

Ecology of health care in Canada

Moira Stewart PhD Bridget Ryan MSc PhD

Abstract

Objective To provide a population-based, Canada-wide picture of health care needs and health care use, and present it in a highly accessible manner, allowing provincial comparisons and comparisons with other international jurisdictions.

Design A comparison of the rates of health care use among jurisdictions, using Canadian-population survey data and health administrative data.

Setting Provincial jurisdictions across Canada.

Main outcome measures Canadian and provincial rates of ill health (presence of chronic conditions) and health care use (contacts with family physicians, contacts with other specialist physicians, contacts with nurses, and hospitalizations) as monthly rates per 1000 population standardized by age and sex.

Results The monthly rate per 1000 population of having at least 1 chronic condition ranged from 524 in Quebec to 638 in Nova Scotia; contacts with family physicians ranged from 158 in Quebec to 295 in British Columbia; contacts with other physician specialists ranged from 53 in Saskatchewan to 79 in Ontario; and contacts with nurses ranged from 23 in British Columbia to 41 in Quebec. Hospital stays ranged from 8 to 11 per 1000 people, and rates were similar among the provinces.

Conclusion Recognizing the differences among jurisdictions is critical to informing health care policy across the country. Differences persisted when rates were standardized for different age and sex compositions in the provinces. This article provides a straightforward methodology using publicly available data that can be employed in each province to examine, in the future, the evolution over time of health care use by provincial jurisdictions.

EDITOR'S KEY POINTS

- This study provides a Canadian synthesis of health care use at a population level comparing provincial jurisdictions. Data were primarily self-reported, identically measured across provinces, and adjusted by age and sex.

- The key differences among the provinces were as follows: use of family physicians was highest in British Columbia and lowest in Quebec; use of nurses was highest in Quebec and lowest in British Columbia; use of other specialist physicians was highest in Ontario and lowest in Saskatchewan. The rates of having at least 1 chronic condition were highest in Nova Scotia and lowest in Quebec.

- The provincial variation in health care use could not be explained by variation in sex and age composition of the population, physician supply, or rates of chronic disease. It is possible the observed variation is related to differences in provincial policies and practices.



This article is eligible for Mainpro-M1 credits. To earn credits, go to www.cfp.ca and click on the Mainpro link.

This article has been peer reviewed.
Can Fam Physician 2015;61:449-53

La traduction en français de cet article se trouve à www.cfp.ca dans la table des matières du numéro de mai 2015 à la page e249.

A panoramic view of the engagement of the population of Canada with health care does not exist. In order for governments, the single payer of health care in Canada, to understand the health behaviour of the citizens, such a view is needed. In order for researchers to appreciate what prevalent issues deserve our attention, this perspective would help. In order for clinicians to understand where they fit into a larger picture, a wide-angle lens is needed.

For the first time in the world literature, to our knowledge, a comparison of health systems was made among jurisdictions, using the ecology of health care methodology.^{1,2}

Our goal was to provide a population-based, Canada-wide picture of health care needs and health care use, and present it in a highly accessible manner that would allow provincial comparisons, as well as comparisons with other international jurisdictions.^{1,2} We examined chronic conditions, visits with family physicians, visits with other specialist physicians, visits with nurses, and hospitalizations, by province and standardized by age and sex.

METHODS

Data

Data for this study came from 4 sources. Most of the data used to conduct this study were from the public file of the 2007 Canadian Community Health Survey (CCHS) cycle 4.1. The CCHS is a population-based, cross-sectional health survey with a multistage, stratified cluster design administered to Canadians 12 years of age and older. Details can be found on the Statistics Canada website.³ Weighted data were used to account for the unequal probability of selection, making the estimates proportionate to the Canadian population. The rates calculated from CCHS self-reported data for this study were for the following: the presence of chronic conditions, visits with family physicians, visits with other specialist physicians, and visits with nurses.

The second source of data was the Canadian Institute for Health Information (CIHI) Discharge Abstract Database (DAD), which provided information on hospital discharges by age, sex, and province. These data were obtained from the CIHI Quick Stats interactive website.⁴

The third source of data was the 2006 Canadian census obtained from the Statistics Canada website.⁵ Canadian and provincial population numbers were used as the denominator for the rates of hospital use and were used to standardize the provincial rates to the Canadian population.

The fourth source of data was the CIHI 2006 report *Supply, Distribution and Migration of Canadian Physicians*.⁶ This report provided data on the supply of family physicians and other specialist physicians in Canada and in each of the provinces.

Both the CCHS and the CIHI DAD reported health care use over the past 12 months. Rates were transformed

from yearly to monthly for Canadians 15 years of age and older. The CCHS provided information for those 12 years of age and older; however, the age groups for the CIHI DAD included 1 group of those aged 10 to 14 years. It was impossible to determine rates from the CCHS for those younger than age 12, and it was impossible to separate rates for those aged 12 to 14 years in the CIHI DAD. Therefore, the rates for this study were limited to those 15 years of age and older.

Analysis

All analyses were conducted for Canada overall and for each of the 10 provinces. For the CCHS, this provided a sufficiently large sample size of 121 801 respondents; however, territories were excluded because of small sample sizes. For each of the rates, age-sex standardized rates were calculated using the direct standardization method standardizing to the 2006 Canadian population. Standardized rates were very comparable to unstandardized rates, and so only standardized provincial rates were reported.

Rates were also compared, with 2 caveats, with a 2001 US study.² First, the US study counted the number of patients who visited, whereas the Canadian data were reported as number of visits. Second, in the US study, primary care typically referred not only to family medicine but also to general internal medicine and pediatrics. Canadian rates were converted to monthly rates to facilitate comparison with the monthly rates reported in the US studies.

Presence of chronic conditions. Respondents to the CCHS indicated the presence of specific chronic conditions and had the option to indicate additional conditions not specified, thereby providing an exhaustive list. For this self-reported measure, respondents were asked to report only conditions diagnosed by health care providers. A variable was created, classifying respondents as those who indicated any chronic condition and those who indicated none. The rate per 1000 people was the number of respondents who indicated the presence of any chronic condition divided by the total number of respondents multiplied by 1000. Given the stability of chronic conditions over time, this yearly rate was used as the value for the monthly rate with no further adjustment. While having a chronic condition was not a measure of health care use, it represented one measure of burden of illness in the population that was related to health care need.

Contacts with family physicians, other specialist physicians, and nurses. The rates for contacts with health care providers were determined using the data generated when respondents were asked to indicate how many times in the past 12 months they had seen or talked to each of these providers. The term *contacts* was used instead of *visits* because in the CCHS health care use

questions, *contacts* could include telephone consultations. The proportion of telephone consultations was estimated based on a question that asked about the location of the respondent's last contact. For family physicians and other specialist physicians, this number was negligible; however, for nurses this number was 11.2%. Nurse contact specifically excluded contact when in hospital. For other specialist physicians, contacts with ophthalmologists were not included because this physician group was included in a separate question about eye doctors that included optometrists.

The mean number of contacts was calculated for each of these utilization variables. This provided the yearly mean for contacts per person. This mean was then divided by 12 and multiplied by 1000 to provide the monthly contact rate per 1000 people. Owing to confidentiality issues with small cell sizes, the publicly available CCHS data capped the number of contacts for each of these providers at an upper end. For family physicians, the upper limit was 31; so those who made more than 31 contacts were counted as if they made 31 contacts. Out of 121 801 respondents, 387 or 0.3% fell into the category of 31 contacts, limiting concerns about underestimated contacts. Similarly for other specialist physicians and nurses, the cap was 12 contacts.

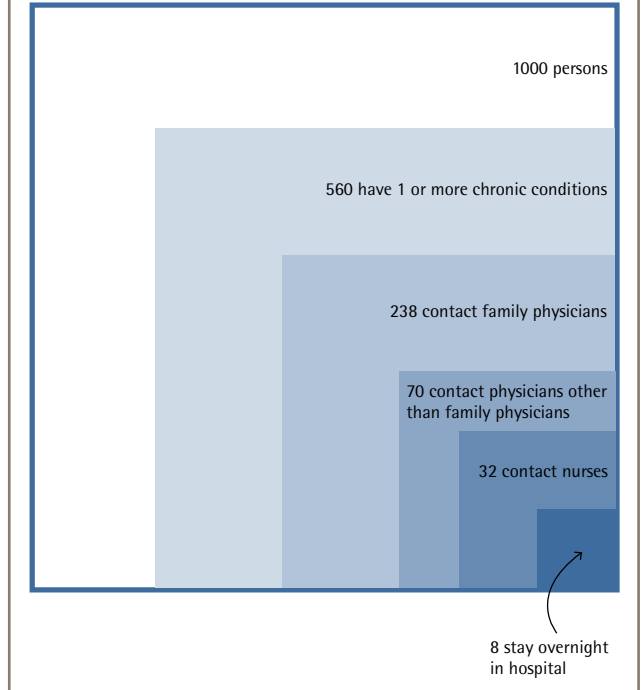
Hospitalizations. Hospitalization rates were determined by dividing the number of hospital discharges from the CIHI DAD by the census population numbers for the given geographic region. This mean number of hospitalizations was then divided by 12 and multiplied by 1000 to create the monthly rate per 1000 people.

Ratio of physician contacts per month to physician supply. Physician contacts were calculated per 1000 population. Physician supply numbers were obtained from the CIHI *Supply, Distribution and Migration of Canadian Physicians*⁶ report. They were reported per 100 000 population and were converted to per 1000 population by dividing the rates by 100. They represent the supply for the year 2006 and were not adjusted for monthly rates given the assumption that supply in any given month would be comparable to the supply for the given year. Ratios were calculated for Canada and for each province with physician contacts as the numerator and physician supply as the denominator.

RESULTS

The primary outcome of this study was the rates of ill health (chronic conditions) and health care use among Canadians reported as monthly rates per 1000 population (Figure 1). Each box in Figure 1 represents a subgroup of the 1000 people. For example, 8 people per 1000 were

Figure 1. Canadian ecology of health care standardized monthly rates per 1000 population of those aged 15 years and older: Each box represents a separate subgroup of the total 1000 persons.



hospitalized in a month, but these are not necessarily 8 of the 32 who contacted a nurse.

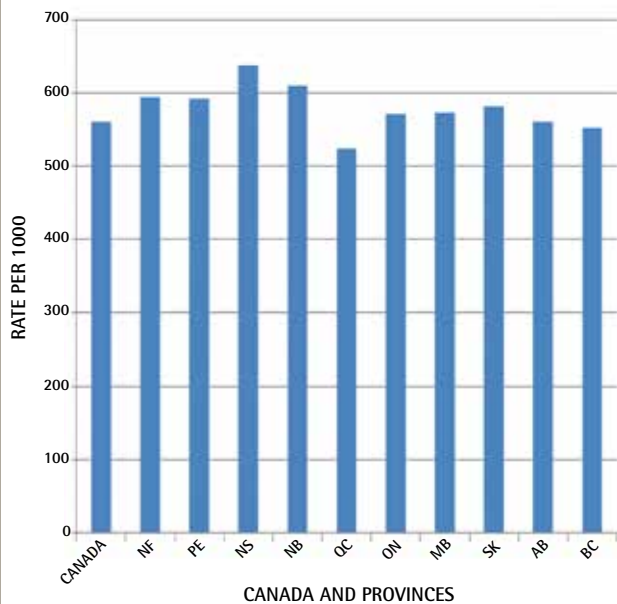
These rates were examined by province. The rates of chronic conditions are reported in Figure 2. The rate per 1000 people of having at least 1 chronic condition varied from a low of 524 in Quebec to a high of 638 in Nova Scotia. The provincial rates of health care use are reported in Figure 3. Rates per 1000 people for contacts with family physicians varied from 158 in Quebec to 295 in British Columbia. Rates per 1000 people for contacts with other specialist physicians ranged from 53 in Saskatchewan to 79 in Ontario. Rates per 1000 people for contacts with nurses ranged from 23 in British Columbia to 41 in Quebec. Hospital stays ranged from 8 to 11 per 1000 people.

A secondary outcome of interest to facilitate comparison among provinces was the supply of physicians in each province. Table 1 shows the number of physician contacts per month relative to physician supply.

DISCUSSION

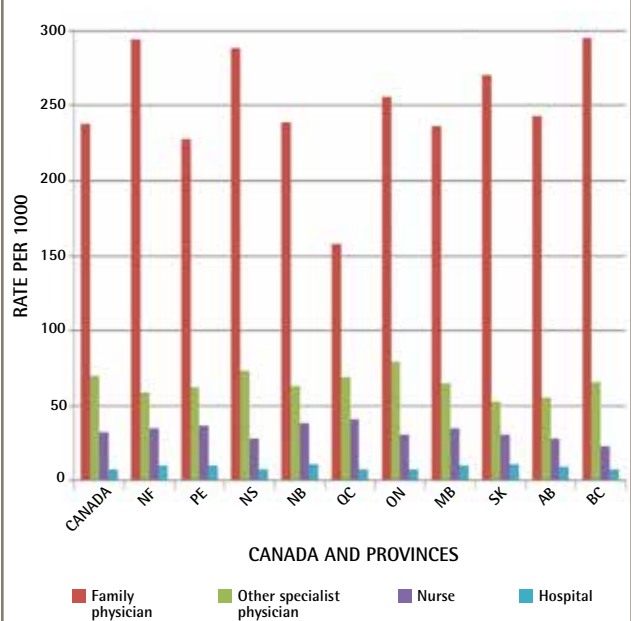
This paper provides a Canadian synthesis of health care use at a population level comparing provincial jurisdictions using the ecology of health care methodology reported in 2 US studies.^{1,2}

Figure 2. Provincial rates of having at least 1 chronic condition per 1000 population of those aged 15 years and older



AB—Alberta, BC—British Columbia, MB—Manitoba, NB—New Brunswick, NF—Newfoundland and Labrador, NS—Nova Scotia, ON—Ontario, PE—Prince Edward Island, QC—Quebec, SK—Saskatchewan.

Figure 3. Provincial ecology of health care use age-sex standardized rates per 1000 population for those aged 15 years and older



AB—Alberta, BC—British Columbia, MB—Manitoba, NB—New Brunswick, NF—Newfoundland and Labrador, NS—Nova Scotia, ON—Ontario, PE—Prince Edward Island, QC—Quebec, SK—Saskatchewan.

Compared with the 2001 landmark US study,² these Canadian data showed noteworthy differences in use of physicians. For use of primary care physicians in the United States, there were 113 patient contacts per month; whereas for use of family physicians in Canada, there were 238 contacts per month. For use of other specialist physicians in the United States, there were 104 patient contacts with physicians other than primary care physicians; whereas in Canada, there were 70 contacts with physicians other than family physicians. These differences in physician use are consistent with

previous comparisons.⁷ On the other hand, hospital stays were similar.

The same landmark methodology has not been used before to compare across the provinces of Canada. This study showed overall similarities, in spite of methodologic differences, to the Provincial Healthcare Index⁸ in terms of level of utilization and the comparison among provinces. Our data were primarily self-reported, identically measured across provinces and adjusted by age and sex. Data from the Provincial Healthcare Index were health administrative

Table 1. National and provincial ratios of monthly physician contacts to physician supply: Ratios were calculated as number of contacts per 1000 population divided by the number of physicians per 1000 population.

VARIABLES	CANADA	PROVINCES									
		NF	PE	NS	NB	QC	ON	MB	SK	AB	BC
No. of family physician contacts per physician	243	285	248	240	225	145	305	254	300	234	271
No. of other specialist physician contacts per physician	76	61	107	74	89	65	88	75	77	63	73
Total no. of contacts per physician	319	346	355	314	314	210	393	329	377	297	344

AB—Alberta, BC—British Columbia, MB—Manitoba, NB—New Brunswick, NF—Newfoundland and Labrador, NS—Nova Scotia, ON—Ontario, PE—Prince Edward Island, QC—Quebec, SK—Saskatchewan.

data potentially measured differently from province to province and were not standardized.

The key message is the differences among the provincial health care systems, with Quebec and British Columbia showing the most marked contrast in family physician and nurse use, while Ontario and Saskatchewan were at different ends of the spectrum for other specialist physician use. Hospitalization rates were similar across the provinces. The key differences among the provinces were as follows: use of family physicians was highest in British Columbia and lowest in Quebec; use of nurses was highest in Quebec and lowest in British Columbia; use of other specialist physicians was highest in Ontario and lowest in Saskatchewan.

None of the explanations that were tested could account for the provincial variation. These differences persisted when rates were standardized for the different age and sex compositions in the provinces. Physician supply did not offer an explanation. This was demonstrated by the persistence of provincial variation in the rates of contacts per physician. Differences in physician use were not related to relative use of family physicians versus other specialist physicians in provinces; ie, when family physician and other specialist physician contacts were combined, differences persisted in overall physician use among the provinces. It was not the provinces with higher rates of people with at least 1 chronic condition that had higher physician contact rates.

Alternative explanations might therefore be considered. It is possible that health care use might be related to other illness measures such as acute illnesses or injuries that could not be measured in this study. It is also possible that health human resources policies might differ in important ways across provinces (eg, nurses versus physicians carrying out vaccinations). Another alternative explanation might be differences across provinces in health care organization policies and practices (eg, the extent of primary health care renewal implementation).

Limitations

It would have been interesting to include emergency department visits in this analysis. Unfortunately, complete data from all provinces were not available for the year 2006. Reporting of emergency department visits is increasing and the reporting is becoming more standardized, so future studies will be able to examine these rates as well. It should be noted that physician supply was based on available physicians and should not be equated to full-time equivalent physician availability. Self-reported health care might not accurately represent actual health care use; over- and under-reporting have been found in other studies.⁹⁻¹¹ It should be noted that monthly rates of health care use were calculated from yearly rates, which assumes that use is constant over a year. This did not allow for possible seasonal variation in the monthly calculations. An

unfortunate limitation was the small sample size in the territories, which prevented reporting rates in these sparsely populated areas. This is an important shortcoming that future research should seek to overcome.

Conclusion

Given that the alternative explanations tested to explain variation were not upheld, the provincial differences in health care use appear to be owing to explanations and factors not available in this analysis. Further research should investigate these alternative explanations that might include variations in health care policy and practice. This paper provides policy analysts with a picture that they can use to benchmark whether the goals of their policies are being met.

This straightforward methodology using publicly available data can be employed in each province to examine the evolution over time of health care use by provincial jurisdictions.

Dr Stewart is Distinguished University Professor in the Centre for Studies in Family Medicine at Western University in London, Ont, and the Dr Brian W. Gilbert Canada Research Chair in Primary Health Care Research. **Dr Ryan** is Assistant Professor in the Department of Family Medicine and the Department of Epidemiology and Biostatistics at Western University.

Contributors

Dr Stewart was responsible for the conception of this study. She designed the analysis and prepared the manuscript. **Dr Ryan** identified data sources, designed and conducted the analysis, and prepared the manuscript.

Competing interests

None declared

Correspondence

Dr Moira Stewart; e-mail moira@uwo.ca

References

- White KL, Williams TF, Greenberg BG. Ecology of medical care. *N Engl J Med* 1961;265(18):885-92.
- Green LA, Fryer GE Jr, Yawn BP, Lanier D, Dovey SM. The ecology of medical care revisited. *N Engl J Med* 2001;344(26):2021-5.
- Statistics Canada [website]. *Canadian Community Health Survey—annual component (CCHS)*. Ottawa, ON: Statistics Canada; 2008. Available from: www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SurvId=3226&SurvVer=1&Instald=15282&InstaVer=4&SDDS=3226&lang=en&db=imdb&adm=8&dis=2. Accessed 2015 Mar 18.
- Canadian Institute for Health Information [website]. *Quick stats. Inpatient hospitalizations: volumes, length of stay, and standardized rates*. Ottawa, ON: Canadian Institute for Health Information; 2015. Available from: www.cihi.ca/CIHI-ext-portal/internet/EN/applicationfull/types-of-care/cihi021682. Accessed 2015 Mar 18.
- Statistics Canada [website]. *Age groups (13) and sex (3) for the population of Canada, provinces and territories, 1921-2006 censuses—100% data*. Ottawa, ON: Statistics Canada; 2014. Available from: www12.statcan.ca/census-recensement/2006/dp-pd/tbt/Rp-eng.cfm?LANG=E&APATH=3&DETAIL=0&DIM=0&FL=A&FREE=0&GC=0&GID=0&GK=0&GRP=1&PID=88977&PRID=0&PTYPE=88971,97154&S=0&SHOWALL=0&SUB=0&Temporal=2006&THEME=66&VID=0&VNAMEE=&VNAMEF=. Accessed 2015 Mar 18.
- Canadian Institute for Health Information. *Supply, distribution and migration of Canadian physicians, 2006. Revised November 2007*. Ottawa, ON: Canadian Institute for Health Information; 2007.
- Anderson GF, Squires DA. Measuring the U.S. health care system: a cross-national comparison. *Issue Brief (Commonw Fund)* 2010;90:1-10.
- Barua B. *Provincial healthcare index 2013*. Vancouver, BC: Fraser Institute; 2013. Available from: www.fraserinstitute.org/uploadedFiles/fraser-ca/Content/research-news/research/publications/provincial-healthcare-index-2013.pdf. Accessed 2015 Mar 23.
- Reijneveld SA, Stronks K. The validity of self-reported use of health care across socioeconomic strata: a comparison of survey and registration data. *Int J Epidemiol* 2001;30(6):1407-14.
- Bhandari A, Wagner T. Self-reported utilization of health care services: improving measurement and accuracy. *Med Care Res Rev* 2006;63(2):217-35.
- Peersman W, Pasteels I, Cambier D, De Maeseneer J, Willems S. Validity of self-reported utilization of physician services: a population study. *Eur J Public Health* 2014;24(1):91-7. Epub 2013 Jun 28.