**The impact of the COVID-19 pandemic on referrals to musculoskeletal services from primary care and subsequent incidence of inflammatory rheumatic musculoskeletal disease: an observational study**

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**ABSTRACT**

**Objectives**

To describe the impact of the COVID-19 pandemic upon referral patterns and incident diagnosis of inflammatory rheumatic and musculoskeletal diseases (iRMDs).

**Methods**

UK primary care data was used to describe referral patterns for patients with musculoskeletal conditions. Trends in referrals to musculoskeletal services and incident diagnoses of iRMDs (specifically rheumatoid arthritis (RA) and juvenile inflammatory arthritis (JIA)) were described using Joinpoint Regression and comparisons made between key pandemic time periods.

**Results**

The incidence of RA and JIA reduced by -13.3% and -17.4% per month respectively between January 2020 and April 2020, and then increased by 1.9% and 3.7% per month respectively between April 2020 and October 2021. The incidence of all diagnosed iRMDs was stable until October 2021. Referrals decreased between February 2020 and May 2020 by -16.8% per month from 4.8% to 2.4% in patients presenting with a musculoskeletal condition. After May 2020, referrals increased significantly (16.8% per month) to 4.5% in July 2020. Time from first musculoskeletal consultation to RA diagnosis, and referral to RA diagnosis increased in the early-pandemic period (rate ratio (RR) 1.11, 95%CI 1.07-1.15; RR 1.23, 95%CI 1.17-1.30) and remained consistently higher in the late-pandemic (RR 1.13, 95%CI 1.11-1.16; RR 1.27, 95%CI 1.23-1.32) periods respectively, compared to the pre-COVID-19 period.

**Conclusion**

Patients with underlying RA and JIA that developed during the pandemic may be yet to present, or be in the referral and/or diagnostic process. Clinicians should remain alert to this possibility and commissioners aware of these findings, enabling the appropriate planning and commissioning of services.

**Key Words:** COVID-19, inflammatory rheumatic and musculoskeletal disease / disorders, electronic healthcare record research

**Key Messages:**

1. Primary care has continued to refer patients with suspected iRMDs after an average of three musculoskeletal-related consultations, throughout the pandemic.

2. The reduced incidence of RA seen during pandemic period suggests that there remain a group of patients with undiagnosed RA.

3. Residents of deprived communities waited longer for their diagnosis once referral had been made.

**INTRODUCTION**

Rheumatic and musculoskeletal diseases (RMDs), defined as problems of the joints, muscles and bones,1 are common and cause a high disease burden globally.2 In the UK, primary care is generally the first point of care for people with RMDs; 20% of adults consult their primary care clinician with an RMD each year.3 Patients are typically managed using a multidisciplinary approach which includes advice and self-care, pharmacological therapy and referral for non-pharmacological treatments, for example physiotherapy, exercise and weight management. However, inflammatory rheumatic musculoskeletal diseases (iRMDs), including rheumatoid arthritis (RA), juvenile inflammatory arthritis (JIA) (and other autoimmune and inflammatory conditions including psoriatic arthritis, axial spondyloarthropathies, systemic lupus erythematosus, polymyalgia rheumatica and giant cell arteritis), require rapid diagnosis and management, often involving specialist care referral.

In March 2020, the COVID-19 pandemic prompted the delivery of UK primary care to change abruptly.4 The ‘total triage’ model of care, whereby all consultations were ‘remote by default’ was widely implemented,5, 6 replacing traditional ‘face-to-face’ healthcare. The Government issued a ‘stay at home’ order, advising the public to ‘protect the NHS,’ and instigated a ‘lockdown.’7 Excepting emergency or urgent cases, including suspected cancer referrals, primary care clinicians were encouraged to reduce referrals to community and secondary care to enable increased acute care capacity.8, 9 These restrictions led to an approximately 30% reduction in primary care consultations per person the week after the introduction of the lockdown, with generally lower consultation rates observed until June 2020.4 Delays in the diagnosis and treatment of cancers ensued10 and similar concerns were expressed regarding other time-critical diagnoses.

Early diagnosis of iRMDs and subsequent timely access to disease modifying therapies is associated with improved health and socio-economic outcomes,11 and forms a key component of national and international guidelines,12, 13 for example timely referral within 3 working days of presentation with suspected RA symptoms to primary care. 12 The UK mandatory National Early Inflammatory Arthritis audit includes standards for referral to rheumatology (three days), seen by a rheumatologist (three weeks), and initiated on treatment (within six weeks of referral); 14 a 14-month audit suspension started in March 2020.

We used routinely collected, anonymized, primary care data to describe the impact of the COVID-19 pandemic upon time to referral and diagnosis of inflammatory rheumatic musculoskeletal disorders iRMDs, including rheumatoid arthritis (RA) and juvenile inflammatory arthritis (JIA), in patients presenting to primary care with musculoskeletal symptoms.

**METHODS**

*Setting, study population and timeline*

Longitudinal routinely collected electronic primary care record data from the Clinical Practice Research Datalink (CPRD) Aurum database were analysed from 01/04/17 to 31/10/2021. CPRD Aurum contains information from over 13 million current patients (20% of the UK population), including children and adults, from 15% of all UK general practices and is broadly representative of primary care in England, and since 2019, Northern Ireland.15 No exclusion criteria were applied; all included patients had at least one musculoskeletal consultation during the observed period.  The study considered three time periods: pre-COVID-19 pandemic 01/04/2017–31/03/2020; early-COVID-19 pandemic 01/04/2020–31/07/2021; and late-COVID-19 pandemic 01/08/2020–31/10/2021. The study was approved by the Independent Scientific Advisory Committee (protocol number 20\_141) and access granted to the data required for the study. Linked data were obtained for patient level index of multiple deprivation (IMD).

*Case definition, preceding musculoskeletal consultations and referral codes*

Comprehensive code lists based on previous published work3 and updated with SNOMED CT codes16 that were introduced to primary care from April 2018, were developed (DOI 10.17605/OSF.IO/RJ56X), through a consensus exercise between practicing clinicians.

Cases of iRMDs were inclusive of diagnoses including rheumatoid arthritis, psoriatic arthritis, inflammatory spondyloarthritidies, connective tissue disease (for example systemic lupus erythromatosis, scleroderma), polymyalgia rheumatica, and gout. iRMD codes were grouped together and further sub-categorized into RA and JIA.  Consultations relating to a musculoskeletal (synonymous with RMD) condition, defined as a symptom, condition, or disease relating to the joints, muscles, and bones, had been previously identified using a similar broader code list, with exclusion of trauma-related entries. Codes relating to referrals were inclusive of rheumatology, musculoskeletal interface service, orthopaedics, and pain services.

*Analysis*

Incidence of iRMDs was defined as the total number of patients with an identified code for iRMD who had no previously recorded code in their record, divided by the total registered population without an iRMD diagnosis at the start date.

The proportion of patients who were referred to specialist musculoskeletal services for the first time, were calculated per 100 musculoskeletal consulters, in each calendar month. Crude incidence of all iRMDs, RA and JIA were calculated as per 100,000 registered population (per 1,000,000 for JIA, due to the small numbers). Temporal trends were determined by calculating the mean monthly percentage change (MPC) using Joinpoint Regression analysis in Joinpoint Program 4.9.10. A positive value MPC suggests an increasing trend and a negative value suggests a decreasing trend. Optimal models (<5 Joinpoints) were selected using a permutation test with 4,500 permutations with a significance level of p<0.05.

For all iRMDs, RA, and JIA categories, four outcomes were defined: time from first (non-traumatic) musculoskeletal consultation to ‘incident iRMD’ diagnosis; first musculoskeletal consultation (in the preceding 24 month period, of any mode) to first musculoskeletal referral; first musculoskeletal referral to ‘incident iRMD’ diagnosis; and number of consultations between first musculoskeletal consultation and referral/ ‘incident iRMD’ diagnosis (noting that not all diagnoses were preceded by a referral). These outcomes were reported as median values with interquartile range (IQR) and stratified by geographical region (England: East Midlands; East of England; London; North East; North West; South Central; South East Coast; South West; West Midlands; Yorkshire and the Humber, and Northern Ireland) and IMD quintiles (Q1: Least deprived, Q5: Most deprived). Age and gender adjusted incidence rate ratios (RRs) were calculated using negative binomial regression and reported with 95% confidence intervals (95% CIs) for each outcome. To ensure all patients with a coded iRMD diagnosis were considered in the analysis, individuals were included in the time period within which their outcome occurred. For example, if they presented to primary care in the pre-pandemic period and were diagnosed with an iRMD in the late-pandemic period, they would be included as a patient in the late-pandemic period.

**Patient and public involvement**

Patient and Public Involvement (PPIE) began after the research question was developed. PPIE added context to statistical results by reflecting upon personal experiences of accessing primary care for RMD symptoms during the pandemic, and navigating the wider NHS environment. PPIE helped to identify study limitations and develop the co-production of further research questions.

**RESULTS**

The numerator population (individuals presenting with an iRMD-related primary care consultation) included 6,057,747 patients from practices in England and Northern Ireland. The denominator population remained largely constant over the course of the study period at approximately 13·5 million individuals.

The prevalence and incidence of musculoskeletal consultations (and associated prescribing) have been described and demonstrated reduced rates in the early-COVID-19 pandemic period with recovery through the late-COVID-19 pandemic period (DOI 10.37361/n.2021.1). Figure 1 (and associated Suppl. Table 1) demonstrate that the proportion of patients with an eventual diagnosis of an iRMD, presenting to primary care with any non-traumatic RMD who had an incident referral to musculoskeletal services in each given month, had been increasing from 2.9% to 4.8% (monthly percentage change (MPC) 1.1)) (95% confidence interval (CI) 1.0 to 1.3), between April 2017 and February 2020. This rate then decreased between February 2020 and May 2020 to 2.4% (MPC -16.8 (95% CI -35.5 to 7.2)). Around the first easing of UK lockdown restrictions, the proportion of patients referred began to increase again to pre-pandemic levels to 4.5% in August 2020 (MPC 16.8 (95% CI 0.2 to 36.1), and then at a slower rate of 0.8 MPC (95% CI 0.1 to 1.4) through to October 2021 with 5.1% of patients having a consultation for a musculoskeletal problem referred that month. There was a discernable ‘dip’ in data points in January 2021 to 3.9% at the time of the third lockdown, however this did not force a Joinpoint in the model.

*Figure 1. Proportion of patients referred to specialist musculoskeletal services for the first time, per 100 musculoskeletal consulters*

*Suppl Table 1. Referrals per 100 patients consulting with musculoskeletal conditions*

In line with referrals, RA incidence had been increasing from 2.5 (95% CI 2.2 to 2.7) to 3.2 (2.9 to 3.5) per 10,000 registered population (MPC 0.3 (95%CI -0.1 to 0.7) from the start of the observed period, until January 2020 (Figure 2 and Suppl Table 2). The rate then decreased during the first lockdown to 1.7/10,000 (95% CI 1.5 to 1.9) in April 2020 (-13.3 (95% CI -35.4 to 16.3)), before starting to increase again back to 2.5/10,000 (95%CI 2.3 to 2.8) (MPC 1.9 (95% CI 0.8 to 2.9)), until the end of the observed period in October 2021.

*Figure 2. Incidence rate per month of rheumatoid arthritis per 100,000 registered population*

*Suppl Table 2. Incidence rate per month of rheumatoid arthritis per 100,000 registered population*

Figure 3 and Suppl Table 3 demonstrate that the incidence of JIA was stable between the start of the observed period and January 2020, 1.3 per 1,000,000 registered population (95% CI 0.7 to 1.9) to 1.8 (95% CI 1.1 to 2.5) (MPC 0.3 (95% CI -0.5 to 1.0), followed by a decrease until March 2020 when the rate was 0.7 (95% CI 0.3 to 1.2) (MPC -17.4 (95% CI -59.4 to 68.1)). Of note, March 2020 is where the Joinpoint lies, however the data points show a reduction into August 2020 when the incidence was 0.7 (0.2 to 1.1). There was then an increase in incidence until the end of the observed period October 2021 to 1.3 (0.7 to 1.9) (MPC 3.7 (95% CI 1.6 to 6.0)).

*Figure 3. Incidence rate per month of juvenile inflammatory arthritis per 1,000,000 registered population*

*Suppl Table 3. Incidence rate per month of juvenile inflammatory arthritis per 1,000,000 registered population*

The incidence of all iRMDs did not change significantly over time. Figure 4 and Suppl Table 4 demonstrate a gradual increase in the incidence from 19.9 (95% CI 19.1 to 20.6) to 20.4 (95% CI 19.6 to 21.1) (MPC-0.2 (95% CI -0.4 to 0.0). Suppl. Table 5 details crude monthly estimates for referral and incidence rates.

*Figure 4. Incidence rate per month of all inflammatory rheumatic musculoskeletal disease per 100,000 registered population*

*Suppl Table 4. Joinpoint analysis of incidence rate per month of all inflammatory rheumatic musculoskeletal disease per 100,000 registered population*

*Suppl. Table 5. Crude monthly estimates for the proportion of patients with a referral following a musculoskeletal consultation in primary care and crude incidence rates of patients diagnosed with rheumatoid arthritis (RA), juvenile inflammatory arthritis (JIA), and any inflammatory rheumatic musculoskeletal disease (iRMD)*

Table 1 demonstrates that not all patients with a coded incident diagnosis of RA/JIA/iRMD had a coded referral. Around 20% of patients who received a diagnosis of RA did not have a referral code, around 50% of patients with a diagnosis of JIA did not have a referral code, and around 60% of patients with a diagnosis of any iRMD did not have a referral code. These percentages were not substantially different between pandemic periods.

For patients with an incident diagnosis of RA, it took a median of 3 musculoskeletal consultations before a referral was coded (or incident diagnosis if this occurred before a referral was recorded) in each period. For patients diagnosed in the pre-COVID period, the time to diagnosis from first (non-traumatic) musculoskeletal consultation was 1026 days ((interquartile range) IQR 405, 1443). This was less than the same measure for patients who were diagnosed in the early-COVID-19 period, when the median was 1237 days (IQR 470, 1596), rate ratio (RR) 1.11 (95% CI 1.07 to 1.15. P<0.001), and late-COVID-19 period when the median was 1264 days (IQR 515, 1649), RR 1.13 (1.11, 1.16). There were no significant differences in time between first musculoskeletal consultation and referral between time periods. The time between referral and RA diagnosis was longest (287 days (IQR 69, 932) for those who received the diagnosis in the late-COVID-19 period, compared to 196 days (IQR 63, 673) in the pre-COVID-19 period RR 1.27 (95% CI 1.23 to 1.32, P<0.001).

Suppl. Table 6a demonstrates that patterns vary according to region. East Midlands, York & Humber, South West and Northern Ireland did not show significant differences between time to first musculoskeletal consultation and RA diagnosis when comparing the pre- and late-COVID-19 periods. Patients residing in more deprived communities experienced longer times between first musculoskeletal consultation and RA diagnosis than those residing in the least deprived areas; and these waiting times were more greatly impacted in the late-pandemic period (IMD 1 – RR 1.09 (1.04, 1.16) versus IMD 5 - 1.16 (1.10, 1.22)). Similar differences were seen to a lesser extent for time from referral to diagnosis and not observed for time from first musculoskeletal consultation and referral.

For patients with an incident diagnosis of JIA, it took a median of two musculoskeletal consultations before a referral was coded (or incident diagnosis if this occurred before a referral was recorded), in each period. There were no significant differences between time periods for: times from first musculoskeletal consultation to JIA diagnosis; first musculoskeletal consultation to referral; or first referral to JIA diagnosis, and this did not vary according to region or deprivation index. We are unable to present this data in tabulated form given CPRD restrictions on the minimum number of individuals that can appear in each cell (n=5).

For patients with an incident diagnosis of any iRMD, it took a median of 3 musculoskeletal consultations before a referral was coded (or incident diagnosis if this occurred before a referral was recorded), in each period. In the pre-COVID-19 period the median time to diagnosis from first (non-traumatic) musculoskeletal consultation was 1082 days (IQR 524, 1478). This was less than for patients who were diagnosed in the early-COVID-19 period (median 1275 days (IQR 654, 1624), rate ratio (RR) 1.12 (95% CI 1.10 to 1.14, P<0.001)), and late-COVID-19 period (median 1292 days (IQR 658, 1646), RR 1.13 (1.12, 1.14)). There were no significant differences between first musculoskeletal consultation and referral between time periods. The time between referral and iRMD diagnosis was longest (511 days (IQR 108, 1093) for those who received the diagnosis in the late-COVID-19 period, compared to 282 days (IQR 81, 794) in the pre-COVID-19 period RR 1.13 (95% CI 1.31 to 1.36, P<0.001).

Acknowledging durations variation between regions, each IMD quintile from least deprived to most deprived has a longer duration for each time period (Suppl. Table 6b). For example, the time between first musculoskeletal consultation and diagnosis in the late-COVID-19 period is 1299 (IQR 682, 1644) for the least deprived quintile and 1320 (734, 1666) for the most deprived quintile.

*Table 1. Median number of days: from first musculoskeletal consultation to RA/JIA/iRMD diagnosis and to first referral; from referral to diagnosis; and the number of consultations between first (non-traumatic) musculoskeletal consultation and referral/diagnosis, and their comparison between time periods*

*Suppl. Table 6a. Median number of days: from first musculoskeletal consultation to rheumatoid arthritis diagnosis and to first referral; from referral to diagnosis; and the number of consultations between first (non-traumatic) musculoskeletal consultation and referral/diagnosis, and their comparison between time periods, by region and deprivation.*

*Suppl. Table 6b. Median number of days: from first musculoskeletal consultation to inflammatory rheumatic musculoskeletal disease diagnosis and to first referral; from referral to diagnosis; and the number of consultations between first (non-traumatic) musculoskeletal consultation and referral/diagnosis, and their comparison between time periods, by region and deprivation.*

**DISCUSSION**

Changes in healthcare delivery due to the COVID-19 pandemic have impacted the care of patients with incident iRMDs. Proportionally, fewer referrals to musculoskeletal specialist care took place in the early COVID-19 period, then increased through the late-pandemic period, though not to pre-pandemic referral rates. Time from first non-traumatic musculoskeletal consultation to referral and subsequent incident JIA diagnosis was not significantly impacted by COVID-19. However, the time from first musculoskeletal consultation to diagnosis and referral to diagnosis for both RA and all iRMDs was significantly impacted by pandemic practice, with residents in more deprived communities waiting for longer for diagnosis.

Prevalence and incidence data for RA pre-pandemic are in line with previous reports17 and provide additional data spanning the pandemic period, similar to that described by Russell et al. 18 Reduced RA incidence in the early- and late-pandemic periods compared to pre-pandemic rates brings a possibility that a cohort of patients with undiagnosed RA is yet to seek healthcare and/or be referred for specialist care. Prevalence and incidence of iRMDs did not materially change throughout the study period which may be explained by the heterogenous diagnoses that comprised this category, including gout and PMR, which are conditions often diagnosed and managed in primary care with secondary care referrals in cases of diagnostic uncertainty or treatment failure. The pandemic may have altered clinician behaviour towards primary care provision of diagnosis and management instead of specialist referral. Not all patients with a diagnosis of RA/JIA had a coded referral in their primary care records. RA/JIA are typically diagnosed and managed in secondary care following fast-tracked primary care referral; this may be explained by primary care clinicians diagnosing RA/JIA themselves in the pandemic period and referring on for confirmation and definitive treatment later, or no referral took place, or was not coded.

The pre-pandemic time from referral to diagnosis for RA was 196 days (IQR 63,673), which increased through to the later-pandemic period (287 days (IQR 69,932), which may in part be due to reduced functioning departmental capacity, redeployment of staff and the cessation of biologic treatments. 19 This identified trend is important for several reasons. Firstly, there is now evidence to help emergency healthcare planning in the case of future pandemics. Secondly, with the potential for an increase in referrals for new suspected RA, healthcare commissioners must consider the possible future need for increased capacity to manage an increased caseload. Thirdly, a diagnosis of RA and subsequent treatment occurring further along the disease trajectory due to longer waiting times has the potential for a longer-term impact upon patients’ health and wellbeing, and upon services supporting patients living with RA; further research to measure this impact would enable evidence-based decisions to be made by healthcare commissioners and policy makers regarding provision of specialist rheumatology services.

It is widely known that deprivation is linked with poorer health, including poorer healthy life expectancy.20 This study demonstrates that residents of more deprived communities wait longer for diagnosis of RA. Our study has also found that residents of more deprived areas have been disproportionately impacted by the COVID-19 pandemic, reflecting UK mortality statistics which demonstrate that deprivation has been associated with a higher rate of death from both COVID-19 and avoidable causes.21 These health inequalities must be tackled on a national level, and the equalization of specialist service provision for patients with suspected RA living in deprived communities must form part of this plan.

Primary care clinicians referred patients who were subsequently diagnosed with an iRMD after an average of three musculoskeletal-related consultations over the course of a year or more. These musculoskeletal consultation codes consisted of a broad range of conditions and it may be that patients are presenting with non-synovitic symptoms (e.g. joint pain, tendonitis, entrapment neuropathy) before the consultation which triggers the referral. Such a prodrome and patterns of increased consultations rates prior to an RA diagnosis have been identified in CPRD previously.22

Our methods and results differed slightly from those of Russell et al who used OpenSAFELY-TPP, an alternative English primary care database, to answer similar questions around the incidence and time to referral and treatment of inflammatory arthritis during the pandemic. The times from referral to diagnosis were longer in our study, likely given the different definitions applied. We defined time of referral as the date a referral to a musculoskeletal specialty was coded in the patient record following the last coded consultation for a musculoskeletal condition, in contrast to Russell et al who defined it as ‘*the last primary care assessment (virtual or in person) before the first rheumatology appointment'* for any condition. 18 As acknowledged by the authors, it is possible that patients continued to present in primary care after their referral date, for further care. We did not however have access to the date patients were seen in rheumatology, nor DMARD prescribing. We were able to describe the time course and number of musculoskeletal consultations leading up to a referral. We also included all age-groups, enabling JIA specifically to be studied.

The use of CPRD data affords benefits including a large, nationally representative population,15 enabling robust estimates of epidemiological trends.23 However, as with all electronic health record research, there are several potential limitations. Diagnostic misclassification; non-attendance in primary care; variation in between GP coding practices and a lack of coding altogether, may all lead to an unmeasured shortfall in observed cases.23 This study did not have linkage to other health databases such as Hospital Episode Statistics (HES) so was reliant on the coding of communications from secondary care being recorded in the primary care record, to include the correct diagnostic code at the correct time (i.e. the date the diagnosis was made, not the date the letter was dictated or received). If this coding was not completed reliably, the accuracy of the results may be questioned. One may assume that coding practice would be uniform over the study period, but COVID-19 may have impacted on the availability and capacity of administrative staff to perform their roles over the course of the pandemic. Whilst the data was examined for potential health inequalities due to geographical region and deprivation, given the substantial amount of missing data in the electronic healthcare record, we were unable to stratify by ethnicity.

Further research is required to quantify the predicted potential increase in RA diagnoses using the most recently available data to enable health care commissioners to plan their delivery accordingly. Further research exploring the impact of the pandemic for people with iRMD according to ethnicity is required. It is possible that increased times from referral to diagnosis during the early- and later-pandemic period is due to the mode of consultation with specialist services as the remote-by-default model was rapidly adopted. Further work to estimate associations between consultation mode and outcomes would provide evidence to support delivery of specialist services. This study has focused on RA and JIA, further work could explore the impact on pandemic practice of other conditions typically diagnosed and managed in primary and secondary care settings, including gout or PMR and SLE, respectively.

**Conclusion**

The reduced incidence of RA seen during the early and late-pandemic period suggests that there may be patients with undiagnosed RA who have yet to present and trigger a referral for diagnosis from primary care. This potential future pressure on specialist services may be exacerbated by the longer-term consequences of longer waits from referral to diagnosis for patients with RA during the pandemic period, particularly for residents of deprived communities who waited longer for their diagnosis after referral than residents of more affluent areas. Health care commissioners can use this information in future pandemic planning, and during decision-making when optimizing service provision across different specialist services. Further research must be conducted to understand the impact of specialist service disruption for underserved communities, particularly around the later diagnosis of iRMDs.

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**Ethical approval:** The study was approved by the CPRD Independent Scientific Advisory Committee (ref 20\_141).

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**Data:** This study is based in part on data from the Clinical Practice Research Datalink obtained under license from the UK Medicines and Healthcare products Regulatory Agency. The data is provided by patients and collected by the NHS as part of their care and support. The interpretation and conclusions contained in this study are those of the authors alone.

**Figures and Tables**


Figure 1. Proportion of patients referred to specialist musculoskeletal services for the first time, per 100 musculoskeletal consulters



Figure 2. Incidence rate per month of rheumatoid arthritis per 100,000 registered population



Figure 3. Incidence rate per month of juvenile inflammatory arthritis per 1,000,000 registered population



Figure 4. Incidence rate per month of all inflammatory rheumatic musculoskeletal disease per 100,000 registered population

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| --- | --- | --- | --- | --- | --- |
| **Outcomes by condition set**   | **Pre-COVID-19 (01/04/2017 – 31/03/2020) period**  | **Early-COVID-19 (01/04/2020 – 31/07/2021) period**  | **Late-COVID-19 lockdown (01/08/2020 – 31/10/2021) period**  | **Pre- vs. Early-COVID-19 period**  | **Pre- vs. Late-COVID-19 period**  |
| **Number of patients**  | **Median number of days (IQR)**  | **Number of patients**  | **Median number of days (IQR)**  | **Number of patients**  | **Median number of days (IQR)**  | **RR** **(95% CI)**  | **RR** **(95% CI)**  |
| **Rheumatoid arthritis**  |
| First musculoskeletal consultation to RA diagnosis (days)  | 32627  | 1026  (405, 1443)  | 2510  | 1237  (470, 1596)  | 5865  | 1264  (515, 1649)  | 1.11  (1.07, 1.15)  | 1.13  (1.11, 1.16)  |
| First musculoskeletal consultation to first referral (days)  | 24842  | 448  (77, 1026)  | 2034  | 458  (53, 1099)  | 4665  | 438  (59, 1091)  | 1.02  (0.96, 1.09)  | 1.03 (0.99, 1.08)  |
| First referral to RA diagnosis (days)  | 24842  | 196  (63, 673)  | 2034  | 274  (64, 910)  | 4665  | 287  (69, 932)  | 1.23  (1.17, 1.30)  | 1.27  (1.23, 1.32)  |
| Number of consultation between 1st MSK & referral/RA diagnosis  | 30143  | 3 (1, 6)  | 2338  | 3 (1, 5)  | 5486  | 3 (1, 5)  | 0.92  (0.88, 0.96)  | 0.92  (0.90, 0.95)  |
| **Juvenile inflammatory arthritis**  |
| First musculoskeletal consultation to JIA diagnosis (days)  | 1277  | 409  (102, 1060)  | 92  | 460  (164, 1041)  | 248  | 523  (92, 1207)  | 1.12 (0.87, 1.44)  | 1.13  (0.96, 1.32)  |
| First musculoskeletal consultation to first referral (days)  | 636  | 143 (43, 585)  | 49  | 223  (49, 645)  | 130  | 159  (25, 705)  | 1.17  (0.75, 1.79)  | 1.15  (0.87, 1.51)  |
| First referral to JIA diagnosis (days)  | 636  | 153 (45, 575)  | 49  | 166  (65, 419)  | 130  | 184  (49, 609)  | 0.74  (0.53, 1.06)  | 1.03  (0.82, 1.29)  |
| Number of consultation between 1st MSK & referral/JIA diagnosis  | 1191  | 2 (1, 4)  | 86  | 2 (1, 4)  | 228  | 2 (1, 4)  | 1.03  (0.87, 1.22)  | 0.95  (0.85, 1.06)  |
| **Inflammatory rheumatic musculoskeletal disease**  |
| First musculoskeletal consultation to iRMD diagnosis (days)  | 189102  | 1082  (524, 1478)  | 18513  | 1275  (654, 1624)  | 40689  | 1292  (658, 1646)  | 1.12  (1.10, 1.14)  | 1.13  (1.12, 1.14)  |
| First musculoskeletal consultation to first referral (days)  | 63259  | 484  (85, 1011)  | 7177  | 401  (52, 963)  | 16417  | 435  (56, 1023)  | 0.93  (0.90, 0.96)  | 0.99  (0.96, 1.01)  |
| First referral to iRMD diagnosis (days)  | 63259  | 282  (81, 794)  | 7177  | 504  (147, 1091)  | 16417  | 511  (108, 1093)  | 1.34  (1.31, 1.38)  | 1.33  (1.31, 1.36)  |
| Number of consultations between 1st MSK & referral/iRMD diagnosis  | 182360  | 3 (1, 6)  | 17709  | 3 (1, 6)  | 38914  | 3 (1, 5)  | 0.96  (0.95, 0.97)  | 0.94  (0.93, 0.95)  |

RR: rate ratio; CI: confidence interval; IQR: interquartile range

Table 1. Median number of days: from first musculoskeletal consultation to RA/JIA/iRMD diagnosis and to first referral; from referral to diagnosis; and the number of consultations between first (non-traumatic) musculoskeletal consultation and referral/diagnosis, and their comparison between time periods

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