




Concise report

Impact of the COVID-19 pandemic on juvenile idiopathic arthritis presentation and research recruitment: results from the CAPRI registry

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Abstract

Objective. The COVID-19 pandemic has disrupted healthcare delivery and clinical research worldwide, with data from areas most affected demonstrating an impact on rheumatology care. This study aimed to characterize the impact of the pandemic on the initial presentation of JIA and JIA-related research in Canada.

Methods. Data collected from the Canadian Alliance of Pediatric Rheumatology Investigators JIA Registry from the year pre-pandemic (11 March 2019 to 10 March 2020) was compared with data collected during the first year of the pandemic (11 March 2020 to 10 March 2021). Outcomes included time from symptom onset to first assessment, disease severity at presentation and registry recruitment. Proportions and medians were used to describe categorical and continuous variables, respectively.

Results. The median time from symptom onset to first assessment was 138 (IQR 64–365) days pre-pandemic vs 146 (IQR 83–359) days during the pandemic. The JIA category frequencies remained overall stable (44% oligoarticular JIA pre-pandemic, 46.8% pandemic), except for systemic JIA (12 cases pre-pandemic, 1 pandemic). Clinical features, disease activity (cJADAS10), disability (CHAQ) and quality of life (JAQQ) scores were similar between the two cohorts. Pre-pandemic, 225 patients were enrolled, compared with 111 in the pandemic year, with the greatest decrease from March to June 2020.

Conclusions. We did not observe the anticipated delay in time to presentation or increased severity at presentation, suggesting that, within Canada, care adapted well to provide support to new patient consults without negative impacts. The COVID-19 pandemic was associated with an initial 50% decrease in registry enrolment but has since improved.

Key words: JIA, COVID-19, pandemic, diagnosis, presentation, quality of life

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Rheumatology key messages

- JIA presentation to paediatric rheumatology care wait times in Canada were unaffected by COVID-19.
- In Canada, COVID-19 has not had a noticeable impact on severity of JIA presentation.
- JIA-related research enrolment decreased early in the pandemic in Canada, but has since recovered.

Introduction

The illness caused by the SARS-CoV-2 virus was declared a global pandemic by the World Health Organization on 11 March 2020. As of April 2021, the total number of cases of COVID-19 in Canada had exceeded 1 million [1]. The pandemic has significantly impacted how healthcare is accessed worldwide [2–4]. In Canada, from March to June 2020, 52% of all healthcare was provided virtually, and emergency department visits decreased by 50% [5]. Data from some of the countries most affected by SARS CoV-2 infections has demonstrated a significant impact on rheumatology care [6–8]. A survey from the UK reported that adult rheumatologists averaged a 50% reduction in clinic function during the first 6 months of the global pandemic [8].

Timely diagnosis and initiation of therapy is critical to improving long-term outcomes and preventing irreversible joint damage in patients with JIA [9]. The diagnosis of JIA hinges on timely referral and a thorough joint examination, both difficult to accommodate when the pandemic forced many medical encounters to occur virtually (telemedicine). Reports from Italy have shown that JIA care has been negatively affected by the pandemic, as evidenced by a significant increase of disease flares presenting to the hospital, presumed to be associated with delayed follow-up with paediatric rheumatology providers [7]. Specifically, changes to routine care during the first lockdown in Italy included in-person appointments being cancelled or replaced by telephone visits [6]. To date, there are no data reporting on the impact of the pandemic on new diagnoses and initial presentation of JIA.

The COVID-19 pandemic has created high levels of anxiety in patients, families and healthcare providers [10]. For patients with JIA, anxieties around the immune-compromising nature of medications in the context of the virus itself and, more recently, administration of the COVID-19 vaccines, must be acknowledged [11]. Early in the pandemic there was uncertainty as to whether the treatment of JIA required adjustment given its immunomodulating nature. The American College of Rheumatology has since released recommendations that DMARDs should only be paused in paediatric patients with rheumatological disease who have a proven, symptomatic COVID-19 infection [12]. For families receiving a new diagnosis of JIA amidst this pandemic, this uncertainty can be overwhelming, and resistance or hesitancy to the initiation of new therapies is understandably a possibility.

The aim of this study was to characterize the impact of the COVID-19 pandemic on the initial presentation of

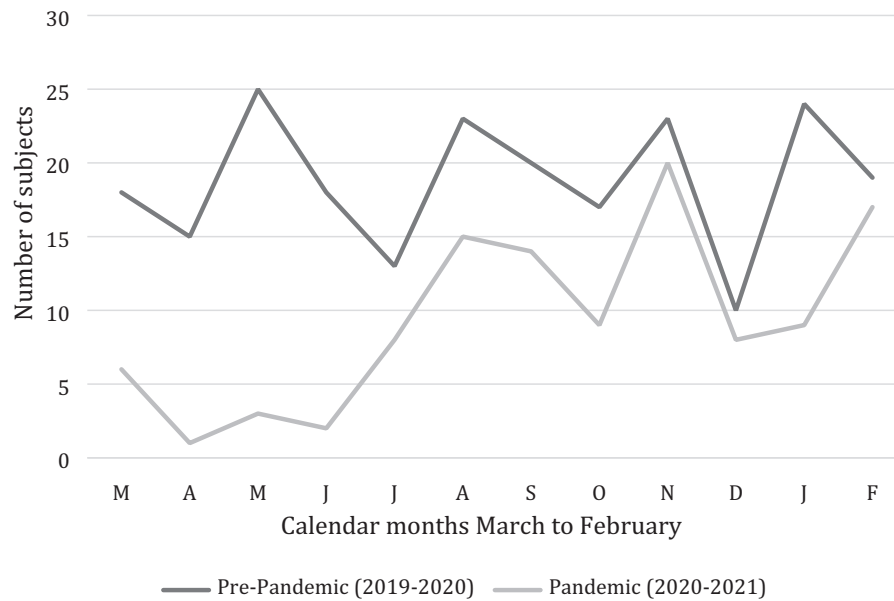
patients with JIA to paediatric rheumatology care in Canada as well as the clinical research thereof. We hypothesized that disruption of care would result in prolongation of time from symptom onset to first assessment and diagnosis, and a greater severity of disease at presentation to care; research disruption would be reflected by a drop in recruitment rates concurrent with research curtailment.

Methods

Data were obtained from the Canadian Alliance of Pediatric Rheumatology Investigators (CAPRI) National JIA Registry, which started in 2017 and enrolls children with JIA within 3 months of diagnosis, following them at every clinic visit. The Registry prospectively collects and shares data on disease course, outcomes and adverse events [13]. Data from the year pre-pandemic (11 March 2019 to 10 March 2020) were compared with data from the pandemic year (11 March 2020 to 10 March 2021). To assess the pandemic's impact, we compared time from symptom onset to first paediatric rheumatology appointment. Disease severity at presentation was assessed by active joint count and limited range of motion joint count, extra-articular manifestations, presence of uveitis and elevated ESR and CRP. Disease indices, including Physician Global Assessment of disease activity (PGA), clinical Juvenile Arthritis Disease Activity Score 10 (cJADAS10) [14] and probability of severe disease [15], were also compared as markers of disease severity at presentation. Parent and patient reported well-being at presentation were compared using the patient pain scale, parent global assessment, Child Health Assessment Questionnaire (CHAQ) score, Juvenile Arthritis Quality of Life Questionnaire (JAQQ) score, and Quality of My Life (QoML) score. Medications prescribed at the time of diagnosis were compared between the two groups. The number of patients enrolled in the registry during the two periods was compared. Descriptive analyses of the data were performed. Categorical outcomes were compared using the χ^2 test and continuous variables were compared using the Mann–Whitney test. Statistical analyses were performed using Microsoft Excel and statistical significance was set at a level of $P < 0.05$.

Ethics

The CAPRI Registry was approved by research ethics boards at each participating institution and all enrolled families signed written informed consent to have their information included in the Registry.

Fig. 1 Monthly recruitment in the CAPRI JIA Registry pre-pandemic and during pandemic

Results

A total of 336 patients with JIA were enrolled into the Registry during the 2-year study period. There were 225 patients enrolled in the pre-pandemic year and 111 enrolled during the pandemic year, supporting that enrolment was negatively affected by the pandemic. Enrolment of patients into the registry was most negatively affected at the onset of the pandemic, in the period from March to June 2020, and subsequently recovered to almost pre-pandemic enrolment rates (Fig. 1). Of note, there was no notable regional variation in recruitment numbers on a month-to-month basis, despite regional variations in pandemic case loads (data not shown).

The distribution of JIA subtypes in patients enrolled remained stable; predominantly oligoarticular JIA (44% pre-pandemic, 46.8% pandemic), with polyarticular JIA and enthesitis-related arthritis being next most common (Table 1). Only one (0.9%) enrolled patient was diagnosed with systemic JIA in the pandemic period compared with 12 (5.3%) during the pre-pandemic year. The median time from symptom onset to first assessment for all patients diagnosed with JIA was 138 (IQR 64–365) days in the pre-pandemic year, and 146 (IQR 83–359) days in the pandemic year ($P=0.28$). Active and limited joint counts at presentation between the two cohorts were identical, with a median of 2.0 active joints (IQR pre-pandemic 1.0–5.0, pandemic 1.0–4.0) and a median of 1.0 limited joints (IQR pre-pandemic 1.0–4.0, pandemic 0.0–3.0) for both cohorts. The proportion of patients with elevated CRP at diagnosis (36.9% pre-pandemic, 37.8% pandemic) and patients with extra-

articular manifestations (21.8% pre-pandemic, 20.7% pandemic) were similar between the two cohorts. Elevated ESR at diagnosis was significantly more common in the pre-pandemic patients (41.8%) compared with the pandemic patients (25.4%) ($P<0.05$). By the time of enrolment, 80 (35.6%) patients had eye exams pre-pandemic, and 42 (37.8%) during the pandemic. There was no statistically significant difference in the presence of uveitis between the two groups at initial presentation (3.1% pre-pandemic, 0% pandemic). Measures of disease activity were nearly identical between the two groups with a median cJADAS10 of 8 in both cohorts (Table 1). Medications prescribed at diagnosis did not significantly differ between the cohorts except for biologic use (5.3% pre-pandemic, 0% pandemic; $P<0.05$). Importantly, this difference is related to the difference in systemic JIA diagnosed in the two timelines.

Patient reported measures were similar between the two cohorts (Table 1). CHAQ scores and JAQQ scores were virtually the same in the two cohorts. Further, no significant difference was noted in patient reported pain, parent global, or QoML scores between the two populations.

Discussion

The COVID-19 pandemic has impacted many aspects of healthcare [2–4]. Despite that and in contrast to our hypothesis, we did not observe a delay in the time to paediatric rheumatology care during the COVID-19 pandemic. In fact, the time from symptom onset to initial paediatric rheumatology assessment was nearly

TABLE 1 Characteristics of patients with JIA at presentation pre-pandemic and during pandemic in Canada

Characteristic	Pre-pandemic cohort (<i>n</i> = 225)	Pandemic cohort (<i>n</i> = 111)
JIA subtype, <i>n</i> (%)		
Oligoarticular	99 (44.0)	52 (46.8)
Systemic ^a	12 (5.3)	1 (0.9)
Polyarticular RF –ve	40 (17.8)	18 (16.2)
Polyarticular RF +ve	11 (4.9)	2 (1.8)
Psoriatic arthritis	14 (6.2)	11 (9.9)
Enthesitis-related arthritis	33 (14.7)	19 (17.1)
Undifferentiated	16 (7.1)	8 (7.2)
Clinical features at presentation, median (IQR)		
Active joint count	2.0 (1.0–5.0)	2.0 (1.0–4.0)
Limited joint count	1.0 (1.0–4.0)	1.0 (0.0–3.0)
Percentage of patients with:		
Extraarticular manifestations ^b	21.8	20.7
Uveitis	3.1	0
Elevated ESR ^{a,c}	41.8	25.4
Elevated CRP ^c	36.9	37.8
PGA (0–10), median (IQR)	3.0 (1.9–5.0)	3.0 (1.6–4.9)
Probability of severe disease, median (IQR), %	6.0 (3.0–12.0)	5.0 (3.0–12.3)
cJADAS10 (0–10), median (IQR)	8.0 (4.0–13.0)	8.0 (4.4–13.0)
Patient reported outcomes, median (IQR)		
Parent Global Score (0–10)	2.0 (0.5–5.0)	1.5 (0.5–5.0)
Patient Pain Score (0–10)	4.0 (0.5–7.0)	3.3 (1.0–5.6)
JAQQ (1–7)	3.0 (1.7–4.0)	2.8 (1.8–3.8)
CHAQ Score (0–3)	0.4 (0.0–1.0)	0.4 (0.0–0.9)
Quality of My Life Score (0–10)	8.0 (5.0–9.0)	7.0 (6.0–9.0)
Medications used, <i>n</i> (%)		
NSAIDs	174 (77.3)	86 (76.8)
DMARDs	47 (20.9)	18 (16.1)
Biologics ^a	12 (5.3)	0 (0.0)
Systemic corticosteroids	21 (9.3)	6 (5.4)
Joint injections	26 (11.6)	15 (13.4)

^a*P*-value < 0.05. ^bIncludes psoriatic rash, nail changes, enthesitis, dactylitis and systemic JIA manifestations. ^c'Elevated' is defined by local laboratory cut-offs for age and sex. CHAQ: Child Health Assessment Questionnaire; cJADAS10: clinical Juvenile Arthritis Disease Activity Score 10; IQR: interquartile range; JAQQ: Juvenile Arthritis Quality of Life Questionnaire; PGA: Physician Global Assessment of Disease Activity.

identical. Similarly, initial eye examinations had occurred in a similar proportion of patients between the two groups. Although the majority of care delivered during the pandemic year shifted to the virtual format, our data suggests that this shift did not significantly delay the referral and assessment of newly diagnosed patients. Canada has a long history of and infrastructure for telemedicine, but it was rarely used for paediatric rheumatology care pre-pandemic. The pandemic forced clinics to adopt triage of referrals to prioritize virtual vs in-person consults. If there was high suspicion of JIA at a virtual encounter, most clinics would expedite an in-person visit to complete an exam and formalize a diagnosis. Our data suggest these triage systems have been successful overall. A possible limitation of these data is that since written informed consent was required by the Registry initially, there may be self-selection and

patients that agree to enrolment may be the most motivated patients. It is possible that a subset of the patients most delayed to presentation and most complex may be missed in our data because they were not enrolled in the Registry. Further, it is important to note that paediatric rheumatologists are only one piece of the puzzle for referral and assessment; many family physicians and primary care paediatricians were seeing patients strictly via telemedicine during the pandemic, and therefore referral patterns may have changed. The fact that disease characteristics of patients diagnosed pre-pandemic were strikingly similar compared with those diagnosed during the pandemic argues against significant bias. Interestingly, however, there was a significant decline in the proportion of patients diagnosed with systemic JIA (Table 1) during the pandemic period. This may be explained by the general rarity of the diagnosis, a

decrease in viral exposures/triggers during the pandemic period, where less children were attending in person schools and daycares, or the overlap in presentation with the new Multisystem Inflammatory Syndrome in Children diagnosis [16, 17]. Otherwise, joint counts, inflammatory markers, physician disease scales (PGA, cJADAS10) and patient reports (pain scales, CHAQ, QoML) were similar, in keeping with analogous timing of presentation and phenotype.

Despite initial uncertainty with the impact of immune-modulating medications on acute COVID-19 infection, our data suggest that prescribing practices with DMARDs was similar to pre-pandemic rates. Biologics were used at a significantly lower rate (at diagnosis) during the pandemic year, which is related to the decrease in patients with systemic JIA enrolled in the Registry. Medication adherence was not assessed in this study; however, there are reports of a minority of patients on immune-modulating medications who discontinued their treatments during the pandemic, most often due to fears of hospital visits, complications or shortages of medications [7, 18].

Overall, the data from the Registry suggests that paediatric rheumatology care adapted well to accommodate new JIA consultations during the COVID-19 pandemic. It suggests that time to referral and diagnosis were not significantly delayed and, therefore, presentation and severity was unchanged during this time.

Further, at the beginning of the pandemic, clinical research was halted completely or at least slowed in hospital settings (e.g. institutions requested research assistants not to enter hospitals). On 26 March 2020, despite any centre-specific changes in research protocols, all CAPRI centres were informed by the Registry Steering Committee to pause recruitment until further notice. This, together with widespread global lockdowns at the onset of the COVID-19 pandemic, likely explains the noticeable decline in patients enrolled in the registry from March to June of 2020. The resumption of recruitment in July/August 2020 reflects a request to have all enrolling centres amend their Research Ethics Board applications to allow for virtual or phone recruitment of patients, followed by a decision from the Registry Steering Committee to resume recruitment on 8 July 2020. Since that time, recruitment rates remain lower than pre-pandemic rates, but are considerably closer to them. Recruitment was again significantly lower than pre-pandemic rates in January 2021, at the peak of the second COVID-19 wave in Canada. Recruitment did not vary by region across Canada, likely because general recommendations for pausing recruitment came from the Registry Steering Committee and were independent of regional variation in COVID-19 caseloads or local responses to halting research activities.

Conclusion

The CAPRI JIA Registry has allowed us to describe the impact of the global COVID-19 pandemic on JIA

presentation to paediatric rheumatology care in Canada. We did not observe the anticipated delay in presentation nor increased disease severity at presentation that we expected. This suggests that, within Canada, paediatric rheumatology teams adapted to provide ongoing support and care to new patient consults and avoided significant negative impacts. Research disruption was associated with a 50% enrolment decrease in the pandemic year, most significantly from March to June 2020, consistent with a limit in non-essential research staff present in hospitals at that time. Recruitment has since recovered to near pre-pandemic rates.

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Data availability statement

The data underlying this article will be shared on reasonable request to the corresponding author.

References

- 1 Canada.ca. Coronavirus disease (COVID-19): Outbreak update. Government of Canada. 2021 [updated 11 April 2021]. <https://www.canada.ca> (11 April 2021, date last accessed).
- 2 Marino LV, Ashton JJ, Beattie RM. The impact of national lockdown on nutritional status of children with inflammatory bowel disease. *J Hum Nutr Diet* 2021;34:656–9.
- 3 Riera R, Bagattini ÂM, Pacheco RL *et al.* Delays and disruptions in cancer health care due to COVID-19 pandemic: systematic review. *JCO Glob Oncol* 2021;7:311–23.
- 4 Di Bidino R, Cicchetti A. Impact of SARS-CoV-2 on provided healthcare. Evidence from the emergency phase in Italy. *Front Public Health* 2020;8:583583.
- 5 CIHI. Overview: COVID-19's impact on health care systems. 2021 [updated July 8 2021]. <https://www.cihi.ca/en/covid-19-resources/impact-of-covid-19-on-canadas-health-care-systems/overview-covid-19s-impact-on> (11 April 2021, date last accessed).
- 6 Miserocchi E, Giuffre C, Modorati GM, Cimaz R. Management of Juvenile idiopathic arthritis-associated uveitis during the COVID-19 pandemic in a pediatric referral center in Lombardy. *Ocul Immunol Inflamm* 2020;28:1305–7.
- 7 Conti G, Galletta F, Carucci NS *et al.* Negative effect of lockdown on juvenile idiopathic arthritis patients. *Clin Rheumatol* 2021;40:3723–7.
- 8 Nune A, Iyengar KP, Ahmed A, Bilgrami S, Sapkota HR. Impact of COVID-19 on rheumatology practice in the UK—a pan-regional rheumatology survey. *Clin Rheumatol* 2021;40:2499–504.
- 9 Ringold S, Angeles-Han ST, Beukelman T *et al.* 2019 American College of Rheumatology/Arthritis Foundation guideline for the treatment of juvenile idiopathic arthritis: therapeutic approaches for non-systemic polyarthritis, sacroiliitis, and enthesitis. *Arthritis Care Res* 2019;71:717–34.
- 10 Magson NR, Freeman JYA, Rapee RM *et al.* Risk and protective factors for prospective changes in adolescent mental health during the COVID-19 pandemic. *J Youth Adolesc* 2021;50:44–57.
- 11 Shoop-Worrall SJW, Verstappen SMM, Costello W *et al.* O31 Trajectories of anxiety in children young people and adults with rheumatic diseases in the wake of COVID-19: results from the COVID-19 European patient registry. *Rheumatology* 2021;60(Suppl 1):keab246.030.
- 12 Wahezi DM, Lo MS, Rubinstein TB *et al.* American College of Rheumatology guidance for the management of pediatric rheumatic disease during the COVID-19 pandemic: version 1. *Arthritis Rheumatol* 2020;72:1809–19.
- 13 Batthish M, Berard R, Cabral D *et al.*; Canadian Alliance of Pediatric Rheumatology Investigators. A new Canadian inception cohort for juvenile idiopathic arthritis: the Canadian Alliance of Pediatric Rheumatology Investigators Registry. *Rheumatology* 2020;59:2796–805.
- 14 Backstrom M, Tynjälä P, Aalto K *et al.* Validating 10-joint juvenile arthritis disease activity score cut-offs for disease activity levels in non-systemic juvenile idiopathic arthritis. *RMD Open* 2019;5:e000888.
- 15 Guzman J, Henrey A, Loughin T *et al.* Predicting which children with juvenile idiopathic arthritis will have a severe disease course: results from the ReACCh-Out cohort. *J Rheumatol* 2019;46:628–35.
- 16 Jones N. How covid-19 is changing the cold and flu season. *Nature* 2020;588:388–90.
- 17 Berard RA, Tam H, Scuccimarri R *et al.* Paediatric inflammatory multisystem syndrome temporally associated with COVID-19 (spring 2021 update). 2020. <https://www.cps.ca/documents/position/pims> (19 September 2021, date last accessed).
- 18 Koker O, Demirkan FG, Kayaalp G *et al.* Does immunosuppressive treatment entail an additional risk for children with rheumatic diseases? A survey-based study in the era of COVID-19. *Rheumatol Int* 2020;40:1613–23.