Musculoskeletal consultations from childhood to adulthood: a longitudinal study

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Abstract

Background

The Global Burden of Disease reports indicate that musculoskeletal conditions are important causes of disability worldwide. Such conditions may originate in childhood, but studies investigating changes longitudinally and from childhood to adulthood are infrequent.

Methods

Nine birth cohorts of children (starting at ages 7-15 years) were followed. Participants were identified from CiPCA, an electronic health record database of 11 English general practices. Musculoskeletal consultation prevalence figures were calculated, and reasons for consultation evaluated.

Results

Annual musculoskeletal consultation prevalence was similar across cohorts for each age. Prevalence increased from 6% to 16% between ages 7 and 22, and was higher in males until age 15, after which prevalence was higher in females. Pain was the most common reason for consultation. Back pain consultations increased from 1 consultation/1,000 7-year olds to 84 consultations/1,000 22-year olds. Lower limb pain consultations increased from 21 consultations/1,000 7-year olds to 56 consultations/1,000 22-year olds.

Conclusions

This study shows that from childhood, individuals are more likely to seek healthcare for musculoskeletal consultations as they age, but rates are not increasing over time. Changes in consultation rates by age, gender and pain region may inform studies on the development of chronic musculoskeletal pain over the life-course.

Background

The World Health Organisation Global Burden of Disease 2015 report indicated that musculoskeletal conditions are a leading cause of disability worldwide.[1] Musculoskeletal conditions, including neck and low back pain, are among the top ten causes of years lived with disability from those aged ten years throughout the life course to those aged over 80 years.[1] Not only is there an impact on individuals, but there are substantial societal costs associated with healthcare and social support for individuals affected by musculoskeletal conditions.[1,2]

The majority of studies examining the occurrence and impact of musculoskeletal conditions have been conducted in adults. Studies of musculoskeletal conditions in children under 18 years have largely focused on adolescents. These studies have found that the prevalence of musculoskeletal pain increases from adolescence to adulthood and those who have pain in childhood or adolescence are more likely to have pain in later adulthood.[3-6] Studies examining trajectories of musculoskeletal pain have found that the majority of adults remain in the same pain trajectory over time.[7,8] By contrast, in adolescents, some musculoskeletal pain trajectories show an increase in pain over time.[3,9] Pain trajectories that indicate the development of musculoskeletal pain in adolescents may be the precursor to musculoskeletal pain conditions in adults. Understanding patterns of musculoskeletal conditions from childhood across the life course into adulthood is important as it may identify critical periods in which prevention strategies may be effective and could thereby reduce the burden in adults.

Evidence from primary care electronic health records (EHR) shows that musculoskeletal conditions are among the most common reasons for consultations in adults,[10] but there is a lack of information regarding paediatric consultations. A cross-sectional primary care EHR study found that 8.3% of 3-17 year olds consulted at least once with a musculoskeletal problem during 2006, with prevalence slightly but significantly higher in males than females.[11] However, no previous studies have used longitudinal primary care EHR to examine how patterns of musculoskeletal consultations may change from childhood to adulthood. Existing observational studies of musculoskeletal pain in children and adolescents have largely used self-report questionnaires which may result in loss to follow-up and attrition bias.[3-6,9] In England, almost 100% of the population are registered with a general practitioner and 90% of NHS consultations occur in primary care.[12,13] The increasing availability of primary care EHR collected over many years enables longitudinal examination of patterns of musculoskeletal consultations, whilst removing the potential selection biases associated with questionnaire studies.

Our aim was to follow birth cohorts of individuals using longitudinal primary care EHR to investigate whether patterns of musculoskeletal consultations change over time and from childhood to adulthood. Our objectives were to determine (i) the prevalence of musculoskeletal consultations from childhood to adulthood for different age cohorts, and (ii) the reasons for consultations.

Methods

Study design and setting

We conducted an observational, longitudinal cohort study using primary care paediatric musculoskeletal EHR data. We used pseudo-anonymised primary care consultation information from 11 general practices contributing to the Consultations in Primary Care Archive (CiPCA), in North Staffordshire, UK. Patients are allocated a unique ID number and data is available on factors including registration status, age on date of consultation, and the Index of Multiple Deprivation (IMD) score. IMD is determined regionally across England using factors including education status and crime rates to determine a deprivation score.[14] The practices undergo training and feedback on the quality of data recording.[15] Musculoskeletal consultation prevalence in CiPCA is comparable to that of national databases.[16] Ethical approval for use of CiPCA in research was granted originally by the North Staffordshire Research Ethics Committee, and updated by North West - Haydock Research Ethics Committee.

Inclusion criteria were being aged between 7 and 15 years in 2003, and being continually registered from 2003 to 2010. Patients who fulfilled these inclusion criteria were split into nine birth cohorts, with the youngest cohort born in 1996 (aged 7 in 2003, followed-up to age 14 in 2010) and the oldest born in 1988 (aged 15 in 2003, followed-up to age 22 in 2010).

Reasons for consultations were determined by the Read code assigned to that consultation. Read codes are used in the UK to classify primary care consultations based on clinical terminology.[17,18] We identified all musculoskeletal consultations in our cohorts from 2003 to 2010. These were categorised by subdividing the Read terms into categories for 'pain' (codes for pain, and conditions in which pain is the predominant symptom e.g. Osgood Schlatter's disease), 'trauma' (fractures, dislocations, injuries), 'problem' (e.g. plantar fasciitis, scoliosis) and 'other' (non-specific codes e.g. bruise, swelling). Further examples of the codes in each category is given in Appendix Table 1. A random sample of examples of these classifications was circulated to 11 academic general practitioners based at Keele University to assess for consensus on categorisation. We also identified consultations within the 'pain' category for 'back' and 'lower limb' pain; we chose to examine these two regions as back pain is among the most common causes of years lived with disability in adulthood whilst lower limb pain has been reported as the most common pain in childhood.[1,16,19]

Analysis

Demographic factors of age, gender and IMD in the population who remained continually registered from 2003 to 2010 were compared with those who did not remain continually registered to determine whether the study population was representative of the target population.

Consultation patterns were analysed as follows:

(i) In order to assess the number of paediatric patients having primary care consultations for musculoskeletal issues, we calculated the annual musculoskeletal consultation prevalence. Annual musculoskeletal consultation prevalence was calculated as the number of patients with at least one musculoskeletal consultation per 1,000 registered population per birth cohort and stratified by gender, for each year from 2003 to 2010. One consultation per

individual per year in primary care was included (i.e. recorded entries for letters from secondary care were excluded). We also calculated the annual musculoskeletal consultation prevalence per 1,000 registered population for each age (7 to 22 years) by combining the data from all birth cohorts.

(ii) In order to determine the number of paediatric consultations in primary care for specific musculoskeletal issues, we examined the total number of consultations. Total number of consultations for each category of musculoskeletal consultation (pain, problems, trauma, other) was calculated per 1,000 registered population per year for each age (7 to 22 years) by combining the data from all cohorts. All primary care musculoskeletal consultations during the study period were included and thus a patient could contribute multiple times in the same year (i.e. results are expressed as number of consultations, rather than the number of individuals consulting, per 1,000 registered population per year). Total number of consultations for back pain and lower limb pain were also calculated per 1,000 registered population per year for each age using data combined from all cohorts.

All analysis was conducted using Stata 14.0 and Microsoft Excel 2010. Ethical approval for use of CiPCA in research was granted originally by the North Staffordshire Research Ethics Committee, and updated by North West - Haydock Research Ethics Committee.

Results

Characteristics of the study population

7,125 children remained continually registered throughout 2003 to 2010 and, of these, 4,390 children had at least one musculoskeletal primary care consultation. There were a slightly higher proportion of females (55.0% not continually registered vs 47.9% continually registered), those from older birth cohorts, and those from more deprived backgrounds (quintile 1) in those who did not remain continually registered from 2003 to 2010 (Appendix Table 2).

Annual musculoskeletal consultation prevalence

Annual musculoskeletal consultation prevalence increased with age. In 7 year olds, 61 per 1,000 registered had a consultation compared with 162 per 1,000 in 22 year olds (Figure 1). At each age, musculoskeletal consultation prevalence was similar in the different birth cohorts, demonstrating that the increase in prevalence over time was due to age, not birth cohort. For example, in 13 year olds, across seven cohorts, prevalence varied between 109/1,000 and 128/1,000 registered population per year. Combining the seven birth cohorts, Table 1 appears to show an increasing trend in annual musculoskeletal consultation prevalence with age overall.

In younger patients, males had higher musculoskeletal consultation prevalence compared with females, with prevalence in 7 year olds of 66/1,000 and 56/1,000, respectively. However, this changed at age 15, after which females had higher consultation prevalence, with a prevalence of 180/1,000 for those aged 22 years, compared to 149/1,000 in males of the same age.

Reasons for consulting

Examining total number of consultations by categorising consultations into pain, trauma, problems and other, we found that pain remained the most common reason for consultation

and increased in frequency with age from 7 to 22 years, whereas number of consultations per 1,000 population for musculoskeletal trauma, problems and other musculoskeletal conditions remained fairly stable (Figure 2). 7 year olds had 42 pain consultations per 1,000 registered population per year compared with 226 per 1,000 22 year olds.

When further subdividing pain into 'back' and 'lower limb' regions, the number of consultations per 1,000 population for both regions increased with increasing patient age (Figure 3). Lower limb consultations were more common than those for back pain between ages 7 and 20, after which back pain consultations were more common, although the number of consultations for back and lower limb pain was similar between ages 16 and 20 years. In 7 year olds, 1 consultation per 1,000 registered population was for back pain compared with 21 consultations per 1,000 registered for lower limb pain. 16 year olds had 29 consultations per 1,000 registered population for back pain compared with 37 for lower limb pain. At 22 years, 84 consultations per 1,000 registered population were for back pain and 56 per 1,000 registered population were for lower limb pain.

Discussion

Main finding of this study

This is the first paper that examines patterns of musculoskeletal consultations from childhood to adulthood using longitudinal primary care EHR data.

Our results showed that from childhood, individuals were more likely to have primary care musculoskeletal consultations as they aged. Consultation rates did not increase over time for any age group demonstrating that the increase in consultation rates was due to an increase in age, not time. Consultations for lower limb pain were more common than for back pain from age 7 to 20, but back pain consultations were more common than those for lower limb pain after age 20.

What is already known on this topic

Previous cross-sectional primary care studies with age ranges up to adolescence found that younger patients were more likely to have lower limb pain whereas older children had both lower limb and back pain.[19,20] A recent cross-sectional EHR study reported 8% annual musculoskeletal consultation prevalence in 3-17 year olds.[11] Two previous self-reported questionnaire based studies found that back pain increased significantly between the ages of 9 to 15[22] and 17 to 22.[3] Pubertal stage has been identified as a potentially important risk factor for persistence of musculoskeletal pain in adolescence.[21]

What this study adds

We report data showing that annual musculoskeletal consultation prevalence increases from 6% to 16% between ages 7 and 22. This is a large increase, and suggests that pubertal stage should be assessed in future studies of the course of back pain from childhood through adolescence to adulthood.

The number of consultations for back pain increased steadily between ages 7 and 22 years with 84 consultations for back pain per 1,000 registered population at age 22 in our study.

Comparison with the cohort studies using self-reported questionnaires provides evidence that there may be a substantial difference in the number of paediatric patients reporting symptoms and the number who consult in primary care. This may be due to paediatric patients not reporting pain to their caregivers or perhaps caregivers are less likely to take children to consult their general practitioner for musculoskeletal problems. We suggest it is important for paediatricians to consider specifically asking patients about musculoskeletal symptoms in acute and outpatient settings so that these symptoms are not missed.

The current study benefits from the use of the CiPCA EHR database; contributing practices have been trained and assessed in the recording of morbidity codes.[15] This longitudinal primary care EHR is collected prospectively, enabling us to identify and follow-up a subset of patients over eight years to examine their musculoskeletal consultation patterns. Previous cohort studies have focused on specific regions of pain, particularly back pain.[3,6,22,23] However, using primary care consultation data enabled us to examine all reasons for musculoskeletal consultations, and then to focus on back and lower limb pain. To our knowledge, no previous studies have used longitudinal primary care EHR to follow patterns of musculoskeletal consultations from childhood to adulthood. Previous studies using medical records to evaluate musculoskeletal pain presentations have not followed the same patients over time.[19,20] Our study followed the same individuals over 8 years and the cohorts spanned the ages of 7 to 22, enabling us to examine patterns of musculoskeletal consultations over a 16-year age range and determine how consultation rates may change from childhood through adolescence and into early adulthood.

Limitations of this study

In order to follow-up a group of patients over a period of time, we excluded patients who did not remain registered at a single primary care practice over the whole time of the study. These patients differed slightly from the population who remained registered, in that there were more females, those from older age cohorts and those from more deprived areas who did not remain registered. However, this is not unexpected, as there is evidence that more females tend to move away from home to university, and those from a lower socioeconomic class are more likely to change address and general practice due to housing.[24]

We could only estimate the prevalence of symptoms of those who consulted, and not all people with a musculoskeletal condition will consult.[3,6] In addition, previous studies have shown that there is much inter-practitioner variation in the choice of Read codes used.[15,25] For example, in this study, there could have been misclassification of trauma and pain if a consultation was coded as pain but may have originally been caused by trauma. Since we could not see the full details for the consultation but only the consultation code, we could only classify based on the code inputted by each clinician. A primary care study in Spain observed that the most common aetiology for musculoskeletal pain in children and adolescents was trauma, although this is likely due to the inclusion of children initially evaluated in the emergency room who required follow-up.[20]

Conclusions

This longitudinal study has highlighted that from childhood, individuals are more likely to have primary care musculoskeletal consultations as they age, but consultation rates are not increasing over time for any age group. Primary care musculoskeletal consultations are

common in paediatric patients, and are predominantly for pain. However, the rates observed are far lower than those from self-reported data; it is important we explore reasons for this discrepancy and that we specifically ask paediatric patients about musculoskeletal symptoms.

A review on low back pain during the life-course suggests that patients may have persistent back pain from adolescence into adulthood.[26] EHR data can be used to examine individual consultation patterns over time from childhood to adulthood to help identify which paediatric patients may be most likely to develop chronic musculoskeletal pain that persists through the life-course. This will inform future studies aiming to develop prevention strategies earlier in the life-course to reduce the development of chronic pain in adults and, therefore, the global burden of disease from musculoskeletal causes.

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Conflicts of interest

Dr Dunn, Miss Barnett, Dr Lacey, Dr Jordan and Dr Prathivadi Bhayankaram report grants from the National Institute for Health Research and North Staffordshire Primary Care Research Consortium during the conduct of the study.

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Table 1: Annual musculoskeletal consultation prevalence per 1,000 registered population for ages 7 to 22, using data from all nine birth cohorts combined

Age	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Annual musculoskeletal consultation prevalence per 1,000 registered population	61	58	68	83	91	104	117	120	138	119	128	140	154	157	174	162

Figure 1: Annual musculoskeletal consultation prevalence per 1,000 registered population by age, in nine birth cohorts

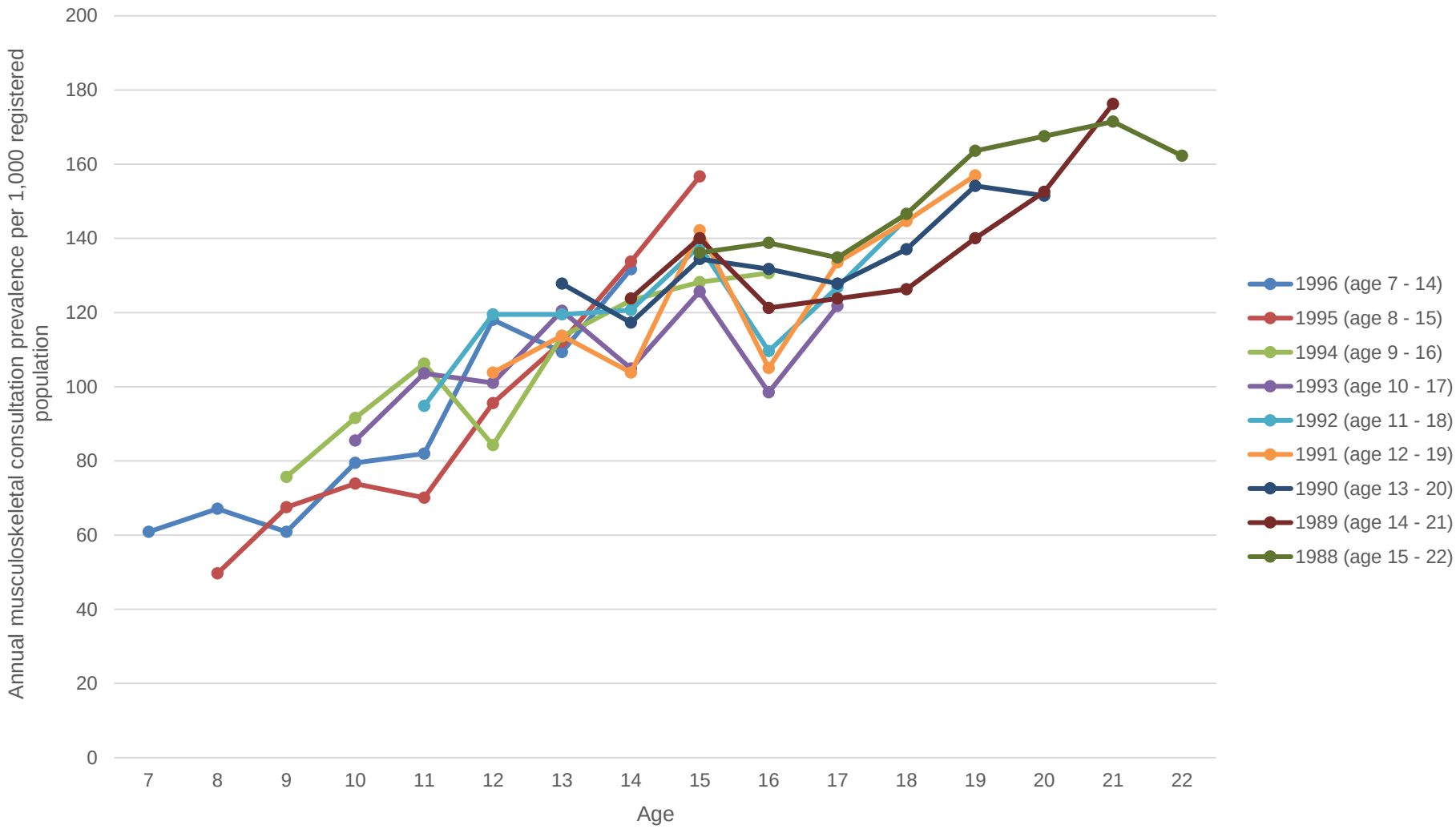

Figure 1: Annual musculoskeletal consultation prevalence per 1,000 registered population by age. Each line represents a birth cohort born in 1988 to those born in 1996

Figure 2: Total number of musculoskeletal consultations per 1,000 registered population by age, for pain, trauma, problems and other musculoskeletal consultations

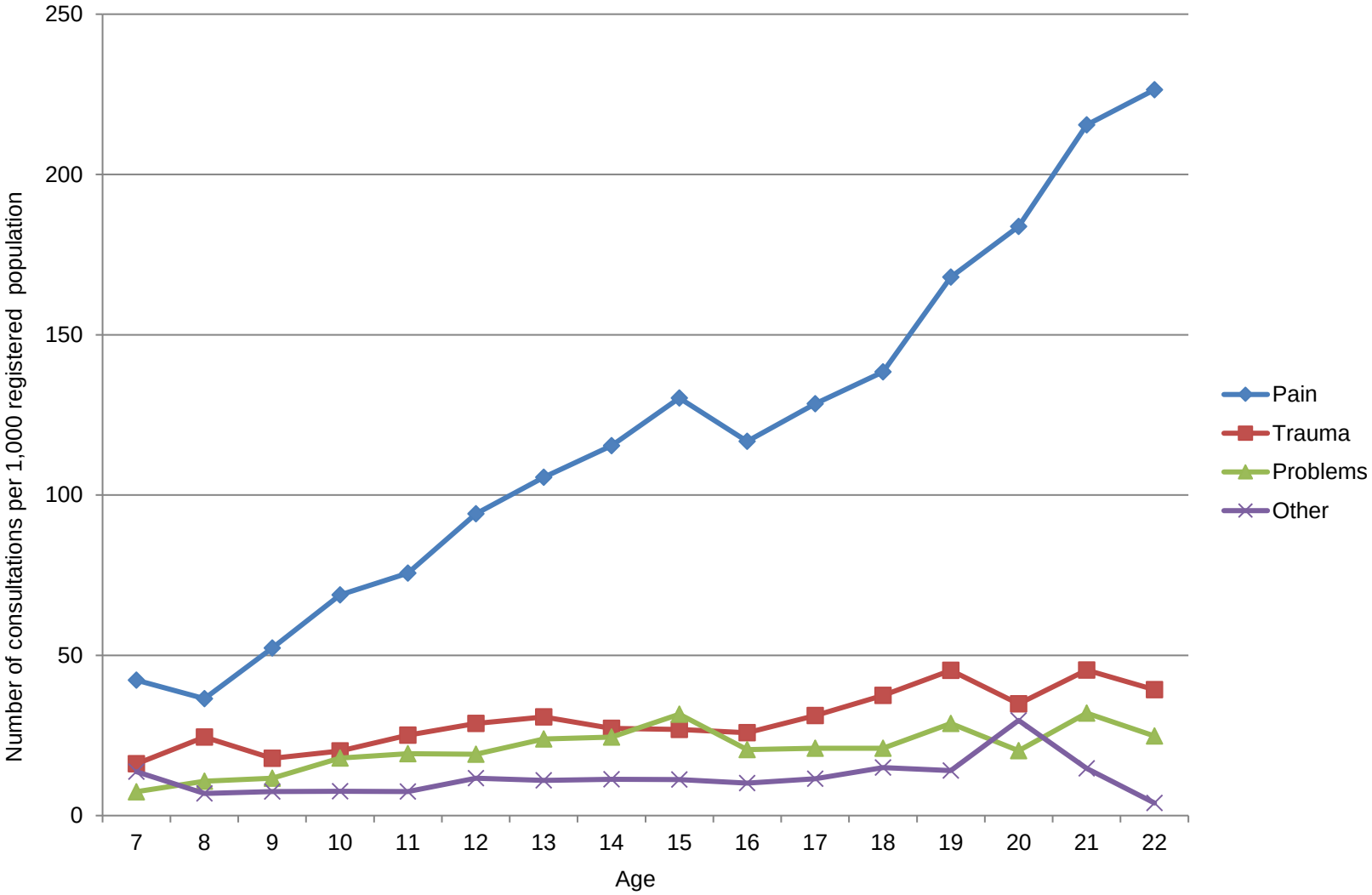

Figure 2: Number of musculoskeletal consultations per 1,000 registered per age 7 to 22 years for pain, trauma, problems and other consultations

Figure 3: Total number of lower limb pain and back pain consultations per 1,000 registered population by age

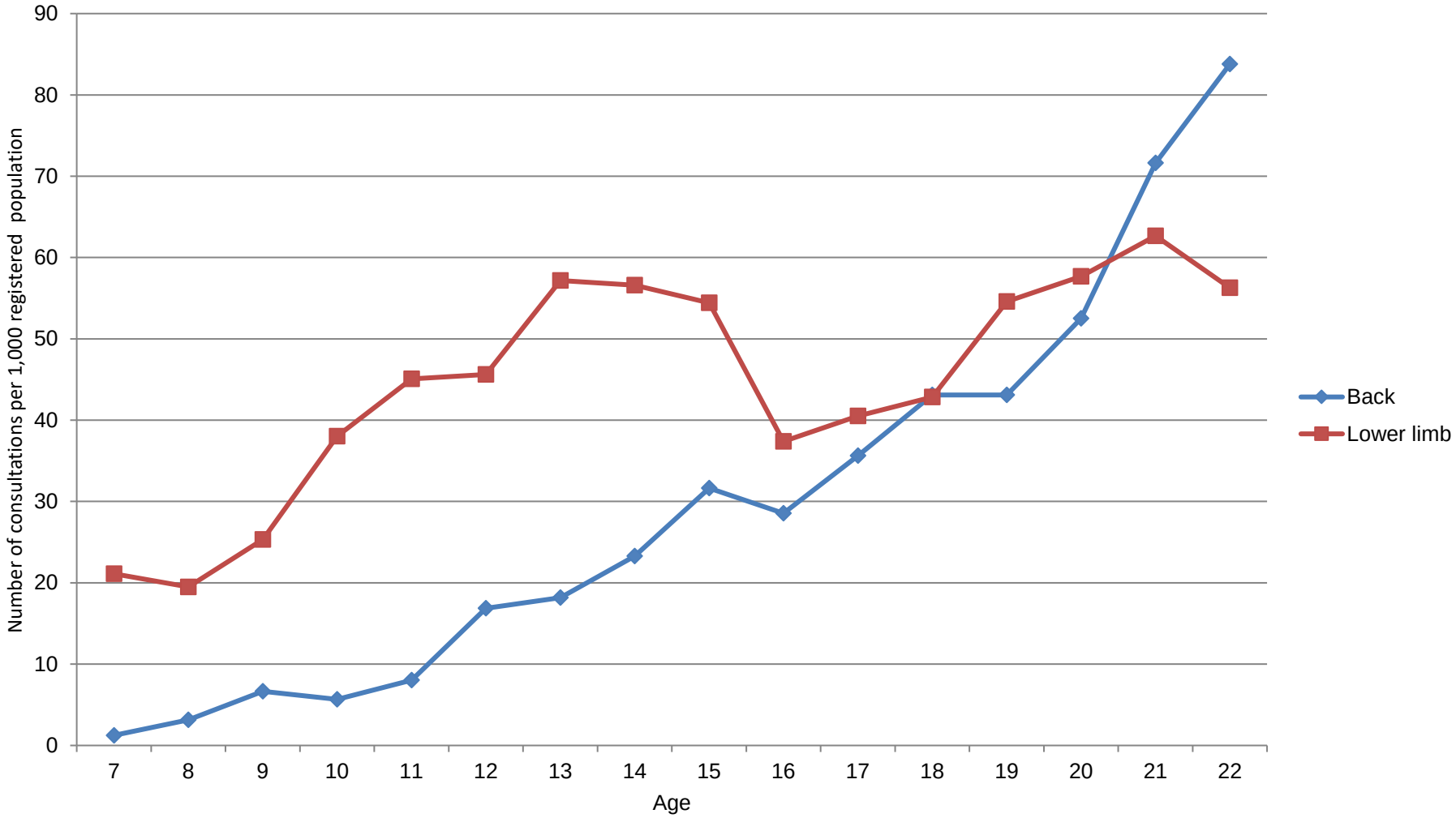

Figure 3: number of consultations for back and lower limb pain per 1,000 registered from age 7 to 22 years