ORIGINAL ARTICLE

Healthcare utilisation among Canadian adults in rural and urban areas – The Canadian Longitudinal Study on Aging

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Abstract

Objective: The objective is to determine the use of health-care services (physician visits, emergency department use and hospitalisations) in rural areas and examine differences in four geographic areas on a rural to urban spectrum.

Methods: We conducted a secondary analysis of cross-sectional data from a population-based prospective cohort study, the Canadian Longitudinal Study on Aging (CLSA). Participants included community-dwelling adults aged 45–85 years old from the tracking cohort of the CLSA (n = 21,241). Rurality was classified based on definitions from the CLSA sampling frame and similar to the 2006 census. Main outcome measures included self-reported family physician and specialist visits, emergency department visits and hospitalisations within the previous 12 months. Results were compared for four geographic areas on a rural-urban continuum. Univariate and bivariate analyses were performed on data from the 'tracking cohort' of the CLSA, Chi-square tests were used for categorical variables. Logistic regression models were created for the main outcome measures.

Results: Participants in rural and mixed rural and urban areas were less likely to have seen a family physician or a specialist physician compared to urban areas. Those living in rural and peri-urban areas were more likely to visit an emergency department compared to urban areas. These differences persisted after adjusting for sociodemographic and health-related variables. There were no significant rural-urban differences in hospitalisations.

Conclusion: Rural-urban differences were found in visits to family physicians, specialists and emergency departments.

Keywords: Canadian Longitudinal Study on Aging, healthcare utilisation, hospitalisation, physician visits, rural-urban disparities

Résumé

Objectif : Déterminer l'utilisation des services de santé (consultations chez un médecin, visites à l'urgence et hospitalisations) dans les régions rurales et examiner les différences dans 4 régions géographiques sur un spectre rural-urbain.

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Méthodologie : Nous avons réalisé une analyse secondaire des données transversales tirées d'une étude de cohorte prospective de population, l'étude CLSA (Canadian Longitudinal Study on Aging). La population était composée d'adultes vivant en communauté de 45 à 85 ans ayant participé à la cohorte de suivi de l'étude CLSA (N = 21 241). La ruralité était classée en fonction des définitions du cadre d'échantillonnage de l'étude CLSA et était semblable au recensement de 2006. Les principaux paramètres d'évaluation étaient les consultations rapportées par les patients chez un médecin de famille et un spécialiste, les visites à l'urgence et les hospitalisations durant les 12 mois précédents. Les résultats ont été comparés sur un continuum rural-urbain dans 4 régions géographiques. Des analyses univariées et bivariées ont été réalisées sur les données de la « cohorte de suivi » de l'étude CLSA, les tests de chi carré ont été utilisés pour les variables catégoriques. Des modèles de régression logistique ont été créés pour les principaux paramètres d'évaluation.

Résultats : Les participants des régions rurales et mixtes rurales-urbaines avaient moins tendance à avoir vu un médecin de famille ou un spécialiste comparativement aux participants des régions urbaines. Les sujets des régions rurales et périurbaines avaient plus tendance à s'être rendus à l'urgence comparativement aux sujets des régions urbaines. Ces différences ont persisté après ajustement en fonction des variables sociodémographiques et liées à la santé. On n'a observé aucune différence significative des hospitalisations entre les régions rurales et urbaines.

Conclusion : Des différences entre les régions rurales et urbaines ont été observées pour les consultations aux médecins de famille et aux spécialistes, et les visites à l'urgence.

Mots-clés : Canadian Longitudinal Study on Aging, disparités rurales-urbaines, visites chez le médecin, hospitalisations, utilisation des soins de santé

INTRODUCTION

Disparities in the health status of rural and urban Canadians have been previously noted.[1-4] While there are many determinants of health, increased attention has recently focused on the effect of rurality in determining health status and access to health services. In general, rural populations in Canada have lower socioeconomic status, lower levels of educational attainment and higher all-cause mortality rates compared to urban Canadians.[1] In addition, disparities exist between rural and urban areas in terms of access to, and utilisation of, health-care services.

Existing research on the relationship between rurality and health-care utilisation shows differences in accessing both primary care and specialist services. MacDonald and Conde noted that rural residents age 55 years and older were less likely than urban residents to have seen a family physician or specialist, even after controlling for physician density and individual health status.[5] Allan and Cloutier-Fisher also reported fewer visits to family physicians and specialists for rural residents over age 65 years compared to their urban counterparts.[6] Among Manitobans, southern rural and northern residents had lower ambulatory physician and specialist visit rates compared to urban residents.[7]

Other important measures of health-care utilisation and access include emergency department visits and hospitalisations. Patterns of emergency department visits may be a useful indicator of access to primary care and outpatient services. Data from the 2003 Canadian Community Health Survey (CCHS) reported that rural residents were more likely to have visited an emergency department compared to urban residents.[8] Similarly, several studies have shown higher hospitalisation rates among rural regions compared to urban.[5,6,9] Kazanjian *et al.* reported that hospitalisation rates increased with increasing degree of rurality.[9]

The study of health in rural areas remains difficult. Challenges exist in comparing rural-urban health as rural areas are heterogeneous in terms of health status and the factors affecting access to health services.[2,4] Studies vary in how they define 'rural' and 'urban' which can make comparisons difficult. In addition, many studies have focused their analyses on provincial level data and relatively small geographical regions.[6,7,10] To date, there are relatively few representative epidemiological studies that include both large urban and rural populations.[1] It follows that we do not currently have a complete description of the utilisation patterns of health-care service use among

rural areas. Subsequently, there are few recent rural-urban comparisons of service use.

To address some of these concerns, we analysed data from a nationally representative, population-based, prospective cohort study. The objectives were to describe the health-care service use in rural areas of Canada and examine rural/urban differences in service use.

The specific objectives are as follows:

1. To determine the use of health-care services, including (a) primary care visits; (b) specialist visits; (c) emergency visits; and (d) hospitalisations during the previous year in rural and urban areas
2. To determine if there are differences in four geographic areas across a rural-urban spectrum in the use of these services after adjusting for potentially confounding factors; and
3. To investigate factors which predict the use of these services, and if there are differences in these factors for these geographic areas.

METHODS

Sample

The data are from the Canadian Longitudinal Study on Aging (CLSA), a population-based, 20-year prospective cohort study.[11-13] Our analyses considered data from the CLSA Tracking cohort (n = 21,241) which was established to be as representative of the Canadian population as possible.[14] Specifically, it included a large rural population (n = 4707). Participants were recruited from Statistics Canada's CCHS 4.2 on Healthy Aging[15] and then supplemented by recruitment using Provincial Healthcare Registration Databases and random digit dialing to achieve a target of approximately 20,000 study participants.[14] Baseline inclusion criteria included community-dwelling[13] adults aged 45–85 years and ability to understand English or French. Those with cognitive impairment at baseline were excluded. Additional exclusion criteria included being a resident of a First Nations reserve, full time members of the Canadian Armed Forces, and not being a permanent resident or Canadian citizen. Individuals living in institutions were excluded. Informed consent was obtained from all participants. Ethics approval for these analyses was granted by the University of Manitoba Bannatyne Campus Research Ethics Board, and the study adhered to the Declaration of Helsinki.

Measurements

Outcome variables

The use of health-care services including self-reported family physician visits, specialist visits, hospitalisations and emergency room visits were obtained from computer-assisted telephone interviews.[16] Participants were asked 'During the past 12 months, have you had contact with any of the following about your physical or mental health?-General practitioner, family physician',

Table 1: Definitions of rurality

Definition for analyses	Definition in CLSA	Sample size	Definition
Rural	Rural	4707	The area that remains after the delineation of urban areas which have been delineated using current census population data
Mixed	Postal code link to dissemination area	2125	This is assigned if a postal code covers a large area and it is a mixture of urban and rural area
Peri-urban	Urban fringe	445	All small urban areas within a CMA or CA that are not contiguous with the urban core of the CMA or CA
Peri-urban	Urban population centre outside CMA and CA	1888	Built up areas that are not contiguous within or contiguous with the urban core of the CMA or CA
Peri-urban	Secondary core	304	A population centre within a CMA that has at least 10, 000 persons and was the core of a CA that has been merged with an adjacent CMA
Urban	Urban core	11,772	A large urban area around which a CMA or a CA is delineated The urban core must have a population (based on the previous census) of at least 50, 000 persons in the case of a CMA, or at least 10, 000 persons in the case of a CA

Peri-urban: Includes Urban fringe, Urban population centre outside CMA and CA, and secondary core. CLSA: Canadian Longitudinal Study on Aging, CMA: Census metropolitan area, CA: Census agglomeration

'During the past 12 months, have you had contact with any of the following about your physical or mental health?-Medical specialist (such as a cardiologist, gynaecologist, psychiatrist)', 'Were you a patient in a hospital overnight during the past 12 months?' and 'Have you been seen in an Emergency Department during the past 12 months?'[14]

Independent variables

We classified rurality based on the definitions in the CLSA sampling frame and similar to the 2006 census.[17] The definition of rurality and the sample size within each category are shown in Table 1. For the purpose of analyses, we collapsed these into four categories: 'Rural' (Rural), 'Mixed' (Postal code link to a large dissemination area, indicating some rural, but could include some peri-urban), 'Peri-urban' (Urban fringe, Urban population centre outside a census metropolitan area or census agglomeration, and secondary core) and 'Urban' (Urban core). Thus, we have a gradient in geography of residence ranging from fully rural to fully urban.

Socio-demographic variables included age, sex, education, marital status, number of individuals in the household, household income and self-reported income adequacy.[18] Self-reported income adequacy was assessed on a 5-point scale by asking participants 'How well do you think that your income currently satisfies your basic needs?'[14] Functional status was measured using the Older Americans' Resources and Services Multidimensional Assessment Questionnaire.[14,19-21] For our analyses, functional status was dichotomised to 'no impairment' versus 'any functional impairment'. Self-reported chronic conditions were also considered including chronic obstructive pulmonary disease (COPD), cancer (any site), stroke or cerebrovascular accident, heart disease (including congestive heart failure, angina and ischaemic heart disease), osteoarthritis and cataracts. [22]

Analyses

To create prevalence estimates that represent the Canadian population and to better estimate associations, the CLSA has calculated inflation weights and analytic weights. These weights were provided in the CLSA data set. We used inflation weights for descriptive statistics, while we used the analytic weights for the analyses.

We performed bivariate and multivariate analyses, using Chi-square tests for categorical variables. Multivariate logistic regression models were created for the outcomes of family physician visits, specialist visits, emergency department visits and hospitalisations. Missing data were not included in the regression models or statistical models. Following CLSA protocol, analytic weights and province of residence were included in each model. Analyses for interactions between variables of interest and rural residence were assessed by including interaction terms in logistic regression models for each independent variable. All analyses were conducted with SAS version 9.4 (SAS™, SAS Institute Inc., Cary, NC, USA).

RESULTS

Baseline characteristics of the sample are shown in Table 2. Of the sample participants, 11,772 (55.4%) lived in urban areas, 2637 (12.4%) in peri-urban areas, 2125 (10%) in mixed areas and 4707 (22.2%) in rural areas. Those living in rural areas were more likely to have a lower income and lower level of education. Numbers and percentages may not add up due to missing variables and the use of weights, as described earlier.

Overall, 17,174 (88.7%) participants saw a family physician in the preceding 12 months. The use of this service varied from 3732 (86.6%) participants in rural areas, to 1708 (88.9%) in mixed, to 2130 (88.4%) in peri-urban, and 9604 (89.4%) in urban areas (P = 0.002). Table 3 illustrates results from logistic regression models. Individuals living in rural and mixed areas were less likely to have seen a family physician. Those with lower education and household income were also less likely to have seen a family physician. Factors associated with visiting a family physician included female sex, living alone and functional impairment. The presence of chronic disease including COPD, cancer, heart disease and osteoarthritis were also associated with having seen a family physician.

Of all participants, 8794 (46.4%) saw a specialist in the previous 12 months with 1855 (43.4%) participants in rural areas, 742 (39.5%) in mixed,

Table 2: Baseline characteristics of the 21,241 sample participants by rurality

Characteristic	Number of participants, *n* (%)				
	Total sample (*n*=21,241)	Rural (*n*=4707)	Mixed (*n*=2125)	Peri-urban (*n*=2637)	Urban (*n*=11,772)
Male sex*	10406 (48.5)	2360 (47.2)	1020 (45.0)	1277 (47.8)	5749 (49.2)
Age* (years)					
44-54	5832 (36.7)	1333 (36.5)	615 (33.8)	719 (34.8)	3165 (37.3)
55-64	6564 (30.9)	1485 (31.4)	659 (33.2)	870 (34.3)	3550 (30.0)
65-74	4634 (19.6)	1095 (21.5)	465 (21.1)	517 (18.0)	2557 (19.2)
75-89	4211 (12.8)	794 (10.6)	386 (12.0)	531 (12.9)	2500 (13.5)
Marital status					
Married/common-law	14601 (73.2)	3496 (80.1)	1588 (78.7)	1878 (76.2)	7639 (70.2)
Never married	1698 (8.2)	344 (6.5)	121 (5.1)	170 (5.7)	1063 (9.4)
Widowed	2361 (7.5)	446 (6.4)	218 (7.6)	298 (7.9)	1399 (7.8)
Divorced/separated	2575 (11.0)	420 (7.0)	198 (8.6)	289 (10.1)	1668 (12.6)
Refused to answer	6 (0.0)	1 (0.0)	0 (0.0)	2 (0.1)	3 (0.0)
Education*					
Less than secondary school graduation	1986 (7.1)	571 (10.2)	262 (10.3)	292 (9.0)	860 (5.6)
Secondary school graduation	2822 (12.7)	729 (15.7)	316 (14.7)	384 (14.3)	1453 (11.4)
Some post-secondary education	1623 (7.5)	361 (7.6)	178 (9.4)	237 (9.4)	847 (7.0)
Post-secondary degree/diploma	14667 (72.2)	3029 (66.1)	1365 (65.5)	1714 (66.8)	8559 (75.6)
≥1 required question not answered	83 (0.4)	16 (0.3)	4 (0.1)	10 (0.5)	53 (0.5)
Functional impairment*					
No ADL problems	18705 (89.9)	4221 (91.0)	1859 (88.1)	2313 (88.6)	10312 (89.9)
Mild/moderate/severe/total impairment	2408 (9.5)	471 (8.7)	260 (11.7)	304 (10.8)	1373 (9.4)
Inconclusive classification	128 (0.6)	15 (0.3)	6 (0.2)	20 (0.6)	87 (0.7)
Living alone*	4925 (18.1)	874 (13.0)	432 (16.1)	594 (16.9)	3025 (20.0)
Number of companions in household*					
1	11094 (50.5)	2724 (58.2)	1225 (59.0)	1436 (53.4)	5709 (46.9)
2	2713 (15.3)	592 (14.0)	256 (12.8)	335 (15.7)	1530 (15.9)
3	1693 (11.0)	346 (10.0)	131 (8.1)	177 (9.5)	1039 (11.8)
4	575 (3.6)	111 (3.1)	54 (2.9)	69 (3.0)	341 (4.0)
5+	241 (1.6)	60 (1.7)	27 (1.1)	26 (1.5)	128 (1.6)
Self-reported income adequacy*					
Very well	9593 (47.9)	1992 (45.8)	895 (44.0)	1123 (44.4)	5583 (49.5)
Adequately	7337 (33.4)	1751 (36.3)	766 (34.6)	954 (35.5)	3866 (32.1)
With some difficulty	1450 (6.3)	347 (6.7)	158 (8.2)	197 (6.8)	748 (6.0)
Not very well	324 (1.5)	62 (1.2)	39 (1.9)	46 (1.6)	177 (1.5)
Totally inadequately	167 (0.7)	28 (0.5)	19 (0.8)	19 (0.7)	101 (0.8)
Don't know/no answer	180 (0.8)	40 (0.6)	18 (0.8)	22 (0.8)	100 (0.8)
Household income* ($)					
<20,000	1347 (5.1)	320 (5.0)	139 (5.1)	179 (5.3)	709 (5.0)
20,000-49,999	5849 (22.6)	1468 (27.0)	666 (27.2)	793 (24.9)	2922 (20.5)
50,000-99,999	7220 (33.9)	662 (36.4)	728 (35.1)	880 (34.1)	3950 (32.9)
100,000-149,999	3215 (18.0)	638 (17.0)	282 (15.5)	396 (18.2)	1899 (18.4)
≥150,000	240 (14.6)	346 (9.7)	190 (11.4)	232 (11.9)	1472 (16.9)
Don't know/no answer	1370 (5.8)	273 (4.8)	120 (5.7)	157 (5.5)	820 (6.2)
Chronic conditions					
COPD	1436 (5.7)	319 (5.6)	156 (6.8)	182 (5.6)	779 (5.7)
Cancer	3265 (13.5)	694 (12.5)	291 (12.4)	411 (14.2)	1869 (13.8)
Stroke or CVA	390 (1.6)	85 (1.6)	37 (1.3)	60 (2.1)	208 (1.5)
Heart disease (including CHF, anginaor IHD)*	2191 (9.2)	455 (8.5)	189 (8.0)	288 (9.5)	1259 (9.5)

Contd...

Table 2: Contd...

Characteristic	Number of participants, *n* (%)				
	Total sample (*n*=21,241)	Rural (*n*=4707)	Mixed (*n*=2125)	Peri-urban (*n*=2637)	Urban (*n*=11,772)
Osteoarthritis*	5657 (24.3)	1276 (26.0)	570 (25.9)	701 (24.6)	3110 (23.7)
Cataracts	5280 (20.0)	1043 (18.6)	518 (21.6)	630 (19.8)	3089 (20.3)

*$P<0.05$. COPD: Chronic obstructive pulmonary disease, CVA: Cerebrovascular accident, CHF: Congestive heart failure, IHD: Ischaemic heart disease, ADL: Activities of daily living

Table 3: Logistic regression models showing the odds ratio and 95% confidence interval of visiting a family physician in the last 12 months, adjusted for potential confounding variables

Variable	OR (95% CI)			
	Model 1	Model 2*	Model 3*	Model 4*
Rurality (ref: Urban)				
Rural	0.81 (0.71-0.92)	0.76 (0.66-0.86)	0.74 (0.64-0.85)	0.74 (0.64-0.85)
Mixed	0.93 (0.77-1.11)	0.76 (0.63-0.93)	0.78 (0.63-0.95)	0.78 (0.63-0.96)
Peri-urban	1.00 (0.85-1.18)	0.91 (0.77-1.08)	0.88 (0.74-1.05)	0.89 (0.74-1.06)
Age (years)		1.04 (1.04-1.05)	1.04 (1.03-1.05)	1.03 (1.02-1.04)
Sex (ref: Male)		1.29 (1.16-1.44)	1.28 (1.13-1.44)	1.22 (1.08-1.37)
Education (ref: Post-secondary degree/ diploma)				
Less than secondary school graduation			0.82 (0.66-1.02)	0.77 (0.62-0.97)
Secondary school graduation			0.93 (0.79-1.10)	0.93 (0.78-1.10)
Some post-secondary education			0.99 (0.76-1.27)	0.95 (0.73-1.23)
Marital status (ref: separated)				
Single/never married			0.68 (0.46-1.01)	0.70 (0.47-1.05)
Married/common-law			0.96 (0.67-1.38)	0.98 (0.68-1.42)
Widowed			0.81 (0.53-1.24)	0.81 (0.53-1.25)
Divorced			0.72 (0.49-1.07)	0.76 (0.51-1.14)
Number of companions in household (ref: 5+people in household, excluding participant)				
0			1.67 (1.02-2.72)	1.65 (1.01-2.72)
1			1.47 (0.95-2.28)	1.47 (0.94-2.30)
2			1.41 (0.90-2.21)	1.39 (0.88-2.19)
3			1.13 (0.72-1.78)	1.13 (0.71-1.79)
4			0.94 (0.57-1.55)	0.95 (0.57-1.57)
Household income (ref: ≥$150,000) ($)				
<20,000			0.73 (0.53-1.00)	0.57 (0.41-0.79)
20,000-49,999			0.81 (0.65-1.02)	0.76 (0.60-0.96)
50,000-99,999			0.87 (0.71-1.06)	0.83 (0.68-1.02)
100,000-149,999			0.93 (0.76-1.15)	0.92 (0.74-1.13)
Functional impairment (ref: No impairment)				1.69 (1.28-2.23)
Chronic conditions (ref: No condition)				
COPD				2.00 (1.44-2.78)
Cancer				1.42 (1.15-1.74)
Stroke or CVA				1.17 (0.65-2.10)
Heart disease (CHF, angina, or IHD)				1.43 (1.11-1.84)
Osteoarthritis				1.88 (1.58-2.23)
Cataracts				1.03 (0.86-1.23)

*Province was included in model. All regression models are weighted by the analytical weights. OR: Odds ratio, CI: Confidence interval, COPD: Chronic obstructive pulmonary disease, CVA: Cerebrovascular accident, CHF: Congestive heart failure, IHD: Ischaemic heart disease

1059 (44.7%) in peri-urban and 5,138 (48.2%) in urban areas ($P < 0.0001$). Results from logistic regression models are shown in Table 4. Those living in rural and mixed areas were less likely

Table 4: Logistic regression models showing the odds ratio and 95% confidence interval of visiting a specialist in the last 12 months, adjusted for potential confounding variables

Variable	OR (95% CI)			
	Model 1	Model 2*	Model 3*	Model 4*
Rurality (ref: Urban)				
Rural	0.84 (0.78-0.91)	0.82 (0.76-0.89)	0.83 (0.76-0.91)	0.84 (0.77-0.92)
Mixed	0.70 (0.63-0.78)	0.72 (0.64-0.81)	0.72 (0.63-0.81)	0.72 (0.64-0.82)
Peri-urban	0.89 (0.80-0.98)	0.88 (0.80-0.97)	0.89 (0.80-0.99)	0.90 (0.80-1.00)
Age (years)		1.02 (1.02-1.03)	1.02 (1.02-1.03)	1.01 (1.00-1.01)
Sex (ref: Male)		1.02 (0.95-1.08)	1.02 (0.95-1.09)	0.98 (0.91-1.06)
Education (ref: Post-secondary degree/ diploma)				
Less than secondary school graduation			0.78 (0.69-0.89)	0.72 (0.63-0.82)
Secondary school graduation			0.87 (0.79-0.97)	0.87 (0.78-0.97)
Some post-secondary education			1.03 (0.91-1.18)	1.01 (0.88-1.15)
Marital status (ref: Separated)				
Single/never married			1.07 (0.83-1.38)	1.12 (0.86-1.45)
Married/common-law			1.07 (0.85-1.36)	1.13 (0.89-1.45)
Widowed			0.90 (0.70-1.16)	0.91 (0.70-1.19)
Divorced			1.10 (0.86-1.40)	1.19 (0.91-1.54)
Number of companions in household (ref: 5+people in household, excluding participant)				
0			1.00 (0.71-1.42)	0.99 (0.70-1.40)
1			0.97 (0.70-1.34)	0.96 (0.69-1.33)
2			0.94 (0.67-1.30)	0.93 (0.66-1.29)
3			0.88 (0.63-1.24)	0.86 (0.61-1.20)
4			0.71 (0.48-1.03)	0.69 (0.47-1.01)
Household income (ref: ≥$150,000) ($)				
<20,000			1.28 (1.05-1.55)	1.04 (0.85-1.27)
20,000-49,999			1.08 (0.95-1.24)	1.01 (0.88-1.16)
50,000-99,999			1.07 (0.94-1.20)	1.04 (0.91-1.17)
100,000-149,999			1.10 (0.97-1.26)	1.09 (0.95-1.24)
Functional impairment (ref: no impairment)				1.74 (1.53-1.96)
Chronic conditions (ref: No condition)				
COPD				1.45 (1.25-1.68)
Cancer				1.99 (1.80-2.21)
Stroke or CVA				0.99 (0.74-1.33)
Heart disease (CHF, angina, or IHD)				2.28 (2.01-2.59)
Osteoarthritis				1.40 (1.29-1.52)
Cataracts				1.15 (1.04-1.26)

*Province was included in model. All regression models are weighted by the analytical weights. OR: Odds ratio, CI: Confidence interval, COPD: Chronic obstructive pulmonary disease, CVA: Cerebrovascular accident, CHF: Congestive heart failure, IHD: Ischaemic heart disease

than their urban counterparts to have seen a specialist. Those with lower educational attainment were also less likely to have seen a specialist. Functional impairment, COPD, cancer, heart disease, osteoarthritis and cataracts were associated with higher access to specialists. There were no differences in specialist use by age, sex, marital status, number of household companions or income.

We noted that 4349 (21.5%) individuals had visited an emergency department in the previous 12 months. According to geography, 1019 (23.7%) rural, 420 (22.1%) mixed, 628 (25.9%) peri-urban and 2282 (20%) urban participants visited an emergency department ($P < 0.0001$). Results from logistic regression models are shown in Table 5. Those living in a rural or peri-urban area were more likely to visit an emergency department for care. Other characteristics associated with the use of emergency departments included functional impairment, and the presence of chronic disease including COPD, cancer, stroke, heart disease, osteoarthritis and cataracts. Those with lower

Table 5: Logistic regression models showing the odds ratio and 95% confidence interval of visiting an emergency department in the last 12 months, adjusted for potential confounding variables

Variable	OR (95% CI)			
	Model 1	Model 2*	Model 3*	Model 4*
Rurality (ref: Urban)				
Rural	1.21 (1.10-1.33)	1.14 (1.03-1.25)	1.10 (1.00-1.22)	1.12 (1.01-1.25)
Mixed	1.06 (0.93-1.21)	1.06 (0.92-1.22)	1.00 (0.87-1.16)	1.01 (0.87-1.17)
Peri-urban	1.39 (1.24-1.56)	1.35 (1.20-1.51)	1.30 (1.16-1.47)	1.32 (1.16-1.49)
Age (years)		1.02 (1.01-1.02)	1.01 (1.00-1.01)	1.00 (0.99-1.00)
Sex (ref: male)		1.03 (0.95-1.11)	0.95 (0.87-1.03)	0.92 (0.85-1.01)
Education (ref: Post-secondary degree/diploma)				
Less than secondary school graduation			1.07 (0.93-1.24)	1.02 (0.88-1.18)
Secondary school graduation			0.99 (0.88-1.12)	1.00 (0.88-1.13)
Some post-secondary education			1.15 (0.99-1.34)	1.12 (0.95-1.30)
Marital status (ref: Separated)				
Single/never married			0.78 (0.59-1.04)	0.77 (0.57-1.03)
Married/common-law			0.73 (0.56-0.95)	0.74 (0.56-0.97)
Widowed			0.86 (0.65-1.14)	0.84 (0.63-1.13)
Divorced			0.74 (0.56-0.98)	0.76 (0.57-1.02)
Number of companions in household (ref: 5+people in household, excluding participant)				
0			1.02 (0.68-1.53)	1.00 (0.66-1.51)
1			1.02 (0.70-1.50)	1.01 (0.69-1.49)
2			1.13 (0.76-1.67)	1.11 (0.75-1.65)
3			1.01 (0.67-1.51)	0.99 (0.66-1.49)
4			0.95 (0.61-1.49)	0.94 (0.60-1.47)
Household income (ref: ≥$150,000) ($)				
<20,000			2.01 (1.61-2.51)	1.63 (1.30-2.04)
20,000-49,999			1.54 (1.31-1.82)	1.41 (1.19-1.67)
50,000-99,999			1.26 (1.08-1.47)	1.21 (1.04-1.42)
100,000-149,999			1.13 (0.96-1.34)	1.12 (0.94-1.32)
Functional impairment (ref: No impairment)				1.49 (1.31-1.69)
Chronic conditions (ref: No condition)				
COPD				1.66 (1.42-1.93)
Cancer				1.21 (1.08-1.36)
Stroke or CVA				1.38 (1.04-1.84)
Heart disease (CHF, angina, or IHD)				1.58 (1.39-1.80)
Osteoarthritis				1.25 (1.14-1.37)
Cataracts				1.21 (1.09-1.34)

*Province was included in model. All regression models are weighted by the analytical weights. OR: Odds ratio, CI: Confidence interval, COPD: Chronic obstructive pulmonary disease, CVA: Cerebrovascular accident, CHF: Congestive heart failure, IHD: Ischaemic heart disease

income were also more likely to visit an emergency department for medical care. No differences were found in emergency department use by age, sex, education or the number of household companions.

Regarding hospitalisations, 1877 (8.8%) individuals of the total sample had been admitted to hospital within the last year. By rurality, 412 (8.7%) rural, 163 (7.8%) mixed, 256 (9.3%) peri-urban and 1046 (8.8%) urban participants were admitted to hospital (P = 0.647). Results of logistic regression models are shown in Table 6. There were no significant rural-urban differences in hospitalisations. Females were less likely to have been hospitalised in the previous 12 months. Single or widowed status, functional impairment, COPD, heart disease and osteoarthritis were all associated with hospitalisation. Household income <$20,000 and between $20,000 and $50,000 was also associated with hospitalisation.

Logistic regression models were used to detect interactions between rural residence and other variables of interest. Some statistically significant interactions were found but effects were small

Table 6: Logistic regression models showing the odds ratio and 95% confidence interval of hospital admission overnight in the last 12 months, adjusted for potential confounding variables

Variable	OR (95% CI)			
	Model 1	Model 2*	Model 3*	Model 4*
Rurality (ref: Urban)				
Rural	1.02 (0.89-1.17)	1.04 (0.91-1.19)	1.02 (0.88-1.18)	1.05 (0.91-1.22)
Mixed	0.89 (0.74-1.08)	0.92 (0.75-1.12)	0.89 (0.72-1.10)	0.92 (0.74-1.14)
Peri-urban	1.12 (0.95-1.31)	1.12 (0.95-1.32)	1.10 (0.93-1.31)	1.11 (0.93-1.33)
Age (years)		1.04 (1.03-1.04)	1.03 (1.02-1.04)	1.02 (1.01-1.02)
Sex (ref: Male)		0.94 (0.85-1.05)	0.84 (0.75-0.95)	0.78 (0.69-0.89)
Education (ref: Post-secondary degree/diploma)				
Less than secondary school graduation			1.18 (0.97-1.45)	1.12 (0.91-1.38)
Secondary school graduation			1.09 (0.93-1.29)	1.12 (0.95-1.33)
Some post-secondary education			1.20 (0.97-1.49)	1.12 (0.91-1.39)
Marital status (ref: Separated)				
Single/never married			1.50 (0.99-2.28)	1.69 (1.08-2.65)
Married/common-law			1.14 (0.77-1.69)	1.27 (0.83-1.94)
Widowed			1.45 (0.96-2.19)	1.60 (1.03-2.50)
Divorced			1.14 (0.75-1.73)	1.35 (0.86-2.11)
Number of companions in household (ref: 5+people in household, excluding participant)				
0			0.77 (0.44-1.34)	0.73 (0.41-1.29)
1			0.80 (0.47-1.35)	0.79 (0.46-1.34)
2			0.79 (0.46-1.35)	0.77 (0.44-1.33)
3			0.61 (0.35-1.07)	0.59 (0.33-1.05)
4			0.65 (0.34-1.24)	0.64 (0.33-1.24)
Household income (ref: ≥$150,000) ($)				
<20,000			2.39 (1.75-3.26)	1.78 (1.29-2.45)
20,000-49,999			1.67 (1.29-2.15)	1.43 (1.10-1.85)
50,000-99,999			1.17 (0.92-1.50)	1.08 (0.85-1.38)
100,000-149,999			1.16 (0.89-1.52)	1.12 (0.85-1.47)
Functional impairment (ref: No impairment)				1.96 (1.66-2.31)
Chronic conditions (ref: No condition)				
COPD				1.56 (1.27-1.90)
Cancer				1.11 (0.95-1.29)
Stroke or CVA				1.37 (0.95-1.97)
Heart disease (CHF, angina, or IHD)				1.75 (1.48-2.06)
Osteoarthritis				1.49 (1.30-1.70)
Cataracts				1.14 (0.98-1.32)

*Province was included in model. All regression models are weighted by the analytical weights. OR: Odds ratio, CI: Confidence interval, COPD: Chronic obstructive pulmonary disease, CVA: Cerebrovascular accident, CHF: Congestive heart failure, IHD: Ischaemic heart disease

and unlikely to alter overall findings. Data are available on request.

DISCUSSION

We conducted an analysis of a population-based epidemiological study and found that there were rural-urban differences in the use of family physicians, specialist use and emergency department use. No major rural-urban differences were found in hospitalisations. Residence in a rural or mixed area reduced the likelihood of seeing a family physician or specialist, compared to urban residence. These results are consistent with previously reported findings within Canada.[5-7] Lower income and lower educational attainment were associated with reduced access to family physicians. Lower educational attainment was also found to be associated with reduced access to specialist services, which is consistent with previous Canadian data.[10,23] Interestingly, we did not find that income was associated with specialist access whereas other Canadian studies have found that low income decreased the likelihood of specialist visits.[10,23]

Rural and peri-urban areas demonstrated a higher frequency of the emergency department visits compared to urban areas. This is consistent with patterns seen in both Canada and the United States.[8,24,25] In rural areas, reduced access to primary care may be absorbed by emergency departments resulting in higher visit rates compared to urban areas where access to primary care may be more readily available. In the United States, the emergency department use in rural areas has been studied as an indicator of access to primary care.[25] In Canada, a survey from 2014 found that 47% of respondents had recently used an emergency department for a condition that could have been treated by their family physician if they were available.[24] Similarly, a population-based study among the general population from Ontario found that having an accessible family physician decreased the likelihood of emergency department use.[26] Again, these data may be useful in targeting medical care in rural areas.

No rural-urban differences were found in the number of hospitalisations and these findings persisted after adjusting for various possible confounders. This is in contrast with other Canadian studies which found that hospitalisation rates were higher in rural and northern regions, possibly related to poorer health status and distance to care.[3,5,6] These differences may be accounted for by variations in how hospitalisation data were defined and collected. For example, our data set did not include information on whether one participant may have been hospitalised multiple times over the previous year. One potential explanation for our findings is that hospitalisation is likely dependent on the number of hospitals and hospital beds in a region, which in most of Canada is determined by provincial planning. This is less true of physician or emergency department use.

STRENGTHS AND LIMITATIONS

Our study approach included both strengths and limitations. Strengths include that the data are from a nationally representative, population-based cohort study. There was a large sample size which importantly included a large rural population. Limitations include the varying definitions of rurality that exist, which can make comparisons of the literature difficult. Only one measure of rurality was included in our analyses, and we recognise that other measures of rurality (population density, distance to urban centre, etc.,) may influence the results. In particular, there may be different results with different definitions of rurality. Remote regions may have even greater differences in access to generalists and specialists than regions closer to large urban centres. We were also unable to consider any region as an individual region, since we used data that do not identify either individuals or their community of residence. Rural areas themselves are heterogeneous in terms of multiple factors, including sociocultural effects. Given our current data, we were unable to assess sociocultural effects on health-care utilisation. Some stereotypes of stoic rural individuals avoiding seeking health care may be true, but we did not consider health beliefs in our analyses. Thus, we cannot determine if differences in health care use are due to differences in accessing care, or sociocultural differences in health beliefs. In addition, we were unable to control for local contextual variables, such as physician density (family physician or specialist) or distance travelled to access healthcare services, which may affect service use estimates. We were also limited by the sampling frame of the CLSA. We did not consider First Nations communities, which may have different health care utilisation patterns than other rural and urban communities. Finally, health-care utilisation by a rural person may not happen in a rural area, but in another geographic area instead. However, we were unable to control for this with the current data.

CONCLUSION

Overall, our findings still provide important information on health-care service use in 4 geographic areas on a rural-to-urban spectrum across Canada. Low income and low educational attainment were characteristics of individuals frequently associated with lower service use. Higher dependency on emergency departments in rural and peri-urban areas may reflect greater difficulty in accessing primary care compared to urban regions. These data may be useful for targeting social interventions among certain groups and prioritising medical care in rural areas.

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REFERENCES

1. DesMeules M, Pong R, Lagacé C, Heng D, Manuel D, Pitblado R, *et al*. How healthy are rural Canadians? In: An Assessment of Their Health Status and Health Determinants. Ottawa, Ontario: Canadian Institute for Health Information; 2006.
2. Lavergne MR, Kephart G. Examining variations in health within rural Canada. Rural Remote Health 2012;12:1848.
3. Fransoo R, Mahar A, The Need To Know Team, Anderson A, Prior H, Koseva I, *et al*. The 2019 RHA Indicators Atlas. Winnipeg, MB: Manitoba Centre for Health Policy; Autumn 2019.
4. Pong RW, Desmeules M, Lagacé C. Rural-urban disparities in health: How does Canada fare and how does Canada compare with Australia? Aust J Rural Health 2009;17:58-64.
5. McDonald JT, Conde H. Does geography matter? The health service use and unmet health care needs of older Canadians. Can J Aging 2010;29:23-37.
6. Allan D, Cloutier-Fisher D. Health service utilization among older adults in British Columbia: Making sense of geography. Can J Aging 2006;25:219-32.
7. Martens PJ, Need to Know Team, Fransoo R, Burchill C, Burland E. Health status and healthcare use patterns of rural, northern and urban Manitobans: Is Romanow right? Healthc Policy 2006;2:108-27.
8. Carrière G. Use of hospital emergency rooms. Health Rep 2004;16:35-9.
9. Pong RW, DesMeules M, Heng D, Lagacé C, Guernsey JR, Kazanjian A, *et al*. Patterns of health services utilization in rural Canada. Chronic Dis Inj Can 2011;31 Suppl 1:1-36.
10. Sibley LM, Weiner JP. An evaluation of access to health care services along the rural-urban continuum in Canada. BMC Health Serv Res 2011;11:20.
11. Raina PS, Wolfson C, Kirkland SA, Griffith LE, Oremus M, Patterson C, *et al*. The Canadian longitudinal study on aging (CLSA). Can J Aging 2009;28:221-9.
12. Kirkland SA, Griffith LE, Menec VH, Wister A, Payette H, Wolfson C, *et al*. Mining a unique Canadian resource: The Canadian longitudinal study on aging. Can J Aging 2015;34:366-77.
13. Raina P, Wolfson C, Kirkland S, Griffith LE, Balion C, Cossette B, *et al*. Cohort profile: The Canadian Longitudinal Study on Aging (CLSA). Int J Epidemiol 2019;48:1752-3j.
14. Raina PS, Wolfson C, Kirkland SA, Griffith LE, Oremus M, Patterson C, *et al*. The Canadian longitudinal study on aging (CLSA). Can J Aging 2009;28:221-9.
15. Statistics Canada. Canadian Community Health Survey (CCHS): Annual Component, 2009-2010; Common Content; Derived Variable (DV) Specifications. Ottawa: Statistics Canada; 2009.
16. Canadian longitudinal study on aging. In: Health Care Utilization Tracking Questionnaire (Baseline). https://www.clsa-elcv.ca/researchers.
17. Statistics Canada. 2006 Census Dictionary. Ottawa: Minister of Industry; 2010.
18. Canadian Longitudinal Study on Aging. Socio-Demographic Characteristics Questionnaire (Baseline) adapted from Statistics Canada. Canadian Community Health Survey (CCHS) 4.2 on Healthy Aging. https://www.clsa-elcv.ca/doc/446.
19. Fillenbaum GG. Multidimensional Functional Assessment of Older Adults: The Duke Older Americans Resources and Services Procedures. Hillsdale, NJ: L. Erlbaum Associates; 1988.
20. Fillenbaum GG, Smyer MA. The development, validity, and reliability of the OARS multidimensional functional assessment questionnaire. J Gerontol 1981;36:428-34.
21. Fillenbaum GG. Canadian Longitudinal Study on Aging. Basic Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) Questionnaire (Baseline) Multidimensional Functional Assessment of Older Adults: The Duke Older American Resource and Services Procedures. Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc; 1988.
22. Canadian longitudinal study on aging. Chronic conditions tracking questionnaire (Baseline). https://www.clsa-elcv.ca/doc/446.
23. Dunlop S, Coyte PC, McIsaac W. Socio-economic status and the utilisation of physicians' services: Results from the Canadian National Population Health Survey. Soc Sci Med 2000;51:123-33.
24. Kitts J, Cook C, Frank C, Kendel D, Moffatt M, Ramsden M, *et al*. Where you live matters: Canadian views on health care quality. Can Health Care Matters 2014;8.
25. Greenwood-Ericksen MB, Kocher K. Trends in emergency department use by rural and urban populations in the United States. JAMA Netw Open 2019;2:e191919.
26. Mian O, Pong R. Does better access to FPs decrease the likelihood of emergency department use? Results from the Primary Care Access Survey. Can Fam Physician 2012;58:e658-66.