

BMJ Open A descriptive study of access to services in a random sample of Canadian rural emergency departments

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Meetings Results have been presented as a moderated poster at the 2012 CAEP conference (2–6 June 2012) in Niagara Falls, Ontario, Canada (Volume 14; S1 of CJEM) and as an oral presentation at the Canadian Rural Health Research Society conference (25–27 October 2012) in Lévis, Québec, Canada.

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ABSTRACT

Objective: To examine 24/7 access to services and consultants in a sample of Canadian rural emergency departments (EDs).

Design: Cross-sectional study—mixed methods (structured interview, survey and government data bases) with random sampling of hospitals.

Setting: Canadian rural EDs (rural small town (RST) definition—Statistics Canada).

Participants: 28% (95/336) of Canadian rural EDs providing 24/7 physician coverage located in hospitals with acute care hospitalisation beds.

Main outcome measures: General characteristics of the rural EDs, information about 24/7 access to consultants, equipment and services, and the proportion of rural hospitals more than 300 km from levels 1 and 2 trauma centres.

Results: Of the 336 rural EDs identified, 122 (36%) were randomly selected and contacted. Overall, 95 EDs participated in the study (participation rate, 78%). Hospitals had, on an average, 23 acute care beds, 7 ED stretchers and 13 500 annual ED visits. The proportion of rural hospitals with local access to the following 24/7 services was paediatrician, 5%; obstetrician, 10%; psychiatrist, 11%; internist, 12%; intensive care unit, 17%; CT scanner, 20%; surgeon, 26%; ultrasound, 28%; basic X-ray, 97% and laboratory services, 99%. Forty-four per cent and 54% of the RST EDs were more than 300 km from a level 1 and level 2 trauma centre, respectively.

Conclusions: This is the first study describing the services available in Canadian rural EDs. Apart from basic laboratory and X-ray services, most rural EDs have limited access to consultants, advanced imaging and critical care services. A detailed study is needed to evaluate the impact of these limited services on patient outcomes, costs and interfacility transport demands.

INTRODUCTION

Approximately 20% of the Canadian population lives in rural or remote areas.¹ Providing sustainable access to emergency care in these areas is challenging.² In the context of limited resources and increased costs, there

Strengths and limitations of this study

- To the best of our knowledge, this is the first nationwide study examining access to services in Canada's rural EDs.
- The current study does not permit representative comparisons between provinces, since a sample of rural EDs was included in this study.
- The study did not examine patient outcomes in relation to the limited services provided in rural facilities.

have been increased efforts to regionalise and centralise healthcare services in rural Canada.^{3–6} This has resulted in local service cuts and hospital closings.^{5 6} Therefore, the current level of services offered in rural hospitals in Canada is unclear. Published data on the subject are scarce, and access to updated resource databases is limited and sensitive.⁷ Despite the accessibility clause of the *Canada Health Act*,⁸ the legislation overseeing the country's publically funded universal healthcare system, disparities in access to emergency care may exist.

Facing similar challenges, the USA developed, in 1997, the critical access hospital (CAH) programme to enhance access to healthcare in rural communities.⁹ This legislation enables CAHs to receive a cost-based reimbursement for medicare beneficiaries with the goal of financially stabilising hospitals in small and remote areas. The legislation also sought to enhance the quality by imposing credentialing and quality assurance requirements. Yet, despite the creation of this programme, recent reports showed that compared with non-CAHs, CAHs had fewer clinical capabilities, worse processes of care and higher mortality rates for acute myocardial infarction, congestive heart failure and pneumonia⁹ and ischaemic stroke.¹⁰

To the best of our knowledge, no comparable Canadian study has been conducted.



While the vast majority of US rural hospitals have 24/7 local access to a CT scanner (94%),¹¹ surgical services (87%) and a significant proportion of intensive care units (ICUs; 41%),⁹ preliminary reports from Canada^{6 12} show that, at least in British Columbia (BC), less than 15% of rural emergency departments (EDs) have local 24/7 access to these services.

Limited access to services in rural areas may preferentially impact the provision of quality emergency care. The principles of emergency medicine rest on timely diagnosis and definitive treatment of life-threatening or limb-threatening conditions. Timely access to diagnostic imaging and consultant support and tertiary trauma centres are essential components of emergency care. A lack of these services leads to an increased need for interfacility transport, with a resultant impact on staff, medical resources, technological support, transfer systems, local and referral centre resources, patient costs and patient safety.^{13 14} Patient transfers also result in significant delays in providing definitive care,¹⁵ particularly in rural communities.^{16–19} Moreover, in these communities, the risk of trauma and trauma death is greater than in urban areas,^{19–23} especially during the prehospital period.^{21 22}

The objective of this study was to examine and describe the current situation concerning access to comprehensive healthcare services in a sample (25%) of Canadian rural hospitals.

METHODS

The protocol was submitted to our internal ethics review board (CHAU Hôtel-Dieu de Lévis) in June 2011. It was deemed not to require further ethics evaluation, based on the Tri-Council Policy Statement, as the research focused on the availability of services in public healthcare facilities and did not involve human participants.

Selection of rural EDs

We focused on rural EDs with 24/7 physician coverage at hospitals with acute care hospitalisation beds. To facilitate eventual comparisons with EDs elsewhere, we excluded community health centres and clinics, nursing stations, mobile health units and private facilities. We consulted the Division of Geography at Statistics Canada to use their definition of 'rural and small town' (RST²⁴; see online supplementary appendix 1). Briefly, they consider RSTs 'towns and municipalities outside the commuting zone of larger urban centres (ie, outside the commuting zone of centres with a population of 10 000 or more)'.

EDs in RST communities were then identified using the *Guide to Canadian Healthcare Facilities*.²⁵ The hospitals' status was then confirmed with the provincial health ministries by phone or email. Furthermore, the list of RSTs where the participating centres were located was submitted to Statistics Canada for confirmation. In the end, 336 RST EDs were identified.

Procedure for random sampling

The complete list of the 336 rural EDs, stratified for the provinces and territories, was submitted to an independent biostatistician, who generated a list of randomly ordered hospitals within each stratum. Our objective was to obtain data from at least 25% of the hospitals in each province and territory. To allow for the refusal to participate, the first 36% (n = 122) of the hospitals listed within each stratum were initially contacted.

Data collection

As a first step, we sought to obtain data on ED patient volumes, local 24/7 access to consultant support, imaging services, access to ICU beds and the distance to designated levels 1 and 2 trauma centres (see Hameed *et al*.²⁶ for the definition and identification of trauma centres), which was calculated with Google Maps.²⁷ This web-based mapping/geographic information system provides valid estimates of road distances at low cost, it has fewer usability problems than other similar systems,²⁸ and it has been used previously in healthcare.^{29 30}

Data were collected between July and December 2011 by research assistants as well as by medical students doing a research rotation. Data were collected from a questionnaire completed by the ED managers, and when necessary, a brief (10 min) telephone interview was administered to complete the missing data. Government databases and official websites (eg, those of provincial health ministries) were also used as sources of information.

Data entry and analysis

All data entry was verified by a second research assistant. Descriptive statistics are presented as percentages, means and SDs.

RESULTS

Of the 336 rural EDs that met the inclusion criteria, 122 (36%) were initially contacted in order to obtain a final sample of at least 25% of the EDs in each province and territory. In total, 95 EDs (28%) of Canadian rural EDs participated in the study (participation rate=78%). The proportions of rural EDs from each province and territory and the sociodemographic characteristics of the RSTs in question are presented in [tables 1](#) and [2](#). The location of the participating EDs and that of levels 1 and 2 trauma centres are shown in [figure 1](#). Data from Statistics Canada.³¹

See [figure 1](#) in a separate digital file named [Figure_1_map_Canada25](#).

The general characteristics of the rural EDs and the results concerning 24/7 access to services and consultants are presented in [tables 3](#) and [4](#). To summarise, RST hospitals had, on an average, 23 acute care beds and 7 ED stretchers and averaged 13 500 annual ED visits. Apart from basic laboratory and X-ray services, the majority of the rural EDs had limited access to

Table 1 Proportions of rural EDs included in the study by province or territory

Province or territory	EDs (n)	Proportion of rural EDs included in the study (%)
All	95	28
Alberta	17	26
British Columbia	9	26
Manitoba	12	27
New Brunswick	3	27
Ontario	17	27
Quebec	7	27
Saskatchewan	13	27
Nova Scotia	5	29
Newfoundland and Labrador	8	35
Nunavut	1	50
Prince Edward Island	1	100
Northwest Territories	1	100
Yukon	1	100

EDs, emergency departments.

professional and ancillary services. Forty-four per cent and 54% of the RST EDs are more than 300 km from a level 1 and level 2 trauma centre, respectively.

DISCUSSION

To the best of our knowledge, this is the first nationwide study examining access to services in Canada's rural EDs. The results of this study pertaining to a random sample of Canada's rural EDs suggest that these EDs have limited 24/7 local access to a CT scanner, consultants and an ICU. A considerable proportion of these rural hospitals are more than 300 km from levels 1 and 2 trauma centres.

Although the current study does not permit representative comparisons between provinces, since a sample (28%) of rural EDs was included in this study, we recently reported considerable differences in access to these services between BC and Quebec (QC).¹² In short, 73% of QC's rural EDs have 24/7 access to a CT scanner compared with only 3% for BC. With respect to support services, 81% of QC's rural EDs have a 24/7 on-call general surgeon compared with 12% for BC. Also, a greater proportion of QC's rural EDs are supported by

an ICU than of those in BC (88% vs 15%). It is still unclear whether the level of services offered in rural EDs reflects ED volumes and how the availability of these services affects interfacility transport issues and patient outcomes. It is also not known how different provincial policies influence the availability of these services. Nevertheless, these findings suggest potential nationwide variations in access to emergency care services.

A somewhat surprising finding in our study was the limited access to CT scanners in Canadian rural hospitals. These results significantly contrast with findings from US rural hospitals. CT scanners play an important role in the diagnosis and early triage of patients with acute and sometimes life-threatening illnesses, including stroke, major trauma, head injury, pulmonary embolism and abdominal pain. Urban and community hospitals have almost universal access to CT scanners, and their use during ED visits has increased 330%, from 3.2% of encounters in 1996 to 13.9% in 2007.³² Even if some of these examinations could be considered superfluous in the context of increased awareness of the risks of ionising radiation,³³ some clinical situations clearly require emergent CT scanning, and many guidelines and clinical decision rules can better guide its use.³⁴

The first CT scanner in a rural setting in Canada was installed in 1999 in Walkerton, Ontario, a town 160 km north of London (population of 5036 at the time).³⁵ It was installed as part of a pilot study, which was cut short because of positive outcomes. It is unclear why, according to our study, 80% of rural EDs do not have access to this technology more than a decade later. If we conservatively estimate the CT scanning needs at the rural hospitals studied to be 10% of emergency visits, an average of 1346 patients would require an interfacility transfer for this test alone.

Likewise, the impact of the minimal level of consultant and critical care services provided in rural hospitals should be examined from a viewpoint akin to that for CT services. Two Canadian studies examining the relationship between interfacility transport requirements and rural hospital services showed that most transfers from rural hospitals are for CT scanning, orthopaedic care, neurological diseases, and general surgical and critical care services.^{36 37} While a nationwide prospective study on interfacility transport processes is awaited, several salient questions remain. How many patients can

Table 2 Sociodemographic characteristics of the rural small towns in which the participating EDs were located

Sociodemographic characteristic	Mean	SD	Range
Population	5781.89	7247.96	172–45 212
Population density per km ²	216.81	219.20	0.6–956.1
Median age of the population	41.56	5.91	20.5–53.8
Median income (\$; people 15 years of age and over)	23 778.33	5772.15	3792–44 885
Median income after tax (\$; people 15 years of age and over)	21 735.48	4641.68	3792–37 985

EDs, emergency departments.

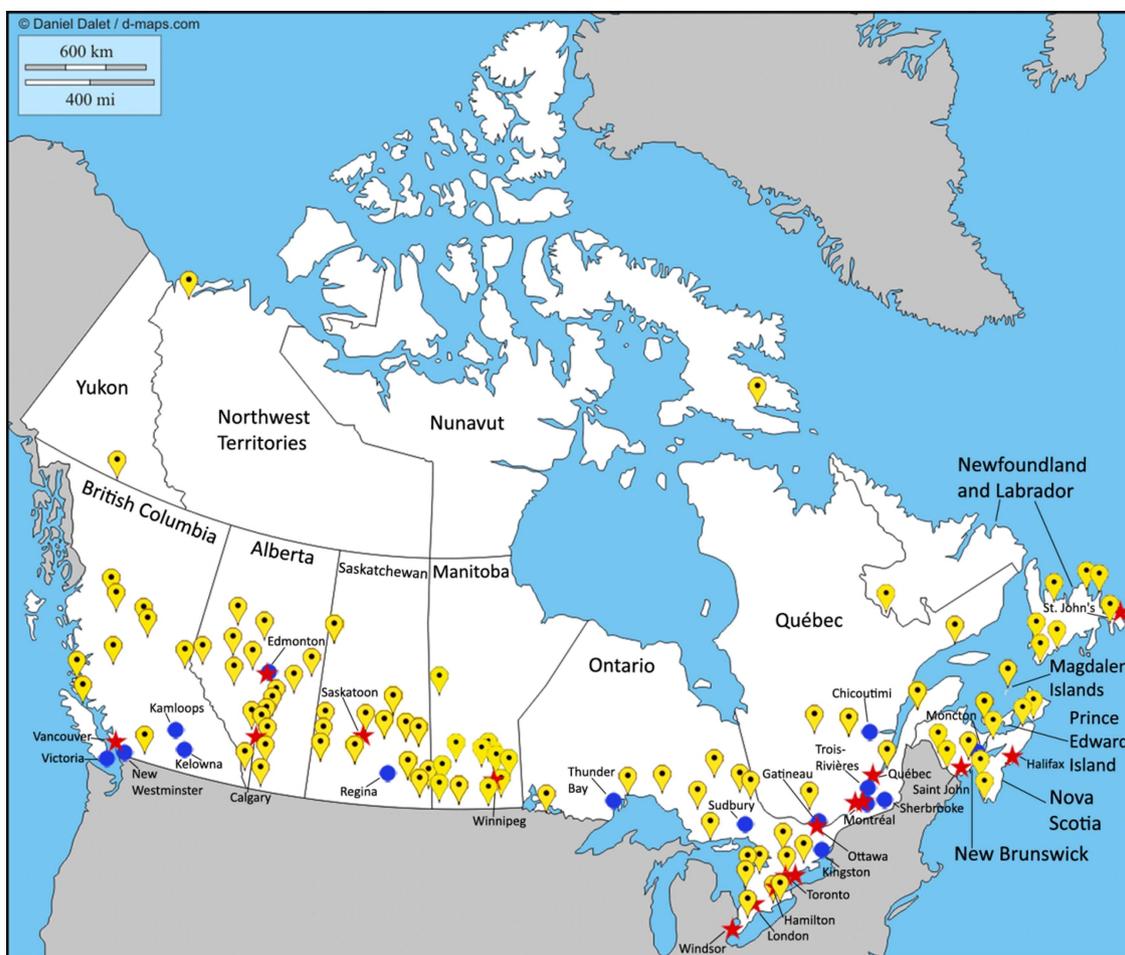


Figure 1 Location of the rural small town (RST) emergency departments (EDs) included in the study and that of levels 1 and 2 trauma centres. The RST EDs included in the study are identified on the map with yellow markers. Red stars represent level 1 trauma centres (see Hameed *et al*²⁶ for the definition of trauma centres). Blue circles represent level 2 trauma centres.

be safely managed in their communities? What reasonable level of local services should we provide to optimise the use of interfacility transport? As reported in this study, the limited level of services available in rural EDs likely requires more interfacility transport. How cost-effective, timely and safe an alternative this is to providing more services rurally needs to be determined?

Our finding that 44% of EDs are more than 300 km from a level 1 trauma centre and that 54% are more than 300 km from a level 2 trauma centre is troubling,

Table 3 General characteristics of the 95 Canadian rural EDs participating in the study

Annual ED patient visits (mean±SD)	13 458±8853
ED stretchers (mean±SD)	6.8±3.9
Acute care beds (mean±SD)	23.0±17.7
Long-term beds (mean±SD)	18.7±23.8
Local ICU	16.8% (n=16/95)
EDs>300 km from a level 1 trauma centre	44.2% (n=42/95)
EDs>300 km from a level 2 trauma centre	54.4% (n=37/68)*

*This proportion was calculated for 68 EDs because 27 (28.4%, n=27/95) do not have access to a level 2 trauma centre, according to Hameed *et al*'s list.²⁶

ED, emergency department; ICU, intensive care unit.

Table 4 Proportion of 24/7 access to consultants, equipment and services in the 95 Canadian rural EDs participating in the study

Consultants	Per cent (n)
Neurologist	0 (0/95)
Paediatrician	5.3 (5/95)
Orthopaedist	6.3 (6/95)
Obstetrician/gynaecologist	9.5 (9/95)
Psychiatrist	10.5 (10/95)
Internist	11.6 (11/95)
Surgeon	26.3 (25/95)
Equipment and services	
MRI	2.1 (2/95)
CT scanner	20.0 (19/95)
Ultrasound	28.4 (27/95)
Bedside ultrasound	48.4 (46/95)
Basic X-ray	96.8 (92/95)
Laboratory	98.9 (94/95)

EDs, emergency departments.

given the limited resources. There are clear benefits to managing trauma patients at these tertiary centres within the albeit debated timeframe of the 'golden hour'.³⁸ However, these distances decrease the likelihood of patients obtaining this standard of care. Improving the level of local services and training of emergency professionals has been proposed as a solution to improving outcomes. Trauma care is particularly important in rural areas, where people are at greater risk for trauma and trauma death than their urban counterparts.^{19–23} For example, Gomez *et al*²¹ observed that this risk was threefold greater for Ontario's rural residents than for urban residents.

In order to legislate in favour of improved access to care in rural areas, evidence-based standards are required. The latest guidelines on the subject by the Canadian Association of Emergency Physicians were written in the context of healthcare cuts and associated risks for patients.³⁹ This report was mainly based on expert opinion in the context of limited evidence on the subject at the time. The report did not make any specific recommendations as to the level of healthcare services that should be provided locally in rural EDs.

Meanwhile, the province of QC has published provincial guidelines with sections addressing rural emergency care.⁴⁰ The QC guide defines what support services an ED should receive, based on the hospital's designation. That designation is determined by several factors, including the annual number of patient visits. In 2006, this guide was revised with the goal of making all stakeholders accountable for quality of care in EDs. It is unclear whether QC has been successful in implementing these recommendations or whether they have led to an increased access to quality care. We are conducting a study to examine this issue.⁴¹

Finally, in light of these results, as well as those from the landmark study by Joynt *et al*,⁹ which showed poor outcomes for rural patients, Canadian healthcare professionals and decision-makers should be pressed to examine the impact of the current level of health services available in rural EDs on patient outcomes and begin to think about solutions so that Canadians can access quality care no matter where they reside or visit. Otherwise, the spirit of Canada's universal healthcare system, which is considered a defining feature of this country, would not be respected.

LIMITATIONS

This study relied on information provided through questionnaires and brief telephone interviews with local healthcare providers. Information was obtained mainly from one source, and cross-checking with other databases was not possible. However, the information requested was straightforward and probably easily accessed by professionals working in these small RST EDs.

To the best of our knowledge, the information obtained on 24/7 access to services in this study is not

easily or reliably accessible through standardised databases in Canada (Wu J. *Program Lead, Decision Support Services, Clinical Administrative Databases, Canadian Institute for Health Information (CIHI)*, personal communication, 2013). Despite all the efforts to select a nationally representative sample of rural EDs from a random list for each province and territory, unique centres with higher or lower levels of local service resources may have been missed. Also, some hospitals may have refused to participate in the study because they are well equipped in terms of imaging or consulting services and may have been less interested in the project. However, the high overall participation rate minimises this potential selection bias.

Another limitation of our study is the lack of estimation of the travel time to levels 1 and 2 trauma centres in combination with the distance estimations. Total inter-facility transfer times (call from rural EDs to arrival at levels 1 and 2 trauma centres) would better represent the care pathways of these patients factoring in weather, geography, roadwork and of course overall transport capabilities. We are planning such a study.

Finally, we reported population statistics on the RSTs where the hospitals were located. We did not obtain data on the hospitals' service areas. It would have been interesting to estimate the populations and the size of the territories served by these rural hospitals. Our experience with this information in a pilot study is that it is difficult to reliably obtain and verify.¹²

CONCLUSION

This preliminary report on a national random sample of Canadian rural EDs suggests that there is limited access to advanced imaging and consultant services in these areas. A larger nationwide study is required to confirm these findings and permit meaningful interprovincial comparisons. Ultimately, a study aimed at examining the relationship between the level of service, interfacility transport requirements and patient outcomes is required. It would be helpful for provinces to uniformly collect, update and verify the data on the services provided in rural hospitals and to provide a better access to these databases.

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Contributors RF had the original idea, designed the study, drafted the first version of the manuscript and is responsible for the final version. JP and PA assisted with the study design, the literature research and editing of the manuscript. JV and JM-G contributed to the study coordination, data analysis

and preparation of the manuscript. All authors contributed to and have approved the final manuscript.

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Competing interests None.

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Data sharing statement Data will not be automatically shared or distributed in a public forum. However, data will be made available on request to the corresponding author on a case-by-case basis.

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REFERENCES

1. Statistics Canada. *Canada's rural population since 1851—population and dwelling counts 2011 Census*. Ottawa 2012.
2. Fleet R, Archambault P, Plant J, *et al*. Access to emergency care in rural Canada: should we be concerned? *CJEM* 2013;15:191–3.
3. McGregor J, Hanlon N, Emmons S, *et al*. If all ambulances could fly: putting provincial standards of emergency care access to the test in Northern British Columbia. *Can J Rural Med* 2005;10:163–8.
4. Ministries of Health Services and Health Planning. *Standards of accessibility and guidelines for provision of sustainable acute care services by health authorities*. Victoria: Government of British Columbia, 2002.
5. Thompson JM, McNair NL. Health care reform and emergency outpatient use of rural hospitals in Alberta, Canada. *J Emerg Med* 1995;13:415–21.
6. Fleet R, Plant J, Ness R, *et al*. Patient advocacy by rural emergency physicians after major service cuts: the case of Nelson, BC. *Can J Rural Med* 2013;18:56–61.
7. Hildebrandt A. Provinces team up to block CBC's hospital data request—Cross-country denials raise questions about accountability, professor says. *CBC News*, 2013.
8. Minister of Justice. *Canada Health Act*. Ottawa: Government of Canada, 2012.
9. Joynt KE, Harris Y, Orav EJ, *et al*. Quality of care and patient outcomes in critical access rural hospitals. *JAMA* 2011;306:45–52.
10. Lichtman JH, Leifheit-Limson EC, Jones SB, *et al*. 30-Day risk-standardized mortality and readmission rates after ischemic stroke in critical access hospitals. *Stroke* 2012;43:2741–7.
11. Ginde AA, Foianini A, Renner DM, *et al*. Availability and quality of computed tomography and magnetic resonance imaging equipment in U.S. emergency departments. *Acad Emerg Med* 2008;15:780–3.
12. Fleet R, Audette LD, Marcoux J, *et al*. Comparison of access to services in rural emergency departments in Quebec and British Columbia. *CJEM* 2013;15:1–12.
13. Bosk EA, Veinot T, Iwashyna TJ. Which patients and where: a qualitative study of patient transfers from community hospitals. *Med Care* 2011;49:592–8.
14. Hains IM, Marks A, Georgiou A, *et al*. Non-emergency patient transport: what are the quality and safety issues? A systematic review. *Int J Qual Health Care* 2011;23:68–75.
15. Harrington DT, Connolly M, Biffi WL, *et al*. Transfer times to definitive care facilities are too long: a consequence of an immature trauma system. *Ann Surg* 2005;241:961–6; discussion 66–8.
16. Branas C, Masckenzie E, Williams J, *et al*. Access to trauma centers in the United States. *JAMA* 2005;293:2626–33.
17. Carr BG, Caplan JM, Pryor JP, *et al*. A meta-analysis of prehospital care times for trauma. *Prehosp Emerg Care* 2006;10:198–206.
18. Schuurman N, Bell N, Hameed MS, *et al*. A model for identifying and ranking need for trauma service in nonmetropolitan regions based on injury risk and access to services. *J Trauma* 2008;65:54–62.
19. Fatovich DM, Phillips M, Langford SA, *et al*. A comparison of metropolitan vs rural major trauma in Western Australia. *Resuscitation* 2011;82:886–90.
20. Fatovich DM, Jacobs IG. The relationship between remoteness and trauma deaths in Western Australia. *J Trauma* 2009;67:910–14.
21. Gomez D, Berube M, Xiong W, *et al*. Identifying targets for potential interventions to reduce rural trauma deaths: a population-based analysis. *J Trauma* 2010;69:633–9.
22. Simons R, Brasher P, Taulu T, *et al*. A population-based analysis of injury-related deaths and access to trauma care in rural-remote Northwest British Columbia. *J Trauma* 2010;69:11–19.
23. Bell N, Simons RK, Lakha N, *et al*. Are we failing our rural communities? Motor vehicle injury in British Columbia, Canada, 2001–2007. *Injury* 2012;43:1888–91.
24. du Plessis V, Beshiri R, Bollman RD, *et al*. *Definitions of rural. Rural and small town Canada analysis bulletin*. Ottawa: Statistics Canada, 2001:1–17. Catalogue no.21-006-XIE.
25. Canadian Healthcare Association. *Guide to Canadian healthcare facilities 2009–2010*. Ottawa: CHA Press, 2009.
26. Hameed SM, Schuurman N, Razek T, *et al*. Access to trauma systems in Canada. *J Trauma* 2010;69:1350–61.
27. Google. Google maps. Secondary Google maps 2013. <https://maps.google.ca/maps?hl=fr&tab=ll>
28. Nivala AM, Brewster S, Sarjakowski TL. Usability evaluation of web mapping sites. *Cartographic J* 2008;45:129–38.
29. Kobayashi S, Fujioka T, Tanaka Y, *et al*. A geographical information system using the Google Map API for guidance to referral hospitals. *J Med Syst* 2010;34:1157–60.
30. Masino C, Rubinstein E, Lem L, *et al*. The impact of telemedicine on greenhouse gas emissions at an academic health science center in Canada. *Telemed J E Health* 2010;16:973–6.
31. Statistics Canada. 2006 Community Profiles. Secondary 2006 Community Profiles 2006. <http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm>
32. Kocher KE, Meurer WJ, Fazel R, *et al*. National trends in use of computed tomography in the emergency department. *Ann Emerg Med* 2011;58:452–62 e3.
33. Griffey RT, Sodickson A. Cumulative radiation exposure and cancer risk estimates in emergency department patients undergoing repeat or multiple CT. *AJR Am J Roentgenol* 2009;192:887–92.
34. Haydon NB. Head injury: audit of a clinical guideline to justify head CT. *J Med Imaging Radiat Oncol* 2013;57:161–8.
35. Merkens B, Mowbray R, Creeden L, *et al*. A rural CT scanner: evaluating the effect on local health care. *Can Assoc Radiol J* 2006;57:224–31.
36. Rourke J, Kennard M. Emergency patient transfers from rural hospitals: a regional study. *CJEM* 2001;3:296–301.
37. De Freitas TL, Spooner GR, Szafran O. Admissions and transfers from a rural emergency department. *Can Fam Physician* 1998;44:789–95.
38. Fleet R, Poitras J. Have we killed the golden hour of trauma? *Ann Emerg Med* 2011;57:73–4; author reply 74–5.
39. Canadian Association of Emergency Physicians. *Recommendations for the management of rural, remote and isolated emergency health care facilities in Canada*. Ottawa: CAEP, 1997.
40. Ministère de la Santé et des Services sociaux du Québec. *Guide de gestion de l'urgence*. Québec: Gouvernement du Québec, 2006.
41. Fleet R, Archambault P, Legare F, *et al*. Portrait of rural emergency departments in Quebec and utilisation of the Quebec Emergency Department Management Guide: a study protocol. *BMJ Open* 2013;3:pii: e002961.

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