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Changes to consultations and diagnosis of osteoarthritis in primary care during the COVID-19 pandemic

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SUMMARY

Objective: General practitioners (GP) are often the first medical professionals to treat musculoskeletal complaints. Yet the impact of COVID-19 on primary care utilisation for musculoskeletal complaints is largely unknown. This study quantifies the impact of the pandemic on primary care utilisation for musculoskeletal complaints and specifically osteoarthritis (OA) in the Netherlands.

Design: We extracted data on GP consultations in 2015–2020 from 118,756 patients over 45 years of age and estimated reductions in consultations in 2020 as compared to 5-year average. Outcomes were GP consultations for: any musculoskeletal complaints, knee and hip OA, knee and hip complaints, and newly diagnosed knee and hip OA/complaints.

Results: The relative reductions in consultations ranged from 46.7% (95% confidence intervals (CI): 43.9–49.3%) (all musculoskeletal consultations) to 61.6% (95% CI: 44.7–73.3%) (hip complaints) at the peak of the first wave, and from 9.3% (95% CI: 5.7–12.7%) (all musculoskeletal consultations) to 26.6% (95% CI: 11.5–39.1%) (knee OA) at the peak of the second wave. The reductions for new diagnoses were 87.0% (95% CI: 71.5–94.1%) for knee OA/complaints, and 70.5% (95% CI: 37.7–86.0%) for hip OA/complaints at the peak of the first wave, and not statistically significant at the peak of the second wave.

Conclusion: We observed 47% reduction in GP consultations for musculoskeletal disorders during the first wave and 9% during the second wave. For hip and knee OA/complaints, the reductions were over 50% during the first, and 10% during the second wave. This disruption may lead to accumulation of patients with severe OA symptoms and more requests for arthroplasty surgery.

Introduction

The COVID-19 pandemic has had serious effects on routine healthcare utilization across disciplines and specialisations[1,2]. In countries in which the general practitioner (GP) is the point of entry into the healthcare system, the pandemic resulted in an extra burden on GPs and a reduction in the ability to provide regular care as many COVID-19 patients were initially seen in primary care[3–5]. Furthermore, lockdown restrictions and fear of contracting the SARS-CoV-2 virus have led to increased healthcare avoidance by patients, especially during periods of high COVID-19 infection rates. This has led to drop in GP contact rates for all major organ systems and complaints; available data suggest that the most vulnerable group of patients were the most likely to avoid or postpone consulting their GPs.[6–9]

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Musculoskeletal disorders are among the leading conditions contributing to the global burden of diseases[10]. Among musculoskeletal disorders, osteoarthritis (OA) is the most prevalent joint disease and fifteenth highest cause of years lived with disability[11]. Experts expressed concerns that the saturated healthcare capacity during the pandemic would result in delays in diagnosis and deferrals in treatment of musculoskeletal disorders, since these are considered less urgent[12,13]. Indeed, several studies showed a marked decline in the number of hospital admissions and elective surgeries related musculoskeletal disorders, following the start of the pandemic[14–19]. However, the impact of COVID-19 on musculoskeletal care at the primary care level remains unknown. Primary care consultations on musculoskeletal disorders amount up to 30% of all consultations; in many cases, GPs are the first medical professional to see a patient with musculoskeletal problems[20,21]. Any disruption at the primary care level will therefore affect pathways of care for musculoskeletal patients with possible delays in diagnosis and treatment.

In this study, we quantified the impact of the COVID-19 pandemic on consultations for musculoskeletal disorders in Dutch primary care throughout the year 2020. Focussing on symptoms and diagnosis of knee and hip OA, we specifically quantified the relative reduction in the number of consultations related to OA in primary care, as well as the reduction in the number of newly registered OA diagnoses, compared to pre-pandemic levels.

Methods

Data

We used data from the Rijnmond Primary Care database (RPCD). RPCD is a region-specific derivative of the Integrated Primary Care Information database[22], a dynamic cohort in which patients are included from the date of their registration at a GP practice until they die or change their practice. The database contains data from more than 300,000 patients in the greater Rotterdam area in the Netherlands; these contain information about patients and episodes of care routinely collected by GPs: diagnoses, symptoms, clinical findings, test results, drug prescriptions, and other relevant information. The study period started on 1 January 2015 and ended on 31 December 2020.

Outcomes

Over the study period, we extracted the weekly number of GP consultations for: (1) any musculoskeletal disorders; (2) knee complaints; (3) knee OA; (4) hip complaints; (5) hip OA; (6) newly diagnosed knee OA or knee complaints; (7) newly diagnosed hip OA or hip complaints.

A GP consultation was defined as any contact between general practice and a patient (in person, by phone, or online), in which symptoms, complaints, diagnoses or treatment was discussed. A new diagnosis of OA or knee/hip symptoms was defined as a consultation with a patient with no record of hip/knee OA or hip/knee complaints in their medical file prior to the start of the study period (January 2015). The consultations for individual diagnoses and complaints were identified using a country-specific version of the International Classification of Primary Care (ICPC). The list of ICPC codes used is in Supplementary information (Table A1).

Data analysis

We included all patients aged 45 years and over with at least 1 year of valid medical history recorded by a RPCD GP practice. A follow-up time for an individual patient started on 1 January 2015, 1 year from registration within a general practice, the first day of the month of turning 45 years of age, or from the date of the inclusion of the general practice in RPCD, whichever came later. Follow-up ended by patient's death, loss to follow-up (transferring to another GP practice or the end of data collection from the patient's practice), or on 31 December 2020, whichever came first. The study was carried out following the REporting of studies COnducted using Observational Routinely-collected Data (RECORD) guidelines[23].

We conducted the analyses in two blocks. First, we calculated the mean consultation rate per 100,000 patients (weighted by sample size) for each week in the pre-pandemic period (2015–2019) and plotted it over the observed weekly consultation rate in 2020. We then calculated percentage reductions in the consultation rates in 2020, taking the 5-year weighted mean as a reference. We calculated the relative reduction for two 1-week periods: at the peak of the first COVID-19 wave in the Netherlands (week 14 of 2020, 30 March-5 April) and at the peak of the second COVID-19 wave (week 45 of 2020, 2–8 November). The relative reductions and associated confidence intervals were calculated as the ratio of two proportions, assuming binomial distribution for the number of GP consultations.We calculated the proportion estimates based on the Wilson score method and using the pooled variance for the mean proportion during the pre-pandemic period[24]. The dates for the peaks of the two COVID-19 waves were defined as the local maxima in the weekly numbers of COVID-19 deaths in the Netherlands as reported by the Dutch National Institute for Public Health and the Environment (RIVM)[25].

Second, to estimate the number of potentially missed or delayed diagnoses of hip and knee complaints or hip and knee OA during the pandemic, we fitted a Poisson regression to the weekly counts of the new diagnoses of knee OA/complaints and hip OA/complaints. To adjust for seasonal trend, we included week number as categorical variable. We used the weekly number of COVID-19 deaths in the Netherlands as a proxy for the severity of the pandemic to model the change in outcomes due to the pandemic during the first and second wave. We modelled this change separately for the first and second wave of the pandemic to assess whether the health-seeking behaviour of musculoskeletal patients changed over the course of the pandemic. Based on preliminary analysis, periods outside the two waves were considered unaffected by the pandemic. The start of the first and second waves were set as the week in which the number of COVID-19 deaths exceeded 100, similarly the end of the first and second waves were set to the weeks in which the number of deaths dropped below 100. For each wave we estimated the reduction in the number of new OA diagnoses per 100 COVID-19 deaths, using two binary variables which were multiplied by the weekly number of COVID-19 deaths. The binary variable fort the first wave was set to 1 for weeks 12 through 21 in 2020 (16 March – 24 May) and to zero everywhere else, the binary variable for the second wave was set to 1 for weeks 40 through 53 in 2020 (28 September – 31 December) and zero everywhere else. We corrected for autocorrelation by including lagged residual errors as an additional term in the model; to account for overdispersion, we calculated the standard errors using heteroscedasticity consistent estimation[26]. The start of the pandemic was set to 24 February 2020 (week 9) as the first week with COVID-19 hospital admissions in the Netherlands.

We then used this model to estimate the expected weekly number of new diagnoses in a counterfactual scenario in which no pandemic occurred, by setting to zero the two pandemic terms for all weeks in the study period. The predicted values of the model for March through December 2020, thus represented the number of newly diagnosed hip and knee OA, as expected based on historical

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data without accounting for the disruption due to the pandemic. Our estimate of the cumulative number of potentially missed diagnoses of hip and knee OA/symptoms was based on the difference between the predicted and observed counts. The number of potentially missed diagnoses (and corresponding odds ratios) were estimated separately for the first wave and second waves. We grouped together the counts of first diagnoses of hip OA and hip complaints and knee OA and knee complaints.

We calculated the denominator population size for each week in the study period. The population size for the analysis of all consultations on musculoskeletal disorders, consultations on hip or knee complaints and consultations on hip or knee OA included all patients in our study population for a given week, regardless of any specific diagnosis. The population size for new diagnoses of hip or knee OA and hip or knee complaints excluded patients with prevalent hip or knee OA or hip or knee complaints. Patients diagnosed with hip or knee OA or symptoms during the study period were excluded following the week of their diagnosis.

As a sensitivity analysis, we examined how well the stringency of the public health interventions to contain the pandemic correlated with the observed reductions in the first diagnosis of knee and hip OA/OA symptoms. We used the Oxford Stringency Index, a composite metric that aggregate government measures related to the pandemic (closures, containments, and health policy)[27]. We fitted two additional models, a model with only the Stringency index as a predictor and a model with both COVID-19 deaths and the Stringency index.

All data is presented graphically (per 100,000 patients), and additionally stratified by age bounds (45–65 years, 66–75 years, and >75 years) and sex.

Results

The total study population (patients aged over 45 years) grew from 82,434 patients in January 2015 to 118,756 in December 2020. In this open cohort study, the mean age and sex distributions of the study population remained stable: at the start of the study period (1 January 2015), the mean age was 62.4 years (interquartile range (IQR): 52.5–70.5) and 52% of patients were females; at the end of the study period (31 December 2020), the mean age was to 63.2 (IQR: 53.5–72.0), and 53% of patients were females. The mean follow-up time was 3.8 years (median 4.25, IQR: 1.75–6.0). The mean and IQR for age and sex ratio calculated throughout the study period are in the Supplementary materials (Table A2).

The relative reduction for all musculoskeletal consultation was 46.7% (95% confidence intervals (CI): 43.9–49.3%) at the peak of the first wave and 9.3% (95% CI: 5.7–12.7%) at the peak of the second wave. The relative reductions in consultations for knee and hip complaints and OA diagnoses ranged from 52.7% (95% CI: 34.9–65.6%) (hip OA diagnosis) to 61.6% (95% CI: 44.7–73.3%) (hip OA complaints) at the peak of the first wave. The reductions at the peak of the second wave ranged from 10.5 (95% CI: −12.5 to 28.8%) (hip OA complaints) to 26.6% (95% CI: 11.5–39.1%) (knee OA diagnosis) (Table I). The weekly number of GP consultations for all musculoskeletal consultations plotted against the 5-year average is shown in Fig. 1, weekly numbers of GP consultations for individual knee and hip OA or complaints with corresponding 5-year averages are shown in Figs. 2 and 3.

The weekly number of first diagnoses for knee OA/complaints and hip OA/complaints were affected more, as compared to the number of consultations for all musculoskeletal complaints. The reduction at the peak of the first wave was 87.0% (95% CI: 71.5–94.1%) for knee OA/complaints, and 70.5% (95% CI: 37.7–86.0%) for hip OA/complaints. The reductions at the peak of the second wave were smaller with wide confidence intervals (21.0%, 95% CI: −12.2 to 44.4% for knee OA/symptoms, and 19.7%, 95% CI: −24.7 to 48.2% for hip OA/symptoms) (Figs. 4 and 5, Table I).

The sensitivity analysis showed that the model with only the number of COVID-19 deaths provides a better fit than the model with only the Stringency index (based on both Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) metrics). Adding both variables – COVID-19 deaths and the Stringency index – did not improve the fit of the original model.

The reduction in new diagnoses of knee OA/complaints during the first wave was 12.3% (95% CI: 8.5–16.0%) per 100 COVID-19 deaths and 8.3% (95% CI: 4.7–11.9%) per 100 COVID-19 deaths for new diagnoses of hip OA/complaints. During the second wave, the reductions were 5.8% (95% CI: 3.2–8.7%) for knee OA/complaints and 5.0% (95% CI: 2.0–8.0%) for hip OA/complaints. We estimated that in our study population there were 236 (95% CI: 178–302) fewer people newly diagnosed with knee OA/complaints during the first wave, and 128 (95% CI: 56–211) fewer people during the second wave, as compared to expected counts. This translates to 1,460 (first wave) and 550 (second wave) fewer diagnoses per 100,000 person-years. For hip OA/complaints, the estimated reductions were 99 (95% CI: 56–152) fewer cases during the first wave (532 per 100,000 person-years) and 66 (95% CI: 16–122) fewer diagnoses during the second wave (240 per 100,000 person-years) (Table II).

The baseline consultation rate and the number of new diagnoses of hip and knee OA/complaints were higher for women and older age groups. The relative reductions at the peak of the first wave

Diagnosis	Relative reduction in number of consultations 1st wave (95% CI)	Relative reduction in number of consultationsv2nd wave (95% CI)
All musculoskeletal consultations	46.7% (43.9–49.3%)	9.3% (5.7–12.7%)
Knee complaints	56.7% (45.2–65.8%)	26.3% (12.2–38.2%)
Knee OA diagnosis	58.0% (46.2–67.3%)	26.6% (11.5–39.1%)
Hip OA complaints	61.6% (44.7–73.3%)	10.5% (−12.5 to 28.8%)
Hip OA diagnosis	52.7% (34.9–65.6%)	25.6% (4.7–41.9%)
First diagnosis knee OA and knee complaints	87.0% (71.5–94.1%)	21.0% (−12.2 to 44.4%)
First diagnosis hip OA and hip complaints	70.5% (37.7–86.0%)	19.7% (−24.7 to 48.2%)

Table I

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Relative reduction in number of GP consultations at the peak of the two COVID-19 pandemic waves in the Netherlands

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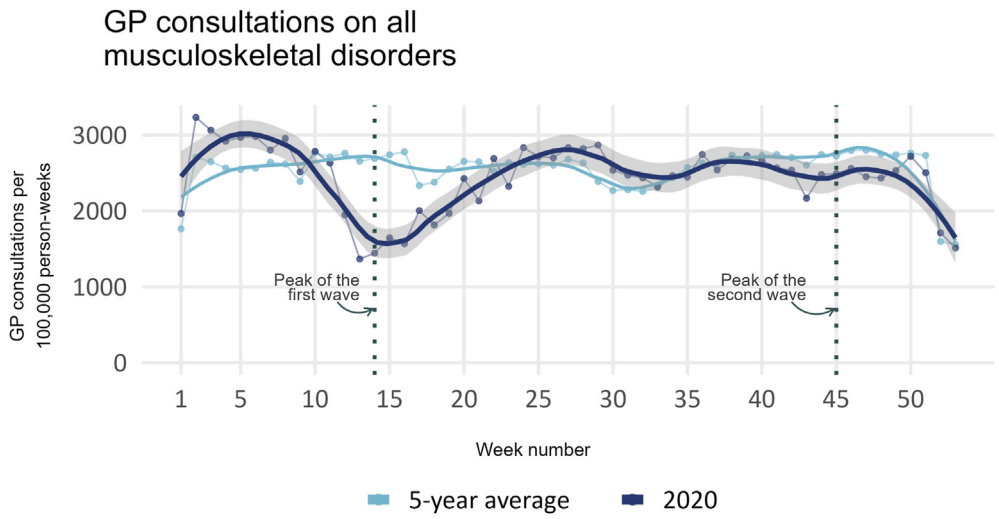

Fig. 1

Osteoarthritis and Cartilage

Weekly number of consultations for all musculoskeletal complaints: 2020 and 5-year average (2015–2019). To highlight the patterns in weekly consultations, the counts were smoothed, using locally estimated scatterplot smoothing with span of 0.3. The 95% confidence intervals of the smoothed line are displayed only for the 2020 data.

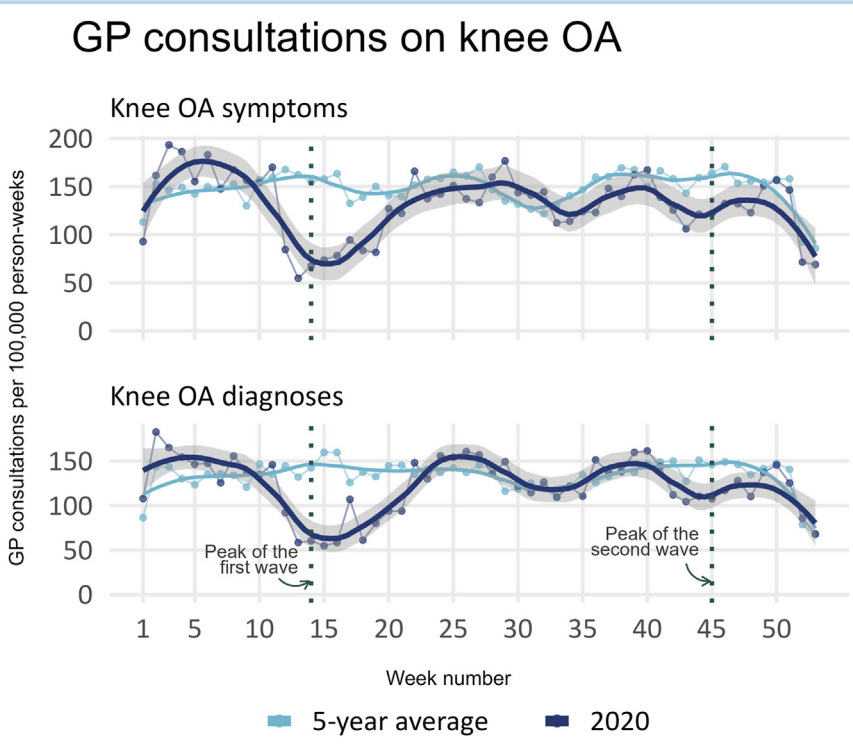

Fig. 2

Osteoarthritis and Cartilage

Weekly number of consultations for knee complaints (top) and knee OA (bottom): 2020 and 5-year average (2015–2019). To highlight the patterns in weekly consultations, the counts were smoothed, using locally estimated scatterplot smoothing with span of 0.3. The 95% confidence intervals of the smoothed line are displayed only for the 2020 data.

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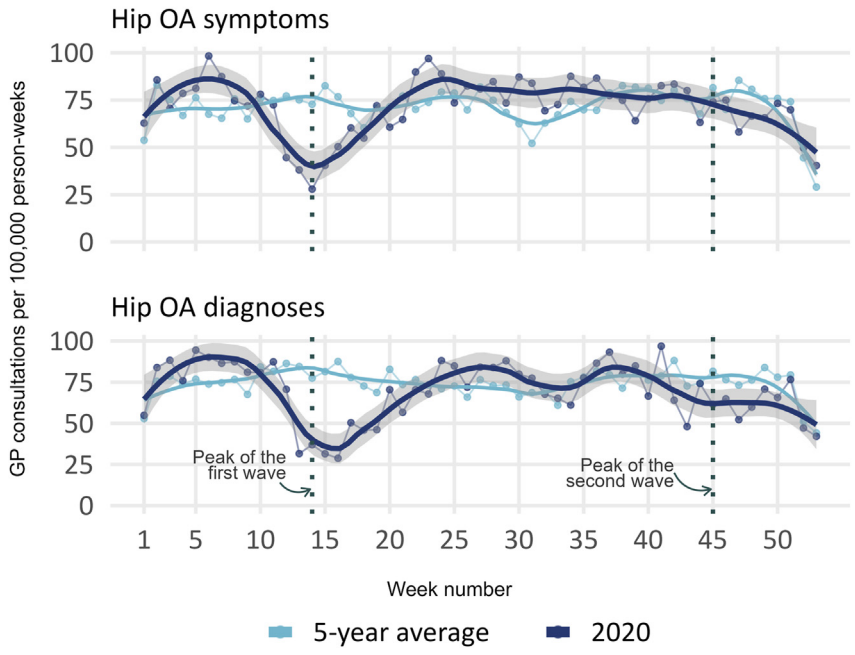

Fig. 3

Osteoarthritis and Cartilage

Weekly number of consultations for hip complaints (top) and hip OA (bottom): 2020 and 5-year average (2015–2019). To highlight the patterns in weekly consultations, the counts were smoothed, using locally estimated scatterplot smoothing with span of 0.3. The 95% confidence intervals of the smoothed line are displayed only for the 2020 data.

were comparable for men and women, but we observed consistently greater relative reductions for women at the peak of the second wave. The observed relative reductions across different age groups did not show any pattern. For detailed results stratified by age and sex, see Supplementary material (Figs. A2–A5, Tables A2–A5).

Discussion

In this observational study, we found that the number of consultations across all outcomes declined at the peak of both the first and second COVID-19 wave. For all outcomes, the reduction at the peak of the first wave was greater than at the peak of the second wave. Between the waves (June–September 2020) the number of consultations returned to pre-pandemic levels.

There are three main findings. First, we observed nearly 50% reduction in the number of GP consultations for all musculoskeletal complaints at the peak of the first wave of the pandemic (March–May 2020), which dropped to 8.6% at the peak of the second wave. Second, the reduction in the number of GP consultations for specific knee and hip complaints and hip and knee OA diagnoses were all greater than 50% at the peak of the first wave and dropped close to 10% at the peak of the second wave. We found relatively small differences in the magnitude of the relative reductions across the outcomes (knee complaints and knee OA, hip complaints and hip OA). Third, alongside the reduction in the number of consultations, we observed over a 70% reduction in the number of new diagnoses of hip and knee OA/complaints at the peak of the first wave and around 20% reduction at the peak of the second wave. The reduction in the number of new diagnoses during both the first and second wave was associated with the severity of the pandemic, represented by the number of COVID-19 deaths.

Clinical implications

People with OA have many of the risk factors associated with a worse COVID-19 prognosis: they are typically older, have higher body mass index and have more often cardiovascular diseases or diabetes mellitus[12]. Therefore, these people were encouraged to stay at home during periods of high COVID-19 caseloads and keep strict physical distancing rules to minimise the risk of infection. Several studies showed that during periods of lockdowns the general population and specifically OA patients limit their physical activity[16,28] even though physical activity is one of the most effective ways to manage OA symptoms[29–31]. Thus, this increase in sedentary behaviour might lead to worsening of OA symptoms[16] which – in normal circumstances – would lead to increased demand for healthcare. However, our data showed that there was an even greater decrease in the GP consultations for OA and knee and hip joint complaints than for musculoskeletal disorders in general. If this trend continues in 2021, we may expect decreased mobility, worsening sarcopenia and frailty among OA patients and consequently more requests for arthroplasty surgery[12,16]. There is also a risk that in the absence of GP consultations, OA patients rely more

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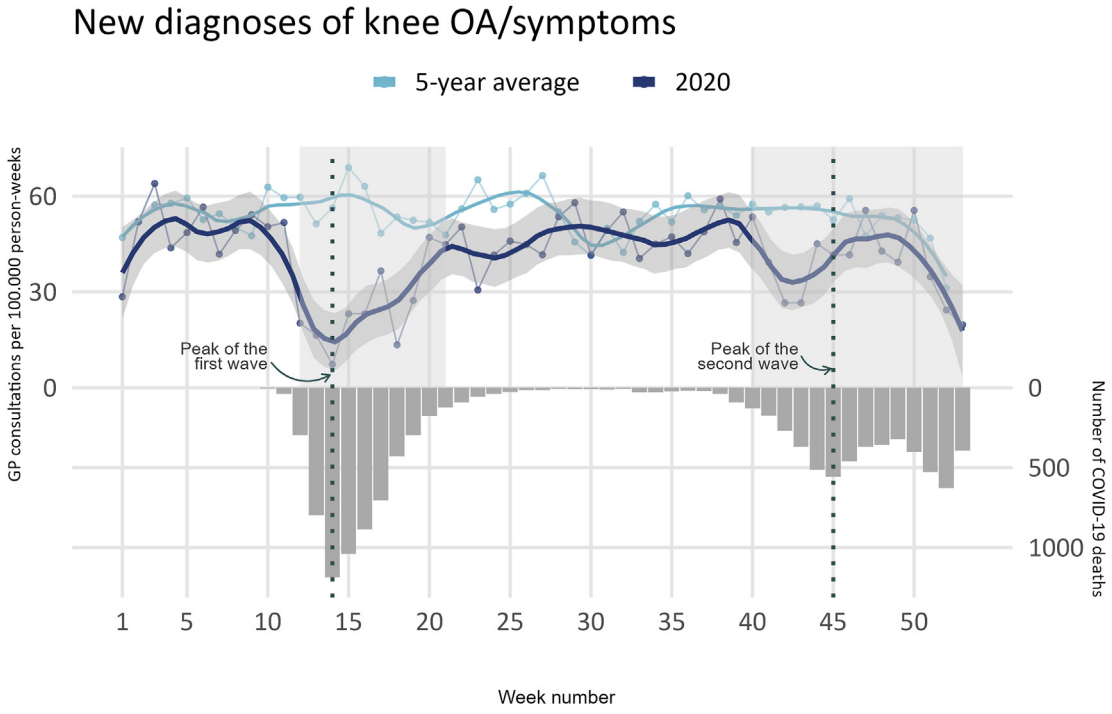

Fig. 4

Osteoarthritis and Cartilage

Weekly number of newly diagnosed knee complaints and knee OA plotted with the weekly number of COVID-19 deaths in the Netherlands. The periods of the two COVID-19 waves in 2020 are shaded in grey. To highlight the patterns in weekly consultations, the counts were smoothed, using locally estimated scatterplot smoothing with span of 0.3. The 95% confidence intervals of the smoothed line are displayed only for the 2020 data.

on self-medication, using over-the-counter nonsteroidal anti-inflammatory drugs, which are associated with an increased risk of gastrointestinal, cardiovascular and renal adverse events[32,33]. On the other hand, fewer consultations with GPs may have led to fewer prescriptions of strong opioids, leading to a net decrease in drug-related adverse events. However, the impact of the pandemic on prescription rates of pain medication among OA patients is a separate question and should be addressed in the future.

The reduction in the number of newly diagnosed OA may lead to worse outcomes over the longer term. Diagnosis of OA at an early stage provides an opportunity to slow-down the OA progression; a longer interval between symptoms onset and diagnosis therefore, means a lost opportunity for early intervention such as exercise therapy or lifestyle change[34]. Available data suggest that at least 14% of patients with incident knee OA suffer from rapid progression of the condition (accelerated knee OA), with quick pain deterioration and functional imitation[35,36]. The reduction in newly diagnosed knee OA during the pandemic may thus lead to significant decrease in health-related quality of life for many patients. Moreover, OA and OA symptoms have been shown to have increased association with reduced time to all-cause-mortality, independent of any risk factors[37], suboptimal treatment of OA and OA symptoms during the pandemic may therefore lead to increased mortality in the long term.

Telemedicine has been suggested as an effective way to mitigate the negative consequences of physical distancing measures on healthcare utilization[38,39]. Available evidence on its effectiveness among OA patients show that online training in home exercise and pain-coping skills is beneficial for patients with chronic knee pain and/or OA[40–42]. On the other hand, the willingness of OA patients to adopt telemedicine may be low, with age being the main barrier[43,44]. GPs should therefore consider strategies for in-person visits, especially for older and more vulnerable patients, and encourage them to monitor their condition and seek medical assistance if their symptoms worsen.

Comparison to previous studies

Our findings are in line with previous research assessing healthcare utilization during the COVID-19 pandemic. A systematic review on the impact of the pandemic on healthcare utilisation found a median of 37% reduction in healthcare services overall, and 42% in visits (including hospital visits)[1]. Compared to primary care utilisation overall during the first wave of the pandemic, the observed reductions for musculoskeletal complaints are significantly greater: A register-based study from Denmark observed 25% decrease in the number of clinical consultations across all complaints[7], analysis of primary care activity in England showed around 30% decrease in the number of all GP consultations[45], a study from Shanghai, China, reported a 30% decrease in the number of GP visits during the first 6 months in 2020.[8]

Analysis of healthcare utilisation during the first wave of the pandemic among people with OA in the Swedish region of Skåne revealed a significant reduction in the number of health care

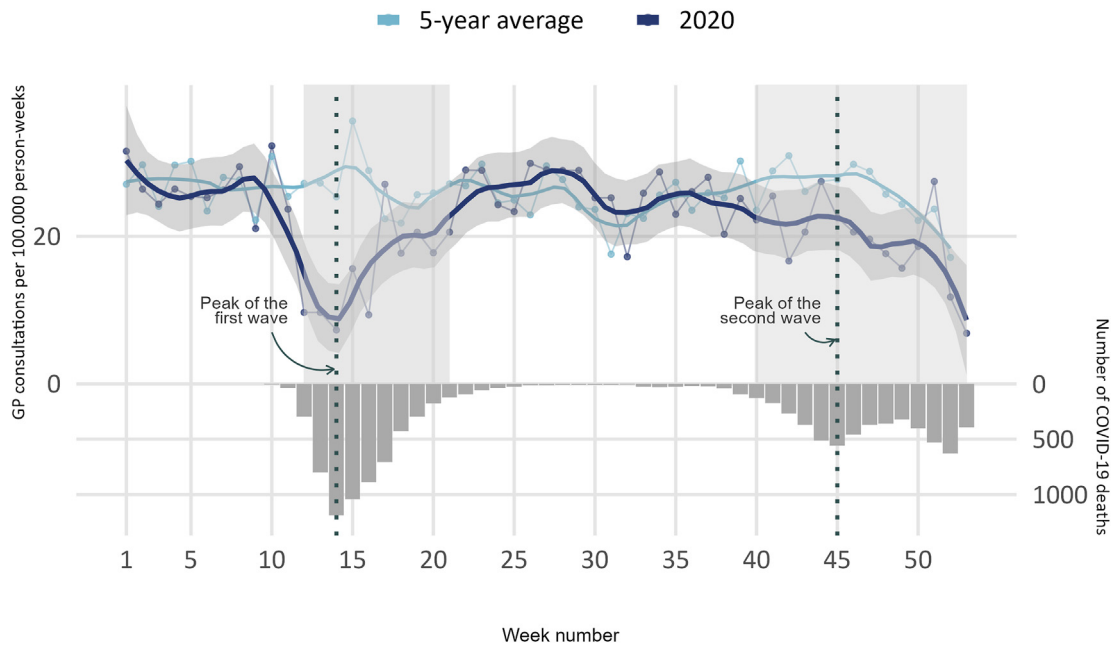

Fig. 5

Osteoarthritis and Cartilage

Weekly number of newly diagnosed hip complaints and hip OA plotted with the weekly number of COVID-19 deaths in the Netherlands. The periods of the two COVID-19 waves in 2020 are shaded in grey. To highlight the patterns in weekly consultations, the counts were smoothed, using locally estimated scatterplot smoothing with span of 0.3. The 95% confidence intervals of the smoothed line are displayed only for the 2020 data.

consultations (both at primary and secondary level) during the first months of the pandemic, even in the absence of any formal lockdown measures[46]. A study among patients with end-stage hip or knee OA in Austria showed clinically relevant loss of joint function as a consequence of the COVID-19 lockdown measures.[16]

The reduction in the number of newly diagnosed hip and knee OA suggests that there are more people with undiagnosed and untreated OA. The pathophysiology of OA is building up slowly over time, sudden reductions in the number of OA diagnoses, such as those observed during the two COVID-19 waves, are therefore most likely a result of underdiagnosis, rather than declines in disease incidence. The fact that we don't observe any increase in the number of OA diagnoses immediately after the first wave means that the diagnoses missed during the first wave were not recuperated later in 2020. This may imply that those missed complaints were either transient, were perceived by patients as less serious, or that some of the patients adopted a self-management tool for OA. Nevertheless, patients with untreated OA might have experienced deterioration of health-related quality of life.

The relative reduction during the second wave was smaller as compared to the first wave, and in some cases (hip OA GP consultations), statistically inconclusive. This suggests that both patients and GPs adapted to some extent to the new circumstances during 2020. Future research should determine what adaptive strategies both on the side of GPs and patients were most effective in mitigating the impact of the pandemic.

Strengths and limitations

Covering the entire year of 2020, we were able to examine the extent of the disruption caused by the pandemic and its evolution over two pandemic waves and associated physical distancing measures.

There are several limitations. First, inconsistent diagnostics may lead to selection bias: previous research showed that the incidence of knee OA increased approximately twofold if narrative diagnoses were included[47]. This means that the incidence of knee OA based on diagnosis code alone gives an underestimated results. We addressed this problem by also including medical code for knee complaints which in our population (people 45 years and older) is indicative of OA symptoms[35,48,49]. On the other hand, consultation for knee complaints might have had other underlying causes, namely injuries, though the prevalence and incidence of orthopaedic trauma are relatively low in our population.

Second, data do not include information about patients who contacted a physiotherapist directly, without a referral from their GP. However, many physiotherapist clinics were closed during the two waves of the pandemic due to lockdown measures. We also did not have data on the use and adoption of different self-management tools for OA patients, which were shown to be effective in managing symptoms of OA[50] and thus limit the need to consult a general practitioner. Third, we have not examined changes in prescription patterns among patients with hip or knee OA or

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Table II
Estimated number of potentially missed new or delayed diagnoses of OA

First diagnosis	Relative reduction per 100 deaths (95% CI)	1st wave: Cumulative number of cases potentially missed – 1st wave (absolute numbers)	1st wave: Cases potentially missed – 1st wave (100.000 person-years)	1st wave: Odds ratio – 1st wave (95% CI)	Relative reduction per 100 deaths (95% CI)	2nd wave: Cumulative number of cases potentially missed – 2nd wave (absolute numbers)	2nd wave: Cases potentially missed – 2nd wave (100.000 person-years)	Odds ratio – 2nd wave (95% CI)
Knee OA diagnosis and complaints	12.3% (8.5–16.0%)	236 (178–302)	1460 (1101–1869)	0.49 (0.41–0.57)	5.8% (3.2–8.57%)	128 (56–211)	550 (240–907)	0.79 (0.70–0.89)
Hip OA diagnosis and complaints	8.3% (4.7–11.9)	99 (56–152)	523 (295–803)	0.5 (0.61–0.75)	5.0% (2.0–8.0%)	66 (16–122)	240 (58–444)	0.69 (0.81–0.95)

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symptoms: information about pain medication may provide additional information about patients outcome during the pandemic. Fourth, we did not have access to the data on income, education levels, smoking status and other lifestyle indicators and could not adjust for them in out analysis. This may have introduced bias to our results as decline in healthcare use among people with low socio-economic have been shown to be higher[9]. Finally, our results may not be readily generalizable to countries with different healthcare systems.

Conclusion

Our results showed a substantial disruption to treatment and diagnosis of knee and hip OA in primary care during the first two waves of the COVID-19 pandemic. There is a risk that this disruption, coupled with an increase in sedentary lifestyle during periods of lockdowns, have led to worsening symptoms in OA patients which may lead to decrease in health-related quality of life. A critical question remains to identify the patients who are most at risk of healthcare avoidance and rapid progression of OA symptoms.

Contributions
EdS, SL, WEvS and JR developed the conception and design of the work, JR, ME acquired funding for this work. PV conducted the data analysis and drafted the first version of the manuscript. All authors were involved in reviewing and critically commenting on the manuscript and interpretation of data. All authors approved the final draft and had final responsibility for the decision to submit for publication.

Competing interests
Authors declare no conflict of interest.

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Ethics approval
All patient data in the Rijnmond Primary Care Database have been de-identified for research purposes, no patient consent was therefore required.

Data availability
Due to legal restraints, data are not made publicly available in a repository. Access to the data will be provided upon reasonable request and subject to approval by the Governance Board of Rijnmond Primary Care.

Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.joca.2023.02.075.

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