
Geographic Variation in the Supply and Distribution of Comprehensive Primary Care Physicians in Ontario

2014/15

July 2017





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Publication Information

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The Institute for Clinical Evaluative Sciences (ICES) is funded by an annual grant from the Ontario Ministry of Health and Long-Term Care (MOHLTC). The opinions, results and conclusions included in this report are those of the authors and are independent from the funding sources. No endorsement by ICES or the MOHLTC is intended or should be inferred.

Parts of this material are based upon data and information compiled and provided by the Canadian Institute for Health Information (CIHI). However, the analysis, conclusions, opinions and statements expressed herein are those of the authors, and not necessarily those of CIHI.

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How to cite this publication

Green ME, Gozdyra P, Frymire E, Glazier RH.
Geographic Variation in the Supply and Distribution of Comprehensive Primary Care Physicians in Ontario, 2014/15. Toronto, ON: Institute for Clinical Evaluative Sciences; 2017.

ISBN 978-1-926850-75-7 (Online)

This document is available at www.ices.on.ca.

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Acknowledgements

The authors wish to acknowledge the funding support of the Ontario Ministry of Health and Long-Term Care, the Innovations Strengthening Primary Healthcare through Research – Primary Healthcare Program (INSPIRE-PHC), and the Ontario SPOR SUPPORT Unit (OSSU).

At the time of this work, Dr. Michael Green was supported by the Clinical Teachers' Association of Queen's University Chair in Applied Health Economics/Health Policy.

Dr. Richard Glazier is supported as a clinician scientist in the Department of Family and Community Medicine at the University of Toronto and at St. Michael's Hospital.

Special thanks to Susan Shiller for her expert copy editing and insights into the final preparation of this report.

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About the Institute for Clinical Evaluative Sciences

Established in 1992, the **Institute for Clinical Evaluative Sciences** (ICES) is an independent not-for-profit corporation with an international reputation as a trusted source of high-quality health and health services research and evidence.

ICES researchers have access to a vast and secure array of Ontario's health-related data, including population-based health surveys, anonymous patient records, and clinical and administrative databases. ICES' unbiased evidence provides measures of health system performance, a clearer understanding of the shifting health care needs of Ontarians, and a stimulus for discussion of practical solutions to optimize scarce resources. ICES research and reports influence the development, implementation and evaluation of health policy and the delivery of health care.

Key to ICES' work is its 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 34 million Canadians allow researchers to follow patient populations through diagnosis and treatment, and to evaluate outcomes. ICES goes to great lengths to protect privacy and is recognized as an international leader in maintaining the security of health information.

ICES receives core funding from the Ontario Ministry of Health and Long-Term Care. In addition, ICES scientists and staff have highly successful track records competing for peer-reviewed grants from federal agencies, such as the Canadian Institutes of Health Research, and from provincial and international funding bodies.

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Executive Summary

This report uses a geographic analytical approach to examine the supply and distribution of comprehensive primary care physicians in 2014/15 in the province of Ontario.

- Geographic access to primary care is an important factor affecting overall population health, especially in suburban and rural areas. A key data gap currently exists in the number, type and mix of local health care providers in relation to population need in these areas. The results obtained from the various mapping techniques used in this report can be used to enhance and support the provision of accurate assessments of both primary health care capacity and population health care needs, thus addressing this data gap.
- There are different approaches to mapping primary care physician supply and distribution. Each approach has inherent strengths and weaknesses, and no single map should be taken as the definitive representation of these patterns of supply and distribution. Together, the various approaches provide a composite picture that improves our understanding of primary care physician access and distribution in urban, suburban and rural areas across Ontario.
- Many access and supply maps use predetermined boundaries, such as census subdivisions and Local Health Integration Networks. Physicians and patients live and function in a geography that is not limited by these predetermined boundaries. This report uses specialized techniques to produce maps without these boundaries, and therefore provides important insight into the actual supply and distribution of comprehensive primary care physicians.
- Using multispecialty physician networks to measure patient/physician ratios is a valuable approach as these networks reflect natural relationships between patients, physicians and hospitals without the constraint of geographic boundaries. Understanding comprehensive primary care physician supply and distribution by examining these hospital networks is especially applicable in major urban settings.

- There is an uneven distribution of comprehensive primary care physicians across the province and further work is required to determine the most appropriate level of analysis. Ideally analytic units should be large enough to allow for data stability but be grounded in the context of local care patterns.
- Two-step floating catchment area (2SFCA) analyses were used in this study. This relatively new set of spatial methods offers a comprehensive measure of accessibility, which reflects spatial interactions between populations and physicians. Empirical evidence of accessibility, or surrogate measures such as hospitalization rates for primary care-sensitive conditions, may be used to determine which type of 2SFCA analysis to use. Despite potential advantages, the application of 2SFCA-type methods in health services research and in health services planning is still rare, likely due to their perceived complexity.
- *Patients First: Action Plan for Health Care*¹ is well served by a population perspective on health for which detailed health status and health care utilization data are needed. Although these reforms are geographically based, they respect current patterns of primary care. These patterns typically include non-local, provider-patient relationships that extend over large geographic distances, especially in major urban centres where populations are mobile and many people commute to work.
- Future directions in research to extend and leverage these mapping approaches include:
 - Using mapping in conjunction with population health care needs to inform the parameters of health human resourcing. Further population stratification involving case-mix would improve this process.
 - Performing equity analyses involving the relative deprivation of the sub-regions being studied (e.g., comparing regions based on selected measures of health care utilization, such as emergency department visits and admissions for ambulatory care-sensitive conditions).
 - Determining population health needs and provider capacity for unattached and underserved patients.
 - Increasing the ability to assess availability and access to team-based care.
 - Improving methods to enable mapping of the full-time-equivalent (FTE) resourcing of clinical staff.
 - Undertaking geographic analyses at the level of the 76 new sub-regions that are currently being implemented within Ontario's 14 Local Health Integration Networks.

Introduction

Prior to 2002 there was a rapidly declining interest in family medicine within Ontario medical schools and an increasing difficulty in obtaining a primary care physician.^{2,3} As a result, ensuring an adequate supply of primary care physicians to support delivery of comprehensive primary health care became a priority for policy makers, and several measures were implemented to achieve this goal.⁴ These measures included developing new models of physician payment, introducing supports for multidisciplinary primary care models, and increasing the number of medical students and family medicine residents trained in Ontario.

This report uses a geographic analytical approach to examine the availability of comprehensive primary care physicians and access to different primary care models in 2014/15 in the province of Ontario. Geographic information system (GIS) software mapping techniques, using administrative data housed at the Institute for Clinical Evaluative Sciences (ICES), were used to examine province-wide and local small area-level availability of comprehensive primary care physicians relative to the underlying population. Data are captured for all residents (approximately 13 million) and comprehensive primary care physicians (approximately 9,000) in

Ontario. The range of spatial analytical methods used and the various maps presented help to visualize the availability of, and access to, comprehensive primary care physicians relative to population numbers and needs. Data are presented at the level of Local Health Integration Networks (LHINs) and census subdivisions; and by multispecialty physician networks (established based on groups of primary care and specialist physicians associated by virtue of sharing care for a common set of patients and admitting patients to the same hospital).^{5,6} Regions with low comprehensive primary care physician availability are identified.

Defining Geographic Access to Primary Care

There are various ways of defining the geographic distribution of people and their physicians, as well as the availability of health care services within the population. Some methods are useful in providing a visual orientation, some are helpful in identifying differences between areas, while others are more suitable for local level service planning.

Geographic availability of physicians usually refers to their density (number of physicians for the population in a given area); geographic accessibility of physicians usually refers to distance (or travel time) to reach the nearest available physician.

It is important to keep in mind that there are several non-spatial characteristics that may contribute to a varying propensity to seek and/or receive care within a given area of the population:

Population characteristics

- General health status
- Socioeconomic status
- Demographic characteristics (age and sex)
- Ethnicity and religion
- Education and language skills

Physician characteristics

- Specialty
- Availability or activity level (full-time equivalent or practice level relative to a full load)
- Demographic characteristics (age and sex)
- Ethnicity
- Non-official languages

Data Sources and Methods

This report focuses on the supply and distribution of comprehensive primary care physicians in Ontario. Comprehensive primary care physicians form a subset of all primary care physicians. Primary care comprehensiveness is based on a primary care physician's fee-for-service billings and shadow billings, that are used to track the scope of services provided.

A physician is defined as being in a comprehensive primary care practice by meeting the following criteria, which are applied in a hierarchical manner:

1. The physician worked a minimum of 44 days during the year.
2. More than 50% of services provided were for core primary care.
3. These core primary care services fell within a minimum of seven of 22 activity areas.

The study period for this report was from April 1, 2014 to March 31, 2015.

Data Sources

Key to the analyses presented is the ability to link provincial, population-based health information at the individual level with administrative data on physicians, practice locations and primary care practice models. The following data sources were used.

HEALTH SERVICES DATABASES

- **Ontario Health Insurance Plan (OHIP)** for physician billings; includes diagnostic codes and procedures, location of visit, and out-of-hospital laboratory tests.
- **Discharge Abstract Database (DAD)** for non-mental health hospital admissions, procedures and transfers; includes the most responsible diagnosis for length of stay, secondary diagnosis codes, comorbidities present upon admission, complications occurring during the hospital stay and attending physician identifier.
- **National Rehabilitation Reporting System (NRS)** for adult inpatient rehabilitation facilities and programs; includes patient diagnostic information.
- **National Ambulatory Care Reporting System (NACRS)** documents emergency department visits and same-day surgery; includes the chief complaint (reason for visit).
- **Client Agency Program Enrolment (CAPE)** identifies patients enrolled in different primary care models over time. A separate file provided by the Ministry of Health and Long-Term Care (MOHLTC) identifies the physicians that were part of a Family Health Team.
- **Generalized Alternate Payment Plan (GAPP)** includes all non-OHIP-related payments (including those to academic health sciences centres), with information on the amount, month, type and original data sources for the payments.
- **ICES Physician Database (IPDB)** contains information about physicians practicing in Ontario. It is created and maintained by ICES, using data from several sources including: the Ontario Physician Human Resource Data Centre (OPHRDC), the OHIP Corporate Provider Database (CPDB), and the OHIP database of physician billings. The IPDB includes: demographic information about each physician (i.e., age, sex), practice location, physician specialty, services provided, where each physician was trained and year of graduation.
- **The Corporate Provider Database (CPDB)** includes physician birth date, gender, school of graduation, year of graduation, reported specialties and postal code of practice.
- **Ontario Drug Benefit (ODB) Program** database for outpatient drug prescriptions for those over age 65; identifies the drug, dose and date the prescription was filled.
- **Ontario Mental Health Reporting System (OMHRS)** database for admissions to mental health-designated hospital beds; includes the most responsible diagnosis.
- **Same Day Surgery (SDS)** database includes ambulatory care visits for inpatient surgery or to the emergency department.
- **Registered Persons Database (RPDB)** includes the resident population of Ontario eligible for health coverage by age, sex and residential address. Residents are eligible for health coverage if they are Canadian citizens, landed immigrants or convention refugees, make their permanent and principal home in Ontario, and are physically present in Ontario 153 days in any 12-month period.
- **Institutions Information System (INST)** is a reference table of geographic, diagnostic and billing codes in Ontario.
- **Reference (REF)** is a series of data sets on health care institutions in Ontario.

GEOGRAPHIC DATABASES AND MAPPING RESOURCES

- **Dissemination area and census subdivision boundary files (2011)**, from the Map Library at the University of Toronto; used as contextual boundary layers and data aggregation units on several maps.
- **DMTI Spatial road network file (2013)** offers the fullest listing of roads in Ontario with their posted speed limits; used for calculating travel times between population points and health care services. These times were further used to calculate minimum driving times and two-step floating catchment area (2SFCA) measures.
- **Postal Code Conversion File (PCCF) (2014)** used to geocode (assign geographic coordinates) postal codes of health resources; a process necessary for preparing locations of health services provision for mapping and access-time analysis.
- **Wooded areas, saturated soils and landscape in Canada, CanVec (March 7, 2016)** from the Earth Sciences Sector of Natural Resources Canada, to identify wooded areas in Ontario.

LOCATION OF HEALTH SERVICES

- **Multispecialty physician networks (2016)** used to define natural networks among patients, physicians and hospitals.^{5,6} Eighty networks were identified, which capture 98% of patients and comprehensive primary care physicians in the region.
- **Comprehensive primary care physicians and patients by multispecialty physician networks (2011/12 to 2013/14)** includes the location of physicians whose primary health care services reflect criteria defined by ICES as comprehensive primary care.
- **Comprehensive primary care physicians by primary care model (2014/15)** includes the location of comprehensive primary care physicians, as well as the type of practice model to which they belong.
- **ArcGIS v.10.2 (ESRI)**, a geographic information system for working with maps and geographic information.

Study Areas

The supply and distribution of comprehensive primary care physicians in large urban areas, small communities and rural areas, as well as in remote northern communities, was included. For the purposes of this report, Ontario was subdivided into six regions, or study areas (**Exhibit 1**):

- South Western Ontario: LHINs 1–6
- South Central Ontario: LHINs 4, 6, 7
- Greater Toronto Area: LHINs 5–8
- South Eastern Ontario: LHINs 9–11
- Central Ontario: LHIN 12
- Northern Ontario: LHINs 13, 14

EXHIBIT 1 Six study areas, based on the 14 Local Health Integration Networks, used to examine the supply and distribution of comprehensive primary care physicians in Ontario, 2014/15

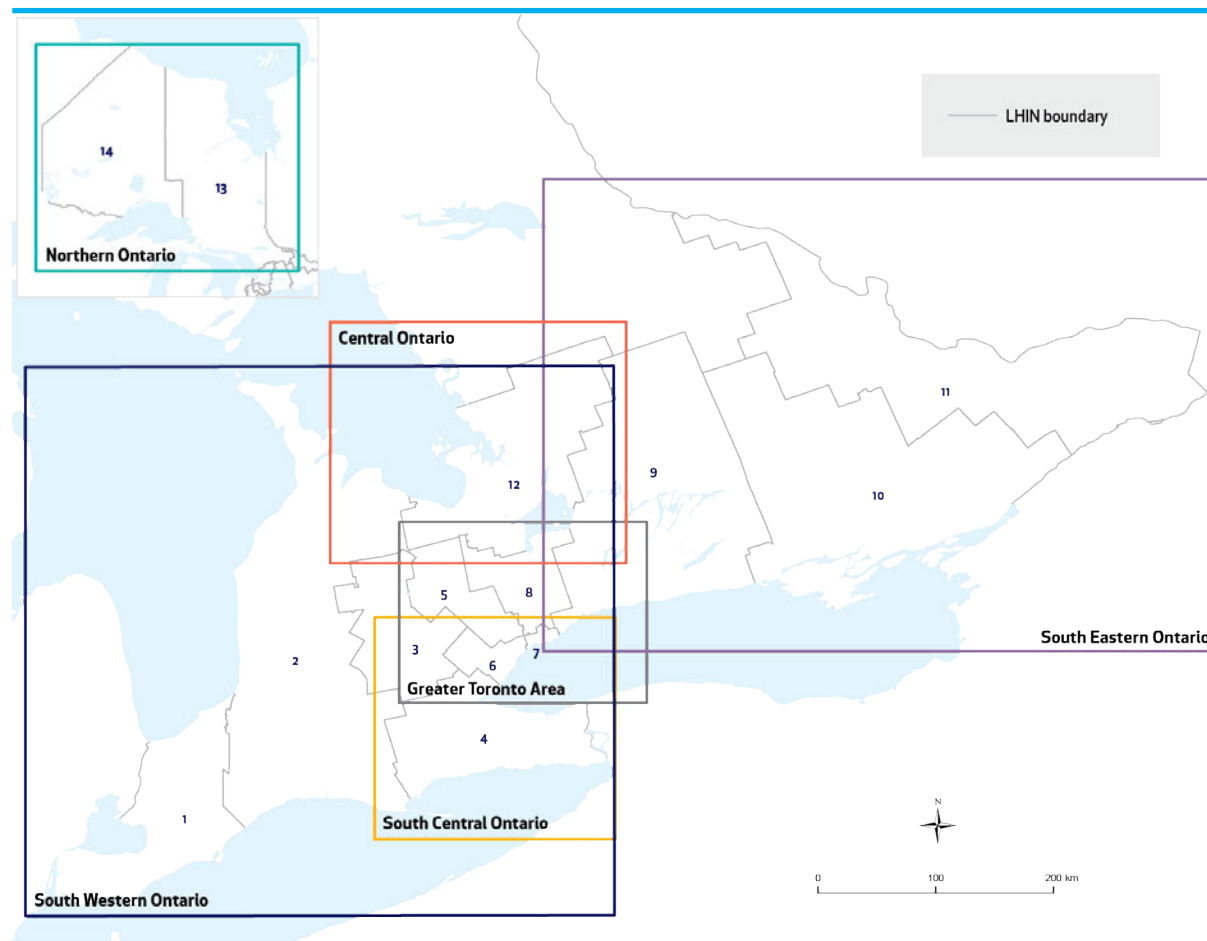


EXHIBIT 2 Wooded areas in Ontario, 2016

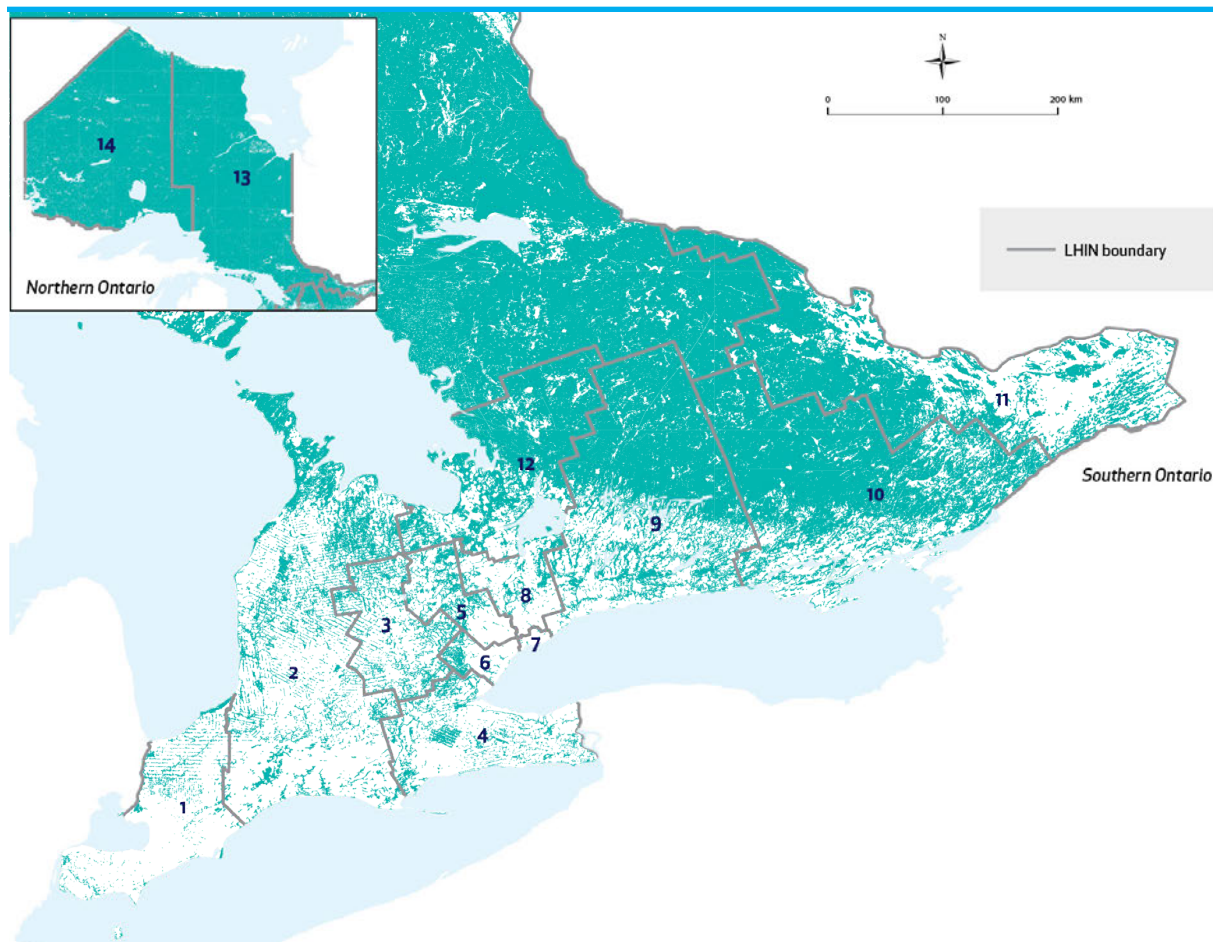


Exhibit 2 shows the major wooded areas in Ontario, where relatively few people reside. It is important to know where these areas are, so that appropriate solutions for primary care physician access can be considered for the residents of these rural and remote locations across the province.

Mapping Techniques

For each of the six Ontario regions, or study areas, the following seven mapping approaches are presented.

Distribution of comprehensive primary care physicians relative to the population, by census subdivision (CSD)

These maps are suitable for looking at relative differences in service provision levels within pre-defined areas. The distribution of the Ontario population and the distribution of comprehensive primary care physicians are shown for each study area.

Density of comprehensive primary care physicians per 100,000 population, by CSD

The number of comprehensive primary care physicians per 100,000 population in a given area is a measure of the density of comprehensive primary care physicians in that area. These maps provide a general orientation to the density of population and primary care physicians within CSDs.

Access to a comprehensive primary care physician within a defined driving time, using the two-step floating catchment area (2SFCA) method, basic formula

The 2SFCA method has emerged in the last decade as a key measure of spatial accessibility, particularly in its application to primary health care access.^{7,8} The composite measure of accessibility, using the basic formula, is calculated by determining the ratio of supply (comprehensive primary care physicians) to demand (population) within a pre-defined road network distance or driving time limit. A 30-minute driving time limit, a commonly-used standard, is used for all study areas in this report.⁹ In the high-density Greater Toronto Area, a 10-minute driving time is also presented. The basic formula treats all physicians and patients equally within the pre-defined driving time. Floating catchment areas overlap thereby enabling the modelling and measurement of 'real-life' health care access behaviour with unrestricted utilisation.

Access to a comprehensive primary care physician within a defined driving time, using the two-step floating catchment area (2SFCA) method, gravity distance decay formula

This is an enhanced 2SFCA method whereby the distance decay function takes into account that as a person become farther away from the service (e.g., comprehensive primary care physician), they are less

likely to seek the service. In this case, physicians and patients who are further away contribute less to the final calculation of the composite accessibility measure by having a distance-inverse weighting factor applied to them.

Minimum driving time in minutes to the nearest comprehensive primary care physician from centres of dissemination areas

The driving time from the population centre to the nearest comprehensive primary care doctor along the existing roads was determined. A posted speed limit was used for the driving time calculations. The population centres were defined as centroids (centre points) of populated dissemination areas (DAs). DAs are the smallest geographic areas for which census data are disseminated.

Number of comprehensive primary care physicians per 100,000 population, by multispecialty physician network

Multispecialty physician networks are groups of primary care and specialist physicians associated by virtue of sharing care for a common set of patients and admitting patients to the same hospital. Physicians are assigned to the hospital where the majority of their patients attend, regardless of the geographical address of the physician. For each study area, the networks included in that area are listed.

Multispecialty physician networks are depicted on these maps by two main sub-categories: provider clusters and network clusters.⁶ A provider cluster comprises the population and physicians linked to a particular hospital. Network clusters are the actual multispecialty physician networks, created by combining provider clusters that share patients and are in close proximity such that the resulting network has a minimum population and includes at least one medium-size or large hospital. A network consists of the local population, physicians and hospitals linked to its component provider cluster. Some networks were large and comprised only one hospital. A satellite network is a collection of small, rural provider clusters that are geographically distant from the large hospital upon which they depend for complex services. The red lines on these maps, labelled as multisite networks, depict the relationship between provider clusters and their corresponding network clusters.

Proportion of comprehensive primary care physicians participating in different primary care models, by CSD

The proportion of physicians participating in different primary care models¹⁰ was plotted in a pie chart for each of the CSDs within a given study area map (**Exhibit 3**). The relative size of the pie chart is proportional to the number of comprehensive primary care physicians practicing in that CSD.

Primary care models included in this analysis:

Family Health Team (FHT)

- An interprofessional team model composed mainly of FHOs and FHNs.

Enhanced Fee-For-Service (FFS)

- Physician payments take the format of a blended or enhanced FFS model.
- Comprised of Family Health Groups (FHGs), group-practice based on a FFS model; and Comprehensive Care Models (CCMs), designed specifically for solo primary care physicians who are providing comprehensive primary care for their patients.

Capitation (CAP)

- Includes Family Health Organizations (FHOs) and Family Health Networks (FHNs), both blended forms of a capitation model, wherein three or more physicians work together as a group.
- FHO and FHN payments are based largely on blended age- and sex-adjusted remuneration.

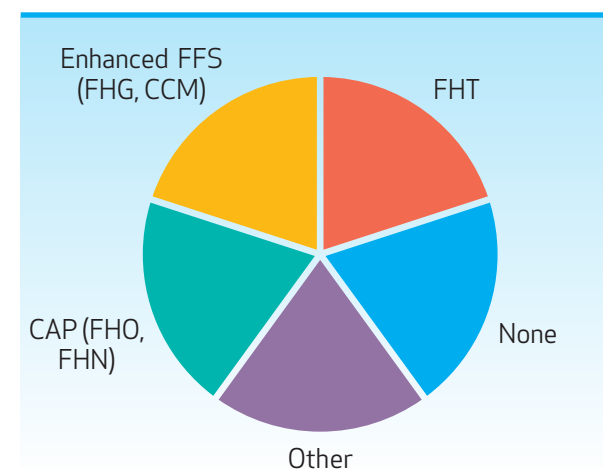
Other

- A primary care model other than Enhanced FFS, CAP or FHT models.

None

- The physician does not belong to a primary care model and payment is based entirely on fee-for-service.

EXHIBIT 3 Visual approach used to represent the proportion of comprehensive primary care physicians participating in different primary care models in Ontario





Results

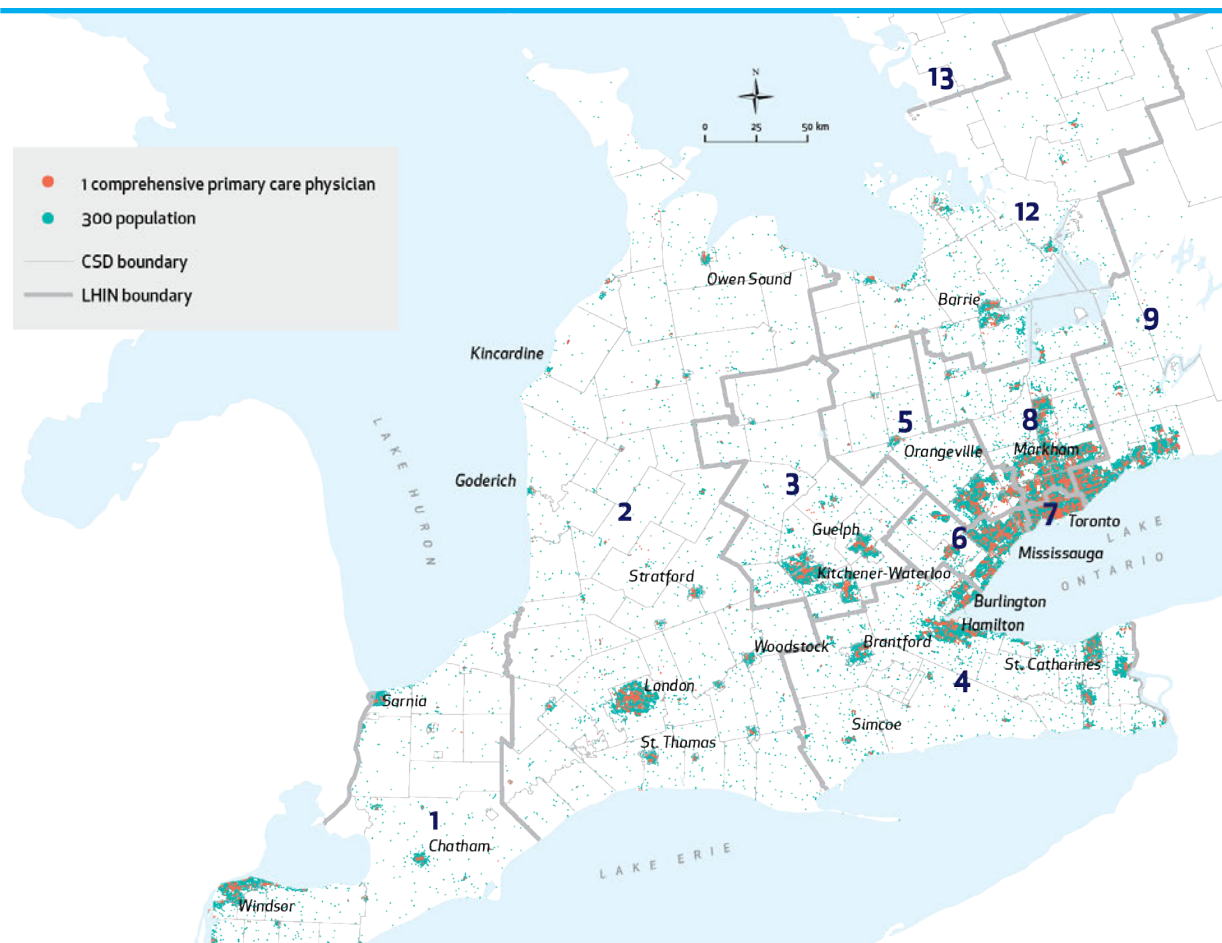
South Western Ontario

Local Health Integration Networks

- | | |
|------------------------------|---|
| 1 Erie St. Clair | 4 Hamilton Niagara Haldimand Brant |
| 2 South West | 5 Central West |
| 3 Waterloo Wellington | 6 Mississauga Halton |

EXHIBIT 4 Distribution of comprehensive primary care physicians relative to the population, by census subdivision, in South Western Ontario, 2014/15**Key Messages**

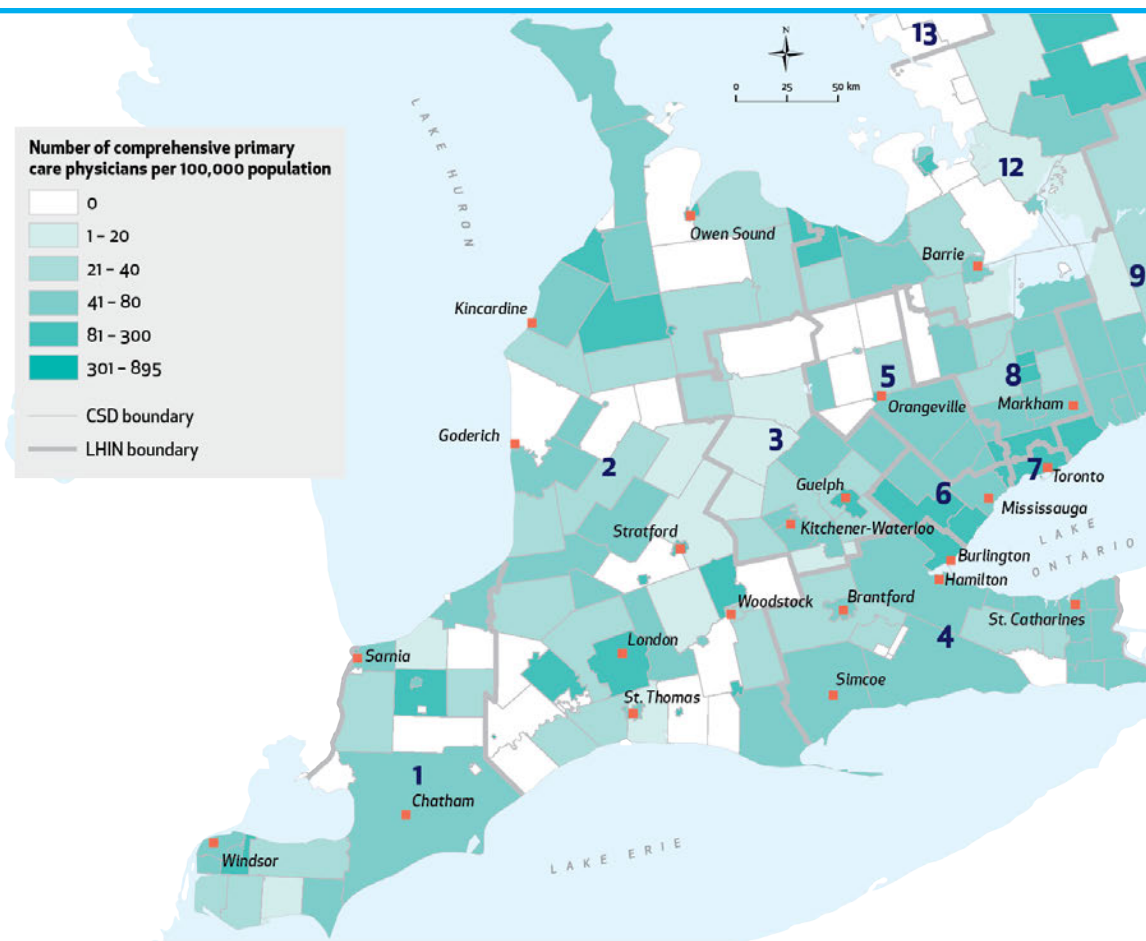
- Most of the comprehensive primary care physicians serving South Western Ontario are concentrated in the densely populated urban areas of Windsor, London, Kitchener-Waterloo, Guelph, Hamilton and the Greater Toronto Area.
- Few comprehensive primary care physicians are located in rural South Western Ontario.



Data sources: 2011 Census of Canada, IPDB

EXHIBIT 5 Number of comprehensive primary care physicians per 100,000 population, by census subdivision, in South Western Ontario, 2014/15**Key Messages**

- Areas with the highest density of comprehensive primary care physicians include those in and around London, Woodstock and Burlington, as well as a few more rural communities.
- Overall, there does not appear to be any significant clustering of low or high physician density, and areas with low physician density relative to the population are present throughout South Western Ontario.
- Many census subdivisions have no comprehensive primary care physicians (density is 0).
- A previous report found that in 2014 there were, on average, 107 primary care physicians per 100,000 population in Ontario, and 114 primary care physicians per 100,000 population across Canada.¹¹

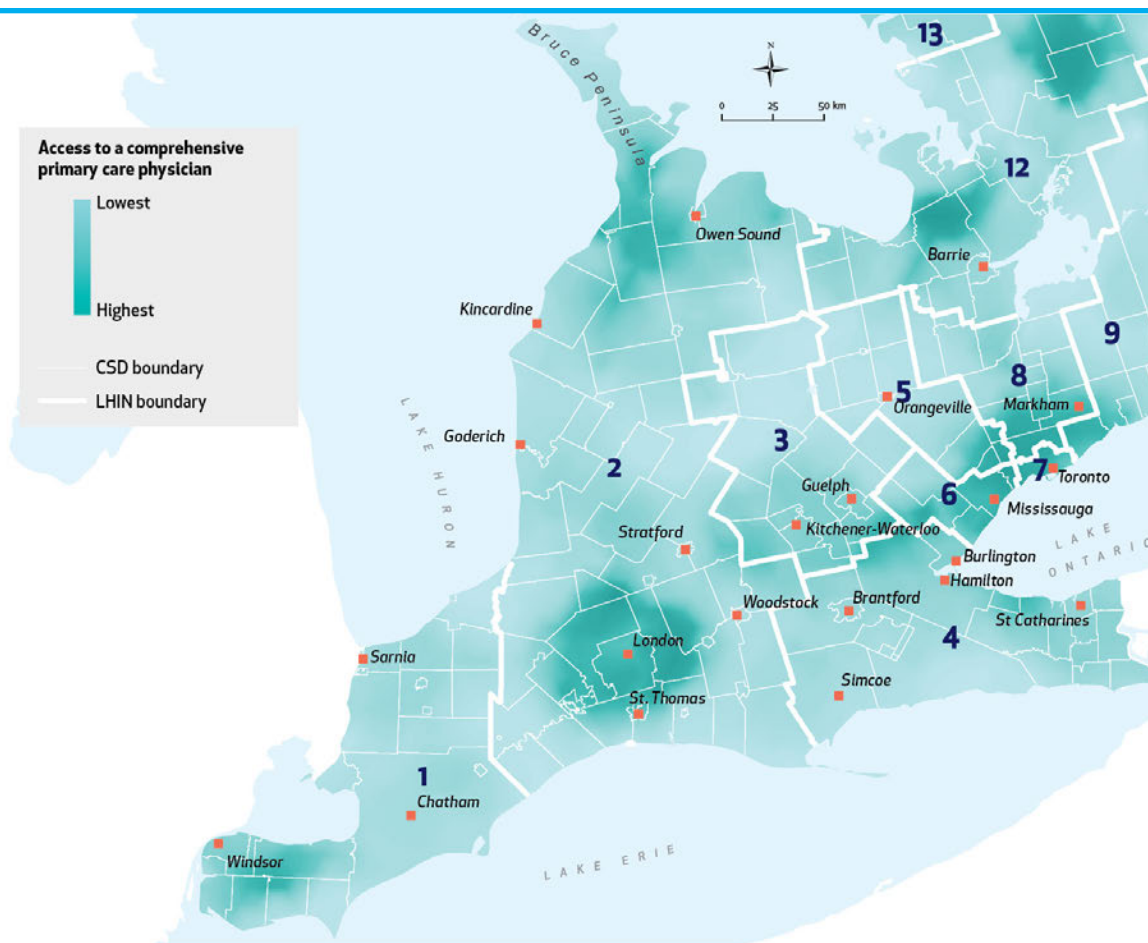


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 6 Access to a comprehensive primary care physician within a 30-minute driving time, using the two-step floating catchment area method, basic formula, in South Western Ontario, 2014/15

Key Messages

- Higher access to comprehensive primary care physicians within 30 minutes is seen for residents of Windsor, London, Hamilton, the Greater Toronto Area, and several smaller towns in South Western Ontario.
- Some rural areas, such as the Bruce Peninsula and areas north and east of Kincardine, may have higher access because of physicians locating their practices in those less-populated communities.
- Residents in rural areas of South Western Ontario have lower access to comprehensive primary care physicians within 30 minutes.

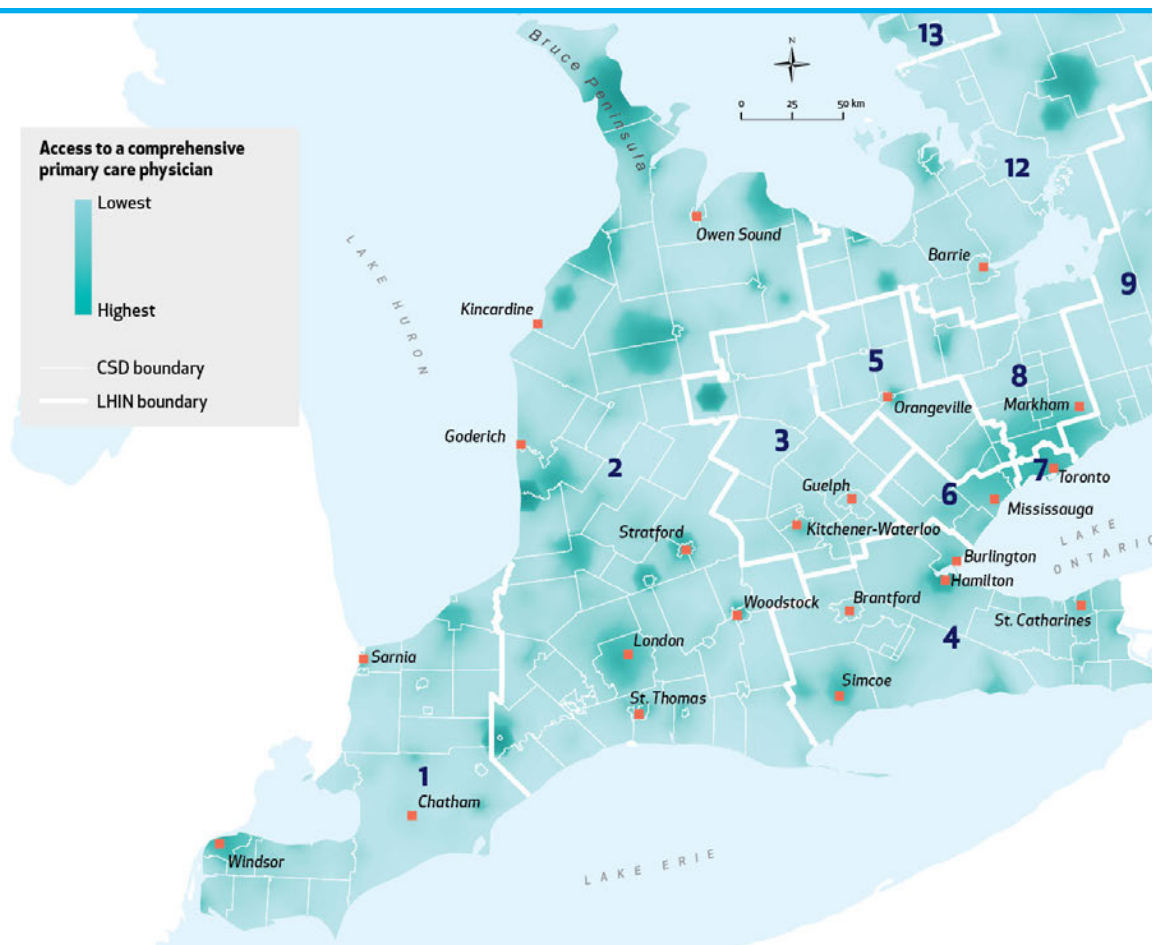


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 7 Access to a comprehensive primary care physician within a 30-minute driving time, using the two-step floating catchment area method, gravity distance decay formula, in South Western Ontario, 2014/15

Key Messages

- Access to comprehensive primary care physicians within 30 minutes is high in Windsor, London, Hamilton, Toronto and several smaller towns in South Western Ontario.
- Some rural areas, such as the Bruce Peninsula and areas north and east of Kincardine, may have higher access because of physicians locating their practices in those less-populated communities.
- The rural areas of the region have the lowest access to comprehensive primary care physicians.

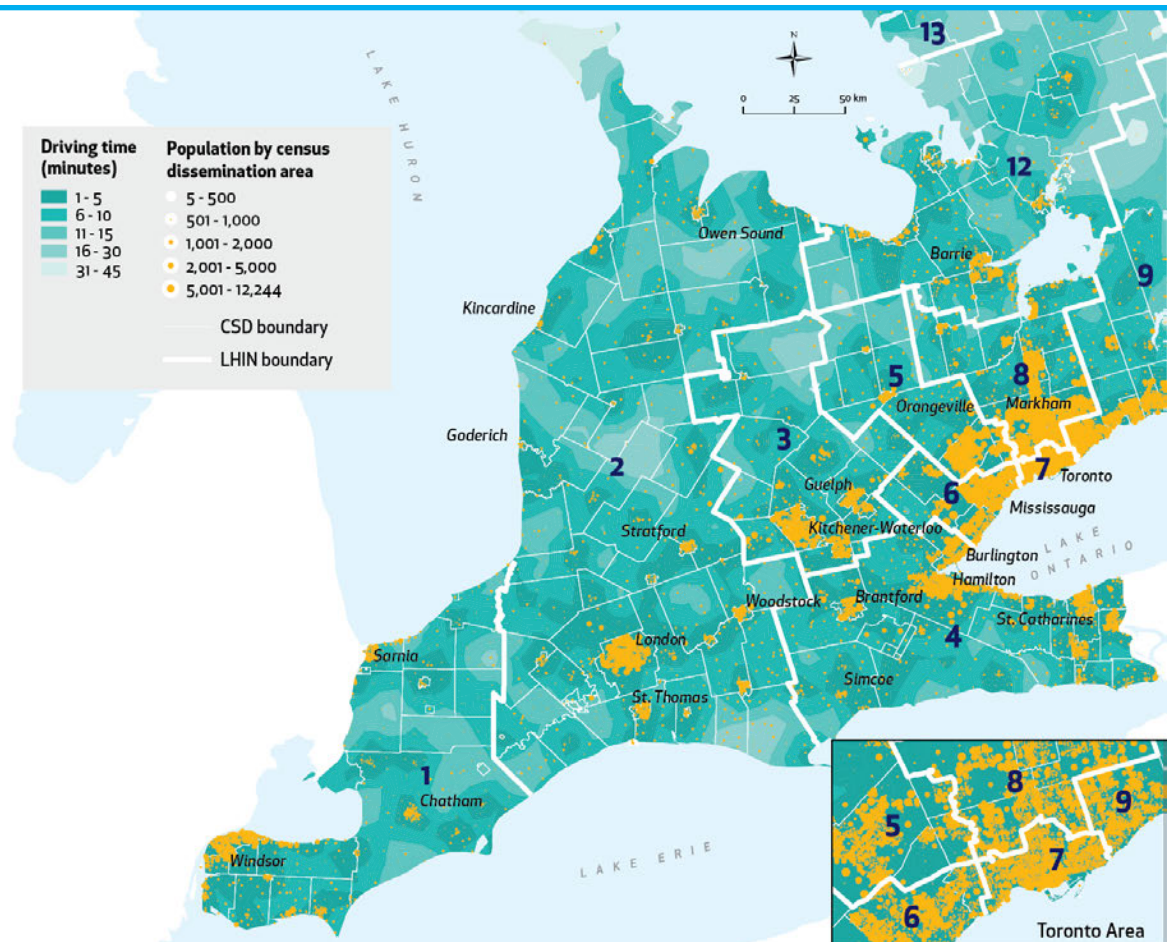


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 8 Minimum driving time in minutes to the nearest comprehensive primary care physician from the centre of each census dissemination area, in South Western Ontario, 2014/15

Key Messages

- Most residents of South Western Ontario benefit from relatively short travel times by car to the nearest comprehensive primary care physician, ranging from one to 15 minutes.
- A few rural areas exhibit travel times of more than 30 minutes; these areas also have low population counts.
- Driving times do not consider delays that may be caused by poor driving conditions, road construction or traffic congestion.



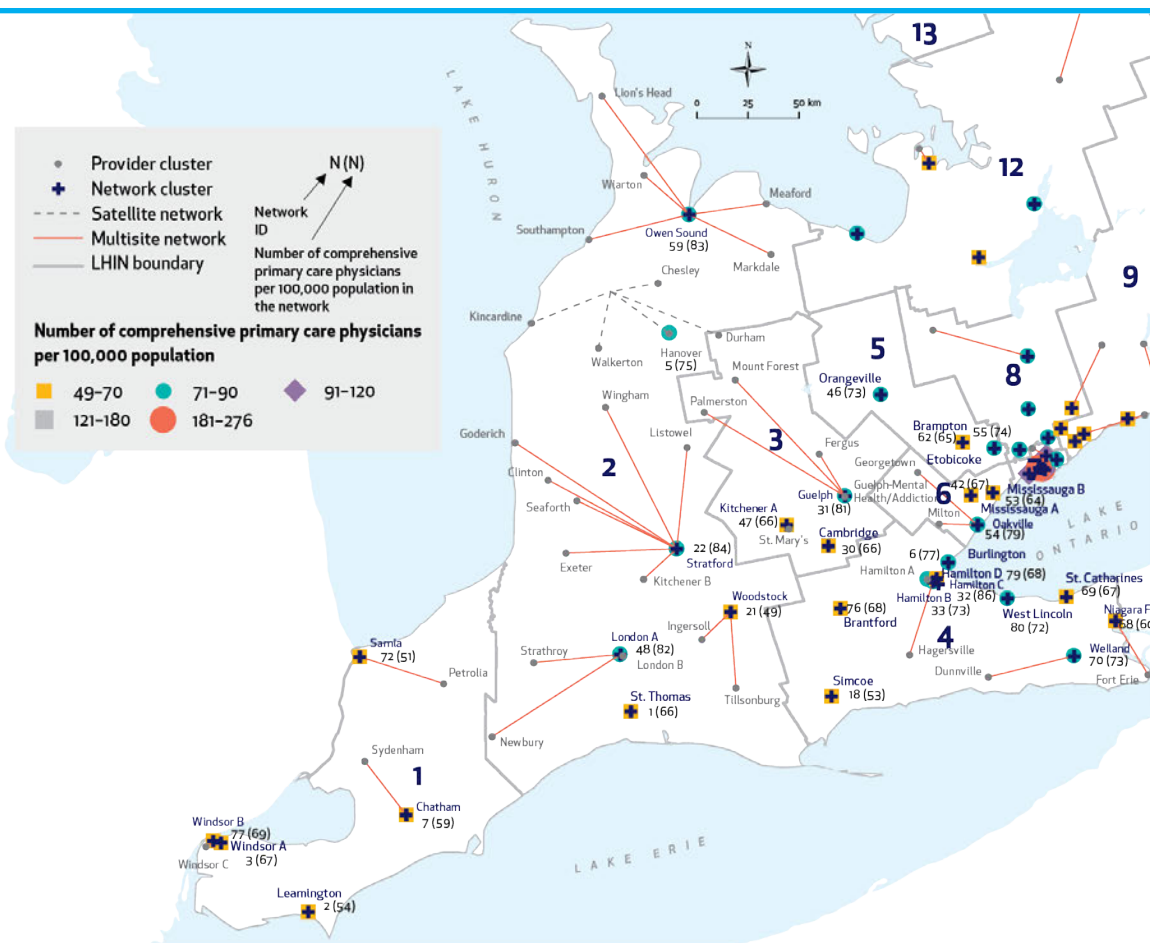
Data sources: 2011 Census of Canada, 2013 DMTI Spatial road network file, IPDB

EXHIBIT 9 Number of comprehensive primary care physicians per 100,000 population, by multispecialty physician network, in South Western Ontario, 2011/12 to 2013/14**Key Messages**

- As is common across the province, network clusters are predominant in larger cities, while provider clusters are prominent in smaller communities in South Western Ontario.
- All physician networks in South Western Ontario have between 49 and 90 comprehensive primary care physicians per 100,000 population.

Multispecialty physician networks in South Western Ontario, by Network ID

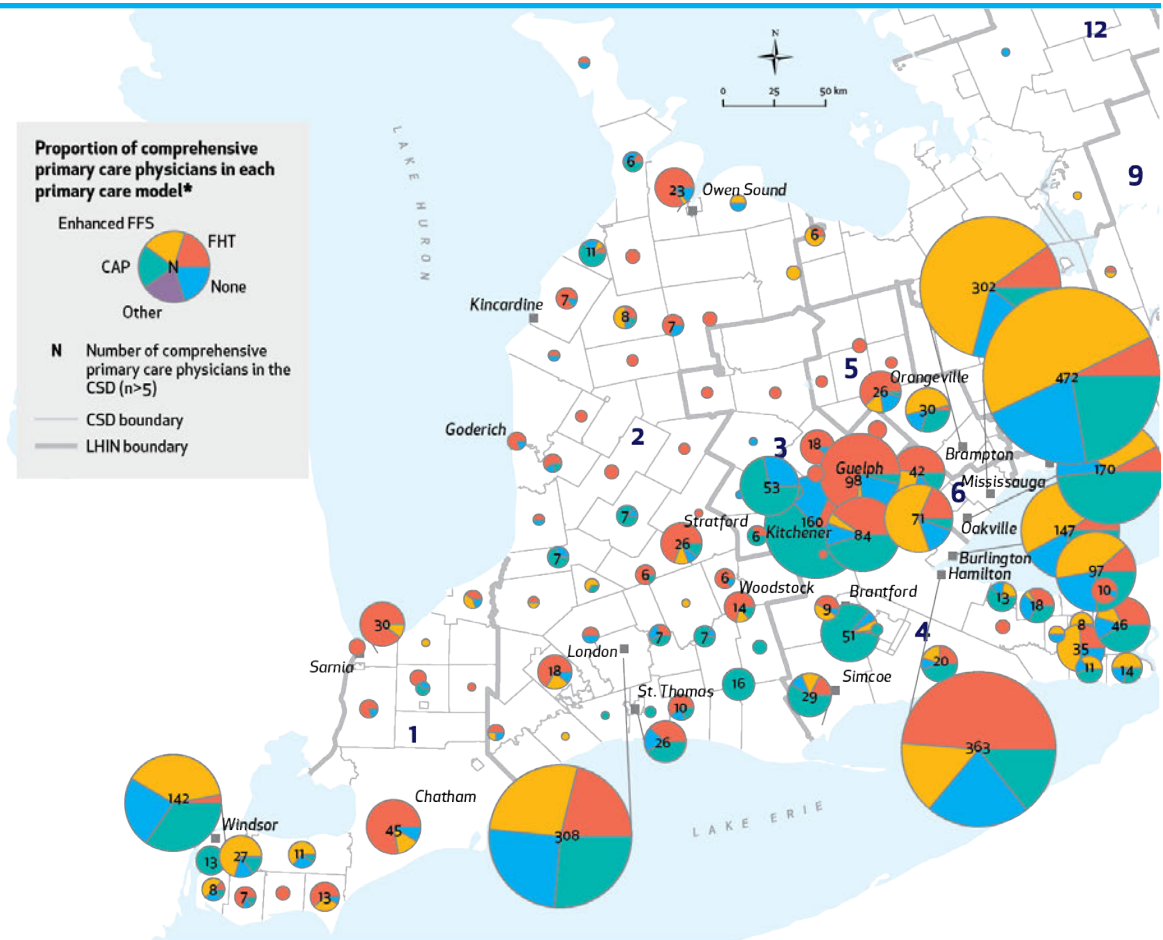
- | | |
|--|---|
| 1 St. Thomas Elgin General Hospital | 48 London Health Sciences Centre-University Hospital |
| 2 Leamington District Memorial Hospital | 53 Trillium Health Partners-Mississauga Hospital |
| 3 Windsor Regional Hospital-Metropolitan Campus | 54 Halton Healthcare-Oakville Trafalgar Memorial Hospital |
| 5 Hanover and District Hospital | 55 William Osler Health System-Etobicoke General Hospital |
| 6 Joseph Brant Hospital | 59 Grey Bruce Health Services-Owen Sound Hospital |
| 7 Chatham-Kent Health Alliance-Chatham Campus | 62 William Osler Health System-Brampton Civic Hospital |
| 18 Norfolk General Hospital | 68 Niagara Health-Greater Niagara General Site |
| 21 Woodstock General Hospital Trust | 69 Niagara Health-St. Catharines Site |
| 22 Stratford General Hospital | 70 Niagara Health-Welland Site |
| 30 Cambridge Memorial Hospital | 72 Bluewater Health-Sarnia |
| 31 Guelph General Hospital | 76 Brant Community Healthcare System-Brantford General Site |
| 32 Hamilton Health Sciences-Juravinski Cancer Centre | 77 Windsor Regional Hospital-Ouellette Campus |
| 33 St. Joseph's Health Care Hamilton | 79 Hamilton Health Sciences-Hamilton General Hospital |
| 42 Trillium Health Partners-The Credit Valley Hospital | 80 Hamilton Health Sciences-West Lincoln Memorial Hospital |
| 46 Headwaters Health Care Centre | |
| 47 Grand River Hospital-KW | |



Data sources: CAPE, CIHI-SDS, CPDB, DAD, INST, IPDB, NACRS, ODB, OHIP, OMHRS, REF, RPDB

EXHIBIT 10 Proportion of comprehensive primary care physicians participating in different primary care models, by census subdivision, in South Western Ontario, 2014/15**Key Messages**

- The proportion of comprehensive primary care physicians participating in the various primary care models varies substantially across South Western Ontario. The eastern part of the Erie St. Clair LHIN and the smaller rural municipalities in the South West, Waterloo Wellington and Central West LHINs have relatively more FHTs.
- Comprehensive primary care physicians in Windsor and London and in the Mississauga Halton LHIN practice predominantly in enhanced FFS and capitation models; while primary care physicians in larger communities in the Waterloo Wellington LHIN and in the Hamilton census subdivision are more likely to practice in FHTs.
- A large proportion of comprehensive primary care physicians in Windsor and London, and in the Waterloo Wellington, Hamilton Niagara Haldimand Brant, and Mississauga Halton LHINs, do not belong to any primary care model (i.e., payment is based entirely on fee-for-service).



Data sources: 2011 Census of Canada, IPDB

*Enhanced FFS=enhanced fee-for-service; includes Family Health Groups and Comprehensive Care Models. CAP=Capitation; includes Family Health Organizations and Family Health Networks. FHT=Family Health Team. Other=primary care model other than enhanced FFS, CAP or FHT. None=does not belong to a primary care model and payment is based entirely on fee-for-service.

South Central Ontario

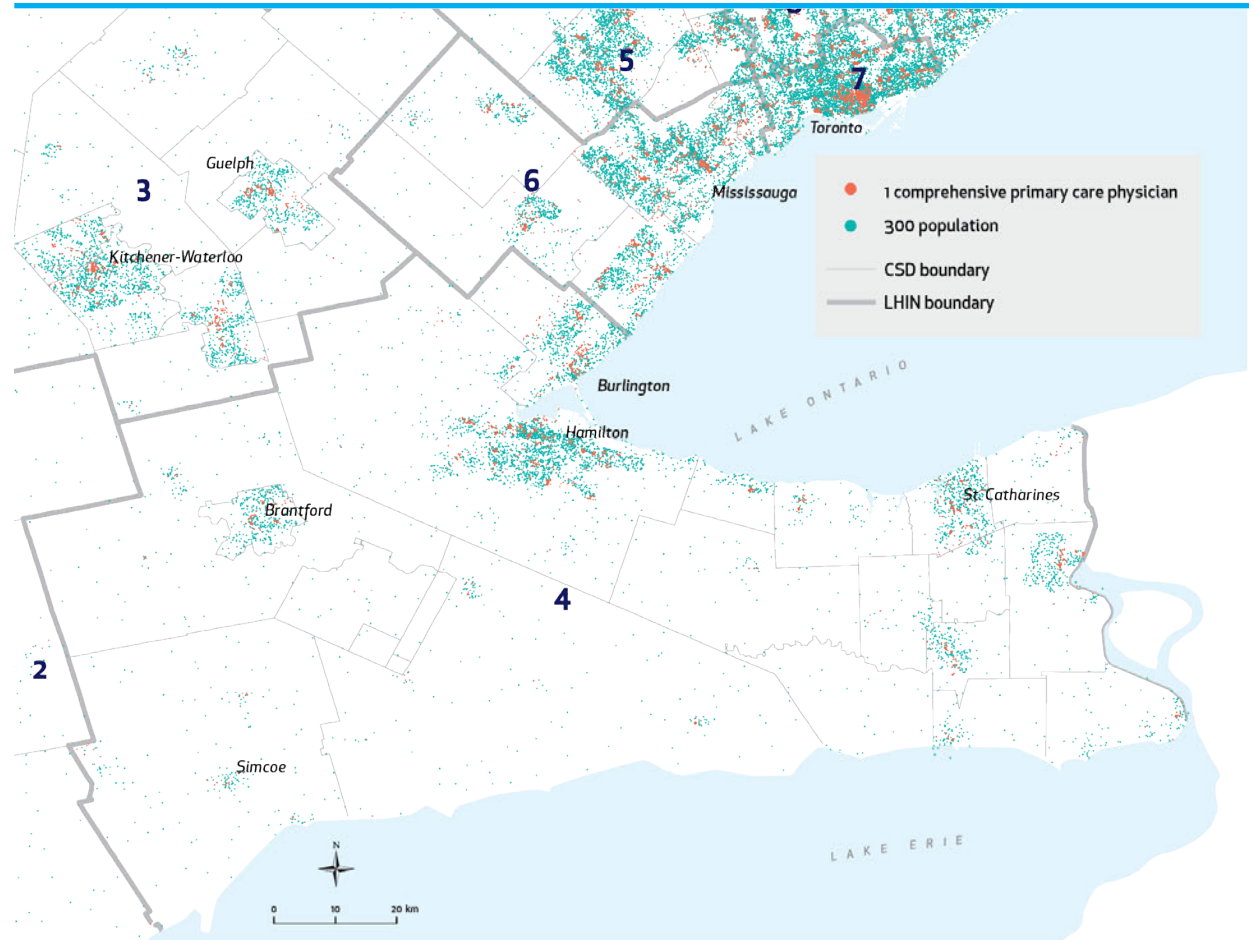
Local Health Integration Networks

- 4** Hamilton Niagara Haldimand Brant
- 6** Mississauga Halton
- 7** Toronto Central

EXHIBIT 11 Distribution of comprehensive primary care physicians relative to the population, by census subdivision, in South Central Ontario, 2014/15

Key Messages

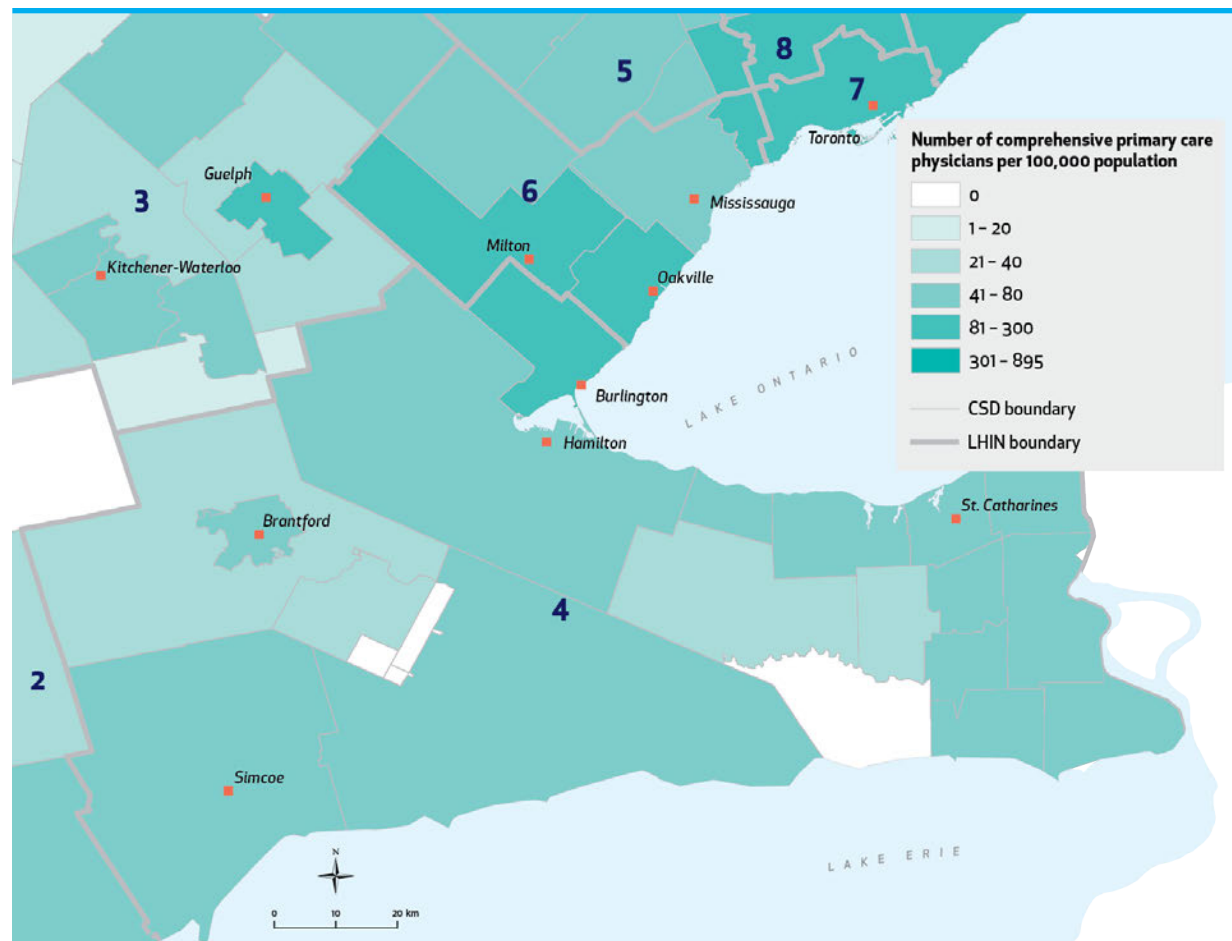
- Most comprehensive primary care physicians serving South Central Ontario are concentrated in the densely populated urban centres.
- Large rural areas with scattered populations, particularly in the Hamilton Niagara Haldimand Brant and Mississauga Halton LHINs, have very few comprehensive primary care physicians.



Data sources: 2011 Census of Canada, IPDB

EXHIBIT 12 Number of comprehensive primary care physicians per 100,000 population, by census subdivision, in South Central Ontario, 2014/15**Key Messages**

- The areas with the highest density of comprehensive primary care physicians include the Toronto, Oakville, Burlington, Milton and Guelph census subdivisions.
- With few exceptions, the density of comprehensive primary care physicians is high across South Central Ontario.
- A previous report found that in 2014 there were, on average, 107 primary care physicians per 100,000 population in Ontario, and 114 primary care physicians per 100,000 population across Canada.¹¹

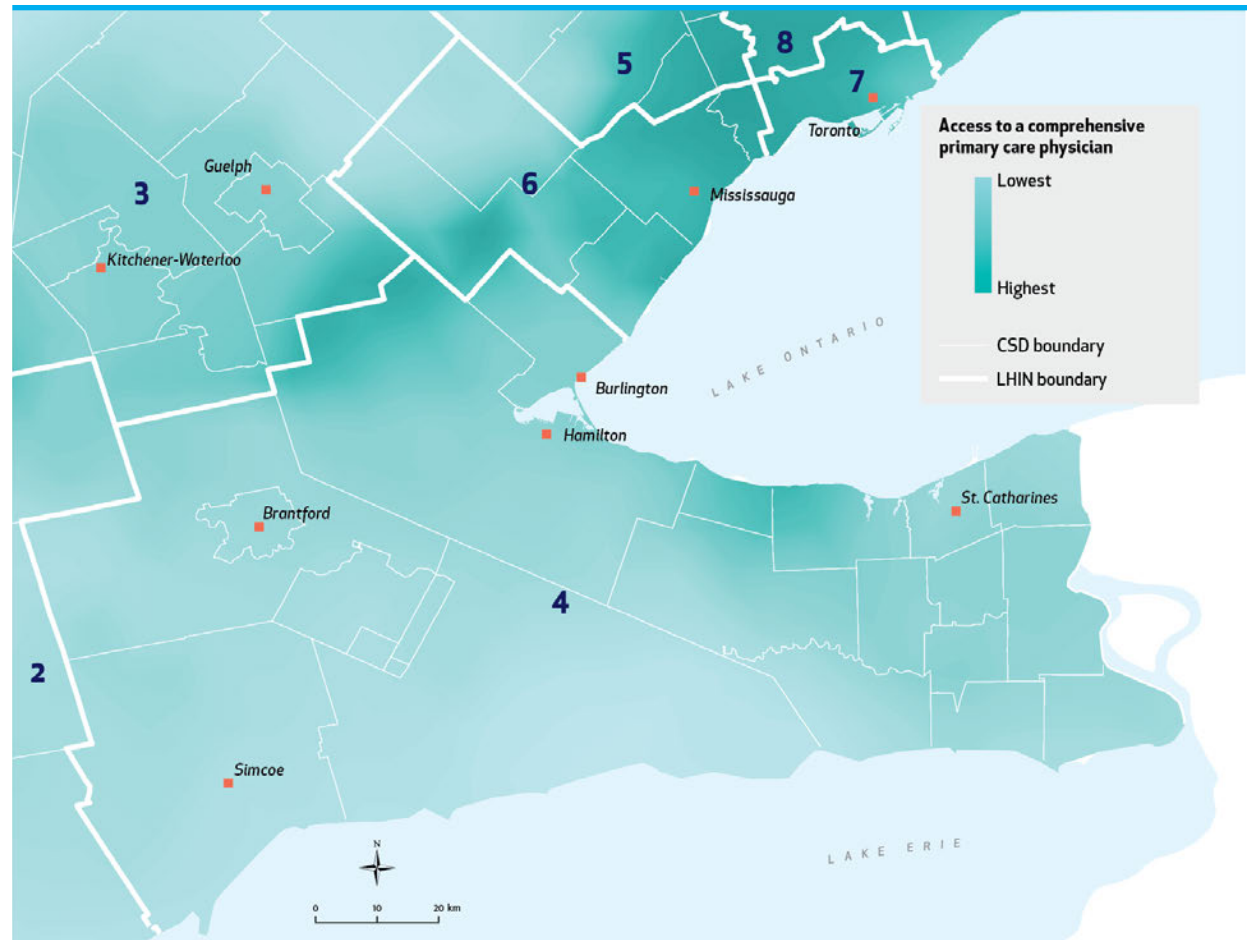


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 13 Access to a comprehensive primary care physician within a 30-minute driving time, using the two-step floating catchment area method, basic formula, in South Central Ontario, 2014/15

Key Messages

- Access to a comprehensive primary care physician within 30 minutes is highest for residents in the Toronto and Mississauga areas.
- While the Hamilton area is an urban setting, physician access is not as high there as in other urban centres in South Central Ontario.
- The more rural areas in the Hamilton Niagara Haldimand Brant and Mississauga Halton LHINs have lower access to comprehensive primary care physicians.

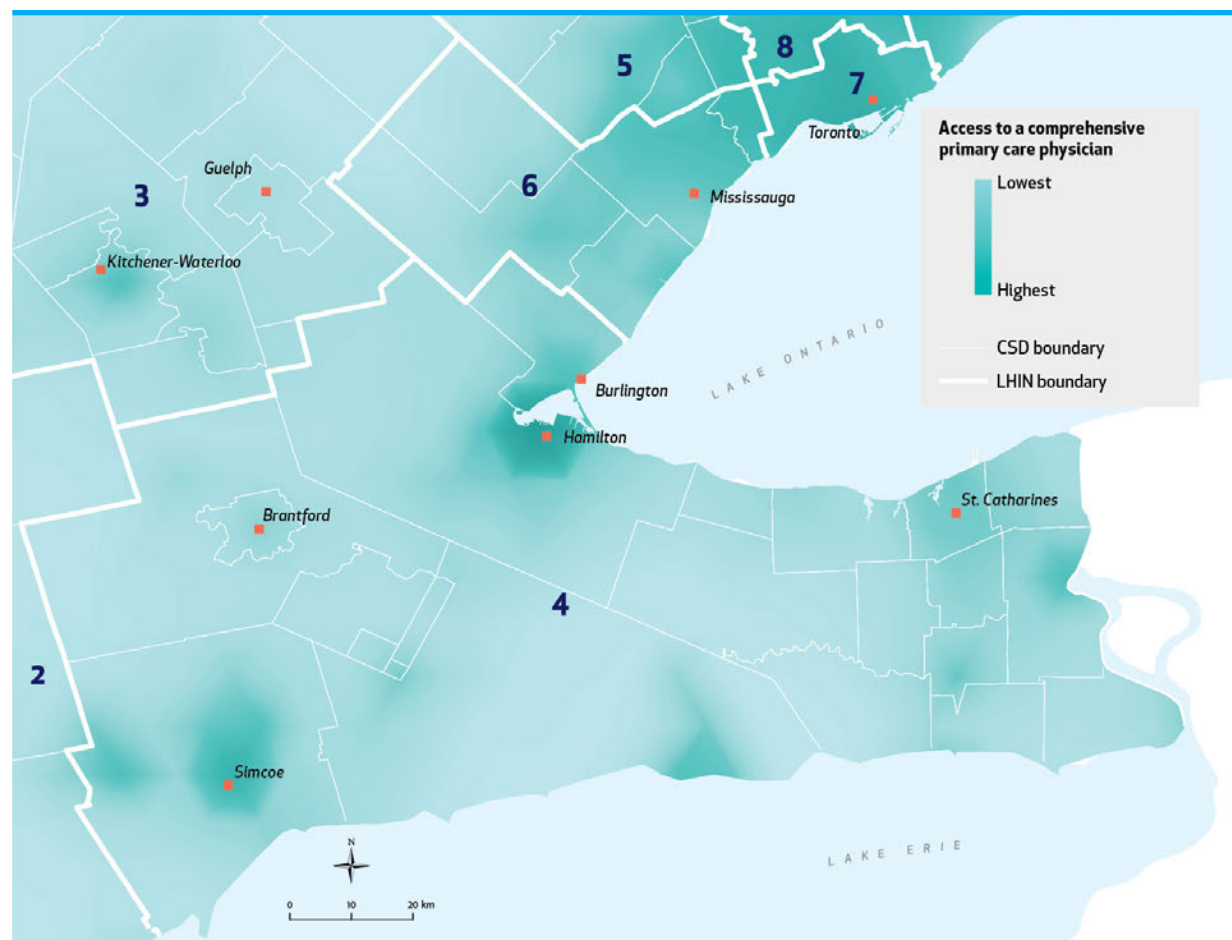


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 14 Access to a comprehensive primary care physician within a 30-minute driving time, using the two-step floating catchment area method, gravity distance decay formula, in South Central Ontario, 2014/15

Key Messages

- Access to comprehensive primary care physicians within 30 minutes is highest in Toronto and Mississauga (similar to the results obtained using the 2SFCA basic formula, Exhibit 13), and in Hamilton, Simcoe, St. Catharines and other small communities across the South Central region.
- Access is lowest in the more rural areas of the Hamilton Niagara Haldimand Brant and Mississauga Halton LHINs.

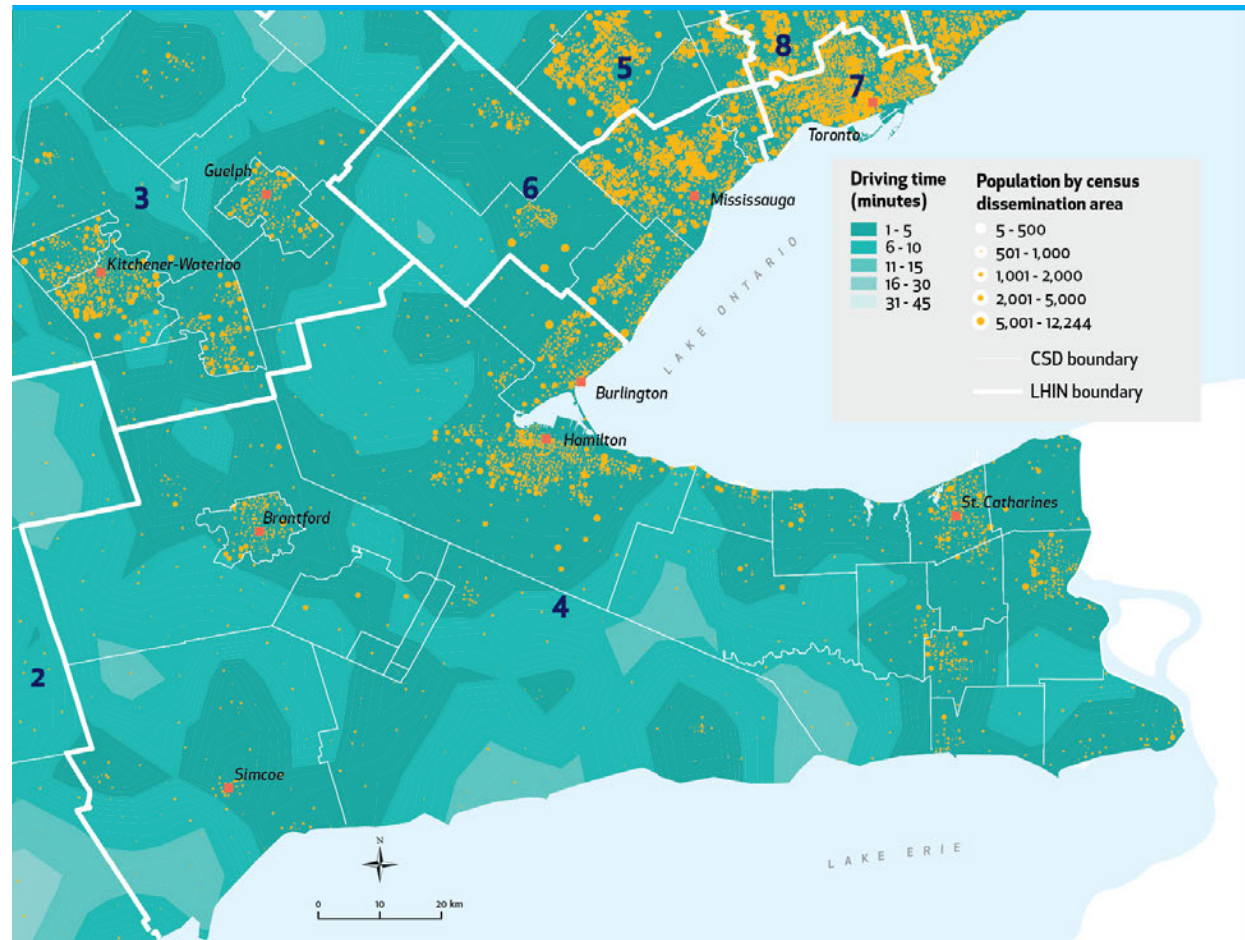


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 15 Minimum driving time in minutes to the nearest comprehensive primary care physician from the centre of each census dissemination area, in South Central Ontario, 2014/15

Key Messages

- Most residents in South Central Ontario benefit from short travel times by car to the nearest comprehensive primary care physician, ranging from one to 15 minutes.
- Driving times do not consider delays that may be caused by poor driving conditions, road construction or traffic congestion.



Data sources: 2011 Census of Canada, 2013 DMTI Spatial road network file, IPDB

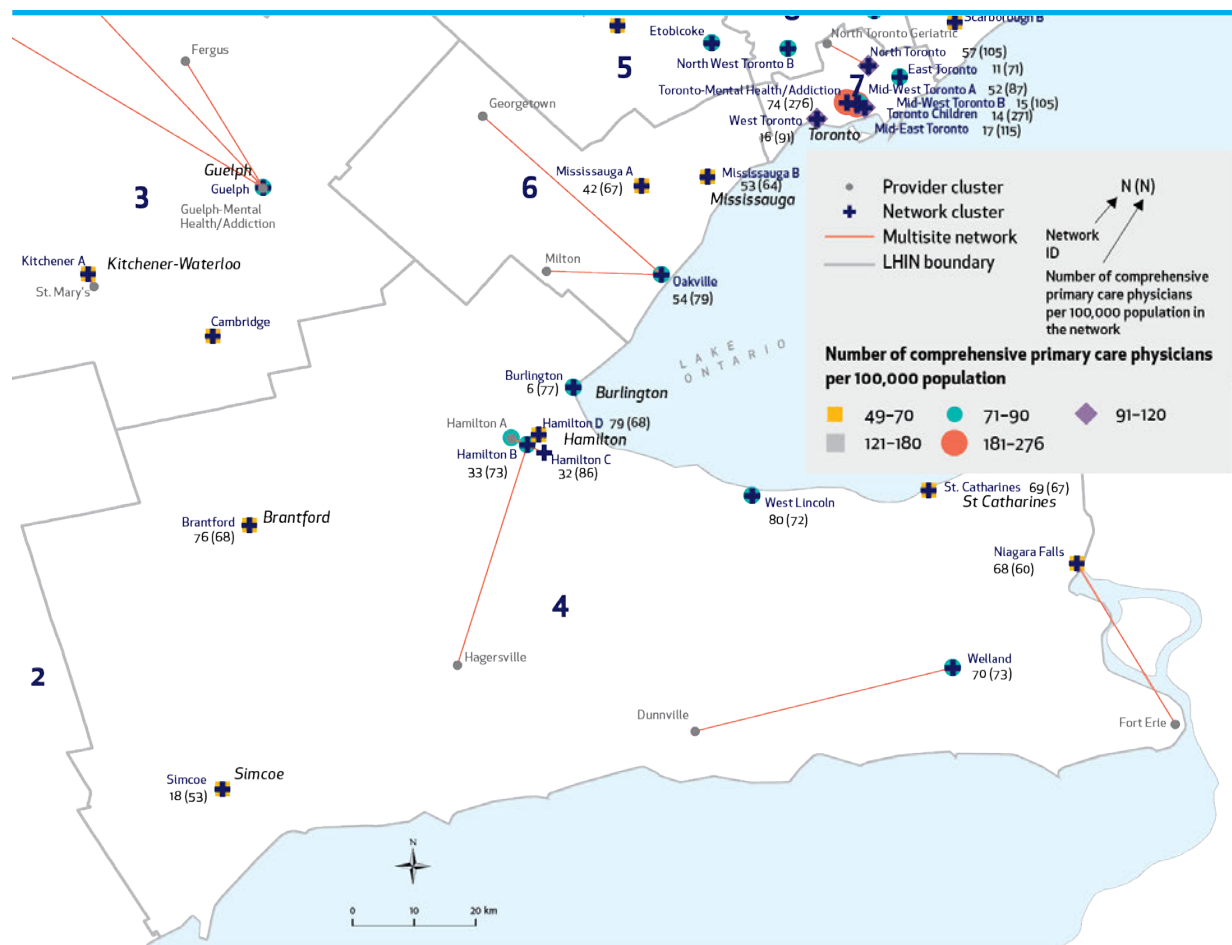
EXHIBIT 16 Number of comprehensive primary care physicians per 100,000 population, by multispecialty physician network, in South Central Ontario, 2011/12 to 2013/14

Key Messages

- There are a large number of multispecialty physician networks across the South Central Ontario. This area is dominated by larger network clusters, with only a few provider clusters in smaller communities.
- All physician networks in the Hamilton Niagara Haldimand Brant and Mississauga Halton LHINs have between 49 and 90 comprehensive primary care physicians per 100,000 population. The physician networks in the Toronto Central LHIN have a higher density of these physicians: between 91 and 276 per 100,000 population.

Multispecialty physician networks in South Central Ontario, by Network ID

- | | |
|---|---|
| 6 Joseph Brant Hospital | 57 Sunnybrook Health Sciences Centre |
| 11 Michael Garron Hospital | 68 Niagara Health-Greater Niagara General Site |
| 14 Hospital for Sick Children | 69 Niagara Health-St. Catharines Site |
| 15 Mount Sinai Hospital | 70 Niagara Health-Welland Site |
| 16 St. Joseph's Health Centre | 74 Centre for Addiction and Mental Health |
| 17 St. Michael's Hospital | 76 Brant Community Healthcare System-Brantford General Site |
| 18 Norfolk General Hospital | 79 Hamilton Health Sciences-Hamilton General Hospital |
| 32 Hamilton Health Sciences-Juravinski Cancer Centre | 80 Hamilton Health Sciences-West Lincoln Memorial Hospital |
| 33 St. Joseph's Health Care Hamilton | |
| 42 Trillium Health Partners-Credit Valley Hospital | |
| 52 University Health Network | |
| 53 Trillium Health Partners-Mississauga Hospital | |
| 54 Halton Healthcare-Oakville Trafalgar Memorial Hospital | |

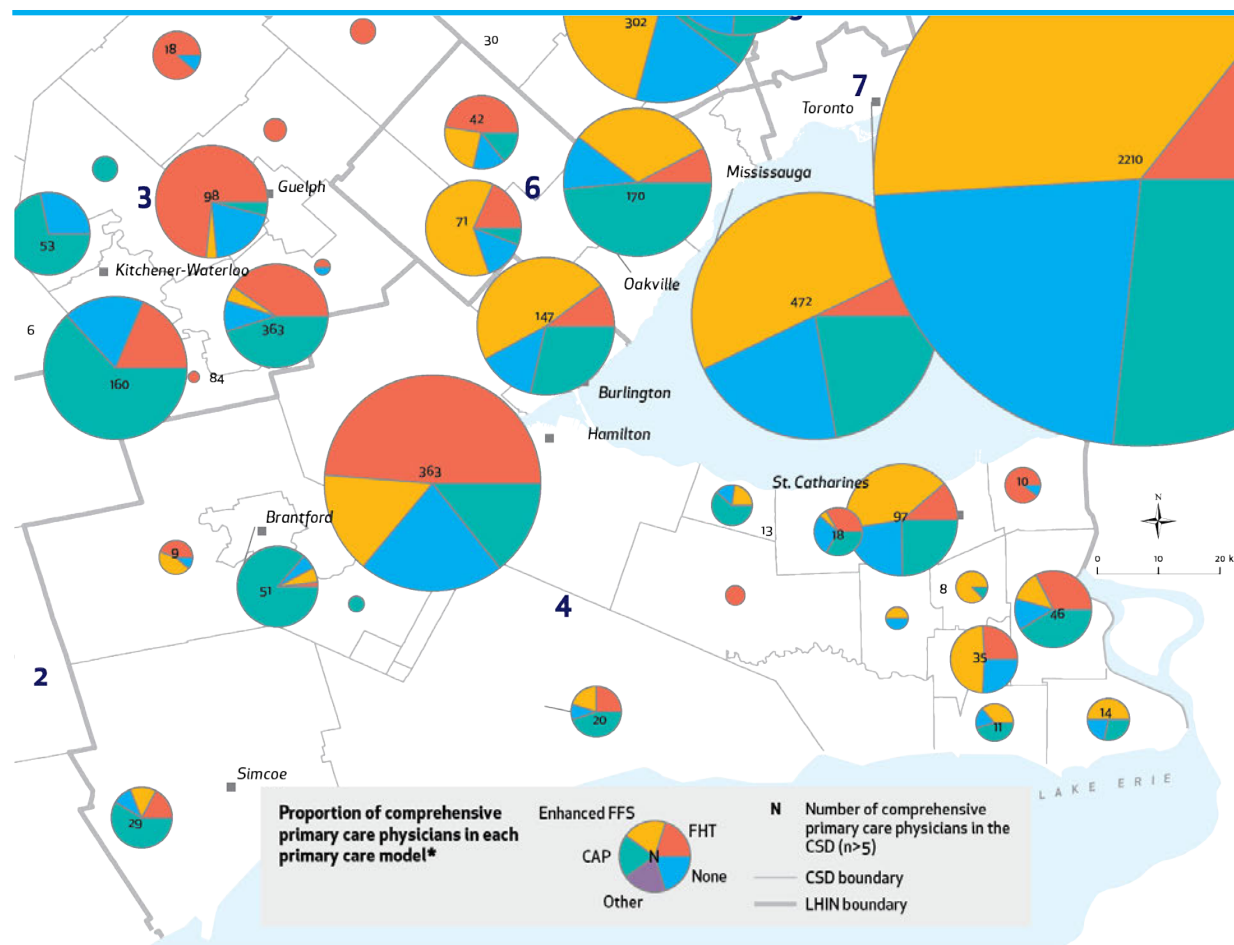


Data sources: CAPE, CIHI-SDS, CPDB, DAD, INST, IPDB, NACRS, ODB, OHIP, OMHRS, REF, RPDB

EXHIBIT 17 Proportion of comprehensive primary care physicians participating in different primary care models, by census subdivision, in South Central Ontario, 2014/15

Key Messages

- The proportion of comprehensive primary care physicians participating in the different primary care care models varies across South Central Ontario.
- Sometimes, even communities that are geographically close to each other have different distributions of primary care models. For example, while many physicians in Hamilton and Guelph practice in FHTs, there are very few, if any, physicians in FHTs in the nearby communities of Brantford and Kitchener-Waterloo.
- In the eastern part of the region, comprehensive primary care physicians are fairly evenly distributed across primary care models. In the western part of the region, they are more likely to practice in capitation models and FHTs, or not to belong to any primary care model (i.e., payment is based entirely on fee-for-service).



Data sources: 2011 Census of Canada, IPDB

*Enhanced FFS=enhanced fee-for-service; includes Family Health Groups and Comprehensive Care Models. CAP=Capitation; includes Family Health Organizations and Family Health Networks; FHT=Family Health Team. Other=primary care model other than enhanced FFS, CAP or FHT. None=does not belong to a primary care model and payment is based entirely on fee-for-service.

Greater Toronto Area

Local Health Integration Networks

5 Central West

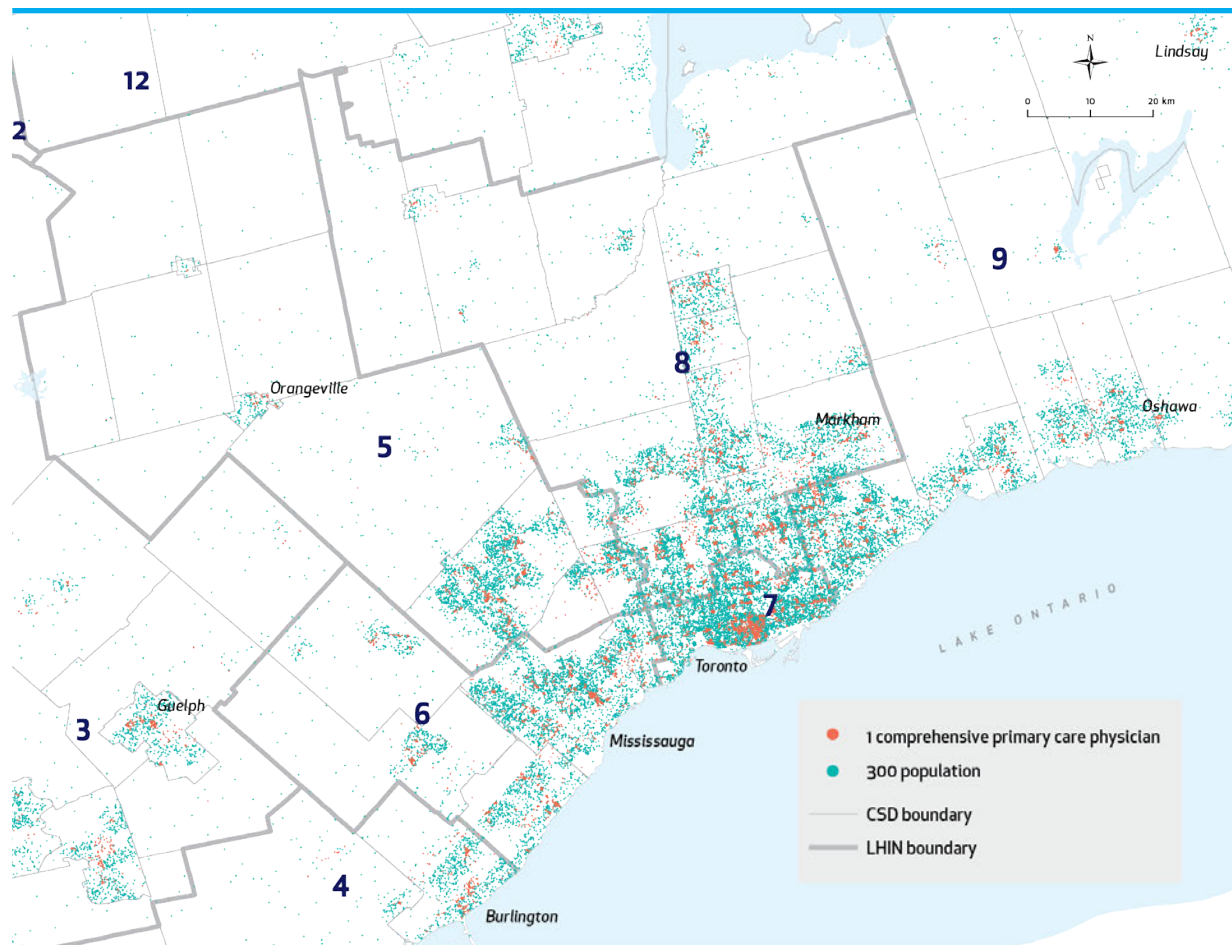
6 Mississauga Halton

7 Toronto Central

8 Central

EXHIBIT 18 Distribution of comprehensive primary care physicians relative to the population, by census subdivision, in the Greater Toronto Area, 2014/15**Key Messages**

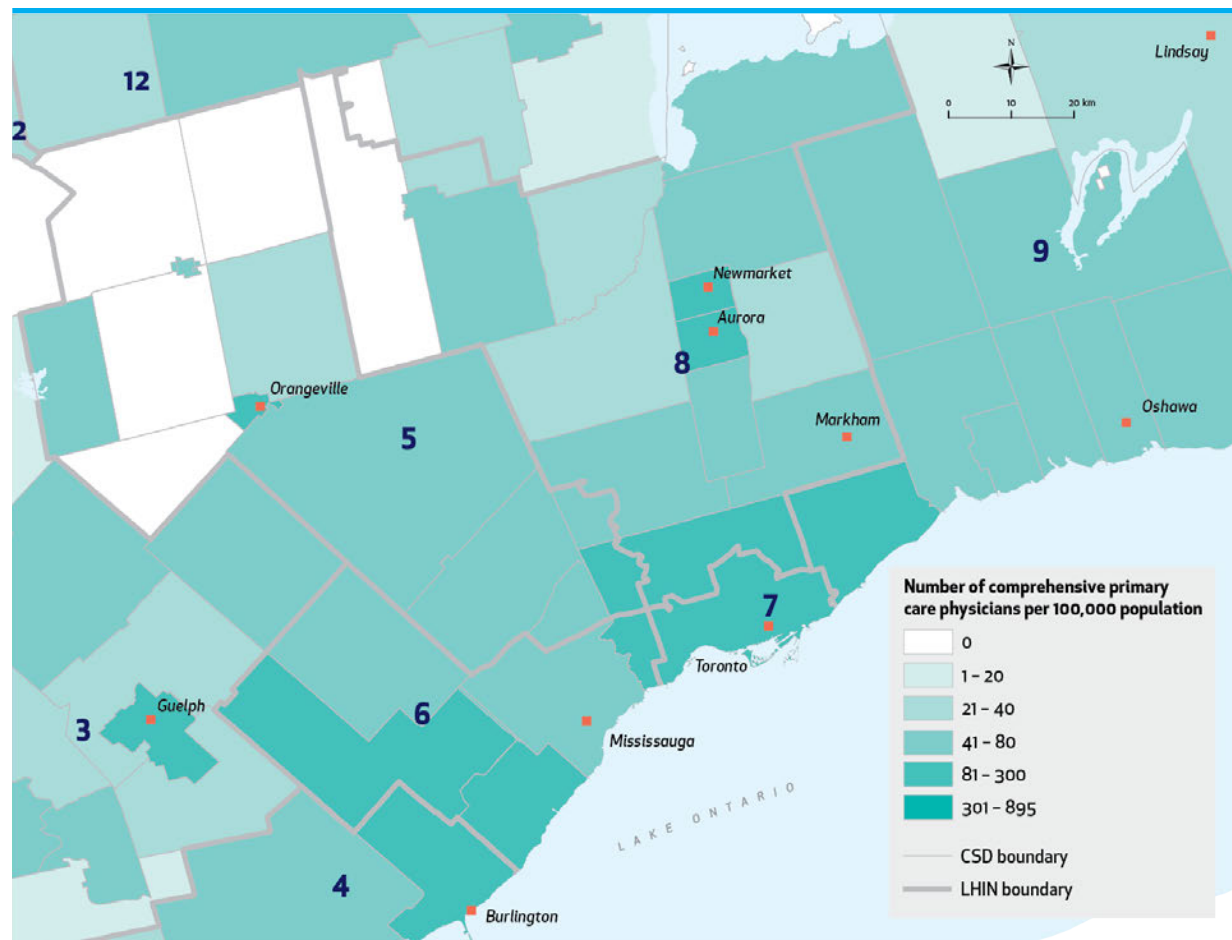
- Comprehensive primary care physicians are concentrated in the densely populated urban areas of the Greater Toronto Area (GTA) and elsewhere in the Central West, Mississauga Halton, Toronto Central, Central and Central East LHINs.
- Downtown Toronto is the most densely populated area in the GTA and has the highest number of comprehensive primary care physicians.
- There are several rural areas in the GTA with few comprehensive primary care physicians.



Data sources: 2011 Census of Canada, IPDB

EXHIBIT 19 Number of comprehensive primary care physicians per 100,000 population, by census subdivision, in the Greater Toronto Area, 2014/15**Key Messages**

- Areas with the highest density of comprehensive primary care physicians include Toronto, Burlington, Oakville, Milton and Guelph, as well as the smaller towns of Orangeville, Aurora and Newmarket.
- There are a number of rural areas north and west of Orangeville that have no comprehensive primary care physicians (density is 0).
- A previous report found that in 2014 there were, on average, 107 primary care physicians per 100,000 population in Ontario, and 114 primary care physicians per 100,000 population across Canada.¹¹

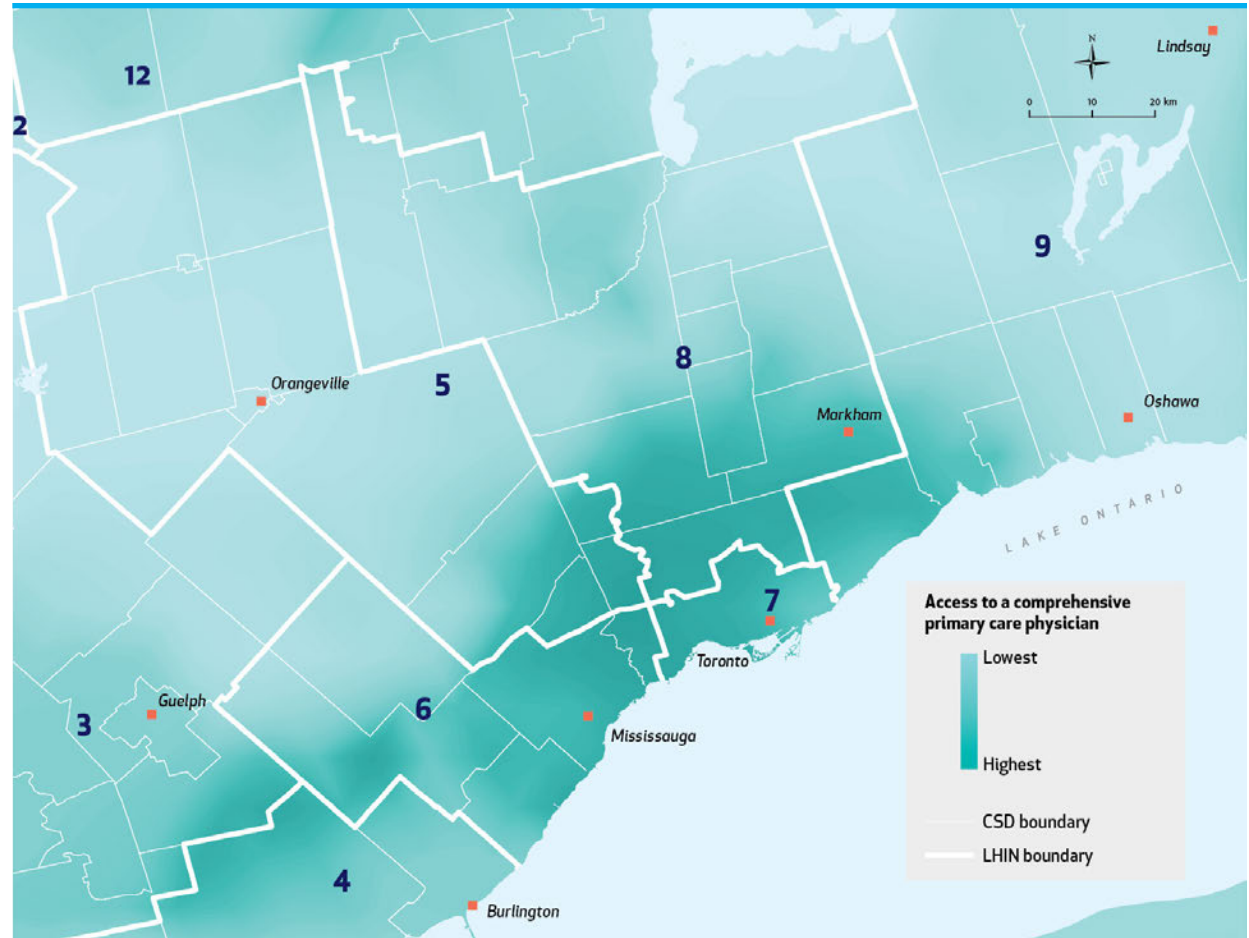


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 20 Access to a comprehensive primary care physician within a 30-minute driving time, using the two-step floating catchment area method, basic formula, in the Greater Toronto Area, 2014/15

Key Messages

- Access to a comprehensive primary care physician within 30 minutes is higher in areas in and around the City of Toronto and in some areas just west of Toronto.
- Access is lower in the rural areas around Orangeville, and in areas east of the GTA in the Central East LHIN.

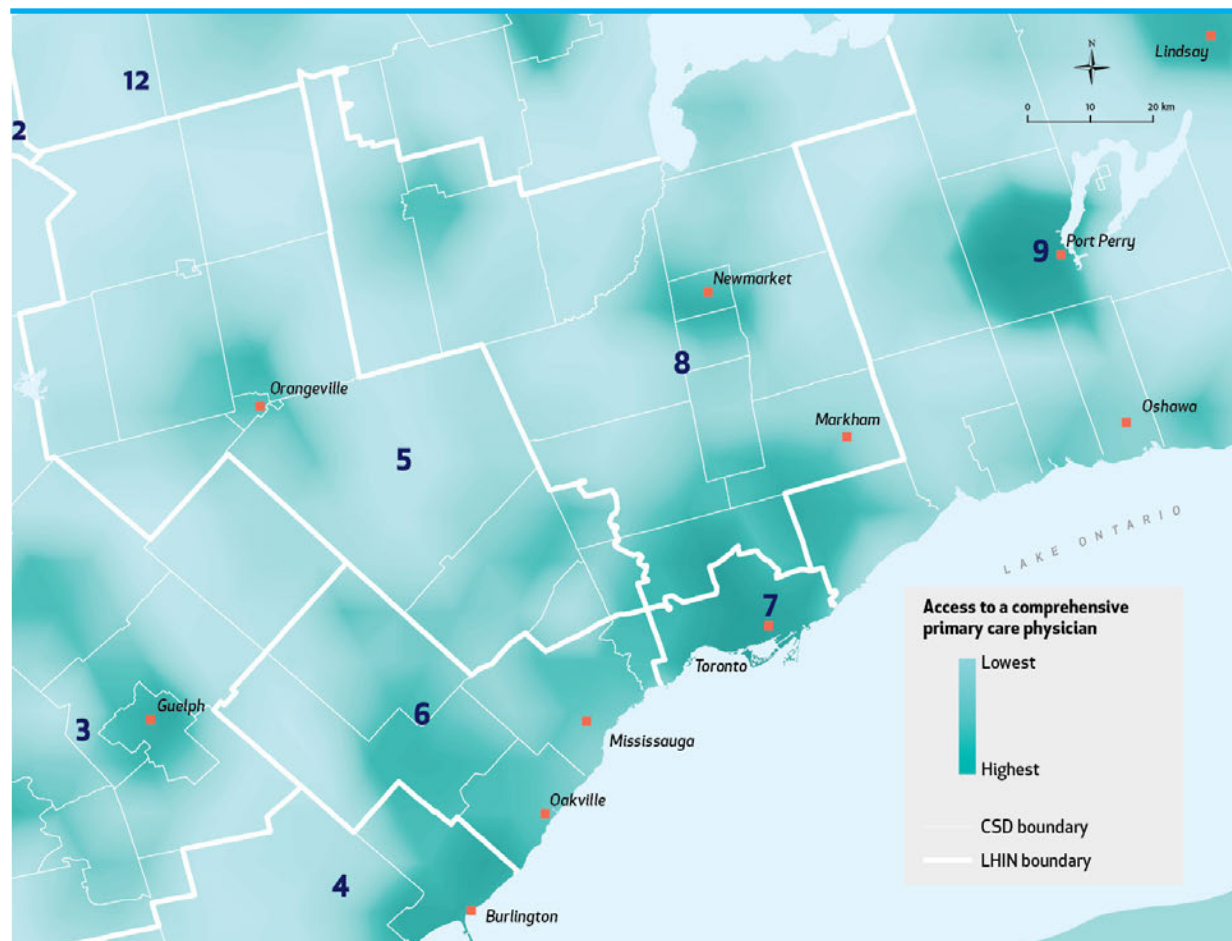


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 21 Access to a comprehensive primary care physician within a 10-minute driving time, using the two-step floating catchment area method, basic formula, in the Greater Toronto Area, 2014/15

Key Messages

- Using a 10-minute driving radius, the areas with higher access to comprehensive primary care physicians are more distinct and patch-like in parts of Toronto, Oakville, Burlington, Guelph, Orangeville, Newmarket and Port Perry (in the Central East LHIN).
- Regions of lower access appear mainly in rural areas, but some more urban areas east of Scarborough also have lower access to comprehensive primary care physicians.

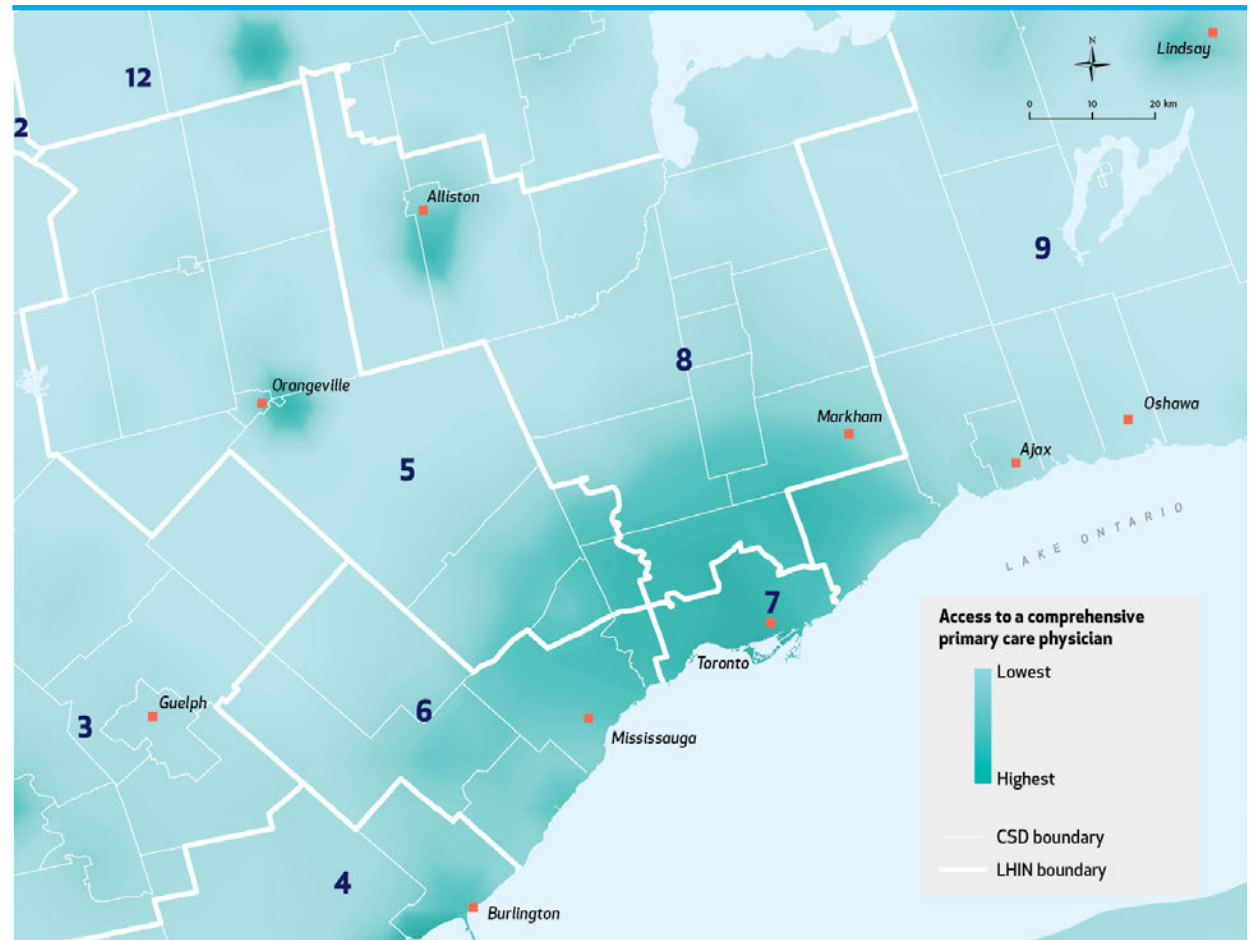


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 22 Access to a comprehensive primary care physician within a 30-minute driving time, using the two-step floating catchment area method, gravity distance decay formula, in the Greater Toronto Area, 2014/15

Key Messages

- Access to a comprehensive primary care physician within 30 minutes is higher in and around Toronto and in a few smaller towns such as Orangeville and Alliston (in the Central LHIN).
- There is lower access in more rural areas, as well as in some smaller urban centres, such as Guelph, and along the Ajax-Oshawa corridor.

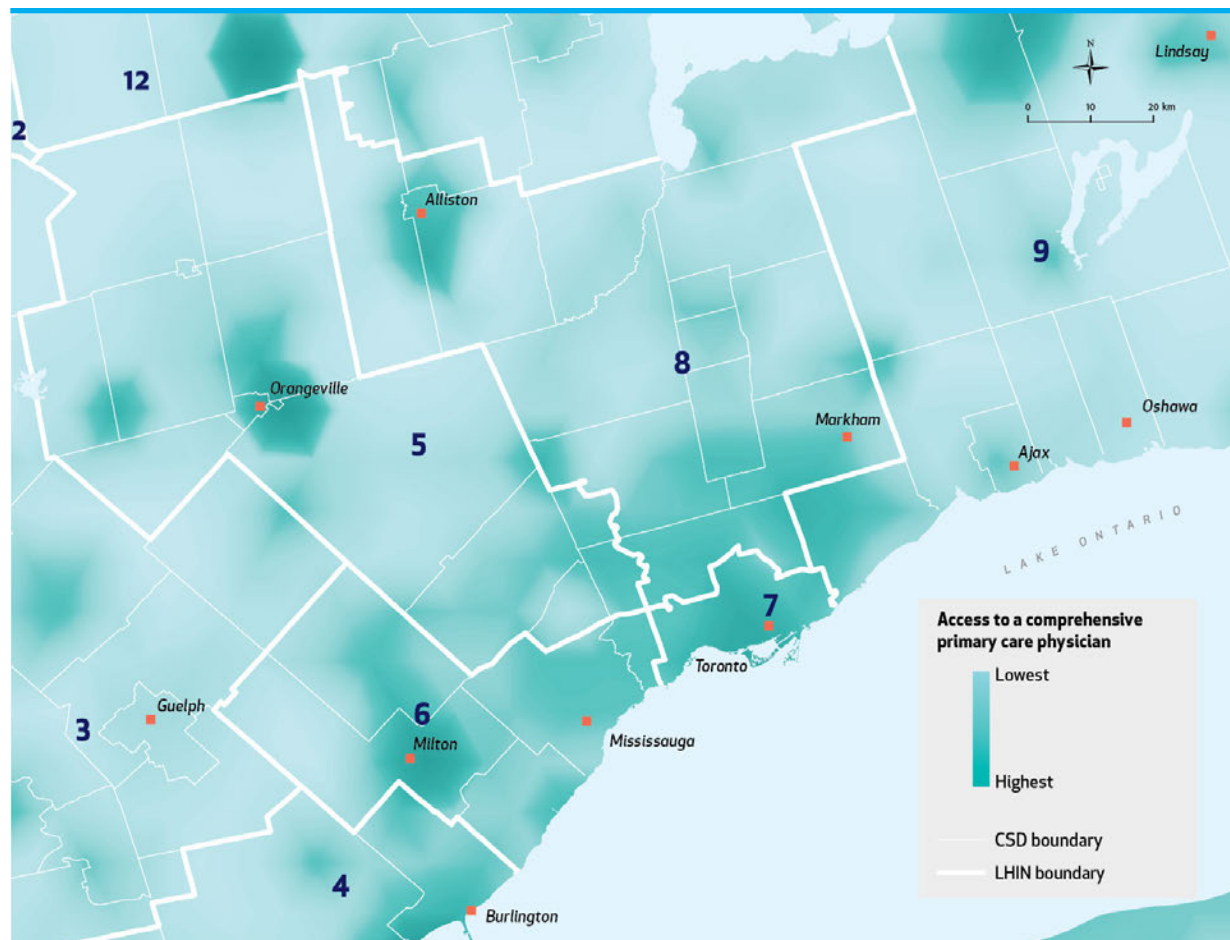


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 23 Access to a comprehensive primary care physician within a 10-minute driving time, using the two-step floating catchment area method, gravity distance decay formula, in the Greater Toronto Area, 2014/15

Key Messages

- Using a 10-minute driving radius, the areas with higher access to comprehensive primary care physicians appeared to be more distinct and patch-like in most of Toronto, as well as in areas around Milton, Orangeville and Alliston.
- Regions of lower access are scattered throughout the map and coincide mainly with rural areas, but some urban areas, such as Guelph and the Ajax-Oshawa corridor, also show lower physician access.

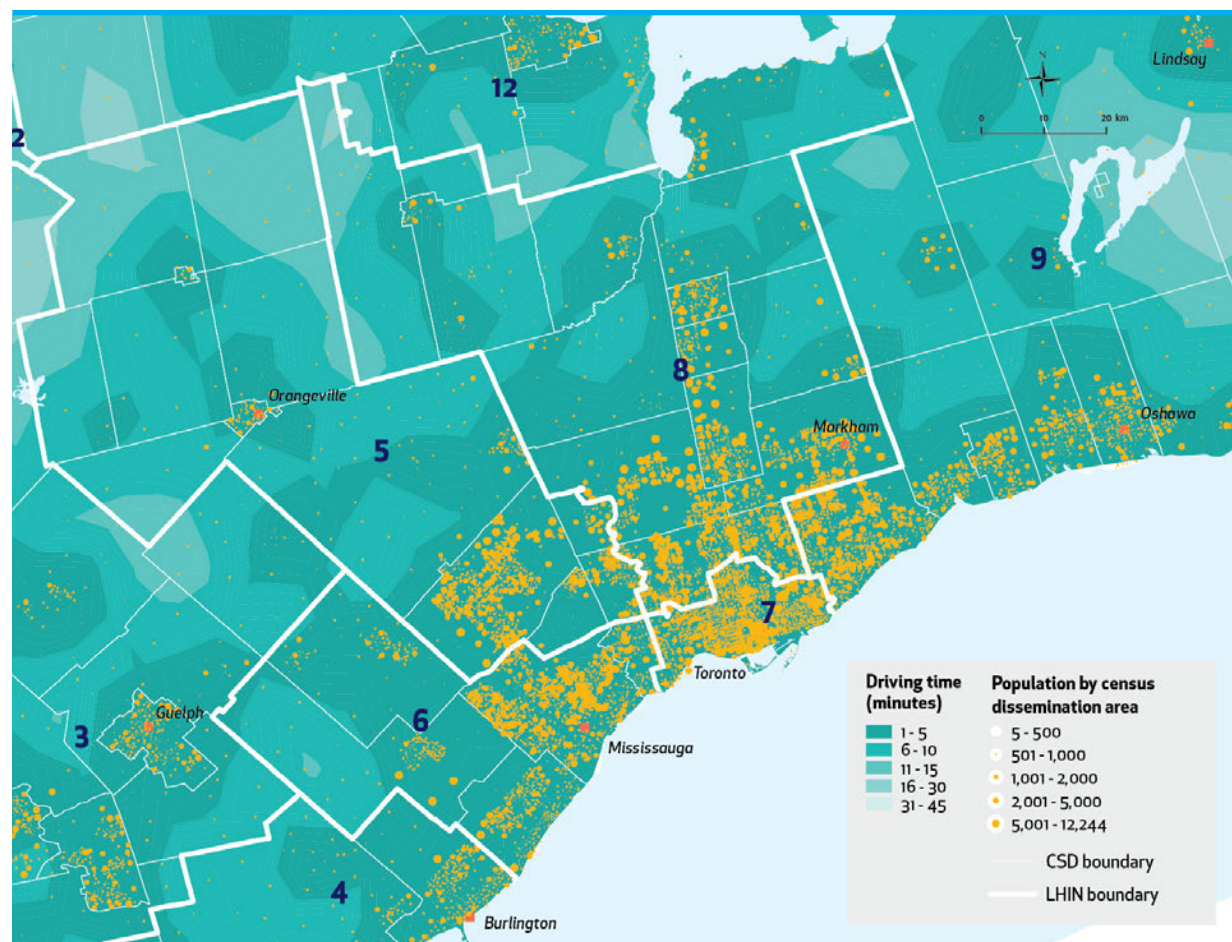


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 24 Minimum driving time in minutes to the nearest comprehensive primary care physician from the centre of each census dissemination area, in the Greater Toronto Area, 2014/15

Key Messages

- Residents in most areas of the GTA benefit from relatively short travel times by car to the nearest comprehensive primary care physician, ranging from one to 15 minutes.
- Driving times do not consider delays that may be caused by poor driving conditions, road construction or traffic congestion.



Data sources: 2011 Census of Canada, 2013 DMTI Spatial road network file, IPDB

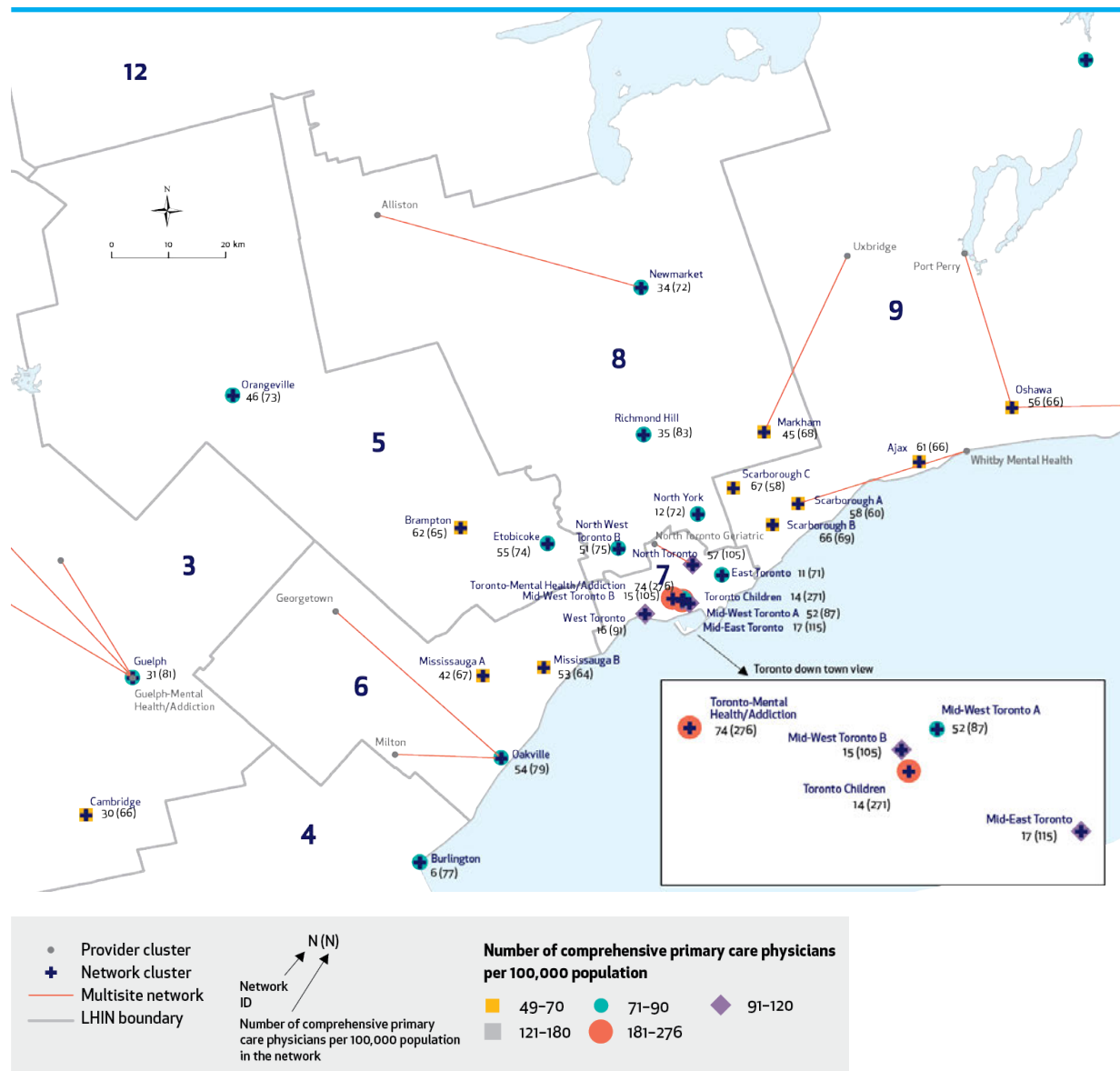
EXHIBIT 25 Number of comprehensive primary care physicians per 100,000 population, by multispecialty physician network, in the Greater Toronto Area, 2011/12 to 2013/14

Key Messages

- There are a large number of multispecialty physician networks in and around Toronto, as well as in most municipalities across the GTA.
- All physician networks in the Central West, Mississauga Halton and Central LHINs (as well as those in the areas of the Central East LHIN that are visible on this map) have between 49 and 90 comprehensive primary care physicians per 100,000 population; whereas networks in the Toronto Central LHIN are larger, with 91 to 276 physicians per 100,000 population.

Multispecialty physician networks in the Greater Toronto Area, by Network ID

6 Joseph Brant Hospital	54 Halton Healthcare-Oakville
11 Michael Garron Hospital	Trafalgar Memorial Hospital
12 North York General Hospital	55 William Osler Health System-
14 Hospital for Sick Children	Etobicoke General Hospital
15 Mount Sinai Hospital	56 Lakeridge Health-Oshawa
16 St. Joseph's Health Centre	57 Sunnybrook Health
17 St. Michael's Hospital	Sciences Centre
30 Cambridge Memorial Hospital	58 Scarborough and Rouge
31 Guelph General Hospital	Hospital-Centenary
34 Southlake Regional	61 Lakeridge Health-Ajax-
Health Centre	Pickering Hospital
35 Mackenzie Health	62 William Osler Health System-
42 Trillium Health Partners-	Brampton Civic Hospital
The Credit Valley Hospital	66 Scarborough and Rouge
45 Markham Stouffville Hospital	Hospital-General Site
46 Headwaters Health Care Centre	67 Scarborough and Rouge
51 Humber River Hospital	Hospital-Birchmount Site
52 University Health Network	74 Centre for Addiction and
53 Trillium Health Partners-	Mental Health
Mississauga Hospital	

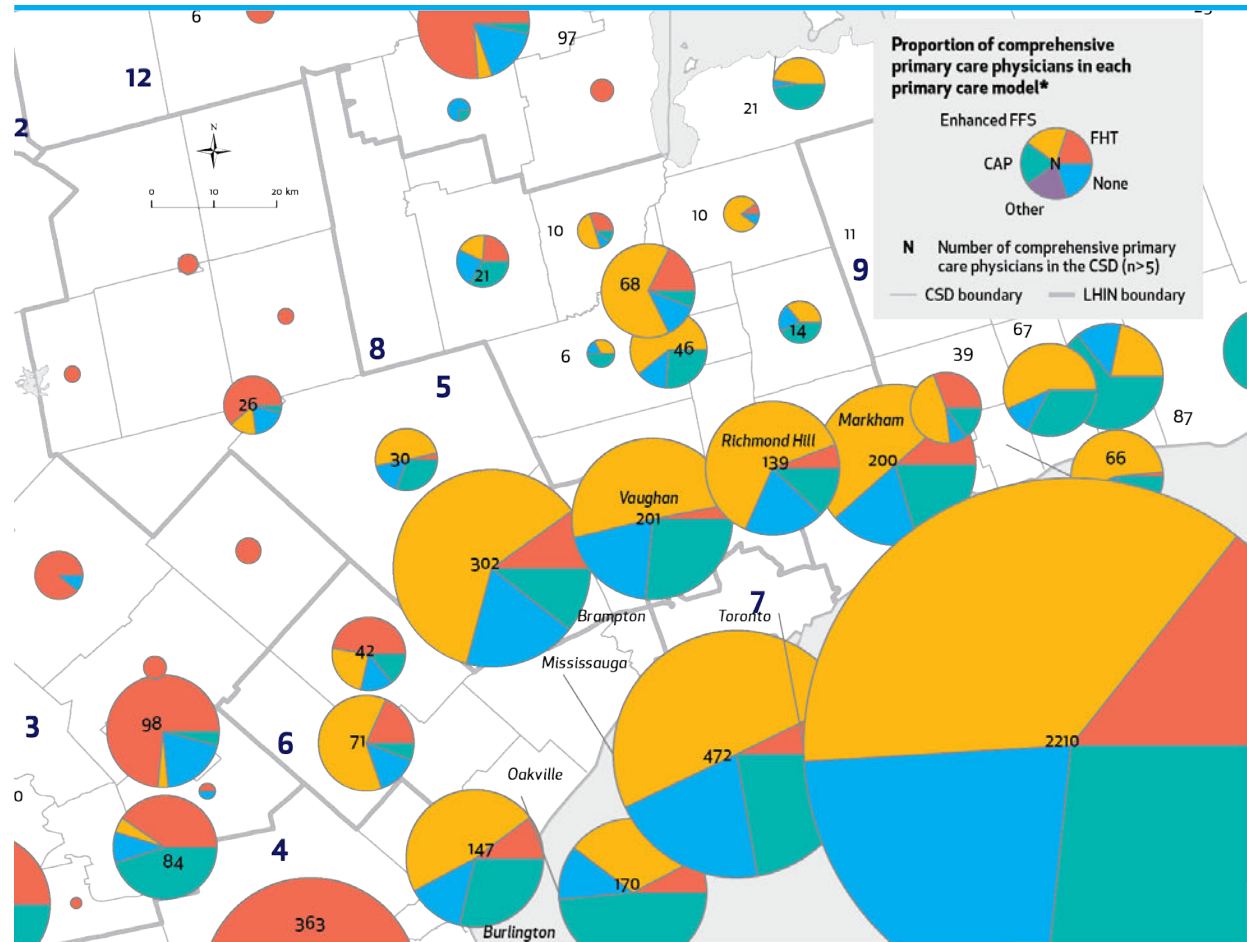


Data sources: CAPE, CIHI-SDS, CPDB, DAD, INST, IPDB, NACRS, ODB, OHIP, OMHRS, REF, RPDB

EXHIBIT 26 Proportion of comprehensive primary care physicians participating in different primary care models, by census subdivision, in the Greater Toronto Area, 2014/15

Key Messages

- The proportion of comprehensive primary care physicians participating in the various primary care models varies substantially across the GTA.
- The western and northern sections of the GTA, as well as its smaller rural municipalities, have relatively more FHTs. In larger urban areas in Toronto and the surrounding municipalities, a larger proportion of comprehensive primary care physicians practice in enhanced fee-for-service and capitation models, or do not belong to any primary care model (i.e., payment is based entirely on fee-for-service).



Data sources: 2011 Census of Canada, IPDB

*Enhanced FFS=enhanced fee-for-service; includes Family Health Groups and Comprehensive Care Models. CAP=Capitation; includes Family Health Organizations and Family Health Networks; FHT=Family Health Team. Other=primary care model other than enhanced FFS, CAP or FHT. None=does not belong to a primary care model and payment is based entirely on fee-for-service.

South Eastern Ontario

Local Health Integration Networks

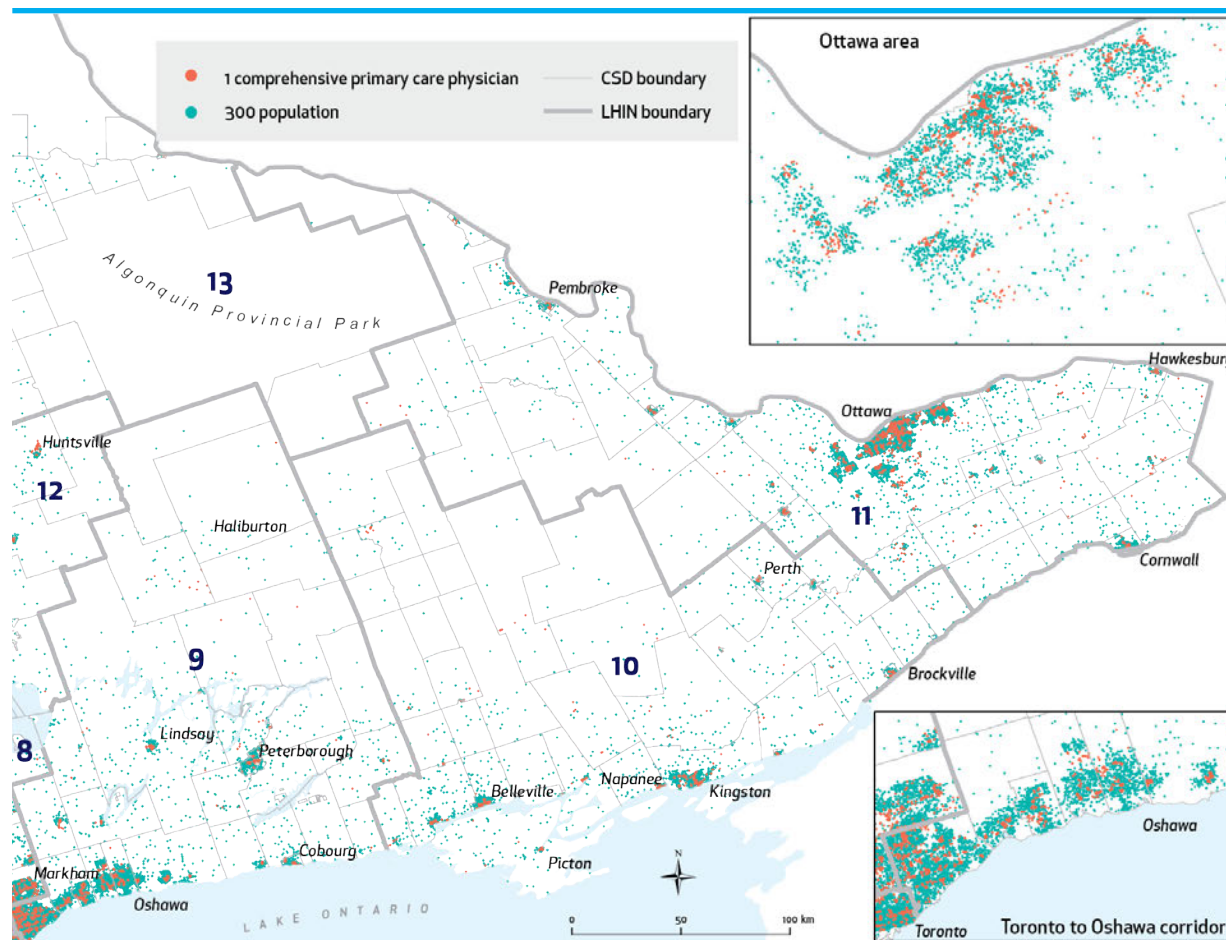
9 Central East

10 South East

11 Champlain

EXHIBIT 27 Distribution of comprehensive primary care physicians relative to the population, by census subdivision, in South Eastern Ontario, 2014/15**Key Messages**

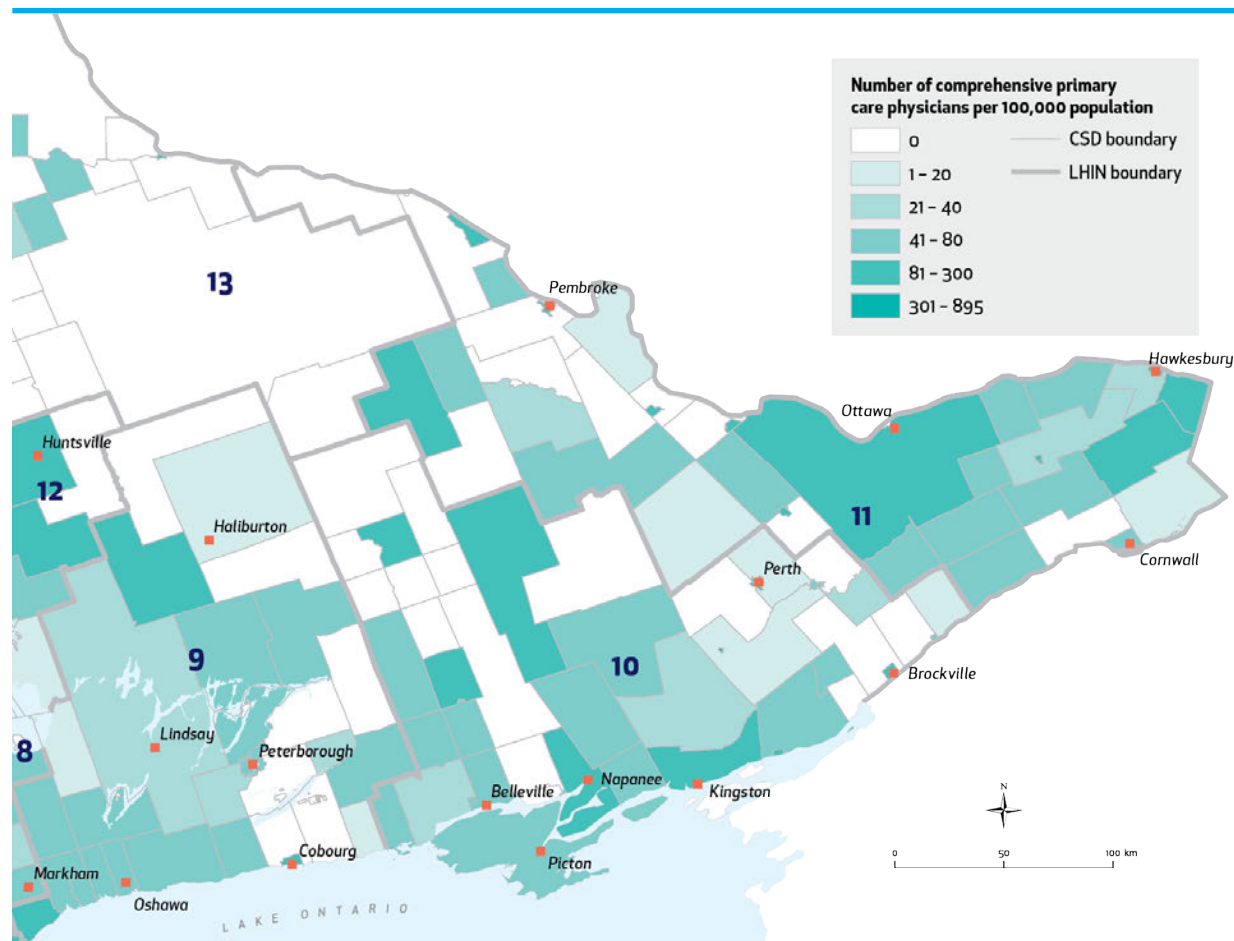
- Most comprehensive primary care physicians serving South Western Ontario are concentrated in the densely populated urban areas of Ottawa, Kingston and Oshawa.
- There are large rural areas in the central and northern parts of the South East LHIN and western parts of the Champlain LHIN where the population is scattered without accompanying comprehensive primary care physicians.
- The Algonquin Provincial Park area is void of comprehensive primary care physicians and residents.



Data sources: 2011 Census of Canada, IPDB

EXHIBIT 28 Number of comprehensive primary care physicians per 100,000 population, by census subdivision, in South Eastern Ontario, 2014/15**Key Messages**

- The areas with the highest density of comprehensive primary care physicians include those in and around Ottawa, Kingston and Napanee, as well as in several rural census subdivisions.
- Many census subdivisions have no comprehensive primary care physicians (density is 0).
- A previous report found that in 2014 there were, on average, 107 primary care physicians per 100,000 population in Ontario, and 114 primary care physicians per 100,000 population across Canada.¹¹

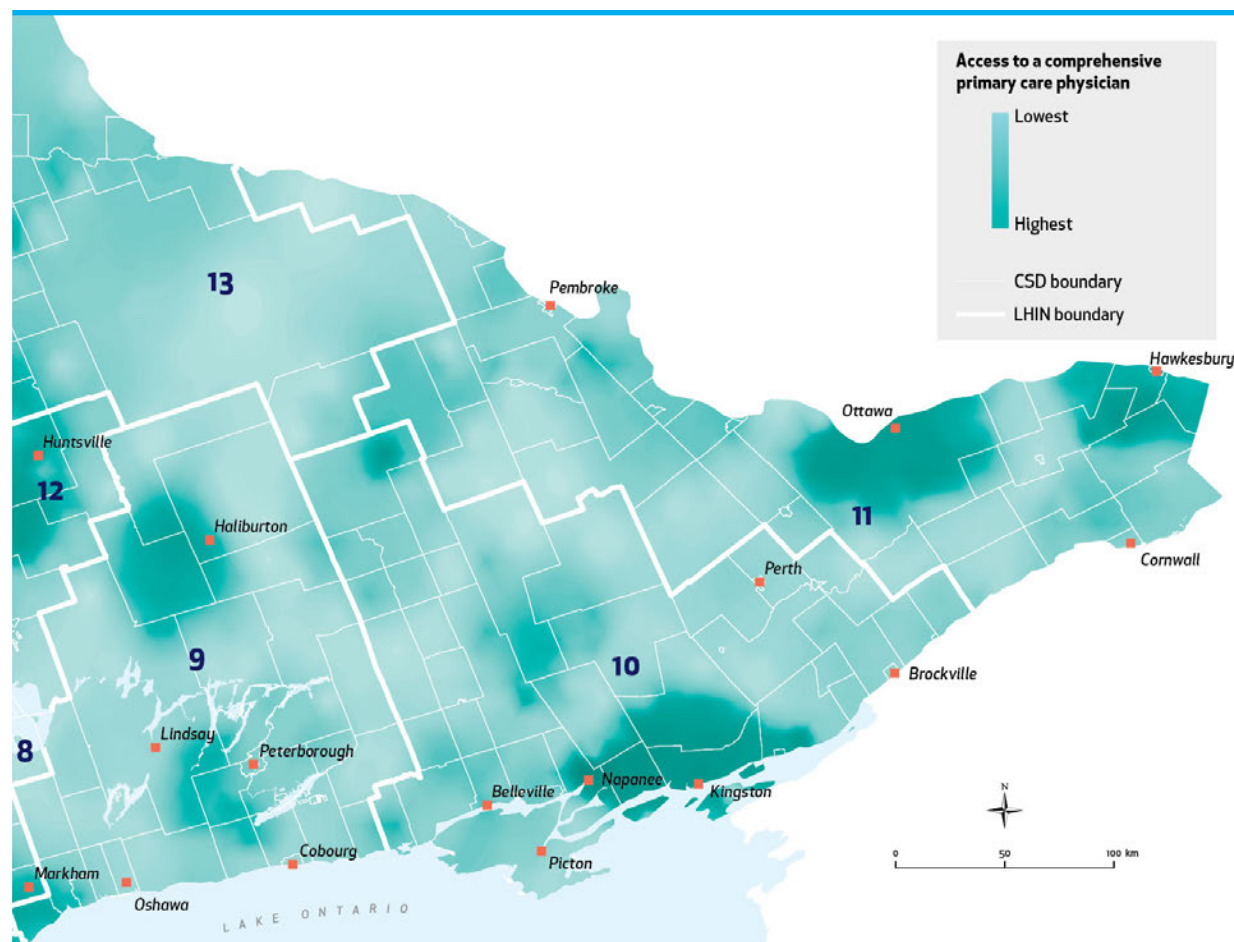


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 29 Access to a comprehensive primary care physician within a 30-minute driving time, using the two-step floating catchment area method, basic formula, in South Eastern Ontario, 2014/15

Key Messages

- Access to a comprehensive primary care physician within 30 minutes is higher for residents in Ottawa, Kingston, Peterborough, Haliburton and a few smaller communities.
- Most rural areas of the region have lower levels of access to comprehensive primary care physicians.

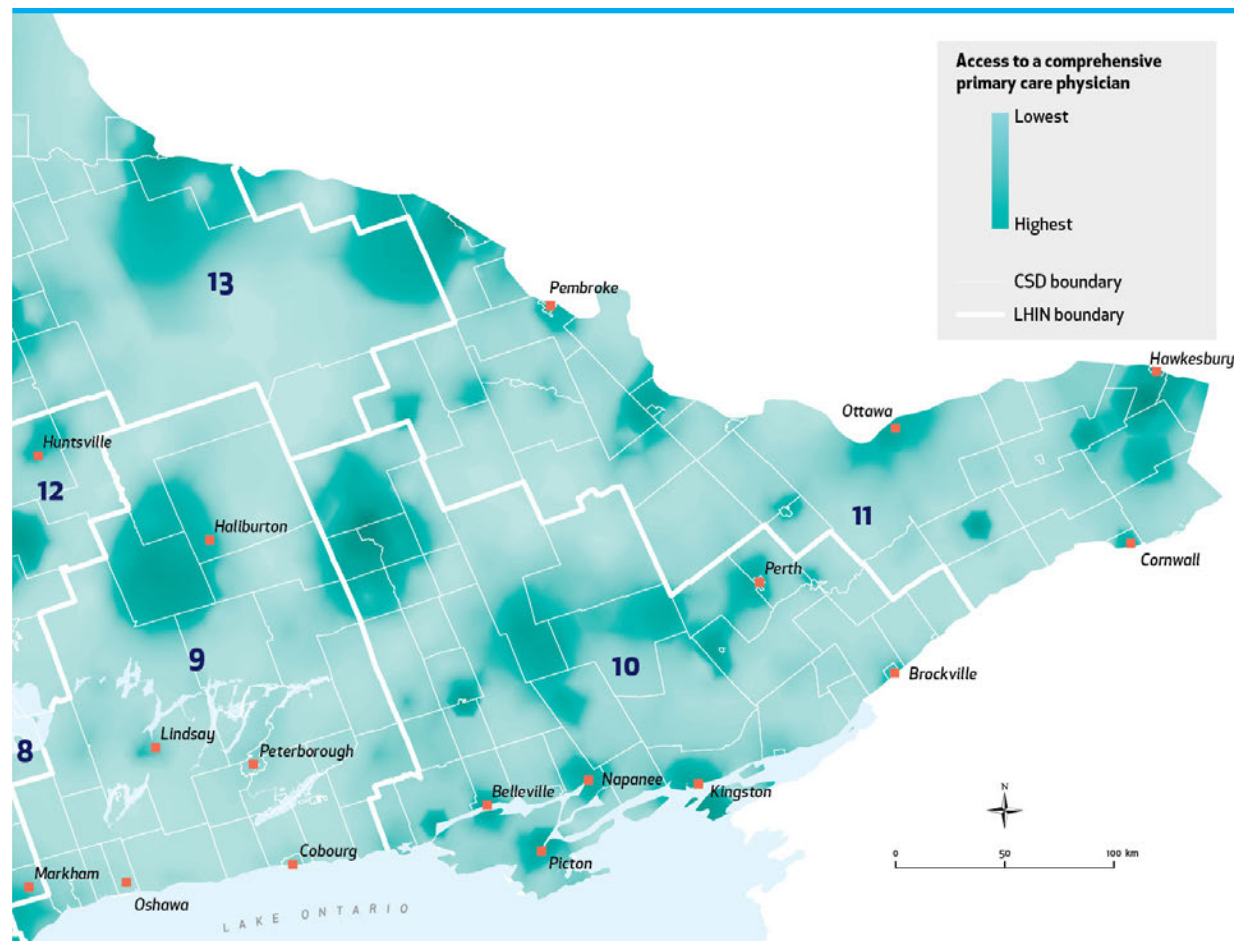


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 30 Access to a comprehensive primary care physician within a 30-minute driving time, using the two-step floating catchment area method, gravity distance decay formula, in South Eastern Ontario, 2014/15

Key Messages

- Access to a comprehensive primary care physician within 30 minutes is varied across the larger urban areas of Ottawa, Kingston and Pembroke, as well as in several smaller towns, including Bancroft, Hawkesbury, Haliburton and Perth.
- Access to a comprehensive primary care physician is lowest in rural areas.

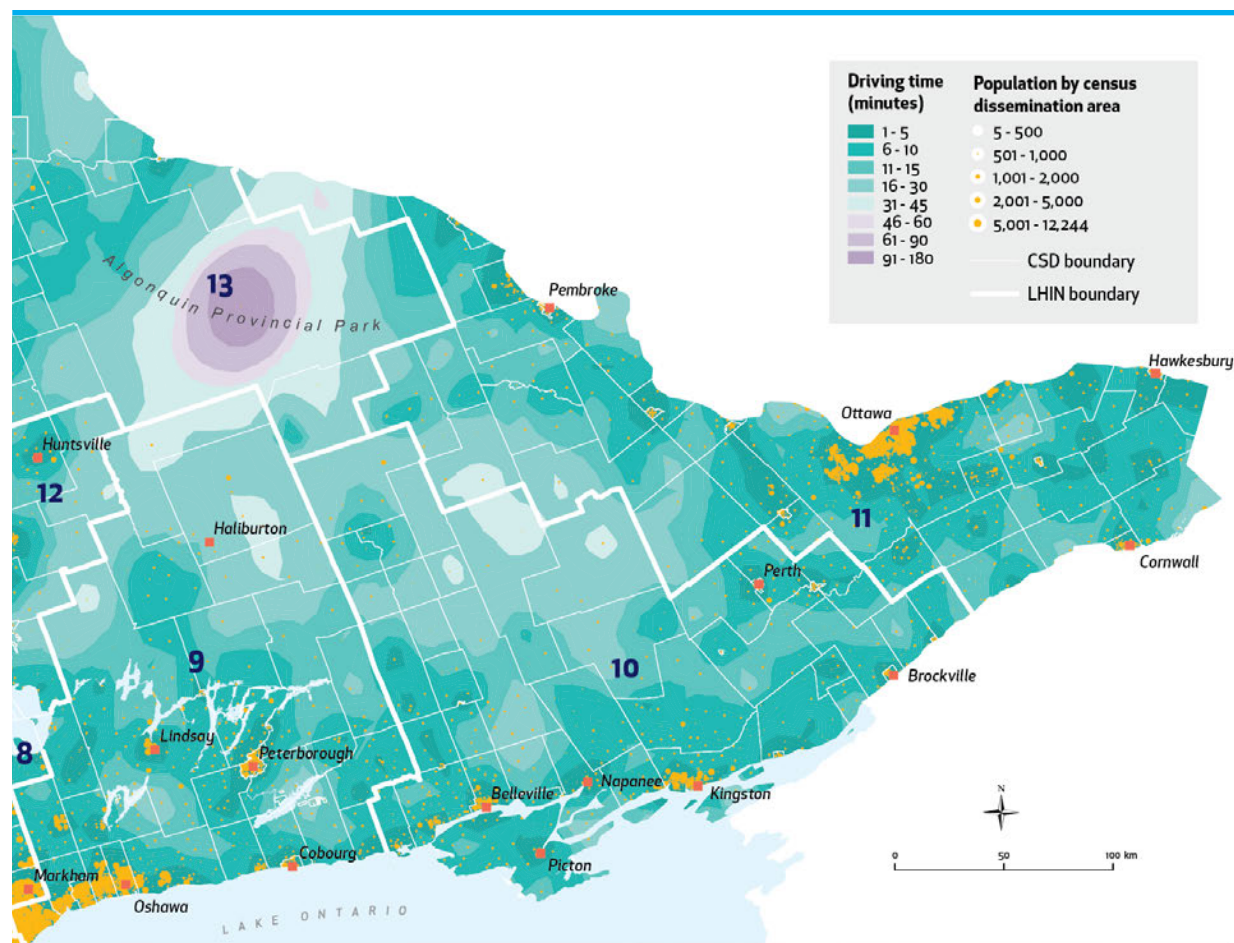


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 31 Minimum driving time in minutes to the nearest comprehensive primary care physician from the centre of each census dissemination area, in South Eastern Ontario, 2014/15

Key Messages

- Most residents of the Champlain LHIN and the southern areas of the Central East and South East LHINs benefit from relatively short travel times by car to the nearest comprehensive primary care physician, ranging from one to 15 minutes.
- More sparsely populated areas in the north of the Central East and South East LHINs, which are predominantly agricultural or natural habitats, exhibit driving times of 45 minutes or more.
- The large cluster of travel times reaching 180 minutes in the North East LHIN coincides with the natural, unpopulated areas of Algonquin Provincial Park.
- Driving times do not consider delays that may be caused by poor driving conditions, road construction or traffic congestion.



Data sources: 2011 Census of Canada, 2013 DMTI Spatial road network file, IPDB

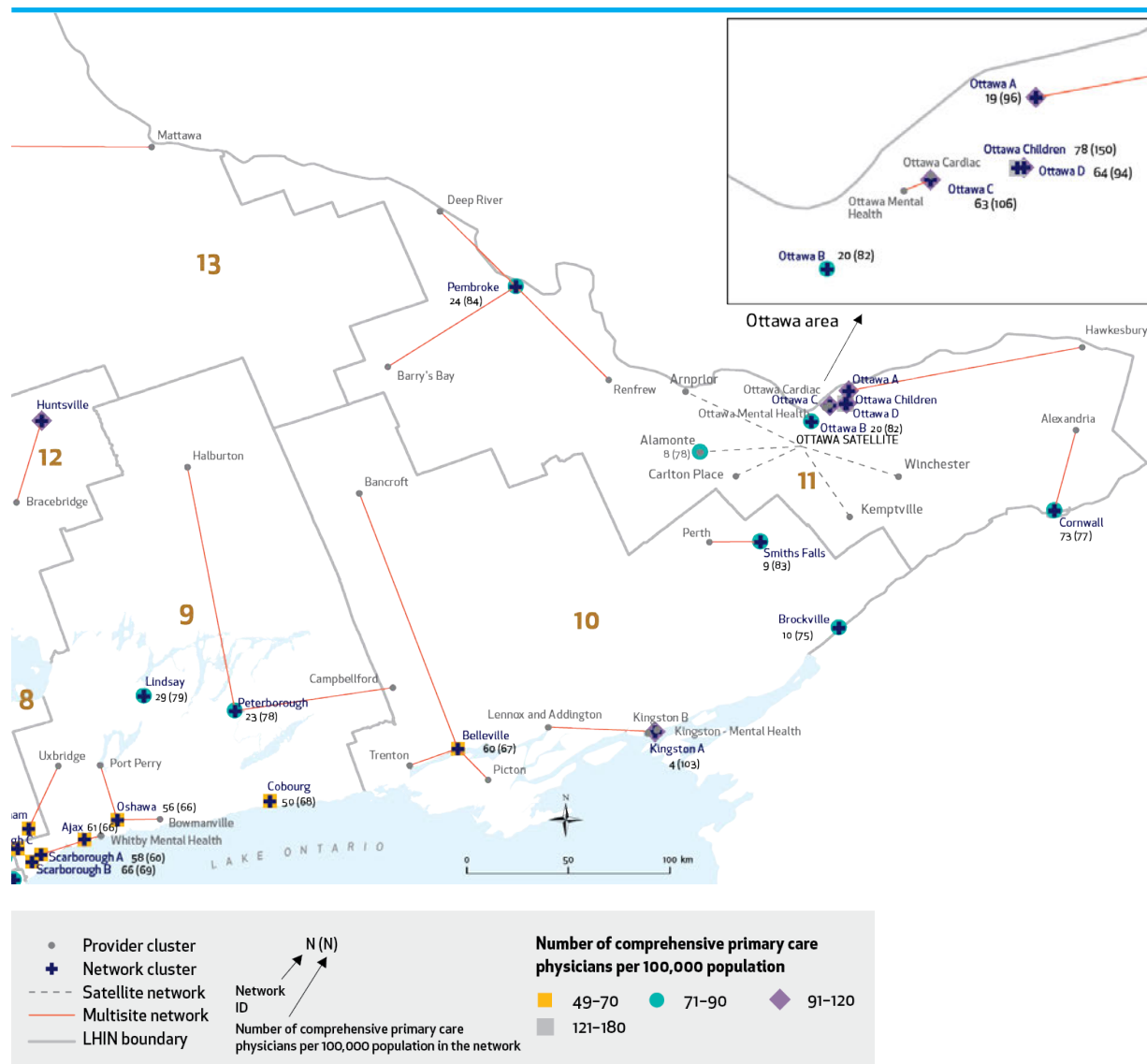
EXHIBIT 32 Number of comprehensive primary care physicians per 100,000 population, by multispecialty physician network, in South Eastern Ontario, 2011/12 to 2013/14

Key Messages

- There are a large number of multispecialty physician networks in and around Ottawa, close to the eastern edges of Toronto, and in the larger municipalities in South Eastern Ontario.
- The more rural areas have fewer provider clusters. There are no physician networks in the large north-central region of the South East LHIN.
- Physician networks in the Central East and South East LHINs and in parts of the Champlain LHIN have between 49 and 90 comprehensive primary physicians per 100,000 population; physician networks in Kingston and Ottawa have between 91 and 180 such physicians per 100,000 population.

Multispecialty physician networks in South Eastern Ontario, by Network ID

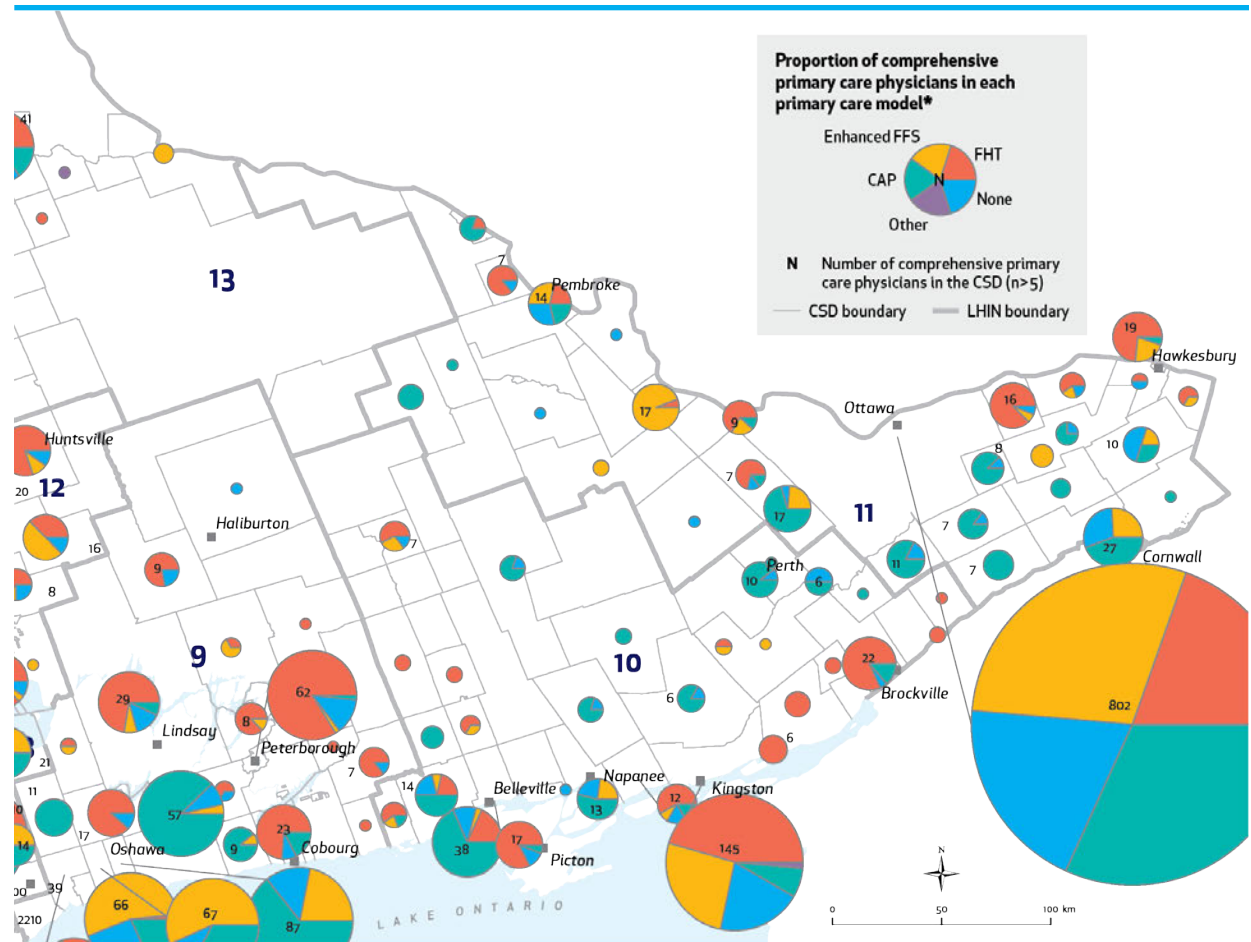
4 Kingston General Hospital	60 Quinte Healthcare Corporation-Belleville General Hospital
8 Almonte General Hospital	61 Lakeridge Health-Ajax-Pickering Hospital
9 Perth & Smiths Falls District Hospital-Smiths Falls Site	63 Ottawa Hospital-Civic Campus
10 Brockville General Hospital	64 Ottawa Hospital-General Campus
19 Hôpital Montfort	66 Scarborough and Rouge Hospital-General Site
20 Queensway-Carleton Hospital	67 Scarborough and Rouge Hospital-Birchmount Site
23 Peterborough Regional Health Centre	73 Cornwall Community Hospital
24 Pembroke Regional Hospital	78 Children's Hospital of Eastern Ontario
29 Ross Memorial Hospital	
50 Northumberland Hills Hospital	
56 Lakeridge Health-Oshawa	
58 Scarborough and Rouge Hospital-Centenary	



Data sources: CAPE, CIHI-SDS, CPDB, DAD, INST, IPDB, NACRS, ODB, OHIP, OMHRS, REF, RPDB

EXHIBIT 33 Proportion of comprehensive primary care physicians participating in different primary care models, by census subdivision, in South Eastern Ontario, 2014/15**Key Messages**

- The rural areas of the South East and Champlain LHINs have more comprehensive primary care physicians participating in capitation models, whereas FHTs are more prominent in the Central East LHIN.
- In the more urban areas of South Eastern Ontario, comprehensive primary care physicians are represented in all primary care models. There are no FHTs in the southern part of the Central East LHIN.



Data sources: 2011 Census of Canada, IPDB

*Enhanced FFS=enhanced fee-for-service; includes Family Health Groups and Comprehensive Care Models. CAP=Capitation; includes Family Health Organizations and Family Health Networks; FHT=Family Health Team. Other=primary care model other than enhanced FFS, CAP or FHT. None=does not belong to a primary care model and payment is based entirely on fee-for-service.

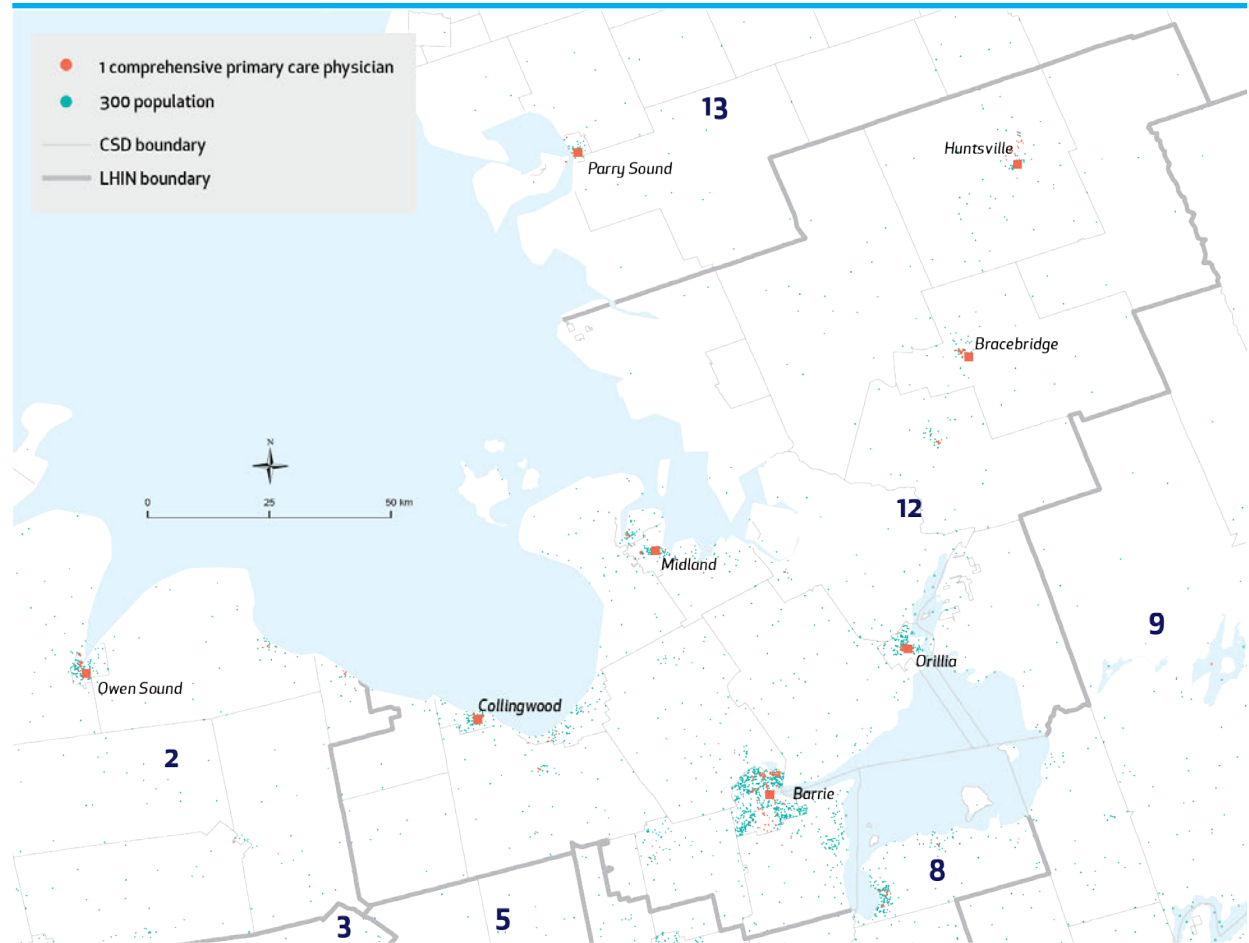
Central Ontario

Local Health Integration Networks

12 North Simcoe Muskoka

EXHIBIT 34 Distribution of comprehensive primary care physicians relative to the population, by census subdivision, in Central Ontario, 2014/15**Key Messages**

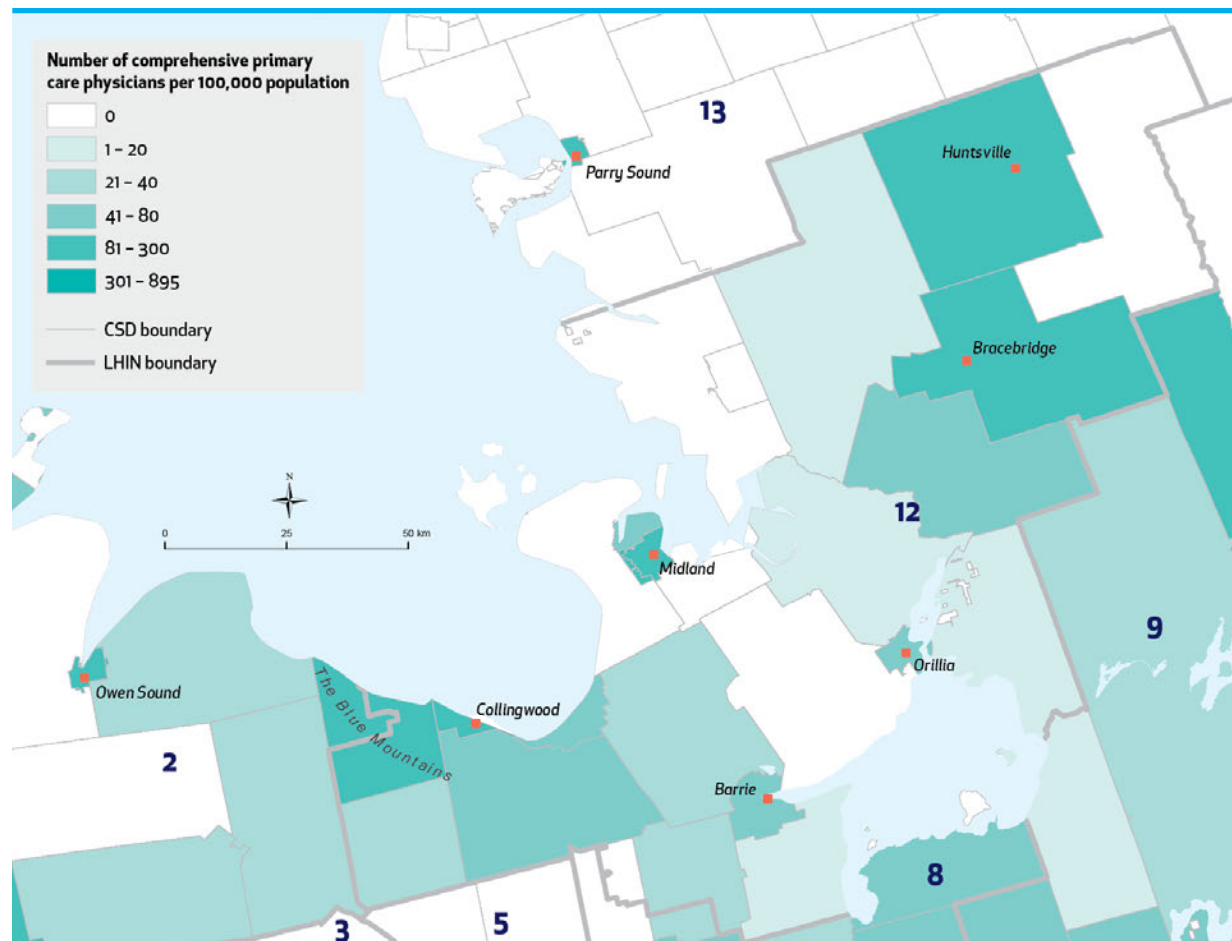
- Most comprehensive primary care physicians serving Central Ontario are concentrated in the densely populated urban areas of Barrie, Collingwood, Orillia, and Midland and some smaller towns.
- The rural areas of Central Ontario are characterized by a scattered population pattern and a limited supply of comprehensive primary care physicians.



Data sources: 2011 Census of Canada, IPDB

EXHIBIT 35 Number of comprehensive primary care physicians per 100,000 population, by census subdivision, in Central Ontario, 2014/15**Key Messages**

- Municipalities with the highest density of comprehensive primary care physicians include the Blue Mountains, Collingwood, Midland, Huntsville and Bracebridge.
- The density of comprehensive primary care physicians is very low in the central and northwest areas of the North Simcoe Muskoka LHIN.
- A previous report found that in 2014 there were, on average, 107 primary care physicians per 100,000 population in Ontario, and 114 primary care physicians per 100,000 population across Canada.¹¹

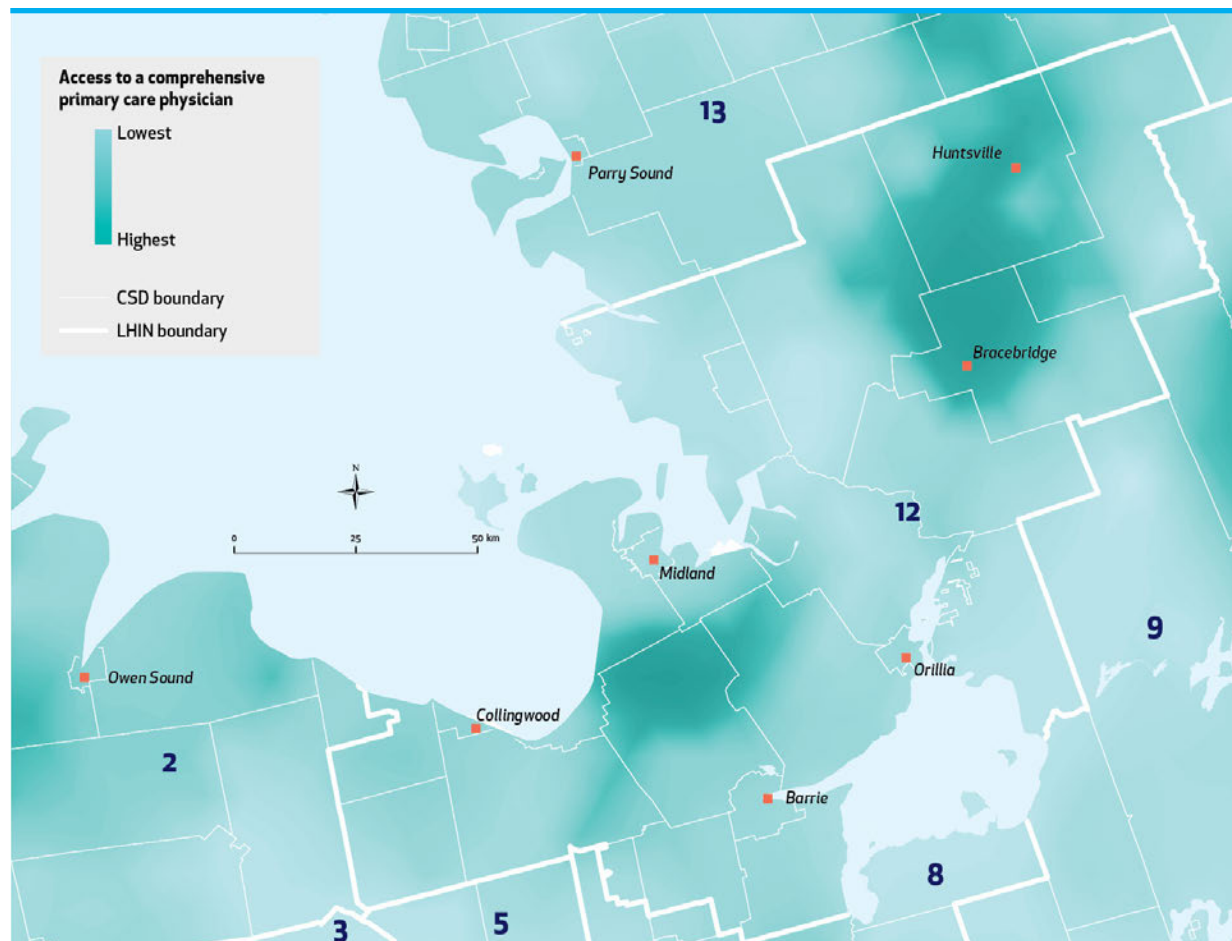


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 36 Access to a comprehensive primary care physician within a 30-minute driving time, using the two-step floating catchment area method, basic formula, in Central Ontario, 2014/15

Key Messages

- Access to a comprehensive primary care physician within 30 minutes is higher for residents in and around Huntsville and Bracebridge and in the central area of the North Simcoe Muskoka LHIN (north of Barrie).
- Most rural areas of the region have lower access to a comprehensive primary care physician.

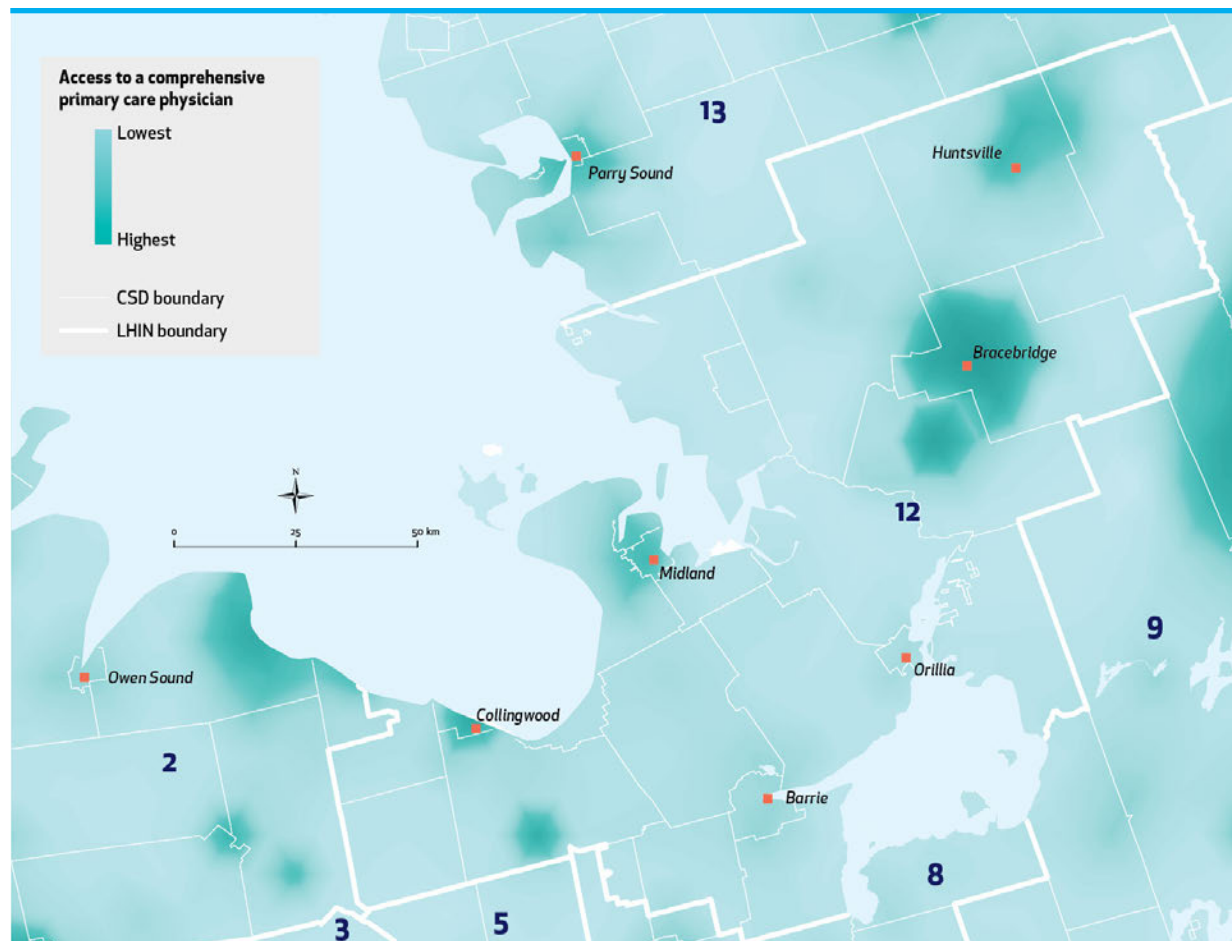


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 37 Access to a comprehensive primary care physician within a 30-minute driving time, using the two-step floating catchment area method, gravity distance decay formula, in Central Ontario, 2014/15

Key Messages

- Areas with high access to comprehensive primary care physicians within 30 minutes are scattered in Central Ontario, and include the larger urban centres of Collingwood, Midland, Huntsville and Bracebridge. Surprisingly, Barrie is not an area with high access.
- There is lower access in the rural areas of the region.

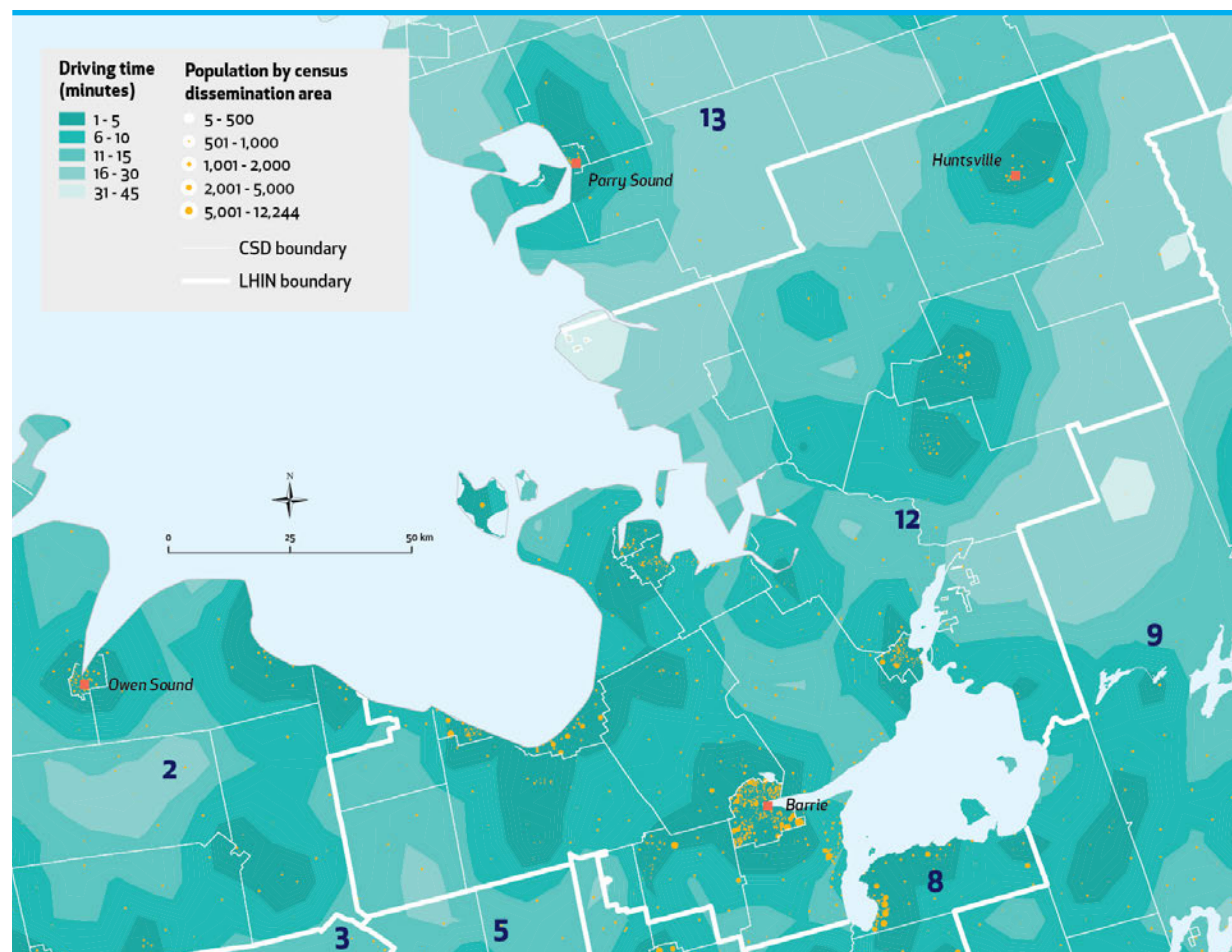


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 38 Minimum driving time in minutes to the nearest comprehensive primary care physician from the centre of each census dissemination area, in Central Ontario, 2014/15

Key Messages

- Most residents in Central Ontario benefit from relatively short travel times by car to the nearest comprehensive primary care physician, ranging from one to 15 minutes.
- Driving times are longer in the more sparsely populated areas in the northern part of the region, typically more than 15 minutes.
- Driving times do not consider delays that may be caused by poor driving conditions, road construction or traffic congestion.



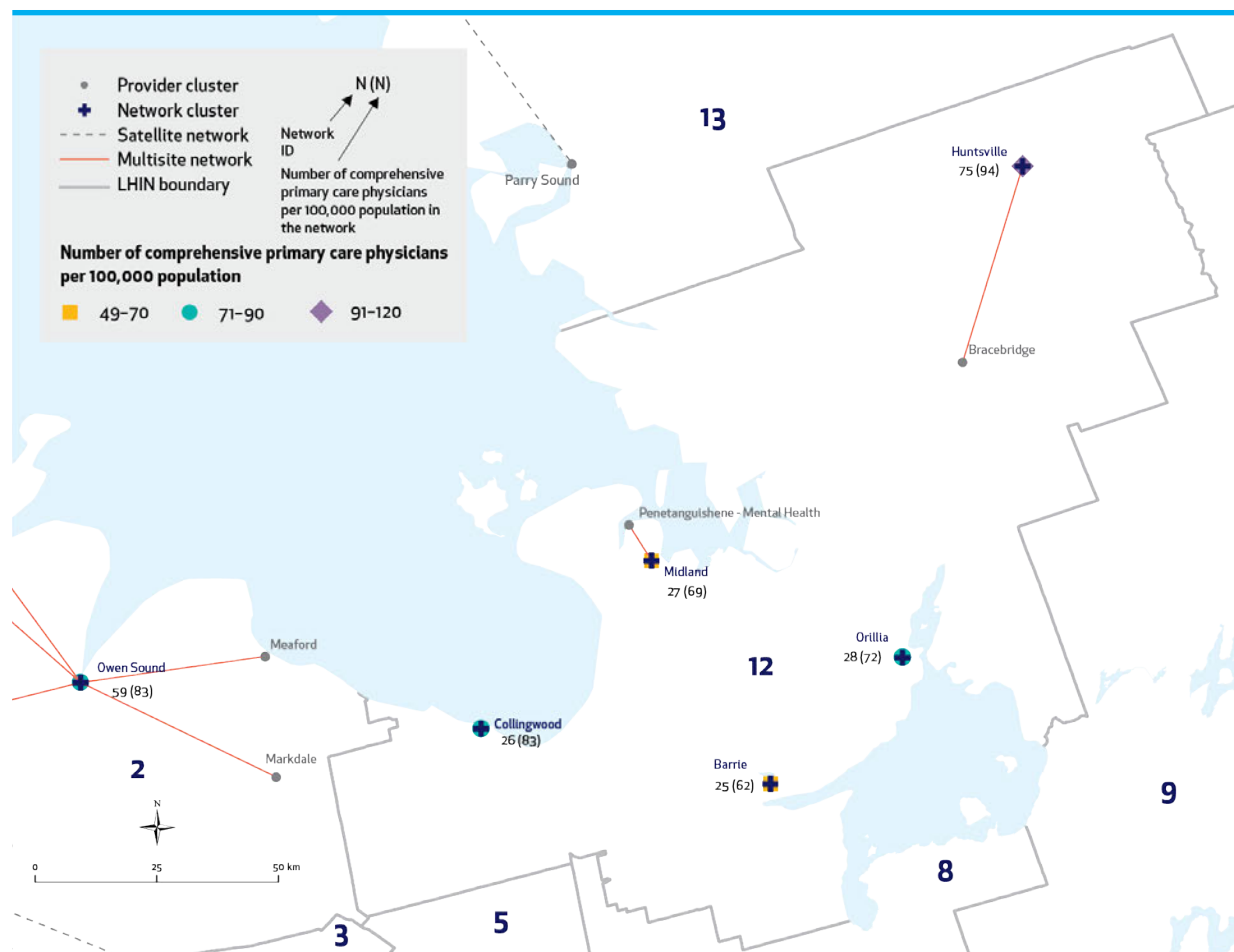
Data sources: 2011 Census of Canada, 2013 DMTI Spatial road network file, IPDB

EXHIBIT 39 Number of comprehensive primary care physicians per 100,000 population, by multispecialty physician network, in Central Ontario, 2011/12 to 2013/14**Key Messages**

- There are relatively few multispecialty physician networks in the North Simcoe Muskoka LHIN, but hospitals seem to be distributed fairly evenly across the LHIN.
- Huntsville, the largest network in the North Simcoe Muskoka LHIN, has 94 comprehensive primary care physicians per 100,000 population.

Multispecialty physician networks in Central Ontario, by Network ID

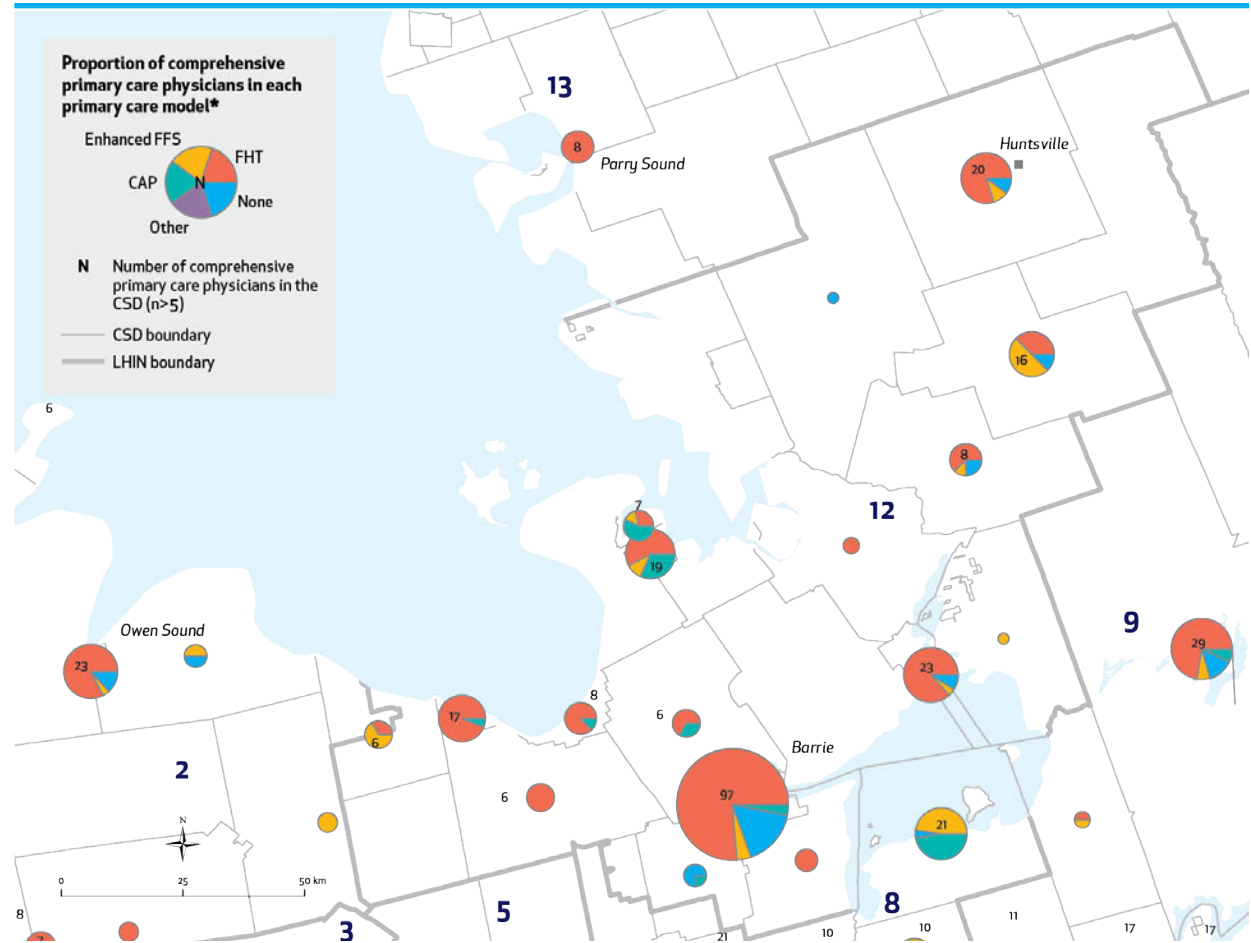
- | | |
|---|---|
| 25 Royal Victoria Regional Health Centre | 29 Ross Memorial Hospital |
| 26 Collingwood General and Marine Hospital | 59 Grey Bruce Health Services-Owen Sound Hospital |
| 27 Georgian Bay General Hospital-Midland Site | 75 Muskoka Algonquin Healthcare-Huntsville District Memorial Hospital |
| 28 Orillia Soldiers' Memorial Hospital | |



Data sources: CAPE, CIHI-SDS, CPDB, DAD, INST, IPDB, NACRS, ODB, OHIP, OMHRS, REF, RPDB

EXHIBIT 40 Proportion of comprehensive primary care physicians participating in different primary care models, by census subdivision, in Central Ontario, 2014/15**Key Message**

- The comprehensive primary care physicians in Central Ontario predominantly practice in FHTs. There are also areas in the LHIN where fee-for-service and capitation models are prominent.



Data sources: 2011 Census of Canada, IPDB

*Enhanced FFS=enhanced fee-for-service; includes Family Health Groups and Comprehensive Care Models. CAP=Capitation; includes Family Health Organizations and Family Health Networks; FHT=Family Health Team. Other=primary care model other than enhanced FFS, CAP or FHT. None=does not belong to a primary care model and payment is based entirely on fee-for-service.

Northern Ontario

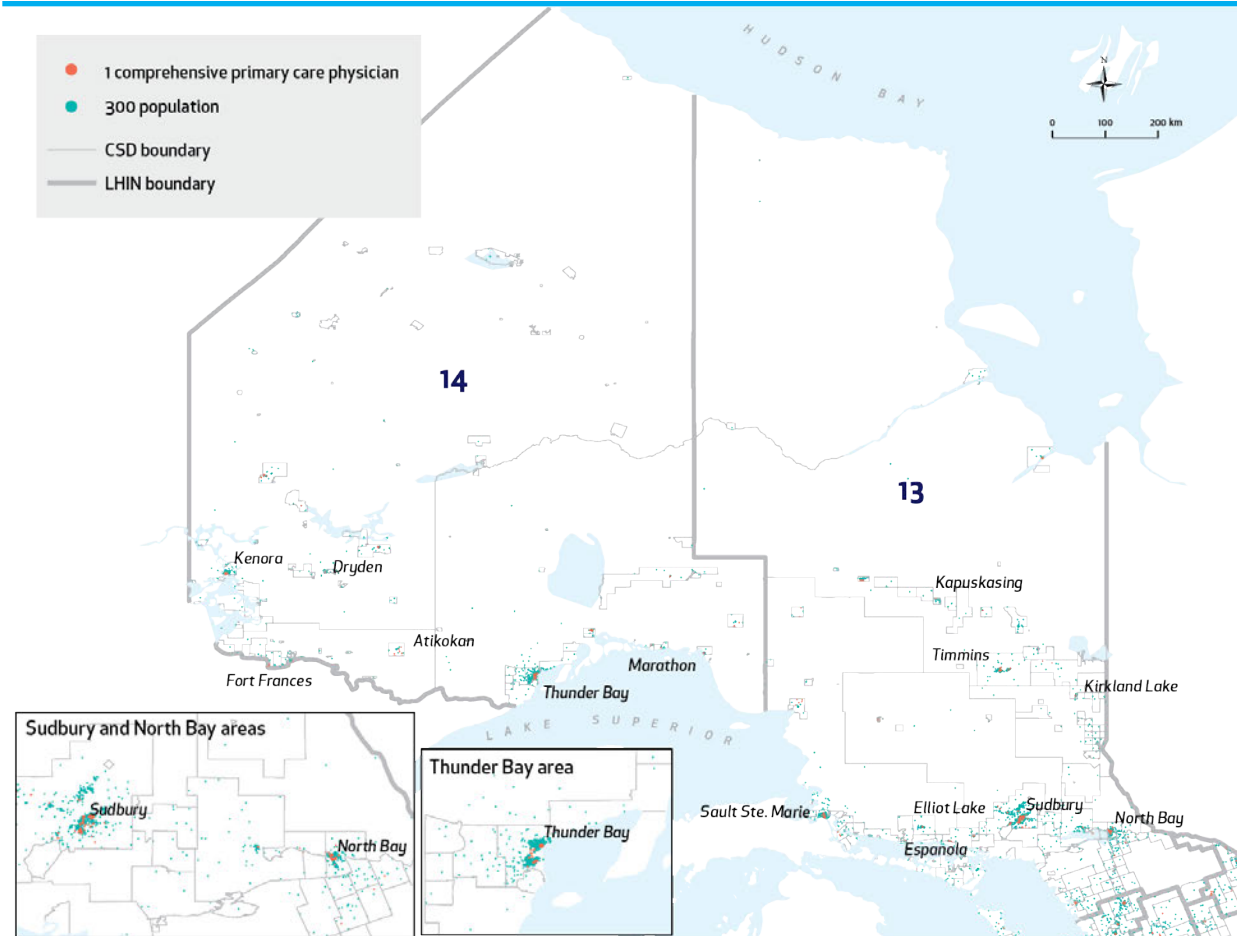
Local Health Integration Networks

13 North East

14 North West

EXHIBIT 41 Distribution of comprehensive primary care physicians relative to the population, by census subdivision, in Northern Ontario, 2014/15**Key Messages**

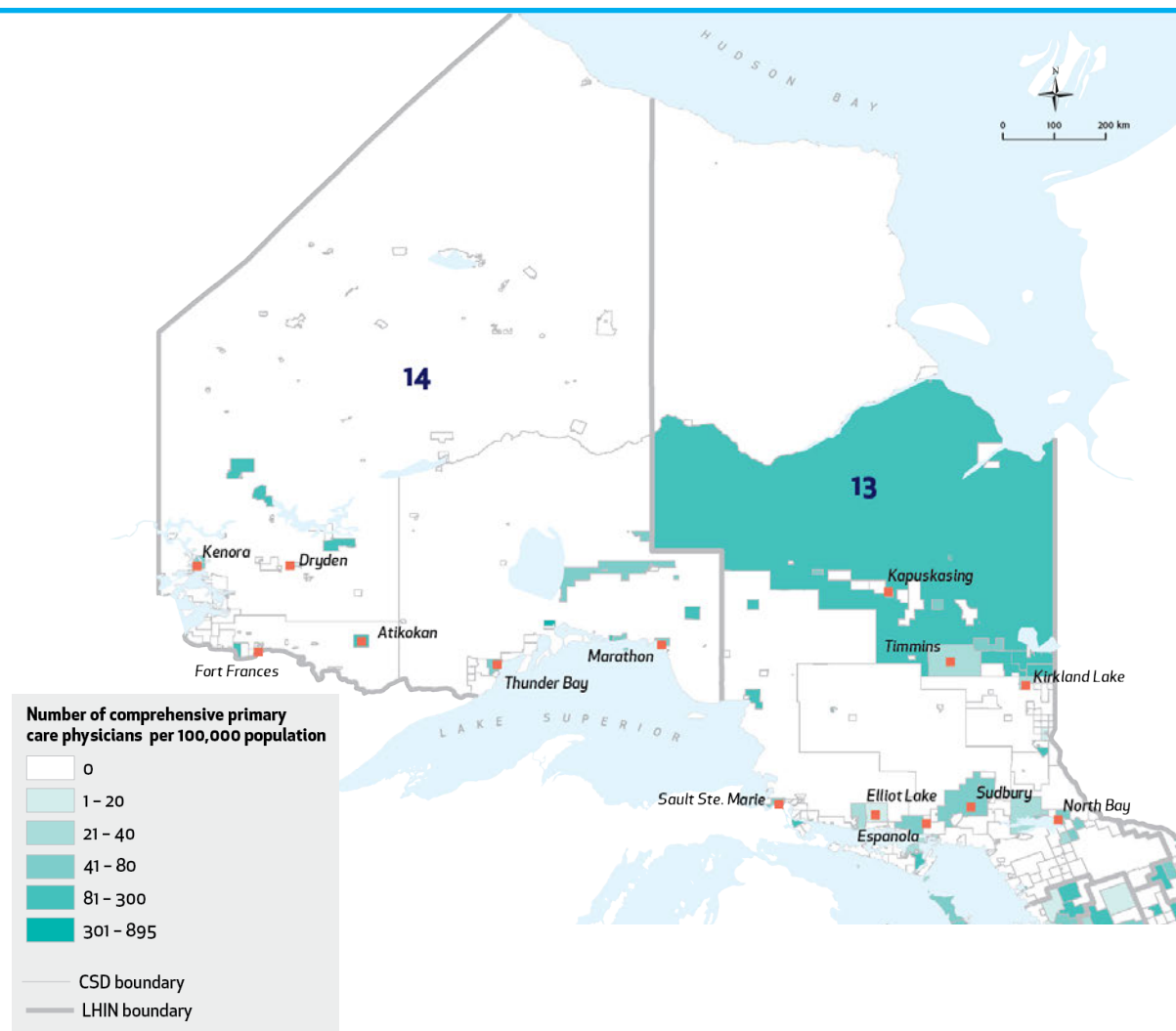
- Most of the comprehensive primary care physicians serving Northern Ontario are concentrated in the densely populated urban areas of North Bay, Sudbury, Timmins and Thunder Bay.
- The North East and North West LHINs contain vast stretches of unpopulated areas with isolated Indigenous settlements. Permanent comprehensive primary care services are rare. Many of the remote communities that are serviced by fly-in and remote health care services are not depicted on the map.



Data sources: 2011 Census of Canada, IPDB

EXHIBIT 42 Number of comprehensive primary care physicians per 100,000 population, by census subdivision, in Northern Ontario, 2014/15**Key Messages**

- The density of comprehensive primary care physicians appears high in many small municipalities and reserves in the North West and North East LHINs, but large parts of this sparsely populated region do not have any comprehensive primary care physicians.
- A previous report found that in 2014 there were, on average, 107 primary care physicians per 100,000 population in Ontario, and 114 primary care physicians per 100,000 population across Canada.¹¹

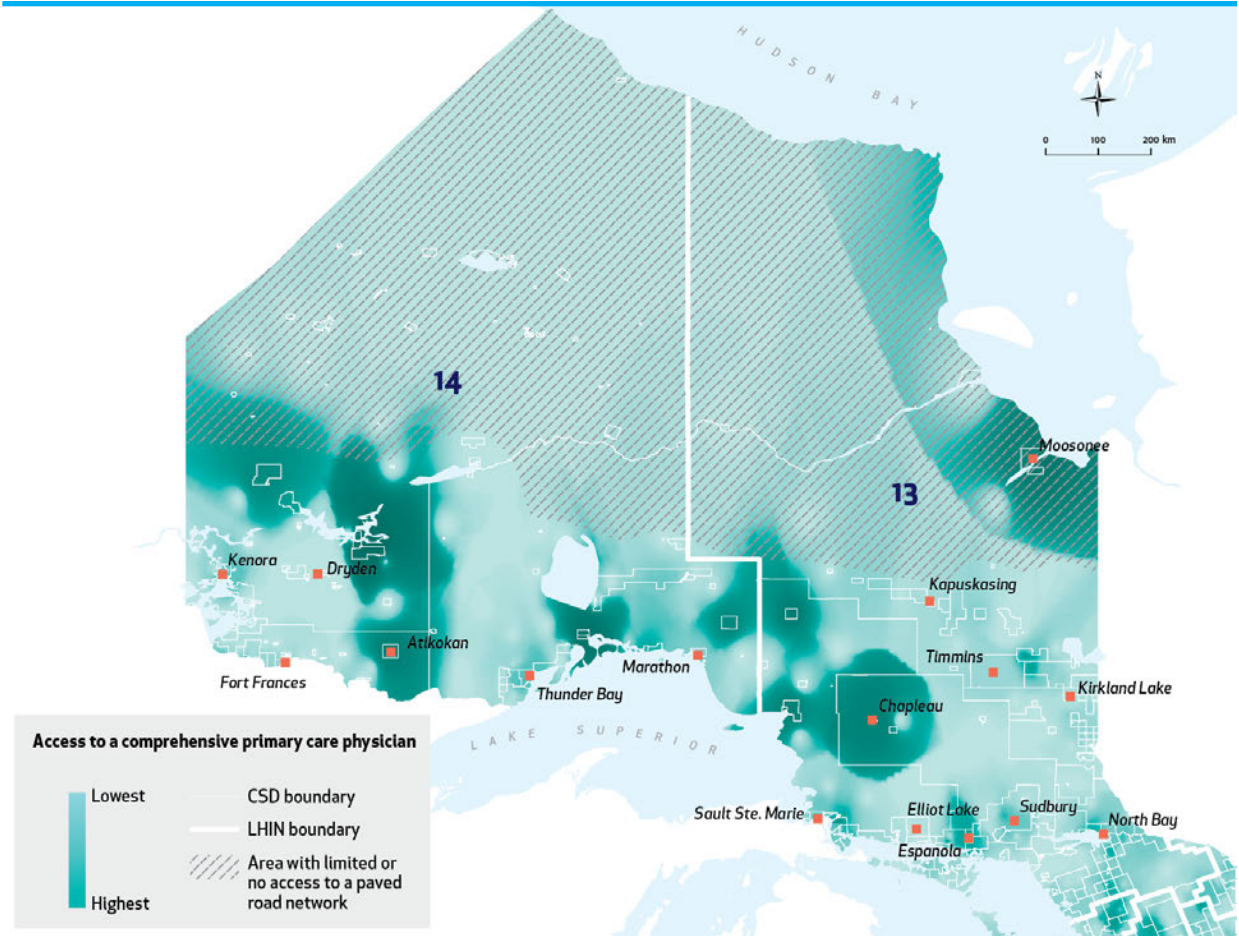


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 43 Access to a comprehensive primary care physician within a 30-minute driving time, using the two-step floating catchment area method, basic formula, in Northern Ontario, 2014/15

Key Message

- Access to a comprehensive primary care physician within 30 minutes has limited validity as an indicator for regions with poor or non-existing access to road networks, as is the case in the North East and North West LHINs. Access is higher in Atikokan, east of Thunder Bay and around Chapleau and Moosonee, but this should be interpreted with caution given these limitations.

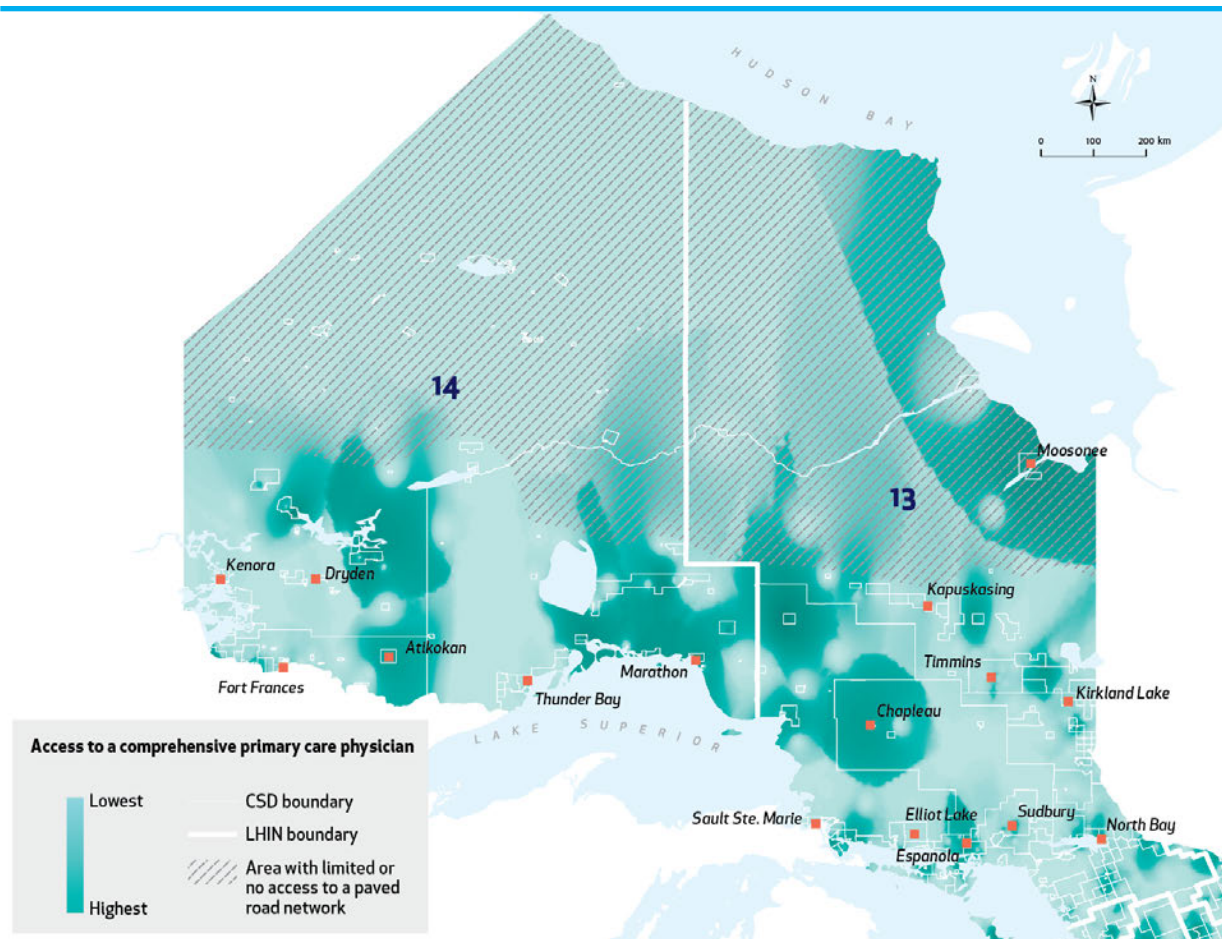


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 44 Access to a comprehensive primary care physician within a 30-minute driving time, using the two-step floating catchment area method, gravity distance decay formula, in Northern Ontario, 2014/15

Key Message

- Access to a comprehensive primary care physician within 30 minutes has limited validity as an indicator for regions with poor or non-existing access to road networks, as is the case in the North East and North West LHINs. Access is higher in Atikokan, east of Thunder Bay and around Chapleau and Moosonee, but this should be interpreted with caution given these limitations.

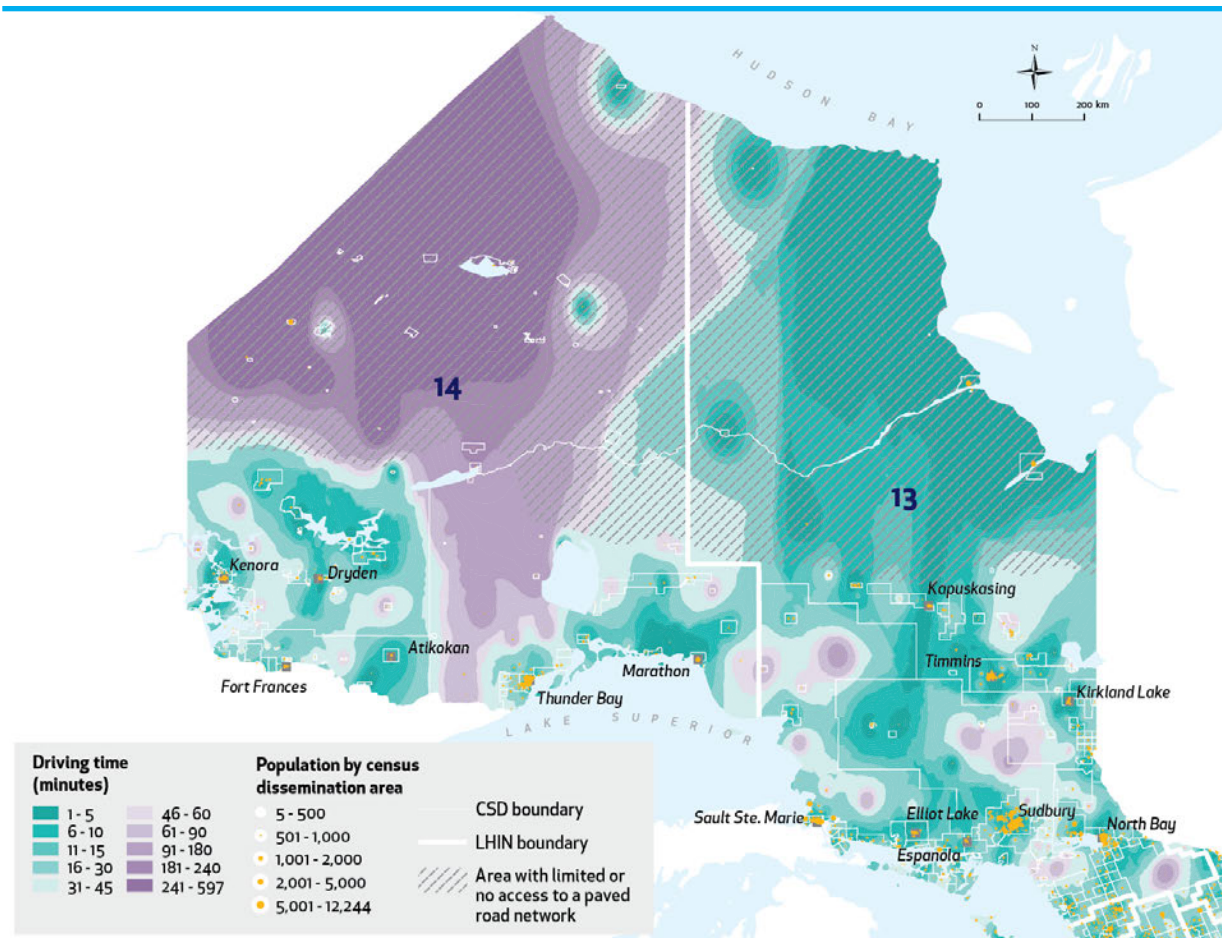


Data sources: 2011 Census of Canada, IPDB

EXHIBIT 45 Minimum driving time in minutes to the nearest comprehensive primary care physician from the centre of each census dissemination area, in Northern Ontario, 2014/15

Key Messages

- Only data for the southern parts of the North East and North West LHINs, which have access to year-round road networks, can be interpreted with some level of certainty. Travel time to a comprehensive primary care physician is relatively short in urban areas.
- Moving out from urban municipalities toward rural areas, a rapid increase in driving time is observed, with times of more than 180 minutes. However, remote areas with limited or no access to a paved road network should not be considered.
- Driving times do not consider delays that may be caused by poor driving conditions, road construction or traffic congestion.



Data sources: 2011 Census of Canada, 2013 DMTI Spatial road network file, IPDB

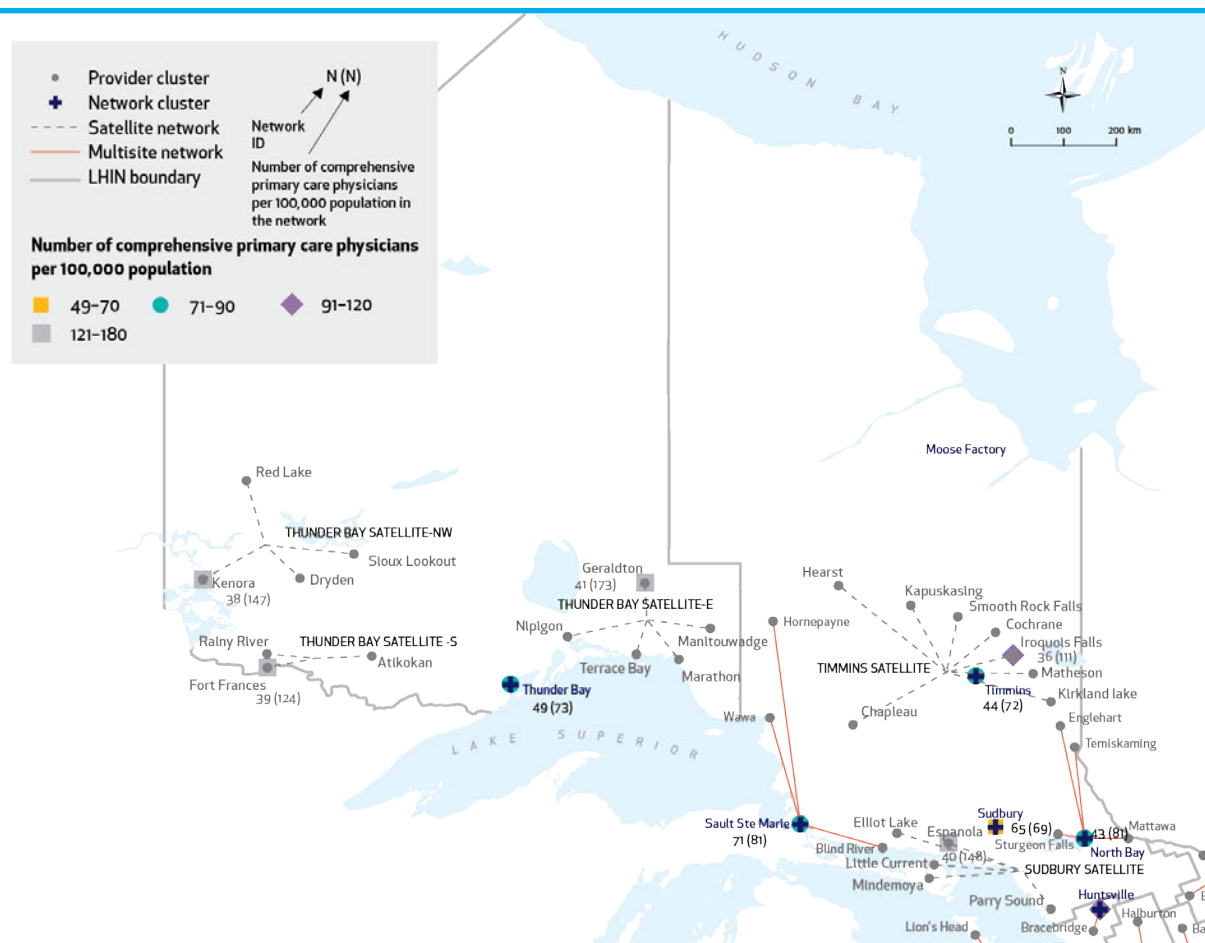
EXHIBIT 46 Number of comprehensive primary care physicians per 100,000 population, by multispecialty physician network, in Northern Ontario, 2011/12 to 2013/14

Key Messages

- There are several geographically distinct multispecialty physician networks in the North East and North West LHINs; five of these are provider clusters without a main hospital.
- The number of comprehensive primary care physicians per 100,000 population varies substantially across physician networks in these two LHINs.
- Attributing patients to providers is challenging in remote northern regions (e.g., Moose Factory), where difficulties with patient health card registration, limited access to primary care physicians and enhanced roles for non-physician primary care providers (e.g., nurse practitioners, nurses with extended roles), may make the number of comprehensive primary care physicians per 100,000 population appear lower than it actually is.

Multispecialty physician networks in Northern Ontario, by Network ID

36	Anson General Hospital	41	Geraldton District Hospital
37	Weeneebayko Area Health Authority-Weeneebayko General Hospital	43	North Bay Regional Health Centre
38	Lake of the Woods District Hospital	44	Timmins and District Hospital
39	Riverside Health Care-La Verendrye General Hospital	49	Thunder Bay Regional Health Sciences Centre
40	Espanola Regional Hospital and Health Centre	65	Health Sciences North
		71	Sault Area Hospital

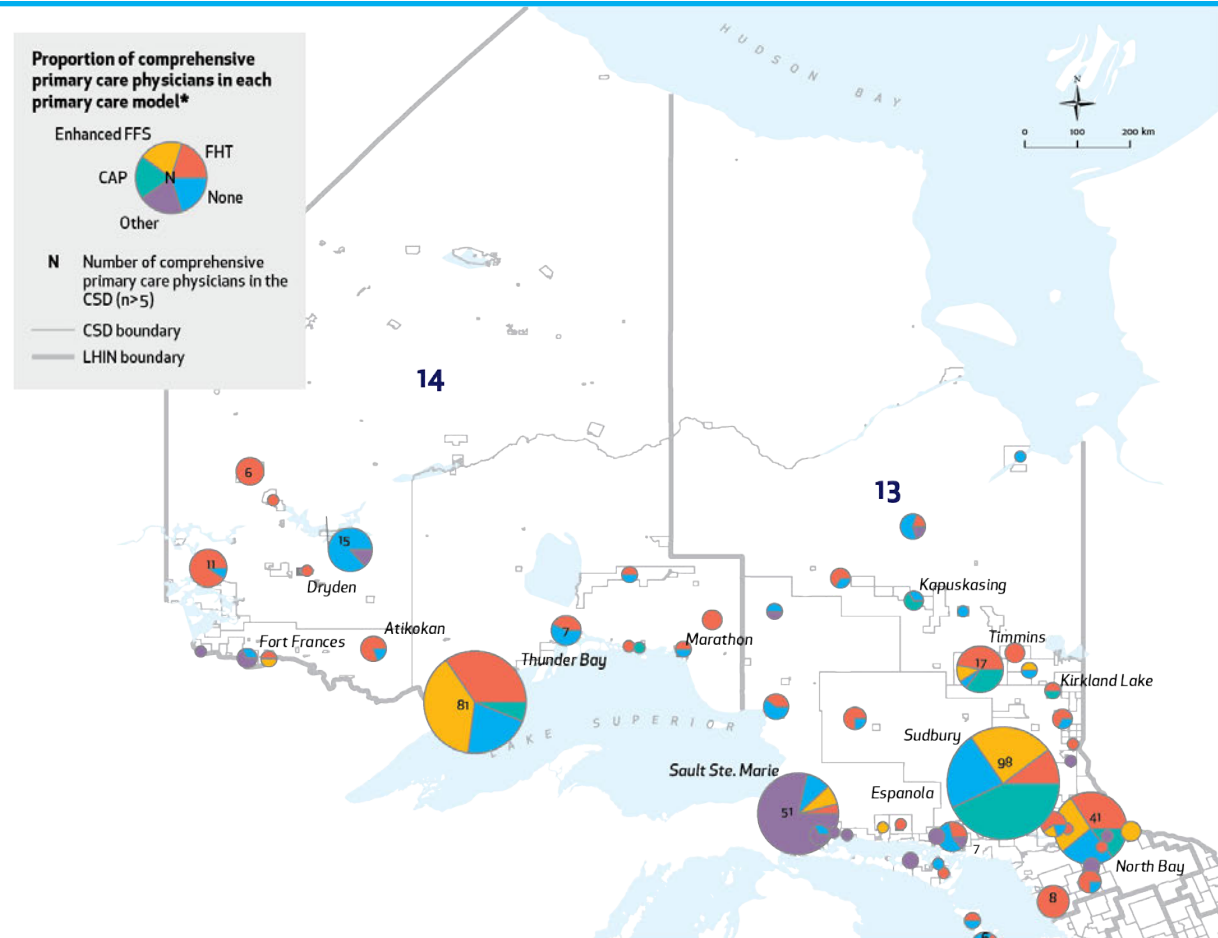


Data sources: CAPE, CIHI-SDS, CPDB, DAD, INST, IPDB, NACRS, ODB, OHIP, OMHRS, REF, RPDB.

EXHIBIT 47 Proportion of comprehensive primary care physicians participating in different primary care models, by census subdivision, in Northern Ontario, 2014/15

Key Messages

- The proportion of comprehensive primary care physicians participating in the various primary care models varies substantially across the North East and North West LHINs.
- In the large urban centres of Thunder Bay and Sudbury, there is variability in the primary care model that comprehensive primary care physicians participate in; whereas these physicians either practice in FHTs or do not belong to a primary care model (i.e., payment is based entirely on fee-for-service) in more remote areas.



Data sources: 2011 Census of Canada, IPDB

*Enhanced FFS=enhanced fee-for-service; includes Family Health Groups and Comprehensive Care Models. CAP=Capitation; includes Family Health Organizations and Family Health Networks. FHT=Family Health Team. Other=primary care model other than enhanced FFS, CAP or FHT. None=does not belong to a primary care model and payment is based entirely on fee-for-service.

Discussion

As part of the call to action embodied by *Patients First*,¹ primary health care in Ontario is being planned and organized around 76 new sub-regions. These fundamental reforms are well served by a population perspective on health for which detailed data on health status and health care utilization are needed. Although the reforms are geographically based, they respect current patterns of primary care that typically include non-local, provider-patient relationships extending over long distances, especially in large urban centres where populations are more mobile and many people commute to work.

The maps presented in this report are a useful resource to further the understanding of physician supply and distribution in major urban areas and

across the province. By not predefining boundaries, these maps provide much-needed insight into the actual supply and distribution of comprehensive primary care physicians in Ontario.

Using multispecialty physician networks to measure patient-physician ratios is a valuable approach as these networks reflect natural relationships between patients, physicians and hospitals without the constraint of geographic boundaries. Understanding physician supply and distribution by examining hospital networks is especially helpful in understanding the delivery of primary care in major urban settings.

There is an uneven distribution of comprehensive primary care physicians across the province and further work is required to determine the most

appropriate level of analysis. Ideally, analytic units should be large enough to allow for data stability but be grounded in the context of local care patterns. Two-step floating catchment area (2SFCA) analyses were used in this study. This relatively new set of spatial methods offers a comprehensive measure of accessibility, which reflects spatial interactions between populations and physicians. Empirical evidence of accessibility, or surrogate measures such as hospitalization rates for primary care-sensitive conditions, may be used to guide use of the right type of 2SFCA analysis. Despite potential advantages, the application of 2SFCA-type methods in health services research and in health services planning is still rare, likely due to their perceived complexity.

The number, type and mix of local care providers in relation to population need is currently a key data gap. Approaches to mapping accessibility have the potential to enhance and support the provision of accurate assessments of both primary health care capacity and population health needs at the level of the newly formed sub-regions in Ontario.

Several directions present themselves as rich areas for analysis and data acquisition. These and subsequent maps can be used in conjunction with population health needs to inform the parameters of health human resources; further population stratifications involving case-mix would further inform this process.* Performing equity analyses, involving the relative deprivation of the sub-regions being studied, is also a direction for future research. This could include, for example, comparing regions based on selected measures of health care use, such as emergency department visits and admissions for ambulatory care-sensitive conditions. Future opportunities also include focusing on population health needs, provider capacity, and unattached and underserved patients; better approaches to capture full-time equivalents for family physicians; and improved identification and measurement of interprofessional team members.

*One approach to case mix would be to use both the Johns Hopkins Adjusted Clinical Group (ACG) methodology, as well as disease cohorts. ACGs are used to measure patient illness burden. The system estimates the illness burden of individual patients and, when aggregated across individuals, of populations.

Limitations

A number of limitations should be considered when interpreting the findings presented in this report.

1. The analyses were not adjusted for age, sex, socioeconomic status or patient complexity and are only partly stratified by urban-rural geography. These characteristics have a major influence on health care and physician utilization and should be taken into account when interpreting variation across groups.
2. The data were based on physician counts and not on full-time equivalents (i.e., part-time work was not taken into account), therefore physician supply was likely overestimated.
3. It was not possible to be sure that all the physicians 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.
4. Population accessibility is expected to vary over time as providers, services and the population move or change.
5. The study did not take into account whether individual or groups of physicians were accepting new patients. It also did not take into account on-call arrangements for after-hours care.
6. Geographical access was only considered under ideal conditions. Actual availability, appropriateness, acceptability, wait times, staffing levels, available transportation, as well as road and weather conditions could create substantially different patterns of access. However, geographical access is an excellent starting point for identifying structural access issues.

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