SPATIAL ACCESS BY PUBLIC TRANSPORT AND LIKELIHOOD **OF HEALTHCARE CONSULTATIONS AT HOSPITALS**

ABSTRACT

- The distribution of access to medical consultations is 0 important to understanding health equity
- **Spatial access** influences whether individuals can reach 0 desired services but does not guarantee utilization of care
- This study examines the **influence of spatial accessibility** to hospitals on the likelihood of consulting a healthcare professional while controlling for individual characteristics using data for eight Canadian metropolitan regions and multi-level regression modelling
- Likelihood of consultations follows a positive household income gradient (high-income OR: 1.205 CI: 1.109-1.309; middle-income OR: 1.073 CI: 0.996-1.156; compared to low-income)
- Living in areas with higher spatial accessibility is significantly and **positively linked to consultation likelihood** (OR: 1.012 CI: 1.005-1.020)
- Presence of chronic conditions (OR: 1.860 CI: 0 1.747-1.981) and having a regular doctor (OR: 1.251 Cl: 1.116-1.402) **increases** the likelihood of consultations while having a **positive perception of health decreases** it (OR: 0.526 CI: 0.491-0.563)

ACCESSIBILITY MEASURE

Calculated using the two-step floating catchment area (2SFCA) method

Service-to-population ratio

Cumulative accessibility

Service-to-population ratio



2016 Canadian Census

Travel time

GTFS data for 10 a.m. on Tuesday

Obtained for Vancouver, Calgary, Edmonto Vinnipea. London, Kitchener-Cambridge Vaterloo, Toroton-Hamilton, Ottawa and alifax. This information was not available f the province of Quebec at the time of the study

$$V_j = \frac{S_j}{\sum_k P_k f(t_{kj})} \text{ and } f(t_{kj}) = \begin{cases} 1 \text{ if } t_{kj} \leq 45 \text{ minutes} \\ 0 \text{ if } t_{kj} > 45 \text{ minutes} \end{cases}$$

s = service to population ratio of hospital j

- = the capacity of \mathbf{i} (number of beds);
- $\mathbf{P}_{\mathbf{k}} = \mathbf{p} \mathbf{o} \mathbf{p} \mathbf{u} \mathbf{l} \mathbf{a} \mathbf{t} \mathbf{i} \mathbf{n}$ census tract $\mathbf{k}_{\mathbf{j}}$

 $\mathbf{f}_{\mathbf{k}}$ = travel time between census tract \mathbf{k} and hospital \mathbf{j} and therefore

 $P_{\mu}f(t_{\mu})$ can be interpreted as the population at location \boldsymbol{k} that can reach the hospital within 45 minutes by transit, assuming on-board capacity is unrestrained

Cumulative accessibility

 $A_{i} = \sum V_{j} f(t_{ji}) \text{ and } f(t_{ji}) = \begin{cases} 1 \text{ if } t_{ji} \leq 45 \text{ minutes} \\ 0 \neq i \neq i \end{cases}$

 $A_i =$ accessibility to hospitals at census tract i; V_i = service to population ratio for hospital j; and t_{ii} = travel time between j and i via public transport

SURVEY DATA

Canadian Community Health Survey (CCHS)

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Variable

Access Age HHsize

Sex HH5yr

Work status

Recent immigrant[^]

HHincome

Pers. Edu.†

Pos. Health

Chronic

Regular Doc the respondent has a regular medical doctor

Insignficant and removed from final model ^tCorrelated and removed from final model *Chronic conditions include asthma, arthritis, back problems, high blood pressure, migraine headaches, COPD, diabetes, heart disease, cancer, stomach or intestinal ulcers, effects of stroke, urinary incontinence, bowel disorder. Alzheimer's disease or dementia, mood disorder, anxiety disorder, fibromyalgia, scoliosis, chronic fatigue, and chemical sensitivities

ational, cross-sectional survey that collects information ated to the health status, healthcare utilization and th determinants of the Canadian population

nducted annually since 2007 and relies on a sample of 000 participants from all provinces and territories (but all components of the survey are answered by condents in all provinces depending on the survey cycle)

ticipants are selected from the **Canadian population 12** rs and older with an exclusion rate of 3%

2012, 2013, and 2014 cycles of the survey are used in study which contained the information needed for the as being examined

tation with healthcare professionals at hospital

he last 12 months,] have you seen, or talked to any of the following alth professionals about your physical, emotional or mental health?



	Description	Question in CCHS
	Accessibility to hospitals in 45 minutes	N/A
	Age of the respondent	DHH_AGE
	Number of persons in the household	DHHDHSZ
	Sex of the respondent	DHH_SEX
	Number of children 5 years old or younger in the household	DHHDLE5
s [†]	Work status of the respondent	LBSDPFT
	Whether the respondent immigrated to Canada within 5 years of the year of the survey	Coded using SDCFIMM
	Household income of the respondent	Coded using INCDHH
	Highest education level of the respondent	Coded using EDUDR04
Ì	Whether the respondent has a positive perception of his/her general health	Coded using GENDHDI
	Whether the respondent has a chronic condition*	CCC_031 – CCC_290

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RESULTS

Population that consulted with a healthcare professional at a hospital in past 12 months

Variable		Ν	Consulted a professional at
			a hospital (%)
	< 45 th percentile	26,589	12.5
Access	45 th to 90 th percentile	27,524	12.4
	> 90 th percentile	5,645	14.3
	2012	14,630	12.2
Year	2013	15,100	12.3
	2014	30,028	13.0
	12-17	464	9.7
Ago	18-24	4,657	9.9
Age	25-64	31,960	12.1
	65+	16,099	15.6
	1	15,277	12.8
	2	20,300	12.4
HH size	3	9,149	13.8
	4	9,730	14.5
	5+	5,302	11.7
Sav	Female	33,002	9.6
Sex	Male	26,756	9.4
	0	53,301	12.9
	1	4,497	10.8
ппэуг	2	1,748	8.5
	3+	212	10.4
Work status	Full-time	24,340	11.0
	Part-time	6,026	12.5
Recent	Yes	1,982	6.9
immiarant	No	15,847	11.2
3	0 to 49.999	21,440	13.4
HH income	50.000 to 99.999	19,969	12.1
HH income	> 100.000	18.349	12.2
		11 347	11 4
Dara Edu	< Secondary	1/150	17.4
Pers. Eau.	Secondary Best see polemy	14,150	12.5
	Posi-secondary	52,995	13.1
Pos. Health	Tes	52,150	
	NO Vac	7,471	24.4
Chronic	res	33,301	10.3
	INO	24,39/	1.1
Kegular	Yes	54,513	13.0
Doc	Νο	5,185	8.8

- healthcare professional at a hospital:
- accessibility
- Those who are 65 and older
- Those who are not recent immigrants
- \$50,000
- Those who have a negative perception of health
- \rightarrow Those who have a chronic condition
- Those who have a regular doctor
- Difference in the percentage of females who consulted compared to males was minimal

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Descriptive statistics

• Groups of which a greater percentage of survey respondents reported having consulted with a

 \rightarrow Those living in census tracts with very high

Regression results

Dependent variable: likelihood of consulting a hea professional at a hospital

Variable	Odds Ratio	95% CI
Access	1.012 ***	1.005 1.020
Age	0.999	0.998 1.001
HHsize	0.953 ***	0.929 0.978
Sex (ref. = male)	0.973	0.919 1.030
HHincome (ref. $=$ low)		
Middle	1.073 *	0.996 1.156
High	1.205 ***	1.109 1.309
Pos. Health (ref. = negative)	0.526 ***	0.491 0.563
Chronic (ref. $=$ no)	1.860 ***	1.747 1.981
Regular Doc (ref. = no)	1.251 ***	1.116 1.402
Constant	0.109 ***	0.089 0.132
No. of observations	59	2,581
Log likelihood	-2	0169
AIC BIC	40365.82	40491.75

* p<0.1 ** p<0.05 *** p<0.01

- O Living in a census tract with higher spatial accessibility increased an individual's odds of consultation, after controlling for predisposing and need factors
- \rightarrow One-unit increase (one additional bed/1000) individuals) in accessibility results in an 1.2%**increase** in likelihood
- Older individuals were not more likely to consult
- Inclusion of other factors better addressed the need for consultations
- Females were not more likely than males to consult
- A consultation gradient was observed
- \rightarrow Compared to the low-income, middle- and high-income households were more likely to consul
- Household size had a negative impact on consultations
- \rightarrow An increase of one additional person decreased the likelihood by 4.7%
- Having a positive perception of one's health status **decreased** the likelihood significantly (50%)
- Presence of a chronic condition greatly increased the likelihood by 86%
- Having a regular doctor increased likelihood by 25%
- \rightarrow These individuals are more likely to have health problems and so would be more likely to visit a hospital for consultations with specialists



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CONCLUSION

- Spatial accessibility was positively associated with the likelihood of an individual consulting a healthcare professional at a hospital, after controlling for the effects of other determinants of healthcare utilization
- A positive income gradient was observed
- Age and sex were not significant factors when perceived and real need for healthcare were accounted for
- O Perceived access should be addressed in future studies to link spatial access to healthcare utilization
- O Similar studies can be conducted to examine consultations at other healthcare facilities using different measures of capacity for the calculation of service-to-population ratios

Policy implications

Spatial access to healthcare can be improved in three ways:

Supply of healthcare	Increase number of beds or variety of services at hospitals
Demand for healthcare	Healthcare service providers can inform individuals of the availability of beds or services at nearby hospitals

Unreliable or infrequent public transport makes it difficult for users to reach facilities on time for appointments or treatments

Improvements in public transport services Quality of may be a way to increase accessibility transport system

> Recognize healthcare facilities as key destinations to be connected to the existing system when planning for system expansions



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