ACR Open Rheumatology
Vol. 2, No. 7, July 2020, pp 424–429
DOI 10.1002/acr2.11158

American College of Rheumatology
Empowering Rheumatology Professionals

BRIEF REPORT

Determination of Rheumatoid Arthritis Incidence and Prevalence in Alberta Using Administrative Health Data

Deborah A. Marshall,[1] Tram Pham,[1] Peter Faris,[2] Guanmin Chen,[2] Siobhan O'Donnell,[3] Claire E. H. Barber,[1] Sharon LeClercq,[1] Steven Katz,[4] Joanne Homik,[4] Jatin N. Patel,[5] Elena Lopatina,[1] Jill Roberts,[2] and Dianne Mosher[1]

Objective. The objective of the study was to estimate the incidence and prevalence of rheumatoid arthritis (RA) in Alberta using administrative health data.

Methods. We identified RA cases in patients 16 years and older by applying a national case definition to linked administrative health data (ie, hospital discharge abstract records, physician claims, and health insurance registry records) using a unique personal identifier. Incidence and prevalence are reported for the 2015-2016 fiscal year and a trend analysis from 2011-2012 to 2015-2016. Incidence and prevalence estimates were standardized using the 2011 Canadian census population.

Results. In 2015-2016, the overall crude incidence was 0.74 [95% confidence interval (CI): 0.71-0.77] per 1000 and crude prevalence was 1.08% (95% CI: 1.07-1.09). The women-to-men crude incidence and prevalence sex ratios were 2.04 and 2.19, respectively. People aged 65 to 79 years had the highest incidence of RA, and the highest prevalence was observed among those 80 years and older. From 2011-2012 to 2015-2016, the overall age-standardized incidence decreased [0.97 (95% CI: 0.94-1.01) to 0.79 (95% CI: 0.76-0.82) per 1000], whereas age-standardized prevalence remained constant [1.17 (95% CI: 1.15-1.18) to 1.18 (95% CI: 1.17-1.19)].

Conclusion. In Alberta, there was a decreasing trend in RA incidence over the study period, whereas prevalence was stable. These estimates, combined with clinical data, will be used to measure system performance for quality improvement and to inform simulation modeling for planning the expected demand for health services for patients living with RA.

INTRODUCTION

Rheumatoid arthritis (RA) is a disabling chronic disorder that affects approximately 1.0% of the Canadian population and, with a growing and aging population, is expected to increase (1). The expected rise in Canadians living with RA will place an increased demand on scarce health care resources, which highlights the urgent need to ensure that those affected have access to health care services, including rheumatologists (2). Access to specialized care and early therapeutic intervention has proven to improve clinical outcomes and reduce disease burden and health care costs (1,3).

Population-based administrative health data offer an efficient way of providing longitudinal epidemiological data to study rheumatic disease burden, treatment outcomes, and quality of care (4,5). However, inconsistences in case definitions and analytical techniques make study comparisons difficult. To address this problem, the Public Health Agency of Canada (PHAC) in collaboration with the Canadian Rheumatology Administrative Data Network developed best practices and algorithms to

This work was funded by a Partnership for Research and Innovation in the Health System (PRIHS) grant Optimizing centralized intake to improve arthritis care in Albertans (grant 201300472) and the Arthritis Society Models of Care grant (MOC-13-007). Dr. Marshall is supported by the Arthur J. E. Child Chair in Rheumatology and a Canada Research Chair in Health Systems and Services Research (2008-2018).

[1]Deborah A. Marshall, PhD, Tram Pham, MPH, Claire E. H. Barber, MD, PhD, Sharon LeClercq, MD, Elena Lopatina, MD, Dianne Mosher, MD: University of Calgary, Alberta, Canada; [2]Peter Faris, PhD, Guanmin Chen, PhD, Jill Roberts, PhD: Alberta Health Services, Calgary, Alberta, Canada; [3]Siobhan O'Donnell, MSc: Public Health Agency of Canada, Ottawa, Ontario, Canada; [4]Steven Katz, MD, Joanne Homik, MD: University of Alberta, Edmonton, Alberta, Canada; [5]Jatin N. Patel, MBT: University of Calgary, Calgary, Alberta and Alberta Health Services, Calgary, Alberta, Canada.

No potential conflicts of interest relevant to this article were reported.

Address correspondence to Deborah A. Marshall, PhD, University of Calgary, Health Research Innovation Centre, 3280 Hospital Drive NW, Calgary, Alberta T2N 4Z6, Canada. E-mail: Damarsha@ucalgary.ca.

Submitted for publication May 4, 2020; accepted in revised form May 5, 2020.

standardize measures for surveillance and to promote the use of administrative health data for rheumatic diseases research and surveillance (4,6).

The study objective was to estimate the incidence and prevalence of RA in Alberta using administrative health data and a national case definition (6). An understanding of the incidence and prevalence of RA will be used to inform the reporting of system performance measures for quality of care monitoring, and to provide a baseline estimate to plan for future health resource needs in the province.

MATERIALS AND METHODS

Ethics approval for this study was obtained from the University of Calgary Conjoint Health Research Ethics Board (Ethics ID: REB13-0822).

Administrative health databases

Administrative health data were acquired from Alberta Health (provincial Ministry of Health) and Alberta Health Services (a province-wide health system responsible for delivering health services to Albertans). Health care services for hospitals and physicians in Canada are publicly funded, and therefore the individuals identified as RA patients include individuals who accessed publicly funded health care services paid for by the Alberta Health Care Insurance Plan (AHCIP). Administrative health data included AHCIP records, hospital discharge abstract records, and physician claims from April 1, 2002, to March 31, 2017. These data were linked using a unique personal health number.

AHCIP Population Registry. The AHCIP covers individuals who have lived in Alberta for at least 3 months and who have registered with Alberta Health (excluding Albertans who opted out of AHCIP and members of the Armed Forces and the Royal Canadian Mounted Police, and federal penitentiary inmates who receive coverage from the federal government). The AHCIP population counts correlate to census population estimates and covers 99.9% of the Alberta population (7). Individual patient-level demographic data (eg, age, sex, and postal code) for all Albertans who are covered by the AHCIP were obtained from the data repository.

Discharge Abstract Database. The Discharge Abstract Database (DAD) includes records of all inpatient services for patients and contains primary and secondary discharge diagnosis codes of the International Classification of Diseases, 10th Revision (ICD-10), with up to 25 diagnosis fields per individual admission.

Physician Claims Database. Physician claims contain information for each outpatient clinic encounter for patients covered by the provincial insurance program and to track shadow-billed claims. Practitioners submit claims for their services, which contain the diagnosis code [International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM)], with up to three diagnosis fields for each visit.

RA case definition

We used the 2016 RA case definition by the PHAC for the Canadian Chronic Disease Surveillance System (CCDSS) (6). A modification to the definition was introduced in 2018, which assigns a case date of 730 days or 2 years after the second physician claims visit or discharge date of hospitalization (whichever came first) to permit the opportunity to use all available data for surveillance purposes. For our study purposes, we assigned the date of the second physician claims visit or discharge date of hospitalization with RA diagnosis code (whichever came first) as the case date for all patients with RA. The base case definition [ie, one hospitalization separation or two physician claims (greater than or equal to 8 weeks apart) within 2 years, with ICD-9-CM codes of 714.x or ICD-10-CA codes of M05.x, M06.x] has been validated and yielded a sensitivity, specificity, positive predictive value, and negative predictive value of 83%, 99%, 52%, and 100%, respectively (8). We identified RA cases of patients aged 16 years and older by applying this case definition to linked health administrative databases (ie, the DAD, Physician Claims Database, and AHCIP Population Registry) using a unique personal identifier.

Subsequent to qualifying, patients were excluded if they were diagnosed with non-RA inflammatory arthritides (ie, systemic autoimmune rheumatic diseases, polyarteritis nodosa and allied conditions, polymyalgia rheumatica, psoriasis, ankylosing spondylitis and other spondyloarthritides, and arthropathy associated with other disorders classified elsewhere) in the following 2 years. These conditions were identified using the following case definition: two physician claims with the same non-RA diagnosis codes (at least 1 day apart) within 2 years with ICD-9-CM codes of 710.x, 446.x, 725.x, 696.x, 713.x, and 720.x. The exclusion criteria were applied to all cases that qualified, and those who were excluded were excluded for the remainder of the study period.

Statistical analysis

Statistical analyses were performed using SAS Enterprise Guide (version 7.1). Cases were defined as incident if the individual was newly diagnosed with RA and never met the case definition in any of the previously available years starting in fiscal years 2002-2003 (starting on April 1 of the measurement year and ending on March 31 of the following year). RA incidence was calculated by dividing the total number of new RA cases in each fiscal year by the total number of people covered by AHCIP during the same fiscal year excluding cases that were prevalent at the beginning of the fiscal year, multiplied by 1000. Prevalence was calculated by dividing the total number of prevalent RA cases during the capture

Table 1. Overall crude and age-standardized RA incidence and prevalence by fiscal year in individuals 16 years and older in Alberta[a]

Fiscal Year	Incident Cases	Crude Incidence per 1000 (95% CI)	Age-Standardized Incidence per 1000 (95% CI)	Prevalent Cases	Crude Prevalence % (95% CI)	Age-Standardized Prevalence % (95% CI)	Population
2011-12	2849	0.90 (0.87-0.93)	0.97 (0.94-1.01)	33 285	1.05 (1.04-1.06)	1.17 (1.15-1.18)	3 167 880
2012-13	2719	0.83 (0.80-0.87)	0.90 (0.86-0.93)	34 161	1.05 (1.04-1.06)	1.15 (1.14-1.17)	3 262 060
2013-14	2825	0.83 (0.80-0.86)	0.89 (0.86-0.92)	36 054	1.06 (1.05-1.07)	1.17 (1.16-1.18)	3 394 057
2014-15	2788	0.79 (0.76-0.82)	0.85 (0.81-0.88)	37 786	1.07 (1.06-1.08)	1.17 (1.16-1.19)	3 528 499
2015-16	2704	0.74 (0.71-0.77)	0.79 (0.76-0.82)	39 348	1.08 (1.07-1.09)	1.18 (1.17-1.19)	3 647 825

Abbreviation: CI = confidence interval, RA = rheumatoid arthritis.
[a] Age-standardized incidence and prevalence estimates were calculated using the 2011 Canadian census population.

period by the total number of people covered by AHCIP during the fiscal year and multiplied by 100.

A run-in period from 2002-2003 to 2010-2011 was used to allow enough time to capture all prevalent cases and to avoid misclassification of prevalent cases as incident given the lack of historical information prior to the index year. The last two years of data were not reported in order to permit each RA case an equal opportunity to be excluded as specified in the case definition. Therefore, estimates are reported for 2015-2016 and a trend analysis from 2011-2012 to 2015-2016.

The age-standardized incidence and prevalence estimates were calculated using the 2011 Canadian census population (patients aged 16 years and older) using the direct standardization method to allow for the comparison of RA estimates over the study period. The 95% confidence intervals (CIs) were calculated based on the gamma distribution. A trend analysis was conducted using a Poisson regression model and significance level of $P < .05$.

RESULTS

RA incidence and prevalence

Crude and age-standardized incidence and prevalence are presented in Table 1. There were 2704 new RA cases and 39 348 prevalent cases in the 2015-2016 fiscal year, with an overall crude incidence of 0.74 (95% CI: 0.71-0.77) per 1000 and crude prevalence of 1.08% (95% CI: 1.07-1.09). Over the reporting period, age-standardized incidence decreased, whereas age-standardized prevalence remained stable. The results of the regression model showed a significant annual decrease of 4.5% (95% CI: 3.3-5.6) in incidence after adjustment for age and sex from 2011-2012 to 2015-2016.

Overall, RA incidence was higher among women compared with men (Table 2). In fiscal year 2015-2016, there was a total of 1798 incident RA cases among women and 906 incident RA cases among men with a crude incidence of 1.00 (95% CI: 0.95-1.04) per 1000 and 0.49 (95% CI: 0.46-0.52) per 1000, respectively. The age-standardized incidence for women was 1.26 (95% CI: 1.20-1.31) per 1000 in 2011-2012 and decreased to 1.05 (95% CI: 1.00-1.10) per 1000 in 2015-2016. Similarly, the age-standardized incidence for men decreased from 0.68 (95% CI: 0.64-0.73) per 1000 to 0.53 (95% CI: 0.50-0.57) per 1000 over the same time period. The prevalence of RA in women was twice the prevalence in men (Table 3). By 2015-2016, there were 26 857 women with RA, whereas there were 12 491 men with RA in Alberta. The crude prevalence rate for that year was 1.49% (95% CI: 1.47-1.51) for women and 0.68% (95% CI: 0.67-0.69) for men. The age-standardized prevalence for women and men was stable from 2011-2012 to 2015-2016.

The incidence and prevalence of RA by age group and sex for 2015-2016 are shown in supplementary Figures 1 and 2, respectively. Overall, the incidence of RA increased with age but declined among those 80 years and older. The incidence of RA was 0.86 (95% CI: 0.78-0.95) and 0.36 (95% CI: 0.31-0.41) per 1000 for women and men age 35-49 years, respectively, and nearly doubled among those who were 35-49 to 50-64 years of age for both sexes. Similarly, the prevalence of RA increased with age, with the

Table 2. Crude and age-standardized RA incidence by sex and fiscal year in individuals 16 years and older in Alberta[a]

Fiscal Year	Incident Cases		Crude Incidence per 1000 (95% CI)		Age-Standardized Incidence per 1000 (95% CI)		Population	
	Women	Men	Women	Men	Women	Men	Women	Men
2011-12	1882	967	1.19 (1.13-1.24)	0.61 (0.57-0.65)	1.26 (1.20-1.31)	0.68 (0.64-0.73)	1 585 027	1 582 853
2012-13	1797	922	1.10 (1.05-1.16)	0.56 (0.53-0.60)	1.16 (1.11-1.21)	0.62 (0.58-0.66)	1 628 964	1 633 096
2013-14	1850	975	1.10 (1.05-1.15)	0.57 (0.54-0.61)	1.15 (1.10-1.21)	0.63 (0.59-0.67)	1 688 079	1 705 978
2014-15	1854	934	1.06 (1.01-1.11)	0.52 (0.49-0.56)	1.12 (1.06-1.17)	0.58 (0.54-0.62)	1 748 963	1 779 536
2015-16	1798	906	1.00 (0.95-1.04)	0.49 (0.46-0.52)	1.05 (1.00-1.10)	0.53 (0.50-0.57)	1 804 165	1 843 660

Abbreviation: CI = confidence interval, RA = rheumatoid arthritis.
[a] Age-standardized incidence estimates were calculated using the 2011 Canadian census population

Table 3. Crude and age-standardized RA prevalence by sex and fiscal year in individuals 16 years and older in Alberta[a]

Fiscal Year	Prevalent Cases		Crude Prevalence % (95% CI)		Age-Standardized Prevalence % (95% CI)		Population	
	Women	Men	Women	Men	Women	Men	Women	Men
2011-12	22 758	10 527	1.44 (1.42-1.45)	0.67 (0.65-0.68)	1.55 (1.53-1.57)	0.77 (0.76-0.79)	1 585 027	1 582 853
2012-13	23 374	10 787	1.43 (1.42-1.45)	0.66 (0.65-0.67)	1.54 (1.52-1.56)	0.76 (0.74-0.77)	1 628 964	1 633 096
2013-14	24 627	11 427	1.46 (1.44-1.48)	0.67 (0.66-0.68)	1.56 (1.54-1.58)	0.77 (0.75-0.78)	1 688 079	1 705 978
2014-15	25 795	11 991	1.47 (1.46-1.49)	0.67 (0.66-0.69)	1.57 (1.55-1.59)	0.77 (0.76-0.78)	1 748 963	1 779 536
2015-16	26 857	12 491	1.49 (1.47-1.51)	0.68 (0.67-0.69)	1.58 (1.56-1.60)	0.77 (0.76-0.78)	1 804 165	1 843 660

Abbreviation: CI = confidence interval, RA = rheumatoid arthritis.
[a] Age-standardized prevalence estimates were calculated using the 2011 Canadian census population.

highest prevalence of RA observed among those 80 years and older. The prevalence of RA more than doubled between the ages of 35-49 and 50-64 years for both men and women.

DISCUSSION

We used administrative health data to estimate the incidence and prevalence of RA in Alberta. Over the study period, the age-standardized incidence decreased, whereas age-standardized prevalence remained stable. Consistent with established disease patterns, women had a higher incidence and prevalence of RA compared with men (9). Estimates of RA were generally higher among older adults and seniors; however, a significant proportion of those in their prime working years were also affected, which has important economic implications for the labor force if left undiagnosed and untreated.

There is currently no gold standard administrative data case definition used in RA, and the use of case definitions will vary depending on the feasibility of accessing data sources and study purpose, which highlights the importance of reporting case definitions in research methods for accurate comparisons (8). The RA case date definition currently used by the PHAC for the CCDSS was not implemented in our study because of differences in our study purpose. For our study and future research using these estimates, we were interested in individual-level health data after case qualification to accurately measure the health care utilization of patients for health care planning purposes and quality improvement efforts.

Previous published studies that have examined the epidemiology of RA using administrative health data however, are not directly comparable on account of different case definitions and methodologies employed (9–12) . A study in the United States reported an overall age- and sex-standardized incidence of 0.41 (95% CI: 0.37-0.45) per 1000 from 2005-2014 (11). Canadian estimates of age- and sex-standardized incidence were 0.54 (95% CI: 0.52-0.55) per 1000 in the province of Ontario in 2010 and 0.68 per 1000 in British Columbia from 2001-2006 (9,12). Age- and sex-standardized prevalence estimates were 0.78% (95% CI: 0.78-0.79) in Ontario (2010) and 1.00% (95% CI: 1.00-1.00) in Alberta (2008-2009) (9,10).

The RA estimates reported in this study are comparable to those produced by PHAC's CCDSS (6). When comparing the latest data available for Alberta from the CCDSS (ie, fiscal year 2014-2015), our age-standardized incidence of RA (0.85 per 1000, 95% CI: 0.81-0.88) was slightly higher than the CCDSS (0.75 per 1000, 95% CI: 0.72-0.78), and our age-standardized prevalence (1.17 %, 95% CI: 1.16-1.19) was a little lower than that produced by the CCDSS (1.22%, 95% CI: 1.21-1.24). The small differences observed between our estimates and the PHAC's CCDSS are likely attributable to the difference in the case date definition used and the shorter run-in period applied in this study because there were fewer years of data available.

Nationally, our Alberta RA incidence and prevalence estimates were higher than the overall Canadian population from the CCDSS in 2015-2016 (6). From 2011-2012 to 2015-2016, the age-standardized incidence of RA decreased in Canada from 0.83 per 1000 (95% CI: 0.82-0.84) to 0.75 per 1000 (95% CI: 0.74-0.76), like what was observed in this study. In contrast, there was an increasing age-standardized prevalence of RA observed in Canada in the same time period [1.09% (95% CI: 1.09-1.09) to 1.13% (95% CI: 1.13-1.14)], whereas we observed a stable trend in Alberta.

Studies have found variability in RA incidence trends, with some reporting an increase in incidence while others have reported a stable or decreasing trend overtime (11,13,14). A study examining the incidence of RA by serological phenotype found a decrease in rheumatoid factor (RF)-positive RA and an increase in RF-negative RA from 2005-2014 compared with the previous decades (11). The decreasing trend in RA incidence may be attributed to the dramatic decline in RA risk factors, such as smoking (15). Another explanation may be a possible birth cohort effect, where the risk of RA changes based on social and environmental conditions at time of birth (13). Changes in data collection, coding, how RA is classified and diagnosed, clinical practice, and/or billing methods are other important considerations for the variation in RA incidence.

These disease burden estimates, in combination with clinical and administrative data, can be used for quality improvement initiatives in the detection and treatment of RA. The development of system performance indictors to evaluate a

centralized intake system for patients with RA and osteoarthritis is one example of quality improvement efforts in Alberta (5). Many of these measures will be tested and operationalized using administrative data sources and will require accurate estimates of disease burden to optimize health care planning. Some of this work is currently underway using administrative data from Alberta (16).

A strength of this study is the use of long periods of administrative health data to minimize the misclassification of prevalent cases as incident and to allow enough time to capture all prevalent cases. For accurate estimates of incidence and prevalence, longitudinal data over long time periods are required; otherwise incidence may be over-reported and prevalence underreported. Other strengths of the study include the capture of medically diagnosed cases, near universal coverage, and ability to measure and monitor incidence overtime.

Limitations of the study warrant discussion. Estimates of RA burden may be underestimated in this study as some individuals may delay seeking medical care for prolonged periods of time and thus were missed in the case ascertainment. The reasons for this delay can be due to patient-dependent factors and initial disease onset and presentation. Delays in referral from primary care providers to specialist care may be another contributing factor. Patients seen by a salaried physician who does not shadow bill may also underestimate burden. Those who accessed private health care services are not reflected in the present cohort, although this number is not expected to be significant as there are no rheumatologists practicing in private medical clinics in Alberta. Furthermore, the ICD diagnosis codes submitted by physicians may not be clinically accurate, and therefore, RA care may not be reflected in the codes reported. The generalizability of these findings may be limited because of variations in coding and classification systems, clinical practices, and billing methods across provinces. We were unable to examine RA trends by patient ethnicity or serological phenotype, as these data are not available in the administrative health data sources. Lastly, only 4 years of data were available to assess trends because of the long run-in period used.

In Canada, RA represents a significant public health issue associated with reduced quality of life and economic burden for patients living with the disease (1). According to a national rheumatology workforce survey in Canada, the current number of rheumatologists may be inadequate to meet population needs for managing patients living with RA (2,17). This is concerning given the expected resource needs of this population in the future (1). The factors contributing to the shortage of rheumatology care, in addition to disease estimates of burden, are critical to adequately planning health services for this population to ensure early diagnosis and treat to target.

AUTHOR CONTRIBUTIONS

All authors were involved in drafting or revising the article for important intellectual content, and all authors have read and approved the final version to be published. Dr. Marshall had full access to all of the data in study and takes responsibility for the integrity of the data and accuracy of the data analysis.

Study conception and design. Marshall, Faris, Barber, Katz, Homik, Mosher.

Acquisition of data. Marshall, Faris, Chen, Katz, Lopatina, Mosher.

Analysis and interpretation of data. Marshall, Pham, Faris, Chen, O'Donnell, Barber, LeClercq, Katz, Homik, Patel, Lopatina, Roberts, Mosher.

REFERENCES

1. Arthritis Alliance of Canada. The impact of arthritis in Canada: today and over the next 30 years. 2011. URL: http://www.arthritisalliance.ca/images/PDF/eng/Initiatives/20111022_2200_impact_of_arthritis.pdf.
2. Barber CE, Jewett L, Badley EM, Lacaille D, Cividino A, Ahluwalia V, et al. Stand up and be counted: measuring and mapping the rheumatology workforce in Canada. J Rheumatol 2017;44:248–57.
3. Quinn MA, Conaghan PG, Emery P. The therapeutic approach of early intervention for rheumatoid arthritis: what is the evidence? Rheumatology (Oxford) 2001;40:1211–20.
4. Bernatsky S, Lix L, O'Donnell S, Lacaille D. CANRAD Network. Consensus statements for the use of administrative health data in rheumatic disease research and surveillance. J Rheumatol 2013;40:66–73.
5. Barber CE, Patel JN, Woodhouse L, Smith C, Weiss S, Homik J, et al. Development of key performance indicators to evaluate centralized intake for patients with osteoarthritis and rheumatoid arthritis. Arthritis Res Ther 2015;17:322.
6. Public Health Agency of Canada. Canadian Chronic Disease Surveillance System (CCDSS). 2017. URL: https://health-infobase.canada.ca/ccdss/data-tool/.
7. Jin Y, Ellehoj E, Sanderson M, Malo S, Haan M, Odynak D. Comparison of Alberta population counts between the AHCIP Registry and the 2006 Census. Edmonton: Alberta Health and Wellness. 2009. URL: https://open.alberta.ca/publications/9780778582502.
8. Widdifield J, Bombardier C, Bernatsky S, Paterson JM, Green D, Young J, et al. An administrative data validation study of the accuracy of algorithms for identifying rheumatoid arthritis: the influence of the reference standard on algorithm performance. BMC Musculoskelet Disord 2014;15:216.
9. Widdifield J, Paterson JM, Bernatsky S, Tu K, Tomlinson G, Kuriya B, et al. The epidemiology of rheumatoid arthritis in Ontario, Canada. Arthritis Rheumatol 2014;66:786–93.
10. Barnabe C, Jones CA, Bernatsky S, Peschken CA, Voaklander D, Homik J, et al. Inflammatory arthritis prevalence and health services use in the First Nations and non-First Nations populations of Alberta, Canada. Arthritis Care Res (Hoboken) 2017;69:467–74.
11. Myasoedova E, Davis J, Matteson EL, Crowson CS. Is the epidemiology of rheumatoid arthritis changing? Results from a population-based incidence study, 1985–2014. Ann Rheum Dis 2020;79:440–4.
12. Lacaille D, Avina-Zubieta JA, Sayre EC, Abrahamowicz M. Improvement in 5-year mortality in incident rheumatoid arthritis compared with the general population—closing the mortality gap. Ann Rheum Dis 2017;76:1057–63.
13. Abhishek A, Doherty M, Kuo CF, Mallen CD, Zhang W, Grainge MJ. Rheumatoid arthritis is getting less frequent—results of a nationwide population-based cohort study. Rheumatology (Oxford) 2017;56:736–44.
14. Myasoedova E, Crowson CS, Kremers HM, Therneau TM, Gabriel SE. Is the incidence of rheumatoid arthritis rising? Results

from Olmsted County, Minnesota, 1955–2007. Arthritis Rheum 2010;62:1576–82.

15. Reid JL, Hammond D, Tariq U, Burkhalter R, Rynard VL, Douglas O. Tobacco use in Canada: patterns and trends. Waterloo, Ontario: Propel Centre for Population Impact, University of Waterloo; 2019.
16. Marshall DA, Faris P, Mosher D, Katz SJ, Homik J, Yee K, et al. Regional variation in system-level performance measures for rheumatoid arthritis in Alberta [abstract]. CRA and AHPA Annual Scientific Meeting: Abstracts from the 2019 Annual Meeting, Montreal, Quebec, February 27-March 2 2019. URL: https://rheum.ca/wp-content/uploads/2019/03/2019-Poster-Presentations-for-JRheum.pdf.
17. Barber CE, Nasr M, Barnabe C, Badley EM, Lacaille D, Pope J, et al. Planning for the rheumatologist workforce: factors associated with work hours and volumes. J Clin Rheumatol 2019;25:142–6.