

# Geographic Access to Primary Care and Hospital Services for Rural and Northern Communities

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Report to the Ontario Ministry of  
Health and Long-Term Care

JANUARY 2011

**ICES** Institute for Clinical  
Evaluative Sciences

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Health and Long-Term Care

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# About the Institute for Clinical Evaluative Sciences

The Institute for Clinical Evaluative Sciences (ICES) is an independent, non-profit organization that produces knowledge to enhance the effectiveness of health care for Ontarians. Internationally recognized for its innovative use of population-based health information, ICES' evidence supports health policy development and guides changes to the organization and delivery of health care services.

Key to our work is our ability to link population-based health information, at the patient-level, in a way that ensures the privacy and confidentiality of personal health information. Linked databases reflecting 13 million of 33 million Canadians allow us to follow patient populations through diagnosis and treatment, and to evaluate outcomes.

ICES brings together the best and the brightest talent from across Ontario. Many of our scientists are not only internationally recognized leaders in their fields but are also practicing clinicians who understand the grassroots of health care delivery, making the knowledge produced at ICES clinically focused and useful in changing practice. Other team members have statistical training, epidemiological backgrounds, project management or communications expertise. The variety of skill sets and educational backgrounds ensures a multi-disciplinary approach to issues and creates a real-world mosaic of perspectives that is vital to shaping Ontario's future health care system.

ICES receives core funding from the Ontario Ministry of Health and Long-Term Care. In addition, our faculty and staff compete for peer-reviewed grants from federal funding agencies, such as the Canadian Institutes of Health Research, and project-specific funds are received from provincial and national organizations. These combined sources enable ICES to have a large number of projects underway, covering a broad range of topics. The knowledge that arises from these efforts is produced independent of our funding bodies, which is critical to our success as Ontario's objective, credible source of *Evidence Guiding Health Care*.

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# Executive Summary

## Issue

What is the geographic access to care by car in Ontario's rural and northern areas?

## Study

The study identified primary care providers, emergency departments, hospitals providing obstetrical delivery care and hospitals with highly specialized services. Travel times of 30, 60 and 240 minutes by car at posted speed limits were calculated to these facilities for Ontario communities with 30,000 or fewer residents.

## Implications

Primary care and urgent care are highly accessible to Ontario communities with 30,000 or fewer people. The results of this study will provide decision-makers with useful information about access to care, and may be used by Government to support future policy decisions.

## KEY FINDINGS

- In 2009, communities with 30,000 or fewer residents comprised 2,588,144 people—approximately 22.7% of the Ontario population.
- Of these people, 99.6% had access to a primary care provider (family physician or nurse in an independent remote nursing station) within 30 minutes, increasing to 99.9% within 60 minutes. All Ontario communities with a population of at least 1,000 people had access to primary care within 60 minutes.
- Emergency departments were accessible within 30 minutes for 97.8% of the population in communities of 30,000 or fewer people and within 60 minutes for 99.0% of that population. All Ontario communities with a population of at least 5,000 people had access to an emergency department within 30 minutes.
- Hospitals with obstetrical delivery beds were accessible to 93.8% of the population in communities of 30,000 or fewer people within 30 minutes and 98.1% within 60 minutes.
- Highly specialized hospitals were less accessible but were still located within a 60-minute drive for 72.2% of Ontario's population living in communities of 30,000 or fewer people.



Ontario is Canada's most populous province, with over 13 million people, and its second largest in area, covering more than one million square kilometres.

The majority of the population lives in urban centres, but there is a substantial population living in rural and northern areas. A large number of Ontario communities are small and, given the vast size of the province, many are geographically remote from major cities. Health care requires highly-trained personnel and specialized equipment, facilities and transportation systems, making its provision in smaller centres especially challenging. Geographic access to care in Ontario has been an important focus for the Ministry of Health and Long-Term Care's Rural and Northern Health Care Panel.<sup>1</sup> The Panel was established to provide a vision, strategic directions and principles to assist the Ministry and the 14 Local Health Integration Networks (LHINs) in ensuring appropriate access and delivery of quality care in rural and northern communities. While geographic access is not always sufficient for people to access the health care they need, it is an essential prerequisite for care. For example, geographic proximity to a family doctor may not necessarily mean that doctor is taking on new patients.

## Objective

The objective of the study was to estimate the number and proportion of people in Ontario communities with populations of 30,000 or less that were within 30, 60 and 240 minutes of travel time by car (at posted speed limits) from services that were likely to be available 24 hours a day, seven days a week ('24/7'). These services included:

- primary care providers (general practitioner/family physician or nurse in an independent remote nursing station)
- emergency departments
- hospitals providing obstetrical delivery care
- hospitals providing specialized care

## Methods

All populations and proportions used in this report were limited to communities with a population of 30,000 or less. These communities were selected from 'communities' and 'municipalities' data layers acquired under the Ontario Geospatial Data Exchange program. For more details, please see the [Technical Appendix](#).

Primary care providers included general practitioners/family physicians and nurses in independent remote nursing stations.\* Emergency departments were open 24/7 and were located in hospitals with inpatient beds. Hospitals providing obstetrical delivery care were those listed as having those services in available data. Hospitals providing specialty care included trauma centres, burn units, interventional cardiology centres and neurosurgical centres.

The data sources used to identify Ontario communities and roads, the locations of health care personnel and facilities and the definitions of each type of provider and facility appear in the [Technical Appendix](#).

The main method used for this project was network analysis, which calculates travel time from a departure point outwards through all existing roads using their posted speed limits. For example, a 30-minute driving time on all roads around a physician's office was calculated, and all communities within that road network were counted as having geographic access to that physician. When calculating the percentage of the population with access to services, the populations of communities that had access on the road network were added together and then divided by the total population of Ontario communities with 30,000 or fewer people.

The presence of different types of hospital services was verified by each of Ontario's Local Health Integration Networks (LHINs).

\*Nurse practitioner-led clinics were not included in this analysis. Twenty-five of these clinics are scheduled to be operational by the end of 2012.

In 2009, communities with 30,000 or fewer people comprised 2,588,144 people—approximately 22.7% of the Ontario population.

This included 346,198 people (38.9% of the population) in northern Ontario and 2,241,946 people (21.3%) in southern Ontario. The population of remote communities (defined as communities that were not on the road network) was 25,605, which comprised 0.22% of the total Ontario population and 0.99% of communities with 30,000 or fewer people.

Among Ontarians living in communities with 30,000 or fewer residents (Exhibit 1):

- 99.6% had access to a primary care provider (family physician or nurse in an independent remote nursing station) within 30 minutes, increasing to 99.9% within 60 minutes.
- Emergency departments were accessible to 97.8% of the population within 30 minutes and 99.0% within 60 minutes.
- Hospitals providing obstetrical delivery care were accessible to 93.8% of the population within 30 minutes and 98.1% within 60 minutes.
- Hospitals with specialized services (trauma centres, burn units, interventional cardiology centres and neurosurgical centres) were accessible to 40.5% of the population within 30 minutes, 72.2% within 60 minutes and 96.5% within 240 minutes.

The patterns seen on the maps illustrate that 68 communities were more than 30 minutes from a source of primary care, including 59 in northern Ontario (Exhibit 2) and nine in southern Ontario (Exhibit 3). Of the 68 communities, 57 had populations of less than 250 people, 10 had populations of between 250 and 1,000, and one had a population of between 1,000 and 5,000 people.

There were 25 communities lacking access to any source of primary care within 60 minutes. Eighteen of these communities were in northern Ontario and seven were in southern Ontario. All but three of the 18 communities had populations of less than 250 people, and none of these communities had more than 1,000 people. Of these communities, three were remote (defined as not being on the road network).

Of the 185 communities that were more than 30 minutes travel time from an emergency department, 131 were in northern Ontario (Exhibit 4) and 54 were in southern Ontario (Exhibit 5). Nine of these communities had populations of over 1,000 people and none had more than 5,000 people. Of the 131 northern Ontario communities with no access to an emergency department within 30 minutes, 27 were remote.

Fifty-five communities did not have access to an emergency department within 60 minutes—all were in northern Ontario and none had more than 5,000 people. Of these 55 communities, 27 were remote.

# Exhibit 1

Percentage of the population that has access to various health services within 30, 60 and 240 minutes travel time by car, in Ontario communities with 30,000 or fewer residents and for the entire province

Categories	Number of providers/institutions	Population within 30 minutes % (n)	Population within 60 minutes % (n)	Population within 240 minutes % (n)
<b>ANY PRIMARY CARE PROVIDER*</b>				
Among Ontario communities with 30,000 or fewer people	12,652	99.6 (2,578,782)	99.9 (2,585,008)	N/A
Among the entire Ontario population		99.9 (11,414,641)	100 (99.97) (11,420,867)	
<b>EMERGENCY DEPARTMENTS</b>				
Among Ontario communities with 30,000 or fewer people	162	97.8 (2,530,363)	99.0 (2,562,489)	N/A
Among the entire Ontario population		99.5 (11,366,222)	99.8 (11,398,348)	
<b>HOSPITALS PROVIDING OBSTETRICAL DELIVERY CARE</b>				
Among Ontario communities with 30,000 or fewer people	105	93.8 (2,427,705)	98.1 (2,537,877)	N/A
<b>HOSPITALS WITH SPECIALIZED SERVICES**</b>				
Among Ontario communities with 30,000 or fewer people	22	40.5 (1,048,845)	72.2 (1,869,811)	96.5 (2,497,756)

\*Family physicians or nurses in independent remote nursing stations

\*\*Trauma centres, burn units, interventional cardiology centres, neurosurgical centres

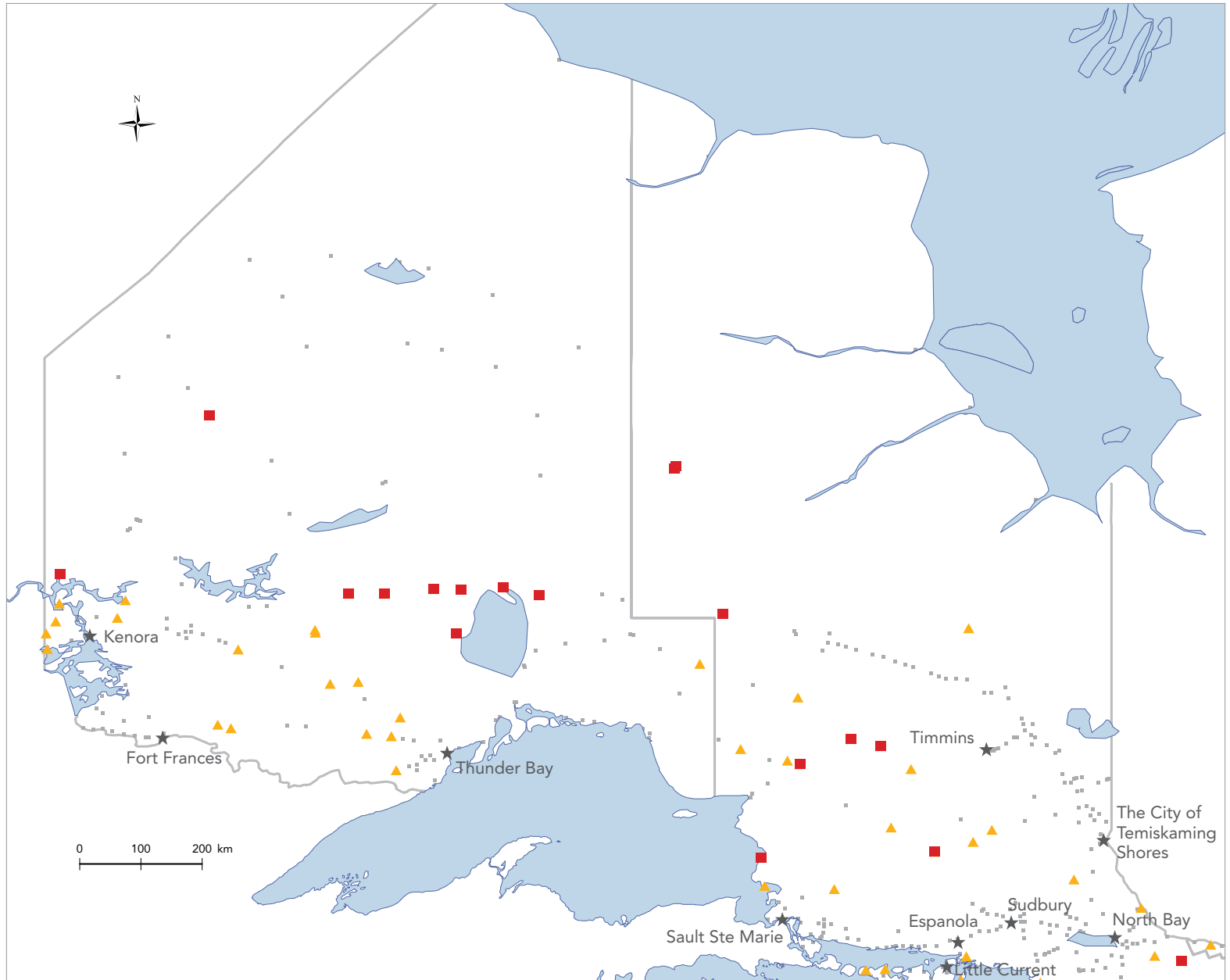
# Exhibit 2

## NORTH VIEW

Ontario communities with 30,000 or fewer residents that are beyond 30 and 60 minutes travel time by car to the nearest primary care provider\*

### LEGEND

- Community more than 60 minutes to the nearest service location
- ▲ Community more than 30 minutes to the nearest service location
- Community with 30,000 or fewer residents
- ★ Larger urban centre
- LHIN boundary



\*Family physicians or nurses in independent remote nursing stations

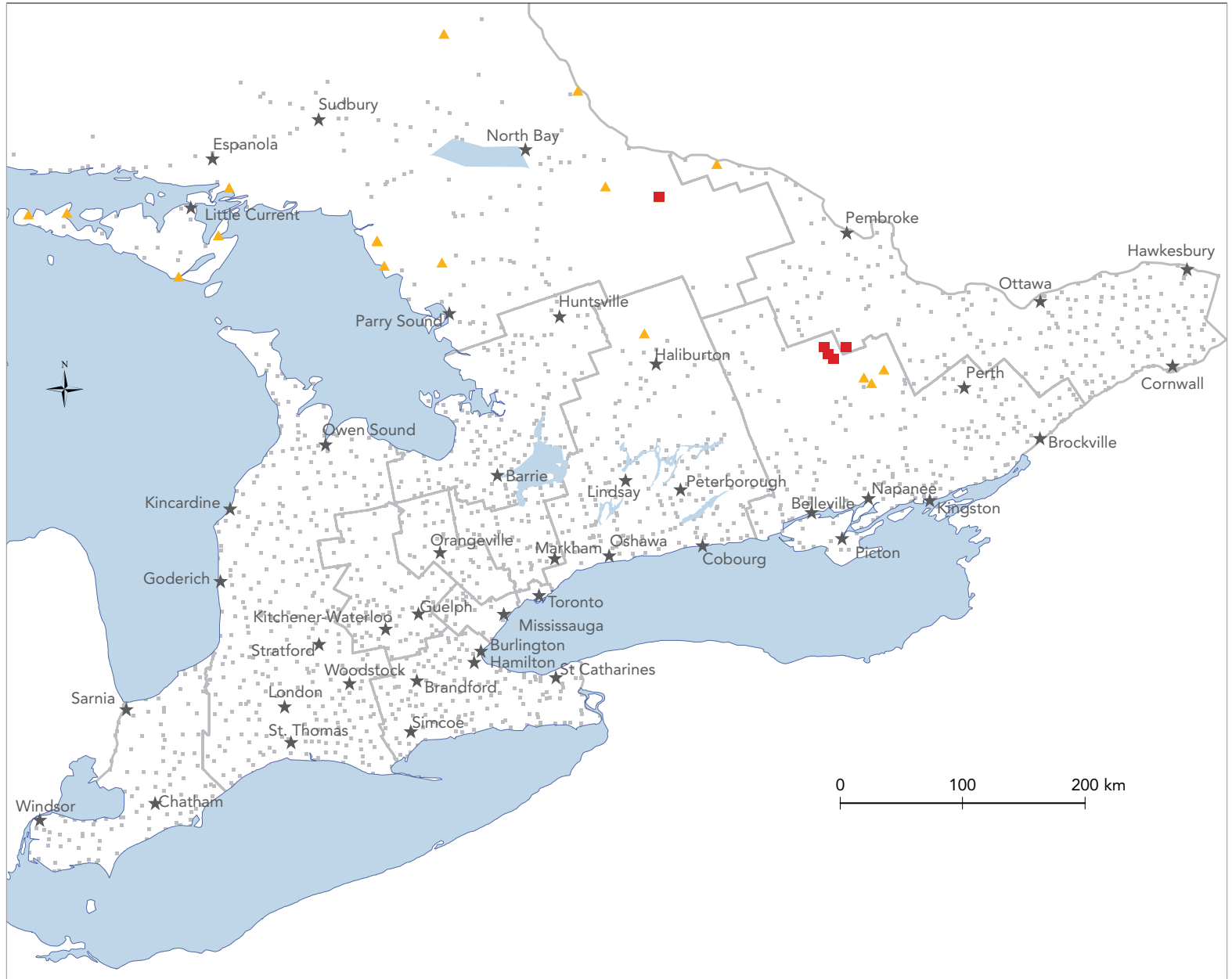
# Exhibit 3

## SOUTH VIEW

Ontario communities with 30,000 or fewer residents that are beyond 30 and 60 minutes travel time by car to the nearest primary care provider\*

### LEGEND

- Community more than 60 minutes to the nearest service location
- ▲ Community more than 30 minutes to the nearest service location
- Community with 30,000 or fewer residents
- ★ Larger urban centre
- LHIN boundary



\*Family physicians or nurses in independent remote nursing stations

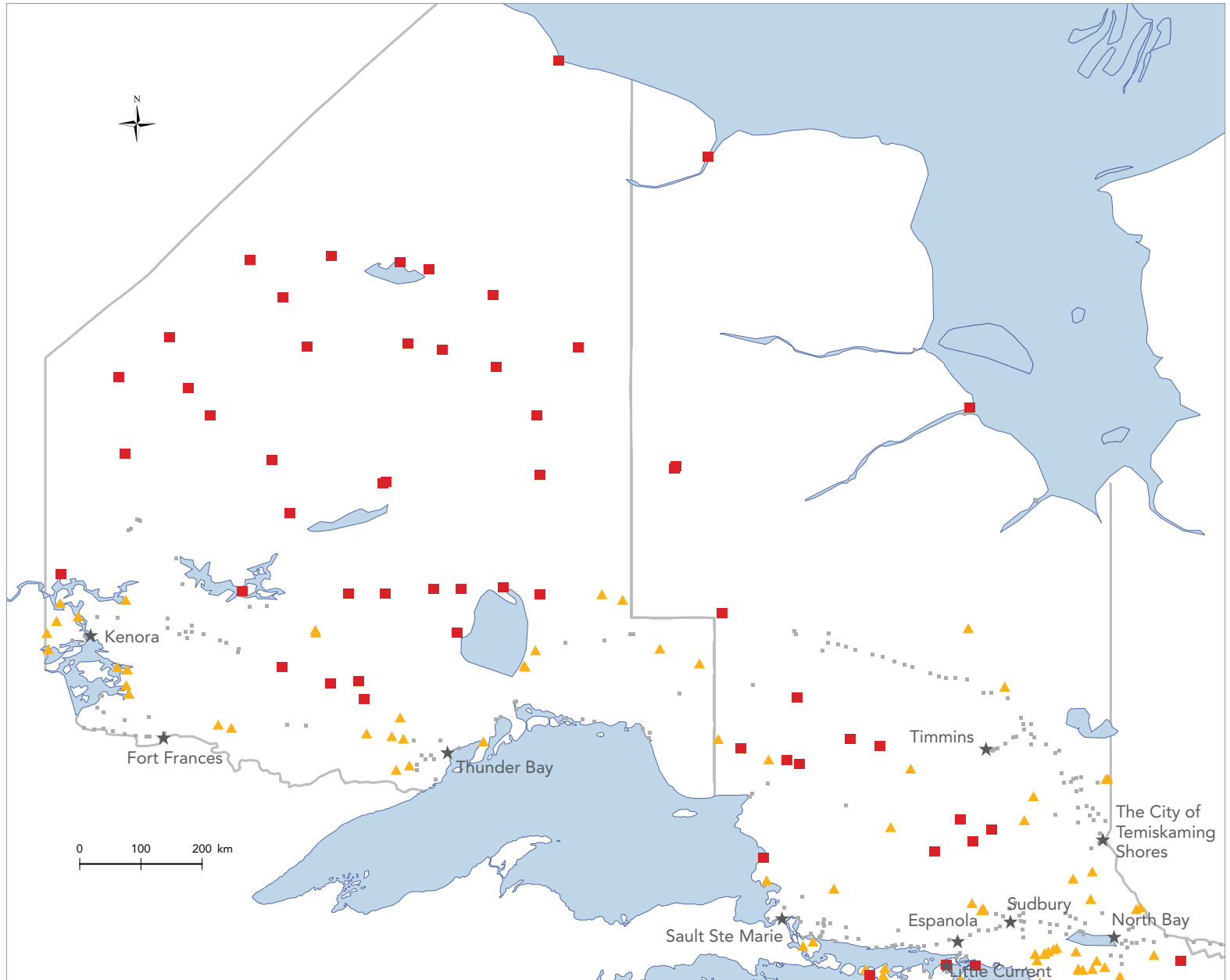
# Exhibit 4

## NORTH VIEW

Ontario communities with 30,000 or fewer residents that are beyond 30 and 60 minutes travel time by car to the nearest emergency department

### LEGEND

- Community more than 60 minutes to the nearest service location
- ▲ Community more than 30 minutes to the nearest service location
- Community with 30,000 or fewer residents
- ★ Larger urban centre
- LHIN boundary



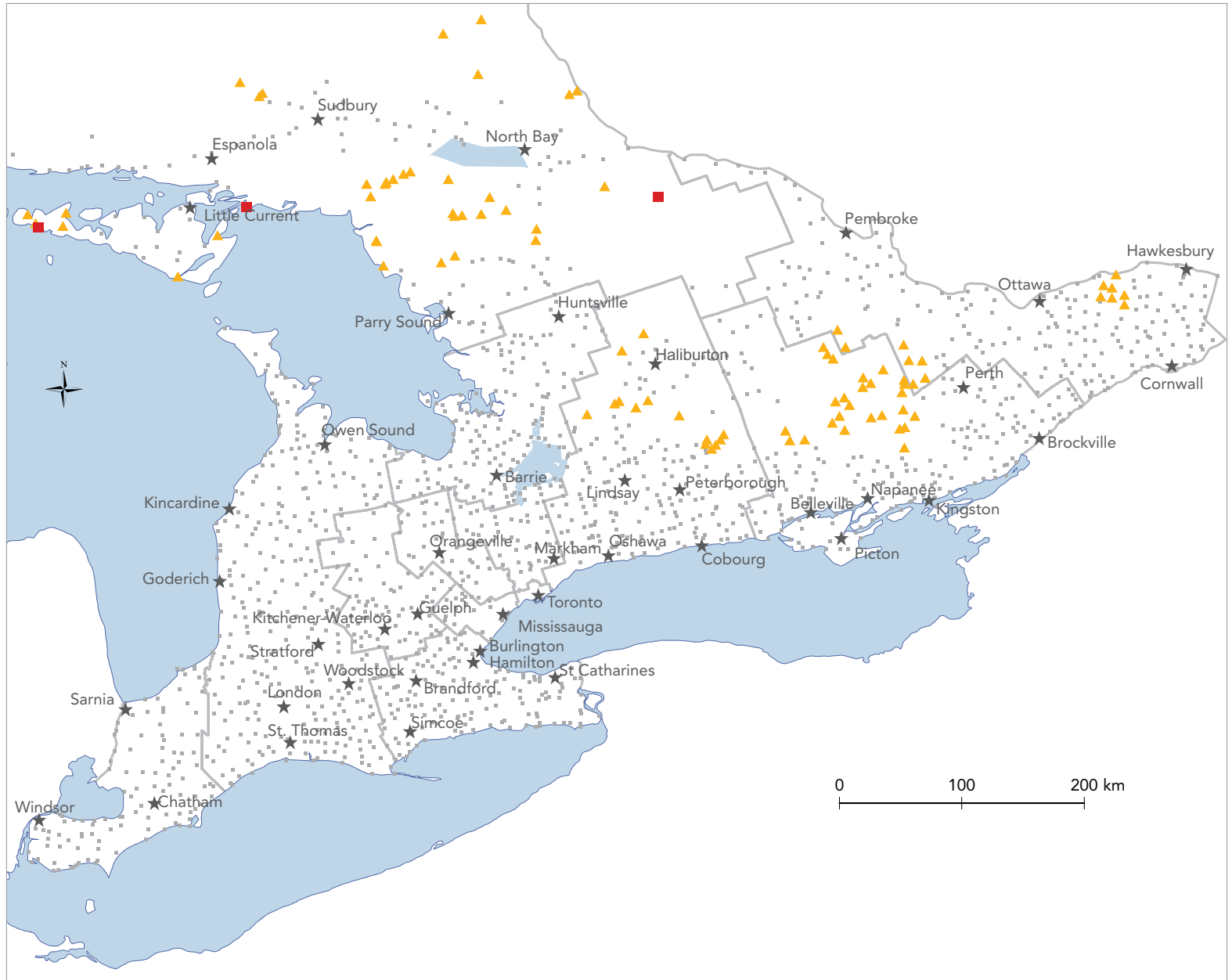
# Exhibit 5

## SOUTH VIEW

Ontario communities with 30,000 or fewer residents that are beyond 30 and 60 minutes travel time by car to the nearest emergency department

### LEGEND

- Community more than 60 minutes to the nearest service location
- ▲ Community more than 30 minutes to the nearest service location
- Community with 30,000 or fewer residents
- ★ Larger urban centre
- LHIN boundary



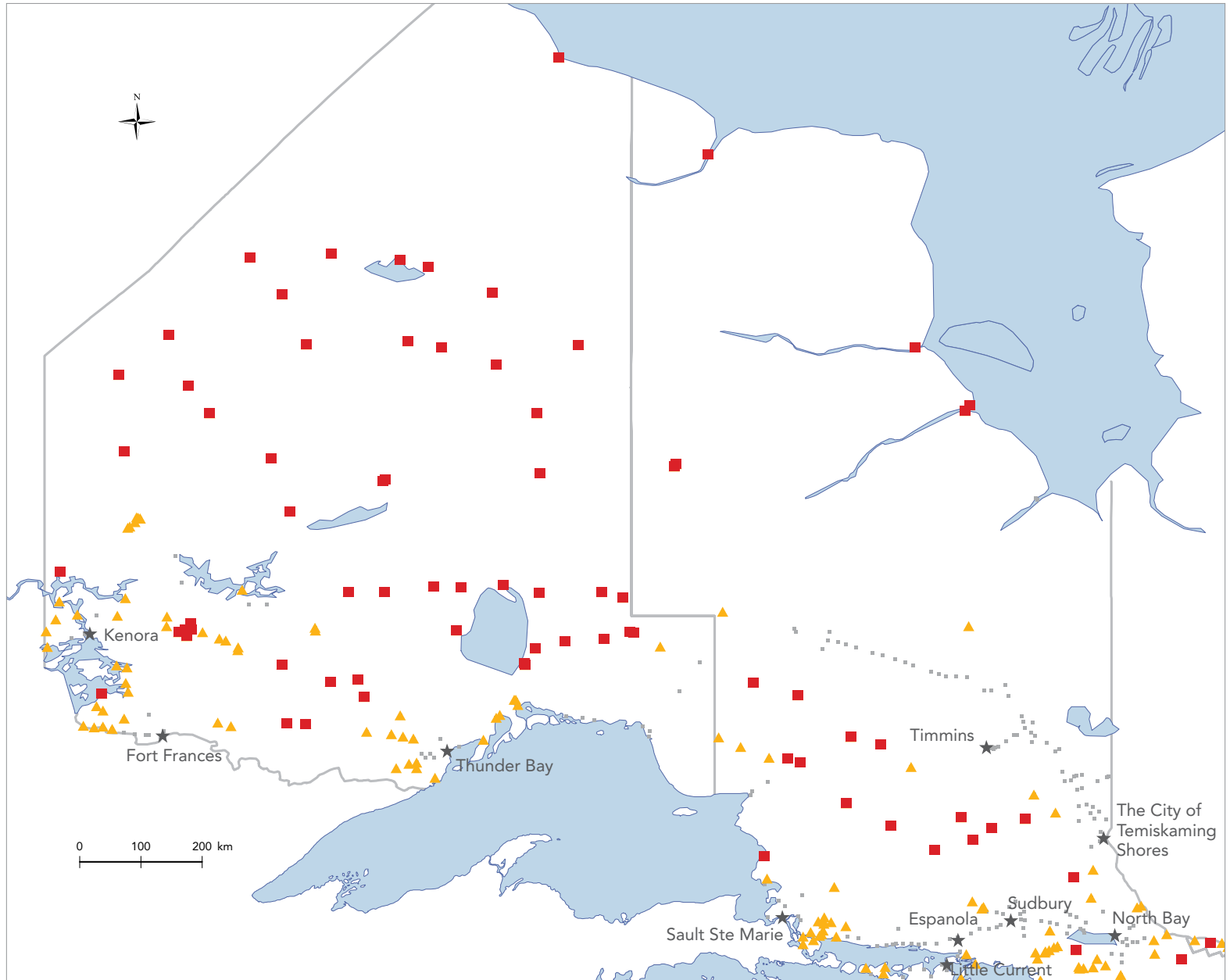
# Exhibit 6

## NORTH VIEW

Ontario communities with 30,000 or fewer residents that are beyond 30 and 60 minutes travel time by car to the nearest hospital providing obstetrical delivery care

### LEGEND

- Community more than 60 minutes to the nearest service location
- ▲ Community more than 30 minutes to the nearest service location
- Community with 30,000 or fewer residents
- ★ Larger urban centre
- LHIN boundary





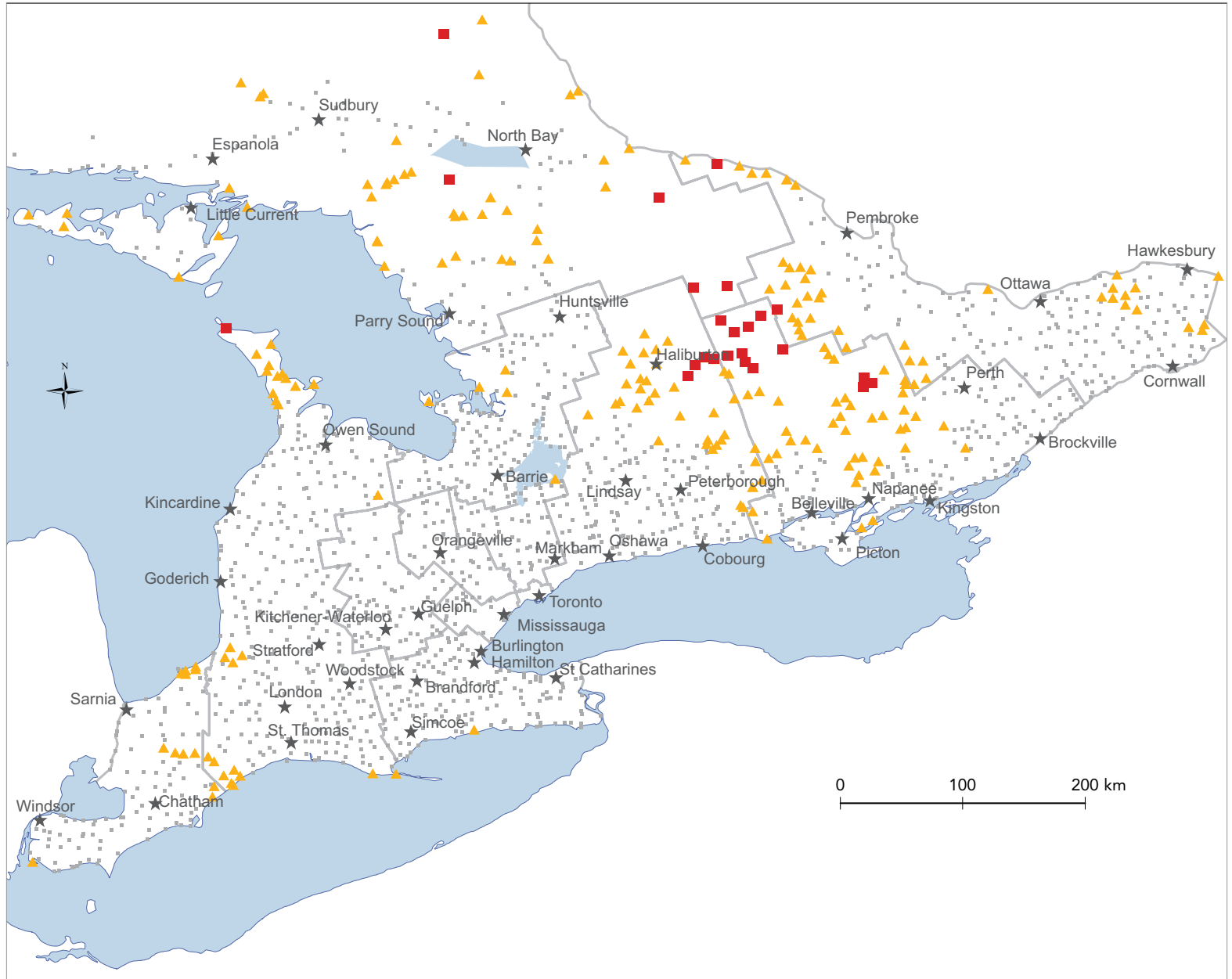
# Exhibit 7

## SOUTH VIEW

Ontario communities with 30,000 or fewer residents that are beyond 30 and 60 minutes travel time by car to the nearest hospital providing obstetrical delivery care

### LEGEND

- Community more than 60 minutes to the nearest service location
- ▲ Community more than 30 minutes to the nearest service location
- Community with 30,000 or fewer residents
- ★ Larger urban centre
- LHIN boundary



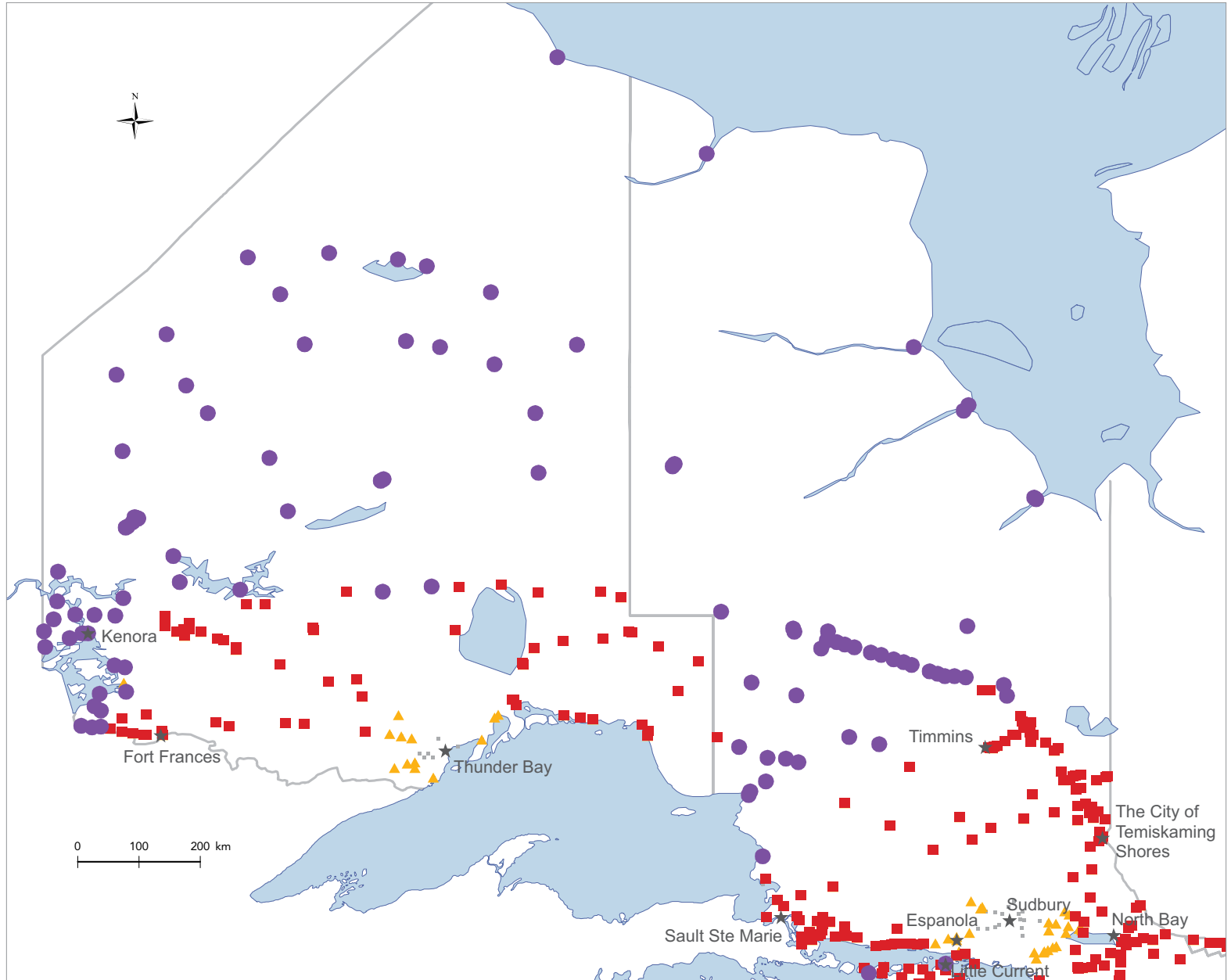
# Exhibit 8

## NORTH VIEW

Ontario communities with 30,000 or fewer residents beyond 30, 60 and 240 minutes travel time by car to the nearest hospital with specialized services\*

### LEGEND

- Community more than 240 minutes to the nearest service location
- Community more than 60 minutes to the nearest service location
- ▲ Community more than 30 minutes to the nearest service location
- Community with 30,000 or fewer residents
- ★ Larger urban centre
- LHIN boundary



\*Trauma centres, burn units, interventional cardiology centres, neurosurgical centres

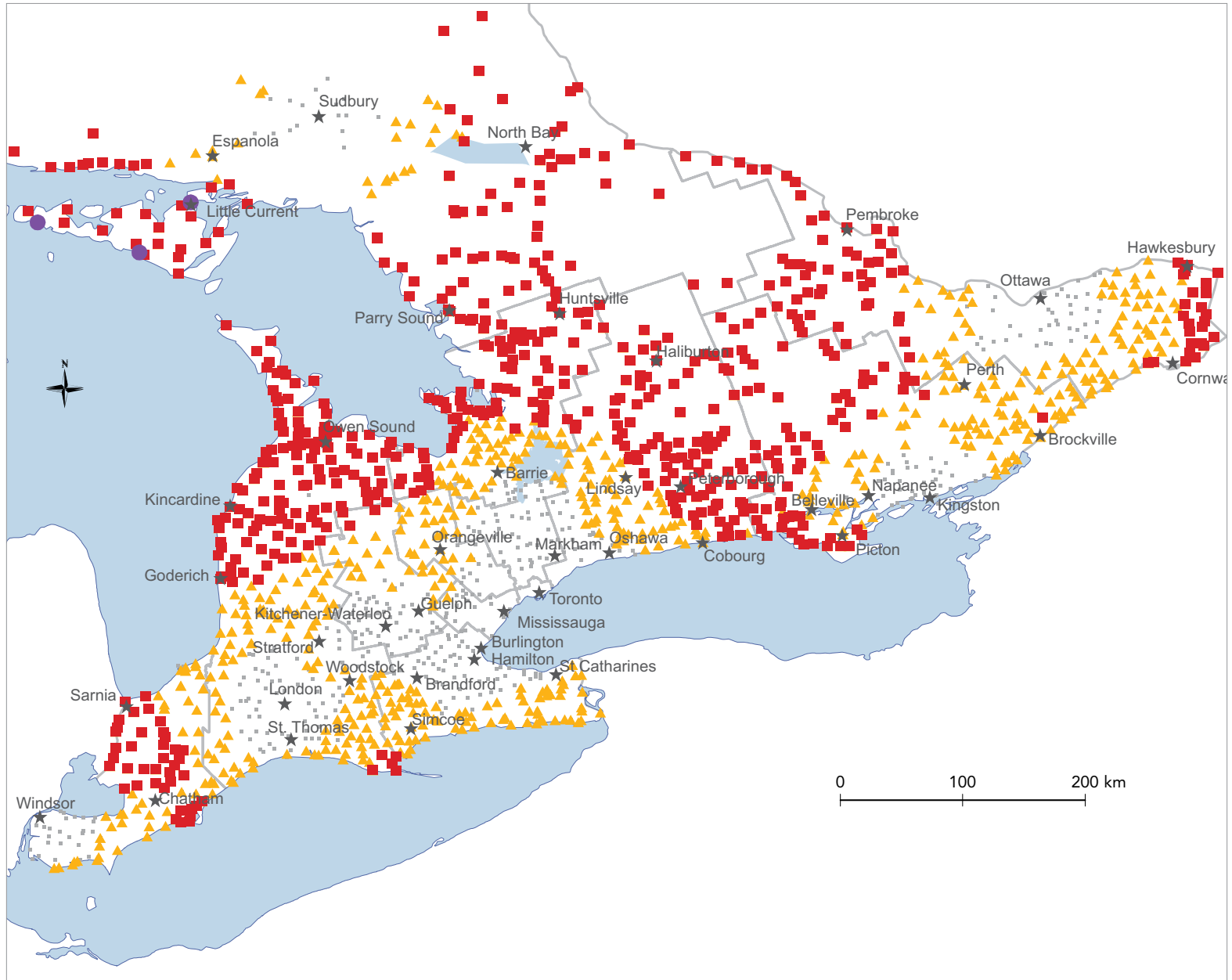
# Exhibit 9

## SOUTH VIEW

Ontario communities with 30,000 or fewer residents beyond 30, 60 and 240 minutes travel time by car to the nearest hospital with specialized services\*

### LEGEND

- Community more than 240 minutes to the nearest service location
- Community more than 60 minutes to the nearest service location
- ▲ Community more than 30 minutes to the nearest service location
- Community with 30,000 or fewer residents
- ★ Larger urban centre
- LHIN boundary



\*Trauma centres, burn units, interventional cardiology centres, neurosurgical centres

## Discussion

Front line, independent primary care physicians or nurses in independent remote nursing stations were available to all but 0.4% of Ontarians living in communities of 30,000 or fewer residents within 30 minutes and 0.1% within 60 minutes. All Ontario towns with a population of 5,000 or more had access to a source of primary care within 30 minutes, and all Ontario towns with a population of 1,000 or more had access within 60 minutes.

Emergency departments were also widely available, reaching all but 2.2% of the population within 30 minutes and all but 1.0% of the population within 60 minutes. All Ontario towns with a population of 5,000 or more had access to an emergency department within 30 minutes.

Hospitals with obstetrical delivery beds were less available but were still accessible to more than 90% of the population of Ontario towns with 30,000 or fewer residents within 30 minutes. Access may be higher because small facilities may report beds as general medical and/or medical/surgical rather than specifically designating obstetrical delivery beds despite providing such services.

Highly specialized services were concentrated in major centres and were less accessible to Ontario's population, especially in the north. Communities without access within 240 minutes were found only in northern Ontario. Of note, air transportation (helicopter or fixed wing) is commonly available in areas with no roads or where travel times are too long for patient safety. For those reasons, the long travel times seen to many Ontario communities by road may not correspond with actual travel times, especially in remote communities in emergency situations or in inclement weather.

## Limitations

These results should be interpreted taking into account several limitations.

- It was not possible to be sure that all of the providers and facilities used were accurately enumerated or that every postal code used for mapping was completely accurate. It was also not possible to manually check that every location was appropriately aligned with the road network. Therefore, these analyses should be considered the starting point for a more detailed examination of geographic access issues in selected communities.
- Statistics Canada data contain the most accurate population counts, but many census subdivisions (CSDs) encompassed several small communities, whose access would not have been determined accurately if the centre point of each CSD location was used for network analysis. For that reason, we used an alternative data source (Ontario Ministry of Transportation data) that more accurately located small settlements but had minor differences in population counts from Statistics Canada data.
- The scope of practice of some health professionals is difficult to ascertain in the administrative data that the Ministry collects and is likely to be different in rural and northern communities. For example, Ontario has more than 12,000 family doctors, but perhaps only two-thirds to three-quarters of them are engaged in comprehensive primary care (meaning that they are devoted to family medicine). That proportion is much higher in rural and northern communities, however, due to relatively lower numbers of specialist physicians and a limited number of physicians who have specialized or focused practices. For those reasons, we have used all of Ontario's non-specialist physicians in these analyses.
- Population accessibility is expected to vary over time as providers, services and the population move or change.
- The study did not take into account whether or not individual, or groups of, physicians were accepting new patients. It also did not take into account on-call arrangements for after-hours care.
- Many communities that did not have access to a primary care provider as defined in this report did have visiting nurses or physicians or other health professionals in their communities.
- Finally, these analyses consider only geographical access under ideal conditions. Actual availability, appropriateness, acceptability, wait times, staffing levels, available transportation, and road and weather conditions could create substantially different patterns of access than those shown in this report. However, geographical access is an excellent starting point for identifying structural access issues.

It is anticipated that these analyses will help to provide decision-makers with useful information about accessibility to primary care and hospital services that will ultimately result in enhanced access to these services by all Ontarians.

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## Definitions and data sources

**Communities of interest** are those that have a population of 30,000 or less.

**Location** includes all of Ontario divided into regions to include northern and rural areas.

The percentages of the population within 30, 60 and 240 minutes' access by car were calculated using a number of spatial datasets and computer tools available through Geographic Information System (GIS) software.

### Datasets

1. **Road map communities and municipalities** (a spatial file containing locations of settlements in Ontario).

This file was acquired by ICES from the Ontario Ministry of Transportation in 2009 through the Ontario Geospatial Data Exchange program organized by the Ontario Ministry of Natural Resources. Although the file is not a Statistics Canada data source for settlements and populations in Ontario, it is still the most comprehensive listing of small, populated locations known to the producers of this report. From this dataset, communities of 30,000 or fewer residents were selected for access-time analysis.

2. **DMTI Spatial road network file (2009)**

This spatial file offers the fullest listing of roads in Ontario with their posted speed limits. This file was used for calculating travel times by car from health services shown in the main results summary table (Exhibit 1).

3. **Postal Code Conversion File (PCCF) (2006)**

This file was used to geocode (assign geographic coordinates to) postal codes of health resources—a process necessary for preparing locations of health services for access-time analysis.

4. **Locations of health services**

The data sources for these locations are described below.

### GIS software

1. ArcGIS v.10 (by ESRI)
2. MapInfo 7

### Spatial analytical methods

The main spatial method used for completing this project was network analysis, which allows calculation of travel time by a specific mode of transportation (by car in this case) from a set of departure points outward through all existing roads using their posted speed limits. For example, network analysis could generate a series of road segments around a doctor's office that could be covered in 30 minutes by car starting at the doctor's office and moving outward from it. When such a network is created, communities of less than 30,000 population that are close to this network (within two kilometres) are selected as *those having access to this doctor's office within 30 minutes of car travel*. Sums of all people in communities selected within 30, 60 and 240 minutes' travel time are used as the numerator for calculating the percentages of all people in communities of 30,000 or fewer residents that have access within these travel times to the health services specified in this report.

*(Continued on next page)*

## *Providers/health care facilities*

- **Family physicians**—General practitioners/family physicians (GP/FPs) with an active billing status and practice address in Ontario were included in the analysis. The data on GP/FPs (with specialty value 00) and their postal codes of practice were obtained from the Corporate Provider Database (CPDB), which is a dataset maintained by the Provider Services Branch of the Ministry of Health and Long-Term Care (MOHLTC) that contains information about all physician providers.
- **Independent nursing stations**—The data on independent remote nursing stations were obtained from the MOHLTC Master Numbering System (MNS) database through the institution type (NS) variable. The nursing stations located in the Moosonee/Moose Factory area and the Sioux Lookout Zone were identified through telephone calls and added to the list. The missing postal codes of the nursing stations were obtained from the Canada Post website. The MNS database doesn't specify the working hours of independent remote nursing stations.
- **Any full-time primary care provider**—This analysis was done to identify the communities that have access to any full-time primary care provider, including family physicians and independent remote nursing stations.
- **Emergency departments (EDs)**—Institutions were defined as EDs if they were open 24/7 and were located at hospital sites with inpatient beds.
- **Hospitals providing obstetrical delivery care**—The hospitals that provide obstetrical services were identified from the MOHLTC Acute Beds Dataset 2008/09. Hospitals that had one or more obstetrical beds were included in the list.
- **Hospitals with trauma services (trauma centres)**—The list of trauma centres in Ontario was provided by the MOHLTC. It is also available from the Ontario Trauma Registry Comprehensive Data Set Data Dictionary Appendix C.<sup>2</sup>
- **Burn centres**—The list of burn centres in Ontario was obtained from the following sources: Inventory of Critical Care Services,<sup>3</sup> Burn Care Facilities<sup>4</sup> and Canadian Burn Care Facilities.<sup>5</sup>
- **Hospitals providing interventional cardiology services**—Hospitals were defined as providing interventional cardiology services if they had percutaneous coronary intervention (PCI) services. The list of hospitals performing interventional cardiology procedures and their postal codes were obtained from the website<sup>6</sup> of the Cardiac Care Network of Ontario and from its 2009/10 annual report.<sup>7</sup>
- **Hospitals providing neurosurgery services**—The list of hospitals providing neurosurgery services was obtained from the Inventory of Critical Care Services,<sup>3</sup> as well as the Report of the Neurosurgery Expert Panel.<sup>8</sup>



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