.94, 92.51)	90.38 (85.91, 93.8)	90.19 (85.39, 93.82)	92.65 (88.16, 95.83)	93.87 (90.24, 96.46)	7.36 (3.11, 11.52)	1.09 (1.04, 1.14)
Non-OA	2000	84.59 (80.15, 88.38)	89.01 (84.76, 92.41)	86.64 (82.32, 90.24)	81.85 (77.3, 85.82)	82.93 (78.41, 86.84)	87.4 (82.77, 91.17)	86.85 (81.56, 91.08)	86.67 (81.52, 90.82)	82.91 (76.95, 87.87)	91.78 (87.32, 95.06)	2.13 (-2.5, 6.7)	1.03 (0.97, 1.08)

OA	2001	88.85 (84.9, 92.07)	90.72 (87.08, 93.61)	90.24 (86.21, 93.42)	89.32 (85.68, 92.29)	89.12 (85.31, 92.22)	91.04 (87.06, 94.12)	92.99 (89.27, 95.73)	90.79 (86.27, 94.21)	91.21 (86.88, 94.48)	93.01 (89.41, 95.68)	3.43 (-0.38, 7.17)	1.04 (1, 1.08)
Non-OA	2001	84.73 (80.5, 88.34)	80.33 (75.42, 84.64)	83.6 (79.05, 87.5)	84.79 (80.62, 88.36)	86.38 (82.44, 89.72)	87.58 (83.36, 91.06)	83.72 (78.64, 88.01)	88.39 (83.46, 92.28)	91.59 (87.18, 94.86)	90.8 (86.52, 94.08)	8.65 (4.23, 13.04)	1.11 (1.05, 1.17)
OA	2002	88.57 (85.13, 91.45)	90.21 (86.81, 92.98)	88.11 (84.47, 91.16)	89.1 (85.76, 91.88)	88.97 (85.64, 91.75)	91.87 (88.39, 94.57)	92.24 (88.91, 94.82)	93.05 (89.76, 95.54)	93.53 (89.96, 96.12)	90.94 (87.09, 93.94)	4.9 (1.47, 8.41)	1.06 (1.02, 1.1)
Non-OA	2002	83.41 (79.6, 86.76)	86.13 (82.22, 89.47)	83.05 (79.11, 86.52)	82.27 (78.38, 85.73)	85.27 (81.48, 88.54)	84.83 (80.68, 88.39)	90.49 (86.9, 93.36)	89.54 (85.56, 92.74)	90.38 (86.13, 93.68)	89.86 (85.85, 93.06)	8.3 (4.37, 12.26)	1.1 (1.05, 1.15)
OA	2003	88.54 (85.72, 90.97)	90.57 (87.79, 92.9)	92.74 (90.09, 94.87)	89.16 (86.42, 91.52)	91.7 (88.98, 93.93)	90.61 (87.56, 93.12)	90.58 (87.48, 93.13)	92.37 (89.16, 94.87)	93.35 (90.19, 95.74)	92.89 (89.89, 95.23)	3.55 (0.63, 6.45)	1.04 (1.01, 1.07)
Non-OA	2003	86.1 (83.06, 88.77)	87.46 (84.47, 90.05)	84.81 (81.39, 87.82)	88.54 (85.65, 91.03)	86.84 (83.71, 89.56)	86.21 (82.71, 89.24)	87.76 (84.3, 90.7)	91.09 (87.83, 93.72)	90 (86.24, 93.02)	90.76 (87.26, 93.55)	4.67 (1.36, 8.02)	1.05 (1.02, 1.09)
OA	2004	87.88 (85.13, 90.29)	91.16 (88.7, 93.24)	91.99 (89.55, 94.02)	90.18 (87.69, 92.31)	88.73 (86.13, 90.99)	89.85 (86.96, 92.28)	92.17 (89.45, 94.37)	92.57 (89.72, 94.83)	94.47 (91.88, 96.43)	94.89 (92.3, 96.81)	5.07 (2.47, 7.68)	1.06 (1.03, 1.09)
Non-OA	2004	85.9 (83.09, 88.4)	87.7 (84.85, 90.19)	86.71 (83.88, 89.2)	85.42 (82.54, 87.99)	86.29 (83.33, 88.9)	86.59 (83.52, 89.27)	86.57 (83.26, 89.44)	89.09 (85.8, 91.85)	89.36 (85.8, 92.29)	87.7 (84.26, 90.62)	2.19 (-0.9, 5.26)	1.03 (0.99, 1.06)
OA	2005	89.35 (86.92, 91.46)	90.14 (87.76, 92.19)	91.24 (88.93, 93.2)	88.65 (86.16, 90.83)	93.09 (91, 94.83)	92.4 (89.96, 94.4)	92.27 (89.79, 94.3)	92.15 (89.54, 94.28)	92.16 (89.47, 94.34)	95.6 (93.13, 97.37)	4.79 (2.34, 7.27)	1.05 (1.03, 1.08)
Non-OA	2005	85.96 (83.3, 88.33)	86.07 (83.47, 88.4)	87.26 (84.53, 89.67)	89.69 (87.21, 91.83)	86.8 (84.21, 89.11)	88.62 (85.75, 91.09)	89.29 (86.5, 91.67)	87.5 (84.35, 90.22)	90.53 (87.53, 93.01)	91.63 (88.55, 94.1)	4.74 (1.81, 7.62)	1.06 (1.02, 1.09)

OA	2006	90.76 (88.41, 92.77)	90.19 (87.88, 92.2)	90.36 (87.98, 92.41)	91.05 (88.79, 92.99)	92.03 (89.84, 93.88)	93.67 (91.55, 95.4)	92.37 (90.01, 94.32)	92.62 (90.15, 94.63)	91.59 (88.64, 93.98)	94.96 (92.53, 96.78)	3.81 (1.42, 6.25)	1.04 (1.02, 1.07)
Non-OA	2006	81.81 (78.91, 84.46)	84.36 (81.68, 86.79)	86.7 (84.04, 89.07)	87.74 (85.25, 89.94)	84.51 (81.83, 86.94)	88.51 (85.64, 90.98)	87.95 (85.04, 90.46)	89.35 (86.42, 91.83)	90.93 (87.94, 93.38)	91.83 (88.72, 94.31)	8.76 (5.8, 11.72)	1.11 (1.07, 1.14)
OA	2007	88.95 (86.68, 90.96)	88.57 (86.21, 90.65)	90.91 (88.77, 92.76)	90.95 (88.79, 92.82)	90.13 (87.94, 92.04)	91.6 (89.29, 93.54)	92.56 (90.36, 94.39)	93.14 (90.87, 94.99)	93.65 (91.32, 95.51)	95.04 (92.76, 96.76)	6.11 (3.88, 8.42)	1.07 (1.04, 1.1)
Non-OA	2007	83.74 (81.27, 86.01)	84.92 (82.4, 87.2)	86.37 (83.84, 88.65)	84.79 (82.15, 87.18)	84.88 (82.31, 87.21)	87.06 (84.35, 89.45)	87.19 (84.44, 89.61)	88.12 (85.22, 90.62)	88.08 (84.83, 90.84)	92.66 (90.07, 94.76)	6.51 (3.8, 9.21)	1.08 (1.04, 1.11)
OA	2008	87.57 (85.42, 89.51)	90.98 (89.03, 92.69)	90.82 (88.85, 92.54)	89.6 (87.47, 91.47)	90.89 (88.83, 92.68)	91.53 (89.41, 93.33)	92.68 (90.66, 94.38)	93.8 (91.71, 95.49)	95.38 (93.47, 96.86)	96.16 (94.34, 97.52)	7.54 (5.49, 9.6)	1.09 (1.06, 1.11)
Non-OA	2008	79.4 (76.87, 81.76)	83.35 (80.93, 85.58)	87.62 (85.43, 89.59)	85.87 (83.47, 88.04)	84.08 (81.64, 86.31)	85.89 (83.29, 88.23)	88.71 (86.23, 90.88)	89.48 (86.92, 91.69)	88.33 (85.49, 90.79)	92.11 (89.65, 94.15)	10.13 (7.5, 12.82)	1.13 (1.09, 1.16)
OA	2009	89.07 (86.9, 90.99)	89.99 (87.66, 92)	89.73 (87.54, 91.65)	90.48 (88.29, 92.38)	91.02 (88.84, 92.9)	92.01 (89.61, 94.01)	91.61 (89.28, 93.56)	93.75 (91.55, 95.52)	94.15 (91.8, 95.99)	94.25 (91.94, 96.06)	5.8 (3.5, 8.09)	1.07 (1.04, 1.09)
Non-OA	2009	83.04 (80.38, 85.48)	86.41 (83.94, 88.62)	85.35 (82.92, 87.55)	84.71 (82.11, 87.06)	89.18 (86.84, 91.23)	88.73 (86.02, 91.08)	87.5 (84.78, 89.89)	89.3 (86.47, 91.71)	90.07 (87.25, 92.45)	90.34 (87.42, 92.76)	7.15 (4.4, 9.86)	1.09 (1.05, 1.12)
OA	2010	86.79 (84.09, 89.18)	88.94 (86.24, 91.28)	89.74 (87.26, 91.89)	90.38 (87.86, 92.53)	89.77 (87.22, 91.97)	91.09 (88.37, 93.36)	93.32 (90.87, 95.28)	93.5 (90.79, 95.6)	93.76 (91.22, 95.75)	96.77 (94.53, 98.27)	8.74 (6.13, 11.38)	1.1 (1.07, 1.13)
Non-OA	2010	81.27 (78.3, 84)	86.54 (83.77, 89)	86.79 (84.14, 89.15)	86.7 (83.85, 89.21)	84.8 (81.86, 87.43)	86.74 (83.55, 89.52)	87.4 (84.11, 90.22)	89.45 (86.26, 92.12)	89.93 (86.58, 92.67)	92.68 (89.65, 95.04)	8.08 (5.04, 11.16)	1.1 (1.06, 1.14)

OA	2011	89.85 (87.18, 92.13)	88.78 (85.94, 91.21)	91.83 (89.37, 93.88)	88.26 (85.35, 90.76)	89.91 (87.07, 92.31)	88.51 (85.28, 91.25)	92.63 (89.81, 94.88)	93.97 (91.02, 96.18)	94.16 (91.3, 96.31)	97.01 (94.58, 98.56)	6.09 (3.41, 8.83)	1.07 (1.04, 1.1)
Non-OA	2011	82.62 (79.5, 85.45)	88.07 (85.19, 90.56)	86.5 (83.5, 89.13)	86.51 (83.44, 89.21)	86.06 (82.86, 88.85)	84.55 (80.94, 87.71)	90.58 (87.48, 93.13)	89.97 (86.5, 92.81)	89.62 (86.03, 92.55)	92.48 (88.94, 95.18)	7.03 (3.71, 10.28)	1.08 (1.04, 1.13)
OA	2012	88.35 (85.39, 90.89)	90.14 (87.18, 92.62)	91.04 (88.19, 93.39)	90.99 (87.93, 93.49)	91.16 (88.24, 93.55)	88.86 (85.34, 91.79)	91.33 (87.85, 94.07)	92.95 (89.52, 95.53)	94.01 (90.59, 96.47)	94.18 (90.72, 96.64)	4.79 (1.62, 7.93)	1.05 (1.02, 1.09)
Non-OA	2012	84.47 (81.14, 87.42)	84.39 (80.93, 87.44)	86.25 (82.84, 89.2)	87.8 (84.27, 90.78)	88.01 (84.61, 90.89)	87.78 (84.2, 90.79)	90.56 (87.05, 93.37)	88.44 (84.75, 91.51)	91.97 (88.29, 94.79)	90.38 (86.13, 93.68)	7.61 (3.89, 11.29)	1.09 (1.05, 1.14)
OA	2013	90.23 (87.19, 92.76)	88.62 (84.98, 91.64)	91.75 (88.66, 94.22)	93.39 (90.32, 95.72)	90.49 (87.13, 93.21)	89.22 (85.39, 92.34)	92.16 (88.65, 94.86)	93.79 (90.47, 96.22)	93.97 (90.08, 96.66)	93.16 (89.13, 96.04)	3.84 (0.45, 7.2)	1.04 (1, 1.08)
Non-OA	2013	83.3 (79.6, 86.57)	87.41 (83.86, 90.43)	83.73 (79.84, 87.14)	88.71 (85.05, 91.74)	87.66 (83.94, 90.79)	86.56 (82.33, 90.1)	87.96 (83.72, 91.42)	90.14 (86.07, 93.35)	88.51 (84, 92.11)	92.17 (87.75, 95.37)	6.8 (2.79, 10.9)	1.08 (1.03, 1.13)
OA	2014	86.36 (82.58, 89.59)	89.61 (85.85, 92.66)	90.43 (86.83, 93.32)	90.4 (86.84, 93.26)	88.86 (85.08, 91.96)	92.67 (89.11, 95.35)	90.51 (86.21, 93.83)	95.1 (91.6, 97.44)	93.78 (89.78, 96.56)	93.62 (89.12, 96.66)	7.37 (3.57, 11.22)	1.08 (1.04, 1.13)
Non-OA	2014	84.83 (80.88, 88.25)	84.75 (80.85, 88.13)	87.67 (83.85, 90.86)	86.62 (82.35, 90.19)	87.71 (83.81, 90.96)	90.81 (86.83, 93.91)	91.07 (87.1, 94.14)	86.81 (81.8, 90.86)	89.5 (84.09, 93.56)	93.33 (88.87, 96.4)	7.36 (3.12, 11.67)	1.09 (1.03, 1.14)
OA	2015	86.75 (83.1, 89.86)	87.07 (82.69, 90.69)	89.57 (85.36, 92.9)	89.3 (84.99, 92.72)	89.64 (85.7, 92.81)	92.99 (88.7, 96.02)	92.86 (88.49, 95.95)	94.33 (90.08, 97.14)	95.63 (91.57, 98.09)	94.22 (89.63, 97.19)	10.02 (5.89, 14.18)	1.12 (1.07, 1.17)
Non-OA	2015	82.8 (78.61, 86.47)	84.64 (79.99, 88.57)	89 (84.9, 92.31)	86.85 (82.4, 90.52)	87.1 (82.59, 90.8)	89.69 (85.36, 93.1)	89.05 (83.9, 93.01)	92.35 (87.5, 95.75)	90.73 (85.9, 94.33)	94.12 (89.13, 97.28)	10.14 (5.47, 14.66)	1.12 (1.07, 1.18)

OA	2016	91.37 (87.7, 94.24)	90.3 (85.79, 93.75)	93.63 (89.35, 96.56)	88.3 (82.52, 92.71)	89.55 (84.47, 93.42)	89.94 (84.17, 94.14)	90.3 (84.73, 94.36)	95.95 (91.39, 98.5)	95.86 (91.21, 98.47)	95.69 (90.23, 98.59)	4.19 (-0.04, 8.5)	1.05 (1, 1.1)
Non-OA	2016	86.89 (82.75, 90.35)	86.64 (81.75, 90.62)	85.13 (79.34, 89.81)	88.27 (82.29, 92.79)	85.78 (80.23, 90.27)	85.82 (78.75, 91.24)	89.89 (84.49, 93.9)	92.31 (86.65, 96.1)	91.03 (85.4, 95.01)	92.92 (86.53, 96.89)	6.31 (1.17, 11.43)	1.07 (1.01, 1.14)
OA	2017	88.54 (84.48, 91.84)	86.02 (80.93, 90.18)	93.85 (89.5, 96.78)	93.79 (88.87, 96.98)	88.37 (82.61, 92.75)	91.53 (84.97, 95.86)	92.42 (86.51, 96.31)	93.65 (87.87, 97.22)	94.9 (88.49, 98.32)	92.5 (84.39, 97.2)	6.6 (1.32, 11.76)	1.08 (1.02, 1.14)
Non-OA	2017	84.66 (80.38, 88.33)	90.38 (86.13, 93.68)	86.86 (80.93, 91.48)	88.24 (81.6, 93.12)	87.21 (81.28, 91.81)	90.83 (84.19, 95.33)	88.98 (82.2, 93.84)	93 (86.11, 97.14)	89.29 (82.03, 94.34)	95.6 (89.13, 98.79)	7.32 (1.67, 13.04)	1.09 (1.02, 1.16)
OA	Age 35-44 years	78.41 (74.34, 82.11)	75.68 (71.39, 79.62)	75.76 (71.57, 79.62)	77.17 (73.11, 80.88)	83.01 (79.28, 86.31)	86.36 (82.8, 89.43)	86.14 (82.53, 89.26)	87.26 (83.67, 90.31)	89.05 (85.95, 91.66)	90 (87.15, 92.4)	17.54 (13.83, 21.41)	1.24 (1.18, 1.3)
Non-OA	Age 35-44 years	67.5 (63.29, 71.51)	67.67 (63.21, 71.91)	71.18 (67.03, 75.07)	68.13 (63.75, 72.28)	74.59 (70.5, 78.38)	78.09 (73.69, 82.06)	77.18 (73.01, 80.99)	80.1 (75.83, 83.92)	81.73 (77.74, 85.28)	88.98 (85.84, 91.64)	22.45 (18.01, 26.73)	1.35 (1.27, 1.43)
OA	Age 45-54 years	83.25 (81.69, 84.73)	86.36 (84.74, 87.87)	87.65 (86.1, 89.08)	86.85 (85.32, 88.27)	88.24 (86.76, 89.62)	88.01 (86.43, 89.47)	89.55 (88.04, 90.92)	91.88 (90.44, 93.15)	92.98 (91.62, 94.18)	93.8 (92.56, 94.89)	10.37 (8.78, 11.97)	1.12 (1.1, 1.15)
Non-OA	Age 45-54 years	77.27 (75.57, 78.9)	79.91 (78.16, 81.57)	80.91 (79.12, 82.61)	81.4 (79.69, 83.02)	81.65 (79.94, 83.28)	82.76 (80.95, 84.47)	84.36 (82.51, 86.08)	85.35 (83.49, 87.07)	85.74 (83.84, 87.5)	89.34 (87.68, 90.84)	10.82 (8.94, 12.72)	1.14 (1.11, 1.17)
OA	Age 55-64 years	89.05 (88.06, 89.98)	90.49 (89.5, 91.43)	92.08 (91.15, 92.95)	91.16 (90.23, 92.03)	90.51 (89.53, 91.43)	92.39 (91.4, 93.31)	93.29 (92.33, 94.16)	93.65 (92.62, 94.57)	95.02 (94.06, 95.87)	95.65 (94.75, 96.43)	6.11 (5.09, 7.13)	1.07 (1.06, 1.08)
Non-OA	Age 55-64 years	85.85 (84.76, 86.88)	87.96 (86.9, 88.97)	87.5 (86.39, 88.56)	88.42 (87.36, 89.42)	87.73 (86.64, 88.75)	89.07 (87.9, 90.16)	90.1 (88.95, 91.16)	90.74 (89.53, 91.84)	91.37 (90.11, 92.52)	92.53 (91.38, 93.57)	6.04 (4.85, 7.25)	1.07 (1.06, 1.08)

OA	Age 65-74 years	90.84 (89.77, 91.83)	91.49 (90.41, 92.48)	92.18 (91.14, 93.13)	91.56 (90.49, 92.55)	91.67 (90.61, 92.64)	91.92 (90.74, 93)	93.25 (92.12, 94.26)	93.65 (92.49, 94.67)	93.71 (92.45, 94.82)	94.11 (92.87, 95.19)	3.2 (2.02, 4.33)	1.04 (1.02, 1.05)
Non-OA	Age 65-74 years	87.03 (85.81, 88.19)	89.27 (88.09, 90.37)	89.1 (87.92, 90.21)	88.58 (87.34, 89.74)	87.72 (86.48, 88.89)	88.8 (87.46, 90.05)	90.27 (88.95, 91.49)	90.33 (88.93, 91.61)	91.21 (89.78, 92.5)	90.69 (89.25, 92.01)	3.27 (1.9, 4.61)	1.04 (1.02, 1.05)
OA	Age 75-84 years	90.31 (88.75, 91.72)	88.9 (87.23, 90.43)	90.19 (88.6, 91.62)	89.55 (87.94, 91.02)	88.92 (87.24, 90.45)	89.02 (87.16, 90.7)	90.7 (88.91, 92.29)	91.76 (89.94, 93.35)	91.31 (89.33, 93.03)	90.62 (88.49, 92.47)	1.51 (-0.31, 3.31)	1.02 (1, 1.04)
Non-OA	Age 75-84 years	84.03 (82.13, 85.8)	85.04 (83.16, 86.79)	85.95 (84.14, 87.63)	83.46 (81.48, 85.3)	84.82 (82.9, 86.6)	85.85 (83.83, 87.7)	84.35 (82.24, 86.3)	87.89 (85.8, 89.77)	87.7 (85.43, 89.73)	86.18 (83.64, 88.45)	2.77 (0.63, 4.88)	1.03 (1.01, 1.06)
OA	Age 85+ years	86.36 (80.39, 91.06)	87.37 (81.79, 91.74)	81.82 (75.73, 86.93)	80.5 (73.48, 86.35)	82.07 (75.75, 87.32)	80.82 (73.49, 86.86)	87.41 (80.84, 92.37)	87.5 (79.57, 93.17)	86.61 (78.87, 92.31)	84 (73.72, 91.45)	0.08 (-6.43, 6.5)	1 (0.93, 1.08)
Non-OA	Age 85+ years	82.14 (75.5, 87.62)	81.11 (74.62, 86.55)	82.72 (76.6, 87.8)	85.08 (79.04, 89.93)	79.47 (73.03, 84.98)	77.46 (69.7, 84.05)	80.92 (73.13, 87.25)	87.3 (80.2, 92.56)	87.5 (78.73, 93.59)	86.81 (78.1, 93)	3.58 (-3.25, 10.57)	1.04 (0.96, 1.13)
OA	Men	88.78 (87.74, 89.75)	89.23 (88.16, 90.23)	90.51 (89.49, 91.46)	89.17 (88.11, 90.16)	89.82 (88.79, 90.79)	90.07 (88.93, 91.13)	91.21 (90.1, 92.24)	91.86 (90.71, 92.9)	93.15 (92.03, 94.16)	94.25 (93.23, 95.16)	4.86 (3.76, 5.97)	1.06 (1.04, 1.07)
Non-OA	Men	86.18 (85.07, 87.24)	87.05 (85.93, 88.12)	87.89 (86.78, 88.94)	88.19 (87.1, 89.23)	87.3 (86.15, 88.38)	88.41 (87.2, 89.54)	89.1 (87.86, 90.25)	89.36 (88.07, 90.55)	90.04 (88.73, 91.26)	91.92 (90.73, 93.01)	4.7 (3.47, 5.96)	1.05 (1.04, 1.07)
OA	Women	87.73 (86.98, 88.44)	89.07 (88.32, 89.79)	89.95 (89.22, 90.63)	89.63 (88.91, 90.31)	89.67 (88.95, 90.36)	90.63 (89.87, 91.35)	91.94 (91.22, 92.62)	92.94 (92.21, 93.62)	93.26 (92.52, 93.94)	93.46 (92.73, 94.13)	6.07 (5.28, 6.86)	1.07 (1.06, 1.08)
Non-OA	Women	81.93 (81.08, 82.76)	84.55 (83.71, 85.37)	84.54 (83.69, 85.36)	84.09 (83.23, 84.92)	84.57 (83.73, 85.38)	85.72 (84.82, 86.59)	86.57 (85.67, 87.43)	88.12 (87.2, 88.99)	88.44 (87.48, 89.35)	89.51 (88.6, 90.37)	6.99 (6.04, 7.94)	1.09 (1.07, 1.1)

OA	East Midlands	86.6 (81.22, 90.91)	88.55 (85.15, 91.41)	89.24 (85.69, 92.17)	89.83 (86.91, 92.29)	89.12 (84.92, 92.49)	88.51 (84.32, 91.91)	90.77 (88.16, 92.97)	88.11 (84.47, 91.16)	90.76 (87.87, 93.16)	88.29 (83.31, 92.21)	1.64 (-2.03, 5.42)	1.02 (0.98, 1.06)
Non-OA	East Midlands	85.97 (80.68, 90.27)	86.1 (82.51, 89.2)	81.86 (77.94, 85.35)	85.95 (82.51, 88.95)	81.54 (76.28, 86.06)	85.29 (80.82, 89.07)	83.01 (79.63, 86.03)	84.47 (80.43, 87.97)	88.43 (85.38, 91.03)	85.78 (80.33, 90.2)	1.99 (-1.98, 5.95)	1.02 (0.98, 1.07)
OA	East of England	87.37 (85.82, 88.8)	89.11 (87.41, 90.64)	88.56 (86.56, 90.35)	88.22 (86.46, 89.82)	89.01 (87.08, 90.74)	90.31 (88.52, 91.91)	89.5 (87.53, 91.26)	90.38 (87.61, 92.71)	89.24 (85.69, 92.17)	92.89 (88.99, 95.73)	3.11 (1, 5.21)	1.04 (1.01, 1.06)
Non-OA	East of England	82.61 (80.88, 84.25)	84.44 (82.5, 86.25)	84.74 (82.53, 86.78)	84.2 (82.23, 86.03)	83.52 (81.34, 85.54)	85.88 (83.77, 87.82)	86.21 (83.97, 88.24)	88.5 (85.5, 91.07)	88.55 (84.98, 91.52)	87.7 (83, 91.49)	4.98 (2.56, 7.39)	1.06 (1.03, 1.09)
OA	London	88.02 (85.21, 90.46)	90.31 (88.11, 92.22)	93.14 (91.07, 94.85)	90.16 (88.15, 91.93)	89.74 (87.79, 91.47)	90.73 (88.68, 92.52)	92.16 (90.38, 93.71)	92.75 (90.99, 94.27)	95.18 (93.65, 96.44)	94.52 (91.58, 96.67)	5.36 (3.31, 7.42)	1.06 (1.04, 1.08)
Non-OA	London	84.92 (81.94, 87.59)	85.7 (83.19, 87.96)	87.23 (84.54, 89.61)	87.92 (85.78, 89.85)	86.44 (84.28, 88.41)	87.85 (85.58, 89.88)	88.03 (85.92, 89.92)	90.27 (88.27, 92.03)	88.21 (86.01, 90.16)	88.15 (84.15, 91.43)	3.81 (1.3, 6.3)	1.04 (1.01, 1.07)
OA	North East	88.56 (84.16, 92.09)	89.78 (85.06, 93.41)	87.59 (81.09, 92.47)	88.13 (83.09, 92.1)	92.47 (86.92, 96.18)	94.57 (91.19, 96.93)	92.02 (88.05, 94.99)	94.85 (92.08, 96.87)	93.78 (89.78, 96.56)	95.07 (93.27, 96.51)	8.31 (4.7, 11.93)	1.09 (1.05, 1.14)
Non-OA	North East	84.78 (79.99, 88.81)	86.44 (82.17, 90.01)	86.18 (79.66, 91.24)	86.08 (80.4, 90.62)	82.58 (75.68, 88.2)	90.91 (86.87, 94.03)	88.56 (83.79, 92.32)	90.59 (87.16, 93.36)	86.46 (80.79, 90.96)	93.33 (91.26, 95.04)	9.71 (5.52, 13.84)	1.12 (1.06, 1.17)
OA	North West	89.02 (87.1, 90.74)	91.56 (90.11, 92.86)	91.62 (90.3, 92.81)	92.14 (90.63, 93.48)	90.86 (89.36, 92.22)	92.5 (91.07, 93.77)	92.6 (91.17, 93.86)	93.65 (92.35, 94.78)	94.44 (93.3, 95.43)	93.92 (92.93, 94.8)	4.49 (3.14, 5.94)	1.05 (1.03, 1.07)
Non-OA	North West	82.66 (80.44, 84.73)	87.51 (85.88, 89.02)	87.61 (86.08, 89.03)	88.1 (86.33, 89.71)	87.93 (86.23, 89.49)	89.29 (87.63, 90.79)	88.75 (87.09, 90.26)	89.43 (87.8, 90.91)	90.63 (89.16, 91.97)	91.39 (90.24, 92.44)	6.6 (4.87, 8.3)	1.08 (1.06, 1.1)

OA	South Central	87.79 (86.57, 88.94)	87.23 (85.35, 88.95)	90.47 (88.51, 92.19)	90.3 (88.45, 91.94)	88.99 (86.97, 90.8)	91.09 (89.06, 92.85)	93.21 (91.3, 94.82)	94.12 (92.02, 95.8)	91.56 (88.41, 94.09)	92.2 (86.47, 96.04)	6.46 (4.46, 8.49)	1.07 (1.05, 1.1)
Non-OA	South Central	82.88 (81.5, 84.2)	82.02 (79.91, 83.99)	84.19 (81.79, 86.4)	85.65 (83.51, 87.62)	86.65 (84.49, 88.61)	83.77 (81.28, 86.05)	88.63 (86.2, 90.77)	87.38 (84.48, 89.91)	86.7 (82.93, 89.91)	87.5 (80.22, 92.83)	5.94 (3.47, 8.39)	1.07 (1.04, 1.11)
OA	South East Coast	87.7 (86.1, 89.18)	87.78 (86.25, 89.2)	90.03 (88.54, 91.39)	89.95 (88.34, 91.4)	89.21 (87.41, 90.83)	89.82 (87.68, 91.71)	90.88 (88.44, 92.95)	92.45 (90.41, 94.18)	94.62 (92.56, 96.25)	94.51 (90.13, 97.33)	5.65 (3.7, 7.59)	1.07 (1.04, 1.09)
Non-OA	South East Coast	82.63 (80.82, 84.33)	85.7 (84.12, 87.18)	85.71 (83.96, 87.33)	84.75 (82.85, 86.51)	87.21 (85.28, 88.98)	85.67 (83.24, 87.87)	87.97 (85.19, 90.39)	88.63 (86.27, 90.72)	88.44 (85.53, 90.95)	87.5 (81.36, 92.19)	5.23 (3, 7.49)	1.06 (1.03, 1.09)
OA	South West	89.16 (86.69, 91.31)	89.19 (87.24, 90.94)	88.86 (86.96, 90.57)	87.87 (85.77, 89.77)	88.52 (87.03, 89.9)	88.62 (86.74, 90.32)	90.15 (88.16, 91.9)	92.65 (90.84, 94.21)	92.54 (90.57, 94.21)	93.28 (91.16, 95.02)	4.52 (2.54, 6.41)	1.05 (1.03, 1.07)
Non-OA	South West	84.49 (81.67, 87.03)	86.6 (84.49, 88.53)	85.45 (83.42, 87.32)	86.01 (83.79, 88.03)	82.03 (80.28, 83.69)	85.13 (83.04, 87.06)	86.76 (84.51, 88.79)	88.51 (86.39, 90.4)	89.83 (87.49, 91.87)	91.17 (88.74, 93.23)	4.75 (2.55, 6.98)	1.06 (1.03, 1.08)
OA	West Midlands	89.21 (87.62, 90.66)	91.3 (89.56, 92.84)	89.93 (88.44, 91.29)	89.25 (87.57, 90.78)	91.76 (90.29, 93.07)	89.78 (87.89, 91.47)	91.91 (90.2, 93.4)	92.64 (90.84, 94.19)	92.51 (90.68, 94.09)	93.5 (92.15, 94.68)	4.14 (2.45, 5.83)	1.05 (1.03, 1.07)
Non-OA	West Midlands	85.29 (83.53, 86.93)	85.4 (83.37, 87.27)	86.7 (85.08, 88.2)	85.96 (84.06, 87.71)	87.99 (86.27, 89.56)	88.64 (86.65, 90.43)	87.05 (84.99, 88.92)	87.53 (85.24, 89.57)	89.52 (87.38, 91.41)	88.82 (87.1, 90.39)	4.18 (2.14, 6.13)	1.05 (1.03, 1.07)
OA	Yorkshire & The Humber	86.18 (82.23, 89.53)	82.22 (77.75, 86.11)	88.24 (85, 90.99)	87.51 (85.44, 89.38)	88.66 (85.93, 91.02)	89.09 (86.18, 91.57)	94.94 (92.68, 96.67)	90.57 (87.12, 93.34)	91.91 (88.66, 94.48)	94.23 (91.91, 96.04)	9.87 (6.95, 12.86)	1.12 (1.08, 1.15)
Non-OA	Yorkshire & The Humber	79.59 (75.22, 83.49)	83.43 (79.03, 87.24)	80.63 (77.04, 83.87)	80.39 (77.89, 82.72)	82.52 (79.55, 85.23)	82.79 (79.38, 85.85)	87.6 (84.33, 90.41)	86.07 (82.05, 89.48)	85.28 (80.96, 88.94)	89.68 (86.69, 92.2)	9.3 (5.78, 12.78)	1.12 (1.07, 1.17)

IMD, Indices of multiple deprivation; 95%CI, 95% confidence interval; CVRF, cardiovascular risk factors; OA, osteoarthritis

Appendix 3.1.7. Inequality in the prevalence of number of ≥2 modifiable CVRF in OA and non-OA samples by subgroups, 1992-2017

OA	Subgroup	Period prevalence by IMD decile (%) (95%CI)	Slope index of	Relative index of

status		1 (Least deprived)	2	3	4	5	6	7	8	9	10(Most deprived)	inequality (95%CI)(%)	inequality (95%CI)
OA	1992	55.56 (30.76, 78.47)	54.84 (36.03, 72.68)	35.48 (19.23, 54.63)	44.9 (30.67, 59.77)	44 (24.4, 65.07)	34.78 (16.38, 57.27)	40.63 (23.7, 59.36)	40.63 (23.7, 59.36)	67.74 (48.63, 83.32)	69.05 (52.91, 82.38)	18.87 (-0.53, 38.24)	1.47 (0.99, 2.33)
Non-OA	1992	27.78 (9.69, 53.48)	34.78 (16.38, 57.27)	42.86 (26.32, 60.65)	39.47 (24.04, 56.61)	34.21 (19.63, 51.35)	44.83 (26.45, 64.31)	27.59 (12.73, 47.24)	36.84 (21.81, 54.01)	38.46 (13.86, 68.42)	38.89 (25.92, 53.12)	1.72 (-17.63, 21.04)	1.05 (0.61, 1.81)
OA	1993	32.26 (22.93, 42.75)	47.06 (34.83, 59.55)	36.71 (26.14, 48.31)	44.85 (36.32, 53.61)	38.4 (29.84, 47.52)	49.12 (39.64, 58.65)	45.54 (35.6, 55.76)	37.65 (27.36, 48.82)	48.53 (36.22, 60.97)	53.47 (43.27, 63.45)	13.25 (2.04, 24.21)	1.36 (1.05, 1.79)
Non-OA	1993	34.15 (24.03, 45.45)	42.67 (31.31, 54.62)	29.03 (20.08, 39.36)	34.55 (27.33, 42.33)	42.15 (33.23, 51.46)	41.18 (31.52, 51.36)	40.91 (30.54, 51.91)	40 (28.85, 51.96)	39.44 (28.03, 51.75)	39.39 (29.72, 49.72)	7.09 (-4.14, 17.89)	1.21 (0.91, 1.62)
OA	1994	34.91 (25.9, 44.78)	51.02 (40.72, 61.26)	46.15 (36.9, 55.61)	44 (36.52, 51.69)	48.12 (39.38, 56.95)	42.75 (34.37, 51.45)	54.46 (44.78, 63.9)	48.78 (37.58, 60.08)	61.45 (50.12, 71.93)	45.65 (37.15, 54.34)	10.58 (0.64, 20.77)	1.25 (1.01, 1.57)
Non-OA	1994	34.65 (26.43, 43.6)	29.63 (21.23, 39.18)	35 (26.52, 44.24)	33.95 (26.71, 41.79)	32.77 (24.45, 41.98)	43.44 (34.5, 52.72)	33 (23.92, 43.12)	42.05 (31.6, 53.05)	41.35 (31.77, 51.42)	40.15 (31.72, 49.04)	10.21 (0.5, 20.34)	1.33 (1, 1.76)
OA	1995	33.08 (25.17, 41.77)	43.3 (33.27, 53.75)	38.46 (29.09, 48.51)	45.09 (37.52, 52.82)	44.74 (36.68, 53.01)	56.55 (48.08, 64.75)	54.55 (45.65, 63.23)	51.55 (41.18, 61.82)	64.86 (55.23, 73.69)	60.26 (52.12, 67.99)	30.2 (20.48, 39.53)	1.88 (1.52, 2.36)
Non-OA	1995	30.08 (22.43, 38.63)	38.53 (29.37, 48.34)	42.86 (34.32, 51.72)	38.16 (30.41, 46.38)	40.26 (32.45, 48.46)	40.63 (32.04, 49.66)	35.66 (27.42, 44.57)	48.54 (38.58, 58.6)	51.89 (41.97, 61.7)	39.22 (31.43, 47.43)	10.34 (0.9, 19.78)	1.3 (1.02, 1.67)
OA	1996	37.17 (30.31, 44.45)	37.97 (30.38, 46.03)	46.77 (37.76, 55.94)	43.81 (36.99, 50.81)	47.98 (40.34, 55.69)	54.55 (46.88, 62.05)	51.83 (43.9, 59.69)	51.09 (42.42, 59.73)	49.64 (41.06, 58.24)	56.91 (49.51, 64.1)	20.03 (11.51, 28.46)	1.53 (1.28, 1.86)

Non-OA	1996	34.16 (27.65, 41.14)	36.49 (28.74, 44.79)	34.51 (26.74, 42.94)	35.03 (28.38, 42.13)	34.74 (27.99, 41.97)	36.46 (29.45, 43.93)	36.36 (29.03, 44.2)	38.69 (30.49, 47.38)	40.17 (31.22, 49.64)	44.2 (36.84, 51.75)	8.63 (0.19, 17.01)	1.26 (1.01, 1.6)
OA	1997	39.46 (33.49, 45.68)	51.27 (44.06, 58.44)	46.52 (39.21, 53.95)	44.54 (37.99, 51.23)	47.6 (41.27, 53.99)	49.03 (42.02, 56.07)	59.11 (52.01, 65.94)	62.68 (54.17, 70.64)	50.76 (41.92, 59.56)	64.45 (57.59, 70.91)	22.37 (14.73, 30.07)	1.56 (1.34, 1.84)
Non-OA	1997	36.19 (30.31, 42.39)	40.55 (33.96, 47.41)	41.62 (34.43, 49.08)	40.32 (34.16, 46.72)	38.31 (32.39, 44.51)	45.15 (38.22, 52.21)	43.86 (36.3, 51.64)	43.84 (35.64, 52.28)	47.69 (38.86, 56.63)	50 (42.83, 57.17)	12.17 (4.46, 20.04)	1.34 (1.11, 1.62)
OA	1998	41.79 (35.94, 47.8)	50.89 (44.15, 57.61)	47.16 (40.55, 53.85)	52.28 (46.31, 58.2)	46.69 (40.64, 52.81)	51.87 (45.36, 58.33)	50.56 (42.98, 58.12)	59.57 (52.19, 66.65)	63.19 (55.29, 70.6)	60.36 (53.6, 66.84)	18.26 (10.94, 25.38)	1.43 (1.24, 1.65)
Non-OA	1998	33.44 (28.17, 39.04)	42.74 (36.31, 49.35)	35.94 (29.56, 42.72)	45.69 (39.61, 51.87)	40.21 (34.48, 46.14)	43.36 (36.81, 50.1)	49.12 (42.43, 55.83)	45.74 (38.48, 53.15)	44.54 (35.43, 53.93)	48.61 (41.77, 55.49)	13.93 (6.86, 21.07)	1.39 (1.17, 1.66)
OA	1999	50.48 (44.81, 56.13)	47.46 (41.45, 53.54)	44.65 (38.63, 50.78)	56.75 (50.82, 62.54)	52.3 (46.52, 58.04)	50 (43.66, 56.34)	57.4 (50.62, 63.98)	57.78 (51.03, 64.31)	64.47 (57.89, 70.68)	63.33 (56.89, 69.44)	17.21 (10.31, 24.03)	1.38 (1.21, 1.57)
Non-OA	1999	40.27 (34.65, 46.08)	36.82 (31.13, 42.8)	41.75 (35.97, 47.72)	41.47 (35.83, 47.28)	41.64 (36.05, 47.39)	42.97 (36.9, 49.19)	44.49 (38.16, 50.95)	46.63 (39.71, 53.66)	45.67 (38.77, 52.7)	48.55 (42.08, 55.05)	10.02 (3.19, 16.89)	1.27 (1.08, 1.49)
OA	2000	48.3 (42.73, 53.9)	48.86 (42.69, 55.07)	56.9 (51.06, 62.61)	54.91 (49.33, 60.4)	52.87 (47.34, 58.35)	61.04 (54.42, 67.37)	53.56 (47.01, 60.01)	57.48 (50.55, 64.19)	61.27 (54.22, 68)	65.13 (59.01, 70.91)	14.71 (8.15, 21.25)	1.3 (1.16, 1.48)
Non-OA	2000	38.99 (33.6, 44.59)	45.74 (39.82, 51.76)	41.04 (35.49, 46.77)	38.69 (33.45, 44.13)	39.63 (34.3, 45.15)	51.15 (44.92, 57.35)	45.07 (38.26, 52.02)	55.11 (48.36, 61.73)	51.26 (44.09, 58.39)	57.08 (50.24, 63.73)	17.19 (10.41, 24.08)	1.47 (1.26, 1.71)
OA	2001	48.3 (42.73, 53.9)	51.8 (46.29, 57.27)	53.66 (47.7, 59.54)	55.07 (49.8, 60.25)	59.41 (53.98, 64.68)	60.57 (54.57, 66.35)	59.41 (53.3, 65.31)	65.35 (58.79, 71.51)	58.16 (51.63, 64.49)	60.84 (54.92, 66.53)	14.41 (7.88, 20.73)	1.29 (1.15, 1.45)

Non-OA	2001	43.23 (37.95, 48.62)	38.69 (33.19, 44.41)	44.48 (38.93, 50.14)	47.89 (42.59, 53.22)	49.86 (44.63, 55.1)	50.65 (44.91, 56.39)	46.12 (39.92, 52.42)	47.77 (41.07, 54.52)	57.96 (51.24, 64.48)	55.6 (49.21, 61.86)	14.91 (8.6, 21.4)	1.37 (1.2, 1.58)
OA	2002	48.33 (43.46, 53.23)	54.12 (49.02, 59.16)	50.13 (45.03, 55.22)	53.83 (48.99, 58.61)	57.47 (52.67, 62.17)	59.34 (53.84, 64.67)	61.78 (56.45, 66.91)	56.8 (51.27, 62.2)	61.15 (55.15, 66.91)	69.8 (64.24, 74.96)	17.73 (12.04, 23.42)	1.37 (1.24, 1.52)
Non-OA	2002	40.45 (35.83, 45.21)	39.47 (34.49, 44.61)	47.73 (42.86, 52.64)	43.41 (38.72, 48.19)	45.65 (40.78, 50.59)	46.63 (41.35, 51.96)	51.59 (46.19, 56.95)	50.65 (44.91, 56.39)	60 (53.77, 66)	59.12 (53.28, 64.77)	19.58 (13.83, 25.29)	1.52 (1.34, 1.72)
OA	2003	47.67 (43.62, 51.75)	53.97 (49.67, 58.23)	57.86 (53.38, 62.25)	55.83 (51.78, 59.82)	58.88 (54.51, 63.15)	60.7 (56.06, 65.2)	60.76 (56.06, 65.32)	66.21 (61.12, 71.04)	64.45 (59.16, 69.5)	70.81 (66.05, 75.26)	20.52 (15.53, 25.33)	1.42 (1.31, 1.56)
Non-OA	2003	43.38 (39.37, 47.47)	47.04 (42.89, 51.21)	44.97 (40.58, 49.42)	48.44 (44.29, 52.6)	52.83 (48.55, 57.08)	51.2 (46.52, 55.88)	51.73 (46.91, 56.53)	55.73 (50.66, 60.7)	53.33 (47.79, 58.82)	63.87 (58.64, 68.86)	16.73 (11.76, 21.79)	1.4 (1.26, 1.55)
OA	2004	49.08 (45.18, 52.99)	54.88 (50.95, 58.77)	57.68 (53.65, 61.63)	58.5 (54.7, 62.23)	55.49 (51.7, 59.24)	62.97 (58.71, 67.09)	64.46 (60.08, 68.67)	63.96 (59.3, 68.44)	71.66 (67.17, 75.85)	72.75 (68.17, 77)	22.09 (17.68, 26.59)	1.45 (1.34, 1.57)
Non-OA	2004	44.89 (41.15, 48.68)	45.95 (41.97, 49.98)	49.4 (45.52, 53.28)	47.13 (43.32, 50.96)	48.06 (44.07, 52.08)	50.7 (46.53, 54.86)	55.91 (51.43, 60.32)	56.36 (51.59, 61.05)	57.45 (52.27, 62.5)	58.77 (54.01, 63.42)	15.28 (10.69, 19.87)	1.36 (1.23, 1.49)
OA	2005	55.53 (51.89, 59.12)	54.32 (50.66, 57.96)	56.75 (53.03, 60.4)	55.01 (51.36, 58.61)	60.91 (57.25, 64.48)	62.5 (58.46, 66.41)	63.75 (59.69, 67.66)	65.61 (61.41, 69.63)	69.22 (65.01, 73.2)	73.11 (68.53, 77.34)	18.56 (14.4, 22.89)	1.36 (1.27, 1.46)
Non-OA	2005	44.99 (41.44, 48.59)	48.18 (44.66, 51.71)	47.88 (44.07, 51.7)	51.55 (47.8, 55.29)	48.51 (44.94, 52.1)	51.55 (47.4, 55.69)	51.36 (47.24, 55.47)	52.31 (47.92, 56.67)	58.32 (53.74, 62.79)	60.05 (55.18, 64.78)	12.54 (8.14, 16.91)	1.28 (1.18, 1.4)
OA	2006	52.41 (48.71, 56.1)	55.74 (52.16, 59.28)	59.78 (56.11, 63.37)	59.74 (56.15, 63.25)	60.81 (57.19, 64.35)	62.95 (59.15, 66.64)	62.64 (58.73, 66.43)	71.18 (67.26, 74.87)	64.16 (59.55, 68.59)	74.56 (70.3, 78.5)	18.77 (14.63, 22.88)	1.36 (1.27, 1.46)

Non-OA	2006	43.35 (39.83, 46.93)	48.77 (45.28, 52.27)	46.27 (42.62, 49.95)	51.96 (48.41, 55.49)	48.7 (45.2, 52.21)	52.49 (48.34, 56.61)	55.35 (51.23, 59.41)	52.9 (48.57, 57.19)	57.45 (52.8, 62)	58.66 (53.69, 63.51)	13.95 (9.63, 18.2)	1.32 (1.21, 1.44)
OA	2007	49.83 (46.45, 53.21)	52.95 (49.49, 56.39)	60.45 (57.07, 63.76)	60.8 (57.38, 64.14)	56.33 (52.94, 59.67)	58.97 (55.23, 62.64)	63.95 (60.26, 67.51)	67.94 (64.13, 71.58)	67.72 (63.7, 71.56)	74.6 (70.57, 78.35)	21.18 (17.29, 25.03)	1.43 (1.34, 1.53)
Non-OA	2007	42.9 (39.76, 46.08)	45.92 (42.62, 49.25)	46.96 (43.5, 50.44)	49.03 (45.56, 52.5)	48.26 (44.87, 51.65)	52.49 (48.72, 56.23)	49.93 (46.1, 53.75)	56.2 (52.08, 60.25)	58.37 (53.8, 62.83)	61.58 (57.24, 65.79)	17.19 (13.16, 21.24)	1.42 (1.3, 1.54)
OA	2008	47.32 (44.26, 50.4)	56.11 (52.97, 59.22)	59.03 (55.9, 62.11)	55.73 (52.49, 58.94)	57.74 (54.46, 60.97)	63.92 (60.54, 67.2)	63.03 (59.59, 66.37)	66.62 (62.92, 70.16)	69.18 (65.47, 72.72)	71.68 (67.97, 75.18)	22.29 (18.7, 25.9)	1.46 (1.37, 1.55)
Non-OA	2008	40.66 (37.73, 43.64)	44.3 (41.24, 47.4)	50.69 (47.56, 53.82)	48.18 (44.93, 51.44)	49.49 (46.33, 52.66)	52.43 (48.91, 55.94)	55.91 (52.28, 59.49)	56.3 (52.46, 60.08)	56.17 (52.09, 60.18)	62.92 (58.9, 66.81)	19.99 (16.34, 23.66)	1.49 (1.38, 1.62)
OA	2009	52.76 (49.51, 55.99)	55.84 (52.27, 59.36)	55.76 (52.41, 59.06)	59.76 (56.36, 63.1)	58.79 (55.32, 62.2)	59.27 (55.3, 63.14)	63.97 (60.26, 67.55)	69.39 (65.61, 72.99)	69.43 (65.32, 73.33)	74.58 (70.69, 78.21)	21.18 (17.23, 25.03)	1.42 (1.33, 1.52)
Non-OA	2009	43.02 (39.7, 46.39)	48.04 (44.67, 51.42)	47.27 (44.03, 50.53)	50.94 (47.52, 54.35)	52.77 (49.27, 56.25)	54.62 (50.66, 58.53)	53.24 (49.4, 57.04)	54.56 (50.37, 58.7)	56.99 (52.7, 61.19)	61.14 (56.75, 65.41)	16.03 (12.09, 20.05)	1.37 (1.27, 1.49)
OA	2010	51.18 (47.46, 54.89)	52.13 (48.16, 56.09)	58.69 (54.95, 62.36)	60.15 (56.29, 63.93)	58.2 (54.34, 61.98)	61.97 (57.72, 66.08)	65.12 (60.93, 69.14)	68.61 (64.08, 72.89)	68.19 (63.82, 72.33)	72.39 (67.74, 76.7)	21.65 (17.22, 25.96)	1.44 (1.33, 1.55)
Non-OA	2010	45.95 (42.35, 49.59)	49.35 (45.56, 53.14)	50.94 (47.28, 54.6)	48.62 (44.73, 52.53)	49.18 (45.33, 53.03)	52.65 (48.29, 56.98)	55.17 (50.61, 59.66)	57.8 (53.12, 62.39)	62.41 (57.5, 67.13)	58.08 (53.05, 62.99)	14.32 (9.82, 18.82)	1.32 (1.21, 1.45)
OA	2011	55.97 (51.93, 59.95)	57.82 (53.72, 61.85)	59.97 (55.96, 63.87)	57.51 (53.37, 61.58)	57.43 (53.16, 61.62)	61.28 (56.71, 65.7)	64.73 (60.11, 69.16)	67.67 (62.61, 72.45)	68.44 (63.48, 73.1)	76.12 (71.18, 80.59)	16.71 (11.99, 21.5)	1.31 (1.21, 1.43)

Non-OA	2011	44.66 (40.82, 48.56)	47.23 (43.15, 51.33)	51 (46.92, 55.07)	50.96 (46.78, 55.14)	52.11 (47.82, 56.37)	51.72 (47.07, 56.34)	57.4 (52.66, 62.04)	60.69 (55.57, 65.64)	60.38 (55.17, 65.43)	66.01 (60.41, 71.31)	19.66 (14.75, 24.63)	1.46 (1.33, 1.61)
OA	2012	51.08 (46.84, 55.3)	57.34 (52.86, 61.74)	59.56 (55.12, 63.89)	55.41 (50.65, 60.09)	57.68 (53.1, 62.17)	65.57 (60.65, 70.25)	63.87 (58.56, 68.94)	63.14 (57.52, 68.51)	69.01 (63.28, 74.34)	73.09 (67.44, 78.24)	18.86 (13.75, 24.07)	1.37 (1.25, 1.5)
Non-OA	2012	47.32 (43.04, 51.62)	46.05 (41.64, 50.5)	50.21 (45.64, 54.77)	50.48 (45.58, 55.37)	53.17 (48.39, 57.9)	56.48 (51.52, 61.34)	57.22 (51.93, 62.39)	54.3 (49.09, 59.45)	62.21 (56.45, 67.73)	62.69 (56.5, 68.59)	16.95 (11.7, 22.48)	1.38 (1.24, 1.54)
OA	2013	51.17 (46.55, 55.77)	52.91 (47.74, 58.03)	60.68 (55.78, 65.43)	61.16 (55.93, 66.2)	58.1 (53.02, 63.05)	60.78 (55.32, 66.05)	65.2 (59.7, 70.42)	64.71 (59.07, 70.06)	68.53 (62.13, 74.45)	70.94 (64.67, 76.67)	18.95 (13.05, 24.64)	1.37 (1.24, 1.51)
Non-OA	2013	46.25 (41.66, 50.89)	52.02 (47.13, 56.88)	51.2 (46.29, 56.08)	54.84 (49.63, 59.97)	57.22 (52.08, 62.24)	53.13 (47.49, 58.7)	57.53 (51.7, 63.2)	60.21 (54.26, 65.95)	60.15 (53.93, 66.14)	70.05 (63.48, 76.06)	18.01 (12.12, 23.9)	1.39 (1.25, 1.55)
OA	2014	50 (44.97, 55.03)	56.68 (51.2, 62.04)	55.07 (49.65, 60.4)	61.58 (56.29, 66.67)	56.86 (51.49, 62.11)	59.33 (53.54, 64.94)	57.31 (50.96, 63.49)	66.94 (60.67, 72.8)	71.11 (64.71, 76.94)	71.28 (64.24, 77.63)	18.91 (12.72, 25.15)	1.38 (1.24, 1.54)
Non-OA	2014	44.73 (39.72, 49.82)	51.75 (46.73, 56.74)	48.22 (42.99, 53.48)	52.87 (47.18, 58.5)	53.71 (48.34, 59.03)	59.01 (53.03, 64.8)	58.57 (52.56, 64.4)	60.85 (54.29, 67.13)	61.33 (53.82, 68.46)	66.67 (59.58, 73.24)	20.28 (13.95, 26.55)	1.46 (1.3, 1.65)
OA	2015	47.95 (43.05, 52.88)	57.14 (51.27, 62.87)	52.88 (46.83, 58.87)	59.78 (53.68, 65.67)	56.63 (50.91, 62.23)	61.21 (54.33, 67.78)	59.52 (52.55, 66.22)	63.92 (56.73, 70.67)	71.04 (63.89, 77.49)	69.94 (62.52, 76.67)	21.35 (14.68, 28.14)	1.45 (1.29, 1.64)
Non-OA	2015	46.3 (41.18, 51.47)	51.19 (45.31, 57.05)	50 (44.2, 55.8)	47.4 (41.53, 53.34)	52.33 (46.29, 58.32)	58.02 (51.79, 64.06)	54.73 (47.57, 61.74)	60.11 (52.62, 67.26)	63.41 (56.42, 70.01)	66.01 (57.93, 73.47)	19.03 (12.25, 25.88)	1.43 (1.25, 1.64)
OA	2016	50.8 (45.12, 56.47)	55.7 (49.12, 62.12)	58.82 (51.74, 65.65)	54.39 (46.61, 62.01)	62.69 (55.6, 69.39)	54.72 (46.64, 62.61)	58.79 (50.87, 66.38)	70.95 (62.92, 78.11)	68.97 (60.76, 76.38)	74.14 (65.18, 81.82)	21.02 (13.25, 28.81)	1.43 (1.25, 1.64)

Non-OA	2016	47.87 (42.35, 53.42)	46.56 (40.21, 52.99)	56.92 (49.66, 63.98)	51.85 (43.88, 59.76)	51.96 (44.87, 58.99)	54.48 (45.65, 63.1)	60.11 (52.52, 67.36)	65.03 (56.62, 72.81)	64.1 (56.04, 71.62)	69.91 (60.57, 78.18)	22.52 (14.42, 30.39)	1.51 (1.3, 1.77)
OA	2017	47.45 (41.82, 53.14)	50.42 (43.86, 56.97)	59.49 (52.24, 66.44)	60.25 (52.25, 67.87)	53.49 (45.74, 61.12)	61.02 (51.61, 69.86)	66.67 (57.94, 74.63)	68.25 (59.37, 76.26)	71.43 (61.42, 80.1)	77.5 (66.79, 86.09)	28.24 (20.07, 36.59)	1.64 (1.41, 1.92)
Non-OA	2017	43.07 (37.73, 48.53)	57.31 (51.05, 63.4)	50.29 (42.64, 57.92)	63.24 (54.55, 71.33)	52.33 (44.59, 59.98)	52.5 (43.18, 61.69)	61.42 (52.37, 69.92)	70 (60.02, 78.76)	64.29 (54.68, 73.12)	69.23 (58.68, 78.49)	24.15 (15.5, 32.58)	1.56 (1.33, 1.85)
OA	Age 35-44 years	37.67 (33.19, 42.3)	35.91 (31.42, 40.59)	41.05 (36.5, 45.71)	42.07 (37.58, 46.66)	44.09 (39.52, 48.73)	47.95 (43.2, 52.74)	53.58 (48.76, 58.35)	50.96 (46.05, 55.86)	55.98 (51.48, 60.42)	59.26 (54.98, 63.44)	26.15 (21.14, 31.16)	1.77 (1.58, 1.99)
Non-OA	Age 35-44 years	26.73 (22.97, 30.76)	28.88 (24.79, 33.24)	33.92 (29.82, 38.21)	30.63 (26.53, 34.96)	38.21 (33.9, 42.67)	42.82 (37.9, 47.85)	38.93 (34.38, 43.62)	42.32 (37.4, 47.35)	46.6 (41.79, 51.46)	50.31 (45.75, 54.87)	25.08 (20.22, 30.01)	2 (1.73, 2.33)
OA	Age 45-54 years	42.02 (40.03, 44.04)	47.89 (45.64, 50.15)	51.16 (48.91, 53.41)	51.7 (49.53, 53.87)	52.63 (50.42, 54.83)	55.45 (53.13, 57.75)	57.63 (55.32, 59.92)	62.61 (60.22, 64.96)	65.13 (62.75, 67.46)	68.83 (66.58, 71.01)	26.71 (24.29, 29.12)	1.65 (1.57, 1.73)
Non-OA	Age 45-54 years	37.13 (35.23, 39.06)	42.21 (40.12, 44.31)	42.88 (40.7, 45.08)	44.06 (41.95, 46.19)	45.19 (43.05, 47.34)	46.09 (43.78, 48.42)	49 (46.55, 51.44)	52.16 (49.64, 54.68)	55.65 (53.05, 58.22)	57.49 (54.97, 59.98)	19.95 (17.47, 22.4)	1.55 (1.47, 1.64)
OA	Age 55-64 years	49.29 (47.76, 50.82)	53.48 (51.85, 55.11)	56.87 (55.22, 58.5)	58.02 (56.45, 59.57)	56.25 (54.65, 57.85)	61.81 (60.07, 63.53)	62.93 (61.17, 64.67)	66.36 (64.48, 68.21)	68.7 (66.77, 70.58)	73.96 (72.15, 75.71)	22.74 (20.89, 24.58)	1.47 (1.43, 1.52)
Non-OA	Age 55-64 years	43.39 (41.9, 44.9)	47.86 (46.28, 49.45)	48.38 (46.75, 50.01)	51.7 (50.1, 53.29)	49.99 (48.39, 51.59)	53.49 (51.69, 55.27)	54.92 (53.08, 56.74)	57.18 (55.22, 59.12)	59.37 (57.26, 61.45)	62.35 (60.34, 64.34)	17.8 (15.9, 19.68)	1.42 (1.36, 1.47)
OA	Age 65-74 years	54.05 (52.27, 55.81)	59.49 (57.68, 61.29)	60 (58.2, 61.78)	59.67 (57.85, 61.46)	60.96 (59.18, 62.73)	62.25 (60.24, 64.23)	64.48 (62.44, 66.48)	67.99 (65.9, 70.02)	68.92 (66.66, 71.11)	71.07 (68.84, 73.23)	15.59 (13.48, 17.7)	1.29 (1.25, 1.34)

Non-OA	Age 65-74 years	45.93 (44.17, 47.69)	49.78 (47.95, 51.61)	50.63 (48.8, 52.45)	48.94 (47.07, 50.82)	50.75 (48.92, 52.58)	54.5 (52.46, 56.52)	54.86 (52.74, 56.97)	56.26 (54.01, 58.48)	59.6 (57.25, 61.91)	59.33 (57.01, 61.63)	13.68 (11.49, 15.85)	1.3 (1.25, 1.36)
OA	Age 75-84 years	55.32 (52.83, 57.78)	57.24 (54.72, 59.72)	59.65 (57.17, 62.1)	57.76 (55.28, 60.21)	57.95 (55.44, 60.44)	62.13 (59.38, 64.82)	63.07 (60.26, 65.81)	64.11 (61.13, 67.01)	65.15 (62.01, 68.19)	65.79 (62.54, 68.93)	10.96 (8.05, 13.93)	1.2 (1.14, 1.26)
Non-OA	Age 75-84 years	49.11 (46.62, 51.61)	46.31 (43.79, 48.85)	49.49 (47, 51.99)	48.37 (45.81, 50.93)	49.07 (46.51, 51.63)	50.08 (47.32, 52.83)	51.8 (49.02, 54.57)	53.3 (50.29, 56.3)	53.45 (50.2, 56.67)	54.45 (50.99, 57.87)	6.95 (3.92, 9.94)	1.15 (1.08, 1.22)
OA	Age 85+ years	48.86 (41.27, 56.5)	53.16 (45.8, 60.42)	55.05 (47.84, 62.11)	54.72 (46.64, 62.61)	54.35 (46.86, 61.69)	51.37 (42.97, 59.72)	50.35 (41.87, 58.81)	58.65 (48.58, 68.23)	57.14 (47.45, 66.45)	48 (36.31, 59.85)	2.5 (-6.64, 11.8)	1.05 (0.88, 1.24)
Non-OA	Age 85+ years	47.02 (39.29, 54.86)	50 (42.47, 57.53)	44.5 (37.33, 51.85)	45.3 (37.91, 52.86)	47.37 (40.1, 54.72)	46.48 (38.07, 55.03)	47.33 (38.55, 56.23)	47.62 (38.65, 56.7)	46.59 (35.88, 57.54)	53.85 (43.08, 64.36)	2.03 (-7.08, 10.99)	1.04 (0.86, 1.27)
OA	Men	51.06 (49.48, 52.64)	54.88 (53.23, 56.53)	56.42 (54.75, 58.07)	56.25 (54.63, 57.87)	56.59 (54.95, 58.22)	60.41 (58.61, 62.18)	60.11 (58.27, 61.94)	64.1 (62.18, 65.99)	65.15 (63.15, 67.11)	69.47 (67.55, 71.33)	16.65 (14.78, 18.53)	1.33 (1.29, 1.38)
Non-OA	Men	53.05 (51.48, 54.61)	55.53 (53.91, 57.14)	55.18 (53.54, 56.81)	56.39 (54.75, 58.01)	57.41 (55.75, 59.05)	58.17 (56.37, 59.96)	59.71 (57.83, 61.56)	60.15 (58.19, 62.1)	62.2 (60.15, 64.22)	64.12 (62.12, 66.09)	10.45 (8.54, 12.35)	1.2 (1.16, 1.24)
OA	Women	48.63 (47.52, 49.73)	53.43 (52.26, 54.6)	56.36 (55.21, 57.52)	56.62 (55.48, 57.75)	56.53 (55.39, 57.67)	59.58 (58.34, 60.81)	62.26 (61.02, 63.49)	65.07 (63.76, 66.36)	67.03 (65.69, 68.34)	69.87 (68.57, 71.15)	20.52 (19.2, 21.83)	1.42 (1.39, 1.46)
Non-OA	Women	37.89 (36.84, 38.95)	41.73 (40.61, 42.86)	43.53 (42.38, 44.68)	43.84 (42.7, 44.99)	44.46 (43.34, 45.59)	47.79 (46.52, 49.05)	48.94 (47.65, 50.23)	51.72 (50.34, 53.09)	54.24 (52.78, 55.69)	56 (54.57, 57.42)	17.94 (16.6, 19.26)	1.48 (1.44, 1.53)
OA	East Midlands	50.72 (43.73, 57.68)	58.41 (53.58, 63.13)	56.96 (51.81, 61.99)	59.88 (55.53, 64.12)	60.7 (54.77, 66.41)	59.8 (53.97, 65.43)	61.24 (57.2, 65.17)	59.95 (54.88, 64.87)	61.24 (56.81, 65.55)	66.22 (59.58, 72.41)	7.9 (2.37, 13.44)	1.14 (1.04, 1.25)

Non-OA	East Midlands	42.08 (35.49, 48.89)	43.96 (39.26, 48.75)	47.62 (42.87, 52.4)	48.85 (44.28, 53.43)	46.92 (40.73, 53.19)	49.67 (43.93, 55.42)	52.06 (47.82, 56.27)	49.47 (44.34, 54.62)	53.32 (48.96, 57.65)	54.5 (47.52, 61.35)	11 (5.49, 16.68)	1.25 (1.12, 1.41)
OA	East of England	46.83 (44.61, 49.06)	53.4 (50.82, 55.96)	55.19 (52.25, 58.11)	55.59 (53.01, 58.14)	56.47 (53.58, 59.33)	60.18 (57.38, 62.93)	59.3 (56.31, 62.24)	61.71 (57.5, 65.78)	64.83 (59.8, 69.62)	67.19 (61.03, 72.94)	17.21 (13.89, 20.55)	1.37 (1.28, 1.45)
Non-OA	East of England	42.28 (40.1, 44.48)	43.97 (41.43, 46.54)	47.78 (44.85, 50.71)	47.95 (45.36, 50.54)	47.27 (44.46, 50.09)	51.06 (48.17, 53.94)	52.2 (49.12, 55.27)	50.83 (46.53, 55.13)	57.76 (52.71, 62.7)	55.95 (49.59, 62.18)	13.36 (9.98, 16.69)	1.33 (1.23, 1.42)
OA	London	48.08 (44.11, 52.08)	54.02 (50.59, 57.42)	60.43 (56.81, 63.97)	56.66 (53.53, 59.75)	59.22 (56.25, 62.14)	60.56 (57.33, 63.72)	64.21 (61.24, 67.1)	64.84 (61.82, 67.77)	67.93 (64.9, 70.85)	75.79 (70.93, 80.21)	19.53 (15.92, 23.15)	1.38 (1.3, 1.47)
Non-OA	London	43.23 (39.38, 47.14)	46.37 (43.01, 49.75)	48.65 (44.9, 52.41)	47.83 (44.74, 50.92)	51.32 (48.32, 54.31)	51.72 (48.45, 54.98)	51.65 (48.59, 54.7)	54.12 (50.99, 57.23)	55.79 (52.61, 58.94)	53.8 (48.25, 59.28)	11.64 (7.92, 15.36)	1.26 (1.17, 1.36)
OA	North East	42.44 (36.48, 48.56)	52 (45.26, 58.69)	50.34 (41.93, 58.75)	55.25 (48.4, 61.95)	54.11 (45.67, 62.38)	63.04 (57.05, 68.75)	62.74 (56.59, 68.6)	66.67 (61.6, 71.46)	63.56 (56.9, 69.85)	73.1 (69.78, 76.24)	32.3 (25.96, 38.47)	1.71 (1.53, 1.91)
Non-OA	North East	39.49 (33.69, 45.53)	49.84 (44.2, 55.48)	47.37 (39.22, 55.62)	49.48 (42.25, 56.74)	45.81 (37.79, 53.99)	55.27 (49.18, 61.25)	49.58 (43.03, 56.14)	54.84 (49.63, 59.97)	55.73 (48.4, 62.88)	62.64 (58.99, 66.18)	22.59 (16.11, 28.97)	1.54 (1.36, 1.75)
OA	North West	49.66 (46.78, 52.55)	55.68 (53.24, 58.09)	57.16 (54.93, 59.36)	59.11 (56.52, 61.66)	58.52 (56.07, 60.93)	61.08 (58.59, 63.53)	61.1 (58.62, 63.55)	66.63 (64.27, 68.92)	67.27 (65.09, 69.4)	70.7 (68.91, 72.44)	20.24 (17.65, 22.82)	1.39 (1.34, 1.46)
Non-OA	North West	42.26 (39.49, 45.06)	50.34 (47.98, 52.69)	49.72 (47.5, 51.95)	52.04 (49.45, 54.62)	52.47 (49.99, 54.94)	54.21 (51.68, 56.73)	56.13 (53.65, 58.6)	55.16 (52.65, 57.64)	58.41 (56.03, 60.75)	61.03 (59.12, 62.91)	16.24 (13.61, 18.86)	1.36 (1.29, 1.43)
OA	South Central	51.93 (50.13, 53.74)	53.85 (51.17, 56.5)	58.66 (55.58, 61.69)	57.08 (54.18, 59.95)	58.93 (55.93, 61.88)	61.09 (57.85, 64.25)	63.69 (60.34, 66.95)	66.87 (63.1, 70.5)	64.02 (59.12, 68.71)	67.38 (58.98, 75.03)	16.42 (13.05, 19.7)	1.33 (1.26, 1.42)

Non-OA	South Central	43.33 (41.57, 45.11)	44.99 (42.37, 47.63)	46.12 (43.01, 49.26)	50.09 (47.17, 53)	46.98 (43.99, 49.99)	47.23 (44.02, 50.45)	50.7 (47.14, 54.26)	56.56 (52.52, 60.53)	52.94 (47.86, 57.98)	57.5 (48.15, 66.47)	11.65 (8.3, 15.04)	1.28 (1.19, 1.38)
OA	South East Coast	48.26 (45.94, 50.59)	52.04 (49.8, 54.28)	55.89 (53.54, 58.22)	56.89 (54.39, 59.38)	56 (53.27, 58.71)	57.88 (54.6, 61.1)	59.64 (55.81, 63.38)	64.36 (60.94, 67.66)	67.41 (63.6, 71.05)	69.23 (61.98, 75.85)	17.27 (14.16, 20.45)	1.36 (1.29, 1.45)
Non-OA	South East Coast	42.75 (40.48, 45.04)	45.59 (43.43, 47.75)	45.09 (42.72, 47.48)	47 (44.48, 49.54)	51.68 (48.93, 54.43)	52.88 (49.59, 56.14)	51.09 (47.15, 55.03)	52.72 (49.25, 56.17)	54.99 (50.81, 59.12)	55 (46.95, 62.86)	13.03 (9.79, 16.3)	1.31 (1.23, 1.41)
OA	South West	50.41 (46.74, 54.07)	55.18 (52.24, 58.1)	54.95 (52.11, 57.77)	56.72 (53.69, 59.71)	54.95 (52.72, 57.17)	58.34 (55.57, 61.07)	63.12 (60.09, 66.08)	64.69 (61.61, 67.69)	67.72 (64.47, 70.84)	68.96 (65.38, 72.37)	17.12 (13.87, 20.28)	1.34 (1.27, 1.42)
Non-OA	South West	41.77 (38.17, 45.43)	48.95 (46.01, 51.89)	48.55 (45.8, 51.29)	47.95 (44.92, 50.99)	45.25 (43.05, 47.46)	48.44 (45.64, 51.25)	52.08 (48.95, 55.19)	56.09 (52.98, 59.17)	58.56 (55, 62.05)	56.93 (53.04, 60.75)	12.66 (9.37, 15.93)	1.29 (1.21, 1.38)
OA	West Midlands	50.72 (48.29, 53.15)	54.18 (51.31, 57.03)	56.1 (53.76, 58.41)	55.41 (52.85, 57.95)	54.56 (52.07, 57.04)	57.84 (54.93, 60.7)	59.71 (56.84, 62.53)	65.12 (62.06, 68.09)	65.54 (62.46, 68.52)	67.23 (64.82, 69.57)	17.13 (14.25, 20.04)	1.35 (1.28, 1.42)
Non-OA	West Midlands	43.95 (41.59, 46.34)	45.95 (43.22, 48.69)	46.57 (44.29, 48.85)	47.72 (45.12, 50.33)	49.39 (46.88, 51.9)	53.17 (50.22, 56.1)	51.29 (48.37, 54.19)	57.04 (53.8, 60.23)	59.14 (55.92, 62.32)	56.85 (54.27, 59.4)	16.18 (13.24, 19.1)	1.38 (1.3, 1.47)
OA	Yorkshire & The Humber	46.88 (41.7, 52.12)	48.98 (43.57, 54.4)	52.73 (48.14, 57.29)	52.97 (50.01, 55.91)	52.76 (48.79, 56.7)	61.82 (57.61, 65.9)	62.45 (58.11, 66.65)	60.38 (55.2, 65.39)	69 (64.02, 73.68)	68.16 (64.03, 72.08)	22.62 (17.9, 27.26)	1.49 (1.37, 1.63)
Non-OA	Yorkshire & The Humber	43.41 (38.41, 48.51)	36.98 (31.82, 42.37)	45.94 (41.69, 50.24)	41.72 (38.76, 44.73)	43.41 (39.76, 47.12)	47.28 (43.05, 51.54)	51.03 (46.48, 55.57)	51.25 (45.95, 56.53)	54.29 (48.72, 59.79)	55.95 (51.49, 60.34)	15.91 (11.13, 20.62)	1.41 (1.27, 1.58)

IMD, Indices of multiple deprivation; 95%CI, 95% confidence interval; CVRF, cardiovascular risk factors; OA, osteoarthritis

Appendix 3.1.8. Inequality in the prevalence of number of ≥3 modifiable CVRFs in OA and non-OA samples by subgroups, 1992-2017

OA status	Subgroup	Period prevalence by IMD decile (%) (95%CI)										Slope index of inequality (95%CI)(%)	Relative index of inequality (95%CI)
		1 (Least deprived)	2	3	4	5	6	7	8	9	10(Most deprived)		
OA	1992	5.56 (0.14, 27.29)	16.13 (5.45, 33.73)	9.68 (2.04, 25.75)	12.24 (4.63, 24.77)	20 (6.83, 40.7)	17.39 (4.95, 38.78)	15.63 (5.28, 32.79)	12.5 (3.51, 28.99)	22.58 (9.59, 41.1)	16.67 (6.97, 31.36)	8.61 (-6.18, 23.25)	1.81 (0.61, 8.22)
Non-OA	1992	11.11 (1.38, 34.71)	8.7 (1.07, 28.04)	11.43 (3.2, 26.74)	18.42 (7.74, 34.33)	15.79 (6.02, 31.25)	20.69 (7.99, 39.72)	6.9 (0.85, 22.77)	15.79 (6.02, 31.25)	15.38 (1.92, 45.45)	12.96 (5.37, 24.9)	1.63 (-12.45, 15.39)	1.12 (0.37, 3.88)
OA	1993	9.68 (4.52, 17.58)	13.24 (6.23, 23.64)	12.66 (6.24, 22.05)	18.38 (12.26, 25.93)	4.8 (1.78, 10.15)	14.91 (8.93, 22.8)	11.88 (6.29, 19.83)	12.94 (6.64, 21.98)	16.18 (8.36, 27.1)	22.77 (15.02, 32.18)	7.15 (-1.28, 15.51)	1.7 (0.91, 3.65)
Non-OA	1993	8.54 (3.5, 16.8)	13.33 (6.58, 23.16)	12.9 (6.85, 21.45)	10.3 (6.12, 15.98)	13.22 (7.75, 20.58)	15.69 (9.24, 24.22)	17.05 (9.87, 26.55)	8 (2.99, 16.6)	12.68 (5.96, 22.7)	13.13 (7.18, 21.41)	2.78 (-4.93, 10.31)	1.25 (0.66, 2.43)
OA	1994	15.09 (8.88, 23.35)	17.35 (10.44, 26.31)	17.95 (11.47, 26.12)	10.29 (6.21, 15.77)	14.29 (8.83, 21.41)	12.32 (7.34, 18.99)	20.54 (13.49, 29.2)	10.98 (5.14, 19.82)	26.51 (17.42, 37.34)	16.67 (10.87, 23.95)	3.85 (-4.05, 11.69)	1.28 (0.76, 2.22)
Non-OA	1994	9.45 (4.98, 15.92)	12.04 (6.57, 19.7)	9.17 (4.67, 15.81)	10.49 (6.23, 16.27)	9.24 (4.71, 15.94)	12.3 (7.05, 19.47)	11 (5.62, 18.83)	12.5 (6.41, 21.27)	12.5 (6.83, 20.43)	18.94 (12.65, 26.68)	7.04 (-0.18, 14.22)	1.85 (0.99, 4)
OA	1995	6.77 (3.14, 12.46)	16.49 (9.73, 25.4)	14.42 (8.3, 22.67)	9.25 (5.38, 14.58)	11.84 (7.17, 18.07)	18.62 (12.64, 25.92)	17.42 (11.38, 24.99)	25.77 (17.42, 35.65)	18.02 (11.37, 26.45)	21.15 (15.03, 28.41)	14.45 (7.35, 21.58)	2.74 (1.64, 5.58)
Non-OA	1995	9.02 (4.75, 15.23)	14.68 (8.63, 22.74)	10.53 (5.88, 17.03)	9.21 (5.13, 14.97)	13.64 (8.64, 20.09)	10.16 (5.52, 16.74)	15.5 (9.73, 22.92)	16.5 (9.92, 25.11)	16.98 (10.39, 25.5)	11.11 (6.61, 17.19)	4.51 (-2.12, 11.12)	1.44 (0.85, 2.65)

OA	1996	10.99 (6.94, 16.31)	14.56 (9.46, 21.04)	8.87 (4.51, 15.32)	13.33 (9.05, 18.69)	19.08 (13.51, 25.73)	19.32 (13.76, 25.93)	15.85 (10.63, 22.36)	19.71 (13.41, 27.36)	22.3 (15.68, 30.14)	16.49 (11.49, 22.58)	9.51 (3.24, 15.71)	1.85 (1.24, 2.93)
Non-OA	1996	8.42 (4.98, 13.13)	15.54 (10.11, 22.4)	7.75 (3.93, 13.44)	12.18 (7.96, 17.58)	12.11 (7.83, 17.61)	9.39 (5.57, 14.61)	12.12 (7.56, 18.1)	16.06 (10.35, 23.3)	7.69 (3.58, 14.1)	13.81 (9.14, 19.71)	2.72 (-2.93, 8.28)	1.27 (0.78, 2.16)
OA	1997	9.96 (6.61, 14.25)	17.77 (12.7, 23.83)	17.65 (12.47, 23.88)	13.97 (9.76, 19.15)	17.6 (13.09, 22.9)	16.99 (12.13, 22.83)	21.67 (16.21, 27.98)	22.54 (15.95, 30.3)	18.94 (12.65, 26.68)	24.64 (18.99, 31.03)	12.35 (6.38, 18.32)	2.07 (1.45, 3.16)
Non-OA	1997	10.12 (6.72, 14.47)	17.97 (13.1, 23.74)	15.14 (10.3, 21.13)	12.5 (8.65, 17.27)	16.09 (11.85, 21.12)	15.53 (10.87, 21.22)	13.45 (8.72, 19.5)	17.81 (11.98, 24.99)	16.92 (10.92, 24.49)	18.69 (13.51, 24.83)	5.47 (-0.24, 11.16)	1.44 (0.99, 2.19)
OA	1998	8.93 (5.86, 12.9)	12.5 (8.47, 17.56)	13.97 (9.76, 19.15)	17.54 (13.31, 22.47)	16.54 (12.33, 21.5)	16.18 (11.77, 21.45)	21.35 (15.57, 28.1)	20.21 (14.72, 26.67)	22.7 (16.51, 29.9)	24.32 (18.83, 30.52)	15.16 (9.65, 20.59)	2.62 (1.82, 4.13)
Non-OA	1998	12.79 (9.25, 17.06)	17.95 (13.25, 23.48)	10.6 (6.84, 15.48)	16.1 (11.91, 21.07)	16.08 (12.02, 20.86)	15.04 (10.65, 20.38)	17.26 (12.57, 22.83)	18.62 (13.32, 24.93)	16.81 (10.58, 24.76)	21.3 (16.03, 27.36)	6.78 (1.24, 12.24)	1.54 (1.08, 2.22)
OA	1999	14.6 (10.89, 18.99)	16.67 (12.47, 21.6)	16.24 (12.05, 21.18)	16.61 (12.51, 21.41)	17.11 (13.05, 21.82)	21.03 (16.17, 26.59)	23.32 (17.93, 29.43)	22.22 (16.97, 28.23)	24.56 (19.12, 30.68)	23.75 (18.51, 29.65)	11.51 (6.08, 17.1)	1.86 (1.38, 2.59)
Non-OA	1999	13.76 (10.06, 18.2)	14.08 (10.21, 18.74)	15.79 (11.76, 20.55)	16.39 (12.38, 21.08)	12.79 (9.25, 17.06)	14.83 (10.76, 19.71)	15.51 (11.22, 20.66)	19.23 (14.11, 25.25)	16.35 (11.59, 22.09)	18.26 (13.59, 23.72)	4.09 (-1.04, 9.26)	1.3 (0.94, 1.84)
OA	2000	15.48 (11.71, 19.89)	15.53 (11.38, 20.47)	19.53 (15.18, 24.5)	18.4 (14.35, 23.05)	17.22 (13.31, 21.73)	20.35 (15.35, 26.12)	25.1 (19.74, 31.1)	27.1 (21.27, 33.58)	26.96 (21, 33.6)	31.42 (25.83, 37.43)	16.55 (10.87, 22.17)	2.29 (1.71, 3.2)
Non-OA	2000	14.47 (10.79, 18.82)	14.89 (10.95, 19.59)	12.7 (9.19, 16.95)	12.2 (8.9, 16.19)	15.24 (11.53, 19.6)	23.28 (18.3, 28.88)	14.55 (10.11, 20.02)	22.22 (16.97, 28.23)	22.11 (16.55, 28.52)	25.11 (19.51, 31.4)	11.96 (6.62, 17.19)	2.08 (1.48, 3.04)

OA	2001	18.27 (14.21, 22.92)	17.37 (13.46, 21.86)	22.3 (17.62, 27.56)	22.74 (18.54, 27.39)	22.94 (18.58, 27.78)	25.09 (20.11, 30.6)	25.46 (20.38, 31.08)	27.19 (21.53, 33.46)	28.03 (22.43, 34.19)	29.72 (24.48, 35.38)	12.88 (7.64, 18.45)	1.75 (1.37, 2.27)
Non-OA	2001	16.43 (12.69, 20.75)	14.1 (10.39, 18.52)	17.67 (13.63, 22.32)	15.21 (11.64, 19.38)	17.71 (13.94, 22.01)	21.24 (16.79, 26.26)	20.16 (15.43, 25.58)	14.73 (10.36, 20.06)	19.47 (14.52, 25.24)	24.8 (19.57, 30.63)	6.96 (1.98, 12)	1.48 (1.11, 2)
OA	2002	18.33 (14.75, 22.37)	19.07 (15.28, 23.34)	20.41 (16.51, 24.78)	20.19 (16.5, 24.29)	25.29 (21.27, 29.65)	24.1 (19.59, 29.07)	22.41 (18.14, 27.16)	25.08 (20.5, 30.11)	25.54 (20.52, 31.09)	35.23 (29.81, 40.95)	12.92 (8.08, 17.8)	1.78 (1.43, 2.26)
Non-OA	2002	12.27 (9.36, 15.71)	18.67 (14.85, 22.99)	16.71 (13.26, 20.63)	15 (11.79, 18.68)	17.39 (13.86, 21.39)	16.01 (12.36, 20.24)	20.17 (16.08, 24.79)	17.97 (13.84, 22.74)	25.38 (20.21, 31.13)	27.36 (22.37, 32.82)	11.16 (6.57, 15.72)	1.89 (1.45, 2.55)
OA	2003	16.28 (13.42, 19.48)	22 (18.57, 25.73)	23.59 (19.92, 27.58)	21.84 (18.62, 25.34)	25.29 (21.6, 29.26)	25.55 (21.61, 29.8)	26.68 (22.63, 31.04)	26.16 (21.73, 30.97)	32.95 (28.02, 38.18)	36.29 (31.54, 41.26)	16.65 (12.24, 21.07)	2.01 (1.66, 2.46)
Non-OA	2003	14.07 (11.38, 17.12)	17.6 (14.57, 20.96)	14.6 (11.64, 17.97)	17.88 (14.84, 21.26)	20.11 (16.83, 23.72)	20.79 (17.16, 24.8)	22.17 (18.34, 26.38)	22.39 (18.36, 26.84)	23.33 (18.88, 28.28)	28.29 (23.68, 33.27)	12.72 (8.64, 16.73)	1.97 (1.57, 2.5)
OA	2004	17.48 (14.65, 20.62)	21.71 (18.58, 25.09)	21.9 (18.68, 25.39)	23.31 (20.19, 26.67)	24.71 (21.54, 28.1)	26.88 (23.16, 30.86)	28.51 (24.59, 32.7)	30.41 (26.16, 34.92)	38.02 (33.43, 42.77)	34.31 (29.72, 39.12)	18.64 (14.55, 22.7)	2.13 (1.79, 2.58)
Non-OA	2004	16.55 (13.86, 19.52)	15.37 (12.62, 18.46)	16.47 (13.72, 19.51)	15.46 (12.83, 18.41)	17.1 (14.22, 20.3)	19.16 (16.02, 22.63)	23.85 (20.17, 27.84)	25.68 (21.66, 30.03)	22.61 (18.48, 27.17)	28.02 (23.86, 32.47)	12.64 (8.88, 16.42)	1.98 (1.6, 2.47)
OA	2005	20.24 (17.42, 23.29)	20.81 (17.94, 23.92)	21.84 (18.87, 25.04)	22.7 (19.74, 25.87)	27.07 (23.87, 30.47)	28.21 (24.62, 32.02)	28.87 (25.21, 32.73)	31.78 (27.85, 35.91)	34.9 (30.76, 39.22)	37.65 (32.94, 42.55)	18.33 (14.42, 22.23)	2.06 (1.76, 2.45)
Non-OA	2005	17.56 (14.93, 20.43)	19.45 (16.75, 22.37)	16.98 (14.24, 20.01)	18.08 (15.31, 21.12)	17.98 (15.34, 20.87)	18.97 (15.85, 22.4)	20.07 (16.9, 23.54)	22.88 (19.34, 26.74)	27.16 (23.21, 31.4)	27.99 (23.74, 32.56)	9.14 (5.53, 12.78)	1.59 (1.32, 1.94)

OA	2006	19.45 (16.63, 22.52)	20.77 (17.97, 23.8)	24.79 (21.69, 28.1)	23.95 (20.95, 27.14)	26.22 (23.08, 29.54)	29.97 (26.51, 33.61)	29.89 (26.33, 33.63)	35.33 (31.39, 39.41)	34.73 (30.35, 39.32)	36.62 (32.19, 41.23)	18.96 (15.18, 22.74)	2.07 (1.77, 2.44)
Non-OA	2006	16.77 (14.21, 19.59)	18.47 (15.86, 21.32)	18.59 (15.84, 21.59)	20.73 (17.96, 23.73)	18.22 (15.61, 21.06)	22.13 (18.82, 25.72)	23.09 (19.74, 26.71)	22.8 (19.31, 26.6)	26.13 (22.19, 30.39)	25.99 (21.78, 30.56)	9.31 (5.85, 12.86)	1.58 (1.33, 1.91)
OA	2007	18.76 (16.21, 21.51)	20.82 (18.11, 23.74)	28.93 (25.89, 32.11)	23.76 (20.9, 26.81)	24.16 (21.33, 27.16)	23.93 (20.82, 27.26)	28.18 (24.87, 31.68)	31.26 (27.65, 35.05)	34.04 (30.14, 38.1)	38.1 (33.84, 42.49)	15.89 (12.3, 19.48)	1.86 (1.62, 2.18)
Non-OA	2007	15.74 (13.51, 18.18)	15.75 (13.43, 18.31)	21.05 (18.31, 24)	19.46 (16.81, 22.34)	18.72 (16.17, 21.49)	21.91 (18.9, 25.15)	21.06 (18.05, 24.32)	24.62 (21.19, 28.3)	24.06 (20.29, 28.15)	30.12 (26.19, 34.27)	11.98 (8.71, 15.3)	1.83 (1.54, 2.19)
OA	2008	19.22 (16.87, 21.74)	26.65 (23.93, 29.51)	24.52 (21.87, 27.32)	25.9 (23.13, 28.83)	26.23 (23.4, 29.22)	28.81 (25.74, 32.03)	27.42 (24.36, 30.64)	30.87 (27.41, 34.5)	34.05 (30.41, 37.84)	32.64 (28.97, 36.47)	12.49 (9.28, 15.86)	1.6 (1.41, 1.83)
Non-OA	2008	15.75 (13.64, 18.05)	17.14 (14.88, 19.58)	20.99 (18.52, 23.63)	20.02 (17.5, 22.73)	17.85 (15.51, 20.39)	23.47 (20.58, 26.56)	24.04 (21.03, 27.25)	27.11 (23.79, 30.63)	26.17 (22.69, 29.88)	32.21 (28.48, 36.13)	14.53 (11.39, 17.63)	2.02 (1.72, 2.38)
OA	2009	18.05 (15.64, 20.65)	23.62 (20.68, 26.76)	24.04 (21.26, 26.99)	26.67 (23.7, 29.8)	28.04 (24.98, 31.27)	25.08 (21.73, 28.67)	26.05 (22.81, 29.49)	35.1 (31.35, 38.98)	35.47 (31.4, 39.71)	39.33 (35.18, 43.6)	18.65 (14.98, 22.21)	2.05 (1.77, 2.38)
Non-OA	2009	16.84 (14.41, 19.5)	18.43 (15.91, 21.18)	17.43 (15.05, 20.02)	19.29 (16.69, 22.11)	22.26 (19.45, 25.28)	22.07 (18.91, 25.48)	25 (21.79, 28.43)	23.16 (19.75, 26.84)	28.31 (24.56, 32.3)	29.98 (26.02, 34.18)	13.19 (9.73, 16.55)	1.89 (1.59, 2.26)
OA	2010	17.11 (14.42, 20.06)	22.91 (19.69, 26.38)	23.5 (20.41, 26.82)	24.89 (21.62, 28.38)	24.51 (21.29, 27.96)	28.2 (24.44, 32.2)	29.13 (25.32, 33.16)	37 (32.5, 41.66)	32.85 (28.66, 37.25)	37.81 (33.05, 42.75)	19.65 (15.65, 23.66)	2.16 (1.83, 2.59)
Non-OA	2010	16.07 (13.52, 18.89)	17.95 (15.15, 21.01)	20.75 (17.89, 23.85)	18.65 (15.74, 21.86)	21.16 (18.13, 24.45)	20.83 (17.45, 24.55)	27.07 (23.16, 31.26)	27.69 (23.63, 32.05)	28.75 (24.4, 33.41)	27.27 (22.94, 31.94)	13.62 (9.88, 17.46)	1.91 (1.59, 2.34)

OA	2011	18.99 (15.95, 22.32)	20.75 (17.54, 24.25)	22.88 (19.6, 26.41)	26.94 (23.37, 30.75)	25.87 (22.24, 29.76)	29.57 (25.48, 33.93)	30.8 (26.56, 35.31)	33.97 (29.12, 39.08)	31.03 (26.4, 35.97)	44.18 (38.78, 49.68)	20.78 (16.49, 25.12)	2.24 (1.86, 2.73)
Non-OA	2011	16.46 (13.71, 19.53)	15.97 (13.11, 19.16)	22.83 (19.53, 26.4)	19.61 (16.43, 23.11)	20 (16.72, 23.61)	23.61 (19.82, 27.73)	28.25 (24.12, 32.68)	27.18 (22.76, 31.95)	32.24 (27.48, 37.29)	34.64 (29.32, 40.26)	18.13 (13.82, 22.4)	2.32 (1.88, 2.92)
OA	2012	17.74 (14.66, 21.17)	23.54 (19.88, 27.52)	26.1 (22.3, 30.17)	18.47 (14.97, 22.4)	25.47 (21.61, 29.64)	29.62 (25.16, 34.39)	28.32 (23.64, 33.39)	29.17 (24.18, 34.55)	30.63 (25.32, 36.35)	37.82 (32.06, 43.84)	15.84 (11.03, 20.73)	1.9 (1.55, 2.34)
Non-OA	2012	16.82 (13.76, 20.24)	17.98 (14.73, 21.61)	17.92 (14.59, 21.65)	21.53 (17.68, 25.79)	23.3 (19.44, 27.53)	24.21 (20.13, 28.66)	24.72 (20.35, 29.51)	26.34 (21.94, 31.13)	28.43 (23.38, 33.91)	31.15 (25.58, 37.17)	14.77 (10.23, 19.29)	1.99 (1.6, 2.54)
OA	2013	20.81 (17.23, 24.76)	18.25 (14.49, 22.52)	23.3 (19.3, 27.69)	26.72 (22.24, 31.59)	23.14 (19.04, 27.65)	26.05 (21.42, 31.1)	28.84 (23.93, 34.15)	33.01 (27.76, 38.58)	40.52 (34.14, 47.14)	36.75 (30.56, 43.28)	19.52 (14.22, 24.81)	2.17 (1.74, 2.79)
Non-OA	2013	19.49 (15.99, 23.37)	20.9 (17.12, 25.1)	24.64 (20.58, 29.06)	24.19 (19.93, 28.88)	25.46 (21.16, 30.15)	27.5 (22.68, 32.74)	27.09 (22.13, 32.51)	34.15 (28.65, 39.99)	27.97 (22.61, 33.84)	35.02 (28.69, 41.77)	14.51 (9.32, 19.68)	1.79 (1.44, 2.24)
OA	2014	17.17 (13.59, 21.25)	22.26 (17.93, 27.08)	22.9 (18.57, 27.7)	23.16 (18.87, 27.91)	22.57 (18.3, 27.32)	25 (20.2, 30.3)	24.9 (19.7, 30.7)	36.33 (30.3, 42.69)	37.78 (31.42, 44.46)	31.91 (25.32, 39.09)	18.01 (12.37, 23.59)	2.11 (1.66, 2.75)
Non-OA	2014	17.48 (13.84, 21.63)	20.75 (16.88, 25.06)	20.82 (16.77, 25.35)	19.75 (15.49, 24.58)	21.14 (16.98, 25.8)	25.09 (20.15, 30.56)	27.5 (22.35, 33.13)	29.79 (24.02, 36.08)	30.39 (23.78, 37.65)	33.33 (26.76, 40.42)	15.42 (10, 20.92)	1.98 (1.54, 2.62)
OA	2015	18.31 (14.71, 22.38)	21.77 (17.19, 26.93)	21.58 (16.89, 26.89)	25.09 (20.04, 30.69)	25.57 (20.8, 30.81)	27.1 (21.27, 33.58)	31.9 (25.66, 38.67)	32.47 (25.94, 39.55)	42.08 (34.83, 49.58)	36.42 (29.25, 44.06)	22.19 (16.06, 28.25)	2.43 (1.87, 3.27)
Non-OA	2015	17.72 (14.01, 21.96)	19.11 (14.77, 24.09)	22.33 (17.75, 27.47)	17.3 (13.12, 22.16)	25.45 (20.44, 30.98)	25.95 (20.75, 31.71)	27.36 (21.33, 34.08)	29.51 (23.01, 36.68)	31.71 (25.4, 38.55)	29.41 (22.33, 37.31)	15.54 (9.74, 21.45)	1.99 (1.52, 2.69)

OA	2016	15.34 (11.53, 19.81)	26.16 (20.68, 32.24)	23.53 (17.89, 29.96)	21.64 (15.72, 28.57)	26.37 (20.42, 33.03)	27.04 (20.31, 34.65)	26.67 (20.09, 34.1)	29.73 (22.5, 37.79)	37.93 (30.01, 46.36)	37.07 (28.29, 46.53)	19.69 (12.56, 26.78)	2.24 (1.65, 3.15)
Non-OA	2016	15.85 (12.07, 20.26)	18.62 (13.97, 24.05)	25.13 (19.21, 31.82)	24.69 (18.26, 32.07)	19.61 (14.39, 25.73)	26.12 (18.92, 34.41)	22.47 (16.57, 29.32)	32.87 (25.25, 41.21)	32.05 (24.81, 39.99)	35.4 (26.63, 44.95)	18.59 (11.6, 25.47)	2.3 (1.67, 3.36)
OA	2017	20.38 (16.07, 25.27)	23.31 (18.07, 29.23)	33.85 (27.24, 40.95)	24.84 (18.38, 32.26)	20.93 (15.11, 27.78)	23.73 (16.38, 32.44)	34.85 (26.77, 43.63)	37.3 (28.85, 46.36)	38.78 (29.1, 49.15)	38.75 (28.06, 50.3)	17.85 (10.19, 25.77)	1.95 (1.45, 2.76)
Non-OA	2017	17.11 (13.26, 21.55)	20.77 (16, 26.21)	21.14 (15.34, 27.95)	28.68 (21.25, 37.05)	17.44 (12.09, 23.95)	23.33 (16.1, 31.93)	31.5 (23.55, 40.33)	29 (20.36, 38.93)	27.68 (19.64, 36.93)	38.46 (28.45, 49.25)	16.75 (9.48, 24.17)	2.12 (1.5, 3.16)
OA	Age 35-44 years	10.13 (7.51, 13.28)	9.09 (6.57, 12.17)	11.35 (8.6, 14.62)	11.21 (8.51, 14.4)	13.33 (10.38, 16.76)	16.36 (13.03, 20.16)	15.01 (11.78, 18.73)	16.35 (12.92, 20.26)	21.91 (18.33, 25.82)	26.11 (22.45, 30.03)	17.33 (13.54, 21.12)	3.6 (2.61, 5.42)
Non-OA	Age 35-44 years	8.85 (6.55, 11.62)	10.13 (7.54, 13.24)	10.39 (7.88, 13.37)	11.67 (8.93, 14.88)	13.01 (10.16, 16.31)	16.12 (12.64, 20.11)	14.09 (11, 17.67)	17.13 (13.55, 21.2)	17.8 (14.29, 21.76)	21 (17.44, 24.91)	12.71 (9.07, 16.29)	2.7 (1.99, 3.86)
OA	Age 45-54 years	12.68 (11.37, 14.08)	17.54 (15.87, 19.32)	19.28 (17.54, 21.11)	19.54 (17.86, 21.31)	21.13 (19.37, 22.98)	21.18 (19.32, 23.13)	24.17 (22.21, 26.21)	26.51 (24.39, 28.72)	31.2 (28.94, 33.53)	30.94 (28.76, 33.18)	18.8 (16.78, 20.86)	2.51 (2.25, 2.82)
Non-OA	Age 45-54 years	12.43 (11.16, 13.79)	16.28 (14.75, 17.9)	16.14 (14.56, 17.83)	15.82 (14.3, 17.43)	17.64 (16.04, 19.33)	17.95 (16.21, 19.8)	20.88 (18.93, 22.92)	20.92 (18.92, 23.03)	25.55 (23.32, 27.88)	25.7 (23.53, 27.97)	13.02 (11.05, 14.97)	2.11 (1.87, 2.39)
OA	Age 55-64 years	17.88 (16.72, 19.08)	21.31 (19.99, 22.67)	23.86 (22.47, 25.29)	23.33 (22.01, 24.69)	24.48 (23.11, 25.89)	26.57 (25.02, 28.16)	28.35 (26.73, 30)	32.68 (30.85, 34.56)	35.59 (33.65, 37.58)	37.55 (35.6, 39.52)	19.15 (17.48, 20.85)	2.16 (2.02, 2.33)
Non-OA	Age 55-64 years	16.31 (15.22, 17.46)	17.91 (16.72, 19.16)	18.5 (17.25, 19.8)	19.11 (17.87, 20.39)	19.2 (17.96, 20.48)	22.56 (21.09, 24.1)	23.08 (21.55, 24.65)	26.36 (24.65, 28.13)	26.11 (24.27, 28.02)	30.79 (28.9, 32.72)	13.4 (11.83, 14.96)	1.93 (1.78, 2.1)

OA	Age 65-74 years	21.06 (19.63, 22.54)	25.39 (23.81, 27.02)	25.59 (24.02, 27.22)	26.36 (24.76, 28)	27.67 (26.06, 29.31)	28.6 (26.76, 30.48)	29.23 (27.33, 31.17)	34.64 (32.56, 36.76)	34.96 (32.69, 37.28)	35.89 (33.6, 38.24)	14.54 (12.54, 16.52)	1.7 (1.58, 1.83)
Non-OA	Age 65-74 years	17.31 (16, 18.68)	19.17 (17.75, 20.64)	20.12 (18.69, 21.62)	19.8 (18.34, 21.33)	20.06 (18.62, 21.56)	23.37 (21.67, 25.13)	25.17 (23.36, 27.06)	24.25 (22.35, 26.22)	26.95 (24.88, 29.11)	27.52 (25.46, 29.67)	10.7 (8.88, 12.53)	1.65 (1.51, 1.81)
OA	Age 75-84 years	19.07 (17.16, 21.09)	22.13 (20.08, 24.29)	24.63 (22.51, 26.85)	20.96 (18.98, 23.06)	22.43 (20.36, 24.6)	27.53 (25.07, 30.09)	27.81 (25.28, 30.44)	29.17 (26.44, 32.01)	28.71 (25.84, 31.71)	30.43 (27.4, 33.6)	11.39 (8.72, 13.97)	1.6 (1.43, 1.79)
Non-OA	Age 75-84 years	17.55 (15.71, 19.52)	16.98 (15.13, 18.96)	20.95 (18.97, 23.04)	18.35 (16.42, 20.4)	19.71 (17.72, 21.81)	19.08 (16.97, 21.32)	21.91 (19.67, 24.28)	25.69 (23.12, 28.39)	23.65 (20.97, 26.49)	24.16 (21.29, 27.22)	7.85 (5.39, 10.32)	1.48 (1.31, 1.68)
OA	Age 85+ years	14.2 (9.41, 20.25)	13.68 (9.14, 19.4)	18.18 (13.07, 24.27)	16.35 (10.97, 23.03)	15.22 (10.36, 21.24)	17.12 (11.4, 24.23)	18.18 (12.23, 25.49)	17.31 (10.59, 25.97)	21.43 (14.24, 30.19)	14.67 (7.56, 24.73)	4.44 (-2.28, 11.28)	1.31 (0.86, 2.03)
Non-OA	Age 85+ years	20.83 (14.96, 27.76)	20.56 (14.91, 27.2)	15.71 (10.86, 21.66)	12.71 (8.23, 18.45)	13.68 (9.14, 19.4)	13.38 (8.25, 20.1)	16.79 (10.83, 24.31)	18.25 (11.94, 26.12)	12.5 (6.41, 21.27)	24.18 (15.81, 34.28)	-2.5 (-9.78, 4.76)	0.86 (0.55, 1.33)
OA	Men	19 (17.78, 20.26)	22.05 (20.7, 23.45)	23.38 (21.98, 24.82)	23.5 (22.14, 24.91)	24.5 (23.1, 25.94)	25.58 (24.01, 27.2)	27.12 (25.47, 28.81)	31.17 (29.35, 33.03)	30.3 (28.41, 32.24)	33.58 (31.66, 35.53)	13.85 (12.15, 15.56)	1.76 (1.63, 1.89)
Non-OA	Men	22.72 (21.42, 24.05)	23.13 (21.78, 24.53)	25.17 (23.76, 26.62)	25.32 (23.92, 26.77)	26.95 (25.48, 28.45)	27.27 (25.67, 28.91)	29.58 (27.86, 31.33)	30.95 (29.13, 32.83)	32.65 (30.7, 34.64)	34.26 (32.32, 36.25)	12.13 (10.37, 13.91)	1.58 (1.48, 1.69)
OA	Women	16.72 (15.91, 17.56)	20.79 (19.85, 21.76)	22.77 (21.8, 23.76)	21.93 (21, 22.89)	23.46 (22.5, 24.45)	25.45 (24.36, 26.56)	26.66 (25.55, 27.8)	29.93 (28.69, 31.18)	33.36 (32.04, 34.7)	33.7 (32.39, 35.04)	16.99 (15.82, 18.15)	2.05 (1.95, 2.17)
Non-OA	Women	12.26 (11.56, 12.99)	14.74 (13.94, 15.56)	15.09 (14.28, 15.93)	14.51 (13.71, 15.34)	15.05 (14.25, 15.87)	17.82 (16.86, 18.8)	19.14 (18.14, 20.17)	20.7 (19.6, 21.83)	21.53 (20.34, 22.75)	23.93 (22.72, 25.17)	11.14 (10.13, 12.18)	1.99 (1.86, 2.13)

OA	East Midlands	17.22 (12.37, 23.04)	23.6 (19.65, 27.91)	27.3 (22.88, 32.07)	26.1 (22.38, 30.1)	25.61 (20.65, 31.09)	24.32 (19.55, 29.62)	23.49 (20.14, 27.1)	26.1 (21.79, 30.78)	31.12 (27.08, 35.39)	29.73 (23.8, 36.21)	7.25 (2.29, 12.1)	1.33 (1.09, 1.62)
Non-OA	East Midlands	16.29 (11.68, 21.83)	15.72 (12.44, 19.47)	18.14 (14.65, 22.06)	19.29 (15.84, 23.12)	23.08 (18.1, 28.68)	18.3 (14.13, 23.1)	22.54 (19.14, 26.23)	19.74 (15.85, 24.1)	22.39 (18.9, 26.19)	27.49 (21.58, 34.04)	8.63 (4.07, 13.14)	1.54 (1.23, 1.97)
OA	East of England	16.54 (14.92, 18.25)	20.71 (18.68, 22.86)	22.62 (20.22, 25.17)	22 (19.91, 24.21)	23.59 (21.19, 26.13)	25.57 (23.15, 28.11)	25.23 (22.67, 27.92)	27.4 (23.72, 31.33)	32.28 (27.61, 37.23)	30.04 (24.46, 36.1)	12.76 (10.01, 15.54)	1.79 (1.56, 2.05)
Non-OA	East of England	15.04 (13.5, 16.68)	17.17 (15.29, 19.19)	19.79 (17.52, 22.22)	16.83 (14.94, 18.84)	17.93 (15.83, 20.17)	22.74 (20.38, 25.24)	22.03 (19.55, 24.67)	23.01 (19.52, 26.79)	25.95 (21.69, 30.59)	25 (19.78, 30.82)	9.8 (7.18, 12.44)	1.7 (1.46, 1.97)
OA	London	17.25 (14.37, 20.44)	20.21 (17.56, 23.08)	24.63 (21.57, 27.89)	22.56 (20.02, 25.28)	26.16 (23.58, 28.86)	27.37 (24.52, 30.36)	30.69 (27.92, 33.57)	30.07 (27.27, 32.98)	36.48 (33.45, 39.58)	42.07 (36.82, 47.46)	19.96 (16.7, 23.28)	2.15 (1.88, 2.48)
Non-OA	London	17.38 (14.55, 20.52)	16.84 (14.41, 19.5)	18.72 (15.91, 21.8)	17.39 (15.13, 19.84)	19.11 (16.82, 21.56)	22.9 (20.24, 25.74)	18.19 (15.91, 20.65)	23.83 (21.23, 26.59)	25.85 (23.12, 28.72)	26.14 (21.47, 31.24)	9.62 (6.51, 12.71)	1.62 (1.39, 1.9)
OA	North East	11.07 (7.59, 15.43)	24 (18.57, 30.13)	15.86 (10.33, 22.84)	20.55 (15.4, 26.51)	23.29 (16.7, 30.99)	26.81 (21.68, 32.45)	29.28 (23.85, 35.18)	26.56 (22.12, 31.38)	31.56 (25.54, 38.06)	34.49 (31.09, 38.01)	22.97 (17.34, 28.61)	2.53 (1.98, 3.31)
Non-OA	North East	17.03 (12.79, 21.99)	18.3 (14.2, 23)	19.74 (13.73, 26.96)	15.98 (11.12, 21.91)	21.29 (15.13, 28.58)	25.82 (20.75, 31.42)	17.8 (13.14, 23.28)	19.35 (15.46, 23.74)	26.04 (19.99, 32.85)	26.94 (23.73, 30.34)	11.37 (6.09, 16.9)	1.71 (1.31, 2.24)
OA	North West	15.46 (13.44, 17.64)	22.53 (20.53, 24.62)	22.6 (20.76, 24.52)	24.06 (21.87, 26.36)	23.46 (21.41, 25.6)	24.9 (22.76, 27.15)	26.23 (24.05, 28.51)	30.78 (28.54, 33.09)	31.34 (29.24, 33.49)	33.82 (32, 35.67)	16.92 (14.61, 19.23)	1.95 (1.77, 2.15)
Non-OA	North West	16.61 (14.58, 18.8)	18.98 (17.18, 20.89)	19.8 (18.07, 21.62)	19.39 (17.4, 21.5)	21.01 (19.04, 23.09)	22.47 (20.4, 24.64)	25.79 (23.65, 28.02)	24.47 (22.36, 26.68)	24.9 (22.87, 27.01)	28.31 (26.58, 30.09)	12.01 (9.78, 14.21)	1.72 (1.55, 1.92)

OA	South Central	19.18 (17.78, 20.64)	22.5 (20.32, 24.79)	25.78 (23.13, 28.57)	21.29 (18.97, 23.75)	26.73 (24.12, 29.48)	27.83 (24.95, 30.84)	28.21 (25.19, 31.39)	30.96 (27.41, 34.68)	33 (28.43, 37.83)	41.84 (33.6, 50.44)	14.82 (11.87, 17.75)	1.88 (1.65, 2.15)
Non-OA	South Central	15.68 (14.41, 17.02)	16.77 (14.86, 18.83)	17.79 (15.48, 20.3)	20.62 (18.33, 23.06)	18.46 (16.21, 20.89)	16.23 (13.95, 18.72)	21.07 (18.27, 24.1)	21.8 (18.59, 25.29)	23.79 (19.65, 28.32)	27.5 (19.75, 36.4)	7.13 (4.54, 9.74)	1.49 (1.28, 1.74)
OA	South East Coast	16.82 (15.13, 18.63)	21.11 (19.32, 22.99)	23.27 (21.32, 25.32)	23.52 (21.43, 25.71)	23.25 (20.99, 25.63)	23.74 (21.02, 26.64)	27.35 (24.01, 30.9)	32.3 (29.09, 35.65)	33.86 (30.17, 37.7)	35.16 (28.25, 42.57)	14.8 (12.01, 17.5)	1.91 (1.69, 2.18)
Non-OA	South East Coast	13.91 (12.36, 15.57)	17.23 (15.63, 18.92)	17.84 (16.06, 19.73)	17.08 (15.23, 19.06)	20.06 (17.92, 22.34)	19.65 (17.13, 22.37)	23.91 (20.65, 27.4)	24.43 (21.53, 27.5)	26.44 (22.87, 30.27)	26.25 (19.62, 33.78)	11.26 (8.71, 13.81)	1.86 (1.6, 2.16)
OA	South West	18.7 (15.95, 21.7)	20.04 (17.75, 22.48)	21.95 (19.66, 24.38)	23.23 (20.73, 25.87)	21.99 (20.18, 23.89)	24.43 (22.08, 26.89)	25.76 (23.1, 28.55)	32.24 (29.32, 35.27)	32.17 (29.05, 35.41)	32.62 (29.15, 36.23)	14.51 (11.63, 17.43)	1.83 (1.61, 2.08)
Non-OA	South West	14.56 (12.09, 17.32)	18.56 (16.35, 20.94)	18.22 (16.16, 20.43)	20.62 (18.23, 23.16)	18.12 (16.45, 19.88)	19.02 (16.88, 21.31)	23.02 (20.46, 25.74)	25.74 (23.08, 28.54)	24.97 (21.96, 28.17)	28.16 (24.75, 31.77)	10.66 (7.89, 13.38)	1.7 (1.48, 1.96)
OA	West Midlands	18.47 (16.63, 20.41)	20.9 (18.63, 23.32)	22.2 (20.3, 24.2)	21.43 (19.37, 23.59)	24.02 (21.93, 26.2)	24.24 (21.8, 26.82)	26.41 (23.9, 29.03)	31.96 (29.06, 34.96)	30.36 (27.48, 33.35)	32.18 (29.85, 34.58)	15.15 (12.66, 17.76)	1.88 (1.69, 2.11)
Non-OA	West Midlands	16.63 (14.9, 18.47)	18.04 (15.99, 20.24)	17.4 (15.71, 19.19)	18.95 (16.96, 21.07)	17.08 (15.25, 19.05)	22.01 (19.63, 24.53)	23.24 (20.84, 25.77)	26.23 (23.44, 29.17)	26.95 (24.13, 29.92)	27.33 (25.07, 29.69)	12.78 (10.29, 15.16)	1.89 (1.66, 2.16)
OA	Yorkshire & The Humber	16.53 (12.89, 20.72)	15.16 (11.53, 19.4)	19.75 (16.26, 23.61)	19.93 (17.64, 22.38)	21.57 (18.44, 24.98)	27.82 (24.11, 31.77)	26.46 (22.69, 30.5)	26.68 (22.25, 31.49)	32.08 (27.35, 37.09)	32.59 (28.64, 36.73)	18.13 (13.98, 22.15)	2.24 (1.85, 2.77)
Non-OA	Yorkshire & The Humber	18.09 (14.38, 22.29)	13.91 (10.4, 18.06)	17.16 (14.08, 20.6)	13.69 (11.7, 15.89)	17.06 (14.38, 20.01)	20.65 (17.35, 24.27)	21.07 (17.52, 24.98)	25.35 (20.93, 30.18)	22.39 (17.98, 27.31)	23.61 (19.97, 27.57)	10.52 (6.78, 14.33)	1.79 (1.45, 2.27)

IMD, Indices of multiple deprivation; 95%CI, 95% confidence interval; CVRF, cardiovascular risk factors; OA, osteoarthritis

Appendix 3.2. Imputed measures of inequality in the prevalence of obesity, dyslipidaemia, and number of risk factors ≥1, ≥2 and ≥3 in people with and without osteoarthritis

Appendix 3.2.1. Imputed measures of inequality in the prevalence of obesity in OA and non-OA samples by subgroups, 1992-2017

OA status	Subgroup	Period prevalence by IMD decile (%) (95%CI)										Slope index of inequality (95%CI)(%)	Relative index of inequality (95%CI)
		1 (Least deprived)	2	3	4	5	6	7	8	9	10(Most deprived)		
OA	1992	16.67 (0.857, 32.48)	25.58 (12.13, 39.03)	29.73 (14.46, 45)	33.85 (22.11, 45.58)	24.39 (10.81, 37.97)	20 (6.231, 33.77)	27.08 (14.17, 40)	26.42 (14.25, 38.58)	45 (29.06, 60.94)	40.68 (27.87, 53.49)	16.5 (1.19, 32.02)	1.75 (1.04, 3.34)
Non-OA	1992	16.67 (0.857, 32.48)	11.11 (0.457, 21.77)	23.53 (11.59, 35.47)	19.05 (9.152, 28.94)	24.44 (11.52, 37.37)	20 (8.621, 31.38)	17.39 (6.122, 28.66)	15.22 (4.538, 25.9)	28.57 (7.882, 49.26)	28.57 (17.19, 39.96)	8.88 (-4.96, 22.34)	1.55 (0.8, 3.41)
OA	1993	23.2 (15.73, 30.67)	30.93 (21.61, 40.25)	24.22 (16.72, 31.71)	31.55 (24.85, 38.26)	27.78 (21.19, 34.37)	27.81 (21.01, 34.62)	27.66 (20.21, 35.11)	26.72 (18.58, 34.86)	27.78 (18.39, 37.16)	31.39 (23.55, 39.23)	2.98 (-5.54, 11.48)	1.11 (0.83, 1.5)

Non-OA	1993	17.39 (10.39, 24.39)	17.65 (10.73, 24.57)	18.11 (11.35, 24.87)	20.28 (14.84, 25.73)	21.02 (14.96, 27.09)	23.57 (16.48, 30.66)	23.13 (15.93, 30.34)	22.52 (14.66, 30.38)	23.71 (15.14, 32.29)	22.3 (15.32, 29.28)	6.95 (-0.61, 14.42)	1.4 (0.97, 2.05)
OA	1994	23.84 (17.03, 30.65)	31.34 (23.42, 39.27)	24.49 (17.48, 31.5)	28.18 (22.2, 34.16)	32.2 (25.27, 39.14)	24.35 (18.26, 30.45)	32.17 (24.44, 39.89)	22.41 (14.74, 30.08)	30.95 (22.8, 39.1)	27.37 (20.8, 33.95)	1.49 (-5.91, 9.18)	1.06 (0.8, 1.4)
Non-OA	1994	16.47 (10.85, 22.09)	15.71 (9.632, 21.8)	15 (9.424, 20.58)	14.67 (10.02, 19.31)	18.56 (12.62, 24.5)	30.82 (23.58, 38.05)	23.66 (16.32, 31.01)	33.05 (24.47, 41.63)	27.74 (20.17, 35.3)	20.33 (14.44, 26.22)	14.39 (7.48, 21.13)	2.05 (1.44, 3.09)
OA	1995	19.16 (13.15, 25.18)	23.26 (15.89, 30.62)	26.97 (19.86, 34.09)	24.22 (18.56, 29.87)	25.49 (19.47, 31.51)	29.08 (22.68, 35.48)	26.92 (19.91, 33.94)	35.66 (27.31, 44)	31.91 (24.15, 39.68)	29.44 (23.04, 35.85)	11.87 (4.66, 19.1)	1.56 (1.18, 2.12)
Non-OA	1995	14.46 (9.068, 19.85)	17.12 (10.96, 23.29)	28.65 (21.83, 35.48)	20.1 (14.5, 25.7)	25 (19.02, 30.98)	20.57 (14.54, 26.6)	22.29 (15.91, 28.67)	29.45 (22, 36.91)	34.15 (25.68, 42.61)	22.73 (16.85, 28.6)	10.16 (3.26, 17.05)	1.56 (1.15, 2.15)
OA	1996	23.11 (17.73, 28.49)	26 (19.88, 32.12)	25.63 (18.81, 32.44)	27.56 (22.04, 33.08)	30.84 (24.8, 36.88)	33.48 (27.23, 39.74)	36.45 (29.79, 43.11)	34.86 (27.75, 41.97)	32.58 (25.65, 39.52)	30.04 (24.13, 35.96)	11.17 (4.4, 17.97)	1.46 (1.15, 1.86)
Non-OA	1996	17.62 (12.82, 22.43)	26.29 (20.05, 32.52)	20.34 (14.37, 26.31)	20.39 (15.42, 25.36)	20.76 (15.56, 25.96)	23.68 (18.14, 29.23)	24.88 (18.86, 30.89)	28.49 (21.69, 35.28)	24.34 (17.46, 31.22)	21.3 (15.98, 26.62)	4.84 (-1.32, 11.26)	1.24 (0.94, 1.66)
OA	1997	19.75 (15.36, 24.13)	28.69 (23.06, 34.31)	30.26 (24.27, 36.26)	25.09 (20.02, 30.16)	29.87 (24.65, 35.08)	28.1 (22.41, 33.79)	34.3 (28.29, 40.31)	38.07 (30.84, 45.29)	30.63 (23.43, 37.82)	39.31 (33.27, 45.34)	16.63 (10.33, 22.83)	1.77 (1.42, 2.24)
Non-OA	1997	17.52 (13.3, 21.74)	23.53 (18.3, 28.76)	23.61 (18.12, 29.09)	24.57 (19.62, 29.52)	25.94 (21.12, 30.76)	28.35 (22.78, 33.92)	28.5 (22.42, 34.59)	27.38 (20.59, 34.17)	32.5 (25.19, 39.81)	27.16 (21.54, 32.78)	11.42 (5.42, 17.23)	1.58 (1.24, 2.04)
OA	1998	22.09 (17.63, 26.55)	28.14 (22.68, 33.6)	28.83 (23.51, 34.14)	31.1 (26.2, 36.01)	28.02 (23.17, 32.86)	32.53 (27.14, 37.93)	32.26 (26, 38.51)	37.33 (30.98, 43.69)	37.56 (30.89, 44.23)	37.04 (31.25, 42.82)	15.09 (9.08, 21)	1.65 (1.34, 2.05)

Non-OA	1998	18.98 (14.88, 23.09)	23.24 (18.31, 28.17)	18.22 (13.48, 22.95)	31.31 (26.28, 36.34)	22.32 (17.91, 26.73)	22.78 (17.85, 27.7)	30.66 (25.17, 36.14)	25.76 (20.07, 31.46)	25.16 (18.36, 31.95)	30.71 (25.01, 36.41)	9.75 (4.25, 15.32)	1.49 (1.19, 1.89)
OA	1999	28.93 (24.21, 33.66)	27.93 (23.09, 32.76)	26.98 (22.06, 31.91)	28.7 (23.91, 33.49)	29.18 (24.57, 33.78)	37.46 (32.02, 42.9)	34.8 (29.12, 40.47)	35.69 (29.78, 41.59)	41.79 (35.86, 47.72)	35.74 (30.21, 41.27)	13.51 (7.73, 19.2)	1.53 (1.28, 1.85)
Non-OA	1999	21.66 (17.25, 26.08)	19.08 (14.79, 23.36)	21.58 (17.12, 26.04)	25.49 (20.95, 30.03)	21.49 (17.33, 25.64)	24.68 (19.91, 29.46)	26.19 (21.14, 31.24)	29.63 (23.86, 35.4)	30.8 (25.05, 36.55)	28.08 (22.91, 33.26)	10.62 (5.3, 16.08)	1.55 (1.24, 1.98)
OA	2000	28.22 (23.59, 32.85)	26.54 (21.59, 31.48)	33.81 (28.85, 38.77)	31.3 (26.6, 36)	29.59 (25.06, 34.12)	34.8 (29.12, 40.47)	36.52 (30.88, 42.17)	34.53 (28.73, 40.32)	42.06 (35.69, 48.43)	40.51 (35.04, 45.99)	13.97 (8.15, 19.71)	1.53 (1.28, 1.84)
Non-OA	2000	22.29 (17.91, 26.66)	29.34 (24.44, 34.24)	23.08 (18.73, 27.42)	22.84 (18.68, 27)	22.65 (18.5, 26.8)	28.43 (23.29, 33.56)	27.42 (21.84, 33)	30.8 (25.19, 36.4)	32.92 (26.98, 38.86)	33.21 (27.54, 38.87)	10.04 (4.55, 15.56)	1.46 (1.19, 1.81)
OA	2001	24.66 (20.22, 29.09)	28.91 (24.36, 33.45)	34.31 (29.25, 39.37)	34.05 (29.49, 38.61)	32.04 (27.52, 36.56)	34.48 (29.25, 39.72)	41.96 (36.5, 47.41)	35.97 (30.3, 41.64)	40.94 (35.12, 46.77)	39.07 (33.89, 44.25)	15.08 (9.58, 20.39)	1.56 (1.33, 1.86)
Non-OA	2001	23.7 (19.43, 27.96)	21.47 (17.18, 25.76)	24.8 (20.36, 29.23)	28.02 (23.68, 32.36)	26.56 (22.39, 30.73)	31.3 (26.5, 36.1)	26.3 (21.36, 31.24)	32.82 (27.07, 38.56)	36 (30.3, 41.7)	36.7 (31.2, 42.2)	14.72 (9.46, 19.94)	1.7 (1.4, 2.08)
OA	2002	25.32 (21.38, 29.26)	28.67 (24.48, 32.86)	30 (25.75, 34.25)	28.32 (24.38, 32.26)	36.51 (32.29, 40.72)	34.63 (29.87, 39.38)	35.44 (30.8, 40.07)	36.01 (31.21, 40.81)	37.74 (32.39, 43.08)	41.45 (36.23, 46.67)	15.44 (10.51, 20.46)	1.61 (1.38, 1.9)
Non-OA	2002	23.92 (20.11, 27.72)	26.01 (21.93, 30.09)	29.33 (25.29, 33.36)	26.39 (22.53, 30.25)	29.63 (25.56, 33.7)	30.08 (25.56, 34.59)	31.93 (27.37, 36.49)	30.73 (25.93, 35.52)	39.93 (34.4, 45.47)	33.33 (28.38, 38.28)	11.75 (6.94, 16.49)	1.5 (1.26, 1.78)
OA	2003	26.25 (22.94, 29.57)	30.6 (27.01, 34.19)	31.54 (27.74, 35.34)	33.99 (30.5, 37.48)	34.48 (30.7, 38.27)	33.59 (29.53, 37.64)	38.86 (34.6, 43.11)	37.12 (32.51, 41.72)	41.58 (36.76, 46.4)	45.84 (41.32, 50.36)	17.38 (13.07, 21.75)	1.67 (1.46, 1.91)

Non-OA	2003	26.25 (22.94, 29.57)	27.9 (24.48, 31.32)	26.44 (22.87, 30.01)	27.65 (24.28, 31.01)	30.06 (26.51, 33.62)	32.76 (28.72, 36.79)	31.92 (27.8, 36.04)	35.6 (31.12, 40.08)	31.82 (27.22, 36.42)	39.91 (35.27, 44.54)	12.17 (7.96, 16.4)	1.5 (1.3, 1.74)
OA	2004	28.25 (24.97, 31.54)	30.82 (27.47, 34.18)	30.89 (27.48, 34.3)	33.25 (29.92, 36.57)	34.41 (31.04, 37.79)	38.17 (34.33, 42.01)	41.31 (37.3, 45.32)	42.3 (38.01, 46.59)	49.19 (44.78, 53.6)	47.6 (43.12, 52.08)	22.14 (18.07, 26.21)	1.87 (1.66, 2.12)
Non-OA	2004	27.26 (24.1, 30.43)	26.02 (22.79, 29.25)	28.02 (24.81, 31.23)	27.02 (23.9, 30.14)	27.89 (24.54, 31.24)	33.02 (29.39, 36.66)	34.39 (30.48, 38.29)	35.59 (31.39, 39.78)	33.63 (29.22, 38.05)	37.02 (32.88, 41.17)	12 (8.08, 16.01)	1.49 (1.31, 1.71)
OA	2005	32.49 (29.37, 35.61)	32.3 (29.13, 35.47)	33.13 (29.87, 36.39)	34.07 (30.9, 37.24)	36.89 (33.61, 40.16)	39.91 (36.24, 43.59)	42.47 (38.73, 46.22)	43.21 (39.27, 47.16)	46.1 (41.98, 50.22)	47.72 (43.25, 52.19)	17.77 (13.72, 21.66)	1.61 (1.45, 1.8)
Non-OA	2005	25.93 (23.04, 28.83)	27.5 (24.56, 30.43)	29.78 (26.57, 33)	29.79 (26.68, 32.91)	32.09 (29, 35.17)	31.76 (28.2, 35.33)	33.69 (30.08, 37.29)	35 (31.18, 38.82)	44.51 (40.29, 48.72)	36.51 (32.25, 40.77)	14.49 (10.81, 18.27)	1.59 (1.41, 1.8)
OA	2006	29 (25.92, 32.07)	32.76 (29.63, 35.89)	37.57 (34.33, 40.82)	36.61 (33.39, 39.82)	39.45 (36.14, 42.76)	41.41 (37.85, 44.96)	40.79 (37.17, 44.41)	47.51 (43.64, 51.38)	44.25 (39.94, 48.56)	47.83 (43.46, 52.19)	18.67 (14.9, 22.4)	1.63 (1.47, 1.82)
Non-OA	2006	25.9 (22.97, 28.82)	28.26 (25.36, 31.17)	29.57 (26.46, 32.67)	30.84 (27.83, 33.84)	31.66 (28.68, 34.64)	30.27 (26.77, 33.77)	34.28 (30.68, 37.89)	34.11 (30.31, 37.91)	36.91 (32.8, 41.03)	36.26 (31.78, 40.75)	10.65 (7.02, 14.3)	1.41 (1.25, 1.59)
OA	2007	28.09 (25.27, 30.91)	33.58 (30.56, 36.6)	38.59 (35.46, 41.71)	38.38 (35.31, 41.46)	36.03 (33.03, 39.02)	39.08 (35.66, 42.5)	41.8 (38.35, 45.26)	45.14 (41.45, 48.84)	48.28 (44.39, 52.16)	47.77 (43.63, 51.91)	18.93 (15.24, 22.62)	1.65 (1.5, 1.82)
Non-OA	2007	25.32 (22.74, 27.91)	26.08 (23.35, 28.81)	29.76 (26.83, 32.7)	30.79 (27.81, 33.76)	31.21 (28.3, 34.13)	32.66 (29.4, 35.93)	34.34 (30.96, 37.72)	35.6 (31.98, 39.21)	39.23 (35.14, 43.33)	41.51 (37.46, 45.56)	15.88 (12.42, 19.33)	1.67 (1.49, 1.88)
OA	2008	29.61 (26.99, 32.22)	35.83 (33.02, 38.64)	35.73 (32.93, 38.54)	35.73 (32.87, 38.58)	37.95 (35.01, 40.9)	42.9 (39.71, 46.1)	42.43 (39.21, 45.66)	45.38 (41.81, 48.95)	47.29 (43.63, 50.94)	45.13 (41.46, 48.8)	17.72 (14.4, 21.16)	1.59 (1.45, 1.74)

Non-OA	2008	23.6 (21.2, 25.99)	25.97 (23.44, 28.51)	32.92 (30.19, 35.66)	29.97 (27.23, 32.72)	29.77 (27.09, 32.45)	31.12 (28.09, 34.14)	35.86 (32.65, 39.08)	39.04 (35.55, 42.53)	37.61 (33.98, 41.24)	42.03 (38.26, 45.81)	17.09 (13.89, 20.33)	1.74 (1.56, 1.94)
OA	2009	28.91 (26.16, 31.66)	33.97 (30.86, 37.08)	33.7 (30.76, 36.65)	38 (34.9, 41.11)	39.1 (35.96, 42.24)	40.31 (36.69, 43.93)	41.68 (38.17, 45.18)	47.62 (43.84, 51.4)	49.91 (45.86, 53.97)	51.24 (47.25, 55.23)	23.08 (19.45, 26.67)	1.83 (1.66, 2.03)
Non-OA	2009	26.73 (23.96, 29.5)	29.39 (26.53, 32.26)	29.17 (26.42, 31.91)	32.64 (29.66, 35.61)	33.45 (30.35, 36.54)	36.18 (32.68, 39.67)	35.79 (32.35, 39.24)	36.52 (32.75, 40.3)	36.11 (32.3, 39.92)	40.5 (36.43, 44.56)	13.26 (9.74, 16.8)	1.51 (1.35, 1.69)
OA	2010	28.92 (25.8, 32.05)	33.01 (29.55, 36.46)	34.91 (31.61, 38.22)	34.24 (30.8, 37.68)	35.09 (31.65, 38.54)	42.52 (38.51, 46.52)	42.11 (38.17, 46.04)	45.16 (40.77, 49.55)	45.96 (41.67, 50.26)	51.6 (46.9, 56.29)	21.53 (17.44, 25.62)	1.79 (1.6, 2.01)
Non-OA	2010	25.39 (22.43, 28.35)	27.19 (24.03, 30.35)	31.29 (28.13, 34.44)	31.23 (27.87, 34.6)	28.29 (25.08, 31.5)	34.63 (30.79, 38.47)	37.61 (33.57, 41.66)	39.44 (35.13, 43.74)	40.31 (35.78, 44.83)	40.7 (36.04, 45.35)	16.94 (13.03, 20.94)	1.71 (1.5, 1.95)
OA	2011	30.27 (26.79, 33.74)	33.59 (29.95, 37.23)	36.96 (33.3, 40.62)	35.6 (31.9, 39.3)	36.32 (32.47, 40.16)	42.83 (38.55, 47.11)	41.92 (37.59, 46.25)	42.75 (37.89, 47.61)	42.55 (37.78, 47.31)	50.54 (45.44, 55.64)	17.25 (12.72, 21.79)	1.58 (1.4, 1.79)
Non-OA	2011	27.43 (24.19, 30.68)	27.38 (23.98, 30.79)	33.79 (30.17, 37.41)	32.18 (28.55, 35.82)	31.9 (28.18, 35.62)	35.91 (31.71, 40.11)	40.32 (36.01, 44.63)	40.78 (36.02, 45.54)	41.04 (36.22, 45.87)	43.24 (37.95, 48.52)	17.55 (13.24, 21.91)	1.69 (1.48, 1.95)
OA	2012	28.27 (24.72, 31.83)	35.74 (31.74, 39.74)	33.76 (29.79, 37.73)	31.66 (27.57, 35.75)	34.42 (30.34, 38.5)	41.82 (37.14, 46.51)	41.02 (36.01, 46.03)	40.06 (34.85, 45.27)	47.92 (42.37, 53.48)	48.83 (43.14, 54.52)	18.89 (13.92, 23.75)	1.69 (1.47, 1.95)
Non-OA	2012	26.61 (23.04, 30.18)	28.29 (24.56, 32.02)	28.54 (24.69, 32.4)	30.67 (26.46, 34.88)	31.97 (27.82, 36.12)	38.86 (34.3, 43.43)	37.5 (32.64, 42.36)	35.77 (31.12, 40.41)	41 (35.75, 46.26)	42.81 (37.11, 48.51)	17.43 (12.67, 22.11)	1.71 (1.48, 2.01)
OA	2013	27.85 (24.04, 31.66)	31.59 (27.14, 36.05)	35 (30.63, 39.37)	37.97 (33.21, 42.72)	35.43 (30.89, 39.97)	41.16 (36.19, 46.13)	38.48 (33.41, 43.55)	43.77 (38.39, 49.15)	48.37 (42.1, 54.65)	49.81 (43.66, 55.95)	21.14 (15.82, 26.53)	1.78 (1.54, 2.09)

Non-OA	2013	27.08 (23.28, 30.88)	31.59 (27.33, 35.85)	32.11 (27.85, 36.37)	33.57 (29.03, 38.12)	37.56 (32.95, 42.17)	36.11 (31.13, 41.09)	38.51 (33.28, 43.74)	43.73 (38.2, 49.26)	40 (34.18, 45.82)	45 (38.67, 51.33)	17.5 (12.17, 22.91)	1.66 (1.42, 1.94)
OA	2014	27.58 (23.42, 31.74)	29.65 (24.99, 34.31)	32.71 (27.93, 37.48)	37.69 (32.87, 42.52)	32.9 (28.18, 37.62)	35.47 (30.27, 40.68)	37.68 (32.02, 43.34)	49.25 (43.21, 55.28)	50.2 (43.96, 56.44)	42.08 (35.23, 48.93)	21.06 (15.36, 26.79)	1.82 (1.54, 2.18)
Non-OA	2014	25.28 (21.24, 29.32)	32.09 (27.67, 36.52)	29.21 (24.76, 33.66)	31.64 (26.78, 36.5)	38.1 (33.18, 43.01)	40.72 (35.2, 46.23)	38.76 (33.29, 44.23)	40 (33.96, 46.04)	42.36 (35.53, 49.2)	47.57 (40.71, 54.43)	20.68 (15.3, 26.23)	1.84 (1.55, 2.2)
OA	2015	26.1 (22.05, 30.14)	35.85 (30.56, 41.14)	35.86 (30.44, 41.27)	34.9 (29.47, 40.33)	38.3 (33.13, 43.47)	42.06 (35.69, 48.43)	43.46 (37.12, 49.8)	39.72 (33.13, 46.31)	50.26 (43.16, 57.36)	53.4 (46.28, 60.52)	24.09 (17.76, 30.28)	1.92 (1.61, 2.32)
Non-OA	2015	27.78 (23.45, 32.11)	34.05 (28.89, 39.21)	36.97 (31.74, 42.2)	28.94 (23.88, 34)	35.37 (30.04, 40.7)	34.17 (28.57, 39.77)	38.53 (32.22, 44.84)	44.67 (37.68, 51.66)	43.18 (36.6, 49.76)	45.24 (37.66, 52.82)	16.05 (9.8, 22.27)	1.58 (1.32, 1.91)
OA	2016	29.57 (24.73, 34.4)	35.82 (30.05, 41.59)	32.33 (26.28, 38.38)	35.2 (28.15, 42.24)	38.12 (31.71, 44.53)	39.77 (32.38, 47.15)	40.68 (33.39, 47.97)	44.03 (36.25, 51.8)	49.33 (41.27, 57.4)	52.03 (43.11, 60.95)	21.22 (14.03, 28.51)	1.78 (1.45, 2.22)
Non-OA	2016	25.42 (20.89, 29.94)	25.84 (20.57, 31.12)	37.04 (30.56, 43.51)	33.33 (26.4, 40.27)	32.19 (26.16, 38.22)	39.31 (31.29, 47.33)	38.86 (31.94, 45.78)	48.68 (40.67, 56.7)	45.45 (37.8, 53.11)	49.15 (40.04, 58.27)	26.26 (19.12, 33.44)	2.19 (1.75, 2.8)
OA	2017	29 (24.1, 33.91)	31.62 (25.86, 37.38)	38.65 (31.97, 45.32)	38.15 (30.86, 45.44)	36.32 (29.63, 43.01)	50 (41.18, 58.82)	47.18 (38.9, 55.47)	47.52 (39.2, 55.83)	45.87 (36.41, 55.33)	54.02 (43.4, 64.65)	25.39 (17.65, 33.43)	1.97 (1.58, 2.49)
Non-OA	2017	27.17 (22.54, 31.8)	32.49 (26.95, 38.03)	35.98 (29.09, 42.87)	40.27 (32.33, 48.21)	33.51 (26.77, 40.25)	34.35 (26.14, 42.56)	40.41 (32.38, 48.44)	41.82 (32.49, 51.14)	40.32 (31.6, 49.04)	47.92 (37.79, 58.04)	17.54 (9.74, 25.32)	1.66 (1.33, 2.12)
OA	Age 35-44 years	29.62 (25.82, 33.42)	32.83 (28.82, 36.84)	35.5 (31.45, 39.55)	39.79 (35.79, 43.79)	39.55 (35.54, 43.56)	41.45 (37.33, 45.58)	45.5 (41.31, 49.69)	42.6 (38.26, 46.94)	51.58 (47.47, 55.7)	49.16 (45.33, 52.99)	22.13 (17.72, 26.54)	1.74 (1.55, 1.96)

Non-OA	Age 35-44 years	22.26 (19, 25.51)	22.22 (18.79, 25.65)	24.63 (21.19, 28.07)	24.29 (20.84, 27.73)	27.87 (24.3, 31.43)	26.83 (22.9, 30.75)	29.26 (25.41, 33.11)	32.43 (28.22, 36.63)	32.75 (28.68, 36.82)	34.45 (30.53, 38.38)	14.28 (10.09, 18.29)	1.7 (1.45, 2.01)
OA	Age 45-54 years	32.54 (30.78, 34.3)	36.67 (34.67, 38.67)	40.59 (38.55, 42.63)	37.74 (35.81, 39.67)	40.68 (38.68, 42.67)	43.84 (41.71, 45.96)	43.52 (41.39, 45.65)	46.39 (44.12, 48.66)	51.37 (49.08, 53.67)	50.38 (48.18, 52.58)	18.99 (16.75, 21.26)	1.59 (1.5, 1.68)
Non-OA	Age 45-54 years	23.71 (22.14, 25.28)	28.16 (26.4, 29.93)	29.18 (27.33, 31.02)	29.82 (28.02, 31.62)	30.56 (28.73, 32.38)	31.78 (29.78, 33.78)	33.14 (31.04, 35.25)	34.14 (31.93, 36.36)	37.16 (34.84, 39.48)	36.15 (33.92, 38.39)	12.9 (10.77, 15.02)	1.53 (1.43, 1.65)
OA	Age 55-64 years	29.11 (27.8, 30.42)	33.64 (32.19, 35.09)	37.32 (35.81, 38.82)	37.71 (36.27, 39.15)	38.31 (36.84, 39.77)	41.03 (39.39, 42.68)	43.95 (42.26, 45.65)	45.43 (43.58, 47.28)	47.42 (45.49, 49.36)	48.4 (46.49, 50.31)	19.86 (18.14, 21.58)	1.68 (1.6, 1.76)
Non-OA	Age 55-64 years	26.23 (24.97, 27.49)	29.03 (27.67, 30.38)	30.91 (29.49, 32.34)	31.18 (29.8, 32.57)	31.98 (30.58, 33.38)	34.02 (32.42, 35.62)	36.86 (35.19, 38.53)	39.23 (37.41, 41.05)	39.74 (37.79, 41.68)	41.83 (39.9, 43.75)	15.89 (14.21, 17.58)	1.63 (1.55, 1.73)
OA	Age 65-74 years	27.1 (25.62, 28.58)	33.46 (31.83, 35.09)	32.29 (30.68, 33.91)	33.7 (32.07, 35.33)	34.25 (32.63, 35.86)	36.83 (34.97, 38.69)	38.49 (36.56, 40.42)	42.44 (40.39, 44.49)	42.33 (40.11, 44.54)	41.69 (39.47, 43.91)	15.42 (13.45, 17.36)	1.56 (1.47, 1.65)
Non-OA	Age 65-74 years	25.54 (24.08, 26.99)	27.2 (25.66, 28.73)	30.18 (28.61, 31.76)	30.12 (28.51, 31.72)	32.03 (30.42, 33.64)	34.21 (32.39, 36.02)	36.09 (34.18, 38)	37.61 (35.57, 39.65)	40.01 (37.84, 42.18)	38.65 (36.51, 40.78)	15.71 (13.79, 17.63)	1.64 (1.54, 1.75)
OA	Age 75-84 years	21.03 (19.18, 22.89)	23.41 (21.47, 25.35)	23.77 (21.85, 25.69)	23.34 (21.44, 25.23)	23.83 (21.9, 25.76)	28.52 (26.23, 30.82)	28.56 (26.24, 30.88)	29.67 (27.17, 32.17)	30.51 (27.83, 33.19)	31.46 (28.72, 34.2)	11.12 (8.73, 13.52)	1.55 (1.41, 1.71)
Non-OA	Age 75-84 years	23.48 (21.54, 25.42)	22.54 (20.62, 24.45)	25.72 (23.74, 27.69)	24.7 (22.73, 26.67)	22.58 (20.67, 24.48)	28.6 (26.35, 30.85)	28.46 (26.18, 30.73)	30.57 (28.07, 33.08)	30.78 (28.12, 33.43)	28.53 (25.83, 31.23)	8.44 (6.02, 10.82)	1.39 (1.26, 1.52)
OA	Age 85+ years	11.07 (7.183, 14.95)	12.59 (8.617, 16.57)	9.689 (6.264, 13.11)	10.42 (6.685, 14.16)	14.29 (10.12, 18.46)	19.27 (14, 24.53)	15.49 (10.61, 20.38)	16.56 (10.81, 22.32)	17.2 (11.25, 23.15)	13.36 (7.391, 19.32)	7.28 (2.18, 12.27)	1.73 (1.18, 2.65)

Non-OA	Age 85+ years	15.77 (11.14, 20.39)	20.38 (15.46, 25.3)	19.86 (15.14, 24.57)	14.59 (10.45, 18.74)	15.73 (11.5, 19.97)	18.1 (12.86, 23.33)	16.16 (11, 21.32)	19.07 (13.51, 24.64)	22.66 (15.33, 29.98)	20.13 (13.64, 26.63)	1.93 (-3.72, 7.59)	1.11 (0.81, 1.53)
OA	Men	28.4 (27.1, 29.7)	31.96 (30.55, 33.37)	33.02 (31.59, 34.44)	33.32 (31.92, 34.72)	34.71 (33.29, 36.12)	37.39 (35.79, 38.99)	37.8 (36.16, 39.45)	40.76 (38.99, 42.52)	42.32 (40.45, 44.2)	42.21 (40.38, 44.04)	14.84 (13.14, 16.51)	1.53 (1.46, 1.61)
Non-OA	Men	25.05 (23.8, 26.3)	25.25 (23.96, 26.53)	28.08 (26.73, 29.43)	27.18 (25.86, 28.51)	28.18 (26.82, 29.54)	28.76 (27.27, 30.25)	31.52 (29.94, 33.11)	31.09 (29.41, 32.78)	32.83 (31.07, 34.6)	31.55 (29.82, 33.28)	8.36 (6.8, 9.95)	1.34 (1.27, 1.42)
OA	Women	27.57 (26.63, 28.5)	32.18 (31.15, 33.21)	34.13 (33.09, 35.17)	34.48 (33.47, 35.5)	35.24 (34.22, 36.27)	38.8 (37.65, 39.96)	40.75 (39.58, 41.93)	42.45 (41.18, 43.72)	45.51 (44.19, 46.83)	45.86 (44.56, 47.17)	19.07 (17.86, 20.28)	1.7 (1.64, 1.76)
Non-OA	Women	24.67 (23.78, 25.56)	27.88 (26.92, 28.85)	29.57 (28.58, 30.56)	29.97 (28.98, 30.95)	30.58 (29.6, 31.56)	33.9 (32.77, 35.02)	34.97 (33.81, 36.13)	37.94 (36.69, 39.19)	39.52 (38.18, 40.85)	40 (38.68, 41.32)	16.33 (15.13, 17.5)	1.69 (1.62, 1.75)
OA	East Midlands	27.95 (22.41, 33.5)	35.2 (31, 39.4)	33.64 (29.18, 38.1)	37.37 (33.45, 41.3)	37.15 (31.86, 42.44)	40.24 (34.95, 45.53)	39.09 (35.36, 42.82)	34.55 (30.22, 38.88)	44.8 (40.58, 49.01)	43.97 (37.87, 50.07)	11.55 (6.45, 16.47)	1.36 (1.19, 1.57)
Non-OA	East Midlands	23.6 (18.31, 28.89)	27.69 (23.77, 31.61)	27.51 (23.58, 31.44)	29.03 (25.28, 32.78)	32.44 (27.11, 37.77)	31.76 (26.8, 36.73)	33.33 (29.61, 37.06)	37.25 (32.73, 41.76)	37.21 (33.31, 41.1)	38.84 (32.67, 45.01)	14.86 (10.05, 19.65)	1.61 (1.37, 1.89)
OA	East of England	24.12 (22.34, 25.9)	31.36 (29.16, 33.56)	32.97 (30.41, 35.54)	32.87 (30.64, 35.09)	32.75 (30.33, 35.17)	37.96 (35.46, 40.46)	35.9 (33.29, 38.51)	36.86 (33.21, 40.51)	43.02 (38.37, 47.68)	42.27 (36.81, 47.73)	15.73 (12.84, 18.56)	1.63 (1.49, 1.79)
Non-OA	East of England	23.11 (21.36, 24.87)	25.87 (23.79, 27.95)	28.6 (26.18, 31.03)	28.63 (26.49, 30.77)	26.57 (24.33, 28.81)	30.74 (28.32, 33.16)	33.03 (30.39, 35.68)	32.49 (28.93, 36.04)	34.79 (30.52, 39.06)	31.49 (26.29, 36.7)	10.9 (8.2, 13.62)	1.48 (1.34, 1.64)
OA	London	26.78 (23.47, 30.1)	31.08 (28.1, 34.05)	34.28 (31.01, 37.54)	31.31 (28.61, 34.01)	34.97 (32.36, 37.58)	37.57 (34.69, 40.45)	43 (40.23, 45.76)	41.29 (38.44, 44.14)	45.56 (42.63, 48.49)	52.81 (47.85, 57.76)	20.99 (17.61, 24.21)	1.78 (1.62, 1.96)

Non-OA	London	26.99 (23.7, 30.27)	25.82 (23.03, 28.6)	29.09 (25.93, 32.26)	26.57 (24.03, 29.12)	30.23 (27.72, 32.75)	32.1 (29.31, 34.89)	33.33 (30.71, 35.96)	34.36 (31.6, 37.13)	37.9 (35.06, 40.74)	38.48 (33.5, 43.46)	13.35 (10.17, 16.53)	1.54 (1.39, 1.72)
OA	North East	21.88 (17.4, 26.37)	33.09 (27.44, 38.73)	33.53 (26.38, 40.68)	34.11 (28.3, 39.92)	37.36 (30.12, 44.6)	37.34 (31.99, 42.7)	40.51 (35.07, 45.94)	40 (35.38, 44.62)	45.31 (39.19, 51.44)	42.58 (39.34, 45.82)	19.24 (13.81, 24.74)	1.69 (1.44, 1.98)
Non-OA	North East	21.13 (16.75, 25.51)	27.88 (23.32, 32.45)	33.52 (26.56, 40.48)	28.24 (22.2, 34.28)	21.51 (15.56, 27.45)	31.94 (26.72, 37.15)	27.53 (22.34, 32.72)	33.71 (29.32, 38.09)	34.98 (28.95, 41.01)	37.87 (34.59, 41.15)	16.76 (11.34, 22.04)	1.73 (1.44, 2.1)
OA	North West	27.35 (24.96, 29.73)	33.37 (31.22, 35.52)	33.64 (31.65, 35.63)	35.22 (32.88, 37.55)	36.81 (34.61, 39)	40.34 (38, 42.69)	38.98 (36.7, 41.26)	42.92 (40.65, 45.18)	43.45 (41.35, 45.54)	44.66 (42.89, 46.43)	17.15 (14.76, 19.47)	1.58 (1.48, 1.68)
Non-OA	North West	24.58 (22.33, 26.82)	29.7 (27.68, 31.71)	30.6 (28.68, 32.53)	31.3 (29.07, 33.54)	34.09 (31.88, 36.29)	34.17 (31.89, 36.45)	34.92 (32.72, 37.12)	33.45 (31.25, 35.65)	35.85 (33.75, 37.94)	36.64 (34.92, 38.36)	10.4 (8.13, 12.7)	1.38 (1.28, 1.48)
OA	South Central	29.08 (27.56, 30.6)	32.92 (30.64, 35.21)	35.72 (33.05, 38.39)	36.65 (34.11, 39.2)	36.27 (33.6, 38.94)	41.55 (38.56, 44.54)	41.68 (38.54, 44.81)	45.01 (41.39, 48.62)	44.87 (40.35, 49.39)	48.19 (40.53, 55.85)	18.71 (15.75, 21.7)	1.71 (1.57, 1.87)
Non-OA	South Central	26.17 (24.71, 27.63)	26.05 (23.94, 28.16)	26.94 (24.41, 29.46)	29.78 (27.38, 32.18)	30.02 (27.48, 32.55)	34 (31.2, 36.8)	34.4 (31.31, 37.49)	36.52 (32.92, 40.12)	40.04 (35.49, 44.6)	41.43 (33.2, 49.66)	13.42 (10.58, 16.29)	1.59 (1.44, 1.76)
OA	South East Coast	27.8 (25.86, 29.74)	31.77 (29.84, 33.7)	34.63 (32.56, 36.7)	35.66 (33.45, 37.87)	35.61 (33.17, 38.04)	37.05 (34.12, 39.97)	40.53 (37.02, 44.04)	44.01 (40.77, 47.25)	45.13 (41.43, 48.83)	49.5 (42.57, 56.44)	16.9 (14.12, 19.77)	1.63 (1.5, 1.78)
Non-OA	South East Coast	23.13 (21.32, 24.94)	26.74 (24.96, 28.53)	27.58 (25.62, 29.55)	29.79 (27.67, 31.9)	31.64 (29.27, 34)	33.62 (30.74, 36.5)	34.53 (31.06, 37.99)	36.69 (33.58, 39.8)	39.12 (35.33, 42.91)	37.3 (30.28, 44.31)	15.53 (12.75, 18.16)	1.71 (1.55, 1.89)
OA	South West	30.41 (27.28, 33.54)	30.86 (28.36, 33.35)	31.72 (29.31, 34.14)	33.95 (31.31, 36.59)	34.66 (32.71, 36.61)	36.33 (33.87, 38.79)	39.09 (36.27, 41.9)	43.33 (40.42, 46.24)	44.2 (41.07, 47.34)	45.81 (42.33, 49.3)	16.58 (13.66, 19.59)	1.59 (1.46, 1.73)

Non-OA	South West	24.79 (21.87, 27.72)	27.2 (24.8, 29.61)	29.79 (27.47, 32.1)	31.59 (29, 34.18)	28.68 (26.85, 30.52)	31.01 (28.63, 33.38)	34.92 (32.14, 37.69)	36.71 (33.9, 39.51)	37.88 (34.67, 41.1)	37.61 (34.17, 41.06)	12.34 (9.45, 15.15)	1.49 (1.35, 1.64)
OA	West Midlands	30.66 (28.58, 32.74)	32.06 (29.55, 34.57)	33.35 (31.31, 35.39)	33.33 (31.08, 35.58)	35.15 (32.93, 37.37)	37.44 (34.83, 40.05)	40.34 (37.67, 43.01)	43.88 (40.91, 46.85)	44.11 (41.18, 47.04)	43.04 (40.7, 45.38)	15.94 (13.28, 18.62)	1.56 (1.44, 1.68)
Non-OA	West Midlands	25.75 (23.78, 27.71)	27.29 (25, 29.57)	29.92 (27.98, 31.87)	28.13 (25.95, 30.31)	30.49 (28.35, 32.64)	31.03 (28.51, 33.54)	34.07 (31.51, 36.62)	40.23 (37.24, 43.22)	38.44 (35.51, 41.37)	37.7 (35.35, 40.04)	14.61 (12.07, 17.12)	1.6 (1.47, 1.75)
OA	Yorkshire & The Humber	28.12 (23.75, 32.49)	29.97 (25.4, 34.55)	34.31 (30.32, 38.31)	31.5 (29, 34)	31.65 (28.22, 35.07)	37.8 (34, 41.6)	40.34 (36.39, 44.29)	38.22 (33.65, 42.78)	47.45 (42.6, 52.29)	44.37 (40.46, 48.29)	17.6 (13.33, 21.75)	1.65 (1.46, 1.87)
Non-OA	Yorkshire & The Humber	26.98 (22.77, 31.18)	22.28 (18.07, 26.5)	28.46 (24.88, 32.03)	25.52 (23.1, 27.93)	24.52 (21.58, 27.45)	29.47 (25.92, 33.01)	32.1 (28.25, 35.95)	36.14 (31.51, 40.78)	35.05 (30.16, 39.95)	36.4 (32.46, 40.33)	12.7 (8.66, 16.68)	1.56 (1.35, 1.82)

IMD, Indices of multiple deprivation; 95%CI, 95% confidence interval; CVRF, cardiovascular risk factors; OA, osteoarthritis

Appendix 3.2.2. Imputed measures of inequality in the prevalence of number of ≥1 CVRFs in OA and non-OA samples by subgroups, 1992-2017

OA status	Subgroup	Period prevalence by IMD decile (%) (95%CI)										Slope index of inequality (95%CI)(%)	Relative index of inequality (95%CI)
		1 (Least deprived)	2	3	4	5	6	7	8	9	10(Most deprived)		
OA	1992	70.83 (51.55, 90.12)	76.74 (63.72, 89.76)	83.78 (71.47, 96.1)	83.08 (73.78, 92.37)	75.61 (62.03, 89.19)	68.57 (52.59, 84.55)	83.33 (72.5, 94.17)	64.15 (50.92, 77.38)	85 (73.56, 96.44)	84.75 (75.37, 94.12)	2.83 (-10.65, 15.97)	1.04 (0.87, 1.23)
Non-OA	1992	79.17 (61.94, 96.39)	69.44 (53.83, 85.06)	68.63 (55.56, 81.69)	63.49 (51.36, 75.62)	80 (67.97, 92.03)	66 (52.52, 79.48)	71.74 (58.35, 85.13)	71.74 (58.35, 85.13)	71.43 (50.74, 92.12)	79.37 (69.17, 89.56)	7.08 (-7.71, 21.53)	1.1 (0.9, 1.36)
OA	1993	80 (72.92, 87.08)	75.26 (66.56, 83.96)	67.97 (59.81, 76.13)	80.75 (75.06, 86.44)	77.22 (71.05, 83.39)	79.88 (73.79, 85.97)	79.43 (72.7, 86.16)	78.45 (70.88, 86.01)	76.67 (67.81, 85.53)	76.64 (69.49, 83.79)	2.03 (-5.65, 9.89)	1.03 (0.93, 1.13)
Non-OA	1993	71.3 (62.95, 79.66)	65.55 (56.92, 74.17)	72.44 (64.59, 80.29)	73.58 (67.62, 79.55)	67.61 (60.65, 74.58)	76.43 (69.34, 83.52)	63.43 (55.2, 71.66)	71.17 (62.65, 79.69)	75.26 (66.56, 83.96)	71.22 (63.63, 78.82)	1.26 (-7.34, 9.67)	1.02 (0.9, 1.15)
OA	1994	76.62 (69.89,	85.07 (78.99,	82.99 (76.87,	79.09 (73.69,	80.79 (74.95,	77.2 (71.25,	86.01 (80.28,	70.69 (62.32,	78.57 (71.34,	78.21 (72.12, 84.3)	-3.69 (-10.44, 3.35)	0.95 (0.87, 1.05)

		83.36)	91.16)	89.12)	84.49)	86.64)	83.16)	91.75)	79.06)	85.81)			
Non-OA	1994	75.88 (69.4, 82.36)	70.71 (63.11, 78.32)	75.63 (68.92, 82.33)	68.89 (62.81, 74.97)	74.85 (68.22, 81.48)	73.58 (66.68, 80.49)	71.76 (63.97, 79.54)	78.81 (71.36, 86.26)	78.83 (71.93, 85.73)	72.53 (66, 79.06)	2.29 (-5.27, 9.71)	1.03 (0.93, 1.15)
OA	1995	78.44 (72.16, 84.73)	83.72 (77.29, 90.15)	80.92 (74.62, 87.22)	80.72 (75.51, 85.92)	79.41 (73.83, 84.99)	80.61 (75.04, 86.18)	84.62 (78.91, 90.32)	85.27 (79.1, 91.45)	81.56 (75.1, 88.02)	82.74 (77.43, 88.05)	3.67 (-2.88, 10.02)	1.05 (0.97, 1.13)
Non-OA	1995	71.08 (64.14, 78.03)	69.86 (62.36, 77.37)	74.85 (68.3, 81.4)	71.86 (65.57, 78.15)	71.08 (64.82, 77.34)	78.86 (72.76, 84.95)	73.49 (66.73, 80.26)	76.03 (69.04, 83.01)	84.55 (78.1, 91)	71.21 (64.87, 77.56)	5.87 (-1.6, 13.3)	1.08 (0.98, 1.2)
OA	1996	78.15 (72.87, 83.43)	75.5 (69.5, 81.5)	79.38 (73.06, 85.69)	82.28 (77.57, 87)	76.65 (71.12, 82.19)	87.78 (83.44, 92.12)	86.7 (82, 91.4)	83.43 (77.88, 88.98)	87.08 (82.12, 92.04)	85.41 (80.85, 89.96)	11.43 (5.65, 17.15)	1.15 (1.07, 1.23)
Non-OA	1996	75.41 (69.98, 80.84)	77.32 (71.39, 83.25)	72.32 (65.68, 78.95)	70.59 (64.97, 76.21)	72.46 (66.73, 78.19)	71.93 (66.07, 77.79)	72.64 (66.44, 78.84)	75.58 (69.11, 82.05)	71.71 (64.49, 78.93)	76.52 (71.01, 82.03)	-0.23 (-6.76, 6.15)	1 (0.91, 1.09)
OA	1997	78.68 (74.17, 83.19)	81.67 (76.86, 86.48)	83.77 (78.96, 88.58)	79.15 (74.4, 83.91)	80.2 (75.66, 84.74)	85.12 (80.62, 89.63)	85.95 (81.55, 90.35)	87.5 (82.58, 92.42)	86.25 (80.87, 91.63)	90.59 (86.99, 94.19)	11.33 (6.3, 16.37)	1.15 (1.08, 1.22)
Non-OA	1997	78.34 (73.77, 82.92)	80.78 (75.93, 85.64)	78.54 (73.24, 83.84)	73.72 (68.66, 78.78)	73.13 (68.25, 78)	77.17 (71.98, 82.35)	78.97 (73.48, 84.46)	78.57 (72.32, 84.82)	82.5 (76.57, 88.43)	76.13 (70.74, 81.52)	-0.34 (-5.96, 5.3)	1 (0.93, 1.07)
OA	1998	82.69 (78.62, 86.75)	83.65 (79.16, 88.14)	82.21 (77.72, 86.7)	85.17 (81.41, 88.94)	84.43 (80.53, 88.33)	81.85 (77.41, 86.29)	83.87 (78.95, 88.79)	90.67 (86.84, 94.49)	89.27 (85.01, 93.53)	87.41 (83.43, 91.38)	6.38 (1.81, 10.86)	1.08 (1.02, 1.14)
Non-OA	1998	79.89 (75.69, 84.08)	75 (69.94, 80.06)	77.52 (72.4, 82.64)	79.64 (75.27, 84)	79.13 (74.83, 83.43)	81.49 (76.93, 86.06)	80.66 (75.96, 85.35)	80.35 (75.18, 85.52)	80.5 (74.3, 86.71)	83.07 (78.44, 87.71)	4.93 (-0.25, 10.17)	1.06 (1, 1.14)
OA	1999	88.76 (85.47,	80.78 (76.53,	83.49 (79.38,	85.8 (82.1,	84.35 (80.67,	86.97 (83.19,	84.98 (80.72,	92.94 (89.78,	90.67 (87.17,	90.72 (87.37,	7.33 (3.47, 11.42)	1.09 (1.04, 1.14)

		92.06)	85.03)	87.61)	89.49)	88.03)	90.75)	89.24)	96.1)	94.17)	94.07)		
Non-OA	1999	78.93 (74.56, 83.3)	78.46 (73.98, 82.95)	79.33 (74.94, 83.72)	77.31 (72.95, 81.67)	79.05 (74.92, 83.17)	78.16 (73.59, 82.74)	76.53 (71.67, 81.4)	79.42 (74.32, 84.53)	78.8 (73.71, 83.89)	79.11 (74.43, 83.79)	-0.11 (-5.06, 5)	1 (0.94, 1.06)
OA	2000	84.93 (81.25, 88.61)	84.14 (80.05, 88.23)	84.09 (80.26, 87.93)	87 (83.6, 90.41)	85.71 (82.24, 89.19)	87.55 (83.61, 91.48)	89.36 (85.75, 92.98)	88.17 (84.24, 92.1)	88.84 (84.78, 92.91)	91.96 (88.93, 95)	7.5 (3.49, 11.49)	1.09 (1.04, 1.14)
Non-OA	2000	82.57 (78.58, 86.56)	85.33 (81.52, 89.14)	83.24 (79.39, 87.09)	78.93 (74.9, 82.97)	78.12 (74.02, 82.22)	82.94 (78.66, 87.22)	82.66 (77.93, 87.4)	83.27 (78.74, 87.8)	78.6 (73.42, 83.78)	83.58 (79.13, 88.04)	-1.6 (-6.17, 3.1)	0.98 (0.93, 1.04)
OA	2001	86.58 (83.07, 90.08)	89.58 (86.52, 92.65)	87.98 (84.51, 91.44)	88.01 (84.88, 91.14)	87.14 (83.89, 90.38)	88.71 (85.23, 92.2)	90.85 (87.67, 94.04)	88.49 (84.72, 92.26)	90.22 (86.7, 93.74)	91.84 (88.93, 94.74)	3.79 (0.29, 7.32)	1.04 (1, 1.09)
Non-OA	2001	83.33 (79.59, 87.07)	76.84 (72.43, 81.25)	81.47 (77.48, 85.46)	80.92 (77.12, 84.71)	82.91 (79.35, 86.47)	83.93 (80.13, 87.73)	78.57 (73.97, 83.17)	84.56 (80.13, 88.98)	83.64 (79.24, 88.03)	85.52 (81.5, 89.54)	4.18 (-0.24, 8.64)	1.05 (1, 1.11)
OA	2002	88.3 (85.38, 91.21)	89.33 (86.47, 92.19)	84.67 (81.33, 88)	87.13 (84.2, 90.06)	87.5 (84.61, 90.39)	89.41 (86.33, 92.48)	90.53 (87.7, 93.37)	90.41 (87.47, 93.36)	91.51 (88.43, 94.58)	90.72 (87.65, 93.8)	4.41 (1.15, 7.61)	1.05 (1.01, 1.09)
Non-OA	2002	81.03 (77.53, 84.53)	83.41 (79.95, 86.87)	81.26 (77.8, 84.72)	78.57 (74.98, 82.16)	81.07 (77.58, 84.56)	82.96 (79.26, 86.66)	86.63 (83.31, 89.96)	84.64 (80.89, 88.38)	85.81 (81.86, 89.75)	84.62 (80.83, 88.4)	5.3 (1.37, 9.24)	1.07 (1.02, 1.12)
OA	2003	86.87 (84.33, 89.42)	88.96 (86.51, 91.4)	90.64 (88.26, 93.02)	88.29 (85.92, 90.66)	89.33 (86.87, 91.78)	89.89 (87.3, 92.47)	89.15 (86.44, 91.87)	91.57 (88.93, 94.21)	92.57 (90.01, 95.14)	92.54 (90.15, 94.92)	4.85 (2.08, 7.59)	1.06 (1.02, 1.09)
Non-OA	2003	83.04 (80.21, 85.87)	84.92 (82.19, 87.65)	81.36 (78.21, 84.51)	84.71 (82, 87.42)	83.02 (80.11, 85.93)	83.72 (80.54, 86.89)	85.05 (81.9, 88.2)	87.53 (84.44, 90.62)	83.59 (79.93, 87.25)	84.45 (81.02, 87.89)	2.1 (-1.28, 5.46)	1.03 (0.99, 1.07)
OA	2004	87.4 (84.97,	89.73 (87.52,	90.97 (88.86,	89.26 (87.08,	88.09 (85.79,	88.83 (86.35,	91.22 (88.92,	91.62 (89.21,	94.35 (92.32,	92.69 (90.36,	4.81 (2.34, 7.35)	1.05 (1.03, 1.08)

		89.82)	91.93)	93.09)	91.45)	90.39)	91.32)	93.53)	94.02)	96.39)	95.03)		
Non-OA	2004	84.8 (82.25, 87.35)	85.37 (82.77, 87.97)	83.4 (80.74, 86.06)	81.56 (78.84, 84.29)	84.25 (81.53, 86.97)	84.03 (81.2, 86.86)	82.98 (79.89, 86.07)	85.09 (81.97, 88.21)	83.75 (80.3, 87.19)	83.78 (80.61, 86.94)	-0.7 (-3.88, 2.44)	0.99 (0.96, 1.03)
OA	2005	87.33 (85.11, 89.54)	88.8 (86.66, 90.93)	90.04 (87.96, 92.11)	87.79 (85.6, 89.98)	91.5 (89.6, 93.39)	91.37 (89.27, 93.48)	91.06 (88.9, 93.22)	90.63 (88.3, 92.95)	92.02 (89.78, 94.26)	93.98 (91.86, 96.11)	5.53 (3.13, 7.91)	1.06 (1.04, 1.09)
Non-OA	2005	82.67 (80.17, 85.17)	83.5 (81.06, 85.94)	84.21 (81.65, 86.78)	85.89 (83.51, 88.26)	85.37 (83.04, 87.71)	85.41 (82.71, 88.11)	86.71 (84.12, 89.3)	83.83 (80.88, 86.79)	87.15 (84.31, 89.99)	86.41 (83.38, 89.44)	3.78 (0.85, 6.69)	1.05 (1.01, 1.08)
OA	2006	89.98 (87.94, 92.01)	89.39 (87.34, 91.44)	89.15 (87.06, 91.23)	89.95 (87.95, 91.96)	91.54 (89.65, 93.42)	92.29 (90.36, 94.21)	91.14 (89.05, 93.23)	91.12 (88.92, 93.33)	92.01 (89.66, 94.36)	93.68 (91.55, 95.8)	3.74 (1.44, 5.98)	1.04 (1.02, 1.07)
Non-OA	2006	79.77 (77.09, 82.45)	81.77 (79.28, 84.26)	83.77 (81.27, 86.28)	85.68 (83.4, 87.96)	81.45 (78.96, 83.94)	85.54 (82.86, 88.22)	84.13 (81.36, 86.91)	87.02 (84.33, 89.71)	85.69 (82.7, 88.67)	87.84 (84.79, 90.89)	6.62 (3.66, 9.45)	1.08 (1.04, 1.12)
OA	2007	88.36 (86.34, 90.37)	87.57 (85.46, 89.68)	89.5 (87.53, 91.47)	89.83 (87.92, 91.74)	89.6 (87.69, 91.5)	90.93 (88.92, 92.95)	91.87 (89.96, 93.78)	92 (89.99, 94.01)	92.79 (90.78, 94.8)	94.12 (92.17, 96.07)	6.15 (3.87, 8.35)	1.07 (1.04, 1.1)
Non-OA	2007	81.93 (79.64, 84.21)	82.35 (79.98, 84.72)	83.73 (81.36, 86.1)	81.7 (79.21, 84.19)	82.24 (79.83, 84.64)	84.17 (81.63, 86.71)	84.87 (82.32, 87.42)	84.79 (82.08, 87.5)	84.12 (81.06, 87.19)	90.02 (87.55, 92.48)	5.3 (2.6, 8.05)	1.07 (1.03, 1.1)
OA	2008	87.03 (85.11, 88.96)	89.84 (88.07, 91.61)	89.78 (88.01, 91.55)	89.04 (87.18, 90.9)	89.67 (87.83, 91.52)	91.12 (89.28, 92.95)	92.27 (90.52, 94.01)	93.19 (91.38, 95)	94.71 (93.08, 96.35)	94.92 (93.3, 96.54)	7.6 (5.67, 9.62)	1.09 (1.06, 1.11)
Non-OA	2008	79.04 (76.75, 81.34)	80.95 (78.69, 83.22)	85.07 (83, 87.15)	82.91 (80.66, 85.17)	80.93 (78.63, 83.23)	83.17 (80.72, 85.61)	85.28 (82.9, 87.66)	85.79 (83.29, 88.29)	84.99 (82.31, 87.66)	89.38 (87.02, 91.73)	7.56 (5, 10.15)	1.1 (1.06, 1.13)
OA	2009	88.55 (86.62,	88.79 (86.72,	88.19 (86.18,	90.13 (88.22,	89.47 (87.5,	90.95 (88.83,	90.83 (88.77,	93.6 (91.75,	93.02 (90.95,	93.55 (91.59,	5.98 (3.81, 8.2)	1.07 (1.04, 1.09)

		90.48)	90.86)	90.21)	92.03)	91.45)	93.07)	92.88)	95.45)	95.08)	95.51)		
Non-OA	2009	81.5 (79.08, 83.93)	83.35 (81.01, 85.69)	82.67 (80.38, 84.96)	82.22 (79.79, 84.64)	86.02 (83.74, 88.29)	85.28 (82.7, 87.86)	84.72 (82.13, 87.3)	86.28 (83.59, 88.98)	86.76 (84.07, 89.45)	87.21 (84.45, 89.98)	5.92 (3.18, 8.66)	1.07 (1.04, 1.11)
OA	2010	86.9 (84.57, 89.23)	87.97 (85.58, 90.36)	89.15 (87, 91.31)	89.63 (87.42, 91.84)	89.84 (87.65, 92.02)	90.48 (88.1, 92.85)	92.43 (90.33, 94.54)	91.94 (89.53, 94.34)	93.27 (91.11, 95.43)	96.58 (94.87, 98.28)	8.28 (5.8, 10.67)	1.1 (1.07, 1.13)
Non-OA	2010	79.64 (76.91, 82.38)	83.27 (80.62, 85.92)	84.12 (81.63, 86.6)	83.97 (81.31, 86.64)	82.11 (79.38, 84.83)	84.63 (81.72, 87.54)	84.45 (81.42, 87.48)	85.92 (82.85, 88.98)	86.78 (83.66, 89.91)	91.4 (88.74, 94.05)	7.7 (4.71, 10.76)	1.1 (1.06, 1.14)
OA	2011	89.02 (86.66, 91.39)	87.37 (84.8, 89.93)	91.36 (89.23, 93.49)	88.24 (85.75, 90.72)	89.39 (86.92, 91.85)	88.18 (85.39, 90.97)	90.82 (88.28, 93.35)	92.5 (89.91, 95.09)	93.51 (91.14, 95.88)	95.7 (93.63, 97.77)	5.71 (3.11, 8.36)	1.07 (1.03, 1.1)
Non-OA	2011	80.66 (77.79, 83.53)	85.93 (83.27, 88.59)	86.15 (83.5, 88.8)	82.89 (79.96, 85.82)	84.63 (81.75, 87.51)	81.75 (78.37, 85.13)	86.83 (83.86, 89.8)	88.83 (85.78, 91.89)	87.06 (83.77, 90.36)	87.94 (84.47, 91.42)	5.37 (2.1, 8.69)	1.07 (1.03, 1.11)
OA	2012	86.59 (83.9, 89.28)	89.71 (87.18, 92.25)	90.51 (88.05, 92.97)	90.38 (87.79, 92.97)	90.63 (88.13, 93.13)	88.55 (85.53, 91.58)	89.81 (86.73, 92.89)	92.11 (89.24, 94.97)	93.61 (90.89, 96.33)	93.65 (90.87, 96.42)	5.38 (2.34, 8.38)	1.06 (1.03, 1.1)
Non-OA	2012	84.24 (81.29, 87.18)	82.56 (79.42, 85.71)	83.36 (80.18, 86.55)	84.88 (81.61, 88.15)	84.84 (81.65, 88.03)	86.59 (83.4, 89.78)	89.32 (86.22, 92.42)	85.64 (82.24, 89.04)	89.09 (85.75, 92.42)	88.01 (84.27, 91.75)	6.18 (2.61, 9.7)	1.08 (1.03, 1.12)
OA	2013	88.41 (85.69, 91.13)	87.41 (84.23, 90.59)	91.3 (88.72, 93.89)	92.56 (89.99, 95.13)	89.04 (86.08, 92.01)	86.81 (83.39, 90.23)	91.85 (89, 94.71)	93.31 (90.6, 96.02)	93.9 (90.9, 96.91)	91.83 (88.46, 95.19)	4.57 (1.4, 7.8)	1.05 (1.02, 1.09)
Non-OA	2013	81.44 (78.12, 84.76)	85.84 (82.64, 89.04)	82.11 (78.62, 85.61)	86.09 (82.76, 89.42)	84.98 (81.57, 88.38)	83.89 (80.08, 87.7)	86.27 (82.57, 89.97)	88.75 (85.22, 92.27)	86.91 (82.9, 90.91)	87.5 (83.29, 91.71)	5.78 (1.85, 9.65)	1.07 (1.02, 1.12)
OA	2014	86.32 (83.13,	88.14 (84.84,	90.62 (87.65,	89.74 (86.72,	87.21 (83.85,	91.44 (88.39,	89.79 (86.25,	94.36 (91.58,	92.77	93.56 (90.16,	6.96 (3.42, 10.45)	1.08 (1.04, 1.12)

		89.52)	91.44)	93.59)	92.76)	90.56)	94.48)	93.33)	97.15)	(89.54, 96)	96.97)		
Non-OA	2014	81.66 (78.06, 85.25)	83.72 (80.22, 87.22)	84.9 (81.4, 88.4)	85.31 (81.61, 89.01)	85.98 (82.47, 89.49)	88.6 (85.03, 92.17)	88.93 (85.4, 92.45)	85.88 (81.59, 90.18)	85.71 (80.87, 90.56)	91.26 (87.38, 95.14)	7.56 (3.34, 11.71)	1.09 (1.04, 1.15)
OA	2015	85.75 (82.53, 88.96)	86.79 (83.06, 90.53)	88.82 (85.26, 92.37)	88.59 (84.97, 92.22)	89.47 (86.21, 92.74)	91.42 (87.8, 95.03)	90.3 (86.51, 94.08)	92.99 (89.55, 96.43)	94.82 (91.67, 97.97)	94.24 (90.92, 97.57)	9.57 (5.81, 13.47)	1.11 (1.07, 1.16)
Non-OA	2015	81.88 (78.16, 85.61)	82.52 (78.38, 86.65)	86.97 (83.32, 90.62)	84.57 (80.53, 88.6)	84.89 (80.89, 88.88)	87.41 (83.49, 91.33)	86.58 (82.16, 91)	90.86 (86.81, 94.91)	89.55 (85.48, 93.61)	91.67 (87.46, 95.88)	9.49 (5.05, 13.88)	1.12 (1.06, 1.18)
OA	2016	90.14 (86.99, 93.3)	90.67 (87.17, 94.17)	91.38 (87.75, 95.01)	86.59 (81.57, 91.62)	88.34 (84.11, 92.58)	90.06 (85.54, 94.58)	90.96 (86.71, 95.21)	94.97 (91.54, 98.39)	96 (92.84, 99.16)	95.12 (91.28, 98.97)	5.09 (1.15, 9.12)	1.06 (1.01, 1.11)
Non-OA	2016	84.64 (80.89, 88.38)	86.14 (81.98, 90.31)	83.33 (78.33, 88.33)	84.44 (79.11, 89.78)	84.12 (79.4, 88.84)	83.45 (77.35, 89.55)	86.01 (81.09, 90.94)	91.45 (86.97, 95.93)	89.7 (85.02, 94.37)	91.53 (86.45, 96.6)	6.11 (1.01, 11.13)	1.07 (1.01, 1.14)
OA	2017	88.22 (84.73, 91.7)	85.77 (81.45, 90.1)	92.75 (89.2, 96.31)	94.22 (90.72, 97.72)	88.56 (84.13, 92.99)	92.06 (87.3, 96.83)	92.25 (87.82, 96.69)	92.91 (88.63, 97.18)	95.41 (91.44, 99.39)	93.1 (87.7, 98.51)	7.28 (2.63, 12.05)	1.08 (1.03, 1.14)
Non-OA	2017	84.03 (80.22, 87.85)	89.53 (85.91, 93.15)	84.13 (78.88, 89.37)	85.91 (80.27, 91.54)	84.29 (79.1, 89.49)	90.08 (84.91, 95.24)	87.67 (82.29, 93.05)	91.82 (86.64, 97)	86.29 (80.18, 92.41)	94.79 (90.29, 99.29)	5.98 (0.75, 11.33)	1.07 (1.01, 1.14)
OA	Age 35-44 years	75.22 (71.63, 78.82)	75.28 (71.6, 78.96)	74.16 (70.46, 77.87)	77.51 (74.1, 80.92)	80.84 (77.61, 84.06)	83.09 (79.95, 86.23)	84.22 (81.15, 87.29)	84.4 (81.21, 87.59)	88.2 (85.55, 90.86)	88.58 (86.15, 91.02)	17.45 (13.89, 20.96)	1.24 (1.19, 1.3)
Non-OA	Age 35-44 years	63.75 (59.99, 67.52)	63.49 (59.52, 67.46)	67.11 (63.36, 70.86)	61.81 (57.9, 65.71)	68.85 (65.17, 72.53)	71.34 (67.34, 75.35)	72.96 (69.21, 76.72)	74.9 (71, 78.79)	76.61 (72.94, 80.28)	81.98 (78.81, 85.15)	19.96 (15.97, 24)	1.33 (1.25, 1.42)
OA	Age 45-54	82.26	84.66 (83.17,	86.42 (85,	85.8 (84.41,	87.04 (85.68,	87.1 (85.67,	88.43 (87.05,	90.09 (88.73,	92.32 (91.1,	93.44 (92.35,	10.87 (9.36, 12.37)	1.13 (1.11, 1.15)

	years	(80.83, 83.7)	86.15)	87.85)	87.19)	88.4)	88.54)	89.8)	91.45)	93.55)	94.53)		
Non-OA	Age 45-54 years	74.81 (73.2, 76.41)	76.78 (75.12, 78.44)	77.46 (75.77, 79.16)	77.83 (76.19, 79.46)	78.42 (76.79, 80.05)	79.58 (77.85, 81.31)	80.83 (79.07, 82.59)	82.39 (80.61, 84.17)	82.29 (80.45, 84.12)	84.49 (82.8, 86.18)	9.53 (7.69, 11.43)	1.13 (1.1, 1.16)
OA	Age 55-64 years	88.29 (87.36, 89.22)	89.47 (88.53, 90.41)	91.08 (90.2, 91.97)	90.56 (89.68, 91.43)	89.71 (88.79, 90.62)	91.35 (90.41, 92.29)	92.66 (91.77, 93.55)	93.03 (92.09, 93.98)	94.22 (93.31, 95.12)	94.56 (93.7, 95.43)	6.12 (5.12, 7.12)	1.07 (1.06, 1.08)
Non-OA	Age 55-64 years	84.24 (83.2, 85.28)	85.34 (84.28, 86.39)	85.22 (84.13, 86.31)	85.58 (84.53, 86.64)	85.03 (83.96, 86.1)	86.67 (85.52, 87.82)	87.12 (85.97, 88.28)	87.78 (86.56, 89)	87.37 (86.05, 88.69)	89.52 (88.33, 90.72)	4.49 (3.24, 5.75)	1.05 (1.04, 1.07)
OA	Age 65-74 years	90.36 (89.37, 91.34)	90.34 (89.32, 91.36)	90.78 (89.78, 91.77)	90.35 (89.33, 91.37)	90.43 (89.43, 91.44)	91.03 (89.93, 92.13)	91.86 (90.78, 92.95)	92.62 (91.54, 93.7)	92.61 (91.44, 93.79)	92.35 (91.15, 93.55)	2.63 (1.47, 3.77)	1.03 (1.02, 1.04)
Non-OA	Age 65-74 years	85.48 (84.3, 86.65)	87.3 (86.15, 88.44)	87.11 (85.96, 88.26)	85.8 (84.58, 87.02)	85.25 (84.03, 86.47)	86.68 (85.38, 87.98)	87.33 (86, 88.65)	87.77 (86.39, 89.15)	87.76 (86.3, 89.21)	86.85 (85.37, 88.33)	1.35 (-0.05, 2.74)	1.02 (1, 1.03)
OA	Age 75-84 years	88.06 (86.58, 89.53)	86.72 (85.16, 88.27)	87.77 (86.29, 89.25)	87 (85.48, 88.51)	85.72 (84.14, 87.31)	86.98 (85.27, 88.69)	88.22 (86.56, 89.87)	88.45 (86.7, 90.2)	88.62 (86.77, 90.47)	87.61 (85.67, 89.56)	0.73 (-1.04, 2.51)	1.01 (0.99, 1.03)
Non-OA	Age 75-84 years	81.68 (79.92, 83.45)	81.84 (80.07, 83.61)	82.68 (80.97, 84.39)	79.53 (77.69, 81.38)	80.01 (78.19, 81.83)	81.34 (79.4, 83.28)	80.48 (78.48, 82.48)	82.84 (80.79, 84.88)	82.5 (80.31, 84.69)	78.25 (75.79, 80.72)	-1.19 (-3.31, 0.97)	0.99 (0.96, 1.01)
OA	Age 85+ years	79.84 (74.87, 84.81)	84.07 (79.69, 88.46)	74.74 (69.71, 79.77)	74.52 (69.19, 79.85)	76.19 (71.12, 81.27)	75.69 (69.96, 81.41)	77.93 (72.33, 83.54)	83.44 (77.68, 89.19)	79.62 (73.27, 85.97)	73.64 (65.97, 81.32)	-2.47 (-8.37, 3.33)	0.97 (0.9, 1.05)
Non-OA	Age 85+ years	75.1 (69.62, 80.59)	73.08 (67.66, 78.49)	75.45 (70.36, 80.54)	73.31 (68.12, 78.5)	72.03 (66.8, 77.25)	68.57 (62.26, 74.89)	67.68 (61.12, 74.23)	75.26 (69.15, 81.37)	75 (67.43, 82.57)	73.15 (65.98, 80.33)	-2.92 (-9.43, 3.6)	0.96 (0.88, 1.05)
OA	Men	87.36 (86.4,	87.74 (86.75,	88.7 (87.74,	88.13 (87.17,	88.49 (87.54,	88.58 (87.53,	89.95 (88.93,	89.87 (88.79,	92.25 (91.23,	92.62 (91.65,	4.89 (3.82, 6.02)	1.06 (1.04, 1.07)

		88.32)	88.73)	89.66)	89.09)	89.44)	89.63)	90.97)	90.96)	93.26)	93.58)		
Non-OA	Men	82.8 (81.71, 83.88)	82.38 (81.25, 83.51)	83.45 (82.34, 84.57)	83.25 (82.14, 84.36)	82 (80.84, 83.16)	83.09 (81.86, 84.33)	83.4 (82.13, 84.67)	83.76 (82.41, 85.11)	83.11 (81.7, 84.51)	84.6 (83.26, 85.95)	1.26 (-0.05, 2.61)	1.02 (1, 1.03)
OA	Women	86.61 (85.9, 87.32)	87.62 (86.9, 88.35)	88.4 (87.69, 89.1)	88.16 (87.47, 88.85)	87.92 (87.21, 88.62)	89.24 (88.51, 89.98)	90.27 (89.57, 90.98)	91.53 (90.82, 92.25)	91.79 (91.06, 92.52)	91.83 (91.12, 92.55)	5.75 (4.95, 6.53)	1.07 (1.06, 1.08)
Non-OA	Women	80.32 (79.5, 81.14)	82.46 (81.64, 83.27)	82.42 (81.6, 83.25)	81.09 (80.25, 81.94)	82.02 (81.2, 82.83)	83.48 (82.59, 84.36)	83.92 (83.03, 84.81)	85.53 (84.63, 86.44)	85.64 (84.68, 86.6)	85.86 (84.92, 86.8)	5.55 (4.6, 6.5)	1.07 (1.06, 1.08)
OA	East Midlands	85.43 (81.07, 89.79)	88 (85.14, 90.86)	87.56 (84.44, 90.67)	88.91 (86.36, 91.46)	86.38 (82.62, 90.13)	87.69 (84.15, 91.23)	90.15 (87.87, 92.43)	86.7 (83.6, 89.79)	90.52 (88.04, 93)	85.6 (81.29, 89.92)	1.55 (-1.86, 4.99)	1.02 (0.98, 1.06)
Non-OA	East Midlands	82 (77.21, 86.79)	82.87 (79.56, 86.17)	79.52 (75.96, 83.07)	82.48 (79.34, 85.62)	78.6 (73.93, 83.26)	83.53 (79.57, 87.49)	80.42 (77.29, 83.56)	80.59 (76.89, 84.28)	83.67 (80.69, 86.65)	78.93 (73.76, 84.09)	-0.23 (-4.29, 3.75)	1 (0.95, 1.05)
OA	East of England	85.91 (84.47, 87.36)	87.24 (85.66, 88.83)	86.64 (84.79, 88.5)	87.51 (85.94, 89.07)	86.7 (84.95, 88.46)	87.97 (86.29, 89.65)	87.06 (85.23, 88.88)	87.54 (85.04, 90.04)	88.33 (85.31, 91.35)	89.27 (85.85, 92.69)	1.95 (-0.14, 4)	1.02 (1, 1.05)
Non-OA	East of England	80.3 (78.64, 81.95)	80.12 (78.22, 82.01)	80.73 (78.62, 82.85)	80.7 (78.83, 82.57)	78.64 (76.56, 80.72)	81.42 (79.38, 83.46)	82.17 (80.02, 84.32)	83.53 (80.72, 86.35)	81.88 (78.42, 85.33)	79.87 (75.37, 84.37)	1.94 (-0.45, 4.35)	1.02 (0.99, 1.05)
OA	London	86.9 (84.37, 89.43)	89.46 (87.49, 91.44)	92.63 (90.83, 94.43)	89.45 (87.66, 91.23)	87.85 (86.06, 89.64)	89.23 (87.38, 91.07)	90.85 (89.24, 92.46)	91.64 (90.03, 93.24)	93.9 (92.5, 95.31)	92.6 (90, 95.2)	4.69 (2.66, 6.64)	1.05 (1.03, 1.08)
Non-OA	London	82.81 (80.02, 85.6)	82.93 (80.53, 85.33)	84.38 (81.85, 86.91)	83.61 (81.47, 85.74)	82.27 (80.17, 84.36)	83.02 (80.78, 85.27)	82.97 (80.88, 85.07)	86.17 (84.16, 88.18)	83.54 (81.37, 85.71)	83.2 (79.37, 87.03)	1.26 (-1.31, 3.78)	1.02 (0.98, 1.05)
OA	North East	84.19 (80.24,	88.85 (85.07,	87.65 (82.66,	88.37 (84.44,	90.8 (86.48,	92.09 (89.1,	89.87 (86.53,	91.72 (89.13,	90.23 (86.58,	92.89 (91.21,	7.72 (4.16, 11.36)	1.09 (1.05, 1.13)

		88.15)	92.63)	92.63)	92.3)	95.13)	95.08)	93.21)	94.32)	93.89)	94.57)		
Non-OA	North East	80.65 (76.42, 84.89)	83.65 (79.88, 87.41)	84.36 (79, 89.72)	82.87 (77.82, 87.92)	76.88 (70.78, 82.98)	87.1 (83.35, 90.84)	82.58 (78.17, 86.99)	85.27 (81.98, 88.56)	80.25 (75.22, 85.28)	88.4 (86.24, 90.56)	7.08 (2.88, 11.24)	1.09 (1.03, 1.14)
OA	North West	87.63 (85.87, 89.39)	90.47 (89.13, 91.81)	90.31 (89.06, 91.56)	90.99 (89.59, 92.39)	90.02 (88.65, 91.38)	91.44 (90.11, 92.78)	91.56 (90.26, 92.86)	92.07 (90.84, 93.31)	93.33 (92.28, 94.38)	92.41 (91.47, 93.36)	4.25 (2.86, 5.63)	1.05 (1.03, 1.06)
Non-OA	North West	80.24 (78.16, 82.32)	85.35 (83.8, 86.91)	85.49 (84.02, 86.97)	84.86 (83.13, 86.59)	85.61 (83.97, 87.24)	86.51 (84.87, 88.15)	85.2 (83.56, 86.84)	86.13 (84.52, 87.75)	86.61 (85.13, 88.1)	86.96 (85.76, 88.16)	4.03 (2.31, 5.79)	1.05 (1.03, 1.07)
OA	South Central	87.19 (86.06, 88.31)	85.59 (83.89, 87.3)	88.5 (86.72, 90.27)	88.73 (87.05, 90.4)	86.71 (84.82, 88.59)	89.78 (87.94, 91.62)	91.83 (90.09, 93.57)	94.12 (92.41, 95.83)	90.81 (88.19, 93.44)	89.76 (85.11, 94.41)	5.82 (3.92, 7.74)	1.07 (1.05, 1.09)
Non-OA	South Central	81.17 (79.87, 82.47)	77.86 (75.86, 79.86)	80.05 (77.78, 82.33)	81.1 (79.05, 83.16)	83.04 (80.96, 85.12)	80.87 (78.55, 83.19)	84.07 (81.68, 86.45)	84.35 (81.63, 87.06)	83.89 (80.48, 87.31)	84.29 (78.2, 90.37)	3.88 (1.53, 6.33)	1.05 (1.02, 1.08)
OA	South East Coast	86.81 (85.34, 88.27)	86.48 (85.06, 87.9)	88.47 (87.08, 89.86)	88.76 (87.3, 90.22)	87.67 (86, 89.34)	88.95 (87.05, 90.85)	89.01 (86.77, 91.24)	90.71 (88.81, 92.6)	92.55 (90.6, 94.5)	94.55 (91.41, 97.7)	4.99 (3.1, 6.88)	1.06 (1.04, 1.08)
Non-OA	South East Coast	80.28 (78.57, 81.99)	83.4 (81.9, 84.9)	82.7 (81.04, 84.37)	80.9 (79.08, 82.72)	84.12 (82.26, 85.97)	83.38 (81.11, 85.65)	84.04 (81.38, 86.71)	85.61 (83.34, 87.87)	85.45 (82.71, 88.19)	83.78 (78.44, 89.13)	4.09 (1.85, 6.33)	1.05 (1.02, 1.08)
OA	South West	87.38 (85.12, 89.64)	87.19 (85.38, 88.99)	87.25 (85.52, 88.99)	86.29 (84.37, 88.21)	87.12 (85.75, 88.5)	87.62 (85.93, 89.3)	88.18 (86.32, 90.04)	90.96 (89.27, 92.64)	90.79 (88.96, 92.61)	91.88 (89.97, 93.79)	4.71 (2.79, 6.6)	1.05 (1.03, 1.08)
Non-OA	South West	82.6 (80.03, 85.17)	83.74 (81.74, 85.73)	83.84 (81.98, 85.7)	82.35 (80.23, 84.48)	79.07 (77.42, 80.72)	82.34 (80.38, 84.3)	84.08 (81.95, 86.21)	84.95 (82.87, 87.03)	86.23 (83.95, 88.52)	85.85 (83.37, 88.32)	2.7 (0.5, 4.97)	1.03 (1.01, 1.06)
OA	West	87.78 (86.31,	90.04 (88.43,	88.09 (86.69,	87.8 (86.24,	90.4 (89.03,	88.73 (87.02,	90.99 (89.43,	91.91 (90.27,	91.39 (89.74,	92.69 (91.46,	5.01 (3.38, 6.69)	1.06 (1.04, 1.08)

	Midlands	89.26)	91.65)	89.49)	89.37)	91.77)	90.44)	92.55)	93.54)	93.05)	93.92)		
Non-OA	West Midlands	83.24 (81.56, 84.92)	83.29 (81.38, 85.2)	83.35 (81.77, 84.93)	83.28 (81.47, 85.09)	84.7 (83.02, 86.38)	85.33 (83.41, 87.25)	84.41 (82.45, 86.36)	84.82 (82.63, 87.01)	85.24 (83.11, 87.38)	84.23 (82.46, 85.99)	2.08 (0.08, 4.09)	1.03 (1, 1.05)
OA	Yorkshire & The Humber	84.84 (81.36, 88.33)	79.59 (75.56, 83.62)	85.5 (82.54, 88.47)	84.78 (82.84, 86.71)	87.48 (85.05, 89.92)	86.44 (83.76, 89.13)	92.44 (90.31, 94.57)	86.73 (83.54, 89.92)	90.51 (87.67, 93.35)	91.64 (89.46, 93.82)	9.55 (6.66, 12.47)	1.12 (1.08, 1.15)
Non-OA	Yorkshire & The Humber	77.91 (73.97, 81.84)	80.64 (76.63, 84.64)	78.54 (75.29, 81.79)	77.03 (74.7, 79.36)	79.59 (76.84, 82.34)	80.41 (77.32, 83.49)	85.36 (82.45, 88.28)	82.89 (79.26, 86.53)	81.79 (77.84, 85.75)	83.88 (80.88, 86.89)	7.17 (3.72, 10.64)	1.09 (1.05, 1.14)
IMD, Indices of multiple deprivation; 95%CI, 95% confidence interval; CVRF, cardiovascular risk factors; OA, osteoarthritis													

Appendix 3.2.3. Imputed measures of inequality in the prevalence of number of ≥2 CVRFs in OA and non-OA samples by subgroups, 1992-2017

OA status	Subgroup	Period prevalence by IMD decile (%) (95%CI)										Slope index of inequality (95%CI)(%)	Relative index of inequality (95%CI)
		1 (Least deprived)	2	3	4	5	6	7	8	9	10(Most deprived)		
OA	1992	41.67 (20.75, 62.58)	41.86 (26.66, 57.06)	32.43 (16.8, 48.07)	41.54 (29.32, 53.76)	34.15 (19.16, 49.14)	37.14 (20.51, 53.78)	33.33 (19.63, 47.04)	32.08 (19.2, 44.95)	55 (39.06, 70.94)	55.93 (42.98, 68.88)	13.85 (-2.62, 30.27)	1.41 (0.93, 2.19)
Non-OA	1992	25 (6.63, 43.37)	25 (10.32, 39.68)	35.29 (21.84, 48.75)	23.81 (13.08, 34.54)	33.33 (19.15, 47.51)	32 (18.73, 45.27)	28.26 (14.87, 41.65)	32.61 (18.67, 46.55)	28.57 (7.88, 49.26)	33.33 (21.45, 45.21)	5.75 (-9.73, 21)	1.21 (0.72, 2.08)
OA	1993	30.4 (22.26, 38.54)	39.18 (29.33, 49.02)	27.34 (19.55, 35.14)	42.78 (35.64, 49.92)	34.44 (27.45, 41.43)	41.42 (33.94, 48.9)	39.72 (31.57, 47.86)	36.21 (27.37, 45.05)	43.33 (32.95, 53.72)	45.26 (36.84, 53.67)	11.64 (2.64, 20.58)	1.36 (1.07, 1.75)
Non-	1993	27.83 (19.55,	31.09 (22.69,	25.2 (17.57,	30.66 (24.42,	34.09 (27.04,	35.71 (27.71,	27.61 (19.97,	30.63 (21.96,	34.02 (24.47,	31.65 (23.85,	4.28 (-4.17, 12.58)	1.15 (0.87, 1.53)

OA		36.11)	39.5)	32.82)	36.9)	41.14)	43.72)	35.25)	39.3)	43.57)	39.46)		
OA	1994	31.17 (23.79, 38.54)	46.27 (37.75, 54.79)	40.82 (32.8, 48.83)	39.09 (32.61, 45.57)	41.81 (34.49, 49.13)	37.31 (30.44, 44.17)	46.85 (38.6, 55.1)	42.24 (33.16, 51.33)	52.38 (43.57, 61.19)	39.66 (32.45, 46.88)	7.85 (-0.6, 16.26)	1.21 (0.99, 1.49)
Non-OA	1994	30.59 (23.61, 37.57)	27.14 (19.71, 34.57)	30 (22.84, 37.16)	29.78 (23.77, 35.79)	26.95 (20.17, 33.73)	38.99 (31.35, 46.63)	28.24 (20.46, 36.03)	36.44 (27.66, 45.22)	35.04 (26.97, 43.1)	33.52 (26.61, 40.42)	6.99 (-0.9, 15.06)	1.25 (0.97, 1.63)
OA	1995	29.94 (22.94, 36.94)	41.09 (32.51, 49.66)	34.87 (27.23, 42.51)	40.36 (33.88, 46.83)	40.69 (33.9, 47.47)	48.98 (41.94, 56.02)	50.64 (42.73, 58.55)	48.84 (40.13, 57.55)	58.87 (50.67, 67.06)	51.78 (44.76, 58.8)	25.54 (17.44, 33.65)	1.81 (1.49, 2.23)
Non-OA	1995	28.31 (21.41, 35.22)	32.19 (24.55, 39.83)	39.18 (31.81, 46.55)	33.17 (26.58, 39.75)	32.84 (26.36, 39.33)	37.14 (29.93, 44.35)	31.93 (24.78, 39.07)	37.67 (29.74, 45.6)	47.15 (38.24, 56.07)	33.33 (26.73, 39.94)	6.79 (-1.08, 14.89)	1.22 (0.96, 1.52)
OA	1996	35.29 (29.19, 41.4)	36.5 (29.79, 43.21)	43.13 (35.39, 50.86)	39.76 (33.72, 45.81)	41.85 (35.4, 48.3)	49.77 (43.14, 56.4)	49.26 (42.34, 56.18)	46.29 (38.85, 53.73)	50 (42.6, 57.4)	51.5 (45.05, 57.95)	18.38 (10.95, 25.65)	1.53 (1.29, 1.83)
Non-OA	1996	31.15 (25.31, 36.99)	33.51 (26.82, 40.19)	32.77 (25.81, 39.73)	32.16 (26.4, 37.92)	31.36 (25.41, 37.31)	32.89 (26.76, 39.03)	33.33 (26.78, 39.89)	33.14 (26.05, 40.22)	33.55 (25.98, 41.12)	36.96 (30.69, 43.23)	3.89 (-3.22, 11.11)	1.13 (0.91, 1.4)
OA	1997	39.18 (33.81, 44.56)	45.42 (39.23, 51.61)	43.86 (37.38, 50.34)	43.82 (38.01, 49.62)	43.62 (37.97, 49.28)	46.69 (40.38, 53.01)	54.13 (47.82, 60.44)	56.82 (49.45, 64.19)	48.13 (40.32, 55.93)	63.53 (57.59, 69.47)	21.22 (14.35, 27.92)	1.57 (1.35, 1.83)
Non-OA	1997	35.03 (29.73, 40.33)	36.47 (30.53, 42.41)	35.19 (29.03, 41.36)	36.86 (31.31, 42.41)	34.69 (29.45, 39.92)	40.94 (34.87, 47.02)	37.85 (31.31, 44.39)	41.07 (33.58, 48.57)	47.5 (39.7, 55.3)	42.8 (36.55, 49.05)	10.05 (3.14, 16.82)	1.3 (1.1, 1.57)
OA	1998	40.3 (35.03, 45.57)	47.53 (41.46, 53.59)	43.06 (37.25, 48.88)	49.42 (44.12, 54.72)	45.81 (40.45, 51.17)	50.34 (44.58, 56.1)	46.54 (39.87, 53.22)	54.67 (48.13, 61.21)	58.54 (51.75, 65.32)	54.81 (48.85, 60.78)	15.34 (8.82, 21.91)	1.38 (1.2, 1.58)
Non-	1998	31.44 (26.58,	38.73 (33.04,	33.33 (27.55,	40.43 (35.1,	36.52 (31.42,	37.72 (32.03,	44.53 (38.61,	40.17 (33.79,	40.25 (32.57,	44.09 (37.96,	10.95 (4.69, 17.28)	1.33 (1.13, 1.58)

OA		36.31)	44.42)	39.11)	45.75)	41.62)	43.41)	50.44)	46.56)	47.93)	50.23)		
OA	1999	48.03 (42.83, 53.24)	42.94 (37.61, 48.28)	41.27 (35.81, 46.73)	51.3 (46.01, 56.6)	47.75 (42.69, 52.8)	50.49 (44.87, 56.1)	51.65 (45.69, 57.6)	56.47 (50.36, 62.59)	60.82 (54.95, 66.69)	60.14 (54.49, 65.79)	18.01 (11.87, 24.02)	1.43 (1.27, 1.63)
Non-OA	1999	36.8 (31.63, 41.96)	34.46 (29.28, 39.65)	39.21 (33.91, 44.5)	38.38 (33.31, 43.44)	38.46 (33.53, 43.39)	39.56 (34.14, 44.97)	40.48 (34.84, 46.11)	44.44 (38.17, 50.72)	41.6 (35.46, 47.74)	44.18 (38.46, 49.9)	8.77 (2.79, 14.73)	1.25 (1.07, 1.46)
OA	2000	47.95 (42.8, 53.09)	44.66 (39.1, 50.23)	51.7 (46.47, 56.94)	53.32 (48.26, 58.37)	50.77 (45.8, 55.73)	57.88 (51.99, 63.76)	50 (44.14, 55.86)	56.49 (50.46, 62.52)	57.51 (51.13, 63.89)	61.41 (55.98, 66.85)	13.73 (7.63, 19.78)	1.3 (1.16, 1.46)
Non-OA	2000	38 (32.9, 43.1)	42.22 (36.9, 47.53)	37.64 (32.64, 42.63)	36.55 (31.78, 41.32)	35.88 (31.12, 40.63)	47.49 (41.81, 53.18)	41.53 (35.37, 47.7)	52.09 (46.03, 58.16)	47.33 (41.02, 53.63)	50 (43.99, 56.01)	13.76 (7.66, 19.82)	1.39 (1.2, 1.61)
OA	2001	46.58 (41.44, 51.71)	50 (44.98, 55.02)	50.73 (45.41, 56.06)	53.24 (48.43, 58.04)	57.52 (52.74, 62.31)	58.31 (52.88, 63.74)	57.41 (51.95, 62.88)	61.87 (56.14, 67.61)	56.52 (50.65, 62.4)	58.89 (53.67, 64.12)	14.05 (8.24, 19.84)	1.29 (1.16, 1.45)
Non-OA	2001	41.93 (36.98, 46.88)	35.59 (30.59, 40.6)	42.23 (37.16, 47.3)	45.89 (41.08, 50.71)	45.5 (40.79, 50.2)	46.81 (41.65, 51.98)	42.86 (37.31, 48.41)	44.79 (38.7, 50.87)	52.73 (46.8, 58.65)	51.18 (45.47, 56.89)	11.94 (6.27, 17.79)	1.31 (1.15, 1.49)
OA	2002	48.09 (43.56, 52.61)	52.67 (48.04, 57.29)	48.22 (43.59, 52.85)	51.68 (47.31, 56.05)	55.36 (51.01, 59.71)	57.11 (52.16, 62.05)	60.68 (55.95, 65.41)	55.7 (50.73, 60.67)	56.92 (51.45, 62.38)	67.54 (62.58, 72.49)	15.95 (10.75, 21.24)	1.34 (1.22, 1.48)
Non-OA	2002	37.94 (33.61, 42.27)	36.55 (32.07, 41.03)	45.21 (40.8, 49.63)	40.67 (36.38, 44.97)	43 (38.59, 47.42)	45.11 (40.22, 50.01)	47.77 (42.89, 52.66)	46.37 (41.19, 51.55)	55.78 (50.16, 61.39)	55.27 (50.05, 60.49)	17.93 (12.7, 23.07)	1.5 (1.33, 1.71)
OA	2003	46.61 (42.85, 50.37)	51.26 (47.36, 55.16)	55.46 (51.4, 59.52)	53.6 (49.92, 57.27)	54.52 (50.55, 58.48)	58.59 (54.36, 62.82)	58.58 (54.28, 62.88)	62.76 (58.16, 67.36)	62.87 (58.15, 67.6)	68.23 (64.01, 72.45)	19.69 (15.23, 24.17)	1.42 (1.31, 1.55)
Non-	2003	40.56 (36.86,	45.4 (41.6,	41.86 (37.88,	45.74 (41.98,	49.07 (45.19,	47.89 (43.6,	48.69 (44.27,	53.29 (48.62,	47.98 (43.04,	57.77 (53.1,	14.01 (9.38, 18.46)	1.35 (1.22, 1.49)

OA		44.26)	49.2)	45.85)	49.49)	52.94)	52.19)	53.1)	57.96)	52.92)	62.45)		
OA	2004	47.92 (44.27, 51.57)	53.56 (49.94, 57.19)	55.01 (51.34, 58.68)	57.7 (54.21, 61.19)	55.24 (51.7, 58.77)	60.19 (56.33, 64.06)	62.65 (58.71, 66.59)	61.4 (57.18, 65.63)	70.56 (66.54, 74.59)	70.15 (66.04, 74.25)	21.18 (17, 25.28)	1.44 (1.34, 1.56)
Non-OA	2004	43.12 (39.6, 46.64)	43.32 (39.67, 46.97)	46.75 (43.18, 50.32)	44.05 (40.56, 47.53)	47.11 (43.38, 50.84)	49.15 (45.28, 53.01)	52.63 (48.52, 56.74)	53.28 (48.91, 57.65)	53.95 (49.3, 58.6)	53.82 (49.54, 58.1)	13.5 (9.19, 17.75)	1.33 (1.21, 1.45)
OA	2005	53.46 (50.13, 56.78)	53.52 (50.14, 56.9)	54.67 (51.22, 58.12)	54.19 (50.85, 57.52)	58.56 (55.22, 61.91)	60.67 (57.01, 64.34)	61.4 (57.71, 65.09)	64.47 (60.66, 68.29)	67.91 (64.05, 71.77)	69.92 (65.81, 74.02)	17.95 (14.02, 21.79)	1.36 (1.27, 1.46)
Non-OA	2005	42.47 (39.2, 45.73)	46.46 (43.19, 49.74)	45.7 (42.2, 49.2)	48.61 (45.21, 52.02)	46.37 (43.08, 49.67)	49.24 (45.41, 53.07)	48.94 (45.13, 52.76)	50.17 (46.16, 54.18)	56.05 (51.84, 60.26)	55.17 (50.77, 59.57)	11.55 (7.53, 15.63)	1.27 (1.17, 1.38)
OA	2006	50.84 (47.45, 54.23)	54.79 (51.47, 58.1)	57.18 (53.86, 60.49)	59.24 (55.96, 62.52)	58.88 (55.55, 62.21)	59.95 (56.41, 63.48)	61.88 (58.31, 65.46)	68.07 (64.46, 71.68)	64.52 (60.37, 68.67)	72.33 (68.42, 76.24)	18.43 (14.55, 22.32)	1.36 (1.28, 1.46)
Non-OA	2006	41.04 (37.76, 44.32)	45.42 (42.21, 48.62)	43.15 (39.78, 46.52)	48.68 (45.42, 51.93)	45.1 (41.91, 48.28)	49.55 (45.74, 53.36)	52.54 (48.75, 56.34)	50.08 (46.08, 54.09)	53.11 (48.85, 57.36)	54.73 (50.09, 59.37)	12.94 (8.89, 16.93)	1.32 (1.21, 1.43)
OA	2007	49.23 (46.1, 52.37)	51.75 (48.56, 54.95)	58.74 (55.57, 61.9)	58.2 (55.08, 61.31)	55.56 (52.46, 58.65)	58.62 (55.17, 62.08)	62.64 (59.26, 66.03)	65.57 (62.05, 69.1)	66.3 (62.63, 69.98)	72.73 (69.03, 76.42)	20.45 (16.83, 24)	1.42 (1.33, 1.51)
Non-OA	2007	41.28 (38.36, 44.21)	43.53 (40.45, 46.61)	44.97 (41.77, 48.16)	46.29 (43.08, 49.5)	45.69 (42.56, 48.82)	49.87 (46.4, 53.35)	47.11 (43.55, 50.66)	53.18 (49.41, 56.94)	54.56 (50.38, 58.74)	59.02 (54.98, 63.06)	15.67 (11.98, 19.44)	1.4 (1.29, 1.51)
OA	2008	46.93 (44.07, 49.79)	53.57 (50.64, 56.49)	57.42 (54.53, 60.31)	55.62 (52.66, 58.58)	57.07 (54.07, 60.08)	62.73 (59.61, 65.85)	61.88 (58.71, 65.05)	65.42 (62.01, 68.83)	68.29 (64.88, 71.7)	69.53 (66.14, 72.93)	22.02 (18.63, 25.37)	1.46 (1.38, 1.55)
Non-	2008	39.36 (36.6,	42.34 (39.49,	48.2 (45.3,	45.56 (42.58,	46.17 (43.25,	49.39 (46.13,	52.69 (49.34,	52.99 (49.42,	53.06 (49.32,	59.79 (56.04,	17.8 (14.41, 21.19)	1.46 (1.35, 1.57)

OA		42.11)	45.19)	51.11)	48.55)	49.09)	52.66)	56.04)	56.56)	56.8)	63.54)		
OA	2009	51.43 (48.4, 54.46)	54.04 (50.76, 57.31)	54.09 (50.98, 57.19)	58.49 (55.34, 61.64)	57.68 (54.5, 60.86)	57.85 (54.2, 61.5)	63.43 (60.01, 66.86)	68.3 (64.78, 71.83)	68.31 (64.54, 72.09)	73.22 (69.69, 76.76)	21.69 (18.17, 25.3)	1.45 (1.35, 1.54)
Non-OA	2009	41.97 (38.88, 45.06)	45.84 (42.7, 48.97)	45.17 (42.17, 48.18)	48.43 (45.26, 51.6)	49.78 (46.49, 53.06)	51.99 (48.36, 55.63)	50.8 (47.21, 54.4)	51.99 (48.08, 55.91)	53.76 (49.8, 57.72)	57.19 (53.1, 61.29)	14 (10.26, 17.76)	1.33 (1.23, 1.45)
OA	2010	50.68 (47.23, 54.13)	50.21 (46.54, 53.88)	56.98 (53.55, 60.41)	57.57 (53.99, 61.16)	58.13 (54.56, 61.7)	61.73 (57.8, 65.67)	64.14 (60.33, 67.96)	66.94 (62.79, 71.09)	67.69 (63.66, 71.72)	70.78 (66.51, 75.05)	21.97 (17.85, 26.11)	1.45 (1.36, 1.56)
Non-OA	2010	43.59 (40.22, 46.96)	46.01 (42.48, 49.55)	48.5 (45.09, 51.9)	46.58 (42.95, 50.2)	46.84 (43.29, 50.4)	50.68 (46.64, 54.71)	51.72 (47.54, 55.89)	55.33 (50.95, 59.71)	58.15 (53.6, 62.7)	57.91 (53.23, 62.59)	14.64 (10.33, 18.85)	1.35 (1.23, 1.47)
OA	2011	54.3 (50.54, 58.07)	55.62 (51.79, 59.45)	58.57 (54.84, 62.3)	56.19 (52.36, 60.03)	56.22 (52.25, 60.19)	61.05 (56.83, 65.26)	63.47 (59.25, 67.7)	66.5 (61.86, 71.14)	66.83 (62.29, 71.36)	72.85 (68.32, 77.38)	16.76 (12.37, 21.17)	1.32 (1.23, 1.43)
Non-OA	2011	42.8 (39.2, 46.4)	46.14 (42.33, 49.95)	50.08 (46.25, 53.91)	47.41 (43.52, 51.29)	49.75 (45.76, 53.74)	49.4 (45.03, 53.78)	53.49 (49.11, 57.87)	58.5 (53.72, 63.27)	57.96 (53.12, 62.8)	62.06 (56.88, 67.24)	17.53 (12.8, 22.17)	1.42 (1.29, 1.56)
OA	2012	49.43 (45.49, 53.38)	56.86 (52.73, 60.99)	58.94 (54.81, 63.07)	54.91 (50.53, 59.29)	57.17 (52.92, 61.42)	65.42 (60.9, 69.94)	60.59 (55.61, 65.57)	61.4 (56.23, 66.58)	69.01 (63.87, 74.15)	72.24 (67.14, 77.34)	18.72 (13.87, 23.56)	1.38 (1.26, 1.5)
Non-OA	2012	46.95 (42.91, 50.98)	45.2 (41.07, 49.32)	47.64 (43.37, 51.9)	47.3 (42.74, 51.86)	50.2 (45.76, 54.65)	55.45 (50.8, 60.11)	55.47 (50.48, 60.46)	53.04 (48.2, 57.88)	58.11 (52.84, 63.38)	59.25 (53.59, 64.91)	14.78 (9.71, 19.84)	1.34 (1.21, 1.49)
OA	2013	48.97 (44.73, 53.22)	51.07 (46.28, 55.86)	59.57 (55.07, 64.06)	60.3 (55.51, 65.09)	56.88 (52.18, 61.58)	58.58 (53.6, 63.55)	62.92 (57.89, 67.96)	64.74 (59.56, 69.92)	68.29 (62.45, 74.14)	69.65 (64, 75.3)	20.1 (14.59, 25.55)	1.41 (1.28, 1.55)
Non-	2013	43.56	50.33 (45.74,	48.92 (44.36,	52.04 (47.23,	52.82 (48.06,	50.28 (45.1,	54.63 (49.28,	58.2 (52.7,	58.55 (52.7,	65.83 (59.8,	17.33 (11.93,	1.4 (1.25, 1.56)

OA		(39.32, 47.8)	54.91)	53.48)	56.85)	57.57)	55.46)	59.98)	63.7)	64.39)	71.86)	22.77)	
OA	2014	50 (45.35, 54.65)	55.26 (50.18, 60.33)	54.69 (49.62, 59.76)	60.26 (55.38, 65.13)	55.61 (50.62, 60.61)	59.33 (53.98, 64.67)	57.39 (51.62, 63.17)	66.17 (60.45, 71.88)	69.48 (63.73, 75.23)	70.3 (63.96, 76.64)	18.55 (12.8, 24.42)	1.38 (1.24, 1.53)
Non-OA	2014	42.06 (37.47, 46.65)	49.77 (45.03, 54.51)	45.54 (40.67, 50.42)	51.13 (45.9, 56.36)	51.59 (46.53, 56.64)	56.68 (51.11, 62.24)	57 (51.44, 62.56)	58.04 (51.95, 64.13)	57.64 (50.8, 64.47)	64.56 (57.99, 71.13)	20.21 (14.32, 26.16)	1.48 (1.32, 1.67)
OA	2015	47.15 (42.56, 51.74)	56.29 (50.82, 61.76)	52.63 (47, 58.27)	58.05 (52.43, 63.68)	56.14 (50.86, 61.42)	60.52 (54.21, 66.82)	57.38 (51.06, 63.71)	62.15 (55.61, 68.69)	70.98 (64.54, 77.43)	71.2 (64.74, 77.67)	21.69 (15.55, 27.91)	1.46 (1.31, 1.64)
Non-OA	2015	44.2 (39.4, 49)	49.08 (43.63, 54.53)	48.18 (42.77, 53.59)	45.66 (40.1, 51.22)	49.84 (44.26, 55.42)	55.76 (49.89, 61.62)	51.08 (44.6, 57.56)	58.88 (51.97, 65.8)	60.91 (54.43, 67.39)	63.69 (56.36, 71.02)	18.38 (12.08, 24.73)	1.44 (1.26, 1.64)
OA	2016	49.86 (44.56, 55.15)	56.34 (50.38, 62.31)	58.19 (51.81, 64.57)	53.07 (45.71, 60.43)	60.99 (54.55, 67.42)	53.8 (46.27, 61.33)	57.63 (50.3, 64.96)	71.07 (63.97, 78.17)	68.67 (61.18, 76.15)	73.98 (66.15, 81.82)	20.8 (13.4, 28.2)	1.43 (1.26, 1.63)
Non-OA	2016	46.09 (40.91, 51.27)	46.07 (40.06, 52.07)	54.63 (47.95, 61.31)	48.89 (41.54, 56.24)	49.79 (43.33, 56.24)	53.1 (44.91, 61.3)	56.48 (49.44, 63.52)	63.16 (55.43, 70.89)	61.21 (53.72, 68.7)	68.64 (60.18, 77.1)	21.02 (13.62, 28.74)	1.49 (1.29, 1.74)
OA	2017	47.43 (42.03, 52.83)	50.59 (44.4, 56.78)	57.97 (51.21, 64.74)	61.27 (53.96, 68.58)	52.24 (45.29, 59.19)	59.52 (50.87, 68.18)	65.49 (57.61, 73.38)	68.09 (60.32, 75.85)	70.64 (61.99, 79.29)	78.16 (69.35, 86.97)	27.46 (19.74, 35.17)	1.62 (1.41, 1.88)
Non-OA	2017	41.74 (36.6, 46.87)	54.15 (48.26, 60.05)	47.09 (39.93, 54.25)	61.07 (53.18, 68.97)	49.74 (42.6, 56.87)	51.91 (43.27, 60.55)	58.22 (50.15, 66.29)	70 (61.34, 78.66)	59.68 (50.96, 68.4)	67.71 (58.23, 77.19)	23.51 (15.51, 31.53)	1.57 (1.34, 1.85)
OA	Age 35-44 years	35.19 (31.21, 39.16)	33.77 (29.74, 37.81)	38.66 (34.54, 42.79)	41.52 (37.5, 45.55)	42.68 (38.63, 46.74)	45.09 (40.92, 49.26)	50.46 (46.25, 54.67)	48.8 (44.41, 53.19)	54.75 (50.65, 58.86)	56.77 (52.98, 60.57)	25.92 (21.44, 30.4)	1.81 (1.63, 2.03)
Non-	Age 35-44	25.6 (22.18,	26.63 (22.99,	30.41 (26.74,	27.14 (23.56,	33.28 (29.53,	37.2 (32.91,	35.74 (31.69,	39.12 (34.74,	42.11 (37.82,	45.23 (41.12,	21.75 (17.48,	1.95 (1.69, 2.25)

OA	years	29.01)	30.28)	34.09)	30.71)	37.03)	41.48)	39.79)	43.51)	46.39)	49.34)	25.95)	
OA	Age 45-54 years	41.28 (39.43, 43.13)	45.48 (43.42, 47.55)	49.01 (46.94, 51.09)	50.17 (48.17, 52.16)	50.77 (48.74, 52.8)	54.45 (52.32, 56.58)	56.15 (54.02, 58.27)	60.24 (58.01, 62.47)	63.93 (61.72, 66.13)	67.73 (65.67, 69.78)	26.78 (24.54, 29.07)	1.67 (1.6, 1.75)
Non-OA	Age 45-54 years	34.89 (33.13, 36.65)	39.13 (37.21, 41.05)	39.93 (37.94, 41.92)	40.76 (38.83, 42.7)	42.23 (40.27, 44.18)	43.72 (41.59, 45.85)	45.71 (43.49, 47.94)	49.38 (47.04, 51.71)	51.77 (49.37, 54.16)	53.13 (50.81, 55.45)	18.62 (16.38, 20.87)	1.55 (1.47, 1.64)
OA	Age 55-64 years	48.27 (46.82, 49.71)	52.11 (50.57, 53.64)	55.6 (54.06, 57.14)	57.2 (55.73, 58.67)	55.4 (53.9, 56.89)	60.43 (58.79, 62.06)	62.14 (60.48, 63.8)	65.34 (63.57, 67.11)	67.7 (65.88, 69.51)	72.28 (70.57, 73.99)	22.59 (20.86, 24.33)	1.48 (1.43, 1.53)
Non-OA	Age 55-64 years	41.84 (40.43, 43.25)	45.36 (43.87, 46.85)	46.02 (44.48, 47.55)	49.14 (47.64, 50.63)	47.47 (45.97, 48.97)	51.02 (49.34, 52.71)	52.06 (50.34, 53.79)	55 (53.15, 56.86)	55.57 (53.6, 57.55)	59.25 (57.33, 61.17)	16.4 (14.61, 18.17)	1.4 (1.35, 1.45)
OA	Age 65-74 years	53.17 (51.51, 54.84)	58.16 (56.45, 59.87)	58.02 (56.32, 59.72)	57.76 (56.06, 59.46)	59.75 (58.08, 61.42)	60.42 (58.53, 62.3)	62.74 (60.82, 64.66)	66.23 (64.27, 68.2)	67.42 (65.31, 69.52)	68.02 (65.92, 70.12)	14.52 (12.53, 16.51)	1.27 (1.23, 1.32)
Non-OA	Age 65-74 years	44.12 (42.46, 45.77)	48.26 (46.54, 49.98)	48.85 (47.14, 50.57)	46.74 (44.99, 48.48)	48.41 (46.69, 50.13)	51.94 (50.03, 53.85)	52.02 (50.03, 54)	53.36 (51.25, 55.46)	56.76 (54.56, 58.96)	55.63 (53.45, 57.8)	11.74 (9.69, 13.82)	1.27 (1.21, 1.32)
OA	Age 75-84 years	52.99 (50.72, 55.26)	53.95 (51.67, 56.23)	55.53 (53.29, 57.77)	54.59 (52.35, 56.82)	53.6 (51.34, 55.85)	58.93 (56.43, 61.43)	58.56 (56.03, 61.09)	59.77 (57.09, 62.45)	61.11 (58.27, 63.95)	59.31 (56.41, 62.21)	8.4 (5.7, 11.05)	1.16 (1.11, 1.22)
Non-OA	Age 75-84 years	46.09 (43.81, 48.37)	43.16 (40.89, 45.43)	46.01 (43.76, 48.27)	44.46 (42.19, 46.73)	44.18 (41.92, 46.44)	46.74 (44.25, 49.23)	47.12 (44.6, 49.64)	48.81 (46.1, 51.53)	48.62 (45.74, 51.5)	47.4 (44.41, 50.38)	4.14 (1.42, 6.84)	1.09 (1.03, 1.16)
OA	Age 85+ years	42.69 (36.56, 48.81)	49.63 (43.64, 55.62)	46.71 (40.94, 52.49)	47.88 (41.76, 53.99)	45.79 (39.85, 51.72)	45.41 (38.77, 52.06)	41.31 (34.66, 47.97)	49.08 (41.35, 56.81)	49.04 (41.16, 56.93)	41.09 (32.51, 49.66)	-1.31 (-8.57, 5.84)	0.97 (0.83, 1.14)
Non-	Age 85+ years	41.08 (34.84,	41.92 (35.9,	38.27 (32.52,	35.94 (30.31,	36.01 (30.43,	38.1 (31.49,	35.86 (29.14,	35.57 (28.79,	39.06 (30.53,	40.27 (32.33,	-3.83 (-10.84, 3.39)	0.9 (0.75, 1.09)

OA		47.32)	47.95)	44.02)	41.58)	41.6)	44.7)	42.58)	42.35)	47.6)	48.21)		
OA	Men	49.4 (47.96, 50.85)	52.46 (50.96, 53.97)	53.78 (52.27, 55.29)	54.65 (53.17, 56.13)	54.61 (53.13, 56.09)	58.01 (56.38, 59.64)	58.27 (56.59, 59.94)	60.9 (59.15, 62.65)	63.63 (61.81, 65.46)	66.71 (64.97, 68.46)	16.18 (14.39, 17.91)	1.34 (1.29, 1.38)
Non-OA	Men	49.27 (47.83, 50.72)	50.72 (49.24, 52.2)	50.96 (49.46, 52.46)	51.37 (49.88, 52.86)	52.25 (50.74, 53.76)	52.98 (51.33, 54.62)	53.31 (51.6, 55.01)	55.3 (53.48, 57.11)	55.23 (53.36, 57.1)	56.99 (55.15, 58.84)	7.43 (5.64, 9.19)	1.15 (1.11, 1.19)
OA	Women	47.44 (46.4, 48.49)	51.62 (50.52, 52.72)	54.22 (53.13, 55.31)	54.75 (53.68, 55.81)	54.63 (53.56, 55.71)	57.8 (56.63, 58.97)	60.02 (58.85, 61.2)	63.23 (61.99, 64.47)	65.09 (63.82, 66.35)	66.91 (65.68, 68.14)	19.53 (18.3, 20.77)	1.42 (1.39, 1.45)
Non-OA	Women	36.47 (35.48, 37.46)	39.95 (38.9, 41)	41.41 (40.34, 42.48)	41.49 (40.43, 42.55)	41.84 (40.79, 42.89)	45.74 (44.55, 46.92)	46.56 (45.35, 47.77)	49.15 (47.86, 50.44)	51.64 (50.27, 53)	52.6 (51.26, 53.94)	16.42 (15.16, 17.68)	1.46 (1.42, 1.51)
OA	East Midlands	48.82 (42.64, 55)	56.6 (52.25, 60.95)	55.53 (50.84, 60.22)	58.19 (54.19, 62.19)	57.89 (52.49, 63.3)	57.36 (52.03, 62.69)	60 (56.26, 63.74)	56.44 (51.92, 60.95)	61.52 (57.4, 65.64)	62.26 (56.3, 68.21)	8 (2.75, 13.04)	1.15 (1.05, 1.26)
Non-OA	East Midlands	40 (33.9, 46.1)	42.63 (38.29, 46.97)	44.78 (40.4, 49.16)	44.96 (40.85, 49.07)	43.14 (37.51, 48.78)	47.65 (42.32, 52.98)	48.87 (44.92, 52.82)	45.15 (40.5, 49.79)	49.66 (45.63, 53.69)	50.41 (44.08, 56.74)	8.74 (3.64, 13.87)	1.21 (1.08, 1.36)
OA	East of England	45.81 (43.74, 47.89)	51.26 (48.89, 53.63)	51.81 (49.09, 54.54)	54 (51.64, 56.36)	53.32 (50.75, 55.9)	56.5 (53.94, 59.06)	56.55 (53.85, 59.25)	58.46 (54.73, 62.18)	62.47 (57.92, 67.02)	62.15 (56.79, 67.51)	14.65 (11.61, 17.68)	1.32 (1.24, 1.4)
Non-OA	East of England	40.17 (38.13, 42.21)	40.53 (38.2, 42.86)	44.73 (42.07, 47.4)	44.49 (42.14, 46.84)	42.72 (40.22, 45.23)	46.89 (44.27, 49.51)	48.07 (45.26, 50.88)	46.71 (42.92, 50.5)	52.5 (48.02, 56.98)	49.68 (44.07, 55.28)	10.4 (7.39, 13.42)	1.27 (1.18, 1.36)
OA	London	47.74 (44, 51.49)	52.58 (49.37, 55.79)	59.58 (56.21, 62.96)	55.85 (52.96, 58.74)	56.23 (53.51, 58.95)	58.66 (55.72, 61.59)	61.62 (58.9, 64.33)	62.89 (60.09, 65.69)	66.28 (63.5, 69.06)	72.45 (68.01, 76.89)	17.69 (14.34, 21.04)	1.35 (1.28, 1.44)
Non-	London	41.76 (38.11,	44.15 (40.99,	45.97 (42.5,	44.78 (41.91,	46.72 (43.98,	47.5 (44.51,	47.78 (45,	50.31 (47.4,	51.42 (48.5,	50.68	9.2 (5.73, 12.65)	1.22 (1.13, 1.31)

OA		45.41)	47.32)	49.44)	47.65)	49.45)	50.48)	50.56)	53.22)	54.35)	(45.56, 55.8)		
OA	North East	39.21 (33.91, 44.5)	48.33 (42.33, 54.33)	50 (42.43, 57.57)	52.71 (46.59, 58.83)	52.3 (44.82, 59.77)	61.39 (56, 66.78)	58.86 (53.41, 64.31)	62.07 (57.5, 66.64)	61.72 (55.74, 67.7)	68.56 (65.52, 71.59)	30.19 (24.66, 35.81)	1.7 (1.53, 1.9)
Non-OA	North East	36.31 (31.15, 41.47)	46.92 (41.84, 52)	43.58 (36.26, 50.89)	46.76 (40.07, 53.45)	42.47 (35.32, 49.62)	52.58 (47, 58.16)	44.95 (39.17, 50.73)	48.66 (44.02, 53.3)	50.21 (43.89, 56.52)	57.16 (53.82, 60.5)	18.93 (13.16, 24.73)	1.48 (1.31, 1.68)
OA	North West	47.99 (45.31, 50.66)	53.79 (51.52, 56.07)	55.28 (53.19, 57.38)	57.83 (55.41, 60.24)	56.99 (54.73, 59.24)	60.25 (57.91, 62.59)	59.43 (57.14, 61.73)	64.12 (61.92, 66.31)	64.98 (62.97, 67)	68.07 (66.41, 69.73)	19.23 (16.87, 21.61)	1.38 (1.33, 1.44)
Non-OA	North West	39.66 (37.11, 42.21)	47.58 (45.37, 49.78)	47.52 (45.43, 49.61)	49.1 (46.69, 51.5)	49.83 (47.5, 52.16)	51.98 (49.58, 54.38)	52.05 (49.74, 54.36)	52.8 (50.47, 55.13)	54.39 (52.21, 56.56)	56.14 (54.37, 57.91)	13.88 (11.47, 16.29)	1.32 (1.25, 1.38)
OA	South Central	50.64 (48.97, 52.32)	51.01 (48.58, 53.44)	55.03 (52.26, 57.8)	55.05 (52.42, 57.69)	56.69 (53.93, 59.44)	59.22 (56.24, 62.2)	61.36 (58.27, 64.45)	66.07 (62.64, 69.51)	63.46 (59.09, 67.84)	63.86 (56.49, 71.22)	16.13 (13.02, 19.15)	1.34 (1.27, 1.42)
Non-OA	South Central	41.7 (40.07, 43.34)	41.82 (39.44, 44.19)	41.92 (39.11, 44.73)	46.53 (43.91, 49.15)	44.19 (41.44, 46.94)	45.15 (42.21, 48.09)	47.47 (44.22, 50.72)	53.33 (49.6, 57.06)	49.22 (44.57, 53.86)	56.43 (48.14, 64.72)	10.04 (6.99, 13.14)	1.26 (1.17, 1.35)
OA	South East Coast	47.52 (45.36, 49.68)	50.91 (48.84, 52.99)	53.84 (51.67, 56.01)	55.04 (52.74, 57.33)	54.56 (52.03, 57.09)	57.52 (54.53, 60.52)	58.01 (54.49, 61.54)	62.28 (59.11, 65.44)	65.76 (62.23, 69.29)	69.8 (63.43, 76.17)	16.61 (13.65, 19.48)	1.36 (1.29, 1.44)
Non-OA	South East Coast	40.26 (38.15, 42.37)	43.39 (41.39, 45.39)	42.31 (40.13, 44.49)	43.88 (41.58, 46.17)	48.59 (46.05, 51.13)	50.14 (47.1, 53.19)	47.87 (44.23, 51.51)	50.54 (47.31, 53.77)	51.49 (47.6, 55.37)	52.43 (45.19, 59.68)	12.25 (9.33, 15.22)	1.31 (1.23, 1.4)
OA	South West	49.04 (45.64, 52.44)	52.69 (49.99, 55.39)	52.87 (50.28, 55.46)	54.68 (51.9, 57.45)	53.43 (51.38, 55.47)	55.51 (52.97, 58.05)	60.91 (58.1, 63.73)	63.12 (60.28, 65.95)	64.39 (61.37, 67.41)	66.12 (62.81, 69.43)	16.13 (13.11, 19.16)	1.33 (1.26, 1.41)
Non-	South West	39.45 (36.14,	46.05 (43.35,	46.48	44.96 (42.19,	42.51 (40.5,	45.72 (43.17,	49.6 (46.69,	52.9 (50,	55.29 (52,	52.16 (48.61,	11.26 (8.24, 14.32)	1.27 (1.2, 1.36)

OA		42.76)	48.74)	(43.95, 49)	47.73)	44.51)	48.28)	52.51)	55.81)	58.58)	55.71)		
OA	West Midlands	48.86 (46.61, 51.12)	52.13 (49.45, 54.82)	53.67 (51.51, 55.83)	53.64 (51.26, 56.02)	53.12 (50.8, 55.44)	56.2 (53.53, 58.88)	58.35 (55.67, 61.04)	63.81 (60.94, 66.69)	64.4 (61.57, 67.23)	65.72 (63.48, 67.96)	18.03 (15.33, 20.71)	1.38 (1.31, 1.45)
Non-OA	West Midlands	42.09 (39.87, 44.31)	43.66 (41.12, 46.2)	44.23 (42.12, 46.34)	45.27 (42.86, 47.68)	46.25 (43.92, 48.57)	50.38 (47.67, 53.1)	48.6 (45.9, 51.3)	54.55 (51.51, 57.58)	55.45 (52.46, 58.44)	52.92 (50.51, 55.34)	14.27 (11.6, 17.02)	1.35 (1.28, 1.44)
OA	Yorkshire & The Humber	44.99 (40.15, 49.82)	46.77 (41.78, 51.76)	49.72 (45.52, 53.93)	50.34 (47.65, 53.03)	51.48 (47.8, 55.16)	59.17 (55.32, 63.03)	59.16 (55.2, 63.12)	56.29 (51.63, 60.96)	66.67 (62.1, 71.24)	63.02 (59.22, 66.82)	20.35 (16.1, 24.76)	1.46 (1.35, 1.59)
Non-OA	Yorkshire & The Humber	42.09 (37.41, 46.77)	35.54 (30.7, 40.39)	43.25 (39.33, 47.18)	38.6 (35.9, 41.29)	40.82 (37.47, 44.17)	44.2 (40.34, 48.06)	46.74 (42.62, 50.85)	48.19 (43.37, 53.01)	50.27 (45.15, 55.4)	50.95 (46.87, 55.04)	12.99 (8.56, 17.32)	1.35 (1.22, 1.5)
IMD, Indices of multiple deprivation; 95%CI, 95% confidence interval; CVRF, cardiovascular risk factors; OA, osteoarthritis													

Appendix 3.2.4. Imputed measures of inequality in the prevalence of number of ≥3 CVRFs in OA and non-OA samples by subgroups, 1992-2017

OA status	Subgroup	Period prevalence by IMD decile (%) (95%CI)										Slope index of inequality (95%CI)(%)	Relative index of inequality (95%CI)
		1 (Least deprived)	2	3	4	5	6	7	8	9	10(Most deprived)		
OA	1992	4.17 (-4.31, 12.64)	11.63 (1.75, 21.51)	8.11 (-1.01, 17.23)	9.23 (2.05, 16.41)	12.2 (1.85, 22.54)	14.29 (2.24, 26.33)	10.42 (1.54, 19.3)	11.32 (2.58, 20.06)	17.5 (5.33, 29.67)	15.25 (5.88, 24.63)	8.53 (-1.92, 18.98)	2.15 (0.78, 9.98)
Non-OA	1992	8.33 (-3.39, 20.06)	5.56 (-2.21, 13.32)	11.76 (2.69, 20.84)	11.11 (3.19, 19.03)	13.33 (3.11, 23.56)	16 (5.57, 26.43)	8.7 (0.32, 17.07)	13.04 (3.03, 23.06)	9.52 (-3.92, 22.97)	11.11 (3.19, 19.03)	2.78 (-7.24, 12.7)	1.28 (0.5, 3.79)
OA	1993	8.8 (3.78, 13.82)	11.34 (4.95, 17.73)	8.59 (3.69, 13.5)	16.04 (10.75, 21.34)	5 (1.79, 8.21)	11.24 (6.45, 16.04)	9.93 (4.95, 14.91)	13.79 (7.45, 20.14)	16.67 (8.86, 24.47)	17.52 (11.1, 23.94)	6.53 (0.31, 12.79)	1.78 (1.02, 3.4)
Non-OA	1993	8.7 (3.49, 13.9)	10.08 (4.62, 15.55)	11.02 (5.52, 16.52)	8.02 (4.34, 11.7)	9.66 (5.26, 14.05)	12.86 (7.26, 18.45)	11.19 (5.81, 16.58)	9.01 (3.62, 14.4)	10.31 (4.18, 16.44)	10.07 (5.02, 15.12)	1.34 (-4.31, 6.81)	1.14 (0.65, 2.07)
OA	1994	11.02 (6.03, 16.01)	15.67 (9.46, 21.88)	16.33 (10.3, 22.35)	9.55 (5.64, 13.45)	13.56 (8.48, 18.64)	10.88 (6.46, 15.3)	17.48 (11.2, 23.76)	11.21 (5.4, 17.01)	19.84 (12.81, 26.87)	15.64 (10.28, 21)	4.06 (-2.02, 10.11)	1.35 (0.86, 2.18)

Non-OA	1994	8.24 (4.07, 12.4)	9.29 (4.44, 14.14)	8.75 (4.34, 13.16)	8.89 (5.15, 12.63)	7.19 (3.24, 11.13)	11.32 (6.36, 16.28)	8.4 (3.6, 13.19)	10.17 (4.66, 15.68)	11.68 (6.25, 17.11)	15.38 (10.11, 20.66)	5.77 (0.46, 11.02)	1.82 (1.05, 3.54)
OA	1995	5.99 (2.36, 9.61)	14.73 (8.55, 20.9)	11.18 (6.13, 16.24)	8.07 (4.48, 11.67)	10.29 (6.1, 14.49)	16.33 (11.12, 21.53)	16.03 (10.22, 21.83)	20.93 (13.84, 28.02)	15.58 (9.54, 21.63)	18.27 (12.84, 23.7)	12.32 (6.69, 18.01)	2.7 (1.68, 5.01)
Non-OA	1995	7.23 (3.26, 11.2)	12.33 (6.95, 17.71)	9.94 (5.42, 14.46)	9.05 (5.04, 13.06)	11.27 (6.91, 15.64)	9.14 (4.84, 13.44)	13.86 (8.56, 19.15)	13.01 (7.51, 18.52)	15.45 (9, 21.9)	9.6 (5.47, 13.72)	3.76 (-1.27, 8.83)	1.42 (0.89, 2.41)
OA	1996	10.92 (6.94, 14.91)	14 (9.16, 18.84)	8.13 (3.86, 12.39)	12.2 (8.16, 16.25)	17.18 (12.25, 22.11)	18.55 (13.4, 23.71)	15.27 (10.29, 20.25)	17.14 (11.52, 22.77)	20.79 (14.78, 26.79)	14.59 (10.04, 19.15)	7.78 (2.5, 12.95)	1.71 (1.19, 2.57)
Non-OA	1996	7.79 (4.41, 11.17)	13.4 (8.58, 18.23)	7.34 (3.47, 11.21)	10.59 (6.79, 14.38)	11.02 (7, 15.03)	9.21 (5.44, 12.98)	11.44 (7.01, 15.87)	12.79 (7.76, 17.82)	6.58 (2.61, 10.55)	11.74 (7.56, 15.92)	1.57 (-2.89, 6.11)	1.17 (0.75, 1.85)
OA	1997	8.78 (5.66, 11.89)	15.12 (10.66, 19.57)	15.79 (11.03, 20.55)	13.43 (9.44, 17.42)	16.11 (11.92, 20.3)	16.12 (11.46, 20.77)	19.42 (14.41, 24.43)	19.32 (13.44, 25.19)	18.13 (12.11, 24.14)	23.45 (18.21, 28.69)	12.33 (7.2, 17.37)	2.23 (1.58, 3.33)
Non-OA	1997	10.19 (6.83, 13.55)	15.69 (11.2, 20.17)	12.45 (8.19, 16.71)	11.6 (7.92, 15.29)	13.44 (9.69, 17.19)	13.78 (9.52, 18.04)	11.21 (6.96, 15.47)	16.67 (10.99, 22.34)	18.13 (12.11, 24.14)	15.23 (10.69, 19.77)	4.52 (-0.29, 9.35)	1.4 (0.99, 2.05)
OA	1998	10.45 (7.16, 13.74)	11.41 (7.55, 15.27)	12.46 (8.58, 16.33)	16.57 (12.63, 20.51)	15.57 (11.67, 19.47)	16.44 (12.17, 20.71)	18.43 (13.24, 23.62)	18.67 (13.55, 23.79)	19.89 (14.38, 25.4)	21.48 (16.56, 26.4)	11.76 (7.11, 16.55)	2.18 (1.57, 3.17)
Non-OA	1998	11.9 (8.51, 15.29)	15.85 (11.58, 20.11)	9.3 (5.74, 12.86)	13.98 (10.22, 17.74)	13.91 (10.25, 17.58)	13.17 (9.2, 17.14)	14.96 (10.72, 19.21)	16.16 (11.36, 20.95)	13.84 (8.43, 19.25)	18.9 (14.06, 23.74)	5.11 (0.57, 9.74)	1.44 (1.04, 2.06)
OA	1999	13.48 (9.92, 17.04)	14.71 (10.9, 18.53)	14.92 (10.97, 18.87)	15.36 (11.54, 19.18)	15.65 (11.97, 19.33)	20.2 (15.69, 24.7)	20.88 (16.04, 25.72)	21.57 (16.5, 26.64)	23.13 (18.06, 28.21)	20.96 (16.27, 25.66)	10.83 (6.08, 15.43)	1.88 (1.43, 2.55)

Non-OA	1999	12.46 (8.92, 16)	12.31 (8.72, 15.89)	14.89 (11.03, 18.76)	14.85 (11.15, 18.55)	11.67 (8.42, 14.92)	13.92 (10.09, 17.76)	14.63 (10.57, 18.68)	18.11 (13.24, 22.97)	14 (9.68, 18.32)	16.1 (11.86, 20.33)	3.57 (-0.75, 7.76)	1.29 (0.95, 1.79)
OA	2000	14.52 (10.89, 18.15)	13.92 (10.04, 17.79)	17.9 (13.88, 21.92)	17.29 (13.46, 21.13)	17.41 (13.64, 21.19)	20.88 (16.04, 25.72)	21.99 (17.13, 26.84)	23.65 (18.48, 28.82)	24.89 (19.31, 30.47)	28.94 (23.88, 34)	14.91 (10.07, 19.75)	2.22 (1.69, 3.03)
Non-OA	2000	13.14 (9.59, 16.69)	13.17 (9.53, 16.81)	12.36 (8.97, 15.76)	11.42 (8.27, 14.57)	13.49 (10.1, 16.87)	21.07 (16.43, 25.71)	13.71 (9.41, 18.01)	22.05 (17.02, 27.09)	20.99 (15.84, 26.13)	22.39 (17.37, 27.4)	11.61 (7.01, 16.1)	2.16 (1.59, 3.09)
OA	2001	18.08 (14.12, 22.04)	16.15 (12.45, 19.84)	20.53 (16.23, 24.83)	21.58 (17.62, 25.54)	20.83 (16.89, 24.76)	24.14 (19.42, 28.85)	22.71 (18.08, 27.34)	24.82 (19.72, 29.92)	25.72 (20.54, 30.9)	29.15 (24.33, 33.98)	11.76 (6.94, 16.53)	1.73 (1.37, 2.21)
Non-OA	2001	15.1 (11.51, 18.7)	12.43 (8.98, 15.88)	15.8 (12.06, 19.55)	14.25 (10.87, 17.63)	16.17 (12.69, 19.64)	18.56 (14.54, 22.58)	18.18 (13.86, 22.51)	13.13 (9, 17.26)	17.82 (13.28, 22.36)	22.56 (17.79, 27.33)	6.3 (1.94, 10.65)	1.48 (1.13, 1.98)
OA	2002	17.66 (14.2, 21.12)	18.67 (15.06, 22.28)	19.56 (15.88, 23.23)	19.01 (15.58, 22.44)	25 (21.21, 28.79)	21.96 (17.83, 26.1)	21.84 (17.84, 25.85)	24.09 (19.81, 28.37)	23.9 (19.19, 28.6)	33.33 (28.34, 38.33)	11.76 (7.35, 16.2)	1.72 (1.4, 2.13)
Non-OA	2002	11.13 (8.33, 13.94)	16.37 (12.92, 19.81)	15.07 (11.9, 18.24)	14.29 (11.22, 17.35)	16.05 (12.78, 19.32)	15.29 (11.75, 18.83)	17.82 (14.08, 21.56)	16.48 (12.62, 20.34)	23.76 (18.95, 28.57)	24.5 (19.99, 29.02)	10.4 (6.42, 14.38)	1.91 (1.48, 2.51)
OA	2003	15.93 (13.17, 18.69)	20.98 (17.8, 24.15)	22.01 (18.62, 25.4)	20.73 (17.74, 23.72)	22.96 (19.61, 26.31)	24.62 (20.92, 28.32)	25.05 (21.27, 28.83)	24.82 (20.72, 28.93)	30.59 (26.08, 35.11)	34.12 (29.81, 38.42)	15.16 (11.35, 19.01)	1.95 (1.63, 2.37)
Non-OA	2003	13.13 (10.58, 15.67)	16.29 (13.47, 19.11)	13.9 (11.1, 16.7)	16.03 (13.27, 18.79)	18.69 (15.67, 21.71)	19.54 (16.13, 22.95)	20.81 (17.22, 24.39)	21.09 (17.27, 24.91)	19.44 (15.53, 23.35)	25.99 (21.83, 30.14)	11.16 (7.66, 14.76)	1.9 (1.54, 2.38)
OA	2004	17.17 (14.42, 19.93)	21.1 (18.13, 24.06)	20.87 (17.88, 23.87)	21.86 (18.94, 24.78)	24.21 (21.17, 27.26)	26.7 (23.2, 30.19)	27.54 (23.9, 31.18)	30.02 (26.04, 34)	35.69 (31.46, 39.91)	33.19 (28.97, 37.42)	17.92 (14.31, 21.69)	2.12 (1.8, 2.53)

Non-OA	2004	15.47 (12.9, 18.03)	15.05 (12.42, 17.68)	15.41 (12.82, 17.99)	13.96 (11.52, 16.39)	17.34 (14.52, 20.17)	18.6 (15.6, 21.61)	22.11 (18.69, 25.52)	24.45 (20.69, 28.22)	20.99 (17.19, 24.8)	24.24 (20.56, 27.91)	11.03 (7.75, 14.45)	1.87 (1.54, 2.3)
OA	2005	19.35 (16.72, 21.99)	20.5 (17.76, 23.24)	20.92 (18.1, 23.74)	21.74 (18.98, 24.51)	25.75 (22.78, 28.72)	27.05 (23.71, 30.38)	27.27 (23.9, 30.65)	29.92 (26.28, 33.57)	34.22 (30.3, 38.14)	34.44 (30.19, 38.69)	16.75 (13.25, 20.4)	1.99 (1.71, 2.35)
Non-OA	2005	16.19 (13.76, 18.63)	18.18 (15.65, 20.72)	15.79 (13.22, 18.35)	16.89 (14.33, 19.44)	17.01 (14.52, 19.49)	17.93 (15, 20.87)	18.43 (15.47, 21.39)	21.83 (18.52, 25.15)	25.33 (21.64, 29.01)	25.35 (21.51, 29.2)	8.54 (5.33, 11.78)	1.59 (1.34, 1.92)
OA	2006	18.5 (15.86, 21.13)	20.07 (17.4, 22.74)	23.45 (20.61, 26.29)	23.09 (20.28, 25.91)	25.15 (22.21, 28.09)	28.42 (25.16, 31.67)	28.55 (25.23, 31.88)	33.49 (29.83, 37.15)	33.33 (29.24, 37.42)	35.6 (31.42, 39.79)	18.22 (14.73, 21.72)	2.08 (1.8, 2.43)
Non-OA	2006	15.26 (12.86, 17.66)	17.15 (14.72, 19.58)	17.43 (14.85, 20.01)	19.38 (16.81, 21.96)	16.74 (14.35, 19.13)	20.03 (16.98, 23.08)	21.41 (18.29, 24.52)	21.46 (18.18, 24.75)	24.29 (20.64, 27.95)	24.1 (20.11, 28.09)	8.71 (5.54, 11.93)	1.59 (1.34, 1.9)
OA	2007	17.67 (15.28, 20.06)	20.51 (17.93, 23.09)	27.12 (24.26, 29.97)	22.37 (19.74, 25.01)	23.54 (20.89, 26.18)	23.63 (20.65, 26.61)	27.57 (24.45, 30.7)	30 (26.6, 33.4)	33.07 (29.41, 36.73)	35.83 (31.85, 39.81)	15.54 (12.32, 18.75)	1.89 (1.65, 2.19)
Non-OA	2007	14.86 (12.75, 16.98)	14.74 (12.54, 16.95)	19.81 (17.25, 22.37)	17.98 (15.5, 20.45)	17.56 (15.16, 19.95)	20.35 (17.55, 23.15)	19.47 (16.65, 22.29)	22.3 (19.16, 25.45)	22.08 (18.6, 25.56)	27.67 (23.99, 31.35)	10.39 (7.41, 13.33)	1.75 (1.48, 2.08)
OA	2008	18.77 (16.53, 21.01)	25.13 (22.59, 27.67)	23.29 (20.82, 25.76)	24.95 (22.38, 27.53)	26.2 (23.53, 28.86)	28.17 (25.26, 31.07)	27.62 (24.71, 30.54)	30.17 (26.88, 33.47)	32.55 (29.11, 35.98)	31.88 (28.44, 35.31)	12.78 (9.76, 15.8)	1.64 (1.46, 1.87)
Non-OA	2008	15.1 (13.08, 17.12)	16.02 (13.9, 18.13)	19.75 (17.44, 22.07)	18.21 (15.89, 20.52)	16.31 (14.15, 18.47)	21.82 (19.12, 24.51)	22.31 (19.52, 25.11)	25.37 (22.25, 28.48)	24.2 (20.99, 27.41)	30.05 (26.54, 33.55)	13.08 (10.3, 15.93)	1.97 (1.69, 2.31)
OA	2009	17.75 (15.43, 20.06)	22.42 (19.68, 25.16)	23.41 (20.77, 26.05)	25.16 (22.38, 27.93)	26.64 (23.79, 29.48)	23.9 (20.75, 27.05)	24.64 (21.58, 27.7)	34.08 (30.49, 37.67)	34.07 (30.23, 37.91)	37.85 (33.98, 41.72)	17.61 (14.28, 20.9)	2.02 (1.76, 2.34)

Non-OA	2009	15.75 (13.47, 18.03)	17.27 (14.89, 19.64)	16.76 (14.51, 19.02)	17.89 (15.45, 20.32)	21.14 (18.46, 23.82)	20.91 (17.95, 23.87)	23.73 (20.67, 26.78)	21.53 (18.31, 24.75)	25.82 (22.34, 29.29)	27.53 (23.83, 31.23)	11.87 (8.8, 14.91)	1.84 (1.56, 2.18)
OA	2010	16.56 (14, 19.13)	22.24 (19.18, 25.29)	22.94 (20.03, 25.86)	24.01 (20.91, 27.11)	24.12 (21.03, 27.21)	27.04 (23.44, 30.64)	28.13 (24.54, 31.71)	35.89 (31.66, 40.12)	32.31 (28.28, 36.34)	36.3 (31.79, 40.82)	18.94 (15.22, 22.66)	2.16 (1.84, 2.55)
Non-OA	2010	14.61 (12.21, 17.01)	16.73 (14.08, 19.38)	19.25 (16.57, 21.94)	17.67 (14.9, 20.44)	19.08 (16.28, 21.88)	19.76 (16.55, 22.98)	25.32 (21.68, 28.95)	25.96 (22.09, 29.82)	26.65 (22.57, 30.73)	28.14 (23.88, 32.4)	13.98 (10.58, 17.48)	2.05 (1.7, 2.5)
OA	2011	18.1 (15.19, 21.01)	19.57 (16.51, 22.63)	22.21 (19.06, 25.36)	26.01 (22.62, 29.4)	24.71 (21.26, 28.16)	29.26 (25.33, 33.2)	30.14 (26.11, 34.17)	33.5 (28.86, 38.14)	30.29 (25.86, 34.72)	41.13 (36.11, 46.15)	20.34 (16.29, 24.41)	2.27 (1.9, 2.73)
Non-OA	2011	15.5 (12.87, 18.13)	16.04 (13.23, 18.84)	21.92 (18.75, 25.09)	18.05 (15.06, 21.05)	18.84 (15.72, 21.97)	22.02 (18.4, 25.65)	25.95 (22.1, 29.8)	26.7 (22.41, 30.98)	29.85 (25.36, 34.34)	32.35 (27.36, 37.34)	16.41 (12.5, 20.29)	2.23 (1.82, 2.77)
OA	2012	16.8 (13.85, 19.75)	23.1 (19.59, 26.62)	25.91 (22.24, 29.59)	18.84 (15.4, 22.28)	25.43 (21.69, 29.17)	29.44 (25.11, 33.77)	27.61 (23.06, 32.17)	27.78 (23.01, 32.54)	30.03 (24.93, 35.13)	37.46 (31.95, 42.97)	15.74 (11.37, 20.2)	1.91 (1.59, 2.33)
Non-OA	2012	16.78 (13.76, 19.8)	17.26 (14.13, 20.39)	17.01 (13.8, 20.22)	20.09 (16.43, 23.75)	22.13 (18.44, 25.82)	23.86 (19.87, 27.86)	23.18 (18.94, 27.41)	24.33 (20.17, 28.49)	25.66 (21, 30.33)	29.11 (23.88, 34.34)	12.64 (8.57, 16.83)	1.85 (1.5, 2.3)
OA	2013	20 (16.6, 23.4)	17.34 (13.71, 20.97)	22.61 (18.78, 26.44)	26.3 (21.99, 30.61)	22.61 (18.64, 26.58)	24.01 (19.7, 28.32)	27.25 (22.61, 31.89)	33.13 (28.03, 38.24)	39.43 (33.29, 45.57)	35.8 (29.91, 41.69)	19.05 (14.28, 23.95)	2.19 (1.77, 2.78)
Non-OA	2013	17.42 (14.18, 20.67)	20.04 (16.37, 23.72)	23.71 (19.83, 27.59)	22.78 (18.74, 26.82)	23.71 (19.66, 27.76)	24.72 (20.25, 29.19)	25.67 (20.98, 30.37)	31.83 (26.64, 37.03)	27.64 (22.33, 32.95)	32.5 (26.54, 38.46)	14.05 (9.35, 18.81)	1.82 (1.48, 2.27)
OA	2014	16.37 (12.92, 19.81)	21.83 (17.62, 26.05)	21.45 (17.27, 25.63)	22.56 (18.4, 26.73)	21.67 (17.53, 25.81)	25.08 (20.36, 29.79)	25.35 (20.27, 30.43)	35.71 (29.93, 41.5)	35.74 (29.76, 41.72)	32.18 (25.7, 38.66)	18.48 (13.24, 23.61)	2.21 (1.75, 2.86)

Non-OA	2014	16.11 (12.69, 19.52)	20.23 (16.42, 24.04)	20.05 (16.13, 23.97)	19.21 (15.09, 23.33)	20.63 (16.54, 24.73)	24.1 (19.3, 28.91)	26.06 (21.13, 30.99)	28.24 (22.68, 33.79)	27.59 (21.4, 33.77)	32.04 (25.63, 38.45)	14.43 (9.5, 19.34)	1.96 (1.55, 2.54)
OA	2015	17.76 (14.25, 21.28)	21.07 (16.57, 25.57)	21.71 (17.06, 26.36)	23.83 (18.97, 28.68)	24.85 (20.26, 29.45)	26.61 (20.91, 32.31)	29.54 (23.7, 35.37)	30.84 (24.62, 37.06)	41.45 (34.46, 48.45)	37.17 (30.27, 44.07)	21.74 (15.96, 27.47)	2.45 (1.92, 3.28)
Non-OA	2015	16.18 (12.63, 19.74)	17.48 (13.35, 21.62)	21.82 (17.35, 26.29)	17.04 (12.85, 21.24)	23.47 (18.74, 28.2)	24.82 (19.72, 29.92)	25.97 (20.29, 31.66)	28.43 (22.09, 34.76)	30.45 (24.34, 36.57)	27.98 (21.14, 34.81)	15.53 (10.17, 20.89)	2.07 (1.6, 2.76)
OA	2016	15.36 (11.54, 19.18)	26.12 (20.84, 31.4)	22.84 (17.41, 28.28)	21.23 (15.2, 27.26)	24.22 (18.56, 29.87)	25.73 (19.13, 32.33)	26.55 (20, 33.11)	29.56 (22.41, 36.71)	36.67 (28.89, 44.44)	39.02 (30.32, 47.73)	19.34 (12.72, 26.02)	2.25 (1.69, 3.16)
Non-OA	2016	15.36 (11.62, 19.11)	17.98 (13.35, 22.6)	24.54 (18.77, 30.31)	22.78 (16.61, 28.95)	19.31 (14.22, 24.41)	25.52 (18.36, 32.67)	21.76 (15.9, 27.62)	31.58 (24.13, 39.03)	30.3 (23.24, 37.37)	34.75 (26.06, 43.43)	17.58 (11.23, 23.97)	2.26 (1.66, 3.27)
OA	2017	19.94 (15.62, 24.26)	22.53 (17.36, 27.7)	31.88 (25.5, 38.27)	24.86 (18.37, 31.34)	21.39 (15.69, 27.1)	23.81 (16.3, 31.32)	33.8 (25.95, 41.65)	37.59 (29.52, 45.65)	35.78 (26.68, 44.88)	40.23 (29.78, 50.68)	18.25 (11.17, 25.45)	2.01 (1.51, 2.8)
Non-OA	2017	16.81 (12.91, 20.7)	19.86 (15.14, 24.57)	20.11 (14.35, 25.86)	26.85 (19.67, 34.02)	16.23 (10.97, 21.49)	21.37 (14.29, 28.46)	28.77 (21.36, 36.17)	27.27 (18.85, 35.69)	26.61 (18.76, 34.47)	36.46 (26.7, 46.21)	14.74 (7.77, 21.69)	2 (1.43, 2.93)
OA	Age 35-44 years	9.34 (6.91, 11.76)	9.06 (6.61, 11.51)	10.04 (7.49, 12.58)	10.9 (8.35, 13.45)	13.41 (10.62, 16.21)	15.45 (12.43, 18.48)	13.94 (11.03, 16.86)	15.6 (12.41, 18.79)	20.95 (17.6, 24.3)	24.05 (20.77, 27.32)	16.02 (12.73, 19.26)	3.48 (2.61, 4.96)
Non-OA	Age 35-44 years	7.95 (5.83, 10.07)	8.99 (6.63, 11.35)	9.75 (7.38, 12.12)	9.55 (7.19, 11.91)	10.98 (8.5, 13.47)	13.82 (10.76, 16.88)	12.41 (9.62, 15.19)	15.69 (12.42, 18.96)	16.57 (13.34, 19.79)	18.2 (15.01, 21.38)	11.26 (8.27, 14.29)	2.72 (2.03, 3.8)
OA	Age 45-54 years	12.38 (11.14, 13.61)	16.55 (15.01, 18.09)	18.15 (16.55, 19.74)	18.54 (16.99, 20.09)	20.36 (18.73, 21.99)	20.61 (18.88, 22.34)	23.29 (21.48, 25.1)	25.32 (23.34, 27.3)	30.1 (27.99, 32.21)	30.01 (27.99, 32.02)	18.31 (16.39, 20.11)	2.55 (2.3, 2.85)

Non-OA	Age 45-54 years	11.46 (10.29, 12.64)	14.66 (13.27, 16.05)	14.95 (13.51, 16.4)	14.45 (13.06, 15.83)	16.28 (14.82, 17.74)	16.87 (15.27, 18.48)	19.12 (17.36, 20.87)	19.42 (17.58, 21.27)	23.16 (21.14, 25.18)	23.24 (21.27, 25.2)	11.85 (10.13, 13.57)	2.09 (1.86, 2.36)
OA	Age 55-64 years	17.18 (16.09, 18.27)	20.69 (19.45, 21.93)	23.22 (21.91, 24.53)	22.62 (21.38, 23.87)	23.82 (22.54, 25.11)	25.95 (24.48, 27.41)	27.87 (26.34, 29.41)	31.97 (30.24, 33.7)	34.65 (32.8, 36.49)	36.35 (34.51, 38.19)	18.81 (17.25, 20.37)	2.18 (2.04, 2.35)
Non-OA	Age 55-64 years	15.48 (14.45, 16.52)	16.77 (15.66, 17.89)	17.46 (16.29, 18.63)	17.65 (16.51, 18.79)	18.28 (17.12, 19.44)	21.16 (19.78, 22.54)	21.72 (20.29, 23.14)	25.09 (23.47, 26.71)	23.98 (22.28, 25.68)	29.05 (27.27, 30.82)	12.46 (11, 13.9)	1.92 (1.77, 2.08)
OA	Age 65-74 years	20.33 (18.99, 21.67)	24.52 (23.03, 26)	24.65 (23.16, 26.13)	25.17 (23.67, 26.67)	26.77 (25.26, 28.28)	27.83 (26.1, 29.56)	28.14 (26.36, 29.92)	33.14 (31.19, 35.09)	32.63 (30.53, 34.74)	34.09 (31.95, 36.22)	13.43 (11.57, 15.25)	1.66 (1.55, 1.79)
Non-OA	Age 65-74 years	16.32 (15.09, 17.55)	18.35 (17.01, 19.68)	19.28 (17.93, 20.64)	18.78 (17.42, 20.15)	19 (17.65, 20.35)	21.92 (20.34, 23.5)	23.58 (21.89, 25.27)	22.88 (21.11, 24.65)	25.31 (23.38, 27.24)	25.5 (23.59, 27.41)	9.61 (7.95, 11.31)	1.61 (1.48, 1.76)
OA	Age 75-84 years	18.5 (16.74, 20.27)	20.25 (18.41, 22.09)	22.18 (20.31, 24.06)	19.67 (17.89, 21.46)	20.34 (18.52, 22.17)	25.1 (22.9, 27.3)	24.73 (22.51, 26.94)	26.66 (24.24, 29.08)	25.87 (23.32, 28.42)	26.96 (24.34, 29.58)	9.1 (6.81, 11.35)	1.51 (1.36, 1.68)
Non-OA	Age 75-84 years	15.71 (14.04, 17.37)	15.48 (13.82, 17.14)	19.18 (17.4, 20.96)	16.5 (14.81, 18.2)	16.81 (15.11, 18.51)	17.43 (15.54, 19.32)	19.52 (17.52, 21.52)	22.91 (20.63, 25.19)	20.78 (18.44, 23.11)	20.72 (18.3, 23.15)	6.27 (4.15, 8.38)	1.42 (1.26, 1.6)
OA	Age 85+ years	11.07 (7.18, 14.95)	14.07 (9.91, 18.24)	13.15 (9.24, 17.06)	12.61 (8.53, 16.69)	13.19 (9.16, 17.22)	14.22 (9.56, 18.88)	13.15 (8.58, 17.71)	14.11 (8.73, 19.5)	18.47 (12.35, 24.59)	13.86 (7.82, 19.91)	3.46 (-1.47, 8.44)	1.29 (0.89, 1.91)
Non-OA	Age 85+ years	17.01 (12.24, 21.78)	17.69 (13.03, 22.35)	12.64 (8.71, 16.57)	11.03 (7.35, 14.71)	10.49 (6.92, 14.06)	10.95 (6.7, 15.2)	11.11 (6.71, 15.52)	11.86 (7.28, 16.43)	11.72 (6.09, 17.35)	15.44 (9.59, 21.29)	-5.04 (-10.11, -0.05)	0.68 (0.44, 1.01)
OA	Men	17.88 (16.78, 18.99)	21.12 (19.89, 22.35)	21.98 (20.73, 23.23)	22.37 (21.13, 23.6)	23.18 (21.92, 24.44)	24.69 (23.26, 26.11)	25.65 (24.17, 27.14)	29.04 (27.41, 30.67)	28.57 (26.85, 30.28)	31.93 (30.2, 33.65)	13.04 (11.53, 14.56)	1.75 (1.63, 1.87)

Non-OA	Men	20.54 (19.38, 21.71)	20.65 (19.44, 21.85)	23.02 (21.76, 24.28)	22.25 (21.02, 23.49)	24 (22.7, 25.29)	24.22 (22.81, 25.63)	25.91 (24.41, 27.41)	27.94 (26.31, 29.58)	28.35 (26.66, 30.04)	29.92 (28.22, 31.63)	9.96 (8.45, 11.49)	1.52 (1.42, 1.63)
OA	Women	16.17 (15.4, 16.94)	19.74 (18.86, 20.62)	21.53 (20.63, 22.43)	20.77 (19.9, 21.64)	22.5 (21.6, 23.4)	24.27 (23.26, 25.29)	25.36 (24.32, 26.4)	28.73 (27.57, 29.89)	31.7 (30.46, 32.93)	31.73 (30.51, 32.95)	15.96 (14.89, 17.04)	2.03 (1.93, 2.14)
Non-OA	Women	11.53 (10.88, 12.19)	13.94 (13.2, 14.68)	14.23 (13.47, 14.99)	13.65 (12.91, 14.39)	14.05 (13.31, 14.79)	16.85 (15.96, 17.74)	17.93 (17, 18.86)	19.39 (18.37, 20.41)	20.13 (19.03, 21.23)	22.1 (20.99, 23.22)	10.19 (9.26, 11.12)	1.95 (1.83, 2.09)
OA	East Midlands	15.75 (11.25, 20.25)	22.8 (19.11, 26.49)	25.12 (21.02, 29.21)	24.4 (20.92, 27.89)	25.08 (20.33, 29.82)	23.72 (19.14, 28.31)	22.73 (19.52, 25.93)	24.03 (20.14, 27.92)	30.3 (26.41, 34.19)	26.85 (21.4, 32.29)	7.11 (2.61, 11.47)	1.34 (1.12, 1.62)
Non-OA	East Midlands	15.6 (11.08, 20.12)	14.54 (11.45, 17.63)	17.47 (14.13, 20.81)	17.52 (14.38, 20.66)	21.74 (17.04, 26.43)	17.06 (13.05, 21.07)	20.87 (17.66, 24.08)	18.51 (14.88, 22.14)	20.71 (17.44, 23.97)	24.79 (19.33, 30.26)	7.49 (3.46, 11.45)	1.5 (1.2, 1.89)
OA	East of England	15.93 (14.41, 17.45)	20.07 (18.17, 21.97)	21.31 (19.08, 23.55)	20.96 (19.03, 22.89)	22.08 (19.94, 24.22)	23.03 (20.86, 25.2)	23.73 (21.41, 26.05)	25.66 (22.36, 28.97)	30.89 (26.55, 35.24)	28.71 (23.71, 33.71)	11.15 (8.58, 13.65)	1.7 (1.51, 1.93)
Non-OA	East of England	14 (12.56, 15.45)	15.84 (14.1, 17.57)	17.7 (15.65, 19.75)	15.63 (13.91, 17.35)	16.22 (14.35, 18.09)	20.37 (18.26, 22.48)	19.88 (17.64, 22.13)	20.96 (17.87, 24.05)	22.71 (18.95, 26.47)	22.08 (17.43, 26.73)	8.15 (5.75, 10.4)	1.62 (1.4, 1.87)
OA	London	17.03 (14.21, 19.85)	20.11 (17.53, 22.69)	23.83 (20.9, 26.76)	21.81 (19.41, 24.21)	24.84 (22.48, 27.21)	27.07 (24.43, 29.72)	28.42 (25.9, 30.94)	29.36 (26.72, 31.99)	34.17 (31.38, 36.96)	39.8 (34.94, 44.66)	17.86 (14.9, 20.9)	2.03 (1.79, 2.31)
Non-OA	London	16.48 (13.73, 19.22)	15.91 (13.58, 18.24)	18.14 (15.45, 20.82)	16.31 (14.18, 18.44)	16.95 (14.9, 19.01)	20.41 (18, 22.82)	16.71 (14.63, 18.79)	21.67 (19.27, 24.07)	23.49 (21.01, 25.97)	24.12 (19.74, 28.5)	7.84 (5.11, 10.52)	1.53 (1.32, 1.78)
OA	North East	10.94 (7.56, 14.33)	21.56 (16.62, 26.5)	15.88 (10.35, 21.42)	19.38 (14.53, 24.23)	22.41 (16.17, 28.65)	25.32 (20.5, 30.13)	26.27 (21.39, 31.14)	23.68 (19.67, 27.68)	30.47 (24.8, 36.13)	32.1 (29.04, 35.15)	21.13 (16.24, 26.04)	2.5 (2, 3.21)

Non-OA	North East	14.88 (11.06, 18.7)	16.62 (12.83, 20.41)	17.88 (12.23, 23.53)	14.35 (9.65, 19.05)	18.82 (13.16, 24.47)	24.52 (19.71, 29.32)	17.07 (12.7, 21.45)	17.41 (13.89, 20.93)	23.87 (18.48, 29.26)	24.14 (21.25, 27.03)	10.3 (5.67, 15.05)	1.71 (1.34, 2.22)
OA	North West	14.98 (13.07, 16.89)	21.56 (19.68, 23.44)	21.6 (19.86, 23.33)	22.55 (20.5, 24.59)	22.94 (21.02, 24.85)	24.54 (22.48, 26.6)	25.21 (23.19, 27.24)	28.77 (26.7, 30.84)	29.67 (27.74, 31.6)	32.39 (30.72, 34.06)	16 (13.9, 18.12)	1.93 (1.76, 2.12)
Non-OA	North West	15.23 (13.35, 17.1)	17.63 (15.95, 19.31)	18.83 (17.19, 20.46)	17.73 (15.89, 19.57)	19.81 (17.95, 21.67)	21.22 (19.26, 23.19)	23.61 (21.65, 25.58)	22.75 (20.79, 24.71)	22.41 (20.59, 24.23)	25.72 (24.16, 27.28)	10.4 (8.37, 12.4)	1.66 (1.51, 1.84)
OA	South Central	18.37 (17.07, 19.67)	21.15 (19.17, 23.13)	23.65 (21.29, 26.02)	20.29 (18.16, 22.42)	25.72 (23.29, 28.15)	26.55 (23.87, 29.23)	26.7 (23.89, 29.51)	30.23 (26.9, 33.57)	31.41 (27.19, 35.63)	36.75 (29.36, 44.14)	13.98 (11.37, 16.65)	1.87 (1.65, 2.13)
Non-OA	South Central	14.59 (13.42, 15.76)	14.92 (13.21, 16.64)	16.08 (13.99, 18.17)	18.25 (16.23, 20.28)	16.88 (14.81, 18.95)	15.14 (13.02, 17.26)	19.56 (16.98, 22.14)	20 (17.01, 22.99)	21.92 (18.08, 25.77)	25.71 (18.41, 33.02)	6.49 (4.11, 8.82)	1.49 (1.28, 1.73)
OA	South East Coast	15.97 (14.38, 17.55)	20.04 (18.38, 21.69)	21.63 (19.83, 23.42)	22.24 (20.32, 24.16)	21.92 (19.82, 24.02)	23.24 (20.68, 25.8)	26.23 (23.08, 29.37)	31.31 (28.28, 34.33)	32.38 (28.9, 35.86)	33.66 (27.11, 40.22)	14.49 (11.94, 16.95)	1.96 (1.73, 2.23)
Non-OA	South East Coast	12.91 (11.47, 14.35)	16.14 (14.66, 17.62)	16.59 (14.95, 18.23)	15.65 (13.96, 17.33)	18.9 (16.91, 20.89)	18.65 (16.27, 21.02)	21.6 (18.6, 24.59)	22.94 (20.23, 25.66)	24.26 (20.93, 27.59)	22.7 (16.63, 28.78)	10.19 (7.89, 12.51)	1.83 (1.59, 2.12)
OA	South West	17.91 (15.3, 20.52)	18.73 (16.62, 20.83)	21.01 (18.89, 23.12)	21.95 (19.64, 24.26)	21.12 (19.45, 22.79)	23.13 (20.97, 25.29)	24.42 (21.94, 26.89)	30.98 (28.26, 33.69)	29.92 (27.03, 32.81)	30.08 (26.87, 33.28)	13.26 (10.68, 15.93)	1.79 (1.59, 2.02)
Non-OA	South West	13.47 (11.16, 15.78)	17.4 (15.35, 19.45)	17.02 (15.12, 18.92)	18.45 (16.29, 20.61)	16.7 (15.18, 18.21)	17.59 (15.64, 19.54)	21.72 (19.32, 24.12)	23.77 (21.29, 26.25)	23.55 (20.74, 26.36)	25.69 (22.58, 28.79)	9.86 (7.42, 12.27)	1.7 (1.49, 1.95)
OA	West Midlands	17.77 (16.04, 19.49)	19.63 (17.49, 21.76)	20.9 (19.15, 22.66)	20.84 (18.9, 22.78)	22.74 (20.79, 24.69)	23.68 (21.38, 25.97)	25.56 (23.18, 27.93)	31.34 (28.57, 34.12)	28.69 (26.02, 31.37)	30.8 (28.62, 32.98)	14.77 (12.41, 17.1)	1.91 (1.71, 2.13)

Non-OA	West Midlands	15.5 (13.87, 17.13)	17.05 (15.13, 18.98)	16.7 (15.11, 18.28)	18.06 (16.2, 19.92)	15.87 (14.16, 17.57)	20.66 (18.46, 22.86)	21.27 (19.06, 23.48)	25.15 (22.5, 27.79)	24.53 (21.94, 27.12)	25.09 (22.99, 27.19)	11.27 (9.02, 13.52)	1.82 (1.61, 2.06)
OA	Yorkshire & The Humber	15.4 (11.89, 18.91)	14.73 (11.19, 18.27)	19.27 (15.95, 22.58)	18.69 (16.59, 20.79)	20.39 (17.43, 23.36)	25.52 (22.1, 28.94)	25.21 (21.71, 28.71)	23.8 (19.79, 27.8)	30.17 (25.72, 34.62)	30.06 (26.45, 33.67)	16 (12.39, 19.65)	2.13 (1.77, 2.59)
Non-OA	Yorkshire & The Humber	17.44 (13.85, 21.04)	13 (9.59, 16.4)	15.93 (13.04, 18.83)	12.52 (10.69, 14.35)	15.58 (13.11, 18.05)	19.28 (16.21, 22.35)	19.22 (15.97, 22.47)	23.61 (19.52, 27.71)	21.2 (17.01, 25.39)	20.97 (17.64, 24.3)	9.18 (5.8, 12.53)	1.73 (1.41, 2.15)
IMD, Indices of multiple deprivation; 95%CI, 95% confidence interval; CVRF, cardiovascular risk factors; OA, osteoarthritis												

Chapter 4 appendices

Appendix 4.1. British National Formulary code list for statins, antidiabetic drugs and antihypertensive drugs

Statins (code)	**Antidiabetic drugs (code)**	**Antihypertensive drugs (code)**
Atorvastatin (0212000B0)	Acarbose (0601023A0)	Ambrisentan (0205010X0)
Cerivastatin (0212000C0)	Albiglutide (0601023AS)	Bosentan (0205010U0)
Fenofibrate/simvastatin (0212000AJ)	Alogliptin (0601023AK)	Diazoxide (0205010E0)
Simvastatin (0212000Y0)	Alogliptin/metformin (0601023AJ)	Hydralazine hydrochloride (0205010J0)
Simvastatin and ezetimibe (0212000AC)	Canagliflozin (0601023AM)	Iloprost (0205010V0)
	Canagliflozin/metformin (0601023AP)	Macitentan (0205010AA)
	Chlorpropamide (0601021E0)	Minoxidil (0205010N0)
	Dapagliflozin (0601023AG)	Riociguat (0205010AB)
	Dapagliflozin/metformin (0601023AL)	Sildenafil(Vasodilator Antihypertensive) (0205010Y0)
	Dulaglutide (0601023AQ)	Sitaxentan sodium (0205010W0)
	Empagliflozin (0601023AN)	Tadalafil (Vasodilator Antihypertensive) (0205010Z0)
	Empagliflozin/linagliptin (0601023AY)	Vericiguat (0205010AC)
	Empagliflozin/metformin (0601023AR)	Clonidine hydrochloride (0205020E0)
	Ertugliflozin (0601023AX)	Guanfacine hydrochloride (0205020G0)
	Exenatide (0601023Y0)	Methyldopa (0205020H0)
	Glibenclamide (0601021H0)	Moxonidine (0205020M0)
	Gliclazide (0601021M0)	Guanethidine monosulfate (0205030N0)
	Glimepiride (0601021A0)	Doxazosin mesilate (0205040D0)
	Glipizide (0601021P0)	Indoramin (0205040I0)
	Guar gum (0601023I0)	Phenoxybenzamine hydrochloride (0205040M0)
	Ins degludec/liraglutide (0601023AU)	Phentolamine mesilate (0205040P0)
	Linagliptin (0601023AE)	Prazosin hydrochloride (0205040S0)
	Linagliptin/metformin (0601023AF)	Terazosin hydrochloride (0205040V0)
	Liraglutide (0601023AB)	Bendroflumethiazide (0202010B0)
	Lixisenatide (0601023AI)	Chlorothiazide (0202010D0)
	Metformin hydrochloride (0601022B0)	Chlortalidone (0202010F0)
	Metformin hydrochloride/pioglitazone (0601023W0)	Cyclopenthiazide (0202010J0)
	Metformin hydrochloride/rosiglitazone (0601023V0)	Hydrochlorothiazide (0202010L0)
	Metformin hydrochloride/sitagliptin (0601023AD)	Indapamide (0202010P0)
	Metformin hydrochloride/vildagliptin (0601023Z0)	Metolazone (0202010V0)
	Nateglinide (0601023U0)	Polythiazide (0202010X0)
	Pioglitazone hydrochloride (0601023B0)	Xipamide (0202010Y0)
	Repaglinide (0601023R0)	Bumetanide (0202020D0)

	Rosiglitazone (0601023S0)	Furosemide (0202020L0)
	Saxagliptin (0601023AC)	Torasemide (0202020U0)
	Saxagliptin/dapagliflozin (0601023AV)	Amiloride hydrochloride (0202030C0)
	Saxagliptin/metformin (0601023AH)	Eplerenone (0202030X0)
	Semaglutide (0601023AW)	Finerenone (0202030Y0)
	Sitagliptin (0601023X0)	Spironolactone (0202030S0)
	Tolbutamide (0601021X0)	Triamterene (0202030W0)
	Vildagliptin (0601023AA)	Amiloride hydrochloride with loop diuretics (0202040D0)
	Biphasic insulin aspart (0601012W0)	Amiloride hydrochloride with thiazides (0202040A0)
	Biphasic insulin lispro (0601012F0)	Co-amilofruse (Amiloride hydrochloride/frusemide) (0202040B0)
	Biphasic isophane insulin (0601012D0)	Co-amilozide (Amiloride hydrochloride/hydrochlorothiazide) (0202040C0)
	Insulin aspart (0601011A0)	Co-flumactone (Hydroflumethiazide/spironolactone) (0202040G0)
	Insulin degludec (0601012Z0)	Co-triamterzide(Triamterene/hydrochlorothiazide) (0202040H0)
	Insulin detemir (0601012X0)	Spironolactone with loop diuretics (0202040T0)
	Insulin glargine (0601012V0)	Spironolactone with thiazides (0202040S0)
	Insulin glargine/lixisenatide (0601012AB)	Triamterene with loop diuretics (0202040U0)
	Insulin glulisine (0601011P0)	Triamterene with thiazides (0202040V0)
	Insulin human (0601011R0)	Mannitol (0202050M0)
	Insulin Lispro (0601011L0)	Bendroflumethiazide/potassium (0202080B0)
	Insulin zinc suspension (0601012G0)	Bumetanide/Amiloride Hydrochloride (0202080D0)
	Insulin zinc suspension (Crystalline) (0601012N0)	Bumetanide/potassium (0202080C0)
	Isophane insulin (0601012S0)	Furosemide/potassium (0202080K0)
	Protamine zinc insulin (0601012U0)	Acebutolol hydrochloride (0204000C0)
	Soluble insulin (Neutral insulin) (0601011N0)	Atenolol (0204000E0)
		Atenolol with calcium channel blocker (0204000U0)
		Atenolol with diuretic (0204000F0)
		Bisoprolol fumarate (0204000H0)
		Bisoprolol fumarate/aspirin (0204000AC)
		Carvedilol (020400080)
		Celiprolol hydrochloride (020400060)
		Co-prenozide (Oxprenolol hydrochloride/cyclopenthiazide) (0204000Y0)
		Co-tenidone (Atenolol/chlortalidone) (020400040)
		Labetalol hydrochloride (0204000I0)
		Metoprolol tartrate (0204000K0)
		Metoprolol tartrate with diuretic (0204000W0)
		Nadolol (0204000M0)
		Nebivolol (0204000AB)
		Oxprenolol hydrochloride (0204000N0)
		Pindolol (0204000P0)
		Pindolol with diuretic (020400010)

		Propranolol hydrochloride (0204000R0)
		Propranolol hydrochloride with diuretic (0204000Q0)
		Sotalol hydrochloride (0204000T0)
		Timolol (0204000V0)
		Timolol with diuretic (020400030)
		Amlodipine (0206020A0)
		Diltiazem hydrochloride (0206020C0)
		Felodipine (0206020F0)
		Isradipine (0206020I0)
		Lacidipine (0206020K0)
		Lercanidipine hydrochloride (0206020L0)
		Nicardipine hydrochloride (0206020Q0)
		Nifedipine (0206020R0)
		Nimodipine (0206020M0)
		Nisoldipine (0206020W0)
		Trimetazidine hydrochloride (0206020B0)
		Valsartan/amlodipine (0206020Z0)
		Verapamil hydrochloride (0206020T0)

Appendix 4.2. Imputed proportion of high/intermediate predicted 10-year CVD risk in osteoarthritis and non-osteoarthritis cohorts by obesity status, 1992-2017

Subgroup	OA		Non-OA		Absolute risk difference (%) (95%CI)	Relative risk ratio (95%CI)
	D	Proportion (%) (95%CI)	D	Proportion (%) (95%CI)		
Total	205368	5.69 (5.59, 5.79)	205368	4.37 (4.28, 4.46)	1.32 (1.18, 1.45)	**1.30 (1.27, 1.34)**
High						
Obesity	76015	5.76 (5.60, 5.93)	57978	5.70 (5.51, 5.88)	0.06 (-0.19, 0.31)	1.01 (0.97, 1.06)
Non-obesity	129353	5.64 (5.52, 5.77)	147390	3.85 (3.75, 3.95)	1.79 (1.63, 1.95)	**1.47 (1.42, 1.52)**
Intermediate						
Obesity	76015	29.94 (28.69, 31.2)	57978	28.09 (26.82, 29.35)	1.85 (1.36, 2.34)	**1.04 (1.02, 1.06)**
Non-obesity	129353	25.5 (24.39, 26.6)	147390	18.98 (17.98, 19.98)	6.52 (6.21, 6.83)	**1.44 (1.41, 1.46)**
CVD, cardiovascular disease; OA, osteoarthritis; 95%CI, 95% confidence interval; D, denominator; values in bold, statistically significant						

Chapter 5 appendices

Appendix 5.1. Code list for ischaemic heart disease

Read code	Read terms
G3...00	Ischaemic heart disease
G30..00	Acute myocardial infarction
G300.00	Acute anterolateral infarction
G301.00	Other specified anterior myocardial infarction
G301000	Acute anteroapical infarction
G30..11	Attack - heart
G301100	Acute anteroseptal infarction
G30..12	Coronary thrombosis
G30..13	Cardiac rupture following myocardial infarction (MI)
G30..14	Heart attack
G30..15	MI - acute myocardial infarction
G30..16	Thrombosis - coronary
G30..17	Silent myocardial infarction
G301z00	Anterior myocardial infarction NOS
G302.00	Acute inferolateral infarction
G303.00	Acute inferoposterior infarction
G304.00	Posterior myocardial infarction NOS
G305.00	Lateral myocardial infarction NOS
G306.00	True posterior myocardial infarction
G307.00	Acute subendocardial infarction
G307000	Acute non-Q wave infarction
G307100	Acute non-ST segment elevation myocardial infarction
G308.00	Inferior myocardial infarction NOS
G309.00	Acute Q-wave infarct
G30B.00	Acute posterolateral myocardial infarction
G30X.00	Acute transmural myocardial infarction of unspecif site
G30X000	Acute ST segment elevation myocardial infarction
G30y.00	Other acute myocardial infarction
G30y000	Acute atrial infarction
G30y100	Acute papillary muscle infarction
G30y200	Acute septal infarction
G30yz00	Other acute myocardial infarction NOS
G30z.00	Acute myocardial infarction NOS
G31..00	Other acute and subacute ischaemic heart disease
G310.00	Postmyocardial infarction syndrome
G310.11	Dressler's syndrome
G3...11	Arteriosclerotic heart disease
G311.00	Preinfarction syndrome
G311000	Myocardial infarction aborted
G311011	MI - myocardial infarction aborted
G311100	Unstable angina

G311.11	Crescendo angina
G311.12	Impending infarction
G311.13	Unstable angina
G311.14	Angina at rest
G311200	Angina at rest
G311300	Refractory angina
G311400	Worsening angina
G311500	Acute coronary syndrome
G311z00	Preinfarction syndrome NOS
G3...12	Atherosclerotic heart disease
G312.00	Coronary thrombosis not resulting in myocardial infarction
G3...13	IHD - Ischaemic heart disease
G31y.00	Other acute and subacute ischaemic heart disease
G31y000	Acute coronary insufficiency
G31y100	Microinfarction of heart
G31y200	Subendocardial ischaemia
G31y300	Transient myocardial ischaemia
G31yz00	Other acute and subacute ischaemic heart disease NOS
G32..00	Old myocardial infarction
G32..11	Healed myocardial infarction
G32..12	Personal history of myocardial infarction
G33..00	Angina pectoris
G330.00	Angina decubitus
G330000	Nocturnal angina
G330z00	Angina decubitus NOS
G33z.00	Angina pectoris NOS
G33z000	Status anginosus
G33z100	Stenocardia
G33z200	Syncope anginosa
G33z300	Angina on effort
G33z400	Ischaemic chest pain
G33z500	Post infarct angina
G33z600	New onset angina
G33z700	Stable angina
G33zz00	Angina pectoris NOS
G34..00	Other chronic ischaemic heart disease
G340.00	Coronary atherosclerosis
G340000	Single coronary vessel disease
G340100	Double coronary vessel disease
G340.11	Triple vessel disease of the heart
G340.12	Coronary artery disease
G342.00	Atherosclerotic cardiovascular disease
G343.00	Ischaemic cardiomyopathy
G344.00	Silent myocardial ischaemia
G34y.00	Other specified chronic ischaemic heart disease

G34y000	Chronic coronary insufficiency
G34y100	Chronic myocardial ischaemia
G34yz00	Other specified chronic ischaemic heart disease NOS
G34z.00	Other chronic ischaemic heart disease NOS
G34z000	Asymptomatic coronary heart disease
G35..00	Subsequent myocardial infarction
G350.00	Subsequent myocardial infarction of anterior wall
G351.00	Subsequent myocardial infarction of inferior wall
G353.00	Subsequent myocardial infarction of other sites
G35X.00	Subsequent myocardial infarction of unspecified site
G36..00	Certain current complication follow acute myocardial infarct
G360.00	Haemopericardium/current comp folow acut myocard infarct
G361.00	Atrial septal defect/curr comp folow acut myocardal infarct
G362.00	Ventric septal defect/curr comp fol acut myocardal infarctn
G363.00	Ruptur cardiac wall w'out haemopericard/cur comp fol ac MI
G364.00	Ruptur chordae tendinae/curr comp fol acute myocard infarct
G365.00	Rupture papillary muscle/curr comp fol acute myocard infarct
G38..00	Postoperative myocardial infarction
G380.00	Postoperative transmural myocardial infarction anterior wall
G381.00	Postoperative transmural myocardial infarction inferior wall
G384.00	Postoperative subendocardial myocardial infarction
G38z.00	Postoperative myocardial infarction; unspecified
G3y..00	Other specified ischaemic heart disease
G3z..00	Ischaemic heart disease NOS
Gyu3.00	[X]Ischaemic heart diseases
Gyu3000	[X]Other forms of angina pectoris
Gyu3200	[X]Other forms of acute ischaemic heart disease
Gyu3300	[X]Other forms of chronic ischaemic heart disease
Gyu3400	[X]Acute transmural myocardial infarction of unspecif site
Gyu3600	[X]Subsequent myocardial infarction of unspecified site

Appendix 5.2. Code list for cerebrovascular disease

Read code	Read term
1477	H/O: cerebrovascular disease
14A7.00	H/O: CVA/stroke
14A7.12	H/O: stroke
4300	SUBARACHNOID HAEMORRHAGE WITH HYPERTENSI
4309	SUBARACHNOID HAEMORRHAGE
4309M	MENINGEAL HAEMORRHAGE
4310	HAEMORRHAGE INTRACEREBRAL WITH HYPERTENS
4319CE	HAEMORRHAGE INTRACEREBRAL
4319CR	HAEMORRHAGE INTRACRANIAL
4350	TRANSIENT CEREBRAL ISCHAEMIA WITH HYPERT

4369B	STROKE
4380	CEREBROVASCULAR DISEASE WITH HYPERTENSIO
4389	CEREBROVASCULAR DISEASE
662M.00	Stroke monitoring
7004300	Evacuation of intracerebral haematoma NEC
8520A	HAEMORRHAGE SUBARACHNOID TRAUMATIC
8520M	MENINGEAL HAEMORRHAGE TRAUMATIC
F11x200	Cerebral degeneration due to cerebrovascular disease
G6...00	Cerebrovascular disease
G60..00	Subarachnoid haemorrhage
G600.00	Ruptured berry aneurysm
G601.00	Subarachnoid haemorrhage from carotid siphon and bifurcation
G602.00	Subarachnoid haemorrhage from middle cerebral artery
G603.00	Subarachnoid haemorrhage from anterior communicating artery
G604.00	Subarachnoid haemorrhage from posterior communicating artery
G605.00	Subarachnoid haemorrhage from basilar artery
G606.00	Subarachnoid haemorrhage from vertebral artery
G60X.00	Subarachnoid haemorrh from intracranial artery; unspecif
G60z.00	Subarachnoid haemorrhage NOS
G61..00	Intracerebral haemorrhage
G61..11	CVA - cerebrovascular accid due to intracerebral haemorrhage
G61..12	Stroke due to intracerebral haemorrhage
G613.00	Cerebellar haemorrhage
G617.00	Intracerebral haemorrhage; intraventricular
G618.00	Intracerebral haemorrhage; multiple localized
G61X.00	Intracerebral haemorrhage in hemisphere; unspecified
G61X000	Left sided intracerebral haemorrhage; unspecified
G61X100	Right sided intracerebral haemorrhage; unspecified
G61z.00	Intracerebral haemorrhage NOS
G623.00	Subdural haemorrhage NOS
G62z.00	Intracranial haemorrhage NOS
G63..00	Precerebral arterial occlusion
G63..12	Stenosis of precerebral arteries
G633.00	Multiple and bilateral precerebral arterial occlusion
G63y.00	Other precerebral artery occlusion
G63z.00	Precerebral artery occlusion NOS
G641000	Cerebral infarction due to embolism of cerebral arteries
G64..13	Stroke due to cerebral arterial occlusion
G65..00	Transient cerebral ischaemia
G65y.00	Other transient cerebral ischaemia
G65z.00	Transient cerebral ischaemia NOS
G65zz00	Transient cerebral ischaemia NOS
G66..00	Stroke and cerebrovascular accident unspecified
G660.00	Middle cerebral artery syndrome

G661.00	Anterior cerebral artery syndrome
G66..11	CVA unspecified
G66..12	Stroke unspecified
G66..13	CVA - Cerebrovascular accident unspecified
G662.00	Posterior cerebral artery syndrome
G663.00	Brain stem stroke syndrome
G664.00	Cerebellar stroke syndrome
G665.00	Pure motor lacunar syndrome
G666.00	Pure sensory lacunar syndrome
G667.00	Left sided CVA
G668.00	Right sided CVA
G669.00	Cerebral palsy; not congenital or infantile; acute
G67..00	Other cerebrovascular disease
G671.00	Generalised ischaemic cerebrovascular disease NOS
G671z00	Generalised ischaemic cerebrovascular disease NOS
G677400	Occlusion??? of multiple and bilat cerebral arteries
G67y.00	Other cerebrovascular disease OS
G67z.00	Other cerebrovascular disease NOS
G68..00	Late effects of cerebrovascular disease
G680.00	Sequelae of subarachnoid haemorrhage
G681.00	Sequelae of intracerebral haemorrhage
G68W.00	Sequelae/other unspecified cerebrovascular diseases
G6y..00	Other specified cerebrovascular disease
G6z..00	Cerebrovascular disease NOS
Gyu6.00	[X]Cerebrovascular diseases
Gyu6000	[X]Subarachnoid haemorrhage from other intracranial arteries
Gyu6100	[X]Other subarachnoid haemorrhage
Gyu6200	[X]Other intracerebral haemorrhage
Gyu6500	[X]Occlusion and stenosis of other precerebral arteries
Gyu6600	[X]Occlusion and stenosis of other cerebral arteries
Gyu6700	[X]Other specified cerebrovascular diseases
Gyu6D00	[X]Sequelae/other unspecified cerebrovascular diseases
Gyu6F00	[X]Intracerebral haemorrhage in hemisphere; unspecified
S620.00	Closed traumatic subarachnoid haemorrhage
S621.00	Open traumatic subarachnoid haemorrhage
S62..12	Subarachnoid haemorrhage following injury
S627.00	Traumatic subarachnoid haemorrhage
S628.00	Traumatic subdural haemorrhage

Appendix 5.3. Code list for heart failure

Read code	Read term
14NB.00	H/O: Peripheral vascular disease procedure
662U.00	Peripheral vascular disease monitoring

7A10100	Bypass aorta by anastomosis axillary to femoral artery NEC
7A11.00	Replacement of aneurysmal bifurcation of aorta
7A11000	Emerg repl aneurysm bifurc aorta by anast aorta to fem art
7A11100	Replace aneurysm bifurc aorta by anast aorta to femoral art
7A11200	Emerg repl aneurysm bifurc aorta by anast aorta to iliac a
7A11211	Y graft of abdominal Aortic aneurysm (emergency)
7A11300	Replace aneurysm bifurc aorta by anast aorta to iliac artery
7A11311	Y graft abdominal Aortic aneurysm
7A11y00	Replacement of aneurysmal bifurcation of aorta OS
7A11z00	Replacement of aneurysmal bifurcation of aorta NOS
7A12000	Emerg bypass bifurc aorta by anast aorta to femoral artery
7A12100	Bypass bifurc aorta by anastom aorta to femoral artery NEC
7A12200	Emerg bypass bifurc aorta by anastom aorta to iliac artery
7A12300	Bypass bifurcation aorta by anastom aorta to iliac artery
7A13100	Emerg replace aneurysm thor aorta by anastom aorta to aorta
7A13200	Emerg replace aneurysm suprarenal aorta by anast aorta/aorta
7A13300	Emerg replace aneurysm infrarenal aorta by anast aorta/aorta
7A13400	Emerg replace aneurysm abdom aorta by anast aorta/aorta NEC
7A13411	Tube graft abdominal Aortic aneurysm (emergency)
7A14100	Replace aneurysm thoracic aorta by anast of aorta/aorta NEC
7A14400	Replace aneurysm abdominal aorta by anast aorta to aorta NEC
7A14411	Tube graft of Abdominal aortic aneurysm
7A1B000	Endovascular stenting infrarenal abdominal aortic aneurysm
7A1B200	Endovascular stenting of thoracic aortic aneurysm
7A22000	Percutaneous transluminal angioplasty of carotid artery
7A27C00	Operation on aneurysm of subclavian artery
7A27D00	Operation on aneurysm of axillary artery
7A27E00	Operation on aneurysm of brachial artery
7A28000	Percutaneous transluminal angioplasty of subclavian artery
7A28100	Percutaneous transluminal angioplasty of brachial artery
7A28200	Percutaneous transluminal angioplasty of vertebral artery
7A28C00	Percutaneous transluminal angioplasty of axillary artery
7A31300	Operation on aneurysm of renal artery
7A32000	Percutaneous transluminal angioplasty of renal artery
7A34C00	Operation on aneurysm of coeliac artery NEC
7A34D00	Operation on aneurysm of superior mesenteric artery NEC
7A34E00	Operation on aneurysm of inferior mesenteric artery NEC
7A34F00	Operation on aneurysm of suprarenal artery NEC
7A34K00	Operation on aneurysm visceral branch of abdominal aorta NEC
7A35000	Percutaneous transluminal angioplasty of coeliac artery NEC
7A35300	Percutaneous transluminal angioplasty suprarenal artery NEC
7A40.00	Replacement of aneurysmal iliac artery
7A40000	Emerg replace aneurysm iliac art by iliac/femoral art anast
7A40100	Replace aneurysmal iliac art by iliac/femoral art anast NEC

7A40.11	Replacement of aneurysmal iliac artery by anastomosis
7A40200	Emerg replace aneurysmal iliac artery by fem/fem art anast
7A40300	Replace aneurysmal iliac artery by fem/fem artery anast NEC
7A40600	Emerg replace aneurysm leg artery by aorta/com fem art anast
7A40700	Emerg replace aneurysm leg artery by aorta/sup fem art anast
7A40800	Emerg replace aneurysm iliac artery by iliac/iliac art anast
7A40900	Replace aneurysm com iliac a by aorta/com iliac a anast NEC
7A40A00	Replace aneurysm iliac art by aorta/ext iliac art anast NEC
7A40B00	Replace aneurysm leg artery by aorta/com fem art anast NEC
7A40C00	Replace aneurysm leg artery by aorta/sup fem art anast NEC
7A40D00	Replace aneurysm iliac artery by iliac/iliac art anast NEC
7A40y00	Other specified replacement of aneurysmal iliac artery
7A40z00	Replacement of aneurysmal iliac artery NOS
7A41.00	Other bypass of iliac artery
7A41100	Bypass iliac artery by iliac/femoral artery anastomosis NEC
7A41.11	Other bypass of iliac artery by anastomosis
7A41200	Emerg bypass iliac artery by femoral/femoral art anast NEC
7A41300	Bypass iliac artery by femoral/femoral art anastomosis NEC
7A41500	Emerg bypass iliac artery by aorta/ext iliac art anast NEC
7A41800	Emerg bypass iliac artery by iliac/iliac art anastomosis NEC
7A41900	Bypass common iliac artery by aorta/com iliac art anast NEC
7A41A00	Bypass iliac artery by aorta/ext iliac art anastomosis NEC
7A41D00	Bypass iliac artery by iliac/iliac artery anastomosis NEC
7A41E00	Emergency bypass of iliac artery by unspecified anastomosis
7A41y00	Other specified other bypass of iliac artery
7A41z00	Other bypass of iliac artery NOS
7A43200	Operation on aneurysm of iliac artery NEC
7A44000	Percutaneous transluminal angioplasty of iliac artery
7A45.00	Emergency replacement of aneurysmal femoral/popliteal artery
7A45000	Emerg replace aneurysm fem art by fem/pop art anast c prosth
7A45100	Emerg replace aneurysm pop art by pop/pop art anast c prosth
7A45.11	Emerg replacement aneurysmal femoral/popl art by anastomosis
7A45.12	Emergency replacement of aneurysmal common femoral artery
7A45.13	Emergency replacement of aneurysmal deep femoral artery
7A45.14	Emergency replacement of aneurysmal popliteal artery
7A45.15	Emergency replacement aneurysmal superficial femoral artery
7A45200	Emerg replace aneurysm fem art by fem/pop anast c vein graft
7A45400	Emerg replace aneurysm femoral art by fem/tib a anast c pros
7A45500	Emerg replace aneurysm pop art by pop/tib art anast c prosth
7A45700	Emerg replace aneurysm pop art by pop/tib anast c vein graft
7A45800	Emerg replace aneurysm fem art by fem/peron a anast c prosth
7A45900	Emerg replace aneurysm pop art by pop/peron a anast c prosth
7A45C00	Emerg replace aneurysm fem artery by fem/fem art anastomosis
7A45D00	Emerg replace aneurysm pop artery by pop/fem art anastomosis

7A45y00	Emergency replacement aneurysmal femoral/popliteal artery OS
7A45z00	Emergency replacement aneurysmal femoral/popliteal art NOS
7A46.00	Other replacement of aneurysmal femoral artery
7A46000	Replace aneurysm fem art by fem/pop art anastom c prosth NEC
7A46100	Replace aneurysm pop art by pop/pop art anastom c prosth NEC
7A46.11	Other replacement aneurysmal femoral artery by anastomosis
7A46.12	Other replacement of aneurysmal common femoral artery
7A46.13	Other replacement of aneurysmal deep femoral artery
7A46.14	Other replacement of aneurysmal popliteal artery
7A46.15	Other replacement of aneurysmal superficial femoral artery
7A46200	Replace aneurysm fem art by fem/pop a anast c vein graft NEC
7A46300	Replace aneurysm pop art by pop/pop a anast c vein graft NEC
7A46400	Replace aneurysm fem art by fem/tib art anast c prosth NEC
7A46500	Replace aneurysm pop art by pop/tib art anast c prosth NEC
7A46600	Replace aneurysm fem art by fem/tib a anast c vein graft NEC
7A46700	Replace aneurysm pop art by pop/tib a anast c vein graft NEC
7A46800	Replace aneurysm fem art by fem/peron art anast c prosth NEC
7A46900	Replace aneurysm pop art by pop/peron art anast c prosth NEC
7A46C00	Replace aneurysm fem artery by fem/fem art anastomosis NEC
7A46D00	Replace aneurysm popliteal artery by pop/fem anastomosis NEC
7A46y00	Other replacement of aneurysmal femoral/popliteal artery OS
7A46z00	Other replacement of aneurysmal femoral/popliteal artery NOS
7A47.00	Other emergency bypass of femoral artery or popliteal artery
7A47.12	Other emergency bypass of common femoral artery
7A47.13	Other emergency bypass of deep femoral artery
7A47.15	Other emergency bypass of superficial femoral artery
7A47.16	Other emergency bypass of femoral artery
7A47C00	Emerg bypass femoral artery by fem/fem art anastomosis NEC
7A48.00	Other bypass of femoral artery or popliteal artery
7A48000	Bypass femoral artery by fem/pop art anast c prosthesis NEC
7A48.12	Other bypass of common femoral artery
7A48.13	Other bypass of deep femoral artery
7A48.14	Other bypass of femoral artery
7A48.16	Other bypass of superficial femoral artery
7A48200	Bypass femoral artery by fem/pop art anast c vein graft NEC
7A48400	Bypass femoral artery by fem/tib art anast c prosthesis NEC
7A48600	Bypass femoral artery by fem/tib art anast c vein graft NEC
7A48800	Bypass femoral artery by fem/peron a anast c prosthesis NEC
7A48A00	Bypass femoral artery by fem/peron a anast c vein graft NEC
7A48C00	Bypass femoral artery by femoral/femoral art anastomosis NEC
7A48y00	Other bypass of femoral artery or popliteal artery OS
7A48z00	Other bypass of femoral artery or popliteal artery NOS
7A4A400	Ligation of aneurysm of popliteal artery
7A4A500	Operation on aneurysm of femoral artery NEC

7A4B000	Percutaneous transluminal angioplasty of femoral artery
7A4B100	Percutaneous transluminal angioplasty of popliteal artery
9N4h.00	DNA - Did not attend peripheral vascular disease clinic
C109F11	Type II diabetes mellitus with peripheral angiopathy
C109F12	Type 2 diabetes mellitus with peripheral angiopathy
C10EG00	Type 1 diabetes mellitus with peripheral angiopathy
C10FF00	Type 2 diabetes mellitus with peripheral angiopathy
C10FF11	Type II diabetes mellitus with peripheral angiopathy
G711.00	Thoracic aortic aneurysm which has ruptured
G711.11	Ruptured thoracic aortic aneurysm
G712.00	Thoracic aortic aneurysm without mention of rupture
G713.00	Abdominal aortic aneurysm which has ruptured
G713000	Ruptured suprarenal aortic aneurysm
G713.11	Ruptured abdominal aortic aneurysm
G714.00	Abdominal aortic aneurysm without mention of rupture
G714000	Juxtarenal aortic aneurysm
G714.11	AAA - Abdominal aortic aneurysm without mention of rupture
G715.00	Ruptured aortic aneurysm NOS
G715000	Thoracoabdominal aortic aneurysm; ruptured
G716000	Thoracoabdominal aortic aneurysm; without mention of rupture
G718.00	Leaking abdominal aortic aneurysm
G720.00	Aneurysm of artery of arm
G720000	Aneurysm of brachial artery
G720100	Aneurysm of radial artery
G720200	Aneurysm of ulnar artery
G720z00	Aneurysm of arm artery NOS
G722.00	Aneurysm of iliac artery
G722000	Aneurysm of common iliac artery
G722100	Aneurysm of external iliac artery
G722200	Aneurysm of internal iliac artery
G722z00	Aneurysm of iliac artery NOS
G723.00	Aneurysm of leg artery
G723000	Aneurysm of femoral artery
G723100	Aneurysm of popliteal artery
G723200	Aneurysm of anterior tibial artery
G723300	Aneurysm of dorsalis pedis artery
G723400	Aneurysm of posterior tibial artery
G723500	Ruptured popliteal artery aneurysm
G723600	Post radiological femoral false aneurysm
G723z00	Aneurysm of leg artery NOS
G72y400	Aneurysm of subclavian artery
G72y500	Aneurysm of splenic artery
G72y600	Aneurysm of axillary artery
G72y700	Aneurysm of coeliac artery

G72y800	Aneurysm of superior mesenteric artery
G72y900	Aneurysm of inferior mesenteric artery
G72yA00	Aneurysm of hepatic artery
G73..00	Other peripheral vascular disease
G731.00	Thromboangiitis obliterans
G731000	Buerger's disease
G73y.00	Other specified peripheral vascular disease
G73y000	Diabetic peripheral angiopathy
G73yz00	Other specified peripheral vascular disease NOS
G73z.00	Peripheral vascular disease NOS
G73z000	Intermittent claudication
G73zz00	Peripheral vascular disease NOS
G76z100	Femoral artery occlusion
G76z200	Popliteal artery occlusion
Gyu7400	[X]Other specified peripheral vascular diseases

Appendix 5.4. Code list for peripheral arterial disease

Read code	Read term
14NB.00	H/O: Peripheral vascular disease procedure
662U.00	Peripheral vascular disease monitoring
7A10100	Bypass aorta by anastomosis axillary to femoral artery NEC
7A11.00	Replacement of aneurysmal bifurcation of aorta
7A11000	Emerg repl aneurysm bifurc aorta by anast aorta to fem art
7A11100	Replace aneurysm bifurc aorta by anast aorta to femoral art
7A11200	Emerg repl aneurysm bifurc aorta by anast aorta to iliac a
7A11211	Y graft of abdominal Aortic aneurysm (emergency)
7A11300	Replace aneurysm bifurc aorta by anast aorta to iliac artery
7A11311	Y graft abdominal Aortic aneurysm
7A11y00	Replacement of aneurysmal bifurcation of aorta OS
7A11z00	Replacement of aneurysmal bifurcation of aorta NOS
7A12000	Emerg bypass bifurc aorta by anast aorta to femoral artery
7A12100	Bypass bifurc aorta by anastom aorta to femoral artery NEC
7A12200	Emerg bypass bifurc aorta by anastom aorta to iliac artery
7A12300	Bypass bifurcation aorta by anastom aorta to iliac artery
7A13100	Emerg replace aneurysm thor aorta by anastom aorta to aorta
7A13200	Emerg replace aneurysm suprarenal aorta by anast aorta/aorta
7A13300	Emerg replace aneurysm infrarenal aorta by anast aorta/aorta
7A13400	Emerg replace aneurysm abdom aorta by anast aorta/aorta NEC
7A13411	Tube graft abdominal Aortic aneurysm (emergency)
7A14100	Replace aneurysm thoracic aorta by anast of aorta/aorta NEC
7A14400	Replace aneurysm abdominal aorta by anast aorta to aorta NEC
7A14411	Tube graft of Abdominal aortic aneurysm
7A1B000	Endovascular stenting infrarenal abdominal aortic aneurysm

7A1B200	Endovascular stenting of thoracic aortic aneurysm
7A22000	Percutaneous transluminal angioplasty of carotid artery
7A27C00	Operation on aneurysm of subclavian artery
7A27D00	Operation on aneurysm of axillary artery
7A27E00	Operation on aneurysm of brachial artery
7A28000	Percutaneous transluminal angioplasty of subclavian artery
7A28100	Percutaneous transluminal angioplasty of brachial artery
7A28200	Percutaneous transluminal angioplasty of vertebral artery
7A28C00	Percutaneous transluminal angioplasty of axillary artery
7A31300	Operation on aneurysm of renal artery
7A32000	Percutaneous transluminal angioplasty of renal artery
7A34C00	Operation on aneurysm of coeliac artery NEC
7A34D00	Operation on aneurysm of superior mesenteric artery NEC
7A34E00	Operation on aneurysm of inferior mesenteric artery NEC
7A34F00	Operation on aneurysm of suprarenal artery NEC
7A34K00	Operation on aneurysm visceral branch of abdominal aorta NEC
7A35000	Percutaneous transluminal angioplasty of coeliac artery NEC
7A35300	Percutaneous transluminal angioplasty suprarenal artery NEC
7A40.00	Replacement of aneurysmal iliac artery
7A40000	Emerg replace aneurysm iliac art by iliac/femoral art anast
7A40100	Replace aneurysmal iliac art by iliac/femoral art anast NEC
7A40.11	Replacement of aneurysmal iliac artery by anastomosis
7A40200	Emerg replace aneurysmal iliac artery by fem/fem art anast
7A40300	Replace aneurysmal iliac artery by fem/fem artery anast NEC
7A40600	Emerg replace aneurysm leg artery by aorta/com fem art anast
7A40700	Emerg replace aneurysm leg artery by aorta/sup fem art anast
7A40800	Emerg replace aneurysm iliac artery by iliac/iliac art anast
7A40900	Replace aneurysm com iliac a by aorta/com iliac a anast NEC
7A40A00	Replace aneurysm iliac art by aorta/ext iliac art anast NEC
7A40B00	Replace aneurysm leg artery by aorta/com fem art anast NEC
7A40C00	Replace aneurysm leg artery by aorta/sup fem art anast NEC
7A40D00	Replace aneurysm iliac artery by iliac/iliac art anast NEC
7A40y00	Other specified replacement of aneurysmal iliac artery
7A40z00	Replacement of aneurysmal iliac artery NOS
7A41.00	Other bypass of iliac artery
7A41100	Bypass iliac artery by iliac/femoral artery anastomosis NEC
7A41.11	Other bypass of iliac artery by anastomosis
7A41200	Emerg bypass iliac artery by femoral/femoral art anast NEC
7A41300	Bypass iliac artery by femoral/femoral art anastomosis NEC
7A41500	Emerg bypass iliac artery by aorta/ext iliac art anast NEC
7A41800	Emerg bypass iliac artery by iliac/iliac art anastomosis NEC
7A41900	Bypass common iliac artery by aorta/com iliac art anast NEC
7A41A00	Bypass iliac artery by aorta/ext iliac art anastomosis NEC
7A41D00	Bypass iliac artery by iliac/iliac artery anastomosis NEC

7A41E00	Emergency bypass of iliac artery by unspecified anastomosis
7A41y00	Other specified other bypass of iliac artery
7A41z00	Other bypass of iliac artery NOS
7A43200	Operation on aneurysm of iliac artery NEC
7A44000	Percutaneous transluminal angioplasty of iliac artery
7A45.00	Emergency replacement of aneurysmal femoral/popliteal artery
7A45000	Emerg replace aneurysm fem art by fem/pop art anast c prosth
7A45100	Emerg replace aneurysm pop art by pop/pop art anast c prosth
7A45.11	Emerg replacement aneurysmal femoral/popl art by anastomosis
7A45.12	Emergency replacement of aneurysmal common femoral artery
7A45.13	Emergency replacement of aneurysmal deep femoral artery
7A45.14	Emergency replacement of aneurysmal popliteal artery
7A45.15	Emergency replacement aneurysmal superficial femoral artery
7A45200	Emerg replace aneurysm fem art by fem/pop anast c vein graft
7A45400	Emerg replace aneurysm femoral art by fem/tib a anast c pros
7A45500	Emerg replace aneurysm pop art by pop/tib art anast c prosth
7A45700	Emerg replace aneurysm pop art by pop/tib anast c vein graft
7A45800	Emerg replace aneurysm fem art by fem/peron a anast c prosth
7A45900	Emerg replace aneurysm pop art by pop/peron a anast c prosth
7A45C00	Emerg replace aneurysm fem artery by fem/fem art anastomosis
7A45D00	Emerg replace aneurysm pop artery by pop/fem art anastomosis
7A45y00	Emergency replacement aneurysmal femoral/popliteal artery OS
7A45z00	Emergency replacement aneurysmal femoral/popliteal art NOS
7A46.00	Other replacement of aneurysmal femoral artery
7A46000	Replace aneurysm fem art by fem/pop art anastom c prosth NEC
7A46100	Replace aneurysm pop art by pop/pop art anastom c prosth NEC
7A46.11	Other replacement aneurysmal femoral artery by anastomosis
7A46.12	Other replacement of aneurysmal common femoral artery
7A46.13	Other replacement of aneurysmal deep femoral artery
7A46.14	Other replacement of aneurysmal popliteal artery
7A46.15	Other replacement of aneurysmal superficial femoral artery
7A46200	Replace aneurysm fem art by fem/pop a anast c vein graft NEC
7A46300	Replace aneurysm pop art by pop/pop a anast c vein graft NEC
7A46400	Replace aneurysm fem art by fem/tib art anast c prosth NEC
7A46500	Replace aneurysm pop art by pop/tib art anast c prosth NEC
7A46600	Replace aneurysm fem art by fem/tib a anast c vein graft NEC
7A46700	Replace aneurysm pop art by pop/tib a anast c vein graft NEC
7A46800	Replace aneurysm fem art by fem/peron art anast c prosth NEC
7A46900	Replace aneurysm pop art by pop/peron art anast c prosth NEC
7A46C00	Replace aneurysm fem artery by fem/fem art anastomosis NEC
7A46D00	Replace aneurysm popliteal artery by pop/fem anastomosis NEC
7A46y00	Other replacement of aneurysmal femoral/popliteal artery OS
7A46z00	Other replacement of aneurysmal femoral/popliteal artery NOS
7A47.00	Other emergency bypass of femoral artery or popliteal artery

7A47.12	Other emergency bypass of common femoral artery
7A47.13	Other emergency bypass of deep femoral artery
7A47.15	Other emergency bypass of superficial femoral artery
7A47.16	Other emergency bypass of femoral artery
7A47C00	Emerg bypass femoral artery by fem/fem art anastomosis NEC
7A48.00	Other bypass of femoral artery or popliteal artery
7A48000	Bypass femoral artery by fem/pop art anast c prosthesis NEC
7A48.12	Other bypass of common femoral artery
7A48.13	Other bypass of deep femoral artery
7A48.14	Other bypass of femoral artery
7A48.16	Other bypass of superficial femoral artery
7A48200	Bypass femoral artery by fem/pop art anast c vein graft NEC
7A48400	Bypass femoral artery by fem/tib art anast c prosthesis NEC
7A48600	Bypass femoral artery by fem/tib art anast c vein graft NEC
7A48800	Bypass femoral artery by fem/peron a anast c prosthesis NEC
7A48A00	Bypass femoral artery by fem/peron a anast c vein graft NEC
7A48C00	Bypass femoral artery by femoral/femoral art anastomosis NEC
7A48y00	Other bypass of femoral artery or popliteal artery OS
7A48z00	Other bypass of femoral artery or popliteal artery NOS
7A4A400	Ligation of aneurysm of popliteal artery
7A4A500	Operation on aneurysm of femoral artery NEC
7A4B000	Percutaneous transluminal angioplasty of femoral artery
7A4B100	Percutaneous transluminal angioplasty of popliteal artery
9N4h.00	DNA - Did not attend peripheral vascular disease clinic
C109F11	Type II diabetes mellitus with peripheral angiopathy
C109F12	Type 2 diabetes mellitus with peripheral angiopathy
C10EG00	Type 1 diabetes mellitus with peripheral angiopathy
C10FF00	Type 2 diabetes mellitus with peripheral angiopathy
C10FF11	Type II diabetes mellitus with peripheral angiopathy
G711.00	Thoracic aortic aneurysm which has ruptured
G711.11	Ruptured thoracic aortic aneurysm
G712.00	Thoracic aortic aneurysm without mention of rupture
G713.00	Abdominal aortic aneurysm which has ruptured
G713000	Ruptured suprarenal aortic aneurysm
G713.11	Ruptured abdominal aortic aneurysm
G714.00	Abdominal aortic aneurysm without mention of rupture
G714000	Juxtarenal aortic aneurysm
G714.11	AAA - Abdominal aortic aneurysm without mention of rupture
G715.00	Ruptured aortic aneurysm NOS
G715000	Thoracoabdominal aortic aneurysm; ruptured
G716000	Thoracoabdominal aortic aneurysm; without mention of rupture
G718.00	Leaking abdominal aortic aneurysm
G720.00	Aneurysm of artery of arm
G720000	Aneurysm of brachial artery

G720100	Aneurysm of radial artery
G720200	Aneurysm of ulnar artery
G720z00	Aneurysm of arm artery NOS
G722.00	Aneurysm of iliac artery
G722000	Aneurysm of common iliac artery
G722100	Aneurysm of external iliac artery
G722200	Aneurysm of internal iliac artery
G722z00	Aneurysm of iliac artery NOS
G723.00	Aneurysm of leg artery
G723000	Aneurysm of femoral artery
G723100	Aneurysm of popliteal artery
G723200	Aneurysm of anterior tibial artery
G723300	Aneurysm of dorsalis pedis artery
G723400	Aneurysm of posterior tibial artery
G723500	Ruptured popliteal artery aneurysm
G723600	Post radiological femoral false aneurysm
G723z00	Aneurysm of leg artery NOS
G72y400	Aneurysm of subclavian artery
G72y500	Aneurysm of splenic artery
G72y600	Aneurysm of axillary artery
G72y700	Aneurysm of coeliac artery
G72y800	Aneurysm of superior mesenteric artery
G72y900	Aneurysm of inferior mesenteric artery
G72yA00	Aneurysm of hepatic artery
G73..00	Other peripheral vascular disease
G731.00	Thromboangiitis obliterans
G731000	Buerger's disease
G73y.00	Other specified peripheral vascular disease
G73y000	Diabetic peripheral angiopathy
G73yz00	Other specified peripheral vascular disease NOS
G73z.00	Peripheral vascular disease NOS
G73z000	Intermittent claudication
G73zz00	Peripheral vascular disease NOS
G76z100	Femoral artery occlusion
G76z200	Popliteal artery occlusion
Gyu7400	[X]Other specified peripheral vascular diseases