

TECHNICAL APPENDIX

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TECHNICAL APPENDIX

This appendix provides definitions, data sources, and methods for report chapters 2 to 5.

Comparisons Involving Regional and Sub-Regional Geographies

The report contains geography-based diabetes comparisons where higher-level regions are compared with subregions. The purpose is to enable a comparison between a subregional statistic and an expected statistic. Some examples are Peel Region compared with Ontario overall, and Peel public health data zones compared with Peel Region overall. Indicator statistics that were calculated for the higher-level region are based on retaining the comparison subregion's data and using all of the data points, i.e., pooling data about a comparison subregion with data about the other subregions in the higher-level region. Consequently, statistics for higher-level regions and comparison subregions, were not calculated from fully independent samples, i.e. there is a small amount of data overlap between subregions and higher-level regions. We note that hypothesis testing for geography-based comparisons in this report were not used.

Chapter 2: Overview of Diabetes Burden in the Peel Region

Definitions

Ontario Health Team (OHT)

An Ontario Health Team is a group of healthcare providers and organizations that self-organize to work as a coordinated team. There are 54 Ontario health teams operating across the province. Four more teams are expected to be approved.¹

Some of the core component activities of Ontario health teams are to:²

- provide a full and coordinated continuum of care within a geographic region
- offer patients round-the-clock access to care coordination and system navigation services
- ensure patients experience seamless transitions throughout their care journey
- improve performance in outcomes like patient and population health; patient, family and caregiver experience; provider experience; and value.

Peel Public Health Data Zones (PHDZ)

Peel public health data zones (PHDZ) are regions that are used to report health status data and are small enough to be helpful for planning programs and services. PHDZs are contiguous surface areas that are based on census tract boundaries of the 2016 Census. PHDZ boundaries respect census tract boundaries (i.e., PHDZs do not split census tracts). When possible, PHDZ boundaries also respect natural and man-made boundaries such as rivers, highways, and municipal boundaries. PHDZ boundaries and enclosed areas lie entirely within one municipality and are never split across the three municipalities. There are 39 PHDZs with populations that range from 22,900 to over 103,100 people. ³

Age Standardized Rate

Age is an important determinant of health and health-related patterns seen across populations. Comparing crude rates for two or more different populations is problematic because the underlying age distributions of the populations may be different and in turn, lead to differences in disease rates. For example, death rates from cancer are lower in young people than in old people. If crude cancer death rates were compared between a region that has a higher proportion of young people and a region that has a higher proportion of older people, the rate difference between the regions will likely reflect differences in age rather than other factors that might be of interest. Therefore, standardized rates are used to facilitate comparisons between two or more populations with different age structures. Standardization can also be used to account for differences based on other characteristics as well, such as different geographic areas or years.⁴

LICO-AT

LICO-AT is the Statistics Canada low-income cut-offs, after tax. Statistics Canada⁵ defines thresholds below which families or persons not in families would probably spend a larger share of their after-tax income than average on food, shelter, and clothing. If after-tax income of a family or person is below the threshold applicable to them, then the family or person is considered to be in low income according to LICO-AT.

After-tax Income

Statistics Canada⁶ provides the following definition:

“After-tax income refers to total income less income taxes of the statistical unit during a specified reference period. Income taxes refers to the sum of federal income taxes, provincial and territorial income taxes, less abatement where applicable. Provincial and territorial income taxes include health care premiums in certain jurisdictions. For the 2021 Census, the reference period for income data is the calendar year 2020, unless otherwise specified.”

Recent Immigrant

Statistics Canada⁷ provides the following definition:

“An immigrant refers to a person who is, or who has ever been, a landed immigrant or permanent resident. Such a person has been granted the right to live in Canada permanently by immigration authorities. Immigrants who have obtained Canadian citizenship by naturalization are included in this group.

A recent immigrant refers to a person who obtained landed immigrant or permanent resident status up to five years prior to a given census year. In the 2021 Census, this period is January 1, 2016, to May 11, 2021. Information on the age at immigration is derived from the immigrant’s date of birth and year of immigration.”

Persons in One-Parent Families

Statistics Canada⁸ defines one-parent families as families with a single parent and their child(ren). Such families do not have a married spouse or common-law partner, however other relatives may be present. Families are considered as those live in the same dwelling that are related to each other by blood, marriage, common-law union, adoption or a foster relationship.⁹

Persons in Private Households Living Alone

Statistics Canada classifies those living alone as a household living arrangement that is distinct from those that include other relatives and/or non-relatives.¹⁰ Private households are made up one or more individuals living in the same dwelling¹¹

Data Sources

Institute for Clinical Evaluative Sciences

The Institute for Clinical Evaluative Sciences (ICES) is an independent, non-profit research organization. ICES collects, manages, maintains, and provides population-based health and social data to support research on health issues in Ontario and Canada. This report relied on several databases that are accessible through ICES.¹²

Ontario Community Health Profiles Partnership (OCHPP)

The Ontario Community Health Profiles Partnership (OCHPP) creates and provides detailed health profiles about Ontario communities in formats that are both timely and user-friendly. The organization makes available to the public high-quality, community-level health data that would not otherwise be publicly accessible. Key health indicators are carefully selected

based on relevance to reducing health inequalities, quality, and consistency with user-identified priorities, and are developed in coordination with other information providers to supplement existing community profile initiatives.¹³ The indicators are derived from population-based health datasets, de-identified patient records, and clinical and administrative databases, and are available for geographic areas and by sociodemographic characteristics.¹⁴

Ontario Diabetes Dataset (ODD)

The Ontario Diabetes Dataset (ODD)¹⁵ is a population-based registry that contains all individuals in Ontario having any type of nongestational diabetes identified since 1991 to December 30, 2020. The database was created using hospital discharge abstracts, Ontario drug benefit claims, OHIP physician service claims, and demographic information about the persons eligible for health care coverage in Ontario. Patients entered the database if they were 19 years of age or older and at least one of the following criteria were recorded about them: (1) two physician claims with diabetes-specific fee codes occurring within 1 year in the OHIP claims¹⁶ database, or (2) one or more claims for a drug related to diabetes mellitus (insulin or an oral anti-glycemic) in the Ontario Drug Benefit¹⁷ database, or (3) a diabetes diagnostic code in a Discharge Abstract Database.¹⁸ The validity of the case identification algorithm was established recently.¹⁹

Postal Code Conversion File (PCCF)

The Canada Post Corporation has assigned approximately 900,000 six-character postal codes in Canada.²⁰ The Postal Code Conversion File (PCCF) is a digital file. It provides a geocoded link between postal codes and Canadian geographic areas that Statistics Canada produces census data and other statistics for. By linking postal codes and data about geographic areas, the PCCF permits data from different sources to be integrated. Integrated data can be used for research, planning, and marketing purposes.

Region of Peel

The Region of Peel provided definitions and map boundaries of Peel Health Data Zones.

Registered Persons Database (RPDB)

The Registered Persons Database²¹ provides basic demographic information about anyone who has ever received an Ontario health card number. The information includes sex, date of birth, age, residential address, changes in OHIP eligibility, and date of death. Core data are supplied by the Ontario Ministry of Health and augmented with information from other data sets held by ICES. One limitation to note is that data in the ICES-linked RPDB are enhanced at ICES by using a probabilistic linkage between the core RPDB and the Ontario Registrar General's database. The probabilistic nature of the procedure causes

information on a small number of deaths to be unmatched and omitted from the ICES-linked RPDB. Consequently, the RPDB could fail to identify some people as decedents when the inclusion criterion of ‘alive’ was used to select cohort cases.

Methods

Exhibit 2.1 is a map displaying age-standardized diabetes prevalence (per 100 population) for 39 Peel Region public health data zones.

In the prevalence calculation, the numerator – persons aged 20 and over with diabetes – derived from the Ontario Diabetes Dataset 2020. The denominator – persons who were alive and living in Ontario on April 1st, 2019 – is derived from the Ontario Ministry of Health’s Registered Persons Database. The OCHPP excluded people with no health system contact for the previous ten years because many of them would no longer be alive and living in Ontario.

To generate population counts for PHDZs, the OCHPP aggregated postal code-level data into Statistics Canada dissemination areas (DAs), and then allocated the data to PHDZs. The OCHPP used Postal Code Conversion File Plus (PCCF+), Version 7A, June 2017.²²

Chapter 3: Built Environment and Diabetes

We first describe the data source, derivation, and limitations of each measure presented in this chapter, as each is unique to the environmental characteristic under study. Thereafter, we describe the methodology used to assess spatial variations across Peel, as well as the spatial relationship between environmental characteristics and diabetes rates.

Measures, Data Sources, and Derivations

Neighbourhood Design

The *Canadian Active Living Environments (Can-ALE) database* is a national set of four individual measures and four summary measures which describe the favourability of neighbourhoods for active living in Canadian communities at the level of the dissemination area (DA). The analyses that guided the selection of measures, data sources, and the methodological approaches for the measures’ derivation have been previously described.²³ We selected the composite clustered score that is composed of features related to how well-connected the street network is, residential density, and the number of walkable destinations using 2016 data, which has been shown to correlate with active transportation use, walking, and other health-related outcomes.^{24 25 26}

Data Sources

- Dwelling density: Census 2016 housing data
- Intersection density and points of interest: OpenStreetMap (OSM) Provincial Extracts.

Derivation

The measures were derived using ArcMap v10.5 and PostGIS v2.3, which is a geographic information system extension for the PostgreSQL object-relational database management system. Circular (Euclidean) buffers of radius 1000 meters were drawn around the centroids of dissemination areas. The street connectivity component of the measure was derived by calculating three-way intersection density using OpenStreetMap intersections of roads, footpaths and recreational trails, and excluded roads that were of limited access to pedestrians, e.g., highways, freeways. The residential density component of the measure was derived using weighted dwelling density derived from Statistics Canada dwelling counts. Neighbourhoods were grouped into five classes using a *k*-medians clustering algorithm, an iterative process that assigns dissemination areas to a group by minimizing within-group median values and maximizing between-group median values. Five classes ranging from very unconducive (Active Living Environment class 1) to very conducive to active living (Active Living Environment class 5) were used.

Parks and Natural Environments

The *proximity of residents to parks and greenspaces* measures the percentage of residents living within a 400-meter network walking distance to any park or conservation area that either contains an active recreation feature (e.g., a playground) or pedestrian infrastructure (e.g., a trail or path). Conservation areas that require paid parking were included in the measure, as payment is only required for automobile parking and not pedestrian entry. Paid-entry green spaces, such as golf courses, are not included in this metric.

Data Sources

- Municipal 2018 datasets on parks, conservation areas, active recreation sites, and trails, using information provided by the Town of Caledon, the City of Brampton, the City of Mississauga, the Region of Peel, Credit Valley Conservation, and the Toronto and Region Conservation Authority
- Region of Peel Single-Line Street Network 2016 (SLSNPEEL).

Derivation

The derivation of this indicator has been described previously²⁷ and was performed in the geographic information system application ArcGIS Desktop 10.2. In brief, park and greenspace features without active recreation amenities or trails were filtered out of the source datasets to eliminate features within the parks dataset that have restricted pedestrian access. Next, access points for parks and conservation areas were created to determine where pedestrians can access parks and conservation areas that contain a trail feature or network. These access points were then loaded as 'facilities' in a service area layer created from the 2016 Region of Peel Pedestrian Network. Buffer polygons around park access points to a specified distance were created to determine which areas fall within a defined service area catchment of a park access point. The indicator is calculated by dividing the total residential area within the parks and green space service catchment for a dissemination area by the total residential area of the dissemination area, and then multiplying the result by the population for the dissemination area.

Transportation

The *proximity of residents to frequent transit stops* was derived by Peel Public Health to measure the percentage of population that resides within a five-minute (400 meter) network walking distance to a municipal transit stop, and/or a 10-minute (800 meter) network walking distance to a GO Transit bus or rail stop with frequent service. Frequent service was defined as a transit stop averaging 15-minute headways during peak hours (6:00 a.m. to 9:00 a.m., and 3:00 p.m. to 6:00 p.m.) and 30-minute headway during non-peak hours (9:00 a.m. to 3:00 p.m., and 6:00 p.m. to 12:00 p.m.).

Data Sources

- Population Data: Census 2016
- Transit stops with frequent service: General Transit Feed Specification (GTFS) feeds for Mississauga (MiWay; June 30, 2016 to September 4, 2016), Brampton (Brampton Transit; May 9, 2016 to September 5 2016), and GO Transit (June 25, 2016 to September 2, 2016)
- Transit stop location: Mississauga (MiWay), Brampton (Brampton Transit), and GO Transit, 2016
- Proximity: Pedestrian Accessible Single-Line Street Network 2016. Includes trails and other pedestrian infrastructure and excludes highways.

Derivation

The derivation of this indicator has been described previously²⁷ and was performed in ArcGIS Desktop 10.2. First, GTSF data were used to determine which transit stops fulfilled the criteria for frequent service as defined above. Transit stations located outside of Peel Region were removed prior to calculating the transit service area. Next, valid access points for train stations were created and added to the dataset. These transit stops and train station access points were loaded as ‘facilities’ in a service area layer created from the 2016 Region of Peel Pedestrian Network. Buffer polygons around transit points to a specified distance were created to determine which areas fall within a defined service area. The indicator is calculated by dividing the total residential area within the frequent transit service catchment for a dissemination area by the total residential area of the dissemination area, and then multiplying the result by the population within the geographic unit.

Food Environment

The *Canadian Food Environment Dataset (Can-FED)* is a national dataset of retail food environment measures that includes relative food outlet proportions and densities of different retail food outlet types.²⁸ We selected the 5-class clustered measure of the proportion of fast-food and full-service restaurants (also known as R_{mix}) as our indicator of interest.

Data Sources

- Food outlet data: Statistics Canada Business Register, a central repository of baseline information on businesses operating in Canada.

Derivation

The analyses that guided the selection of measures, data sources, and the methodological approaches for the measures’ derivation have been previously described.²⁹ Briefly, food outlets were extracted from the Statistics Canada Business Register using North American Industry Classification System (NAICS) codes. The codes identify the primary function of a business and can be used to classify the primary business function of companies and enterprises. Food outlets were extracted if they had an operating outlet as of July 2018 and if the NAICS code associated with the outlet indicated that it was a type of retail food outlet. Food outlets were then classified based primarily on NAICS codes and in some cases, further classified using a name-based assignment method that included keyword searches, e.g., “burger” or the name of a chain restaurant that may be further classified as a *fast-food outlet*. Outlets were then imported into ArcMap based on latitude and longitude geocoded location from the Business Register. We chose to focus on the measure generated using 1-kilometer buffers generated from the population-weighted centroid of each dissemination area, representing a 10–15-minute walk from the dissemination area

to a food outlet. Point features for the food outlets were joined to the buffers, and the number of outlets located within each buffer was summed for each food outlet. The fast-food restaurant mix (R_{mix}) was calculated as the proportion of fast-food restaurants relative to fast-food and full-service restaurants combined. Five categories were created (0, and groups 1–4) by setting aside scores of zero as a separate category and using a k -medians clustering approach to create the four remaining categories of densities for each outlet type. Group 1 represents the lowest non-zero densities of fast-food outlets while group 4 represents the highest densities of fast-food outlets.

Housing

The *core housing need* measure is a 2-stage indicator developed by the Canada Mortgage and Housing Corporation (CMHC) to identify households living in dwellings considered unsuitable, inadequate or unaffordable. Core housing need takes account of whether the household's income level is sufficient to obtain alternative suitable and adequate housing in the community. For a household to be in core housing need, it must fail to meet at least one of three housing standards. They include adequacy, affordability, and suitability standards; and the household would have to spend 30% or more of its total before-tax income to pay the median rent of alternative local housing that meets or exceeds all three housing standards.

Data Sources

- Canadian Census 2016
- Canadian Income Survey
- Canadian Housing Survey

Derivation

First, a determination was made on whether a household dwelling is adequate, suitable, and affordable. Housing was deemed adequate if the dwelling does not need major repairs for problems like defective plumbing or electrical wiring, or structural elements like walls, floors, and ceilings. A suitable dwelling has sufficient bedrooms for the size and composition of resident households according to National Occupancy Standard (NOS) requirements.³⁰ The dwelling was deemed affordable if housing costs were less than 30% of total before-tax household income.

Second, a determination is made on whether a household would have to spend 30% or more of its total before-tax income to pay the median rent of alternative local housing that meets all three housing standards. For this determination, the median market rent of rental units with the number of bedrooms the household requires is estimated. When market rents cannot be

estimated, the cost of acceptable local housing is calculated by using the estimated monthly carrying cost of a newly constructed home having the number of bedrooms the household requires.³¹

Some households are excluded from affordability calculations. They include: (1) households with income greater than zero and shelter-cost-to-income ratios (STIRs) of 100% or more, (2) STIRs for households with income of zero or less, and (3) STIRs of households living in non-band housing on reserves. Other households that are not assessed for core housing need are: farms, because farm households cannot be separated from the related costs to other farm structures and buildings; bands, because shelter costs are not collected for households whose housing costs are paid through band housing arrangements; and reserve households, because communal land tenure in most on-reserve communities is less clear than it is for off-reserve households.

Air Quality

Air quality comprises the annual average nitrogen dioxide (NO₂) concentration at a postal code in parts per billion, which is achieved using the national NO₂ land use regression model developed from 2012 national air pollution surveillance (NAPS) monitoring data.³²³³³⁴

Data Sources

- 2012 national air pollution surveillance (NAPS) monitoring data available from the Canadian Urban Environmental Health Research Consortium (CANUE).

Derivation

As detailed previously in Hystad et al.³², 2012 national pollutant models for NO₂ were created from routinely collected fixed-site monitoring data in Canada. In multiple regression models, satellite estimates and geographic predictor variables were combined to capture background and regional pollutant variation. Deterministic gradients to capture local-scale variation were also used, modeled using deterministic gradients from the literature and kernel density measures. For 2016 estimates, CANUE used the estimated NO₂ levels for 2012 as the base year and derived annual adjustment factors for 2013–16 using provincial averages of annual NO₂ levels from NAPS monitoring stations.³⁵ Each postal code was then assigned a province identification, and province-specific annual factors were applied to the 2012 base year. Continuous NO₂ values were grouped into quintiles for each map at the level of dissemination area, census tract, and Peel public health data zone.

Mapping Methodology

Each indicator was initially provided to us at the level dissemination area or postal code. The following aggregation strategy was used to generate census tract- and PHDZ-level maps: For the Parks and Natural Environments and Transportation indicators, the numerator and denominator values were available at the dissemination area level and aggregated to the census tract or PHDZ level using summation. Once the new numerator and denominators were summed, the indicator was recalculated using the initial calculation described in the Data Sources and Derivations subsections of the Neighbourhood Design section above. For the Food Environment and Housing indicators, our team did not have access to the original data, only the pre-calculated average values for each dissemination area. Therefore, indicator values at the census tract and PHDZ level were generated using the average (mean) value for each dissemination area located within the corresponding census tract or PHDZ. Given the nature of the dissemination area–census tract and census tract–PHDZ spatial hierarchy (i.e., no overlap), each dissemination area value contributed to only one mean value calculation for a census tract or PHDZ. For the Air Quality indicator, non-missing values for annual average NO₂ concentrations by 2016 postal codes were mapped using latitude/longitude XY coordinates for each postal code in Peel, and each postal code within 5 kilometers of the Peel border, to account for edge effect and ensure a continuous surface for all areas within Peel. The postal code-level NO₂ concentrations were then interpolated using inverse distance weighting (IDW) (Spatial Analyst Tools, ArcMap 10.4.1). Given that the postal code-level air quality data was derived from a multiple regression model accounting for large- and small-scale trends, IDW was deemed a suitable interpolation method to generate a surface to provide values throughout the geographic zones (dissemination area, census tract, PHDZ). The *Zonal Statistics as Table* tool (Spatial Analyst Tools, ArcMap 10.4.1), a function that provides descriptive statistics based on the cell values of a raster within the zones of another dataset, was used to calculate descriptive statistics, including the mean for each zone (i.e., dissemination area, census tract, PHDZ). The values were then joined to the matching 2021 geographic boundary files (dissemination area, census tract, PHDZ) and mapped using the mean value. Unless otherwise specified, quintile classification breaks of each indicator were dichotomized (bottom three quintiles Q1–Q3, top two quintiles Q4–Q5) and mapped against diabetes rate ratios dichotomized as low (<1.0) and high (>1.0). Choropleth univariate and bivariate maps were generated using ArcGIS Pro 3.0.0.

Other Definitions

General Transit Feed Specification Data (GTFS)

The General Transit Feed Specification (GTFS) is a data format for publishing electronic public transit agency data.³⁶ GTFS has schedule, fare, and geographic transit information. GTFS data can be used by software applications for purposes like planning trips, creating timetables, visualizing data, and analysis planning.

Census Tract (CT)

Statistics Canada³⁷ defined census tracts as,

“small, relatively stable geographic areas that usually have a population of fewer than 7,500 persons, based on data from the previous Census of Population Program. They are located in census metropolitan areas (CMAs) and in census agglomerations (CAs) that had a core population of 50,000 or more in the previous census.

A committee of local specialists (for example, municipal planners and others) initially delineates CTs in conjunction with Statistics Canada. Once a CMA or CA has been subdivided into CTs, the CTs are maintained even if the core population subsequently declines below 50,000.”

There were 282 census tracts in Peel Region.

Dissemination Area (DA)

Statistics Canada³⁸ defined a dissemination area as

“a small, relatively stable geographic unit composed of one or more adjacent dissemination blocks with an average population of 400 to 700 persons based on data from the previous Census of Population Program. It is the smallest standard geographic area for which all census data are disseminated. DAs cover all the territory of Canada.”

There were 1,746 dissemination areas in Peel Region.

Peel Public Health Data Zones (PHDZ)

Peel public health data zones were defined above. There are 39 public health data zones in Peel Region.

Chapter 4: Demographic, Behavioural, and Social Determinants and Future Risk of Type 2 Diabetes

Data Sources

Canadian Community Health Survey (CCHS)

The CCHS is a cross-sectional survey conducted by Statistics Canada. The CCHS collects information about health status, health care utilization and health determinants for the Canadian population. The survey uses a large sample of respondents and is designed to provide reliable estimates at the health region level.³⁹

In 2017 the CCHS covered the population 12 years of age and over living in the ten provinces and the three territories. Some people were excluded from the survey's coverage including persons living on reserves and other Aboriginal settlements in the provinces; full-time members of the Canadian Forces; the institutionalized population, children aged 12–17 that are living in foster care, and persons living in the Quebec health regions of Région du Nunavik and Région des Terres-Cries-de-la-Baie-James.³⁹

Definitions

CCHS

CCHS is the Canadian Community Health Survey – Annual Component for 2017/2018.

Age

Age refers to the CCHS survey respondent's age at their previous birthday. The CCHS reported age in groups. For ages 20 and older, the groups are 5-year intervals such as 20–24, 25–29, and so on. The oldest group is 80 and older.⁴⁰ We made a derived variable for the analysis by recoding age with three categories: 20–44, 45–64, or 65+.

Sex

Sex means the sex assigned at birth. It is based on a person's physical characteristics and reproductive system.⁴¹ Response categories used for analysis were male and female.⁴²

Ethnicity

Ethnicity indicates the respondent's cultural or racial background. It excludes respondents who identified as aboriginal. A derived variable used for analysis had response categories of White and non-White (visible or ethnic minority). A category of 'not stated' indicates respondents who did not answer a required question.⁴⁰

Visible Minority

Visible minority means a person who is a visible minority as defined in Canadian federal law. In the Employment Equity Act, visible minorities are defined as "persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in colour." The visible minority population mainly includes persons from these groups: South Asian, Chinese, Black, Filipino, Arab, Latin American, Southeast Asian, West Asian, Korean and Japanese. 'Person' means an individual.⁴³

Immigration Status

The CCHS reported three classifications of immigrant status:⁴⁴

- Non-immigrant: "Persons who are Canadian citizens by birth."
- Immigrant: "Persons who are, or who have ever been, landed immigrants or permanent residents. Such persons have been granted the right to live in Canada permanently by immigration authorities. Immigrants who have obtained Canadian citizenship by naturalization are included in this category."
- Non-permanent resident: "Persons from another country who have a work or study permit or who are refugee claimants, and their family members sharing the same permit and living in Canada with them."

Our analyses used a derived variable that combined landed immigrants and non-permanent residents into a category, and non-immigrants (Canadian born) into another category. A third category, 'not stated,' codes respondents who did not answer the CCHS questions that are needed for the derivation.⁴⁰

BMI

BMI is Body Mass Index. BMI is a method of classifying body weight according to health risk. BMI is a calculation involving weight in kilograms divided by height in metres squared. The CCHS did not calculate the BMI of pregnant women. The following categories and class boundaries were used:^{40,45}

- Underweight: BMI less than 18.50 kg/m²

- Normal weight: BMI 18.50 to 24.99 kg/m²
- Overweight: BMI 25.00 to 29.99 kg/m²
- Obese: BMI 30.00 to 39.99 kg/m²
- Severe Obesity: BMI 40.00 kg/m² and greater.

Obesity

Obesity is a dichotomous variable derived from the BMI variable. Persons having BMI less than 30 kg/m² were classified as not obese ('No'). Persons having BMI 30.0 kg/m² and greater were classified as obese ('Yes'). Obesity was not derived for pregnant women, females who did not answer the survey question about pregnancy, respondents who did not report a valid height and weight, and respondents who had an extremely low (<12) or extremely high (>58) BMI.⁴⁰

Household Income

Household income is based on the respondent's best estimate of total household income received by all household members, from all sources, before taxes and deductions, during the year ending December 31. Income includes sources such as work, investments, pensions, government programs like Employment Insurance, social assistance, the Child Tax Benefit, and other income such as child support, spousal support (alimony) and rental income. Capital gains are excluded from household income.⁴⁶ A derived variable having ordered categories was used for analysis. The income categories were:

- No income or less than \$20,000
- \$20,000 to \$39,999
- \$40,000 to \$59,999
- \$60,000 to \$79,999
- \$80,000 or more.

There is also a category of 'not stated' for respondents who did not answer one or more required questions.⁴⁰

Physical Activity

Physical activity refers to the Canadian Physical Activity Guidelines that are published by the Canadian Society for Exercise Physiology (CSEP). The guidelines hold that to realize health benefits, adults should accumulate at least 150 minutes of

moderate to vigorous aerobic physical activity per week.⁴⁷ The CCHS derived a variable to measure respondent physical activity assessed against the CSEP guidelines. The CCHS variable has three levels:⁴⁰

- No physical activity minutes reported
- Physically active below recommended level from CPAG
- Physically active at or above recommended level from CPAG.

We characterized the CCHS variables' categories with these corresponding labels for the report:

- inactive
- moderately active
- active.

The CCHS also used a category of 'not stated' for respondents who did not answer one or more required questions.

Smoking

Smoking indicates the type of smoker the respondent is, based on his or her smoking habits. The variable includes lifetime cigarette consumption.⁴⁰ Three derived categories were used for analysis:

- Daily smoker
- Occasional smoker
- Non-smoker, i.e., former smokers of any frequency and lifetime abstainers.

A fourth category includes respondents who did not answer one or more required questions.

Hypertension

The CCHS survey question was, "Do you have high blood pressure?"⁴² Two response categories were used for analysis: yes and no. The CCHS also reports responses of don't know and refused.

Perceived Health

The CCHS questionnaire contains this explanation:

“Perceived health is an indicator of overall health status. It can reflect aspects of health not captured in other measures, such as: incipient disease, disease severity, aspects of positive health status, physiological and psychological reserves and social and mental function. Perceived health refers to the perception of a person’s health in general, either by the person himself or herself, or, in the case of proxy response, by the person responding. Health means not only the absence of disease or injury but also physical, mental and social well being.”⁴⁸

Response categories used for analysis were:

- Poor
- Fair
- Good
- Very good
- Excellent.

The CCHS also reports a category for respondents who did not answer one or more required questions.⁴⁰

Perceived Mental Health

Perceived mental health indicates the respondent’s mental health status based on their own judgement. Response categories used for analysis were:

- Poor
- Fair
- Good
- Very good
- Excellent.

The CCHS also reports a category for respondents who did not answer one or more required questions.⁴⁰

Sense of Belonging

Sense of belonging refers to local community integration. The survey question was, “How would you describe your sense of belonging to your local community? Would you say it is...?”⁴⁹ Response categories used for analysis were:

- Very strong
- Somewhat strong
- Somewhat weak
- Very weak.

The CCHS also reports a category for respondents who didn't know or did not give a response.

Food Security

Ten questions elicited the food security situation of the household's adults in the previous 12 months.⁴⁰ Response categories used for analysis were:

- Food secure: No, or one, indication of difficulty with income-related food access
- Moderately food insecure: indication of compromise in quality and/or quantity of food consumed (2 to 5 affirmative responses to questions)
- Severely food insecure: indication of reduced food intake and disrupted eating patterns (≥ 6 affirmative responses).

The CCHS also reported a category for respondents who did not answer at least one required question.

Diabetes

The CCHS survey question was, “Do you have diabetes?”⁴⁶ The response options were:

- Yes
- No
- Don't know
- Refuse to answer.

The responses were used to obtain the prevalence of risk factors among respondents living with (Yes) and without (No) diabetes. Respondents who did not have diabetes (No) were used in analyses to predict future incidence of diabetes.

Incidence (of diabetes)

Incidence is the frequency of diagnoses of new (diabetes) cases in a given time period.

DPoRT

DPoRT is the Diabetes Population Risk Tool.⁵⁰ DPoRT is a decision support tool that uses routinely collected population characteristics applied to a validated risk prediction algorithm. DPoRT estimates the number of new and existing physician-diagnosed Type 2 diabetes cases in a population. The purposes of using DPoRT to obtain diabetes estimates include understanding distribution of risk in the population, diabetes prevention, diabetes health resource planning, and setting priorities and making decisions.

The DPoRT algorithm was developed using data from Ontario respondents to the 1996-97 National Population Health Survey (NPHS).⁵¹ It was validated in two cohorts and data sources: a cohort of Manitoba respondents to the 1996-97 NPHS and a cohort of Ontario respondents to the 2000 Canadian Community Health Survey.⁵² The DPoRT algorithm was updated to DPoRT 2.0 in 2014.⁵³ The DPoRT 2.0 risk prediction variables are age, body mass index (BMI), education level, ethnicity, heart disease, hypertension, immigrant status, income level, sex, and smoking status.

DPoRT 2.0 predictions represent community-dwelling residents who lived in the 10 Canadian provinces during the year of CCHS data collection. DPoRT estimates do not represent:

- residents of First Nation reserves
- people who live in institutions such as nursing homes
- full-time members of the Canadian Forces
- residents of certain remote regions, and
- people who may immigrate to Canada in a ten-year period after the CCHS data collection.

Chapter 5: Health Services and Quality of Care

Data Sources

Ontario Diabetes Dataset (ODD)

Please see the ODD description for Chapter 2.

Registered Persons Database (RPDB)

Please see the RPDB description for Chapter 2.

Canadian Institutes for Health Information (CIHI) Discharge Abstract Database (DAD)

The Canadian Institutes for Health Information (CIHI) Discharge Abstract Database (DAD)¹⁸ contains demographic, administrative and clinical data about patients discharged from hospital inpatient stays and day surgeries. A hospital separation is defined as a patient's separation from a hospital because of death, discharge to home, or transfer to another facility. In the DAD, the primary reason for the hospital stay is designated by a code indicating the diagnosis that is the one most responsible for the patient's stay in hospital. Before April 1, 2001, the most responsible diagnosis was coded using the Ninth Revision of the International Classification of Diseases (ICD-9). After this date, the Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems, Canada (ICD-10-CA) was used.

Limitations:

The DAD data have several limitations:

- (1) Hospitalization data are coarse measures of health conditions for several reasons: A person might be hospitalized several times for the same disease or injury, may be discharged from more than one hospital (when transferred) for the same disease or injury, or may not seek care at a hospital.
- (2) The most responsible diagnosis has classification uncertainty because of comorbidity with other health conditions.
- (3) Factors that are unrelated to health status, such as availability and accessibility of care and administrative policies and procedures, may influence the data in DAD records.
- (4) DAD data available to Ontario researchers does not have information about Ontario residents treated outside of Ontario.

Canadian Institutes for Health Information (CIHI) National Ambulatory Care Reporting System (NACRS)

The Canadian Institutes for Health Information (CIHI) National Ambulatory Care Reporting System (NACRS)⁵⁴ receives information about patient visits submitted by hospital emergency departments. NACRS began receiving data in July 2000. The patient's main problem or diagnosis, as determined by the emergency department (ED), is the basis for assigning the

main diagnostic code for the ED visit. The code is based on the Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems, Canada (ICD-10-CA).

Limitations:

The NACRS data have several limitations.

- (1) Data are not considered to be reliable before April 1, 2002.
- (2) Ambulatory visit data are coarse measures of health conditions for several reasons: A person might not seek care at an emergency department or may visit several times for the same disease or injury or may visit more than one hospital for the same disease or injury.
- (3) The most responsible diagnosis has classification uncertainty because of comorbidity with other health conditions.
- (4) Factors that are unrelated to health status, such as availability and accessibility of care and administrative policies and procedures, may influence the data in NACRS records.
- (5) NACRS data available to Ontario researchers does not have information about Ontario residents treated outside of Ontario.

Ontario Health Insurance Plan (OHIP) Database

Medical services information was obtained from the Ontario Health Insurance Plan (OHIP)¹⁶ file of approved claims. The file has service and payment information on (1) fee-for-service (FFS) claims submitted by physicians and other licensed health professionals, and (2) some of the “shadow billings” submitted from providers in organizations that use alternate, non-FFS payment arrangements. A typical claim in the file has information about the patient, provider, fee schedule code or procedure performed, number of services or units delivered, and some diagnostic information. OHIP uses a unique coding system for diagnoses.

Limitations:

The OHIP database has several limitations:

- (1) Only some of the claims from the Ontario Ministry of Health’s alternate payment programs or “shadow billers” are included, and total volume for some services may be undercounted.

- (2) Some diagnosis codes may have different meanings depending on the health service provider's specialty.
- (3) Approximately half of the diagnosis codes are missing from the approved claims since there is no requirement to include the codes.

Ontario Laboratory Information System (OLIS)

Beginning in 2006, community, hospital, and public health laboratories in Ontario began submitting information about laboratory test results to the Ontario Laboratory Information System (OLIS).⁵⁵ As of 2012 all Public Health Ontario laboratories had joined OLIS. As of August 2016, OLIS had completed connections with hospital laboratories in 13 out of 14 local health integration networks (LHINs). At the time of the Baseline Data Strategy report writing, all community and most hospital-based laboratories were contributing information to OLIS.

Limitations:

There are circumstances that can cause laboratory test results not to appear in OLIS. For example:

- (1) tests performed for reasons other than direct patient care, e.g., pre-employment screening and other employment-related testing, clinical trials testing
- (2) tests that could not be performed for exceptional reasons, e.g., broken test tubes
- (3) tests requested when the Ontario health card was expired, lost, or stolen
- (4) laboratory requisitions for out-of-province patients
- (5) laboratory requisitions made by out-of-province practitioners
- (6) tests on uninsured patients where necessary Ontario patient identification information was unavailable
- (7) non-insured tests where necessary Ontario patient identification information was unavailable
- (8) pilot sites such as reports from long-term care facilities and hospitals that refer patients to an external lab because they lack an on-site laboratory, and the results are not sent directly to OLIS from the hospital.

Ontario Drug Benefit (ODB) Database

The Ontario Drug Benefit (ODB)¹⁷ database contains claims for outpatient prescription drugs received under the Ontario Drug Benefit program. Most are for individuals 65 years old and higher, who have a valid Ontario health card. From 1997 forward the database has information on other ODB insurance programs where individuals may be younger than 65. The ODB program covers drugs listed on the ODB formulary, some nutritional products, and some diabetic testing products. Some primary data elements in the ODB include patient, physician, and pharmacy indicators, the drug identification number, date the drug was dispensed, quantity of drug dispensed, and the cost.

Limitations:

The ODB database does not have information about dispensed drugs that were not paid for by the Ontario Ministry of Health, e.g., drugs paid for out of pocket and by private insurance.

Methods

Overview

This was a retrospective descriptive study using population-based data from ICES.

Study Population

Residents were assigned to the Mississauga Ontario Health Team (OHT) using the procedure described below. We included all residents assigned to the Mississauga OHT who were alive and had a diagnosis of diabetes on or before April 1, 2019, or April 1, 2020. Diabetes was diagnosed by inclusion in the Ontario Diabetes Dataset.¹⁹

Ontario residents were assigned to the primary care physician based on each physician's roster at the midpoint of each year from April 1, 2019 to March 3, 2021.⁵⁶ Residents not on any primary care physician's roster were assigned to the primary care physician who provided the most primary care services. Residents receiving no primary care services had no assigned primary care physician. Each primary care physician was linked to the hospital where most of his or her patients were admitted for non-maternal medical care using the method described by Stukel et al.⁵⁶ Primary care physicians linked to Trillium Health Partners (located in Mississauga) were defined as being part of the Mississauga Ontario Health Team (OHT). Residents were assigned to Mississauga OHT if their assigned primary care physician was affiliated with Mississauga OHT. Residents without

an assigned primary care provider were assigned to Mississauga OHT if the majority of individuals living in their postal code dissemination area were assigned to Mississauga OHT.

Data Sources

Residents of Ontario were identified using the Registered Persons Database. We used the Canadian Institute for Health Information Discharge Abstract Database, National Ambulatory Care Reporting System, and the Ontario Health Insurance Plan database for hospitalization discharge abstracts, emergency department records, and physician billing codes respectively. The Ontario Laboratory Information System includes laboratory results from community, hospital, and public health laboratories from 2007 onward.⁵⁷ Over 95% of HbA_{1c} and LDL cholesterol values in Ontario are captured in this database.⁵⁵ The Ontario Drug Benefit database includes outpatient prescriptions for insured individuals including those aged ≥65 years and select individuals <65 years.⁵⁸ These datasets were linked using unique encoded identifiers and analyzed at ICES.

Indicators

For this phase of the NHP Baseline Data Strategy, we examined laboratory, retinopathy screening, prescription, and hospitalization indicators separately for the years of April 1, 2019 to March 31, 2020 and April 1, 2020 to March 31, 2021. The laboratory indicators included percentage receiving at least one HbA_{1c} test within the past 12 months, at least one LDL cholesterol test within the past 12 months, the mean HbA_{1c} level, and the mean LDL cholesterol level, all examined among people aged ≥40 years. The retinopathy screening indicator was defined as the percentage of people aged ≥40 years undergoing at least one retinal examination by an optometrist or ophthalmologist in the past 24 months. The prescription indicators consisted of the percentage of adults aged ≥65 years receiving an ACEi or ARB prescription, and a statin prescription, both within the past 12 months. The hospitalization indicators were classified as long-term complications (retinopathy, nephropathy, neuropathy, cardiovascular disease, or multiple complications of diabetes) and short-term complications (diabetic ketoacidosis, hyperglycemic hyperosmolar state, hypoglycemia) both among adults aged ≥18 years.

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