

# Proximity and emergency department use

## Multilevel analysis using administrative data from patients with cardiovascular risk factors

Patrick Bergeron PhD Josiane Courteau PhD Alain Vanasse MD PhD

### Abstract

**Objective** To determine if geographic proximity to an emergency department (ED) is related to ED use in a metropolitan population of patients with cardiovascular risk factors.

**Design** Population-based, retrospective cohort study.

**Setting** The census metropolitan area of Montreal, Que.

**Participants** Cohort of 99 400 patients with diabetes, hypertension, or dyslipidemia in 2007 without a history of cardiovascular disease. Each patient was spatially referred to 1 of 5857 dissemination areas (DAs).

**Main outcome measures** Annual number of visits to an ED with respect to the distance between the centroid of a patient's DA and the closest ED, controlling for age, sex, comorbidities, and neighbourhood immigration, social, and material characteristics. Multilevel logistic and negative binomial regressions were used to determine if the proximity to the closest ED was related to ED use, frequent ED use ( $\geq 4$  visits in a year), and number of ED visits.

#### EDITOR'S KEY POINTS

- Geographic proximity to medical facilities is likely to play a substantial role in their use, especially for emergency departments (EDs), which have no restriction on accessibility. Yet, there is currently very little quantitative evidence of such an effect. A better understanding of how a neighbourhood uses its proximal medical facilities might help to plan the delivery of care.
- The distance to an ED was a statistically significant ( $P < .001$ ) factor in its use even after accounting for age, sex, presence of comorbidities, and neighbourhood socioeconomic attributes. Distance to care is not a trivial factor and should be considered more often in ED-use studies.
- The geographic distance to an ED also affects the probability of being a frequent user ( $\geq 4$  visits in a year). However, it cannot predict the number of ED visits in this group. This result is concordant with recent evidence suggesting that factors affecting ED use among frequent users are much more complex than previously expected and might involve behavioural components.

**Results** A total of 25 889 (26.0%) patients in the cohort visited an ED at least once during a 1-year period, among which 4563 (4.6%) were frequent users with at least 4 visits. These frequent users were responsible for 28 249 (45.5%) of all 62 021 visits to EDs. The distance between a DA and its closest ED was significantly and negatively correlated with ED use ( $P < .001$ ), even after controlling for confounding variables. Patients living in a DA close to an ED were also more likely to be frequent users, but the extent of use among them (range from 4 to 82 ED visits) was not related to the distance to the closest ED.

**Conclusion** These results suggest that patients at risk of cardiovascular disease living in a metropolitan area are more likely to seek a medical encounter at the ED if they live closer to it.

This article has been peer reviewed.  
*Can Fam Physician* 2015;61:e391-7

# La proximité d'un service d'urgence et son utilisation

## Analyse multiniveau à l'aide de données administratives provenant de patients présentant des facteurs de risque cardiovasculaire

Patrick Bergeron PhD Josiane Courteau PhD Alain Vanasse MD PhD

### Résumé

**Objectif** Déterminer s'il existe une relation entre la proximité géographique d'un service d'urgence (SU) et son utilisation par des patients d'une région métropolitaine présentant des facteurs de risque cardiovasculaire.

**Type d'étude** Étude de cohorte rétrospective de nature démographique.

**Contexte** L'aire de recensement du Montréal métropolitain, au Québec.

**Participants** Une cohorte de 99 400 patients souffrant de diabète, d'hypertension ou de dyslipidémie en 2007, sans histoire de maladie cardiovasculaire. Chaque patient a été assigné à une des 5857 aires de diffusion (AD).

**Principaux paramètres à l'étude** Le nombre de visites annuelles à un SU par rapport à la distance entre le centroïde de l'AD du patient et le SU le plus proche, en tenant compte de l'âge, du sexe, de la comorbidité et des caractéristiques sociales, matérielles et d'immigration du voisinage. On a utilisé des régressions logistiques multiniveau et binomiales négatives pour déterminer s'il existe une relation entre la proximité d'un SU et son utilisation, son utilisation fréquente ( $\geq 4$  visites par année) et le nombre de visites au SU.

**Résultats** Un total de 25 889 patients de la cohorte (26,0 %) ont visité un SU au moins une fois sur une période d'un an; parmi ceux-ci, 4563 étaient des utilisateurs fréquents (au moins 4 visites). Les utilisateurs fréquents étaient responsables de 28 249 visites aux SU, soit 45,5 % des 62 021 visites. La distance entre une AD et son plus proche SU était significativement et négativement corrélée avec l'utilisation du SU ( $P < ,001$ ), même après avoir contrôlé pour les facteurs de confusion. Les patients qui habitaient dans une AD proche d'un SU étaient aussi plus susceptibles d'être des usagers fréquents, mais le nombre de leurs visites (entre 4 et 82) n'avait pas de relation avec la distance du SU le plus proche.

**Conclusion** Ces résultats suggèrent que les patients avec risques de maladies cardiovasculaires qui vivent dans une région métropolitaine sont plus susceptibles de rechercher une assistance médicale dans le SU le plus près de chez eux.

### POINTS DE REPÈRE DU RÉDACTEUR

- Le fait de vivre à proximité d'un service médical est susceptible d'avoir une influence importante sur son utilisation, notamment dans le cas d'un service d'urgence (SU), dont l'accessibilité n'est pas restreinte. À l'heure actuelle, toutefois, il y a très peu de données quantitatives à l'appui d'un tel effet. Une meilleure compréhension de la façon dont ceux qui habitent près d'un service médical choisissent de l'utiliser pourrait nous aider à planifier la dispensation des soins.
- La proximité d'un SU avait une influence statistiquement significative ( $P < ,001$ ) sur son utilisation, même en tenant compte de l'âge, du sexe, de la présence de comorbidités et des caractéristiques socioéconomiques du voisinage. La proximité d'un service de santé est un facteur non négligeable dont on devrait tenir compte plus souvent dans les études sur l'utilisation des SU.
- La proximité géographique d'un SU affecte aussi la probabilité d'en être un usager fréquent ( $\geq 4$  visites par année). Elle ne peut toutefois pas prédire le nombre de visites pour ce type d'usager. Ces observations concordent avec certaines données récentes qui suggèrent que les facteurs qui influencent l'utilisation des SU chez les usagers fréquents sont plus complexes qu'on ne le pensait et qu'ils pourraient comporter des composantes comportementales.

Cet article fait l'objet d'une révision par des pairs.  
*Can Fam Physician* 2015;61:e391-7

Emergency department (ED) overcrowding has become a critical issue for many hospitals, and attention has been directed toward understanding the effects of users' socioeconomic and health status on ED use.<sup>1</sup> Although most patients seldom use the ED, about 5% of the population uses it at least 4 times a year, accounting for 21% to 28% of all ED visits.<sup>1,2</sup> This "frequent users" group has received much attention lately, and it seems there is no single explanation for their frequent ED use.<sup>3,4</sup>

The geographic proximity between a patient's home and an ED has also been recognized as a contributing factor for ED use. While this factor is being increasingly acknowledged, there is little quantitative evidence of its effect, especially from the perspective of contrasting occasional with frequent users. So far it has been shown that patients are more likely to seek help for their children in an ED if they live close to it<sup>5</sup> and that proximity to an ED increases its use by the general public.<sup>6,7</sup>

Patients with diabetes, hypertension, or dyslipidemia are high users of health care services,<sup>8</sup> as they have important risk factors for cardiovascular disease (CVD).<sup>9</sup> Although such patients can be efficiently managed within ambulatory care settings, they are still common ED users.<sup>8</sup> The objective of this study was to explore if the geographic proximity to an ED was associated with the probability of visiting EDs, and the probability of visiting them frequently, among a population of patients at risk of CVD living in the census metropolitan area of Montreal (CMA-M) in Quebec.

## METHODS

### Design and data sources

This is a retrospective, population-based cohort study using information from linked provincial administrative databases<sup>10</sup> (ie, patients' demographic characteristics including the residence postal code, physician billing, and hospital discharge information from the MED-ÉCHO database).

Neighbourhood attributes were measured using the available information for dissemination areas (DAs) in the CMA-M as provided by the 2006 Canadian population census. A DA is a small, relatively stable geographic unit composed of 1 or more adjacent dissemination blocks. It is the smallest geographic area for which all census data are disseminated. In CMA-M, DAs are very small (median surface area of 0.11 km<sup>2</sup>) and have an average of about 600 residents. Each patient was spatially linked to a single DA using the Postal Code Conversion File from Statistics Canada.<sup>11</sup> Spatial information came from the DA cartographic boundary files for the CMA-M.<sup>12</sup> This study was approved by the Research Ethics Board Committee of the University of Sherbrooke in

Quebec and by the provincial Commission d'accès à l'information.

### Case definition

A patient was considered to be at risk of CVD if he or she had received a primary or secondary diagnosis of diabetes, hypertension, or dyslipidemia (**Table 1**) during a hospitalization or had at least 3 physician claims within a year for one of these diagnoses.

### Studied population

The studied population included individuals 30 years of age or older living in the CMA-M who were considered to be at risk of CVD in 2007, without a history of CVD or gestational-related events<sup>13</sup> (**Table 1**). The first diagnosis observed in 2007 was the reference date.

**Table 1. Health conditions and their associated classification codes**

HEALTH CONDITION	ICD-9 CODE	ICD-10 CODE
Gestational-related event	630-676, 760-779, V22-V24, V27-V28	O00-O99, Z32-Z39
Diabetes	250	E10-E14
Hypertension	401	I10
Dyslipidemia	272	E78
Cardiovascular disease	410-414, 428, 430-438	I20-I25, I50, I60-I69

ICD—International Classification of Diseases.

### Variables

The following individual-level dependent variables were considered within a year after the reference date: having at least 1 visit to an ED, being a frequent ED user ( $\geq 4$  visits), and number of ED visits.

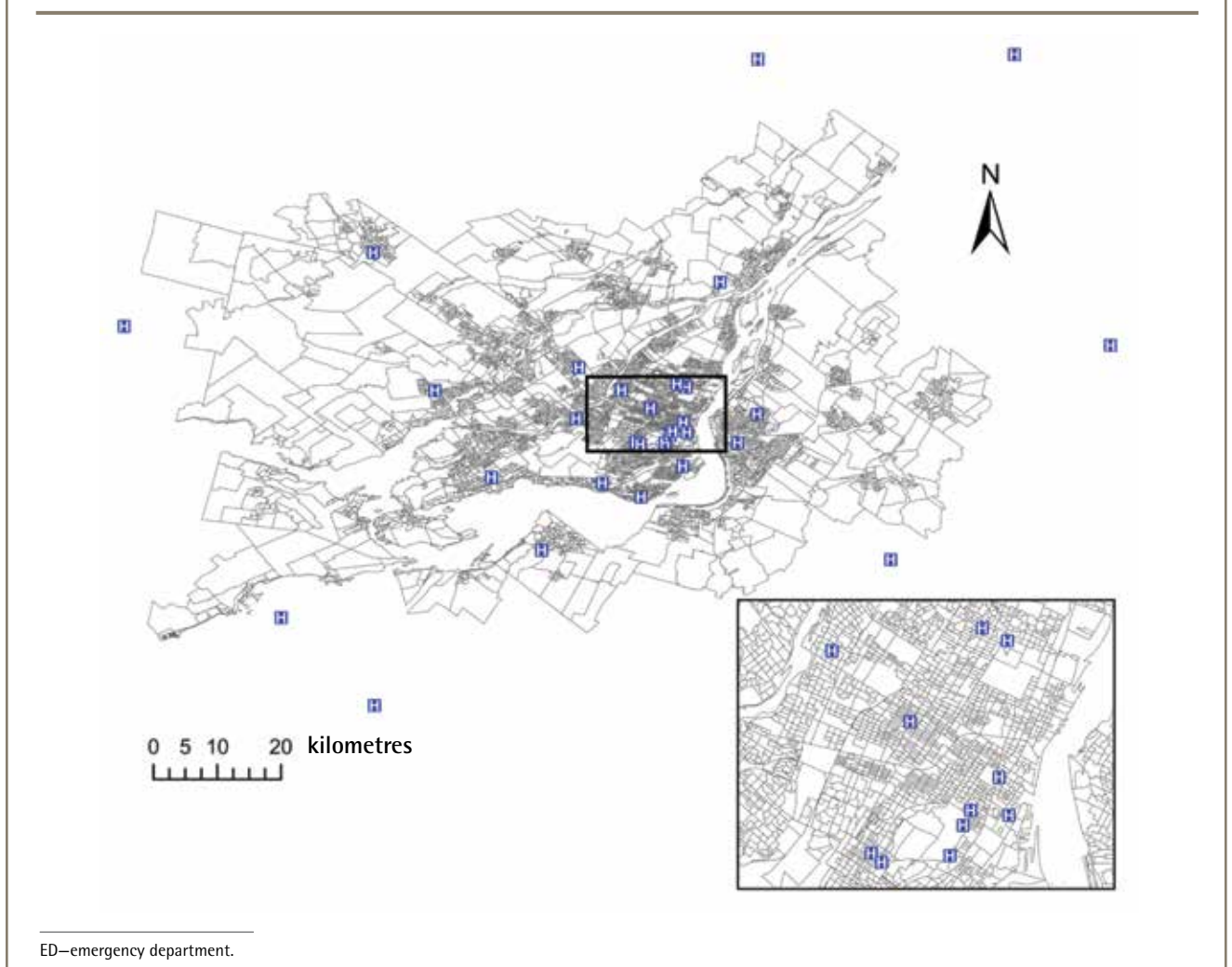
The primary independent variable was proximity to the nearest ED, defined as the Euclidean distance between the geographic centroids of a patient's residence DA and the closest ED<sup>14</sup> and calculated with a geographic information system<sup>15</sup> (**Figure 1**). This distance was considered both continuous and categorical ( $< 1$  km,  $\geq 1$  km to  $< 2$  km,  $\geq 2$  km to  $< 3$  km,  $\geq 3$  km to  $< 5$  km,  $\geq 5$  km to  $< 10$  km, and  $\geq 10$  km).

We also accounted for the following individual-level independent variables: sex, age, having been hospitalized in the past year, and D'Hoore comorbidity index score,<sup>16,17</sup> calculated using the diagnoses reported in the MED-ÉCHO database and physicians' claims registered in the past year. Immigration score and material and social deprivation scores (described elsewhere<sup>18</sup>) were used at the DA level.

### Data analysis

To simultaneously take into account individual-level and

**Figure 1.** Distribution of EDs in the census metropolitan area of Montreal in Quebec



neighbourhood (DA) aggregated variables, the probability of being an ED user or frequent ED user was modeled using multilevel logistic regression.<sup>19</sup> We also used multilevel negative binomial regression to explore if the number of ED visits among frequent users was associated with proximity to the closest ED.

## RESULTS

The cohort included 99 400 individuals living in 5857 DAs (Figure 2). More than a quarter visited an ED at least once during a 1-year period, and 4.6% visited an ED at least 4 times and were identified as frequent users (Table 2). These frequent users accounted for 28 249 (45.5%) of all 62 021 visits to EDs (Figure 3). Those who used EDs (compared with nonusers) and frequent ED users (compared with occasional users) lived closer to EDs, had more comorbidities, were more likely to have been previously hospitalized, and lived in neighbourhoods

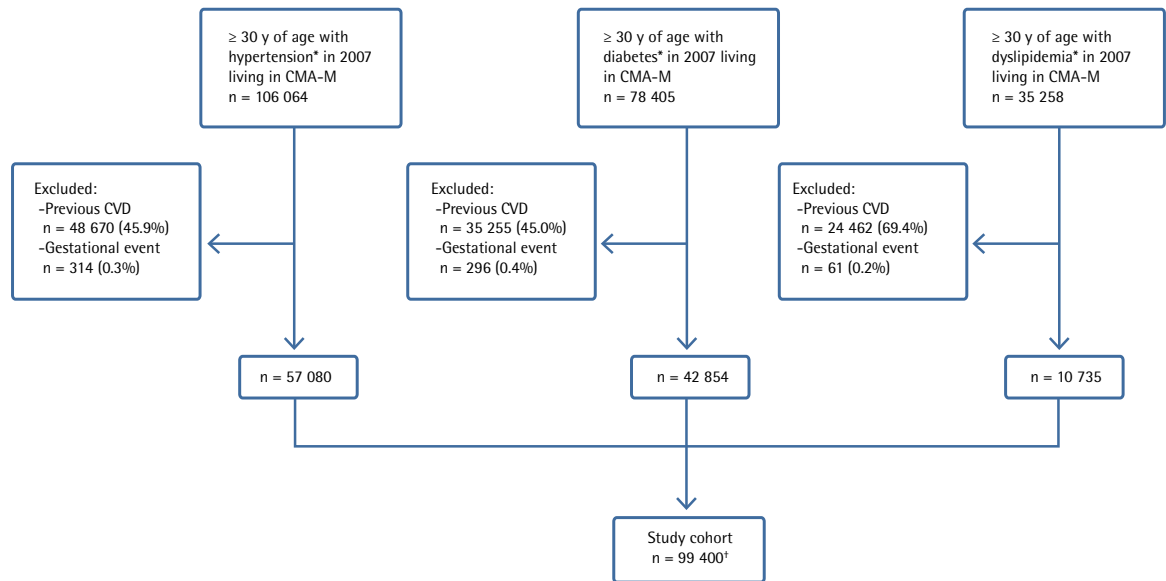
with higher social and material deprivation scores and higher immigration scores (Table 2).

The proximity to EDs was significantly and negatively correlated with ED use and frequent use (Figure 4). For example, compared with patients living farther ( $\geq 10$  km), those living near an ED ( $< 1$  km) were significantly more inclined to frequently visit EDs (odds ratio of 1.32, 95% CI 1.12 to 1.56). Results were similar when the distance to the nearest ED was treated as a continuous variable in the models (data not shown). However, the extent of use among frequent users (range of 4 to 82 ED visits) was not significantly related to proximity to an ED ( $P = .395$ ).

## DISCUSSION

This study shows that proximity to EDs was associated with ED use and frequent ED use ( $\geq 4$  times) during a 1-year period, even after controlling for patient

Figure 2. Study cohort



CMA-M—census metropolitan area of Montreal, CVD—cardiovascular disease, ICD—International Classification of Diseases.

\*A patient was considered to be at risk of CVD if he or she had received a primary or secondary diagnosis of hypertension (ICD-9 code 401, ICD-10 code I10), diabetes (ICD-9 code 250, ICD-10 code E10-E14), or dyslipidemia (ICD-9 code 272, ICD-10 code E78) during a hospitalization or at least 3 physician claims within 1 y with an identical diagnosis.

†A patient could be present in more than 1 disease-specific cohort (eg, a patient with hypertension could also have diabetes).

Table 2. Characteristics of the study cohort

CHARACTERISTICS	TOTAL	ED NONUSERS (NO VISIT)	ED USERS (≥ 1 VISITS)	P VALUE*	ED OCCASIONAL USERS (1-3 VISITS)	ED FREQUENT USERS (≥ 4 VISITS)	P VALUE*
Total, n (%)	99 400 (100.0)	73 511 (74.0)	25 889 (26.0)	NA	21 326 (21.5)	4563 (4.6)	NA
No. of ED visits, mean (SD)	0.62 (1.62)	0.00 (0.00)	2.40 (2.41)	NA	1.58 (0.73)	6.19 (3.61)	NA
Sex, n (%)				<.001			.284
• Female	55 018 (55.4)	40 241 (54.7)	14 777 (57.1)		12 140 (56.9)	2637 (57.8)	
• Male	44 382 (44.6)	33 270 (45.3)	11 112 (42.9)		9186 (43.1)	1926 (42.2)	
Age in years, mean (SD)	64.7 (13.0)	64.4 (12.8)	65.6 (13.8)	<.001	65.4 (13.6)	66.6 (14.5)	<.001
Comorbidity index score, <sup>†</sup> mean (SD)	1.67 (2.01)	1.53 (1.85)	2.06 (2.35)	<.001	1.92 (2.23)	2.67 (2.80)	<.001
Previous hospitalization, n (%)	29 231 (29.4)	18 678 (25.4)	10 553 (40.8)	<.001	8095 (38.0)	2458 (53.9)	<.001
Immigration score, <sup>‡</sup> mean (SD)	0.16 (3.70)	0.08 (3.69)	0.39 (3.73)	<.001	0.36 (3.74)	0.54 (3.69)	.003
Material deprivation score, <sup>§</sup> mean (SD)	0.46 (1.83)	0.40 (1.83)	0.60 (1.82)	<.001	0.58 (1.83)	0.70 (1.77)	<.001
Social deprivation score, <sup>§</sup> mean (SD)	0.38 (1.96)	0.31 (1.95)	0.57 (1.95)	<.001	0.53 (1.96)	0.77 (1.94)	<.001
Distance to nearest ED in km, mean (SD)	4.51 (4.04)	4.62 (4.11)	4.20 (3.85)	<.001	4.27 (3.89)	3.88 (3.65)	<.001
Distance to nearest ED in km, n (%)				<.001			<.001
• <1	10 183 (10.2)	7107 (9.7)	3076 (11.9)		2452 (11.5)	624 (13.7)	
• ≥1 to <2	18 411 (18.5)	13 311 (18.1)	5100 (19.7)		4158 (19.5)	942 (20.6)	
• ≥2 to <3	19 194 (19.3)	14 010 (19.1)	5184 (20.0)		4208 (19.7)	976 (21.4)	
• ≥3 to <5	20 761 (20.9)	15 382 (20.9)	5379 (20.8)		4466 (20.9)	913 (20.0)	
• ≥5 to <10	21 233 (21.4)	16 278 (22.1)	4955 (19.1)		4177 (19.6)	778 (17.1)	
• ≥10	9618 (9.7)	7423 (10.1)	2195 (8.5)		1865 (8.7)	330 (7.2)	

DA—dissemination area, ED—emergency department, NA—not applicable.

\*P values are associated with *t* tests (continuous variables) or  $\chi^2$  tests (categorical variables).

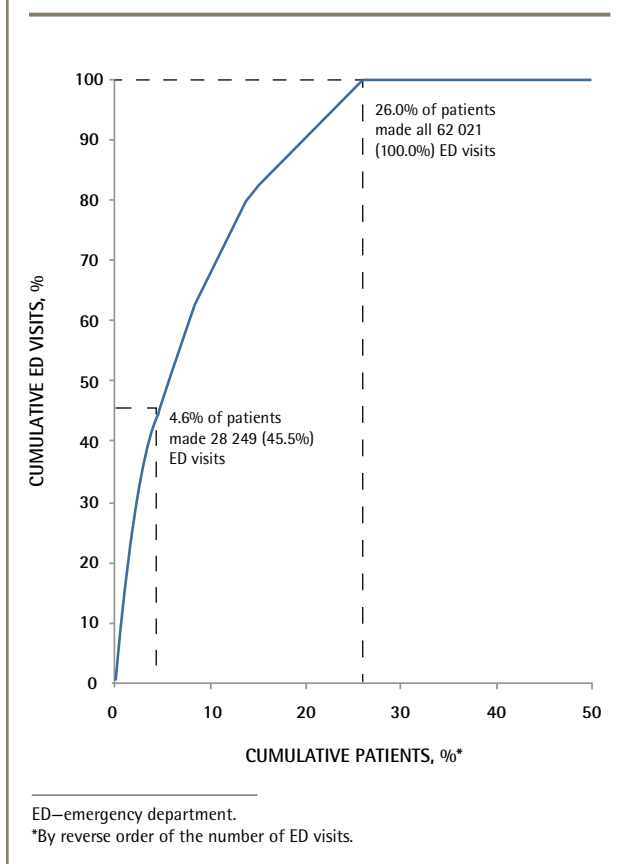
<sup>†</sup>Higher scores indicate greater comorbidity.

<sup>‡</sup>Higher scores indicate higher levels of immigration in the DA.

<sup>§</sup>Higher scores indicate greater deprivation in the DA.



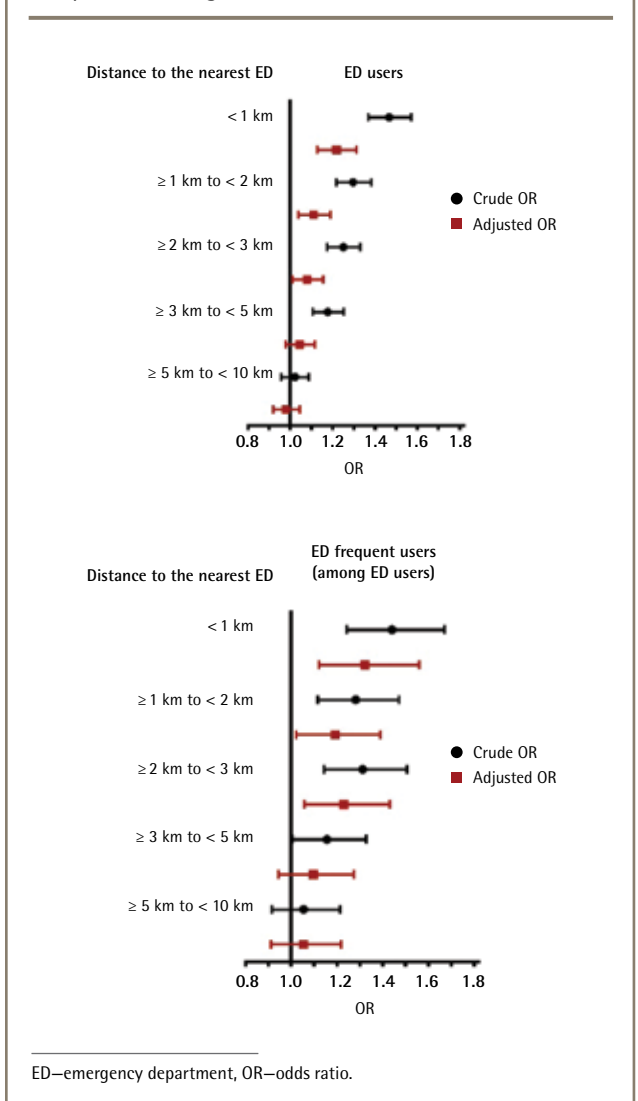
**Figure 3. Cumulative number of ED visits in the 1-year follow-up period according to the cumulative proportion of patients**



and neighbourhood variables. This inverse relationship between ED use and the distance to the nearest ED has also been reported elsewhere.<sup>5-7</sup> In a study conducted in a pediatric Medicaid cohort of patients, children living more than 1.9 km from the nearest ED had 11% lower ED use than those living within 0.8 km.<sup>5</sup> In a sample of adults residing in Spain<sup>7</sup> there was a decrease in ED use among patients living more than 34 minutes away from the hospital compared with those living up to 7 minutes away (odds ratio of 0.49).

Interestingly, among frequent ED users, the number of ED visits was not related to the proximity to EDs. This suggests that, once a patient is already a frequent user, living closer to an ED is not an important predictor of the number of visits. One can argue that patients living closer to EDs are using this primary care facility instead of other ambulatory services, but additional analyses reveal that, compared with nonusers, ED users and frequent ED users also have higher use of other ambulatory services (data not shown). This might reflect the influence of behavioural factors on care use<sup>20</sup> that were not taken into account in this study but which should be further investigated.

**Figure 4. Crude and adjusted ORs for the probability of being an ED user and a frequent ED user (among ED users) according to distance to EDs: The reference group was patients living 10 km or farther from EDs.**



### Limitations

The study's limitations are primarily related to our use of administrative databases. Some would consider the impossibility of capturing some individual-level information (eg, socioeconomic status, immigration status, presence of a family doctor) to be a considerable limitation. However, neighbourhood-level variables available from the Canadian population census, such as socioeconomic and immigration attributes, were considered in multilevel analyses in order to simultaneously explore the association between neighbourhood-level and individual-level predictors, by taking into account the nonindependence of the observations within neighbourhoods. As this study was performed on a specific subpopulation (with CVD risk factors) living in the CMA-M, these results

might not be generalizable to the general population. Yet the proportion of frequent users is the same as is generally reported in other studies.<sup>1,2</sup> Also, 4 or more visits was set as a threshold to define a frequent ED user. Although this threshold has been used in a number of studies,<sup>4,21,22</sup> other thresholds have been reported elsewhere.<sup>23-26</sup> Nevertheless, the conclusions of this study remain the same when using different thresholds (5 to 9, data not shown). Finally, the use of the centroid of the DA of the patient's residence might overestimate or underestimate the actual distance between the residence and the closest ED. However, because we limited our study to the CMA-M, where the surface areas of DAs are very small (median of 0.11 km<sup>2</sup>; median population of 535), the DA centroid provides a very good approximation of the actual residence localization. Therefore, we have no reason to believe that systematic bias would affect our analyses.

## Conclusion

This study suggests that patients at risk of CVD living in the Montreal metropolitan area are more likely to seek health care in an ED if they live closer to it. However, in the subpopulation who are frequent ED users, the pattern is more complex, and the number of visits among frequent users does not seem to be influenced by distance to the ED. Health decision makers should take this information into account in their efforts to better deliver health care to metropolitan populations.

**Dr Bergeron** is Professor in the Department of Biological Sciences at Bishop's University in Sherbrooke, Que. **Dr Courteau** is Scientific Research Assistant for the Groupe de recherche PRIMUS in Sherbrooke. **Dr Vanasse** is a family physician and Full Professor in the Département de médecine de famille et de médecine d'urgence at the University of Sherbrooke and Director of the Groupe de recherche PRIMUS.

### Acknowledgment

This study was supported by the Canadian Institutes of Health Research (CIHR #204982), the Fonds de recherche du Québec—Santé, the Département de médecine de famille et de médecine d'urgence at the University of Sherbrooke, and the Centre de Recherche du CHUS.

### Contributors

All authors contributed to the concept and design of the study, and data gathering and interpretation. **Drs Bergeron** and **Courteau** performed the analyses. All authors participated in the writing of the manuscript.

### Competing interests

None declared

### Correspondence

**Dr Alain Vanasse**; e-mail [alain.vanasse@usherbrooke.ca](mailto:alain.vanasse@usherbrooke.ca)

### References

- Hunt KA, Weber EJ, Showstack JA, Colby DC, Callahan ML. Characteristics of frequent users of emergency departments. *Ann Emerg Med* 2006;48(1):1-8. Epub 2008 Mar 30.
- LaCalle E, Rabin E. Frequent users of emergency departments: the myths, the data, and the policy implications. *Ann Emerg Med* 2010;56(1):42-8. Epub 2010 Mar 26.
- Ruger JP, Richter CJ, Spitznagel EL, Lewis LM. Analysis of costs, length of stay, and utilization of emergency department services by frequent users: implications for health policy. *Acad Emerg Med* 2004;11(12):1311-7.
- Palmer E, Leblanc-Duchin D, Murray J, Atkinson P. Emergency department use. Is frequent use associated with a lack of primary care provider? *Can Fam Physician* 2014;60:e223-9. Available from: [www.cfp.ca/content/60/4/e223.full.pdf+html](http://www.cfp.ca/content/60/4/e223.full.pdf+html). Accessed 2015 Jul 14.
- Ludwick A, Fu R, Warden C, Lowe RA. Distances to emergency department and to primary care provider's office affect emergency department use in children. *Acad Emerg Med* 2009;16(5):411-7. Epub 2009 Apr 10.
- Magnusson G. The role of proximity in the use of hospital emergency departments. *Sociol Health Illn* 1980;2(2):202-14.
- Sanz-Barbero B, Otero García L, Blasco Hernández T. The effect of distance on the use of emergency hospital services in a Spanish region with high population dispersion: a multilevel analysis. *Med Care* 2012;50(11):27-34.
- Natarajan S, Nietert PJ. Hypertension, diabetes, hypercholesterolemia, and their combinations increased health care utilization and decreased health status. *J Clin Epidemiol* 2004;57(9):954-61.
- Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJ; Comparative Risk Assessment Collaborating Group. Selected major risk factors and global and regional burden of disease. *Lancet* 2002;360(9343):1347-60.
- Régie de l'assurance maladie du Québec [website]. *Data and statistics*. Quebec city, QC: Régie de l'assurance maladie du Québec; 2014. Available from: [www.ramq.gouv.qc.ca/en/data-statistics/Pages/data-statistics.aspx](http://www.ramq.gouv.qc.ca/en/data-statistics/Pages/data-statistics.aspx). Accessed 2015 Jul 14.
- Statistics Canada. *Fichier de conversion des codes postaux (FCCP). Guide de référence*. Ottawa, ON: Statistics Canada; 2010.
- Statistics Canada. *2006 census—boundary files*. Ottawa, ON: Statistics Canada; 2013. Available from: [www12.statcan.gc.ca/census-recensement/2011/geo/bound-limit/bound-limit-2006-eng.cfm](http://www12.statcan.gc.ca/census-recensement/2011/geo/bound-limit/bound-limit-2006-eng.cfm). Accessed 2015 Jul 14.
- Hux JE, Ivis F, Flintoft V, Bica A. Diabetes in Ontario: determination of prevalence and incidence using a validated administrative data algorithm. *Diabetes Care* 2002;25(3):512-6.
- Ng E, Wilkins R, Perras A. How far is the nearest hospital? Calculating distances using the Statistics Canada Postal Code Conversion File. *Health Rep* 1993;5(2):179-88.
- ArcGIS, *ArcMap, version 10.2* [geographic information system]. Redmond, CA: Esri Inc.
- D'Hoore W, Bouckaert A, Tilquin C. Practical considerations on the use of the Charlson comorbidity index with administrative data bases. *J Clin Epidemiol* 1996;49(12):1429-33.
- Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* 1987;40(5):373-83.
- Vanasse A, Courteau J, Orzanco MG, Bergeron P, Cohen AA, Niyonsenga T. Neighbourhood immigration, health care utilization and outcomes in patients with diabetes in a metropolitan region (Canada): a population health perspective. *BMC Health Serv Res* 2015;15:146.
- Diez-Roux AV. Multilevel analysis in public health research. *Annu Rev Public Health* 2000;21:171-92.
- Phillips KA, Morrison KR, Andersen R, Aday LA. Understanding the context of healthcare utilization: assessing environmental and provider-related variables in the behavioral model of utilization. *Health Serv Res* 1998;33(3 Pt 1):571-96.
- Lucas RH, Sanford SM. An analysis of frequent users of emergency care at an urban university hospital. *Ann Emerg Med* 1998;32(5):563-8.
- Moore L, Deehan A, Seed P, Jones R. Characteristics of frequent attenders in an emergency department: analysis of 1-year attendance data. *Emerg Med J* 2009;26(4):263-7.
- Purdie FR, Honigman B, Rosen P. The chronic emergency department patient. *Ann Emerg Med* 1981;10(6):298-301.
- Ngamini-Ngui A, Fleury MJ, Moisan J, Grégoire JP, Lesage A, Vanasse A. High users of emergency departments in Quebec among patients with both schizophrenia and a substance use disorder. *Psychiatr Serv* 2014;65(11):1389-91. Epub 2014 Oct 31.
- Kne T, Young R, Spillane L. Frequent ED users: patterns of use over time. *Am J Emerg Med* 1998;16(7):648-52.
- Lambe S, Washington DL, Fink A, Herbst K, Liu H, Fosse JS, et al. Trends in the use and capacity of California's emergency departments, 1990-1999. *Ann Emerg Med* 2002;39(4):389-96.

— \* \* \* —