Measuring the Rheumatology Workforce in Canada: A Literature Review

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ABSTRACT. ***Objective.*** The number of rheumatologists per capita has been proposed as a performance measure for arthritis care. This study reviews what is known about the rheumatologist workforce in Canada.

Methods. A systematic search was conducted in EMBASE and MEDLINE using the search themes "rheumatology" AND "workforce" AND "Canada" from 2000 until December 2014. Additionally, workforce databases and rheumatology websites were searched. Data were abstracted on the numbers of rheumatologists, demographics, retirement projections, and barriers to healthcare.

Results. Twenty-five sources for rheumatology workforce information were found: 6 surveys, 14 databases, 2 patient/provider resources, and 3 epidemiologic studies. Recent estimates say there are 398 to 428 rheumatologists in Canada, but there were limited data on allocation of time to clinical practice. Although the net number of rheumatologists has increased, the mean age was ≥ 47.7 years, and up to one-third are planning to retire in the next decade. There is a clustering of rheumatologists around academic centers, while some provinces/territories have suboptimal ratios of rheumatologists per capita (range 0-1.1). Limited information was found on whether rural areas are receiving adequate services. The most consistent barrier reported by rheumatologists was lack of allied health professionals.

Conclusion. In Canada there are regional disparities in access to rheumatologist care and an aging rheumatologist workforce. To address these workforce capacity issues, better data are needed including information on clinical full-time equivalents, delivery of care to remote communities, and use of alternative models of care to increase clinical capacity. (J Rheumatol First Release April 1 2016; doi:10.3899/jrheum.151174)

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ACCESS TO HEALTHCARE MEDICAL STAFF RHEUMATOLOGY SPECIALTY CANADA

Rheumatologists are the primary medical specialists who care for patients with inflammatory arthritis and autoimmune rheumatic disorders. In Canada, there is a rising burden of arthritis exacerbated in part by the aging of the population[1,2], and in many regions there are reported shortages of rheumatologists[2,3,4]. This may contribute to prolonged wait times for care[3,5]. Yet it is well documented that consultation with a rheumatologist is critical for diagnosis of rheumatic disorders and early appropriate treatment[6,7]. Early treatment is associated with improved outcomes, especially for inflammatory arthritis[8]. The number of rheumatologists per capita has recently been proposed as a performance measure for arthritis care in Canada[9].

To plan for the future healthcare needs of people with rheumatic disorders, it is important to determine the number of rheumatologists in Canada and their available time to see patients as well as projected retirements and trainee influx. Perhaps more complex, but equally important, is under-

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standing how rheumatologists might increase their clinical capacity through collaboration with allied healthcare professionals using alternative models of care. Additionally, as seen in other countries such as the United States, there is likely a maldistribution of rheumatologists, clustering in major urban centers[10]; therefore understanding how rheumatologists deliver care to rural and remote regions is an important consideration when evaluating the workforce capacity. The objective of this study was to summarize the data available on the rheumatologist workforce. We focused on Canadian national and provincial physician workforce surveys and databases to answer the following questions: (1) What is the current number of rheumatologists in Canada, and what is their available clinical time to see patients? (2) What is the projected rheumatologist workforce based on current information about projected retirements and Canadian trainee numbers? (3) What is the geographic distribution of rheumatologists and what do we know about the provision of care to rural and remote communities using traveling clinics and technologies such as Tele-health? (4) What are perceived barriers to rheumatology care?

MATERIALS AND METHODS

In collaboration with a medical librarian, the EMBASE and MEDLINE electronic medical databases were searched from January 1, 2000, to December 4, 2014. Key search themes included "rheumatology" AND "workforce" AND "Canada" using Medical Subject Heading terms and keywords. The grey literature was also searched between December 1, 2014, and May 25, 2015, including websites for provincial and national rheumatology associations, general medical associations, and medical regulatory bodies (provincial College of Physicians and Surgeons) as well as other provincial or national patient or physician rheumatology resources (Supplementary material, available online at jrheum.org). Additionally, the following strategies were used to ensure completeness of searching: (1) a hand search of the references of included studies; and (2) authors of workforce surveys and organizations such as the Canadian Rheumatology Association (CRA), the Canadian Council of Academic Rheumatologists (CCAR), and the Paediatric Committee of the CRA (PedsCRA) were contacted for unpublished data on the rheumatologist workforce. Complete search strategies are shown in Appendix 1 (Supplementary data, available online at jrheum.org).

Sources were included if they reported data from the year 2000 onward, and provided some measure of rheumatology workforce capacity in Canada or one of its provinces. Two reviewers (JB and CEB) determined the appropriateness of the sources for inclusion, and data were abstracted. Categories for data abstraction were predetermined and included the following major themes: (1) current rheumatology workforce estimates including rheumatologist and practice demographics and percentage clinical time; (2) future workforce estimates including projected retirement and trainee data; (3) provision of care to rural and remote areas through traveling clinics and telemedicine; and (4) barriers to rheumatology care. To identify trends in the rheumatology workforce, where multiple iterations of data were published since 2000, we abstracted data from all available years; otherwise, the most recent results are presented.

RESULTS

Data sources. Twenty-five unique sources were included (Figure 1) and sources are summarized in Table 1. These sources included 6 surveys: 4 national[4,11,12] and 2 provincial[13,14] (Table 2). Estimates of the number of rheumatologists could also be abstracted from 16 databases (Table 3).

There were also 3 epidemiologic, population-based studies from Ontario on rheumatologist availability[2,3,15]. Longitudinal trends were identified from 6 sources that had multiple iterations since 2000: 4 surveys[4,11,13,14] and 2 databases[16,17].

Table 2 summarizes the methods and the types of data obtained from surveys. Four national level surveys were identified and are described briefly below: the National Physician Survey (NPS), CCAR, and 2 CRA surveys.

Since 2012 the NPS[11] has conducted a yearly workforce survey of either all Canadian physicians or all residents and medical students on alternate years. The survey is conducted in collaboration with the Canadian Medical Association (CMA), the College of Family Physicians of Canada (CFPC), and the Royal College of Physicians and Surgeons of Canada (RCPSC), with support from the Canadian Institute for Health Information (CIHI) and Health Canada.

CCAR includes the heads of each academic rheumatology unit across Canada. Since 1998, CCAR has conducted an annual survey of academic units. Three of these surveys have been published[18,19,20], and the organization collects and reports this information yearly[4].

The CRA is the national rheumatology organization in Canada. The CRA Paediatric Committee has performed 4 surveys of pediatric rheumatology division heads across Canada to address current workforce capacity since 2004. Data from the last survey were made available[21]. Additionally, in 2012 the CRA conducted a national survey of Canadian rheumatologists on the provision of rheumatic care for Aboriginal Canadians[12].

In 2 provinces, Ontario and British Columbia (BC), workforce studies have been conducted. In Ontario, we identified 2 provincial-level surveys[14,26] conducted by The Arthritis Community Research and Evaluation Unit (ACREU). ACREU is an interdisciplinary research unit that carries out research on delivery of care to people with arthritis. There were 3 additional epidemiologic studies on the rheumatologist workforce in this province[2,3,15]. The BC rheumatology association has conducted 2 rheumatologist workforce surveys[13,22].

In addition to the workforce estimates provided by national and provincial-level surveys, there are also many national databases that compile rheumatology workforce information (Table 1 and Table 3). The CMA is the national association of over 80,000 physicians in Canada[23]. The CMA Masterfile is an original CMA database. It receives data from the RCPSC, CFPC, Collège des Médecins du Québec (CMQ), and from its own members.

CIHI has been collecting data on the Canadian physician workforce since the 1970s[16]. Its primary data sources include the National Physician Database (NPDB) and Scott's Medical

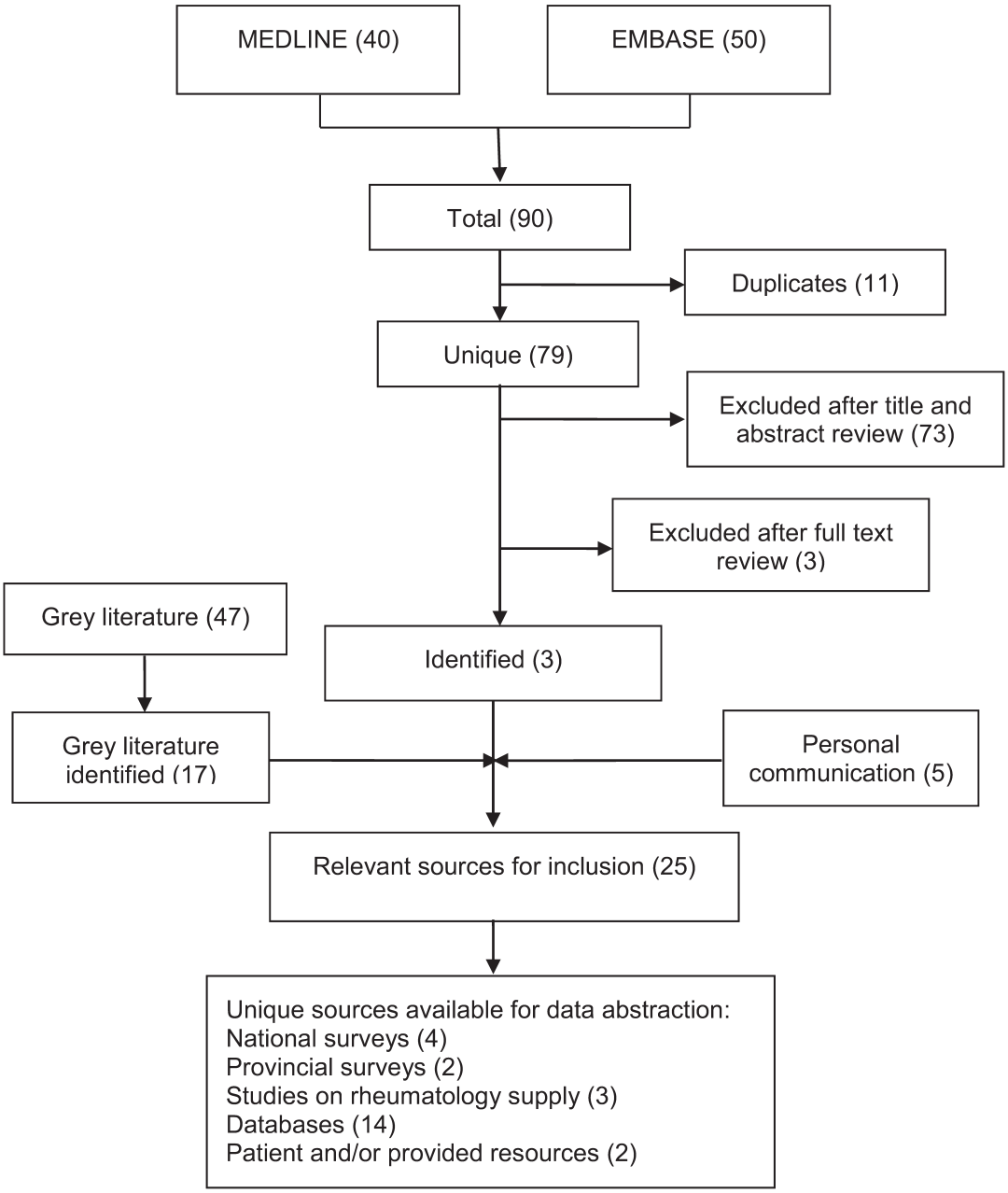

Figure 1. Flow diagram depicting sources searched and included sources.

Database (SMDB). The NPDB provides information on physicians' salaries, payments, and activity within the Canadian healthcare system. Reports on these data are available from 1989 to 2013, but no rheumatology-specific information could be obtained.

SMDB provides information on the number of physicians and their distribution across the country. All data collection is done by Scott's Directories[24] and is obtained from organizations and institutions such as jurisdictional registrars, medical schools, RCPSC, CFPC, CMQ, and Canadian hospitals. As well, Scott's Directories[24] administers a biannual questionnaire of all active physicians to update the information that has been obtained. Data have been collected from 1968 to 2013. Based on these data, the CIHI has produced an annual Supply, Distribution, and Migration of Canadian Physicians report[16] (available from 1999 to 2013). In the most recent report there is no rheumatology-specific workforce information.

The Canadian Post-M.D. Education Registry (CAPER)[17] was established in 1986 and conducts an annual census and reports comprehensive statistics on post-MD training in Canada.

Table 1. Types of sources and examples of where information on the rheumatologist workforce can be found.

Sources	Examples
Membership databases	
Rheumatology associations	British Columbia Society of Rheumatologists
Provincial medical associations	Newfoundland and Labrador Medical Association
National medical associations	Canadian Medical Association Masterfile
Accreditation databases	Royal College of Physicians and Surgeons
Licensing databases	Provincial physician licensing bodies (e.g., College of Physicians and Surgeons of Alberta)
Institutes for health information	Canadian Institute for Health Information
Physician directories	Scott's Directories
Postgraduate medical databases	Canadian Post-M.D. Education Registry
Workforce surveys	
National physician surveys	National Physician Survey
National rheumatology surveys	Canadian Council of Academic Rheumatologists Canadian Rheumatology Association surveys (e.g., pediatric workforce survey)
Provincial rheumatology surveys	British Columbia rheumatology society Arthritis Community Research and Evaluation Unit
Other sources for information	
Population-based cohort studies on rheumatology supply	Administrative data including physician billing information can be used to estimate rheumatologist supply
Other patient/provider resources	The Arthritis Society Alberta Rheumatology

Abstracted results. What is the current number of practicing rheumatologists in Canada, and what is their available clinical time to see patients?

Estimates of the total number of Canadian rheumatologists and their demographics are shown in Table 3 and provincial estimates in Table 4. The most recent workforce estimates (2015) were available from the CMA[23] and the RCPSC[25], which estimated there were 398 and 428 rheumatologists, respectively. The CMA[23] also reports the average number of rheumatologists per 100,000 is 1.1 (provincial range 0-1.5, Table 4). Estimates from the same years varied between sources and this was due to the population included in each estimate. For example, CCAR[4] and PedsCRA[21] estimates included only academic rheumatologists and pediatric academic rheumatologists, respectively. The RCPSC[25] data include fellows in rheumatology but may include individuals no longer practicing. Data from the CMA[23] and CIHI[16] were derived from multiple sources and may be more robust, although CI are not presented in any of the data estimates obtained.

Demographic data were available from 4 sources (Table 3) and demonstrated that roughly half of practicing rheumatologists were male, which differed from rheumatology trainee data (Table 5), where only 31% were male. Although the NPS and the surveys by Averns, *et al*[12] collected demographic data, they were excluded from Table 3 because of low response rates, which limited the reliability of their data (13% and 29%, respectively).

Limited information on pediatric rheumatologists was found. The PedsCRA survey[21] in 2012 identified 32 pediatric rheumatologists while in the same year CIHI[16] identified 34 pediatric rheumatologists. There were no pediatric rheumatologists in 3 regions (Prince Edward Island, Manitoba, and the Northwest Territories). The PedsCRA survey[21] also identified 3 adult rheumatologists who covered pediatrics in underserviced areas.

There are limited data on the amount of time rheumatologists allocate to clinical care (Table 2), and the way this is reported varies by source. Surveys conducted in 2014 by CCAR[4] and the CRA pediatric committee[21] provided data on the number of full-time equivalents (FTE; allocation of time to the academic unit). According to the CCAR data[4], the average FTE for all rheumatologists (adult and pediatric) across 16 academic centers was 0.81, with the following average allocations of time: clinical care 0.55 (range 0.15–0.75), teaching 0.16 (0.08-0.26), research 0.20 (0.08–0.38), and administration 0.07 (0.02-0.16). The average number of pediatric FTE per site (with 13/19 sites reporting)[21] was 1.90 (0.1-6.75), with an average FTE for clinical care of 0.97 (0.10-3.20), research 0.46 (0-2.58), teaching 0.24 (0-0.82), and administration 0.22 (0-0.54).

The NPS[11] also provided information on the percentage of time allocated to clinical work and work hours. The 2014 NPS reported the typical work week (excluding on-call) was 54.6 h, of which 30 h involved direct patient care[11].

In the 2010 provincial BC survey[22], 49 rheumatologists contributed 32 clinical FTE to serve a population of over 4 million people (a full-time FTE in this study was defined as

Table 2. National and provincial data sources about rheumatologist workforce characteristics.

Source	Population Surveyed	Methods	Interval of Data Collection	Year[a]	Data Collected[b]								
					Physician Demographics[e]	Practice Demographics[f]	Clinical FTE[g]	Geographic Information[h]	Vacant Positions	Retirement Data	Rheumatology Trainee Data	Alternative Models of Care	Allied Health
National surveys													
NPS	Canadian rheumatologists	Electronic survey of Canadian physicians	Yearly[c]	2014	✓	✓	✓[i]	✓				✓	
				2013	✓	✓		✓		✓			✓
				2010	✓	✓	✓[i]	✓		✓		✓	✓
				2007	✓	✓	✓[i]	✓		✓		✓	
CCAR	Canadian rheumatologists	Paper survey of division heads of academic rheumatology units	Yearly; since 1998[d]	2014	✓	✓	✓	✓	✓	✓	✓		
				2000–2009	✓	✓	✓	✓	✓		✓		
PedsCRA	Canadian pediatric rheumatologists	Electronic survey of division heads of academic units	Four times; since 2004[j]	2012		✓	✓	✓	✓	✓	✓	✓	✓
Averns, *et al*[12]	Canadian rheumatologists	Electronic survey of CRA members	Once	2012	✓	✓						✓	✓
Provincial surveys													
BCSR	Rheumatologists in British Columbia	Electronic survey of BCSR members	Twice	2010, 2013	✓	✓	✓	✓		✓			
ACREU	Rheumatologists in Ontario[k]	Paper survey of Ontario rheumatologists	Four times; since 1992[c]	2007	✓	✓		✓		✓		✓	✓
				2000	✓	✓		✓					✓

[a]Year of data collection. If multiple iterations of the survey, listed together. If surveys differed in variables to be extracted, listed separately. [b] Check marks (✓) indicate this type of data was collected. [c] Yearly since 2012. Also performed in 2004 and 2012: no information on rheumatology workforce. [d] Only results since the year 2000 included. [e] Physician demographics include age, sex of rheumatologist. [f] Practice demographics include practice setting (community/hospital/academic, group/solo, mixed), distribution of time (teaching/clinical care/research/administration). [g] Reported as clinical FTE or average FTE with allocation of time to clinical care, unless otherwise specified. [h] Geographic information includes information on community served (population vs urban/suburban/rural, etc.), postal code, LHIN or sub-LHIN. [i] Reported as total hours (excluding on-call) worked per week in direct patient care. [j] Only results from the most recent survey reported. [k] Rheumatologists in Ontario caring for patients ≥ 15 years old. ACREU: Arthritis Community Research and Evaluation Unit; BCSR: British Columbia Society of Rheumatologists; CCAR: Canadian Council of Academic Rheumatologists; CRA: Canadian Rheumatology Association; PedsCRA: CRA Pediatric Committee; FTE: full-time equivalent; LHIN: Local Health Integration Network; NPS: National Physicians Survey.

5 clinical working days per week). This equated to a ratio of 1 FTE rheumatologist per 140,000 population, whereas the CRA recommends 1 per 75,000 population[22], which would indicate that BC has 30 rheumatologists fewer than recommended[22]. An update in BC in 2013[13] showed some improvement, with 41 FTE rheumatologists practicing in the province for a ratio of 1 for 112,000 population, which was still lower than the recommended ratio. In the ACREU report[14], there were 1.2 rheumatologists per 100,000 for Ontario in 2007; however, regionally this ratio varied between 0.31-3.97 per 100,000.

The next question is to determine the projected rheumatologist workforce based on current information about projected retirements and trainee numbers.

Since 2000, several sources[4,17,23] have reported an increase in rheumatologist (Table 3) and rheumatology trainee numbers (Table 5). For example, CCAR[4] has reported a net increase of 75 academic rheumatologists and 41 rheumatology trainees and CIHI[16] has reported a net increase of 128 rheumatologists over the same period (Table 3). Despite this net increase, the mean age of practicing rheumatologists (excluding trainees) in most surveys from 2013 to 2015 is ≥ 47.7 years (Table 3), and some sources have reported high anticipated retirement projections and many current unfilled positions.

For example, according to CCAR in 2014, 16 different academic sites reported a loss of staff. While overall there was an increase in both faculty members and trainees over a 16-year period (1998-2014), there were still numerous unfilled positions[4]. This report noted that 12 of the 16 academic units were recruiting, with 31 vacant positions Canada-wide. Based on the PedsCRA survey, 5 of the 32 pediatric rheumatologists are expected to retire within the next 5 years while 2 sites had 9 pediatric rheumatology trainees[21].

Table 3. Survey results and database findings of estimates of the rheumatologist workforce numbers and demographics between 2000 and 2014.

Source	Year[a]	Study Results				
		No. Rheumatologists Identified/ surveyed[b]	Survey Response Rate, n (%)	Adult/pediatric, N[c]	Mean Age, yrs	Sex, % male
National level — surveys of academic units						
CCAR	2014	241	16 (100)	207/34	51.5	50.2
	2009[e]	221	—	—	49.8	56.6
	2002[f]	168	15 (94)	144/24	48.9	65.5
	2000[g]	162	15 (94)	139/23	48	67.8
PedsCRA	2012	32	13 (69)	—/32	—	—
National level — databases						
CIHI	2012	406	N/A	372/34	—	—
	2011	381		352/29	—	—
	2010	363		336/27	—	—
	2009	347		324/23	—	—
	2008	300		300/ —	—	—
CMA[h]	2015	398	N/A	—	—[d]	50.0
	2013	371		—	—[d]	52.6
RCPSC	2015	428		—	—	—
Provincial level — surveys						
BCSR	2013	62	58 (94)	—	—	60
	2010	50	49 (98)	—	—	69
ACREU	2007	164	111 (68)[i]	105/6	43	63
	2000	158	131 (83)[i]	125/6	—	66

[a] Year of data collection (may not reflect year of publication of data). [b] No. rheumatologists identified varied by source. There were important variations in the source denominators: CCAR numbers represent only academic rheumatologists, PedCRA survey numbers represent only pediatric rheumatologists from participating centers. CIHI and CMA data represent overlapping data sources. RCPSC numbers reflect specialist fellowship numbers, which may include individuals not currently in practice. [c] Adult/pediatric rheumatologists. As reported, or calculated from percentage to nearest whole number. [d] Age reported in categories: CMA 2013 and CMA 2015, 45.6% and 44.0% of rheumatologists were ≥ 55 years old, respectively. [e] Only reporting most recent results (2009). [f] Only reporting most recent results (2002). [g] Only reporting most recent results (2000). [h] CMA 2013 data extracted from "Rheumatology Profile," which includes CMA Masterfile and data from other sources. [i] Represents entire survey response rate. Part 1 response rate was 152 (93%) and 164 (100%) for the 2008 and 2001 surveys, respectively. ACREU: Arthritis Community Research and Evaluation Unit; BCSR: British Columbia Society of Rheumatologists; CCAR: Canadian Council of Academic Rheumatologists; CRA: Canadian Rheumatology Association; PedsCRA: CRA Pediatric Committee; CIHI: Canadian Institute for Health Information; CMA: Canadian Medical Association; RCPSC: Royal College of Physicians and Surgeons of Canada; N/A: not applicable.

In the ACREU study of Ontario rheumatologists[14], almost one-third reported a plan to retire within 10 years. Similarly, a survey of rheumatologists in BC in 2013[13] reported that 21% planned on retiring in 5 years and 48% plan on retiring within 10 years. In the 2014 NPS survey[11], 29.5% of responding rheumatologists plan to reduce their work hours and another 7.4% plan to retire within 2 years, although the NPS sample included a younger rheumatology demographic and low sample size (n = 50).

Next we studied the distribution of rheumatologists and the provision of care to rural and remote communities using traveling clinics and technologies such as Tele-health.

Provincial-level data on the rheumatologist workforce were available from 7 sources and are shown in Table 4. There were no rheumatologists practicing in 1 province (Prince Edward Island) or in any of the territories documented in any of the sources reviewed.

Three national studies[11,12,21] and 3 provincial studies[2,14,15] have provided information on the practice location of rheumatologists, although the level of geographic detail varied by study. According to the most recent NPS[11], about 45% of rheumatologists surveyed worked in a community practice and 78% were based in urban or suburban communities. Additionally, 20% of rheumatologists provide Tele-health services to rural or remote communities[11]. Similarly, in a national survey of the provision of rheumatology care to Aboriginal populations, 28 respondents (19%) reported that they provided care to remote communities through Tele-health and traveling clinics[12]. In the most recent PedsCRA study in 2012[21], 5 sites reported providing a total of 75 half-day outreach clinics per year to 7 underserviced communities.

Three studies done in Ontario[3,14,15] report a maldistribution of rheumatologists, with a clustering in the areas around teaching hospitals and in the more populated areas. There is considerable regional variation in access to rheumatology services, especially in the northern parts of the province.

Barriers to rheumatology care were reported in many surveys[2,11,12,14,15,21,26]. A consistent theme reported by rheumatologists was lack of access to appropriate allied health professionals. The 2013 NPS[11] found that unsatisfactory access to allied health personnel was common, with 57% reporting inadequate access to nurses, 61% to social workers, and 49% to both physiotherapists and occupational

Table 4. No. rheumatologists per province identified in databases and surveys (most recent data available reported).

Source	Year	Type	No. Rheumatologists Identified per Province/territory											
			NL	PEI	NS	NB	QC	ON	MB	SK	AB	BC	YT/ NU/NWT	Total
CIHI	2012	Adult	4	0	9	9	103	148	11	5	38	45	0	372
		Pediatric	1	0	4	0	4	13	0	2	4	6	0	34
		Total	5	0	13	9	107	161	11	7	42	51	0	406
CMA	2015	Not specified	5	0	14	7	106	154	11	7	39	55	0	398
RCPSC	2015	Both	5	0	14	7	84	194	13	7	45	59	0	428
Provincial regulatory authorities	2015	Both	4	—	8	14	—	225	15	—	50	65	—	
The Arthritis Society	2015	Both	—	—	14	10	—	—	14	11	—	—	—	
Provincial rheumatology listings	2015	Adult	—	—	—	—	—	—	—	—	40	63	—	
		Pediatric									—	9		
CCAR	2014	Adult (academic)	3	—	10	—	61	76	9	2	24	22	—	207
		Pediatric (academic)	1	—	4	—	8	13	0	2	1	5	—	34
		Total	4	—	14	—	69	89	9	4	25	27	—	241
Estimate of rheumatologists per 100,000 population														
CMA	2015	Both	0.8	0.0	1.5	0.9	1.1	1.1	0.9	0.6	1.0	1.1	0.0	1.1

AB: Alberta; BC: British Columbia; CCAR: Canadian Council of Academic Rheumatologists; CIHI: Canadian Institute for Health Information; CMA: Canadian Medical Association; MB: Manitoba; NB: New Brunswick; NL: Newfoundland and Labrador; NWT: Northwest Territories; NS: Nova Scotia; NU: Nunavut; ON: Ontario; QC: Quebec; RCPSC: Royal College of Physicians and Surgeons of Canada; SK: Saskatchewan; YT: Yukon; PEI: Prince Edward Island.

therapists. Other identified barriers to rheumatology care[2,3,14,15] were long waiting lists, lack of patient access to family physicians, lower socioeconomic status, high cost of medications, and geographic location. Specific challenges reported in providing care to rural and remote Aboriginal communities include difficulties in monitoring, adjusting, and assessing medication compliance[12]. Over half of the respondents reported poor information technology access as a major contributor to these difficulties[12].

DISCUSSION

Media and anecdotal reports of a shortage of Canadian rheumatologists combined with complaints of long wait times to see a rheumatologist are pervasive. Our study reviews what is known about the rheumatologist workforce in Canada. Our results highlight that the number of rheumatologists varies by source, but the most recent 2015 estimates were from the CMA and the RCPSC, which estimated there were 398 and 428 rheumatologists in Canada, respectively. The variance in estimates is likely explained by differing sources of information (for example, the RCPSC counts certified specialists, including some who may no longer be practicing). The most accurate numbers are likely obtained by organizations that draw from many longitudinally collected sources (e.g., the CMA and CIHI). Further, information on rheumatologists' time spent in clinical practice (clinical FTE) was lacking in most studies; therefore true estimates of the national workforce capacity were limited.

Although our findings indicate that there has been an increase in the number of rheumatologists and rheumatology trainees in Canada since 2000, it appears that overall the workforce is aging, with a large proportion of rheumatologists preparing for retirement. In addition, there is a geographic maldistribution of rheumatologists, with suboptimal ratios of rheumatologists per capita in certain provinces/territories. There is also limited information on how care is delivered to patients with rheumatic diseases in these regions and other rural/remote parts of the country. Finally, lack of access to allied health processionals emerged as a consistent barrier to rheumatology care.

Recently, the Arthritis Alliance of Canada proposed that the number of rheumatologists per capita be reported as a performance measure of arthritis care in Canada[9]. Unfortunately the regional location of rheumatologists in relation to the population served was not often reported in the studies we reviewed. Further, the optimal number of rheumatologists to provide care to a population is not clearly defined[27]. Ideally, rheumatologist per capita benchmarks would be based on the prevalence of common rheumatic conditions in the population, the average number of annual visits to a rheumatologist for each condition, and the clinical capacity of rheumatologists to see new and followup cases. In Canada,

Table 5. Rheumatology trainee numbers from 2000 to 2014/15.

Source	Year	Total Trainees*	Total Trainees* Adult/pediatric*	Sex, % male*	Total Residents N = Total (N = excluding visa trainees)	Total Fellows	N = Total: any funding source, any level of training
CAPER	2014/15	68	63/5	30.9	61 (58)	39 (10)	100
	2013/14	64	57/7	32.8	59 (56)	29 (8)	88
	2012/13	67	59/8	28.4	62 (59)	29 (8)	91
	2011/12	65	57/8	24.6	59 (55)	27 (10)	84
	2010/11	66	54/12	15.2	55 (54)	29 (12)	84
	2009/10	54	43/11	14.8	52 (47)	28 (7)	80
	2008/09	33	24/9	24.2	41 (32)	26 (1)	67
	2007/08	38	31/7	21.1	41 (35)	31 (3)	72
	2006/07	29	24/5	20.7	33 (28)	26 (1)	59
	2005/06	26	23/3	15.4	37 (24)	19 (2)	56
	2004/05	26	24/2	19.2	30[a]	22[a]	52
	2003/04	21	17/4	23.8	29[a]	18[a]	47
	2002/03	23	19/4	34.8	32[a]	15[a]	47
	2001/02	18	15/3	50.0	23[a]	10[a]	33
	2000/01	23	19/4	52.2	25[a]	8[a]	33
		Total trainees (residents only, no fellows)			Ministry of Health Funding	Arthritis Society Funding	Other
CCAR[b]	2014	70	61/9	25.7	59	0	11
	2009	54	—	—	41	1	12
	2002	30	22/8	—	12	10	8
	2000	29	25/4	51.7	12	6	11
PedsCRA	2012	9[c]	—	—	—	—	—

* Excluding visa trainees, includes fellows and residents. [a]During this time period CAPER data do not report a breakdown of residents versus fellows based on citizenship status that was available in its reports. [b] CCAR data do not specify citizenship of trainees and include only 2 years of training. Where data were presented in graphical form, numbers were extracted by estimation of the nearest whole number. [c] The PedsCRA survey enumerated residents in 13 programs only and counted up to 4 years of training in the program (funding sources were not specified, nor was citizenship). The Canadian Medical Association also reports on rheumatology trainees, but the 2014 file includes data from CAPER 2012/13. CCAR: Canadian Council of Academic Rheumatologists; CAPER: Canadian Post-M.D. Education Registry; PedsCRA: Canadian Rheumatology Association Pediatric Committee.

the CRA recommends a ratio of 1 rheumatologist per 75,000 population (oral communication with the Human Resources Committee, CRA, November 2010, as described by Kur and Koehler[22]). This benchmark is similar to those in the United Kingdom and the United States[27], but further work is needed in this area in Canada. Based on the 2015 CMA data and current estimates of the Canadian population using the CRA recommended ratio, there is a deficit of about 79 rheumatologists nationwide. This, however, does not take into account time spent in clinical practice and is likely an underestimate given the time many rheumatologists allocate to other activities including teaching and research.

This maldistribution and shortage of rheumatologists is not unique to Canada; similar concerns have been reported by the American College of Rheumatology[10] and in studies from New Zealand[28], East Africa[29], and China[30]. In our review, remote and northern communities were found to be particularly disadvantaged, especially considering that these regions have a high prevalence of rheumatoid arthritis[2]. To mitigate this maldistribution of rheumatology resources, newer ways of delivering care may be necessary such as traveling clinics, Tele-health, or E-consultation. From our study, there appears to be limited information on the use of technology in rheumatology and little is known about whether there is adequate provision of rheumatologist services to rural and remote areas.

Our review also highlights that the rheumatology workforce is aging. Canada has an aging general population combined with an increasing prevalence of arthritis including rheumatoid arthritis[2], and the availability of rheumatologists may not be able to meet this ever-increasing demand.

Although this is to our knowledge the most comprehensive review of this topic to date, there are several limitations that should be recognized. First, there was significant heterogeneity in the data sources we found; therefore we did not attempt to report an overall estimate of the numbers of rheumatologists or their demographics and instead reported on the sources and the estimate each one provides. It is also possible that some of the sources cited did not have complete information (for example there is a rheumatologist practicing in PEI who is not recorded in the data sources we reviewed). The estimates also do not reflect the number of full-time clinical rheumatologists because very few of our sources provided information on the amount of time devoted to clinical practice (clinical FTE). The discrepancy between the number of rheumatologists and the available clinical FTE was most clearly shown by the BC provincial surveys[13,22] and the CCAR results[4]. Understanding how rheumatologists

spend their time and the number available for clinical practice is critical for accurate workforce estimation and projection. A final limitation is that some of the survey data recording self-reported information may be limited by response rates and may not be representative of the complete workforce.

Our review highlights that we do not have comprehensive Canadian data on the rheumatologist workforce. The data that we do have indicate regional and national disparities in access to rheumatologist care and a challenged workforce. To address the current and future supply of rheumatologists and the provision of optimal access to services, better data are needed on the workforce's capacity to deliver care, including more comprehensive information on clinical FTE, delivery of care to rural and remote communities, and use of allied health professionals to increase clinical capacity through alternative models of care.

ONLINE SUPPLEMENT

Supplementary data for this article are available online at jrheum.org.

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