Mississauga Ontario Health Team Population Health Data Report

Data Overview

An overview of socio-demographic, health, and self-reported data to characterize the attributed Mississauga Ontario Health Team population.

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Table of Contents:

Executive Summary 2
Chapter 1: Introducing the M-OHT and this Report 3
Chapter 2: Characterizing the Mississauga-OHT Population 4
2.1 M-OHT Demographic Characteristics 4
2.2. A Closer Look at Neighbourhood Socioeconomic Status 7
2.3 Self-Reported Health Characteristics 9
Health Risk Factors 9
Life Satisfaction and Community Belonging Measures 10
Summary of Chapter 2 Findings 11
Chapter 3: Health Conditions in the Mississauga-OHT 12
3.1 Health Conditions by Sub-Region 12
Health Risk Groupings 14
3.2 Health Conditions by Sociodemographic Factors 15
Conditions by Age Group 15
Conditions by Immigrant Status 16
Conditions by Neighbourhood Material Deprivation/SES 17
3.3 Premature Mortality 19
3.4 Multimorbidity at Death 20
Summary of Chapter 3 Findings 22
Chapter 4: Healthcare Utilization 23
Utilization Groups 23
Health Service Utilization 23
Ambulatory Care Sensitive Condition (ACSC) Hospitalizations 25
Primary Care Visits and Continuity 25
High Resource User in Next 5 Years 26
Summary of Chapter 4 Findings 27
Chapter 5: Discussion 28
5.1 Linking Key Findings 28
Morbidity and Multimorbidity 28
Healthcare Utilization 29
Life Satisfaction and Sense of Community Belonging 30
5.2 Conclusion and Next Steps 30
References 32
Appendix A - Technical Appendix 36
Key Variables 36
Data Sources 37
Methods 40
Appendix B - Extra Tables and Figures 43

Executive Summary

The Mississauga Ontario Health Team (M-OHT) was created in 2019 as part of a province-wide health system restructuring to provide better-connected care across the health system within a defined population. A comprehensive analysis of the population served by the M-OHT is a critical first step to understanding needs and health care use and serves as a baseline for ongoing planning and evaluation. The report compiles available national and provincial data to give a snapshot of the M-OHT population's characteristics. This data report aims to establish baseline knowledge and demonstrate the range of data holdings used to support population health management in the M-OHT. This report is intentionally general in scope to be comprehensive as a baseline report. We anticipate future reports to dive deeper and more precisely into the data to inform care provision and health systems planning around particular issues.

This report also provides a high-level overview of the health of individuals in the M-OHT population at the time of analysis who were alive in the 2018 fiscal year (before COVID-19), using available data from 2018 and previous years. Firstly, the report details the M-OHT in terms of socio-demographics and self-reported health characteristics. Secondly, the most common health conditions in the M-OHT (by region, age, immigrant status, and SES). Lastly, available information on healthcare utilization and system resources are presented. Each chapter comprises a series of figures and descriptions to summarize data and a chapter summary to tie findings together. Our findings can be used to support priority efforts for the M-OHT, including efforts aimed at prevention, care coordination, integrated care within and across sectors, and reducing health inequities.

Most of the attributed M-OHT population are in the 20-64 age group. Overall, 27% live in low SES neighbourhoods, 8% report being food insecure, and chronic disease risk factors (e.g., smoking) vary significantly across the region. The six most common health conditions in the M-OHT (from the highest to lowest) are osteo- and other arthritis, mood disorder, hypertension, asthma, other mental health disorder, and diabetes. Aside from asthma, the prevalence of these conditions increases with age, and there are socioeconomic status (SES) gradients for all health conditions (i.e., low SES neighbourhoods have higher proportions of individuals with chronic disease). Premature mortality, a robust indicator of overall population health, varied across the M-OHT and by SES. For healthcare utilization, we found that in the period covered in this report, most individuals in the regions used low-cost health services, while a small number of individuals accounted for a large amount of health care system costs. Sub-regional (i.e. geographic) differences in the M-OHT were also evident in our findings and described in detail in the full report.

Chapter 1: Introducing the M-OHT and this Report

The Ontario Health Teams (OHTs) healthcare model was initiated province-wide in 2019 as a mechanism to integrate different health care providers within a community to work together and seamlessly deliver care under one unified health care system. The Mississauga OHT (M-OHT) was one of the first 24 OHTs identified upon initiation of the OHT model. The vision of the M-OHT is “to work together to improve the health of people in our community by creating an interconnected system of care across the continuum, from prenatal care to birth to end of life and bereavement. It aims to provide care that will address physical, mental, social and emotional well-being, and will be reliable, high quality and grounded in exceptional experiences and sustainability, delivering on the Quadruple Aim" [1].

OHTs serve a population defined by where individuals receive most of their healthcare. The M-OHT, for instance, is responsible for the care of patients who receive most of their healthcare in Mississauga. Thus, the M-OHT population includes both individuals who live in and outside of the city of Mississauga. The detailed attribution methodology for OHTs is based on physician specialty networks and is described in more detail in Appendix A [2].

This M-OHT Data report broadly introduces the baseline information of the M-OHT population's sociodemographics, health conditions, healthcare utilization, and certain self-reported measures related to health (mental health, stress, health characteristics, life satisfaction, and sense of community belonging). It intentionally uses pre-COVID-19 data, encompassing individuals alive in fiscal year (FY) 2018 and data from 2018 and previous years. Each chapter comprises a series of figures and descriptions to summarize data and a chapter summary to tie findings together. It is important to note that individuals attributed to the M-OHT do not necessarily receive most care in the region they reside, and some receiving care in Mississauga do not live in the region. Thus, examining the full M-OHT population (residents and non-residents) becomes necessary to inform health systems planning for the M-OHT. OHT definitions are dynamic as the definitions are applied to data that is updated regularly. As a result, the OHT denominators are updated to reflect changes to the attribution methodology and population. This is essential to keep in mind when comparing with future reports.

To facilitate population planning, the data have been presented by sub-regions where possible. For the purpose of this report, we report on sub-region, which have been defined based on where individuals live, including East Mississauga, North West Mississauga, South West Mississauga, and Outside Mississauga. Future work on identifying meaningful neighbourhoods will allow for continued mapping and reporting for the M-OHT. We also stratified our reporting using neighbourhood material deprivation quintiles taken from the Ontario Marginalization Index (ON-MARG), which measures area-based SES [3].

As accountable and integrated care systems, OHTs need information regarding their populations' health care, but more broadly, the social, environmental, and economic factors that play a critical role in maintaining one's health. This gap can most effectively be filled by compiling data. Despite limited data sources to show a complete picture of one's social, environmental, and economic context, a lot can be understood using currently available census and health administrative data. Thus, this report is a first step in the M-OHT's move towards data-informed health system planning and population management. The main goal is to show the variety of information that can be gathered based on existing databases alone, point out gaps in data, and at the same time present a baseline characterization of the attributed M-OHT population to facilitate planning and evaluation.

This report is meant to provide a summary of the health of the attributed M-OHT population from existing health and survey data. The report is intended to be descriptive, and no specific hypotheses are being tested. As a result, data was intentionally not age- or sex-adjusted in order to accurately represent the population for planning purposes [4,5].

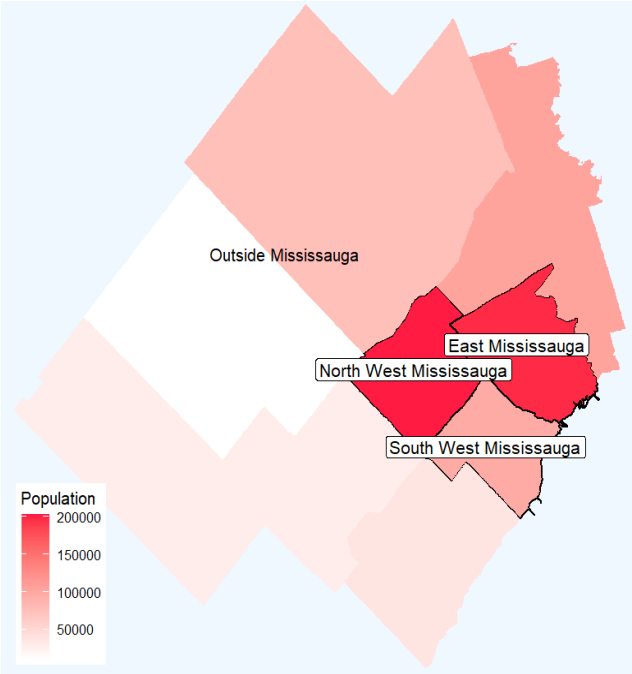
Chapter 2: Characterizing the Mississauga-OHT Population

This chapter will cover demographics, socioeconomic status (SES), and self-reported life satisfaction and community belonging measures of the attributed M-OHT population alive in FY 2018. We purposefully start with these demographic and sociodemographic factors to emphasize that these characteristics underlie a population health management approach. We will also present some self-reported health behaviours and perceptions of life satisfaction and community belonging as experienced by the attributed M-OHT population to further describe the overall well-being in the population.

2.1 M-OHT Demographic Characteristics

Of the attributed M-OHT population in Mississauga, most live in North West Mississauga, followed by East Mississauga and South West Mississauga (see **Figure 2.1.1**). Importantly, 42% of the M-OHT population live outside Mississauga, mainly in Toronto (12%), Brampton (9%), and Oakville (4%). Across all sub-regions, there are slightly more females than males in the population. North West Mississauga and Outside Mississauga have younger populations. Overall, individuals aged 20-44 represent the highest proportion of the population (see **Table 2.1.1**).

Figure 2.1.1 Place of residence for individuals in the M-OHT population.



Note: only neighbouring Mississauga sub-regions are shown; those in the M-OHT that live Outside Mississauga extend beyond this map.

Table 2.1.1 Percentage of the attributed M-OHT population by age, sex, sub-region.

		East Mississauga (N=197,488) **%**	**North West Mississauga** (N= 202,689) **%**	**South West Mississauga** (N=96,160) **%**	**Outside Mississauga** (N=363,055) **%**	**Mississauga Overall** (N=859,392) **%**
Sex	Female	52.6	51.7	52.0	50.8	51.6
	Male	47.4	48.3	48.0	49.2	48.4
Age	0-19	20.4	24.7	20.7	20.9	21.7
	20-44	30.4	31.2	28.9	37.6	33.5
	45-64	29.0	31.1	30.2	27.9	29.2
	65-74	10.9	7.8	11.5	8.1	9.0
	75+	9.2	5.2	8.7	5.5	6.6

Source: 2016 Census

Most individuals work in *sales and service occupations*; *business, finance and administration occupations*; and *trades, transport and equipment operators and related occupations* (see **Table 2.1.2**).

Table 2.1.2 Distribution of employment in the attributed M-OHT population, based on National Occupational Classification of Canada (NOC) occupational groups

Employment Sector (from the National Occupational Classification of Canada)[1]	**%**
Sales and service occupations	24.1
Business, finance and administration occupations	19.2
Trades, transport and equipment operators and related occupations	12.1
Management occupations	11.5
Natural and applied sciences and related occupations	9.8
Occupations in education, law and social, community and government services	9.1
Health occupations	5.5
Occupations in manufacturing and utilities	5.2
Occupations in art, culture, recreation and sport	2.5
Natural resources, agriculture and related production occupations	0.7
Unemployment Rate (out of all individuals eligible for work)	8.3

Source: 2016 Census

Immigrant status is reported by recent immigrants (immigrated in past five years), long-term immigrants (immigrated five or more years ago), or long-term residents (individuals born in Canada, those who immigrated before 1985) from Immigrant, Refugee, and Citizenship Canada (IRCC) database [6].[2] Most recent immigrants in the M-OHT come from *Asia and Pacific*, and *Africa and Middle East* world regions. Most long-term immigrants in the M-OHT come from *Asia and Pacific,* and *Europe* world regions (see **Table 2.1.3**).

Table 2.1.3 Immigrant and refugee status in the attributed M-OHT population

		Recent immigrant (<5 years) (N=24,432) %	**Long-term immigrant (≥5 years)** (N=253,592) %	**Long-term resident or born in Canada** (N=580,368) %
Age	0-19	24.9	7.3	27.8
	20-44	54.0	39.5	29.9
	45-64	14.0	40.7	24.8
	65-74	4.4	7.7	9.8
	75+	2.6	4.8	7.6
Refugees[3]		22.0	12.8	N/A
World Region[4]	Africa & Middle East	28.4	15.9	N/A
	Americas	6.8	10.5	N/A
	Asia & Pacific	54.4	55.8	N/A
	Europe	8.4	16.5	N/A
	United States of America	2.0	1.4	N/A

Source: CIC

[1] Employment sectors are designated by the NOC. For more information, see https://noc.esdc.gc.ca/Home/Welcome/a7d94a5404264941b7a53cf36b7daf9f?GoCTemplateCulture=en-CA.

[2] The long-term resident group also include immigrants who landed in another province before coming to Ontario.

[3] Refugees include all permanent residents who applied for and received permanent resident status in Canada after refugee claim was accepted, see https://www.canada.ca/en/services/immigration-citizenship/helpcentre/glossary.html#r for more information.

[4] World Regions are based on the Standard Classification of Countries and Areas of Interest (SCCAI) 2019, see https://www.statcan.gc.ca/eng/subjects/standard/sccai/2019/index for more information.

Overall, 33% of the M-OHT population are recent or long-term immigrants. North West Mississauga has the highest proportion of long-term immigrants. East Mississauga has the second-highest proportion of long-term immigrants and the highest proportion of recent immigrants. South West Mississauga has the lowest proportion of both long-term and recent immigrants (see **Figure 2.1.1**).

Neighbourhood visible minority quintiles indicate the proportion of residents in a neighbourhood who self-identified as belonging to a visible minority group, according to the 2016 Canadian Census. The proportions are then categorized into quintiles that range from Q1 (neighbourhoods with the lowest percentage of visible minorities) to Q5 (neighbourhoods with the highest percentage of visible minorities) based on the percentage of residents identifying as visible minorities in all areas across Ontario. The distribution of visible minority residents differ according to region (see **Figure 2.1.2**).

Figure 2.1.2 Distribution of immigrant status by sub-region

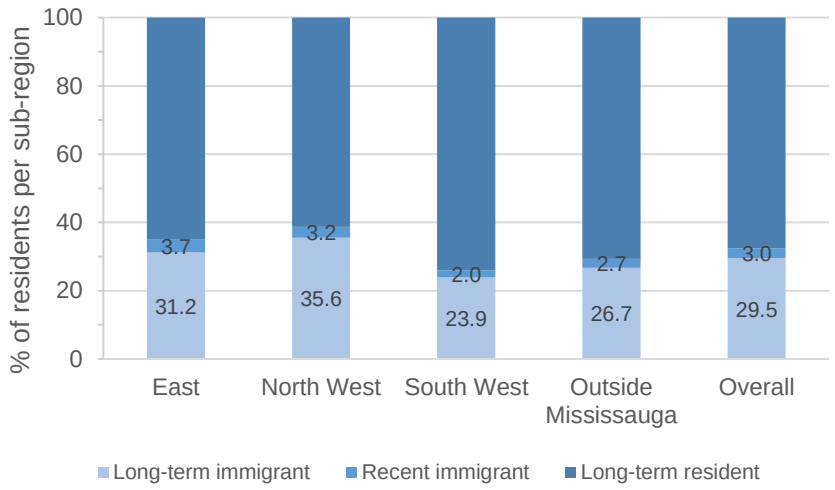
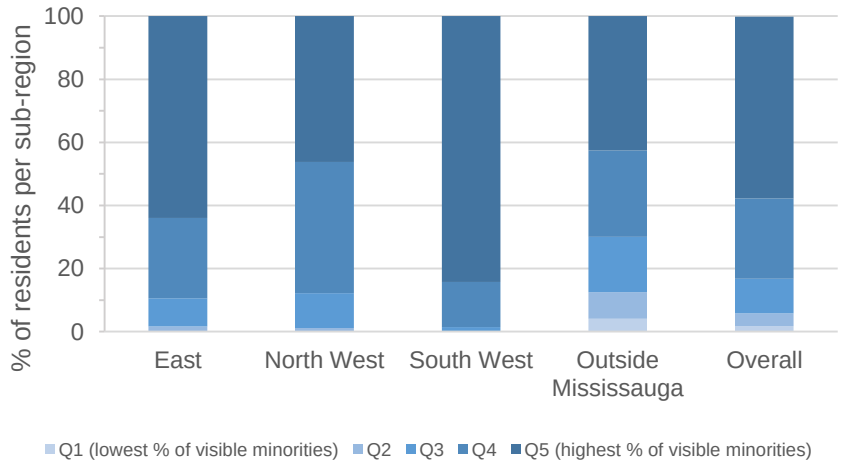


Figure 2.1.3 Distribution of neighbourhood visible minority quintile by sub-region



2.2. A Closer Look at Neighbourhood Socioeconomic Status

Neighbourhood material deprivation quintiles are used to describe the overall SES of the neighbourhoods in which an individual lives. These quintiles were taken from ON-MARG[5] and range from Q1 (least deprived/highest SES) to Q5 (most deprived/lowest SES). This variable is based on census characteristics of income, education, and employment. It can be interpreted as the extent to which an individual is likely to be unable to afford or obtain essential goods and services.

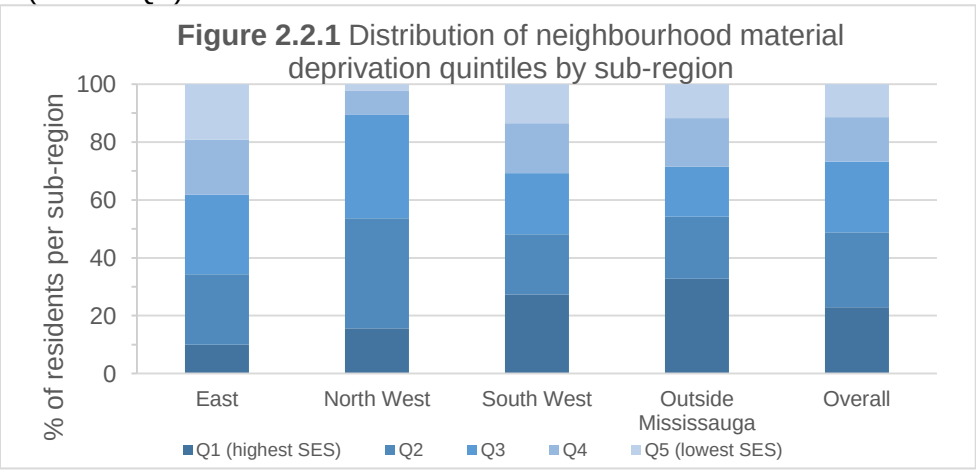
The M-OHT population, broken down by individuals' neighbourhood material deprivation quintiles and demographic distributions, is shown in **Table 2.2.1**. Most of the M-OHT population live in higher SES neighbourhoods relative to the rest of Ontario (Q1, Q2, and Q3). In addition, the sex and age distributions across different quintiles are similar.

Table 2.2.1 Neighbourhood material deprivation quintiles overall and by age in the attributed M-OHT population.

		Quintile 1 (highest SES) (N=196,253) %	**Quintile 2** (N=222,695) %	**Quintile 3** (N=209,128) %	**Quintile 4** (N=131,553) %	**Quintile 5 (lowest SES)** (N=98,081) %
Sex	Female	51.2	51.5	51.6	51.8	52.0
	Male	48.8	48.5	48.4	48.2	48.0
Age	0-19	21.3	22.0	22.1	20.6	22.4
	20-44	34.0	32.5	33.0	34.0	34.9
	45-64	29.0	30.0	29.5	28.6	27.7
	65-74	9.1	9.0	8.9	9.5	8.5
	75+	6.7	6.5	6.5	7.3	6.5

Source: RPDB and ON-MARG

Figure 2.2.1 shows the distribution of neighbourhood material deprivation quintiles of the M-OHT overall and its sub-regions. Those within the OHT that live outside Mississauga have the greatest proportion of those that live in the highest SES neighbourhoods (33%). For those within the OHT that live in Mississauga, East Mississauga has the highest proportion of those living in low SES neighbourhoods (19% in Q5). North West Mississauga has the lowest proportion of individuals from low SES neighbourhoods (2% in Q5), with most individuals from higher-SES Q2 and Q3 (combined total of 74%). South West Mississauga has both the highest proportion of individuals from a high SES neighbourhood (27% in Q1) in Mississauga and a high proportion of individuals from a low SES neighbourhood (14% in Q5).



[5] See the Ontario Marginalization Index (ON-MARG) User Guide for more information on how neighbourhood material deprivation quintile were created, https://www.publichealthontario.ca/en/eRepository/userguide-on-marg.pdf.

Figure 2.2.2 shows the distribution of neighbourhood material deprivation quintiles within visible minority quintiles of the M-OHT population. Individuals who live in neighbourhoods with a moderate percent visible minority (Q2, Q3, and Q4) have a higher proportion of individuals living in neighbourhoods with high SES. Conversely, both Q1 and Q5 have the highest proportions of individuals living in neighbourhoods with low SES (10% and 14% in material deprivation Q5, respectively) and the lowest proportions of individuals living in neighbourhoods with high SES (25% and 16% in material deprivation Q1, respectively).

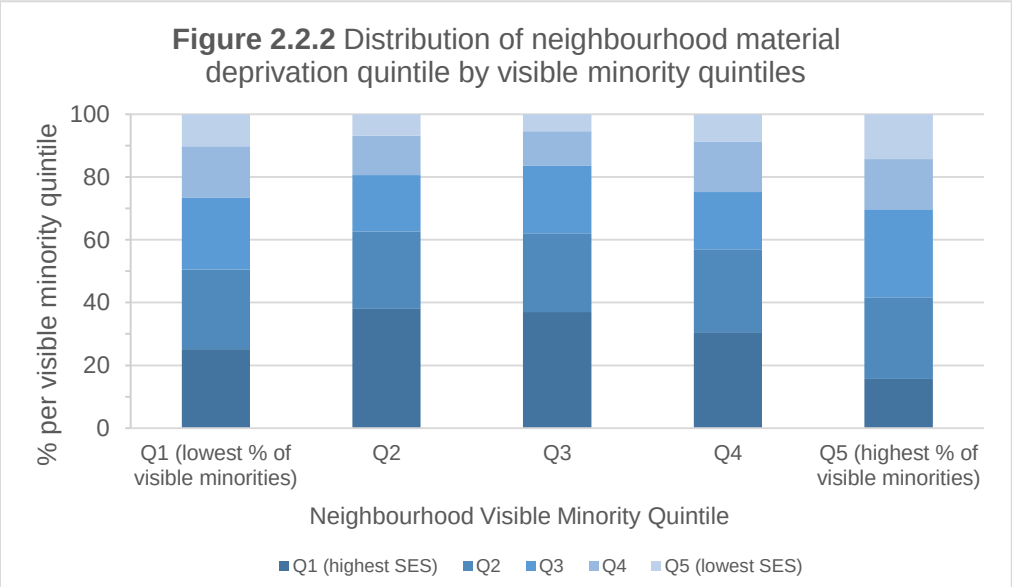
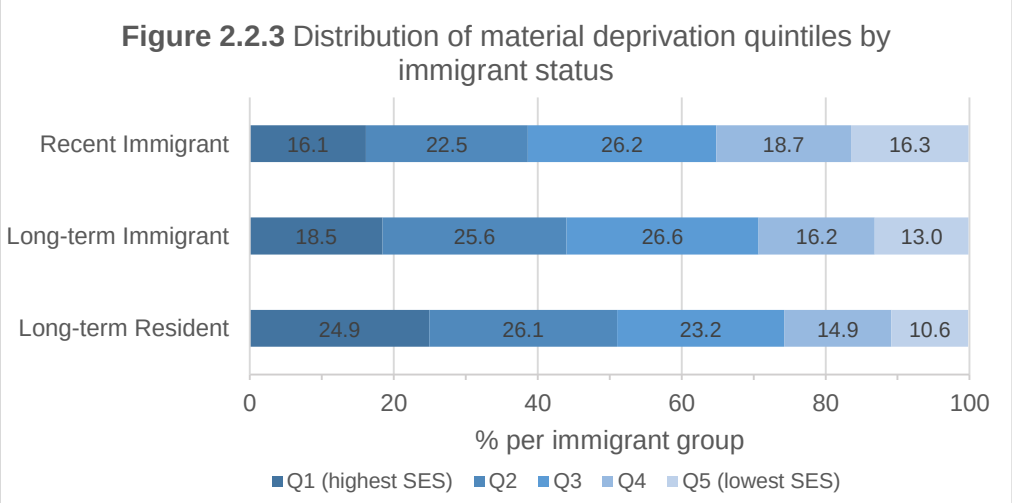


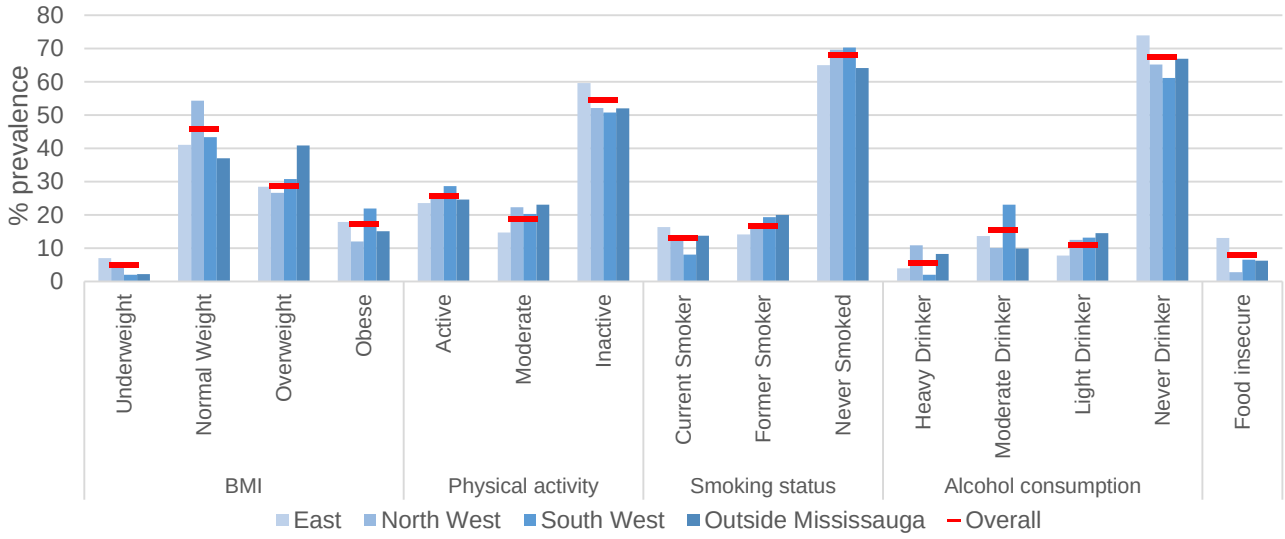
Figure 2.2.3 shows the distribution of neighbourhood material deprivation quintiles by immigrant status groups in the M-OHT population. Of the immigrant status groupings used, long-term residents are most likely to live in high-SES neighbourhoods (Q1 and Q2).



2.3 Self-Reported Health Characteristics

Health Risk Factors

Figure 2.3.1 Self-reported health risk factors by sub-region



We report the following self-reported health characteristics of the attributed M-OHT population and sub-regions based on the 2013-14 Canadian Community Health Survey (CCHS), a representative survey conducted by Statistics Canada annually.[6] In **Figure 2.3.1**, body mass index (BMI), smoking status, physical activity, alcohol consumption, and food insecurity are reported across the M-OHT sub-regional populations. BMI was calculated by dividing self-reported body weight by self-reported height and classified based on Health Canada guidelines.[7] Physical activity levels were classified by CCHS based on the self-reported amount of time spent on various leisure and transportation activities (e.g., walking, cycling, and sports) in the last three months and the calculated daily energy expended during these activities (kcal/kg/day).[8] Alcohol consumption levels were classified based on the self-reported number of drinks consumed per week, with different ranges for each sex [7].[9] Individuals were deemed food insecure if they reported being anxious about running out of food or having to consume more inferior quality food, or are experiencing hunger or reduced quantities of food.[10] *Note: red lines on the figure correspond to the average percentage for the entire attributed M-OHT population.*

Based on the self-report data for the M-OHT population, 46% are in the *normal* BMI range, and 55% are physically *inactive*. Additionally, 68% have *never smoked*, 67% are *never drinkers*, and 8% are food insecure. For BMI, East Mississauga has an above-average proportion of individuals who are in the *underweight* range (7% of its population), North West Mississauga has an above-average proportion of BMIs in the *normal* range (54%), South West Mississauga has an above-average proportion of BMIs in the *overweight* and *obese* ranges (31% and 22%, respectively), and Outside Mississauga has an above-average proportion BMIs in the *overweight* range (41%). For physical activity, South West Mississauga has an above-average proportion of individuals who are *active*

[6] See https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3226&lang=en&db=imdb&adm=8&dis=2 for more information on the CCHS.
[7] See Health Canada's BMI ranges here, https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/healthy-weights/canadian-guidelines-body-weight-classification-adults/body-mass-index-nomogram.html.
[8] 3.0 kcal/kg/day or more = active; 1.5 to 2.9 kcal/kg/day = moderate; less than 1.5 kcal/kg/day = inactive, retrieved from http://www.statcan.gc.ca/imdb-bmdi/document/3226_D2_T9_V6-eng.pdf.
[9] 3 or fewer drinks/week for males and 2 or fewer drinks/week for females = light; 3-21 drinks/week for males and 2-14 drinks/week for females = moderate; 21 or more drinks/week for males, 14 or more drinks/week for females = heavy.
[10] See description of survey items here: http://www.statcan.gc.ca/imdb-bmdi/document/3226_D2_T9_V6-eng.pdf.

(29%), North West and Outside Mississauga have above-average proportions of *moderately active* individuals (22% and 23%, respectively), and East Mississauga has an above-average proportion of *inactive* individuals (60%). For smoking, East Mississauga has an above-average proportion of *current smokers* (16%), Outside Mississauga and South West Mississauga have slightly above-average proportions of *former smoke*rs (19% and 20%, respectively), and North West and South West Mississauga have slightly above-average proportions of *never smokers* (19% and 20%, respectively). For alcohol consumption, North West and Outside Mississauga have above-average proportions of *heavy drinkers* (11% and 8%, respectively), South West Mississauga has an above-average proportion of *moderate drinkers* (23%), North West, South West, and Outside Mississauga have slightly above-average proportions of *light drinkers* (13%, 13%, and 15%, respectively), and East Mississauga has an above-average proportion of *never drinkers* (74%). Lastly, East Mississauga has an above-average (and highest) proportion of individuals who are food insecure (13%).

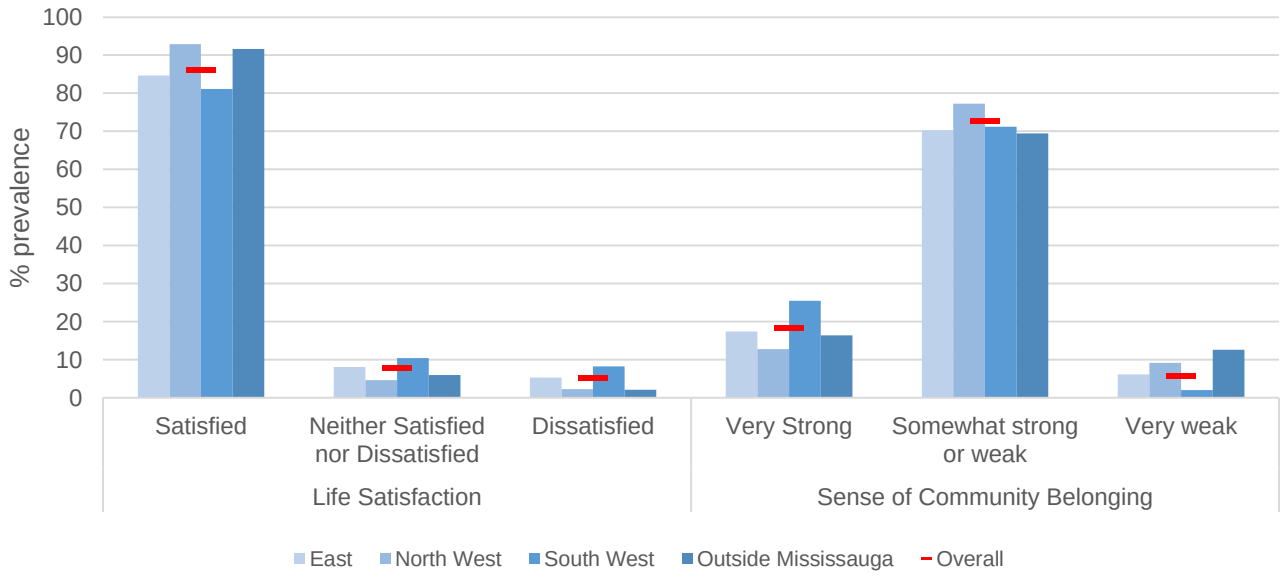
Life Satisfaction and Community Belonging Measures

Figure 2.1.3 describes self-reported levels of life satisfaction and sense of community belonging across the M-OHT sub-regional populations using data from the 2013-14 CCHS. *Note: red lines on the figure correspond to the average percentage for the entire attributed M-OHT population.*

Individuals from Outside Mississauga and North West Mississauga report above-average levels of life satisfaction, compared to the M-OHT population as a whole. South West Mississauga has an above-average proportion of individuals who reported being *neither satisfied nor dissatisfied* and *dissatisfied*. East Mississauga's level of life satisfaction is approximately near average for all levels.

South West Mississauga has an above-average proportion of individuals reporting a *very strong* sense of community belonging. North West Mississauga has an above-average proportion of people reporting a *somewhat strong or weak* sense of community belonging. Individuals from Outside Mississauga reported somewhat lower community belonging levels, with above-average proportions of individuals reporting a *very weak* sense of community belonging. East Mississauga's sense of community belonging is near average for all levels.

Figure 2.3.1 Distribution of self-reported life satisfaction and sense of community belonging by sub-region



Summary of Chapter 2 Findings

This chapter covers the demographic and socioeconomic characteristics of the M-OHT. The findings highlight important demographic and socioeconomic characteristics that need to be considered for population health planning in the region. Broadly, 26.7% of the population are in low SES quintiles, and most individuals are in the 20-64 age group. Important regional differences in sociodemopgrahic and socioeconomic characteristics were also highlighted across the M-OHT region.

Life satisfaction and sense of community belonging are important metrics to capture overall wellness in the community. Levels varied regionally in the M-OHT. For example, compared to the M-OHT average, life satisfaction in North West is higher and fewer individuals report a strong sense of community belonging. Conversely, in South West Mississauga, life satisfaction is lower and more individuals report a strong sense of community belonging than the average.

Finally, examining self-reported health risk factors shows that known chronic disease risk factors are prevalent in Mississauga (e.g., obesity and low physical activity levels) with variation across the M-OHT. The proportion of overweight or obese individuals is highest in South West, and physical inactivity is particularly high in East Mississauga. In addition, relative to other sub-regions, East Mississauga had the highest proportion of current smokers and food insecure individuals. These findings can inform the range of population health management strategies needed across the M-OHT, including health promotion approaches aimed at reducing risk factors for chronic diseases.

The following chapters will focus on health conditions and health care utilization. In understanding this information, it is important to continually keep in mind the sociodemographic and socioeconomic patterns in the attributed population to appropriately plan for M-OHT needs.

Chapter 3: Health Conditions in the Mississauga-OHT

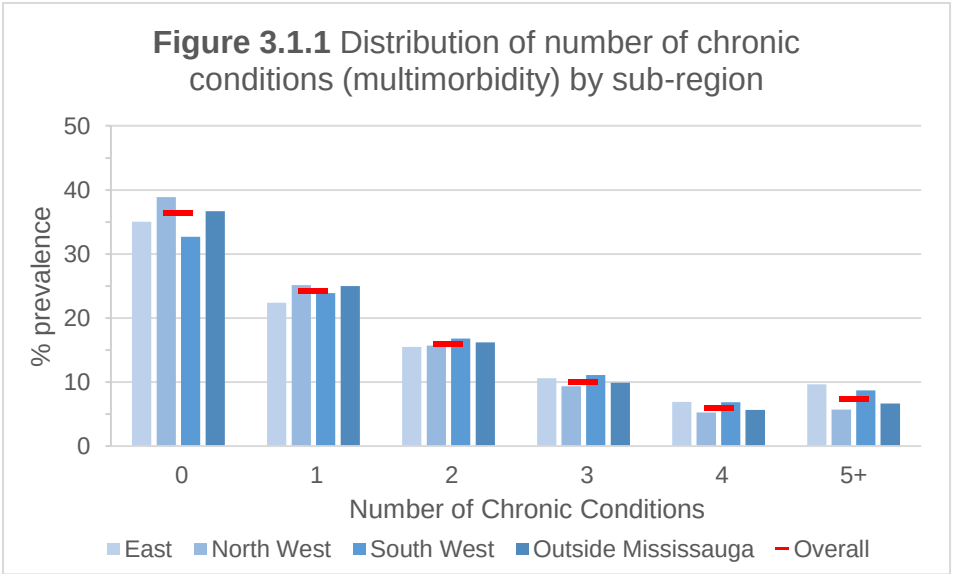
This chapter will examine the trends in chronic health conditions across the attributed M-OHT sub-regions, including levels of multimorbidity, common health conditions, and health risk groupings. First, the prevalence of 18 chronic conditions according to existing administratively defined algorithms[11] was assessed in the attributed M-OHT population, which was used to determine levels of multimorbidity (i.e., the number of co-occurring chronic conditions) and the distribution of specific conditions by sub-region. Please see Appendix B for the prevalence of all 18 chronic conditions in the attributed M-OHT population.

Multimorbidity and common health conditions will then be presented within key sociodemographic groups (age, immigrant status, and neighbourhood SES), which will support identifying and meeting needs across sub-groups in the attributed population. We also provide additional exhibits related to mental health conditions, given the unique age distribution across the M-OHT population. *Note: red lines on figures correspond to the overall prevalence in the attributed M-OHT population.*

3.1 Health Conditions by Sub-Region

The distribution of chronic conditions per individual in the M-OHT population is shown by sub-region in **Figure 3.1.1**. Overall, 36% of the attributed M-OHT populations have no comorbidities, with North West Mississauga having the largest proportion with no chronic conditions. This is somewhat expected given the younger age profile of the North West sub-region. Conversely, East and South West Mississauga have the highest proportions of individuals with 5+ chronic conditions at approximately 10% and 7%, respectively.

Figure 3.1.1 Distribution of number of chronic conditions (multimorbidity) by sub-region

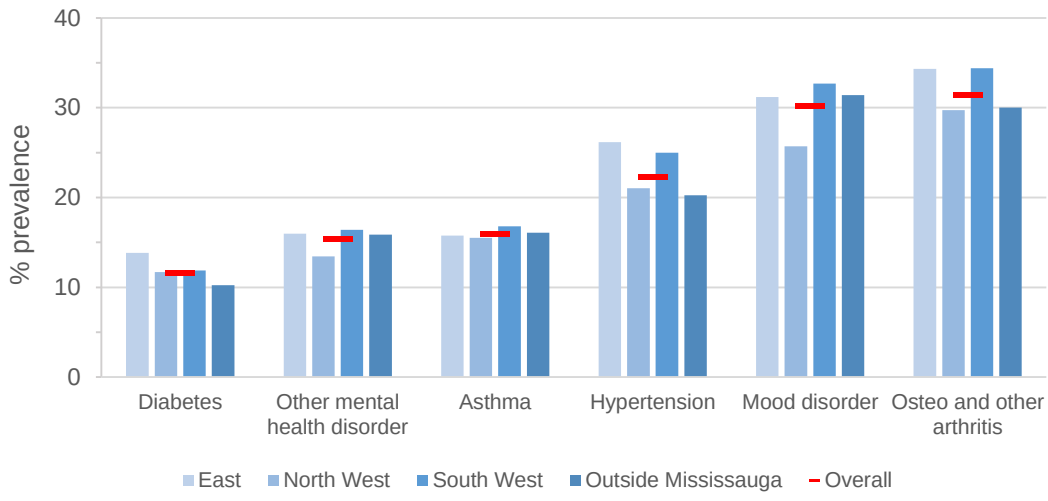


The six most common chronic conditions in the M-OHT population are osteo- and other arthritis (31%), mood disorders (which includes anxiety disorders; 30%), hypertension (22%), asthma (16%), other

[11] The 18 chronic condition categories include: Crohn's colitis disease, acute myocardial infarction (AMI), rheumatoid arthritis, dementia, stroke, chronic heart failure (CHF), acute renal failure, cardiac arrhythmia, osteoporosis, cancer, chronic obstructive pulmonary disease (COPD), chronic coronary syndrome, diabetes, mood disorders, other mental health disorders, asthma, hypertension, and osteo and other arthritis.

mental illness (excluding mood and anxiety disorders; 15%), and diabetes (12%). **Figure 3.1.2** shows the distribution of these six chronic conditions within sub-regional populations of the M-OHT. East and South West Mississauga generally have higher than average proportions of individuals with these six most common morbidities, especially hypertension and osteo- and other arthritis.

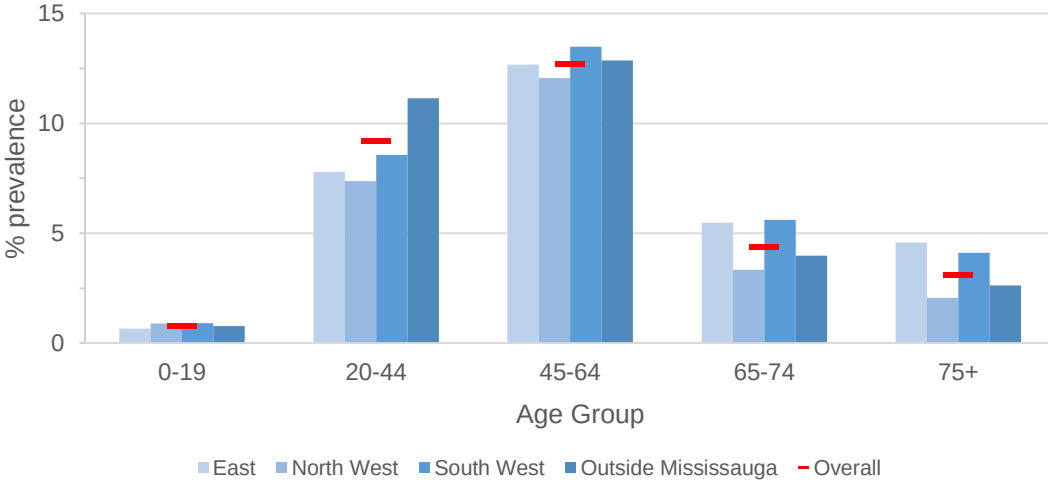
Figure 3.1.2 The six most prevalent chronic conditions



The age distribution of mood disorders and other mental health disorders in the M-OHT population is shown in **Figure 3.1.3**. A total of 259,130 individuals in the M-OHT (30%) have a mood disorder, and 132, 205 individuals in the M-OHT (15%) have other mental health disorders. Individuals aged 45-64 have the highest proportion of mood and other mental health disorders, followed by 20-44-year-olds, then 65-74-year-olds.

Across sub-regions, the prevalence of mood disorders among ages <19 and 45-64 are similar, with South West Mississauga having a slightly higher prevalence among individuals aged 45-64. Those attributed to the M-OHT but live outside Mississauga have a higher than average prevalence of mood disorder among 20-44-year-olds. Both South West and East Mississauga have a higher than average prevalence of individuals aged 65-74 and 75+ with health care visits related to mood disorders. North West Mississauga has the lowest prevalence of mood disorders in all age categories except 0-19.

Figure 3.1.3 Prevalence of mood disorder by age group and sub-region

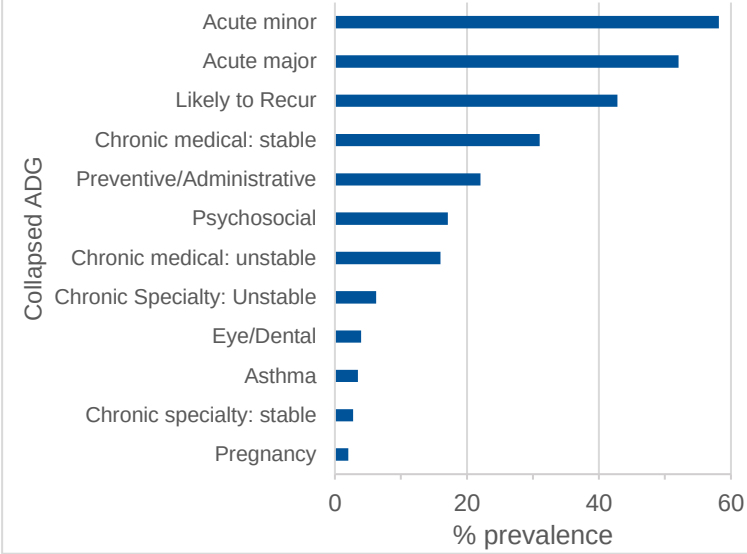


Health Risk Groupings

The John Hopkins ADG® System Aggregated Diagnostic Groups Groups (ADG)[12] and Population Risk Adjusted Groupings (PRAGs)[13] are classification systems used to categorize all diagnoses in a population into different risk categories. Overall, these classification systems can be used to understand the overall health burden of the population.

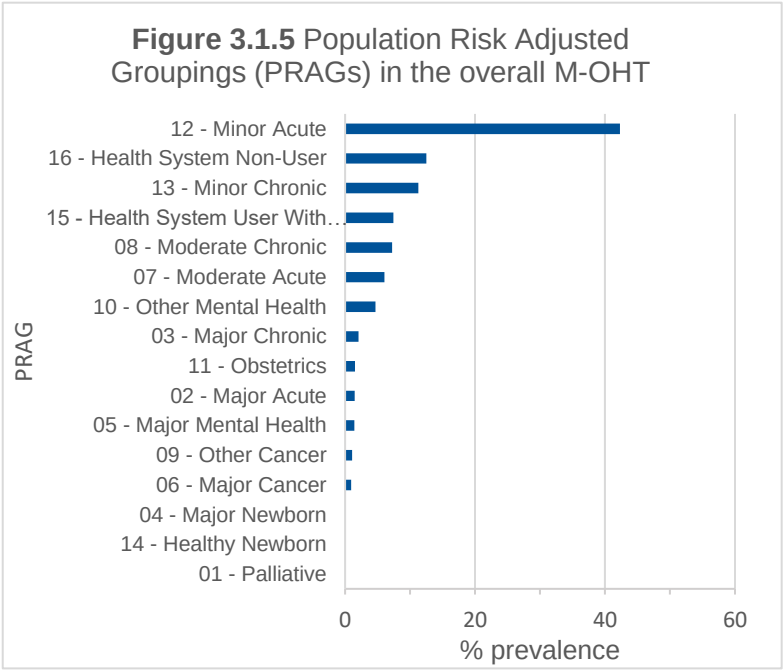
ADGs, developed by Johns Hopkins University, assign diagnoses to 32 categories based on five criteria: persistence of diagnosis, the severity of illness, etiology, diagnostic certainty, and need for specialty care interventions. An individual may have more than one diagnosis; thus, ADGs categories are not mutually exclusive. Below, Collapsed ADGs, with 12 categories, are displayed in **Figure 3.1.4** for the attributed M-OHT population.

Figure 3.1.4 Aggregated Diagnosis Groups (ADGs) in the overall M-OHT



PRAGs, developed by the Canadian Institute for Health Information (CIHI), similarly takes individual clinical profiles over two years and assign individuals to 16 different groupings based on their predicted health care use (e.g., primary care, emergency department, and long-term care). PRAGs are ordered from 01-16 by decreasing severity, but in **Figure 3.1.5**, they are ordered by prevalence for the attributed M-OHT population.

Figure 3.1.5 Population Risk Adjusted Groupings (PRAGs) in the overall M-OHT



In the attributed M-OHT population according to ADGs, most diagnoses (58%) are classified into *acute minor*, 52% have diagnoses classified as *acute major*, and 43% have diagnoses that are *likely to recur*. The analysis using PRAGs is similar, with 42% in the *minor acute* category.

[12] The Johns Hopkins University ADG® classification system, see http://www.acg.jhsph.org/index.php?option=com_content&view=article&id=55:describing-morbidity-burden&catid=37:system-components&Itemid=315 for more information on the methodology.

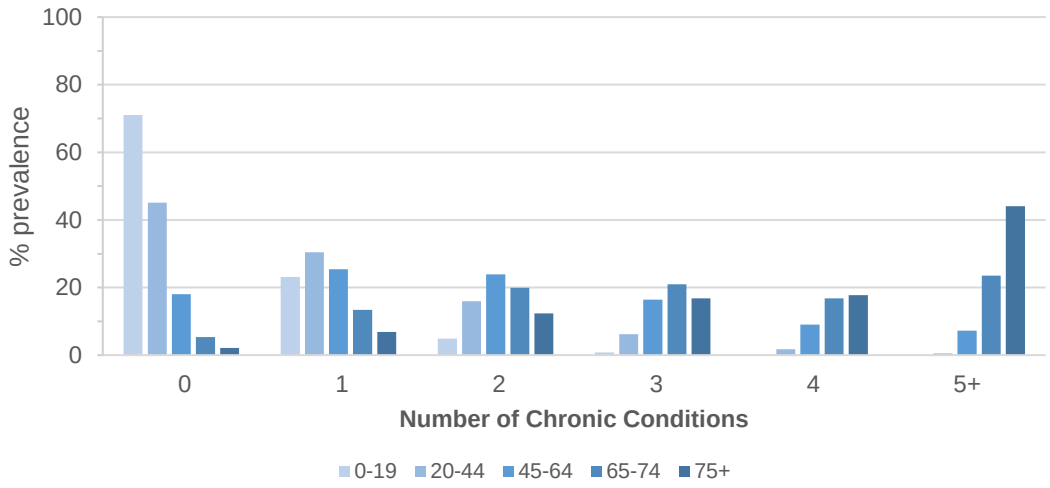
[13] Also known as CIHI's Pop Grouper, see https://www.cihi.ca/en/document/population-grouping-methodology-0 for more information on the methodology.

3.2 Health Conditions by Sociodemographic Factors

Conditions by Age Group

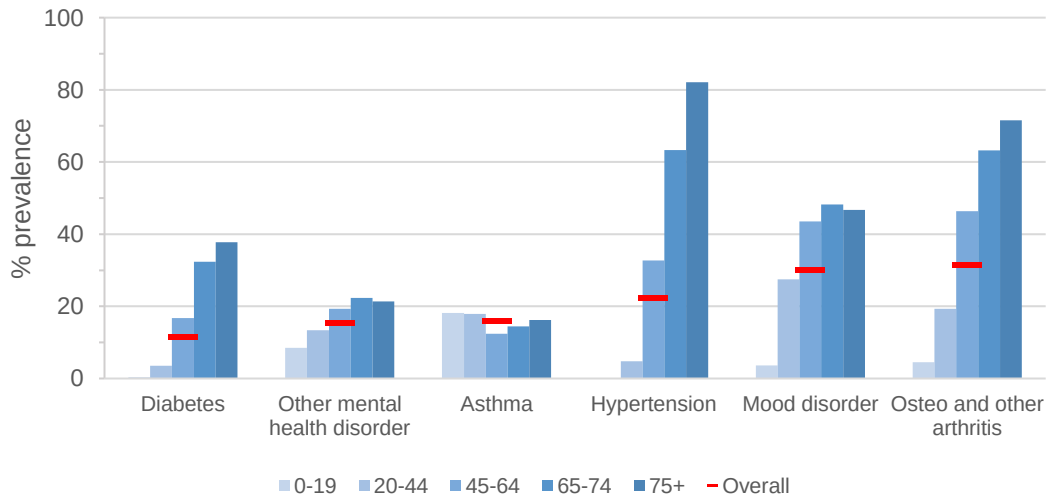
The age distribution of multimorbidity in the M-OHT population is shown in **Figure 3.2.1**. As expected, individuals from lower age groups have fewer chronic diseases than individuals from higher age groups. There is a clear relationship between age and increasing multimorbidity seen for degrees 4 and 5+, where prevalence increases with each successive increase in age.

Figure 3.2.1 Multimorbidity by age group



The age distribution of the six most common chronic conditions in the M-OHT population is shown in **Figure 3.2.2**. Except for asthma, which is the most common chronic condition in the youngest age group, there is a clear relationship between increasing age and the increasing prevalence of each of the chronic conditions shown.

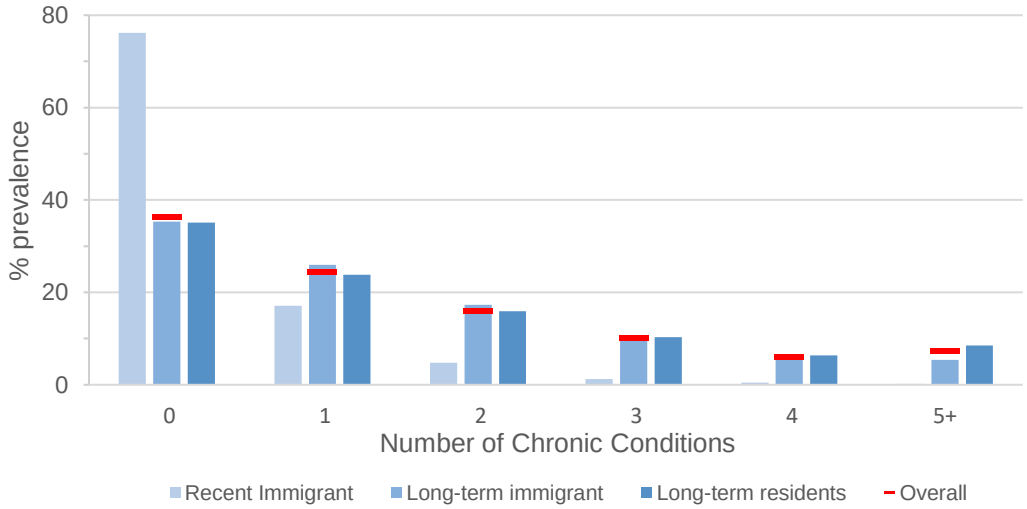
Figure 3.2.2 Most prevalent chronic conditions by age group



Conditions by Immigrant Status

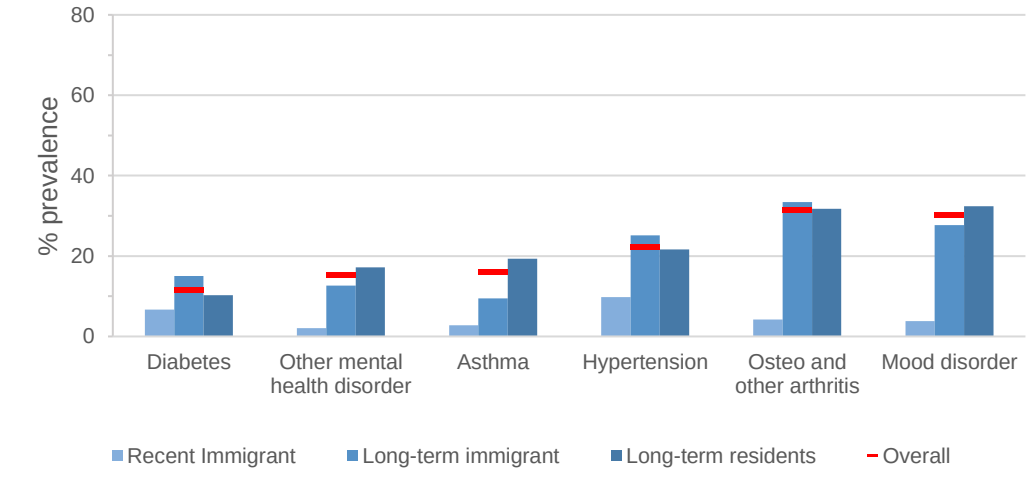
The degree of multimorbidity in the M-OHT population is shown by immigrant status in **Figure 3.2.3**. Recent immigrants have the highest proportion without any chronic condition (76%). Long-term immigrants and long-term residents have similar proportions of individuals with each degree of multimorbidity. However, a notably higher proportion of long-term residents have five or more chronic conditions than long-term immigrants (9% versus 5%). This is somewhat expected given the younger age of the immigrant population (noted in chapter 2).

Figure 3.2.3 Multimorbidity by immigrant status



The six most common chronic conditions in the M-OHT are shown by immigrant status in **Figure 3.2.4**. The most common condition for recent immigrants is hypertension (10%); for long-term immigrants, it is osteo- and other arthritis (33%); and for long-term residents, it is mood disorder (32%). Overall, each chronic condition is more common among long-term immigrants and long-term residents than among recent immigrants, which may be related to the young age of this population and strong age effects on many chronic conditions.

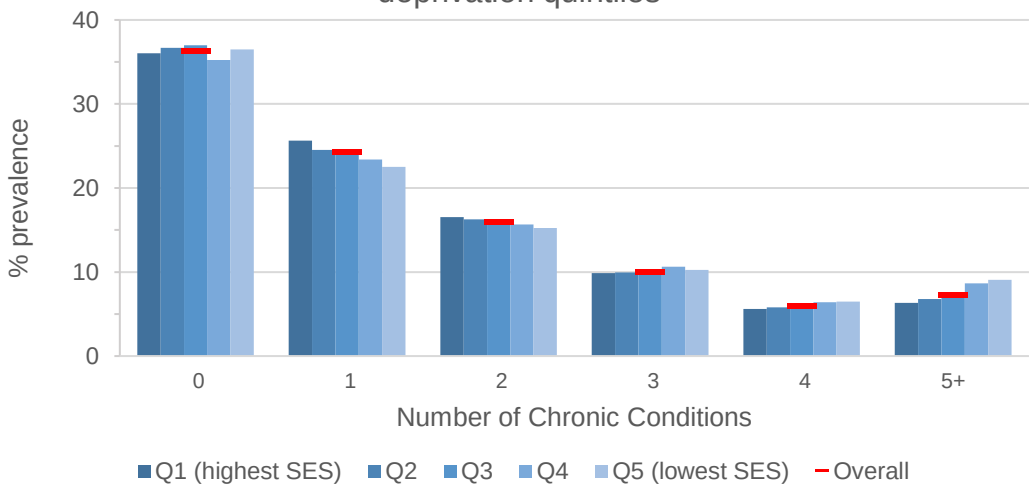
Figure 3.2.4 Most prevalent chronic conditions by immigrant status



Conditions by Neighbourhood Material Deprivation/SES

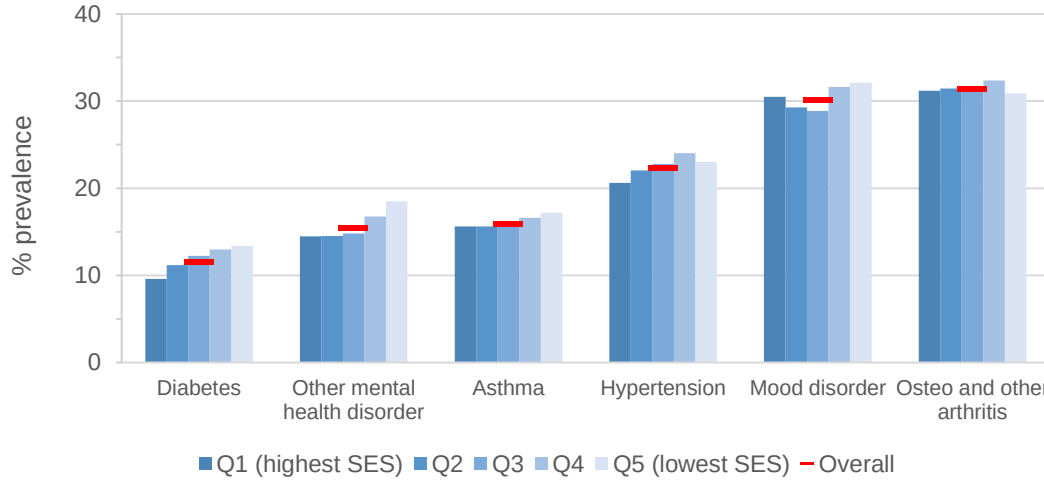
The degree of multimorbidity in the M-OHT population is shown by neighbourhood material deprivation quintiles area by in **Figure 3.2.5**. Individuals with lower degrees of morbidity are mostly from higher SES neighbourhoods. Those from lower SES neighbourhoods represent a higher proportion of individuals with 3, 4, and 5+ degrees of morbidity. There is a socioeconomic gradient for 4 and 5+ degrees of multimorbidity, where prevalence increases with each successive increase in neighbourhood SES.

Figure 3.2.5 Multimorbidity by neighbourhood material deprivation quintiles



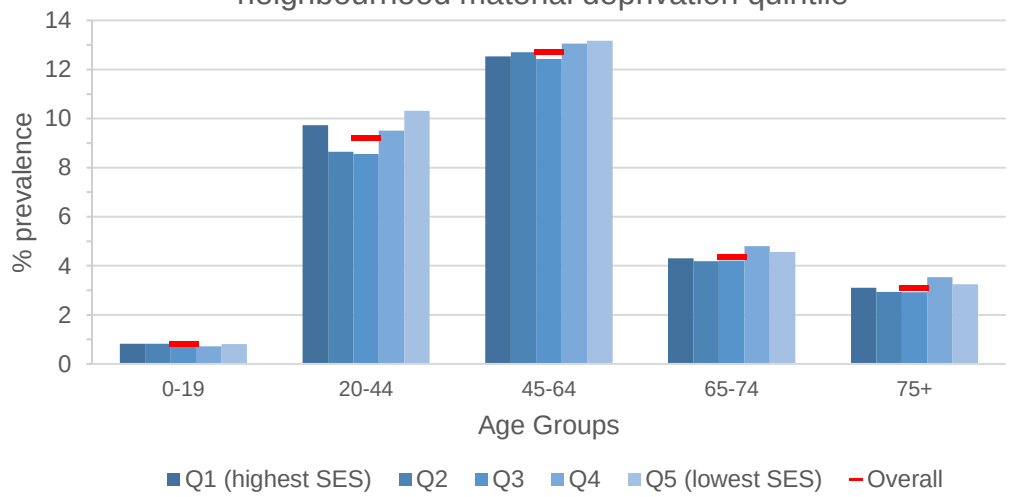
The six most common chronic conditions in the M-OHT population by material deprivation quintiles are shown in **Figure 3.2.6**. There is a greater burden among lower SES neighbourhoods for all six conditions, except mood disorder, which has a U-shaped distribution with higher prevalence in Q1, Q4, and Q5.

Figure 3.2.6 Most prevalent chronic conditions by neighbourhood material deprivation quintiles



According to existing billing codes[14], the mood disorder distribution in the M-OHT population is shown by age and neighbourhood material deprivation quintiles in **Figure 3.2.6** (these include visits for mood, anxiety, dissociative, somatoform, adjustment, and major depressive disorders). For age categories 20-44 and 45-64, there is a relationship between decreasing SES and the prevalence of mood disorders. A U-shaped distribution is also seen for the 20-44 range, with higher prevalence in Q1, Q4, and Q5. The relationship between low SES and mood disorders is less pronounced for the 0-19, 65-74, and 75+ age categories.

Figure 3.2.6 Prevalence of mood disorders by age and neighbourhood material deprivation quintile

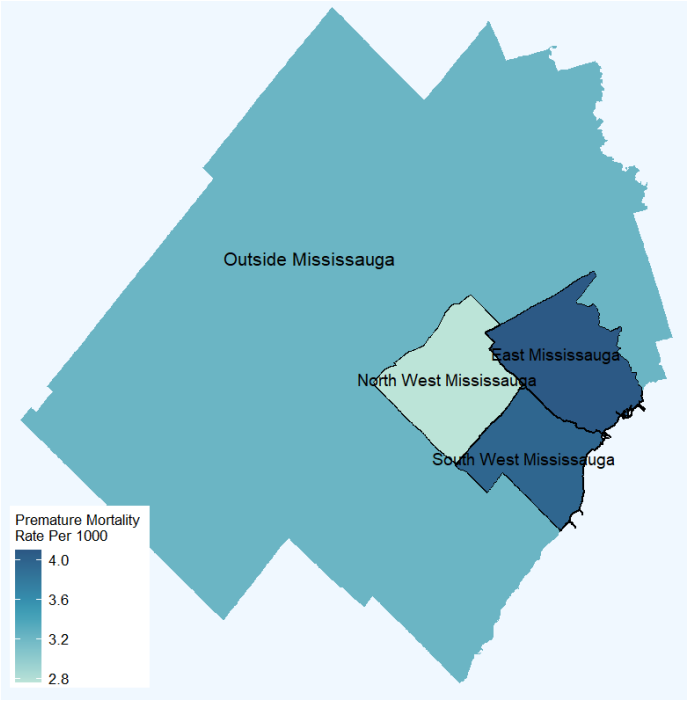


[14] For billing codes classified as mood disorders and all other chronic conditions, see https://www.healthaffairs.org/doi/suppl/10.1377/hlthaff.2017.1150/suppl_file/2017-1150_suppl_appendix.pdf

3.3 Premature Mortality

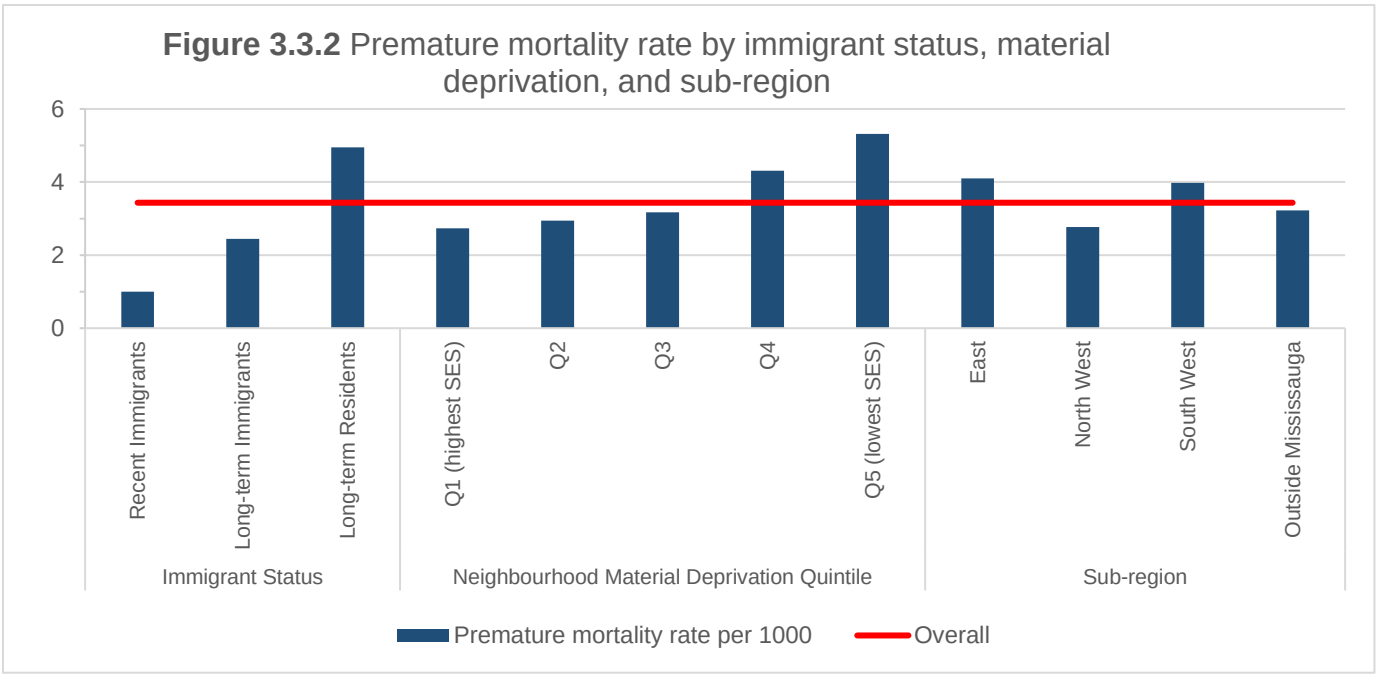
The mean premature mortality rate per 1000 individuals for April 2019 – March 2020 (2019 fiscal year) by immigrant status, neighbourhood material deprivation, and regional subgroups of the M-OHT population are shown in **Figure 3.3.1** and **Figure 3.3.2**. The results show higher premature mortality among long-term residents, residents of low-SES neighbourhoods, and those who live in East and South West Mississauga.

Figure 3.3.1 Premature mortality rate by sub-region



Note: Outside Mississauga extends beyond this map.

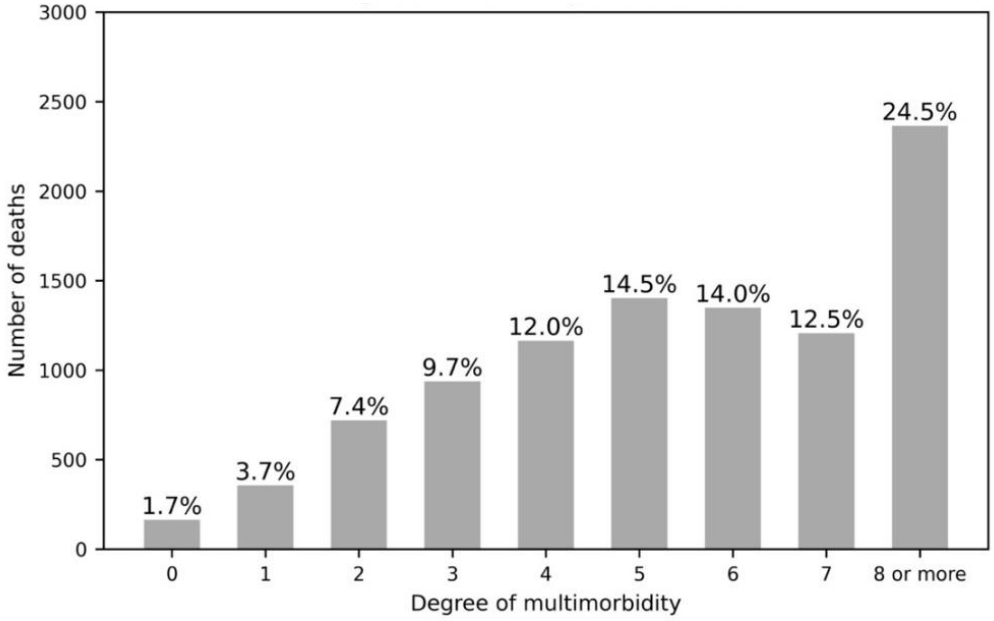
Figure 3.3.2 Premature mortality rate by immigrant status, material deprivation, and sub-region



3.4 Multimorbidity at Death

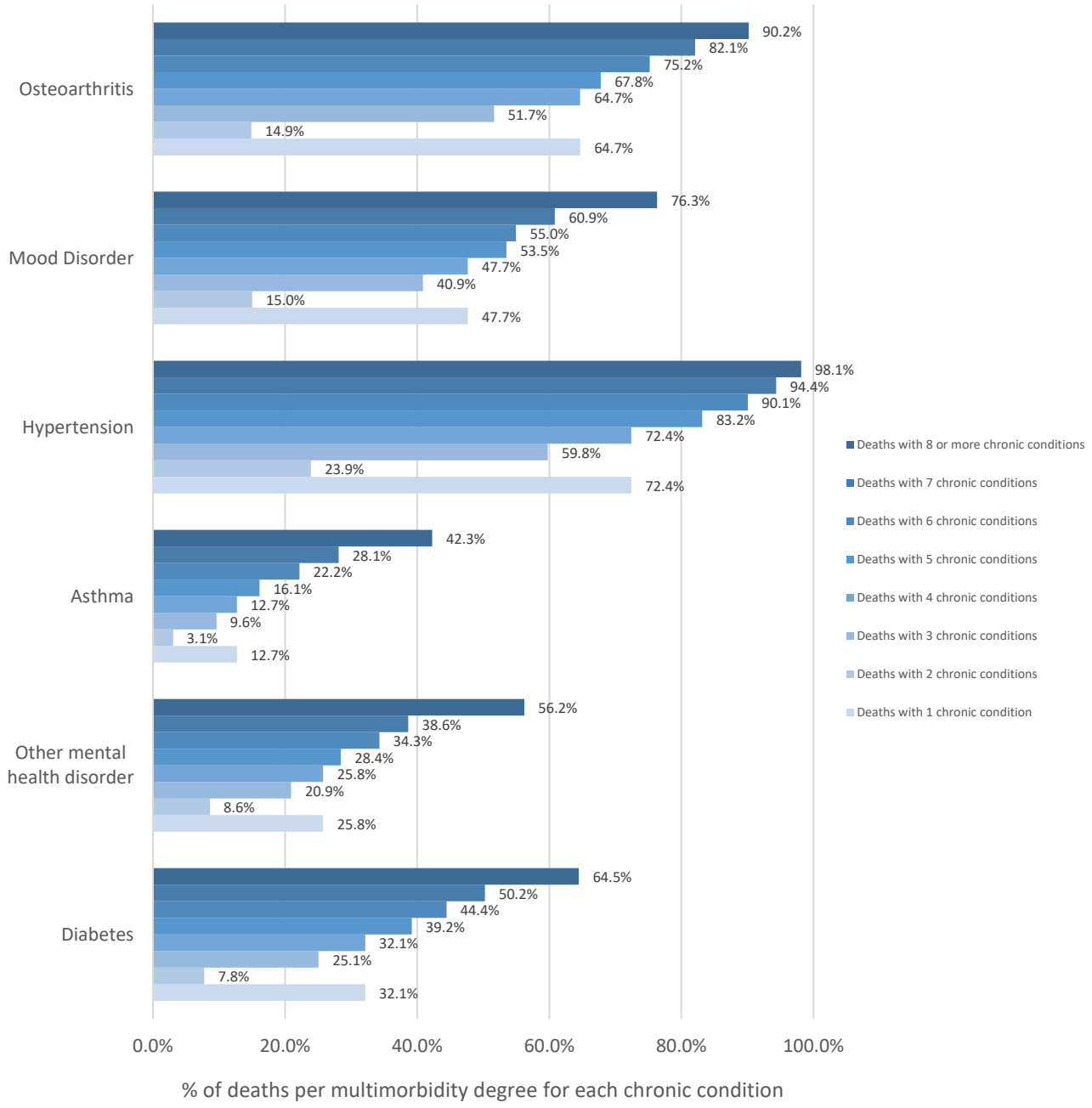
The number of chronic conditions at the time of death in the M-OHT population in FY 2018 is shown in **Figure 3.4.1**. This analysis provides a different perspective of multimorbidity by demonstrating the conditions people accumulate of their life and health care needs at their time of death (Rosella et al., 2018). Overall, multimorbidity was highly prevalent among decedents in the M-OHT population, with 94.6% of deceased having 2 or more chronic conditions. A large proportion (24.5%) of decedents in the M-OHT population accrued 8 or more chronic conditions before their death, while very few decedents (1.7%) died with none of the 18 chronic conditions.

Figure 3.4.1. Multimorbidity at time for death.



The proportion of deaths per degree of multimorbidity for the 6 most prevalent chronic conditions (most prevalent at top, least prevalent at bottom) at time of death in the M-OHT population in FY 2018 is shown in **Figure 3.4.2**. Within each degree of multimorbidity, the various combinations contribute unequally to the overall burden. Across the various chronic conditions studied, there is a range in prevalence – from 1-2% for Crohn's disease to 23-98% for hypertension (ranging by degree). This also emphasizes the high burden of care needed at the end of life.

Figure 3.4.1. Percent of deaths per each degree of multimorbidity that have a prevalent chronic condition (in top 6 in the M-OHT) at time of death.



Summary of Chapter 3 Findings

The majority of individuals (84%) in the M-OHT population (from FY 2018) were experiencing zero or one health condition. Multimorbidity (2+ chronic conditions) is more common among older adults, long-term immigrants and residents and individuals from low SES neighbourhoods. At death, a substantial proportion of individuals had 8 or more conditions, and few had none at the time of death. In particular, individuals that died with hypertension, osteoarthritis and mood disorder had high levels of multimorbidity.

Five of the six most common health conditions in Mississauga (excluding asthma) are more common among older adults. As well, four of the six most common health conditions in Mississauga (hypertension, asthma, other mental health disorder, and diabetes) are disproportionately experienced by those from low SES neighbourhoods. Conversely, osteo- and other arthritis similarly impacts individuals from all SES level neighbourhoods.

Mood disorder patterns are distinct from the other chronic conditions. They affect both individuals from the highest and lowest SES neighbourhoods (U-shaped distribution) and are especially high among individuals aged 45-64 (overall and also for each sub-region and SES levels). The U-shaped distribution for SES is reflected in the 20-44 age category only. There is less of an SES impact on the prevalence of mood disorders for other age categories.

Overall, the M-OHT population demonstrates a range of health needs, varying according to demographic and socioeconomic conditions. Therefore, the distribution of various health needs and variations by these factors is key for health system planning. This chapter demonstrated where the burden of certain health conditions lies, but this information alone does not capture how individuals manage these conditions. Thus, we will look at health service utilization in the following chapter.

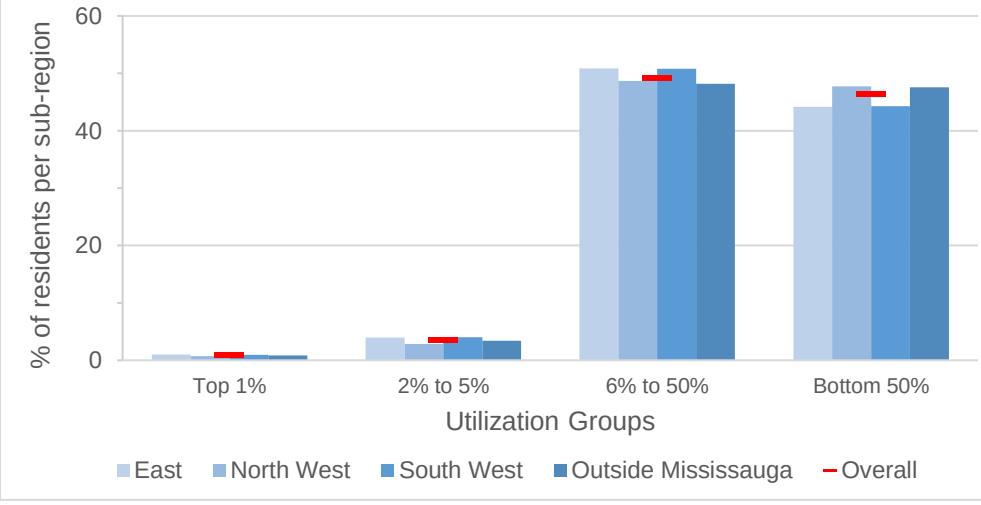
Chapter 4: Healthcare Utilization

This chapter will report on the overall healthcare utilization of the attributed M-OHT population. These results are based on health administrative data (e.g. OHIP billing, hospital and ED records) from FY 2018 (April 1, 2018, to March 31, 2019). *Note: red lines on figures correspond to the overall proportion in the attributed M-OHT population.*

Utilization Groups

High-cost healthcare resource utilization groups by M-OHT population sub-regions are presented in **Figure 4.1.1**. These groups are based on ranking all cost-incurring health care system users in Ontario for the 2018 fiscal year. All sub-regions have less than 1% of the highest resource utilization group (*Top 1%*). East and South West Mississauga have slightly higher than average proportions of individuals in the *2%-5%* and *6%-50%* groups. Correspondingly, North West Mississauga and Outside Mississauga have slightly higher than average proportions for the *bottom 50%* group.

Figure 4.1.1 Distribution of health care utilization groups in FY 2018 by sub-region

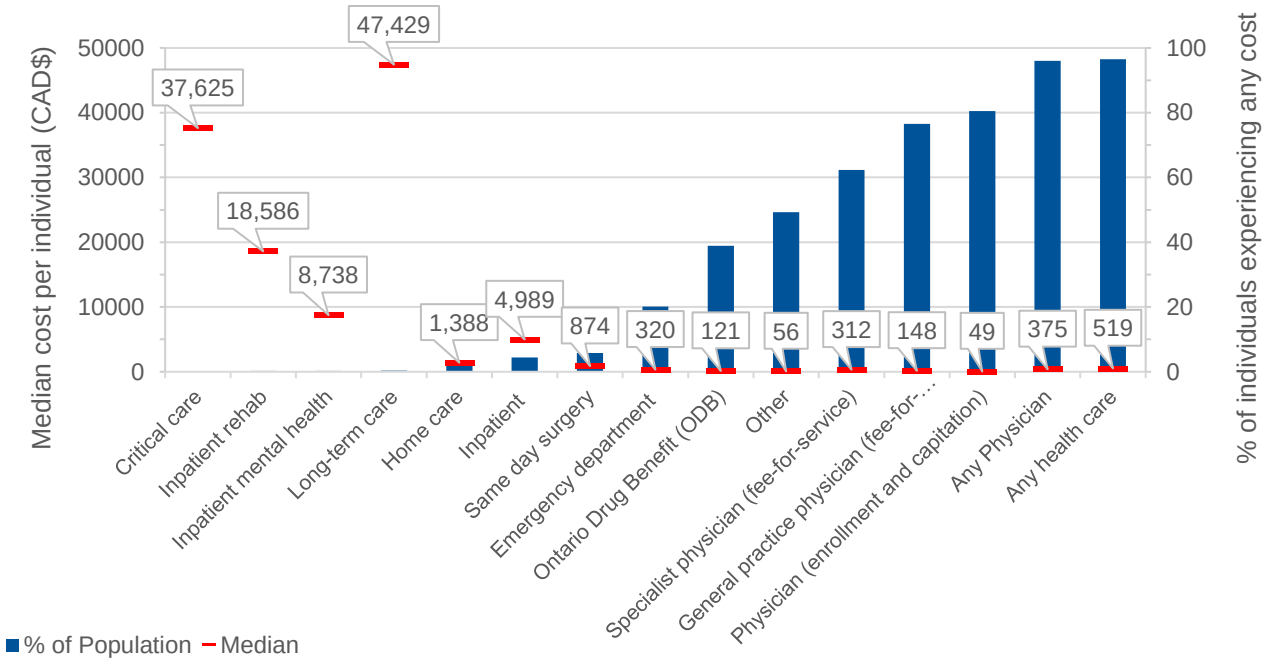


Health Service Utilization

The median cost and percent of individuals experiencing costs for 15 cost-based health service categories[15] in the M-OHT population are shown in **Figure 4.1.2**. Median costs (in CAD) per individual for each service are labelled. Overall, services with the highest median costs (billed to OHIP) are used by the lowest percentage of individuals and vice versa.

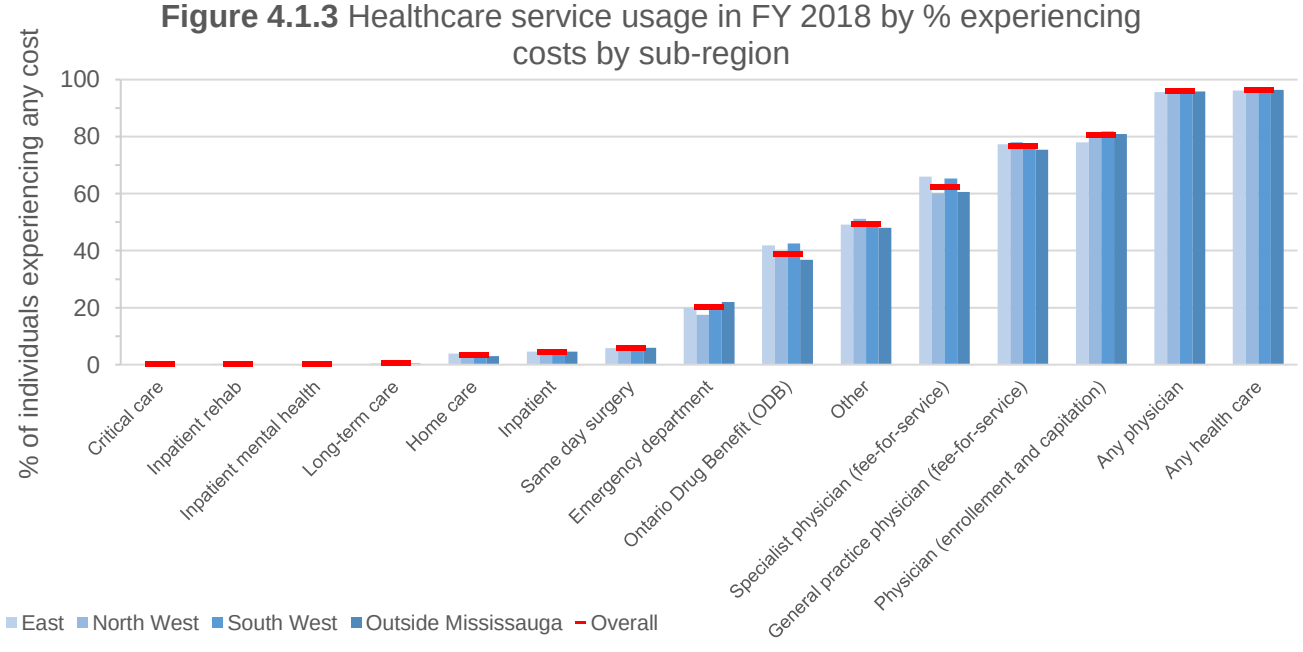
[15] Note: Physician (enrollment and capitation), or ECP, includes both capitated physician payment models (FHOs and FHNs) and individuals enrolled in a comprehensive care payment model (not capitated/for after-hours care only).

Figure 4.1.2 Healthcare service usage in FY 2018 by median cost per individual and % of individuals experiencing the cost in the M-OHT



The percent of individuals experiencing costs for 15 health service categories by M-OHT population sub-regions is shown in **Figure 4.1.3**. Overall, sub-regions have similar percentages of individuals in their populations that use each service (near the M-OHT average). Exceptions to these findings include *physician (fee-for-service specialist)*, *ODB* (where both East and South West have a higher percentage of individuals that experience costs) and *emergency department* (where North West has the lowest percentage of individuals who experience that cost).

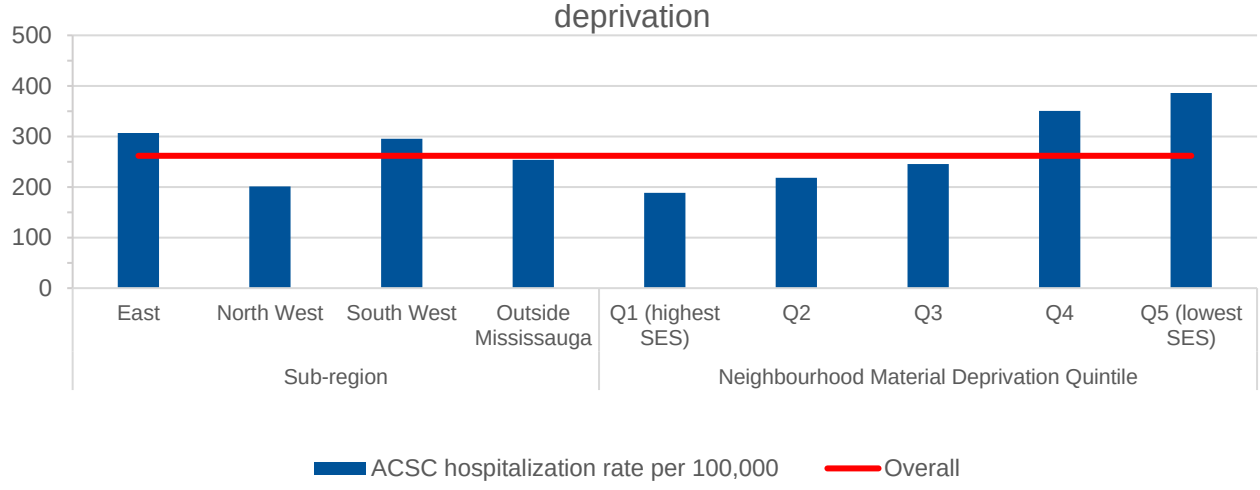
Figure 4.1.3 Healthcare service usage in FY 2018 by % experiencing costs by sub-region



Ambulatory Care Sensitive Condition (ACSC) Hospitalizations

ACSCs are health conditions that, if monitored effectively, should reduce the likelihood of hospital admission for individuals aged 0 to 74.[16] The mean rate of ACSC hospitalizations per 100,000 individuals by sub-region and neighbourhood material deprivation quintiles is shown in **Figure 4.1.4**. East and South West Mississauga have the highest level of ACSC hospitalizations, also above the M-OHT average. As neighbourhood SES increases, ACSC hospitalizations increase.

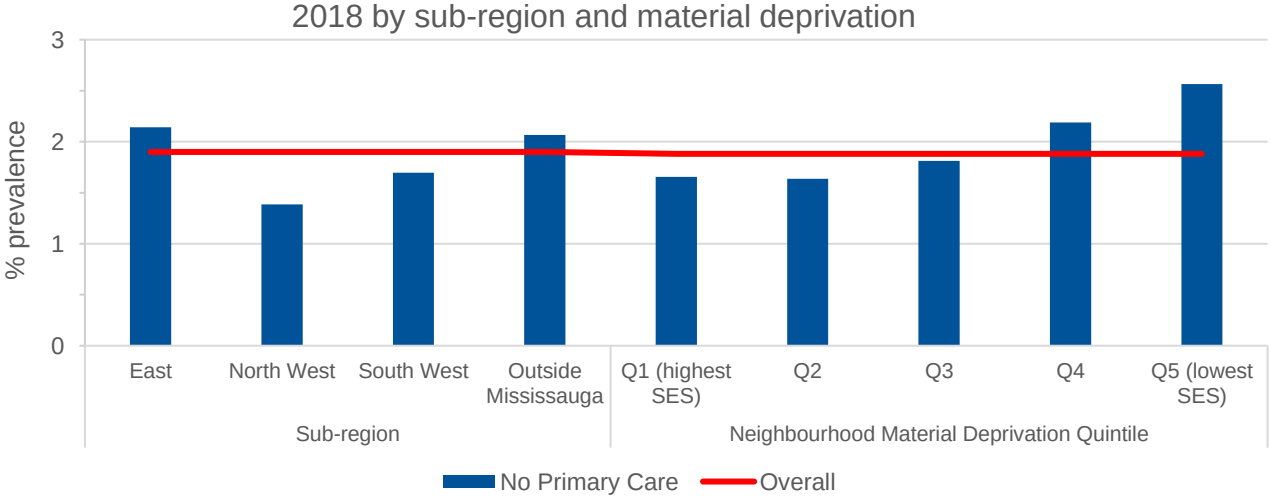
Figure 4.1.4 Amublatory care sensitive conditions (ACSC) hospitalizations in FY 2018 by sub-region and neighbourhood material deprivation



Primary Care Visits and Continuity

The proportion of individuals with no primary care visits in the previous year by M-OHT population sub-regions and neighbourhood material deprivation quintiles is shown in **Figure 4.1.5**. East Mississauga and Outside Mississauga have higher than average proportions of individuals who did not have any primary care visits. The proportion of individuals with no primary care visits also increases with decreasing neighbourhood SES.

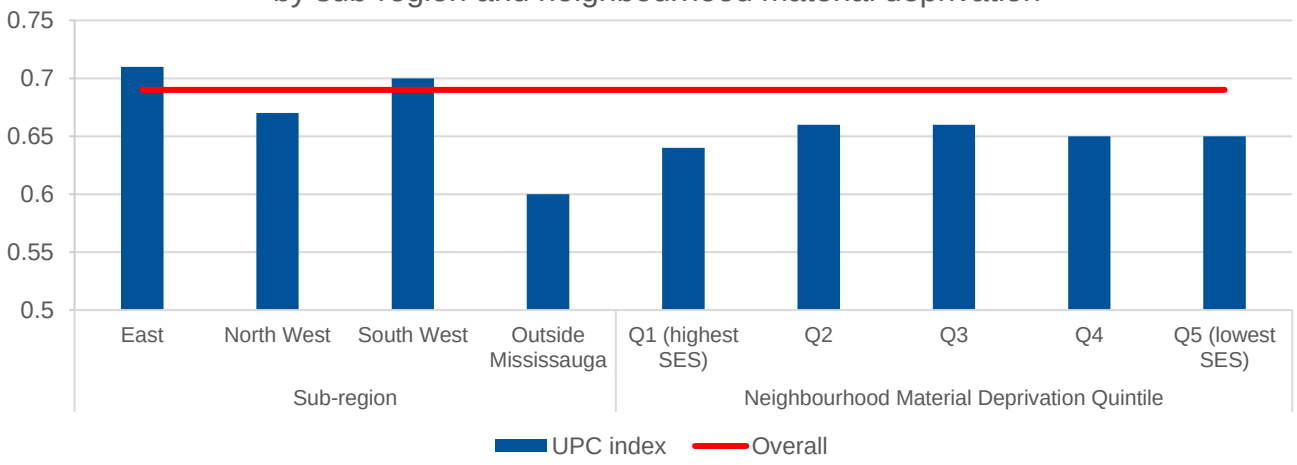
Figure 4.1.5 Proportion of individuals with no primary care visits in FY 2018 by sub-region and material deprivation



[16] ACSCs include the following chronic conditions: grand mal status and other epileptic convulsions, chronic obstructive pulmonary disease, asthma, congestive heart failure and pulmonary edema, hypertension, angina, diabetes, and lower respiratory illness.

The mean usual provider of continuity (UPC) index[17], a measure of continuity of care, by sub-region and neighbourhood material deprivation quintiles, is shown in **Figure 4.1.6.** East and South West Mississauga have the highest index scores, also above the M-OHT average. Thus, individuals in these regions more frequently see their regular providers than other providers they have visited. There is no SES trend for the UPC index.

Figure 4.1.6 Usual provider of continuity (UPC) index score for FY 2018 by sub-region and neighbourhood material deprivation

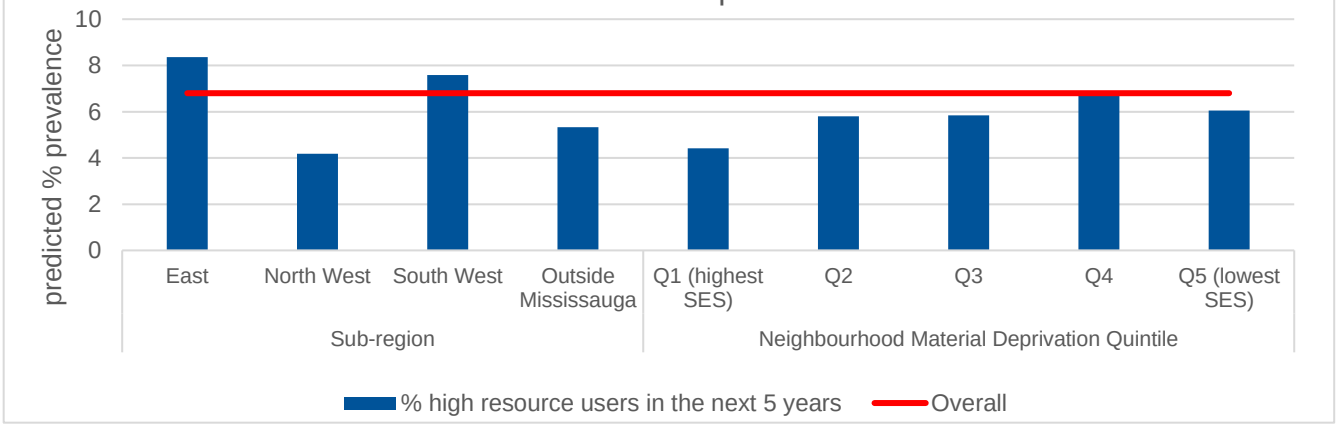


Note: UPC is the number of visits to a usual provider in a given period over the total number of visits to similar providers. E.g., an index score of 1.0 indicates that all visits were with the same provider.

High Resource User in Next 5 Years

The predicted proportion of individuals who will be a part of Ontario's top 5% of health care service users in the next 5 years is derived from a risk prediction model that uses self-reported clinical, sociodemographic, and health behavioural factors[18] from CCHS data (Rosella et al., 2018). This measure, reported by M-OHT population sub-regions and material deprivation quintiles, is shown in **Figure 4.1.7.** East and South West Mississauga are predicted to have a higher than average proportion of individuals who will become a high resource user in the next 5 years. As well, there is a slight increase in the predicted percent of high resource users as SES decreases.

Figure 4.1.7 Predicted high resource user in next 5 years by sub-region and material deprivation



[17] UPC is the number of visits to a usual provider in a given period over the total number of visits to similar providers.

[18] Factors include: sex, age, history of chronic condition, ethnicity, immigrant status, household income quintile, food security, perceived general health, BMI, smoking status, physical activity, and alcohol consumption.

Summary of Chapter 4 Findings

In the 2018 fiscal year, healthcare usage per cost-based resource utilization group for each sub-region is near M-OHT population averages. However, the proportion of high resource users in East and South West Mississauga are predicted to exceed that of the M-OHT in the next 5 years.

Looking specifically at health service categories, we saw that the greatest proportion of individuals use low-cost services while few individuals use the highest-cost services. Additionally, certain sub-regions use more fee-for-service specialist physician services, Ontario Drug Benefit, and emergency department services than others. Separately, ACSC hospitalizations were highest in East and South West Mississauga and among individuals from low SES neighbourhoods. The proportion of individuals with no primary care visits in the past year is highest in East Mississauga, Outside Mississauga, and among those from neighbourhoods with lower SES. This potentially indicates challenges with access to primary and specialist care in those regions and among individuals from low SES neighbourhoods.

While this chapter gives an overview of health service utilization, it is important to note that it does not capture the use of allied health and community health services, which could play a major role in how individuals maintain and manage their health. Addressing this data gap is a priority area of focus.

Chapter 5: Discussion

5.1 Linking Key Findings

This M-OHT report provides a broad overview of the M-OHT population's sociodemographics, health conditions, healthcare utilization, and certain self-reported measures related to health (mental health, stress, health characteristics, life satisfaction, and sense of community belonging). It is meant to provide a baseline summary of the health of the attributed M-OHT population and show a subset of available data from existing provincial health administrative databases and national census and survey data. All data presented are descriptive and for planning purposes. Data was intentionally not age- or sex-adjusted to accurately represent the population for planning purposes [4,5].

Morbidity and Multimorbidity

The number of individuals with multiple chronic conditions is significant in the region, and important variations across age, region and SES were evident. Multimorbidity and premature mortality were higher among individuals from neighbourhoods with low SES deprivation and long-term residents, consistent with prior literature [10–14]. In addition, the six most common health conditions in the M-OHT (from the highest to lowest) are osteo- and other arthritis, mood disorder, hypertension, asthma, other mental health disorder, and diabetes. Looking at morbidity at the time of death offers an opportunity to look at the accumulation of conditions over life and the complexity of care needed at the end of life. A substantial proportion of the population had 8 or more chronic conditions, and few died with none of the 18 conditions we examined. Those who died with hypertension, osteoarthritis, and a mood disorder commonly had high levels of multimorbidity. Such a pattern indicates the complexity of multimorbidity, reinforcing the findings from previous studies that there is complexity in the types of combinations that contribute to the burden of multimorbidity amidst some more prevalent conditions (Rosella et al., 2020).

These results combined with health risk factors and self-reported life satisfaction and sense of community belonging measures in our data reveal important information about the health of the Mississauga OHT.

Osteoarthritis and Hypertension. The trends for osteoarthritis (and other arthritis) and hypertension showed similar results. These conditions were high among long-term immigrants, and rates increased with decreasing neighbourhood SES. Sub-regions with high rates of these conditions (East and South West Mississauga) had high multimorbidity rates, an older population (compared to the other two sub-regions), and a higher-than-average proportion of individuals from neighbourhoods with low SES.

Our findings on the relationship between age and osteoarthritis (the most common type of arthritis) are consistent with national data and international studies [16,17]. Studies have also found osteoarthritis to be more common among individuals who are overweight or obese, which could explain rates in South West Mississauga [18,19]. Osteoarthritis has social impacts such as the loss of productivity in work [20], explaining the observed relationship with SES. Some factors not captured in our report that might be relevant to osteoarthritis risk include diet, genetics, gender, previous injuries, and other lifestyle factors [21].

Our findings for hypertension were also consistent with prior literature that found the condition to be more common in individuals who are older, obese, or physically inactive [22,23].

Diabetes. In the M-OHT, diabetes was more common among older populations as expected, and therefore higher among long-term residents who are older. Sub-regionally, diabetes rates were higher in East Mississauga, which, compared to other sub-regions, also reported higher than average current smokers, inactivity, and food insecurity. Like hypertension, literature on type 2 diabetes finds that

being overweight or obese, food insecurity, and being less physically active are common risk factors for diabetes [24,25].

Although we did not investigate which chronic diseases are likely to co-occur for this report, studies in Canada (and globally) have found co-occurrence of hypertension and diabetes to be very common and significant public health concern [22,26]. In our data, a higher degree of comorbidity (generally) was found among sub-regions with already high rates of hypertension and diabetes (East and South West Mississauga). Both conditions were also highest among long-term immigrants. Thus, targeted public health or health care interventions or further investigation on the co-occurrence of these conditions may be necessary for these groups. These conditions, together, could lead to cardiovascular disease and cardiovascular events (e.g., stroke, heart failure), making blood pressure management (and monitoring hypertension) among those with diabetes to be very important [27–29].

Asthma. Consistent with previous findings, asthma was most common among long-term residents, and rates increased with decreasing neighbourhood SES [30,31]. Past studies have also identified genetics, obesity and other environmental exposures (prenatally and in childhood) as significant risk factors for asthma [32,33]. Though we did not measure these characteristics at an individual level, these risk factors align somewhat with our finding that more former smokers and a higher-than-average proportion of overweight and obese individuals in South West Mississauga (where asthma rates are high). The present report does not capture other environmental factors, which are important for a more detailed consideration of asthma and other respiratory disorders.

Mood disorders and other mental health conditions. Our data showed mood disorders (including anxiety disorders) and other mental health disorders to be most common among individuals aged 45-64 and long-term residents. This age trend is inconsistent with national findings that the greatest proportion of mood disorders is 18–34-year-olds, although their study methodology differed from our approach [34]. This finding is in line with the Canadian Chronic Disease Surveillance System (CCDSS), which finds mental health disorders to be highest among 30-54-year-olds [35] and findings that mood disorders and other disorder types are lower among immigrants [36–40]. Additional factors influencing mood disorder trends among different immigrant groups from prior literature include the age of immigration and length of time in Canada [41]. Recent immigrants have also been more likely to move into lower-income neighbourhoods, which may impact their mental health, and where immigrants originate also influences their level of service use [37,42].

Lastly, we found increasing rates of other mental health disorders with decreasing neighbourhood SES except for mood disorders, high among the highest and lowest neighbourhood SES quintiles (a U-shaped distribution). Past studies found that individuals with low household incomes are more likely to rate their mental health as fair or poor [43]. However, for mood disorders, evidence on why they are also prevalent among affluent individuals is scarce. A potential avenue would be to examine how mood disorders relate to self-rated life satisfaction and community belonging; however, the extent of this report could not capture these relationships [39]. It is also important to note that our analysis cannot distinguish between specific types of mood disorders due to the limitations in the billing data.

Healthcare Utilization

Our main findings for healthcare utilization found that sub-regions with higher neighbourhood SES had lower ACSC hospitalizations, the proportion of individuals with no primary care visits, and predicted high-resource users in 5 years, which are all consistent with previously reported findings (Wallar & Rosella, 2020; Fitzpatrick et al., 2015; Dunlop et al., 2000; Olah et al., 2013). Together, these potentially indicate challenges with access to primary physician and specialist services among low SES neighbourhoods. On the other hand, the UPC index (indicating continuity of care) did not vary by SES, reflecting existing literature (Chau et al., 2021).

Sub-regionally, East and South West Mississauga have a slightly higher than average proportion of individuals currently in the top 2%-50% of high resource user groups, compared to the M-OHT overall. In parallel, the proportion of ACSC hospitalizations and predicted high resource users in 5 years for these regions are also higher than average. These findings could be explained by these sub-regions having higher proportions of individuals from low SES neighbourhoods, the highest proportion of individuals with multimorbidity, and the six most common health conditions in the M-OHT (including ACSCs). As well, both of these sub-regions have near-average proportions of individuals using all health service categories but a notably higher-than-average proportion of fee-for-service (FFS) specialist physician and Ontario Drug Benefit (ODB) usage. East Mississauga, in particular, also has a lower-than-average proportion of individuals using enrollment and capitated payment (ECP) physicians (for South West Mississauga, this is near-average).

In contrast, North West Mississauga has a low proportion of current high resource utilizers, the lowest predicted proportion of high resource users in 5 years (below M-OHT average), the lowest proportion of ACSC hospitalizations, and low proportions of both multimorbidity and the six most common health conditions. In addition, it has near-average proportions of service usage in all categories except a notably lower-than-average use of FFS specialist physician and emergency department (ED). Those residing outside Mississauga also experience higher-than-average usage of ED and lower-than-average use of FFS specialist physicians and ODB.

These findings on service utilization in M-OHT can partly capture how individuals manage their health, and it would be interesting to examine it alongside morbidity data. In particular, we could investigate how health conditions relate to the use of ECP payment and FFS specialist physicians, ODB, and ED. Moreover, both higher *and* lower utilization patterns should be noted, as these could indicate the absence or existence of healthcare access barriers (e.g., access to convenient transportation and knowledge about services) that direct individuals towards one service over another.

Life Satisfaction and Sense of Community Belonging

In addition to morbidity and healthcare utilization data, measures such as life satisfaction and community belonging are also important perspectives to understand the self-perceived health and wellness of a population, especially how well individuals manage their health. In prior literature, life satisfaction and sense of community belonging have been associated with the management of long-term conditions, health behaviours, health behaviour change, and health outcomes (Jeffries et al., 2015; Hystad & Carpiano, 2012; Strine et al., 2008; Rosella et al., 2019). In our brief analysis, we found these measures to be highly varied among different M-OHT sub-regions. Future reports should continue considering these measures of well-being alongside other similar measures and health data.

5.2 Conclusion and Next Steps

Our findings report the baseline demographic, socioeconomic, health and health care use in the M-OHT, which is critical to inform population health management in our region.

These findings can be used to sub-regionally plan population health; however, it is important to note that this report does not exhaustively cover all sub-groups and neighbourhoods. Overall patterns between different variables were not necessarily reflected in each sub-region; thus, it is likely that there are additional place-based or sub-regional factors to account for in future efforts to characterize the M-OHT. A more detailed neighbourhood-level analysis is an important next step planned by the M-OHT.

This report aims to give an overview of health in the M-OHT, but more importantly, demonstrate the type of data available through linking available provincial and national databases alone. Trends that are reported should not be interpreted as causal or for testing specific hypotheses. Instead, the report should be viewed as a mechanism to understand the population and appropriately plan for the needs in order to have a greater impact. The key differences in health outcomes were shown by

demographics in order to understand differences across subgroups in the M-OHT population. Not all subgroups in the population are reported on due to limitations in data.

Importantly, this report confirms and supports previous findings that there are health inequities in the M-OHT and underscores the importance of a population health approach [48]. Further detailed work on understanding and acting on these inequities is a priority for M-OHT, and this includes better capture of these data, meaningful community engagement and strong governance mechanisms to ensure safe and appropriate use. Overall, it provides valuable insight into how the M-OHT can focus its attention, further investigation, and action.

The next steps building from this report include:

- Determining which intersections of data need a deeper dive in the future to help inform decisions.
- Planning how self-reported and social experience data should be used to inform health policies and decisions.
- Articulating areas of importance that current data do not allow for and creating processes and partnerships to collect and use such data.
- Identify and support sector(s) currently lacking common data collection capacity who serve Mississauga–OHT priority populations as health system partners

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Appendix A - Technical Appendix

Key Variables

Immigrant status includes whether an individual is a recent immigrant (<5 years), long-term immigrant, or long-term resident. Long-term residents include mostly individuals born in Canada as well as a small number of immigrants who arrived in Canada prior to January 1985 or whose record from RPDB and the Permanent Resident database could not be linked.

Visible minority quintiles indicates the diversity of an area. Specifically, this variable describes the proportion of residents in an area that self-identified as belonging to a visible minority group in the 2016 Canadian Census. This ranges from Q1 (areas with lowest percent of visible minorities) to Q5 (areas with highest percent of visible minorities).

Material deprivation quintiles describe the overall socioeconomic status of the area in which an individual lives. This variable is derived from the Ontario Marginalization Index, and is based on census characteristics of income, education, and employment, and can be interpreted as the extent to which an individual is likely to be unable to afford or obtain essential goods and services. These quintiles range from Q1 (least deprived/highest SES) to Q5 (most deprived/lowest SES).

Aggregated Diagnosis Groups (ADGs)® is a classification system used to categorize all diagnoses in a population into different risk categories and can be used to understand the overall health burden of a population. This system was developed by Johns Hopkins University[19], assigns diagnoses to 32 categories based on 5 criteria: persistence of diagnosis, severity of illness, etiology, diagnostic certainty, and need for specialty care interventions. An individual may have more than one diagnoses, thus, ADGs categories are not mutually exclusive. In this report, the 32 ADGs have been transformed into 12 collapsed ADGs.

Population Risk-Adjusted Groupings (PRAGs), similar to ADGs, is a classification system used to categorize all diagnoses in a population into different risk categories and can be used to understand the overall health burden of a population. This system was developed by the Canadian Institute for Health Information (CIHI)[20], similarly takes individual clinical profiles over a two-year period and assigns individuals to 16 different groupings based on their predicted health care use (e.g., primary care, emergency department, and long-term care).

Adult Premature Mortality includes all deaths between the ages of 18 and 74 registered in Ontario between 1992 and 2017, with residence in Ontario at the time of death (this aligns with CIHI's definition).[21]

Predicted High Resource User in 5 Years is derived from the high resource user population risk tool (HRUPoRT)[22], which is a validated risk prediction model that uses data from the Canadian Community Health Survey (CCHS) to predict who will become the top 5% of health care service users over a 5-year period. This tool factors-in sex, age, history of chronic condition, ethnicity, immigrant status,

[19] The Johns Hopkins University ADG classification system, see http://www.acg.jhsph.org/index.php?option=com_content&view=article&id=55:describing-morbidity-burden&catid=37:system-components&Itemid=315 for more information on the methodology.
[20] CIHI's Population Groupings, see https://www.cihi.ca/en/document/population-grouping-methodology-0 for more information on the methodology.
[21] CIHI's Health Indicators 2012, see https://secure.cihi.ca/estore/productSeries.htm?pc=PCC140
[22] Rosella LC, Kornas K, Yao Z, Manuel DG, Bornbaum C, Fransoo R, Stukel T. Predicting High Health Care Resource Utilization in a Single-payer Public Health Care System: Development and Validation of the High Resource User Population Risk Tool. Med Care. 2018 Oct;56(10):e61-e69.

household income quintile, food security, perceived general health, BMI, smoking status, physical activity, and alcohol consumption.

Usual Provider of Continuity (UPC) Index Score is calculated from the number of visits to a usual provider in a given period divided by the total number of visits to similar providers. This score is used as an indication of continuity of care but as total number of visits to a provider increase, the entire index decreases. UPC ranges from 0 (no continuity) to 1 (perfect continuity).[23]

ACSC Hospitalizations include admissions due to chronic conditions (grand mal status and other epileptic convulsions, chronic obstructive pulmonary disease, asthma, congestive heart failure and pulmonary edema, hypertension, angina, diabetes, and lower respiratory illness) that, if monitored effectively, should reduce likelihood of hospital admission (for individuals aged 0-74). This measure can inform the level of access to primary/specialist care.

Data Sources

The following is a list of databases and registries linked at the Institute for Clinical Evaluative Sciences (ICES) used in this report. ICES is an independent, non-profit research institute whose legal status under Ontario's health information privacy law allows it to collect and analyze health care and demographic data, without consent, for health system evaluation and improvement. This report is supported by ICES, which is funded by an annual grant from the Ontario Ministry of Health (MOH) and the Ministry of Long-Term Care (MLTC). The analyses, conclusions, opinions and statements expressed herein are solely those of the authors and do not reflect those of the funding or data sources; no endorsement is intended or should be inferred. The use of the data in this project is authorized under section 45 of Ontario's Personal Health Information Protection Act (PHIPA) and does not require review by a Research Ethics Board. These datasets were linked using unique encoded identifiers and analyzed at ICES.[24]

Census

The Canadian census is administered every 5 years to all Canadian residents. The most recent census in 2016 was used for this report. It contains information on respondents' age, sex, housing, families, marital status, language, income, immigration, ethno cultural diversity, education, labour and migration.

Registered Persons Database (RPDB)

RPDB is the central population registry file in Ontario with basic demographic information for all individuals that have ever been registered for insured health services in Ontario.

Ontario Multispecialty Physician Network Database (PHYSNET)

PHYSNET is a database that identifies a multispecialty physician network for all residents in Ontario. These physician networks are virtual and created using health administrative data on patterns of patient flow. In general, the assignment methodology[25] involves assigning every Ontario resident to a usual provider of care (UPC) and assigning every physician to a hospital based on their past activity. Ontario residents were then assigned to a hospital where their UPC was assigned. Subsequently, hospitals and their associated physicians and residents were aggregated into physician networks.

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[23] Chau, E., Rosella, L. C., Mondor, L., & Wodchis, W. P. (2021). Association between continuity of care and subsequent diagnosis of multimorbidity in Ontario, Canada from 2001-2015: A retrospective cohort study. *PloS one*, *16*(3), e0245193. https://doi.org/10.1371/journal.pone.0245193

[24] See https://www.ices.on.ca/Data-and-Privacy/ICES-data/Working-with-ICES-Data for more information.

[25] For a detailed explanation on PHYSNET's methodology, see Stukel, T. A., Glazier, R. H., Schultz, S. E., Guan, J., Zagorski, B. M., Gozdyra, P., & Henry, D. A. (2013). Multispecialty physician networks in Ontario. *Open medicine : a peer-reviewed, independent, open-access journal*, *7*(2), e40–e55.

Immigration, Refugees and Citizenship Canada Permanent Residents Database (CIC)
CIC is a database that contains records for all immigrants who landed in Ontario between 1985 and 2012. It does not include records for immigrants who landed in another Canadian province and later relocated to Ontario. It contains demographic information such as country of citizenship, level of education, mother tongue, and landing date. *Note: this report uses data compiled and provided by IRCC current to the 2018 fiscal year. However, the analyses, conclusions, opinions and statements expressed in the material are those of the authors, and not necessarily those of IRCC.*

Ontario Marginalization Index (ONMARG)
ONMARG is a census-derived index which measures levels of marginalization across Ontario at the dissemination area level (created using 2006 census data).[26] It can be used as a proxy measure for SES in Ontario populations. Material deprivation describes the likelihood that an individual is unable to afford or attain necessary goods and services. It is comprised of 4 major dimensions thought to underlie the construct of marginalization: residential instability, material deprivation, dependency and ethnic concentration.

Canadian Community Health Survey (CCHS)
CCHS is a national cross-sectional survey, conducted by Statistics Canada.[27] The CCHS collects information related to health status, health care utilization and health determinants for the Canadian population. The target population of the CCHS includes household residents in all provinces and territories (excluding of populations on Indian Reserves, Canadian Forces Bases, and some remote areas). There is one randomly selected respondent per household. Prior to 2007, the CCHS operated on a two-year collection cycle. Since 2007, data have been collected annually and are reported for both one-year and two-year cycles.

Ontario Health Insurance Plan Claims Database (OHIP)
OHIP contains fee-for-service (FFS) claims paid to physicians via the Ontario Health Insurance Plan. Among these FFS physicians, approximately 95% are specialists and 50% are primary care physicians. Non-FFS physicians (except for the few hundreds who work in Community Health Centres and are not captured in this dataset) submit shadow billings, which are still included in the data but have a $0 payment amount. This dataset does not include some lab services, services received in provincial psychiatric hospitals, services provided by health service organizations and other alternate funding plans, inpatient diagnostic procedures, and lab services performed at hospitals (inpatient and same day). Each record represents one billable service performed by one physician one time (e.g., the same service performed twice in one visit will generate two records). Information that is recorded includes the service provided, the date of service, the relevant diagnosis, the physician number, and (if applicable) the referring physician number.

Discharge Abstract Database (DAD)
DAD is a database that contains patient-level data for acute, rehab, chronic, and day surgery institutions in Ontario. These include clinical data, demographic data, administrative data, and data used to evaluate patient length of stay and resource consumption.

ICES Chronic Disease Cohorts include datasets that were created at ICES through applying models that identify individuals with specific health conditions from a combination of hospital, emergency department, outpatient, and drug claim data. All datasets are cumulative, which means they contain both prevalent and incident cases from the beginning of the case-finding period. *Note: this report uses*

[26] Matheson et al. "Development of the Canadian Marginalization Index: a new tool for the study of inequality." Canadian Journal of Public Health, 2012;103(Suppl. 2):S12-S16.
[27] https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3226&lang=en&db=imdb&adm=8&dis=2

data compiled and provided by CIHI. However, the analyses, conclusions, opinions and statements expressed in the material are those of the authors, and not necessarily those of CIHI.

- **Ontario Asthma Database (ASTHMA)** – contains all Ontario asthma patients identified since 1991.
- **Ontario Diabetes Database (ODD)** – contains all individuals in Ontario with any type of non-gestational diabetes (without distinguishing between types of diabetes) identified since 1991.
- **Chronic Obstructive Pulmonary Disease Database (COPD)** - contains all Ontario COPD patients identified since 1991.
- **Ontario Myocardial Infarction Database (OMID)** – contains acute myocardial infarction inpatient admissions. It is not a comprehensive database of all patients with AMI in Ontario as the current algorithm does not capture outpatients AMIs, recurrent AMIs within a year of the index, or AMIs occurring as in-hospital complications on a non-cardiac surgical ward.
- **Ontario Rheumatoid Arthritis Dataset (ORAD)** – contains all Ontario rheumatoid arthritis patients identified since 1991.
- **Ontario Chron's and Colitis Cohort Database (OCCC)** – contains all Ontario patients who were identified with Crohn's disease or Ulcerative Colitis which means Inflammatory Bowel Disease (IBD) when they were aged 0-105 years. Ontarians identified since 1991 are included, but the case definitions are different for patients aged <18, 18-64 and 65+ years old on the date of meeting case definition.
- **Ontario Hypertension Database (HYPER)** – contains all Ontario hypertension patients identified since 1991.

Ontario Cancer Registry (OCR)
OCR contains all recorded information on Ontario residents who have been diagnosed or died with cancer since 1979. This is a passive registry that encompasses four major data sources: hospital discharge and day surgery summaries (with a cancer diagnosis), pathology reports (with any mention of cancer), records of patients referred to major cancer centers in Ontario, and death certificates (with cancer recorded as the cause of death).

Office of the Registrar General – Deaths Dataset (ORG-D)
ORG-D is an annual dataset containing information on all deaths (all causes) registered in Ontario starting on January 1 1990. *Note: this report uses data based on Ontario Registrar General (ORG) information on deaths, the original source of which is ServiceOntario. The views expressed therein are those of the authors and do not necessarily reflect those of ORG or the Ministry of Government Services.*

National Ambulatory Care Reporting System (NACRS)
NACRS is a data collection tool used to capture information on patient visits to hospital and community based ambulatory care: day surgery, outpatient clinics and emergency departments.

National Rehabilitation Reporting System (NRS)
NRS contains client data collected from participating adult inpatient rehabilitation facilities and programs across Canada.

Ontario Drug Benefit Claims (ODB)
ODB contains claims for prescription drugs received under the Ontario Drug Benefit program. Most are for those >=65 but from 1997 forward we also have data on other ODB programs. We thank IQVIA Solutions Canada Inc. for use of their Drug Information File.

Continuing Care Reporting System (CCRS)

CCRS contains clinical and demographic information on residents receiving facility based continuing care services (including hospital-based continuing care and residential care providing 24-hour nursing services).

Home Care Database (HCD)
HCD is a clinical, client-centered database that captures all home care services provided or coordinated by Local Health Integration Networks. This dataset contains information on client, intake, assessment, admission, diagnostic and surgical procedure, and service delivery.

Same Day Surgery Database (SDS)
SDS contains patient-level data for day surgery institutions in Ontario.

Ontario Mental Health Reporting System (OMHRS)
OMHRS collects data on patients in adult designated inpatient mental health beds. This includes beds in General, Provincial Psychiatric, and Specialty Psychiatric facilities.

Primary Care Population Dataset (PCPOP)[28]
PCPOP is a population level dataset that includes all people in Ontario who are alive and eligible at a given point in time. In addition to the basic demographic variables, the dataset includes information on primary care rostering and on which physician/group and FHT the patient is enrolled or virtually enrolled to.

Methods

Population

The M-OHT cohort was created by linking the Registered Persons Database (RPDB) and the Ontario Multispecialty Physician Network Database (PHYSNET) to include all individuals who were alive and belonging to the MOHT in fiscal year 2018. A pre-COVID-19 year was used intentionally (despite M-OHT forming in 2019) to avoid any abnormal patterns in the data (e.g., drastic changes in healthcare use). In general, the attribution methodology to isolate the MOHT population encompasses both residents and non-residents of Mississauga, including individuals who are rostered to a primary care physician in Mississauga or predominantly use primary services in Mississauga (even if not rostered to a physician in Mississauga).29 OHT definitions are dynamic as the definitions are applied to data that is updated regularly. As a result, the OHT denominators are updated to reflect changes to the attribution methodology and population. This is essential to keep in mind when comparing with future reports. For this report, we have also linked Mississauga residents' most representative postal code (from their health record) to their Local Health Integration Network (LHIN) sub-region as an indication of the region of Mississauga where they reside (including East, South West and North West Mississauga). The remainder of people are assumed to live outside Mississauga.

Sociodemographics

Demographic information (i.e., sex, age) and individual geographic regions were obtained from RPDB. Immigrant status, neighbourhood material deprivation, and neighbourhood visible minority came from linkage to the Immigration, Refugees and Citizenship Canada Permanent Residents Database (CIC),

[28] Source: Ontario Ministry of Health and Long-Term Care: IntelliHEALTH ONTARIO
[29] See data sources for more information on physician network attribution methodology.

the Ontario Marginalization Index (ON-MARG), and self-reported data from the Canadian Community Health Survey (CCHS). Employment information was derived from linking to the 2016 Census.

Health Characteristics

Self-rated life satisfaction, sense of community belonging, mental health, stress, and health characteristics came from linking the M-OHT population to the 2013-14 Canadian Community Health Survey (CCHS). All CCHS respondents were linked to RPDB to determine the characteristics of individuals living in each sub-region. We used the CCHS survey weights provided by Statistics Canada to generate representative population-level estimates of CCHS characteristics.

Health Conditions

A total of 18 chronic health conditions were examined30 and their lifetime prevalence was reported. The co-occurrence of these chronic conditions were also used to determine the degree of multimorbidity. These conditions included: asthma, cancer, diabetes, chronic obstructive pulmonary disease, rheumatoid arthritis, osteo- and arthritis, osteoporosis, mood disorder, other mental health disorders, hypertension, chronic coronary syndrome, cardiac arrhythmia, acute renal failure, congestive heart failure, stroke, dementia, acute myocardial infarction, and Crohn's colitis disease. These data were obtained by linking with the Ontario Health Insurance Plan Claims Database (OHIP), Discharge Abstract Database (DAD), Ontario Asthma Database (ASTHMA), Ontario Cancer Registry (OCR), Ontario Diabetes Database (ODD), Chronic Obstructive Pulmonary Disease Database (COPD), Ontario Myocardial Infarction Database (OMID), Ontario Rheumatoid Arthritis Dataset (ORAD), Ontario Chron's and Colitis Cohort Database (OCCC), and Ontario Hypertension Database (HYPER).

Premature mortality rates were calculated using registered deaths (for individuals aged 18-74) in the 2019 fiscal year (April 2019 to March 2020) using linked data from Office of the Registrar General - Deaths Database (ORG-D) and RPDB and reported as deaths per 1000 individuals.

Health risk groupings were calculated using two well-established and validated classification systems software. First was Aggregated Diagnosis Group (ADG) scores, which is based on John's Hopkins' Adjusted Clinical Group (ACG) System Version 10 and has been validated and deemed reliable for predicting mortality in Ontario.[31] Second, we also used CIHI's Population Risk Adjusted Grouping (PRAG) methodology.[32] Both classifications use administrative health records.

Healthcare Utilization Measures

Healthcare utilization and costs from the 2018 fiscal year (April 1, 2018 to March 31, 2019) were derived from linking to health administrative data (OHIP, DAD, NACRS, National Rehabilitation Reporting System (NRS), Ontario Drug Benefit Claims (ODB), Continuing Care Reporting System (CCRS), Home Care Database (HCD), Same Day Surgery Database (SDS), and Ontario Mental

[30] For definitions and data sources used for defining chronic conditions at time of death see https://www.healthaffairs.org/doi/suppl/10.1377/hlthaff.2017.1150/suppl_file/2017-1150_suppl_appendix.pdf

[31] Austin PC, van Walraven C, Wodchis WP, Newman A, Anderson GM. Using the Johns Hopkins Aggregated Diagnosis Groups (ADGs) to predict mortality in a general adult population cohort in Ontario, Canada. Med Care. 2011 Oct;49(10):932-9.

[32] CIHI's Population Groupings, see https://www.cihi.ca/en/document/population-grouping-methodology-0 for more information on the methodology.

Health Reporting System (OMHRS)) and cost information collected by MOHLTC. The costing methodology has been described elsewhere.[33]

Hospitalizations from ambulatory care sensitive conditions (ACSCs) was calculated per 100,000 using data from DAD and RPDB. Information on primary care use was derived from the Primary Care Population dataset (PCPOP). Usual Provider of Care (UPC) index was calculated using data from OHIP and RPDB. Lastly, the HRUPoRT estimated predicted numbers of high resource users over the next 5 years using population demographics and health characteristics captured by the CCHS.[34]

All reported percentages in table and figure descriptions were rounded up to the nearest percentage. Unless specified, all tables and figures reported values in percentage.

[33] https://tspace.library.utoronto.ca/bitstream/1807/87373/1/Wodchis%20et%20al_2013_Guidelines%20on%20Person-Level%20Costing.pdf

[34] Rosella LC, Kornas K, Yao Z, Manuel DG, Bornbaum C, Fransoo R, Stukel T. Predicting High Health Care Resource Utilization in a Single-payer Public Health Care System: Development and Validation of the High Resource User Population Risk Tool. Med Care. 2018 Oct;56(10):e61-e69.

Appendix B - Extra Tables and Figures