Mississauga Ontario Health Team Population Health Data Report

COVID-19 Data

A description of the COVID-19 pandemic in the Mississauga Ontario Health Team population, relating to cases over time, case socio-demographics, epidemiology, outcomes, & vaccinations.

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Executive Summary

The Peel Region, where the majority of the population in the Mississauga Ontario Health Team (M-OHT) reside, has experienced a high burden of COVID-19 cases throughout the pandemic. This report aims to help understand the epidemiology of COVID-19 in the population that the M-OHT serves, to consider which sub-populations have been most greatly affected by the virus, and to help guide future public health strategies for future infectious outbreaks.

This report uses validated COVID-19 case reports from the Ontario Ministry of Health Public Health Case and Contact Management System (CCM), a centralized information system used by Ontario's Public Health Units for the reporting and surveillance of infectious disease, including COVID-19 [1]. The data contain PCR-confirmed case records between March 13, 2020 to June 14, 2021, reported to the Ministry of Health and Long-Term Care (MOHLTC) by Public Health Units. This report covers COVID-19 demographics, socioeconomic analyses, epidemiology, case outcomes, and vaccinations. Note that cases are likely overestimated among individuals who live outside of Mississauga, which we will clarify later in this report.

COVID-19 case trends over time in the M-OHT were similar to the rest of the province in timing, with three major waves. Among areas served by the M-OHT, the largest proportion of COVID-19 cases occurred among people living outside Mississauga, accounting for 70% of cases in the M-OHT. Within Mississauga, East Mississauga had the highest number of cases, accounting for 13% of cases in the M-OHT. The highest proportion of COVID-19 cases occurred in the 20-29 age group, and the lowest proportion of cases occurred among the older age groups of 70-79 and 80+. Occupations at higher risk for COVID-19 were categorized as: healthcare workers, education setting (student and staff), and other high-risk settings, of which the highest number of cases was among healthcare workers.

No consistent area-based socioeconomic pattern in the M-OHT for total COVID-19 cases and both fatal and hospitalized COVID-19 cases. However, a strong pattern was seen for neighbourhood visible minority status quintile, with higher cases in neighbourhoods with a high number of residents who self-identify as belonging to a visible minority group based on the Census.

The majority of COVID-19 cases were attributed to household and close contact transmission. Across all sub-regions, in the M-OHT, 97-98% of COVID-19 cases are resolved. Across the M-OHT, 1% of cases resulted in death, and 4% resulted in hospitalization. Furthermore, the majority of fatal and hospitalized COVID-19 cases occurred among the 60+ category, with 92% of cases being fatal and 58% of cases being hospitalized.

Finally, the proportion of Mississauga residents that received at least one vaccine dose in Mississauga was 69% as of July 25, 2021. Areas of high socioeconomic status have higher rates of vaccination for age groups 70+, and areas of low socioeconomic status have higher rates of vaccination for age groups 18-69.

Chapter 1: Introducing the M-OHT and this Report

In 2019, the Ontario Health Teams (OHTs) initiated a province-wide healthcare model as a way to integrate different health care sectors and providers within a community, allowing them to work together and seamlessly deliver care under one unified system. The Mississauga OHT (M-OHT) was one of the 24 OHTs identified under the first OHT model. M-OHT works to improve the health of individuals in our community by providing an interconnected system of care from prenatal, to birth, to end of life and bereavement [2]. The high-quality care provided by the M-OHT aims to address not only physical health and well-being but mental, social, and emotional well-being as well.

OHTs describe a population defined by where individuals receive most of their care; in this case, the M-OHT represents those who receive most of their healthcare in Mississauga, including people who reside in and outside of the city of Mississauga [3]. To facilitate population health planning, the M-OHT has been presented by sub-regions where possible. These sub-regions have been defined based on where individuals live; they include East Mississauga, North West Mississauga, South West Mississauga, and Outside Mississauga. 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.

A previous report on the M-OHT introduced the population's sociodemographic, health conditions, healthcare utilization, and self-reported measures related to health, using pre-COVID-19 data [4]. However, when the coronavirus disease 2019 (COVID-19) was first seen in Mississauga in March 2020, this healthcare emergency was prioritized over population health planning. As a result, hospitals across Mississauga took action against the pandemic by creating temporary Pandemic Response Units, closing Urgent Care Centers to maximize care space, and providing virtual care options to prepare for the influx of COVID-19 people [5,6].

Despite substantial efforts from across the M-OHT, Peel Region (where the majority of people in the M-OHT reside) became one of the worst-hit regions across Ontario [7]. In September, 2020, Peel Region had more active COVID-19 cases than any other public-health unit in Ontario, even more than Toronto, which has a population twice the size of Peel's [8]. This trend remained unwavering throughout the pandemic: in May, 2021, Peel had the worst COVID-19 percent positivity of all of Ontario's public health units [9]. Moreover, out of the 50 areas in Ontario with the highest COVID-19 percent positivity, eight were in Mississauga, with one postal code rising to a 22% COVID-19 positivity rate [10].

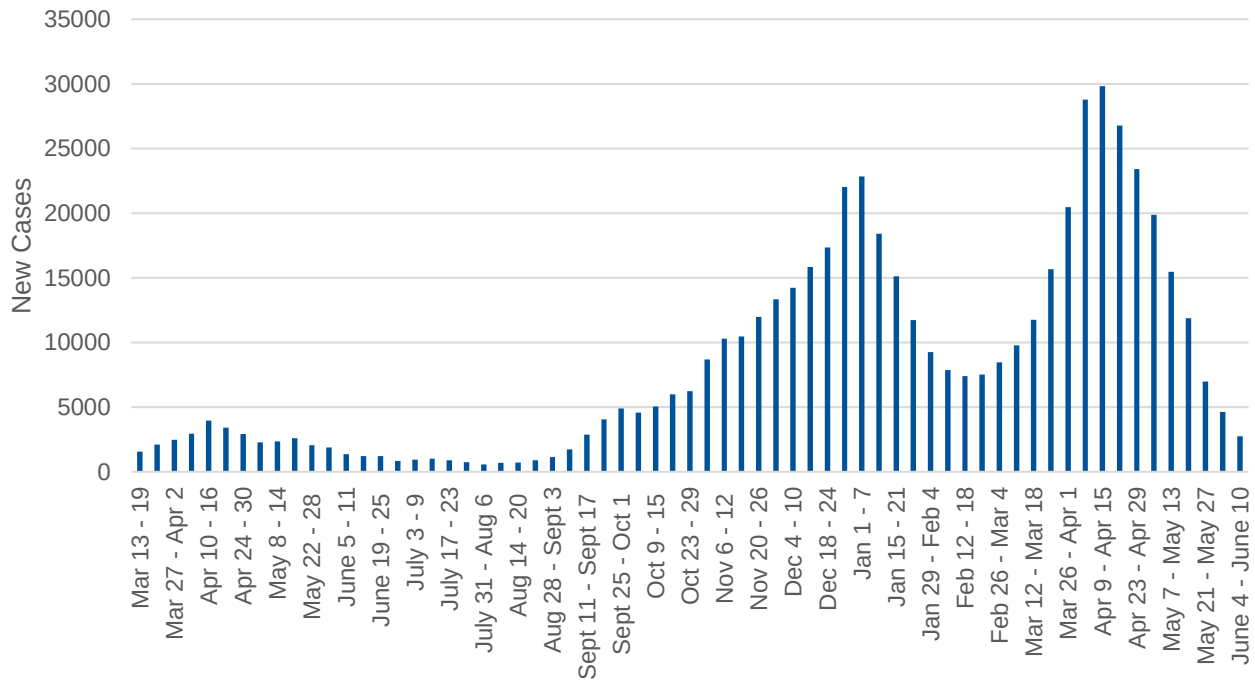
Understanding the epidemiology of COVID-19 in the M-OHT is essential to managing disease risk and informing public health strategies for future infectious outbreaks. Furthermore, as the effects of this pandemic are likely to last for years to come, understanding which sub-populations within the M-OHT have been most greatly affected by COVID-19 is necessary to address health inequities and improve the physical and mental well-being of these people.

This report uses validated COVID-19 case reports from the Ontario Ministry of Health Public Health Case and Contact Management System (CCM), a centralized information system used by Ontario's Public Health Units for the reporting and surveillance of infection. The data contain test-confirmed case records between March 13, 2020 to June 14, 2021, reported to the Ministry of Health and Long-Term Care (MOHLTC) by Public Health Units. This time period was chosen as community transmission had been identified in Ontario prior to March 13, 2020, and June 13, 2021 was generally around the end of the third wave of COVID-19 cases in Ontario.

Chapter 2: Overview of COVID-19 Cases in the M-OHT

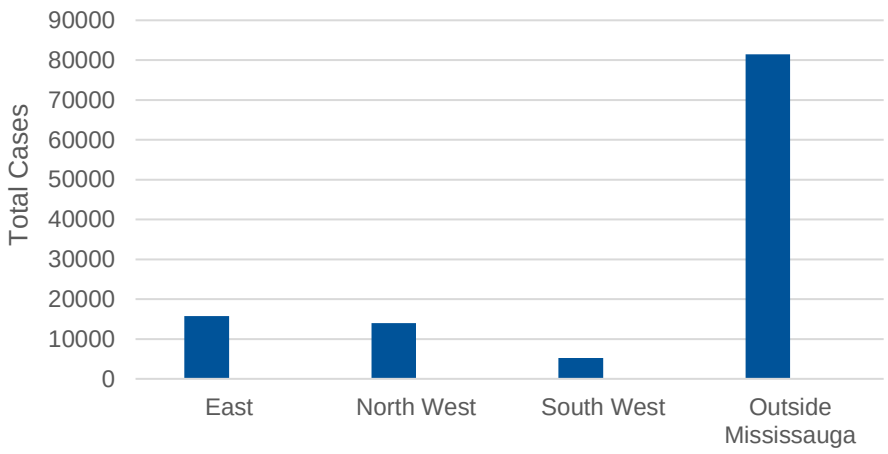
This chapter provides an overview of COVID-19 case trends in the M-OHT. The COVID-19 case trend, based on the onset of episode, from March 13, 2020, to June 10, 2021 is shown in **Figure 2.1.** Case trends in the M-OHT were similar to the rest of the province (in timing, but not magnitude), with three major peaks. The smallest peak occurred closest to the beginning of the pandemic, during the week of April 10 to 16th, 2020 (3970 cases). Two larger peaks then occurred on the week of January 1 to 7th, 2021 (22,840 cases), and the week of April 9 to 15th, 2021 (29,811 cases), which was the highest recorded case count in the M-OHT to date. Since this last peak, cases have declined steadily over time. Through the pandemic, the lowest recorded weekly case count was 567 COVID-19 cases, on the week of July 31 to August 6, 2020.

Figure 2.1 New weekly COVID-19 cases in the M-OHT (March 13, 2020 - June 10, 2021)



As described earlier, the sub-regions of the M-OHT are divided into East, North West, South West, and Outside Mississauga. These sub-regions were defined based on the postal code of residence in the CCM case record. The total number of cumulative COVID-19 cases in the M-OHT, as of June 14 2021, is 116,477, and this distribution by sub-region is shown in **Figure 2.2**.

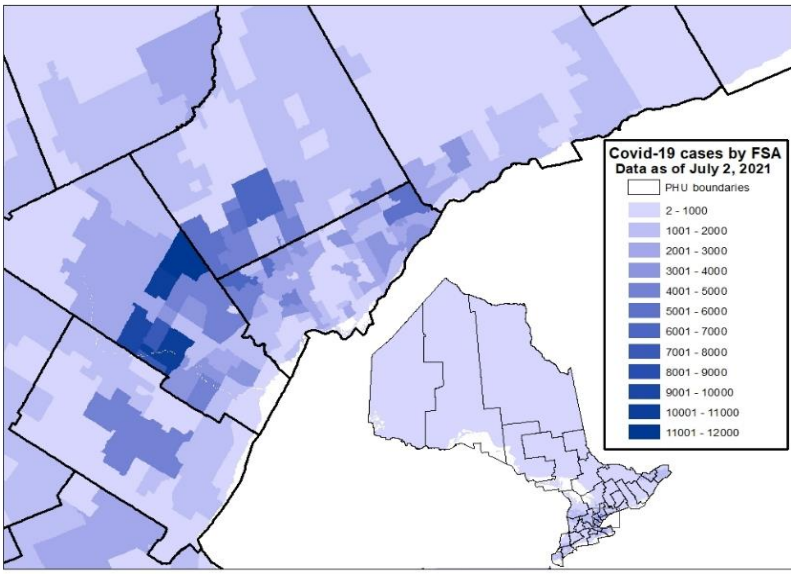
Figure 2.2 Total cumulative COVID-19 cases in the M-OHT (March 13, 2020 - June 14, 2021)



Most cases were from Outside Mississauga, accounting for 81,496 cases (70% of cases in the M-OHT). Within Mississauga, the East Mississauga sub-region had the highest number of cases, accounting for 15,721 cases (13% of cases). South West Mississauga had the lowest case counts, accounting for 5233 cases (4% of cases).

Cases that reside outside of Mississauga in neighbourhoods that are known to contain people of the M-OHT population were considered as Outside Mississauga. In the Peel region, the highest number of cases were in Brampton, and some Brampton residents are attributed to the M-OHT, which may explain the large number of cases outside the Mississauga region.[1] Some cases from Northwest Etobicoke were also designated as residing outside Mississauga. **Figure 2.3** shows COVID-19 case distributions by Forward Sortation Area (FSA)[2] data across Southern Ontario.

Figure 2.3 COVID-19 cases by FSA as of July 2nd, 2021 in Southern Ontario



[1]Many cases from Brampton have been attributed to the M-OHT population as belonging to Outside Mississauga in this report and as such, many of the cases in the M-OHT population are from Outside Mississauga. We used an attribution methodology that assigned to the M-OHT *all* cases from neighbourhoods where *some* residents belong to the M-OHT population – as a result, cases in some areas, particularly those outside Mississauga, may be over attributed to the M-OHT.

[2] FSA is represented by the first 3 digits of a 6-digit postal code.

Chapter 3: Characteristics of COVID-19 Cases in the M-OHT

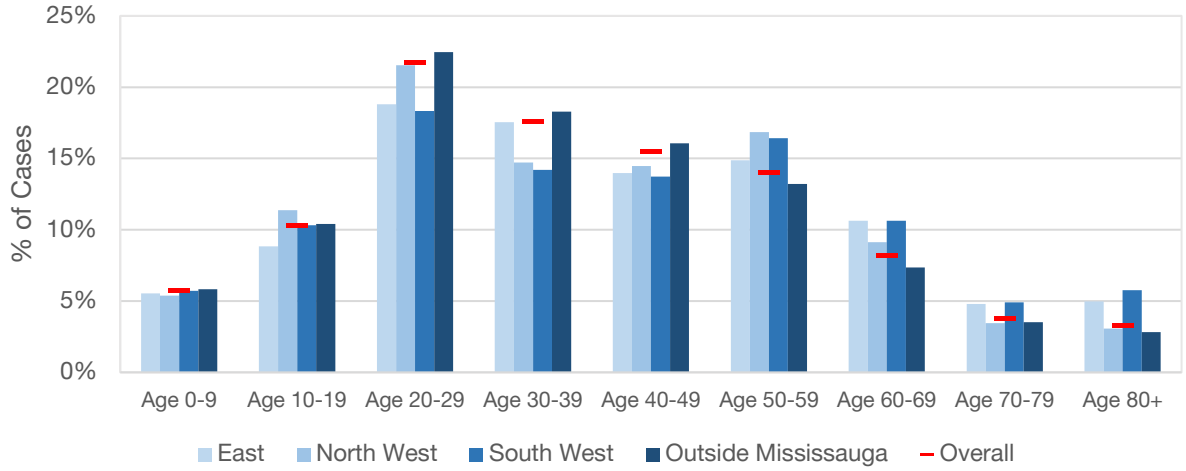
This chapter will examine the trends in COVID-19 case distribution across the attributed M-OHT sub-regions, considering demographics, socioeconomic status (SES) and visible minority status. *Note: red lines on figures correspond to the overall prevalence in the attributed M-OHT population.*

3.1 Cases by Demographics

The proportion of COVID-19 cases were approximately equal among males and females in the M-OHT (data not shown). The proportion of COVID-19 cases among males was 49%, 51%, 49%, and 51% for East Mississauga, North West Mississauga, South West Mississauga, and Outside Mississauga, respectively.

The age distribution of COVID-19 cases in the M-OHT by sub-region is shown in **Figure 3.1.1**. In all sub-regions of the M-OHT, the highest proportion of COVID-19 cases occurred in the 20-29 age group. Conversely, the lowest proportion of COVID-19 cases occurred among the oldest age groups (ages 70-80+). The age distribution of cases varied somewhat between regions.

Figure 3.1.1 Age distribution of COVID-19 cases in the M-OHT by sub-region (March 13th, 2020 - June 14th, 2021)



The COVID-19 high-risk occupations captured by the CCM were categorized as *healthcare workers*, *education settings (student and staff)*, and *other high-risk occupations* (neither health care workers nor education workers; mostly congregate setting-related). Case counts per 10,000 for each occupation are displayed in **Table 3.1.1.** Based on contact tracing, pre-defined occupations were captured in the CCM data and categorized in this table; detailed information on specific occupations excluded here due to small cell sizes and uncomprehensive data. The healthcare workers' category (e.g., long-term care staff, personal support workers, and nurses) had the highest COVID-19 case rates per 10,000. In education settings, *students* had the highest rate of COVID-19 cases per 10,000.

Table 3.1.1 COVID-19 cases per 10,000[3] by occupation in the M-OHT by healthcare, education and other high-risk setting

Reported Occupation	COVID-19 Cases per 10,000
Healthcare Workers	9213
Education setting (student)	6293
Education setting (staff)	406
Other high-risk setting	1602

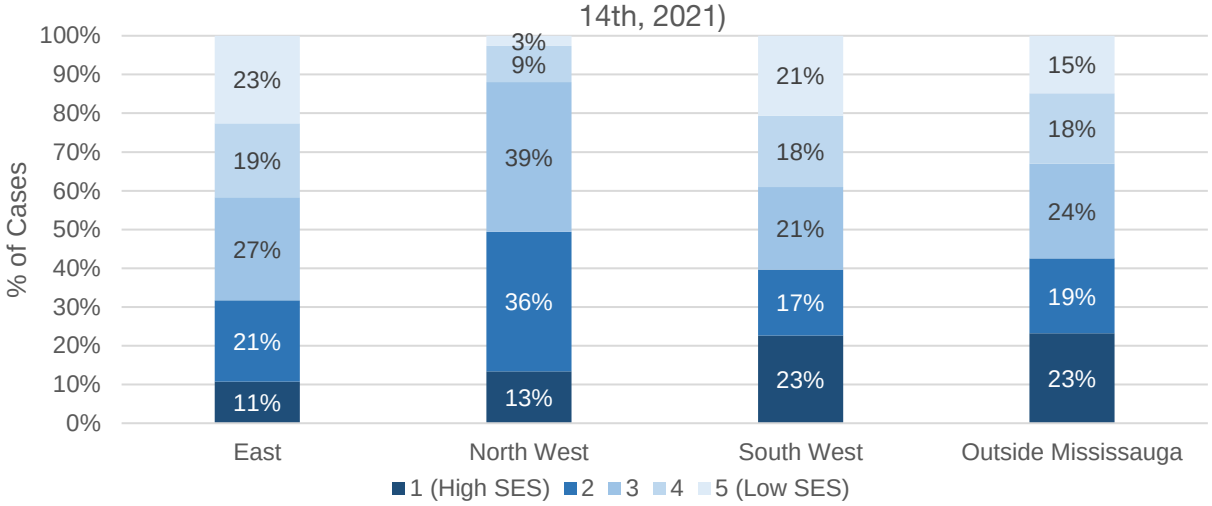
3.2 Cases by Socioeconomic and Visible Minority Status

Neighbourhood material deprivation quintiles from the Ontario Marginalization Index (ON-MARG)[11] were used to describe the overall socioeconomic status (SES) of the neighbourhoods where cases reside. Material deprivation scores include census variables for education, income, employment, and household characteristics. It 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 and highest SES) to Q5 (most deprived and lowest SES).

COVID-19 cases in the M-OHT by sub-region and neighbourhood material deprivation are shown in **Figure 3.2.1**. Consistently across every region of the M-OHT, no clear SES gradient for COVID-19 exists. For every sub-region except for South West Mississauga, the highest number of cases occurred in Quintile 3; East Mississauga, North West Mississauga, and the Outside Mississauga regions had 27%, 39%, and 24% of their cases within this quintile, respectively. South West Mississauga, in contrast, had the highest number of cases within Quintile 1 (highest SES), at 23%. No other SES patterns exist between the regions of the M-OHT.

[3] Cases per 10,000 were calculated by dividing the number of cases for each occupation by the total number of cases in each sub-region, multiplied by 10,000. (i.e. (# of cases in occupation / # of total cases in sub-region * 10,000)).

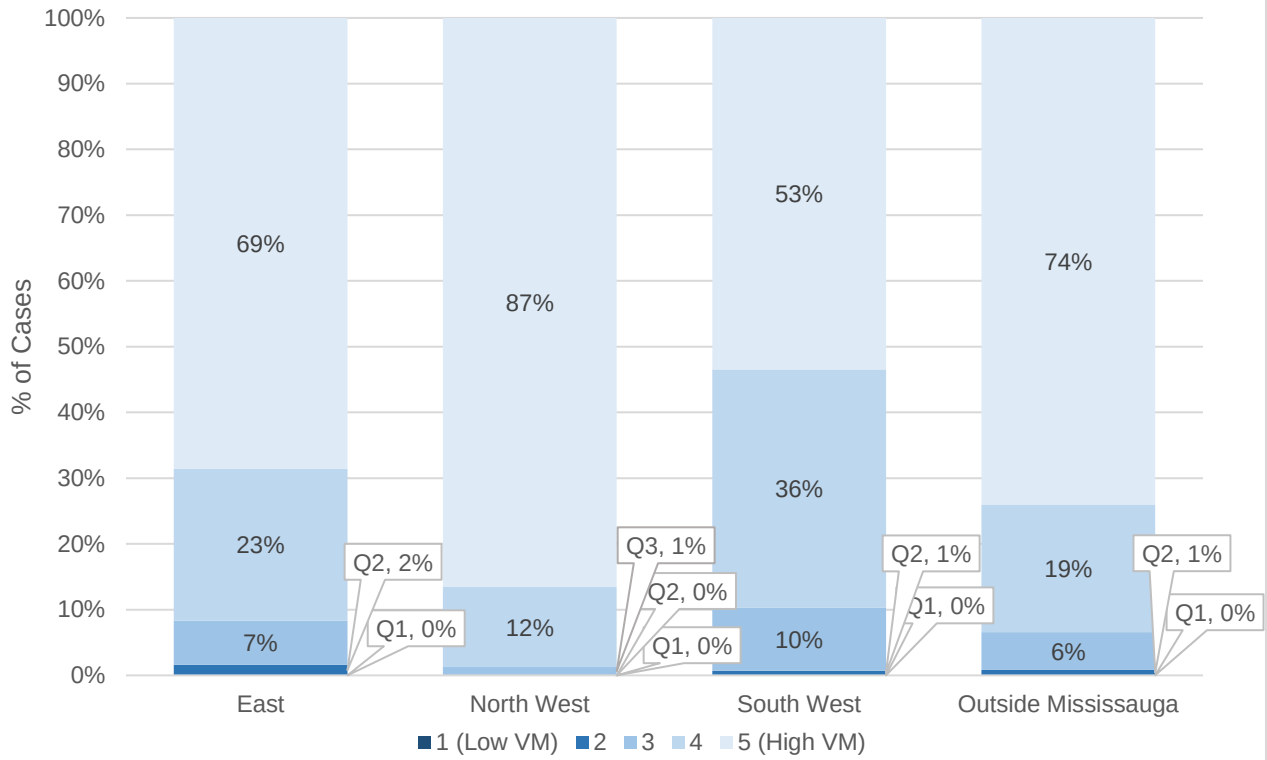
Figure 3.2.1 Distribution of COVID-19 cases in the M-OHT by sub-region and neighbourhood material deprivation quintile (March 13th, 2020 - June 14th, 2021)



Neighbourhood visible minority quintiles from the Canadian Census indicate the proportion of residents in a neighbourhood who self-identify as belonging to a visible minority group. These proportions are 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 range across all neighbourhoods in Ontario.

The distribution of COVID-19 cases in the M-OHT by sub-region and neighbourhood visible minority quintile is shown in **Figure 3.2.2**. A clear gradient exists in the M-OHT, where cases were more prevalent among individuals who live in areas with large visible minority populations. Every sub-region of the M-OHT has over 50% of cases concentrated within neighbourhoods of the highest visible minority quintile (Q5), and 94% of cases in the M-OHT were concentrated in the top two quintiles of high visible minority areas in total (Q4 and Q5). North West Mississauga and Outside Mississauga have the highest concentration of cases within Q5, with 87% and 74% of cases being concentrated in these areas, respectively. Similarly, East Mississauga and South West Mississauga have 69% and 53% of their cases concentrated in Q5, respectively. In total, 74% of COVID-19 cases were concentrated in the M-OHT were concentrated Q5.

Figure 3.2.2 Distribution of COVID-19 cases in the M-OHT by sub-region and neighbourhood visible minority (VM) status quintile (March 13th, 2020 - June 14th, 2021)

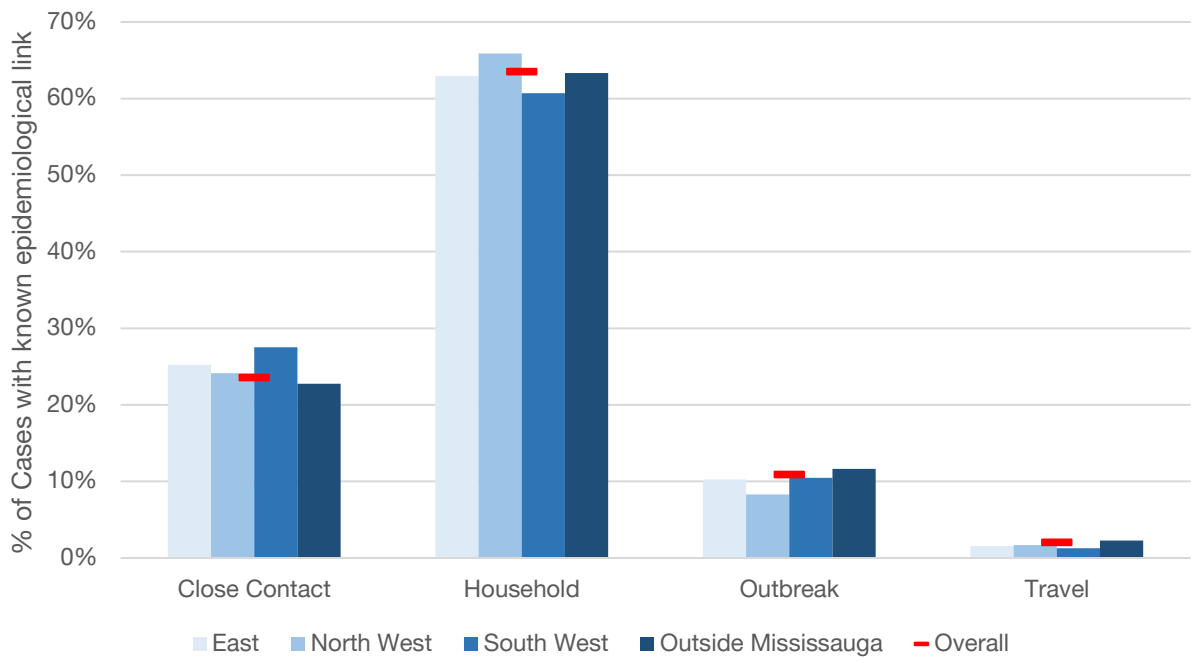


Chapter 4: Epidemiological Characteristics of COVID-19 in the M-OHT

This chapter will report on the epidemiology of COVID-19 cases by M-OHT sub-regions, by link status and household size. For cases with a known transmission mechanism, an epidemiological link status is identified in CCM, and refers to the suspected source of COVID-19 infection. The categories indicated in the CCM data include close contact, household contact, outbreak-related, or travel; cases with no indicated epidemiological link may result from unknown infection sources or incomplete contact tracing. Household size is also an important determinant of COVID-19 case transmission [12]. *Note: red lines on figures correspond to the overall prevalence in the attributed M-OHT population.*

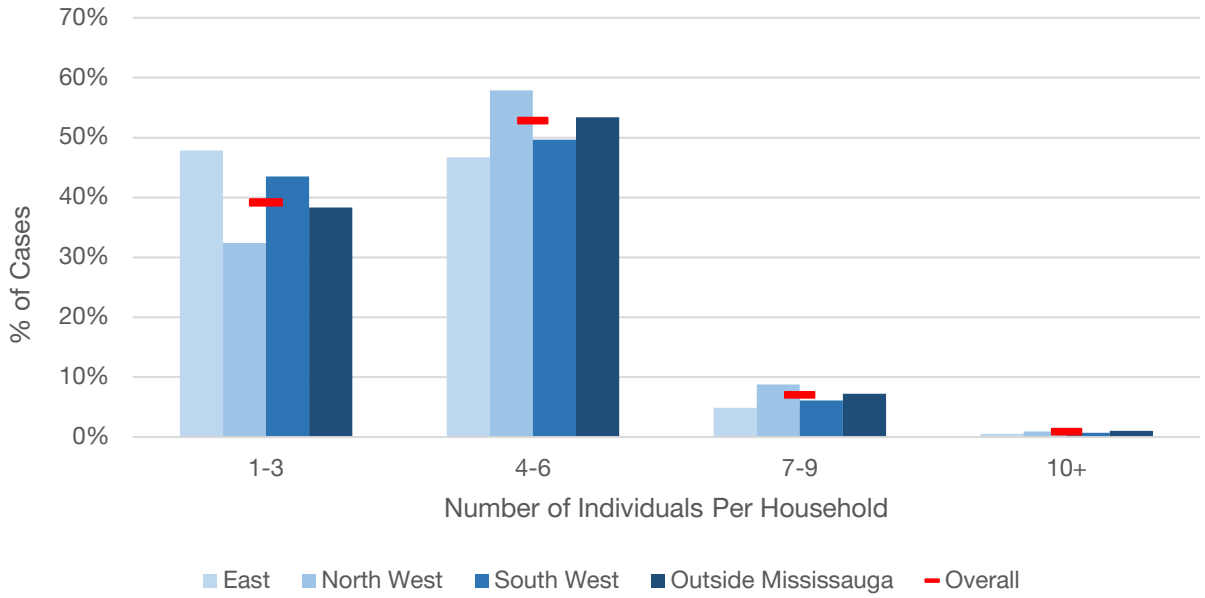
The distribution of COVID-19 cases by epidemiological link status by M-OHT sub-regions is shown in **Figure 4.1.** Overall, 55% of cases in the M-OHT had a known epidemiological link. Among cases with an indicated link, the largest proportion was attributed to household contact, at 64%. This was consistent across regions. The lowest proportion of cases within the M-OHT were attributable to travel, with only 2% of cases in total being attributed to this reason.

Figure 4.1 Epidemiological link status of COVID-19 cases in the M-OHT sub-regions (March 13th, 2020 - June 14th, 2021)



The distribution of COVID-19 cases by household size in the M-OHT sub-regions is shown in **Figure 4.2**. The majority of cases across the M-OHT regions occurred in households with 4-6 individuals; North West Mississauga had a higher than average proportion of cases in this category, at 58%. Interestingly, North West Mississauga also had the lowest proportion of cases occurring in households with 1-3 people (32%), and the highest proportion of cases occurring in households of 7-9 (9%), and 10+ (0.9%). In contrast, East Mississauga had the highest proportion of cases occurring in households with 1-3 people (48%), and the lowest proportion of cases occurring in households 7-9 (5%) and 10+ (0.5%).

Figure 4.2 Distribution of COVID-19 cases by household size in the M-OHT sub-regions (March 13th, 2020 - June 14th, 2021)



Chapter 5: Outcomes of COVID-19 Cases in the M-OHT

This chapter will report on the outcomes of COVID-19 cases by M-OHT sub-regions. Cases that were hospitalized at any point during COVID-19 infection and recorded in CCM were identified. Cases that resulted in death were classified as fatal. Cases that were resolved without death were considered resolved. *Note: red lines on figures correspond to the overall prevalence in the attributed M-OHT population.*

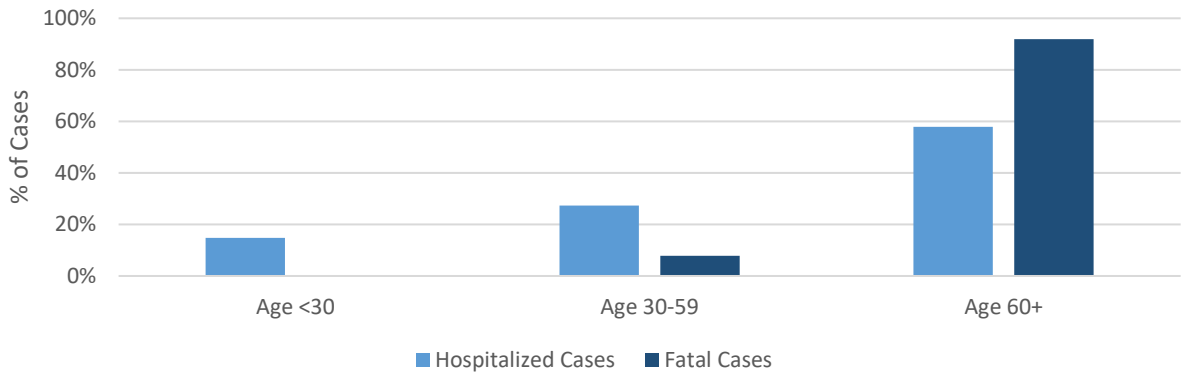
5.1 Outcomes by Sub-region

Across all sub-regions in the M-OHT, 97-98% of COVID-19 cases were resolved (data not shown). Overall, 1% and 4% of cases resulted in death or hospitalization, respectively, across the M-OHT. East Mississauga had a higher than average proportion of COVID-19 fatalities across M-OHT regions, with 2% of cases resulting in death. Similarly, South West Mississauga had a slightly higher than average proportion of COVID-19 cases resulting in hospitalizations at 5%.

5.2 Outcomes by Age

The age distribution of hospitalized and fatal COVID-19 cases in the M-OHT is shown in **Figure 5.2.1.** There were no substantial differences in COVID-19 fatalities and age across sub-regions. Most fatal COVID-19 cases occurred in the 60+ age category (92% of deaths). 8% and 0.3% of fatalities occurred among age groups 30-59 and <30 in the M-OHT, respectively. Consistent with fatality rates, there were no substantial differences in COVID-19 hospitalizations and age across sub-regions (data not shown). Compared to fatalities, COVID-19 cases resulting in hospitalization were more distributed across all age groups. Most hospitalized COVID-19 cases still occurred among the 60+ age category (58% of total hospitalized). 28% and 15% of total hospitalized COVID-19 cases occurred in the 30-59 age group and <30 age group, respectively.

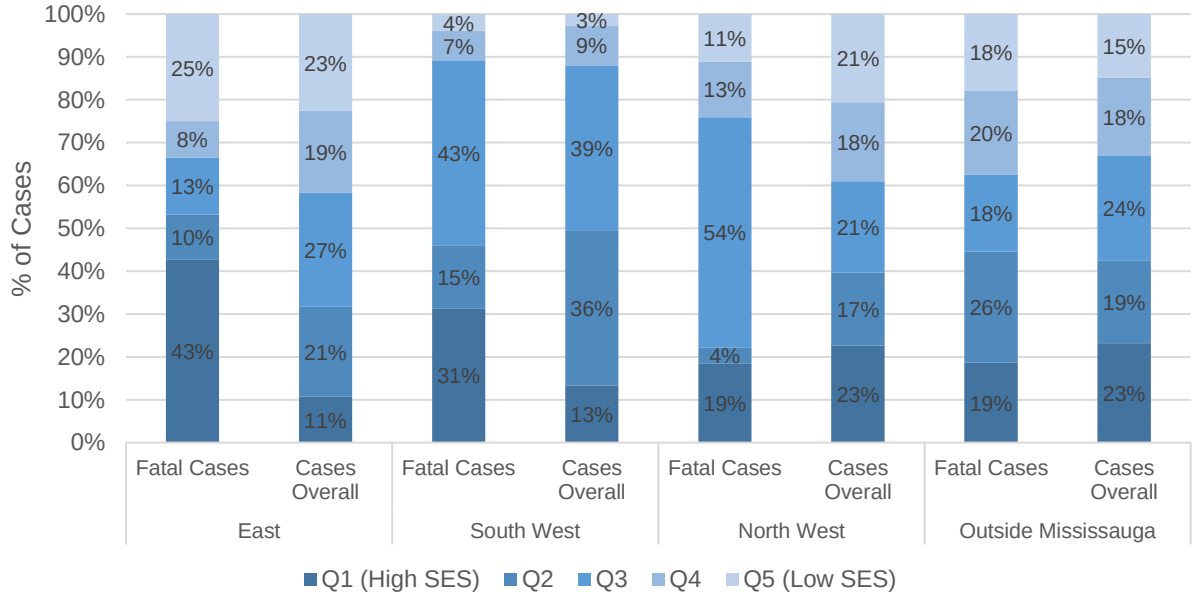
Figure 5.2.1 Age distribution of hospitalized and fatal COVID-19 cases in the M-OHT (March 13th, 2020 - June 14th, 2021)



5.3 Outcomes by Socioeconomic Status

The distribution of fatal COVID-19 cases and overall cases in the M-OHT by sub-region and neighbourhood material deprivation quintile[4] are shown in **Figure 5.3.1**. Compared to the distribution of total COVID-19 cases by material deprivation, a higher proportion of fatal cases were concentrated within the highest SES quintile (Q1) for both East Mississauga (43% vs. 11%) and North West Mississauga (31% vs. 13%). South West Mississauga has a higher proportion of fatal COVID-19 cases concentrated within quintile 3 than total COVID-19 cases (54% vs. 21%).

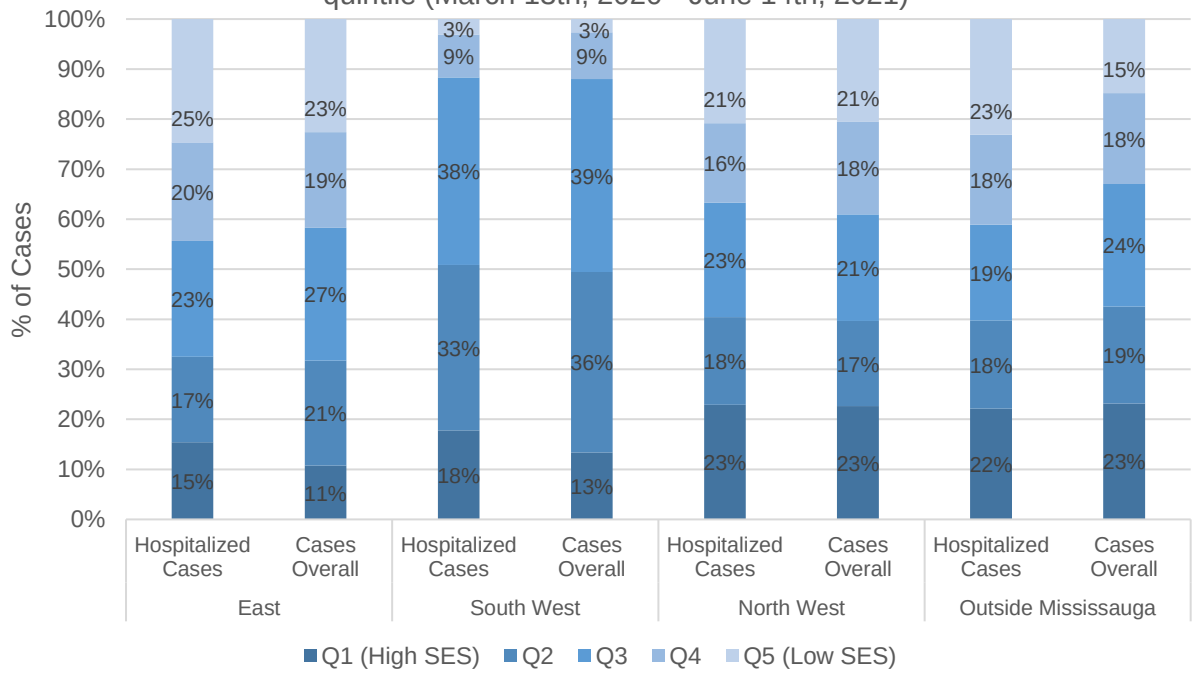
Figure 5.3.1. Distribution of fatal COVID-19 cases and cases overall in the M-OHT by sub-region and neighbourhood material deprivation quintile (March 13th, 2020 - June 14th, 2021)



[4] Note: our socioeconomic analysis does not account for age differences, which is a large driver of COVID-19 case outcomes.

The distribution of hospitalized COVID-19 cases and overall cases in the M-OHT by sub-region and neighbourhood material deprivation quintile is shown in **Figure 5.3.2**. Compared to the distribution of total COVID-19 cases by material deprivation, Outside Mississauga had a higher proportion of cases within the lowest SES quintile (Q5) (23% vs. 15%). In contrast, East Mississauga (15% vs. 11%) and North West Mississauga (18% vs. 13%) had a higher proportion of cases within the highest SES quintile (Q1) compared to the total COVID-19 case distribution.

Figure 5.3.2. Distribution of hospitalized COVID-19 cases and cases overall in the M-OHT by sub-region and neighbourhood material deprivation quintile (March 13th, 2020 - June 14th, 2021)

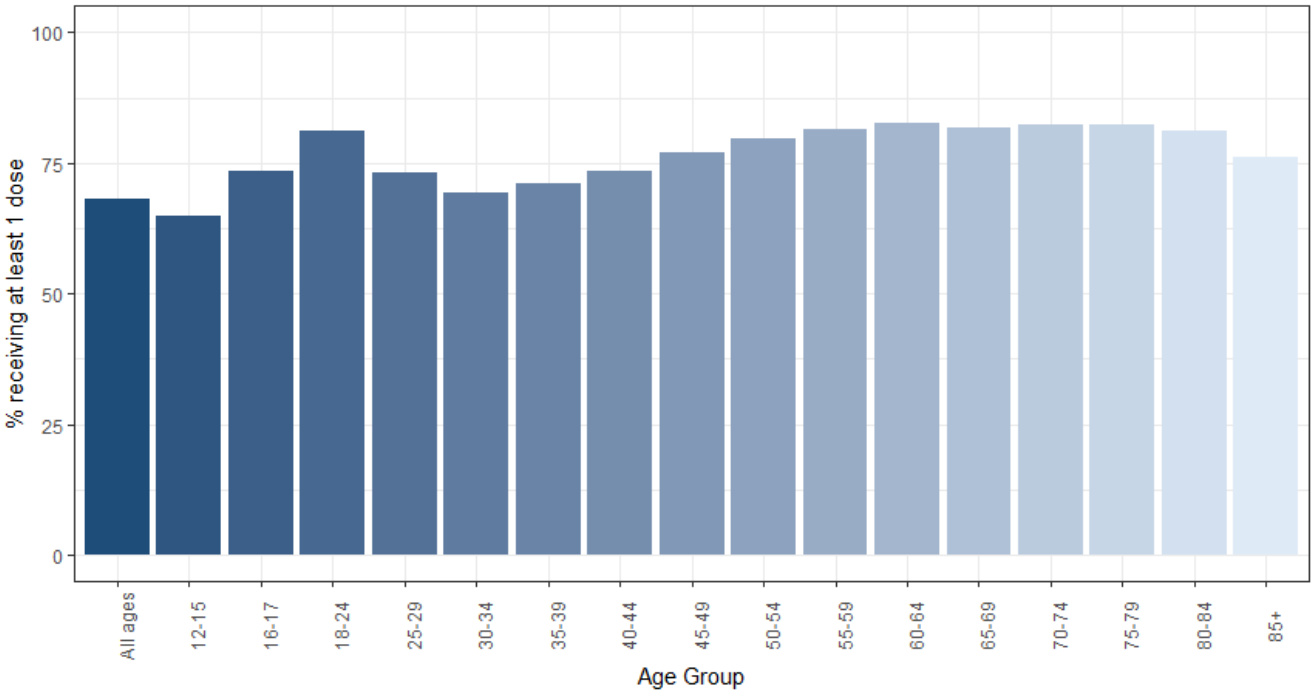


Chapter 6: Vaccinations

As vaccination data is not available for vaccinations within the M-OHT specifically, this chapter will report COVID-19 vaccination trends for Mississauga and Peel Region. Vaccination data in this section are current as of July 25, 2021.

The percent of residents receiving at least 1 dose of a COVID-19 vaccine before July 25 by age group in Mississauga is shown in **Figure 6.1**. Overall, the proportion of Mississauga residents that received at least one vaccine dose in Mississauga was 69% as of July 25, 2021. Within Mississauga, rates of vaccination increase steadily from ages 30-34 to 70-74, with the highest rates of vaccination being among the 70-74 age group. After this peak, rates of vaccination decrease slightly across the 75-85+ age groups. Among the younger age groups of 18-34, the 18-24 age group has the highest vaccination rates, and the 30-34 age group has the lowest rates of vaccination[5].

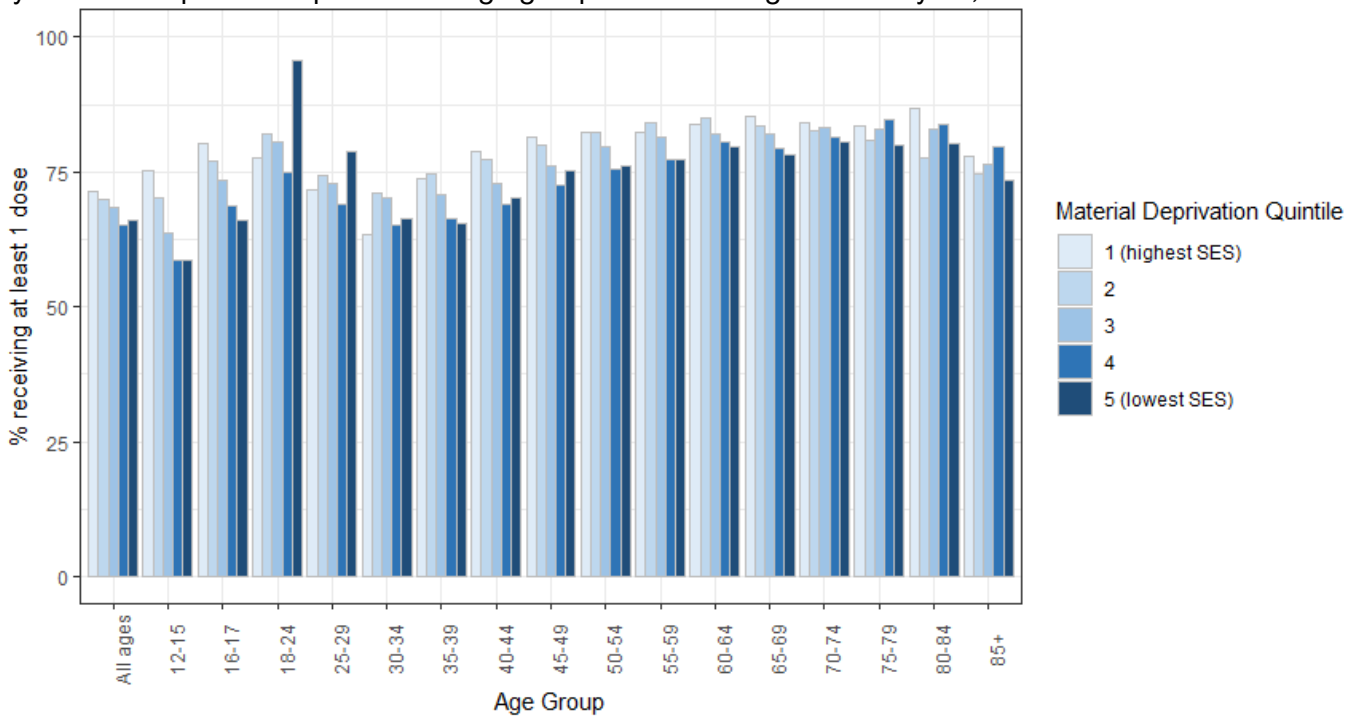
Figure 6.1. Population receiving at least one dose of a COVID-19 vaccine (%) by age group in Mississauga as of July 25, 2021



[5] This finding excludes the younger age groups of 12-15 and 16-17, which still have vaccination restrictions.

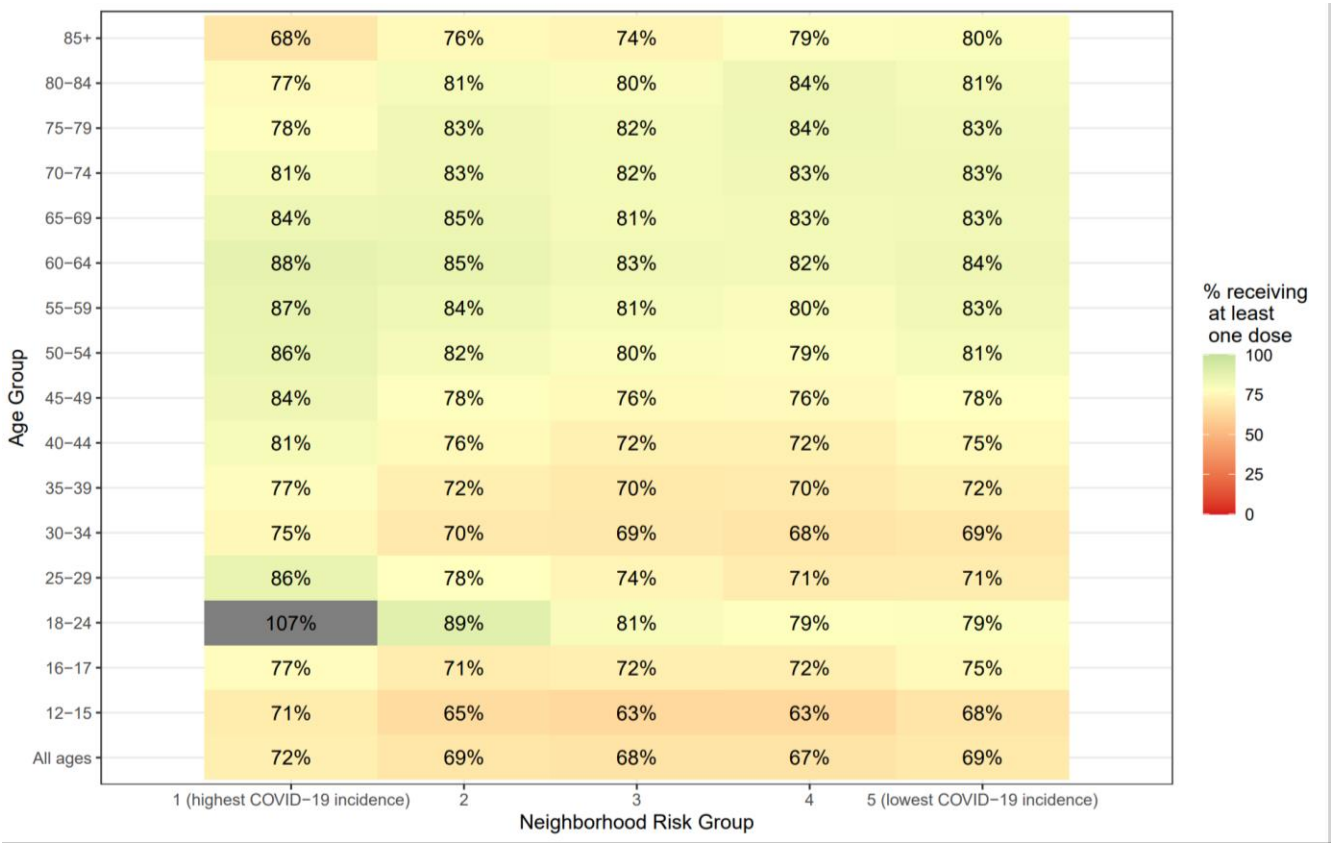
The percentage of individuals receiving at least one dose of a COVID-19 vaccine by material deprivation quintile and age group in Mississauga is shown in **Figure 6.2**. Overall, an SES gradient exists for vaccination rates in Mississauga, where areas of high SES (Q1) have higher vaccination rates than those of low SES (Q5). This gradient exists among age groups ranging from 40-74. Among the older age groups of 75 and up, areas of high SES (Q1) have the highest vaccination rates, as well as quintiles 3 and 4. Notably, among the age group 18-24, low areas of SES (Q5) have higher vaccination rates than quintile 1. The SES gradient was very pronounced for the youngest age groups (ages 12 to 17).

Figure 6.2. Percentage (%) of individuals who have received at least one dose of a COVID-19 vaccine by material deprivation quintile and age group in Mississauga as of July 25, 2021



The percentage of Peel Region receiving at least one dose of the COVID-19 vaccine by age group and neighbourhood COVID-19 infection risk is shown in **Figure 6.3**.[6] In Peel Region, among age groups 70+, areas of high COVID-19 risk have slightly *lower* rates of vaccination compared to areas with a lower risk of COVID-19. For example, in the 85+ age group, 80% of individuals in areas of the lowest COVID-19 incidence have at least one dose, versus 68% of individuals in areas of the highest COVID-19 incidence. In contrast, among the age groups of 18-69, areas of high COVID-19 risk have *higher* rates of vaccinations compared to areas with a lower risk of COVID-19.

Figure 6.3. Percentage of Peel Region residents receiving at least one dose of COVID-19 vaccine, by age group and neighbourhood COVID-19 infection risk



[6] Different data sources were used for vaccine numerators (ICES) and denominators (Canadian Census). Due to mismatches between data sources, percentages can exceed 100%.

Chapter 7: Discussion

Key Findings

This M-OHT COVID-19 report covers COVID-19 demographics, socioeconomic analyses, epidemiology, case outcomes, and vaccinations. All data presented are descriptive and for planning purposes. Data was intentionally not age- or sex-adjusted to represent the population for planning purposes accurately.

Of the attributed M-OHT population, we found that those from the Outside Mississauga sub-region had the highest concentration of COVID-19 cases. As discussed at the beginning of this report, Peel Region has been one of the worst-hit regions in Ontario during this pandemic. The majority of cases within Peel Region were not from Mississauga but Brampton. As of August 8, 2021, 60% of Peel's total cases are from Brampton, many of which can be attributed to the M-OHT population [13,14]. Brampton has a high concentration of essential workers who cannot socially distance themselves at work; for example, one Amazon facility in Brampton had been linked to over 600 cases of COVID-19 in March 2021 [15]. Thus, the high concentration of COVID-19 cases Outside of Mississauga is likely attributed to people residing in Brampton. However, it is also important to note that the high number of cases outside Mississauga may be partly due to our attribution methodology. We assigned all cases to the M-OHT that resided in neighbourhoods where some residents belong M-OHT population.

Age trends in COVID-19 cases, for the most part, follow the actual age distributions of the M-OHT sub-regions. For example, across the M-OHT, the highest proportion of COVID-19 cases occurred in the 20-29 age group, with the Outside Mississauga region and North West Mississauga having the most cases in this age group. This finding is consistent with the age demographics of these two sub-regions, which have the highest proportion of people among the youngest age groups of 0-19 and 20-44 [4]. Similarly, compared to the other sub-regions, East Mississauga and South West Mississauga have the highest proportion of COVID-19 cases among the older age groups [4]. Data from the Peel Region also agrees with our age findings, where COVID-19 cases are more concentrated among the younger age group of 20-29 and less among the older age groups of 60+ [14]. Thus, it is likely that our findings reflect both the population demographics of the M-OHT sub-regions and COVID-19 case trends.

Overall, our findings show that the highest number of COVID-19 cases occurred in the healthcare workers' category for cases. This aligns with past evidence that found hospital-linked transmission to be a significant route of spreading the virus. For instance, in April 2020, healthcare workers in Ontario were found to make up 1 in every 10 known cases of COVID-19 [16,17]. Findings on cases among students (including elementary, secondary, and post-secondary) parallel data from September 2020 (when schools in Peel were open), where 40% of Ontario schools with active COVID-19 cases were located in Mississauga or Brampton [18,19]. Despite social distancing and other safety measures within classrooms, students were often reported to be in close contact with one another in social settings, at bus stops, and on public transportation [19].

Consistent across every sub-region of the M-OHT, no socioeconomic gradient was evident for total COVID-19 cases, as well as distributions for fatal and hospitalized COVID-19 cases. This finding differs from Ontario-wide data, where, for instance, in June 2020, just under half of the COVID-19 cases resided in neighbourhoods of the lowest SES [20]. However, our findings, similar to age distribution trends, also reflect the population demographics of the M-OHT. A previous report on the M-OHT showed that (unlike Ontario), residents are not evenly distributed across material deprivation quintiles and vary across sub-region. For example, the North West Mississauga sub-region has a relatively small proportion of residents in the lowest SES quintile (2%) [4], and correspondingly, a small number of COVID-19 cases in this quintile (3%). Thus, socioeconomic trends for COVID-19 in the M-OHT are likely reflecting population demographics.

A pronounced gradient is seen for COVID-19 cases and visible minority concentration, where cases in the M-OHT were concentrated among individuals residing in the highest visible minority concentrated areas. These findings are similar to those of all of Ontario, where in May 2020, the province reported 66% of COVID-19 cases being concentrated among these same areas [21]. However, similar to material deprivation, visible minority trends may also be reflecting the actual population of the M-OHT. The population of the M-OHT is already concentrated greatly among areas of the highest visible minority quintiles[4]. Thus, the observed trend may be reflecting both the population demographics of the M-OHT and COVID-19 case trends.

Our findings show that household contact is the main source of COVID-19 case linkage in the M-OHT, followed by close contact. An epidemiological report from Peel Public Health from April 2021 reported similar findings, where 44% of cases could be attributed to within the household and 17% to close contact [22]. In Brampton, a quarter of all households consists of five or more people, compared to less than 10% of households in all of Ontario [23]. Large, multi-generational households across the M-OHT can lead to more concentrated, crowded housing, making it difficult for residents to socially distance and exacerbating COVID-19 transmission in this population[23].

In the M-OHT, a large proportion of cases were resolved, and a smaller proportion has resulted in death or hospitalization. This finding is consistent with that of Ontario, where 2% and 5% of cases have resulted in death and hospitalization, respectively. Ontario also has similar age distribution trends in deaths and hospitalizations compared to the M-OHT, where most fatal and hospitalized cases are among the age groups of 60+. For Ontario, 92% and 64% of deaths and hospitalizations have been among that same age group, respectively. Older people have been known to have a higher risk of contracting COVID-19 due to physiological and immune changes that come with ageing and underlying health conditions.

Our findings show that individuals residing in Mississauga within the 18-24 age group have higher, or relatively the same, vaccination rates as those 30+, where over 75% of these individuals have received at least one dose. This trend is different from all of Ontario, where individuals 18-29 have the lowest vaccination rates compared to the rest of the adult age groups, at 72% [24]. Additionally, individuals within the 18-24 and 25-29 age groups residing in areas of low SES have *higher* vaccination rates than their counterparts in areas of high SES. It

could be that in Mississauga, vaccination campaigns, access to vaccines, and pop-up vaccine clinics were more readily available for these younger age groups in lower SES areas. Moreover, as mentioned earlier in the report, the highest rates of COVID-19 infection in the M-OHT have been among the 20-29 age group. Young adults in the M-OHT may have decided to get vaccinated to protect themselves, their families, and their friends from alarmingly high infection rates among their age group. Correspondingly, areas with high COVID-19 incidence have higher vaccination rates than those with low COVID-19 incidence for 18-69. Perhaps being heavily exposed to COVID-19, and experiencing people close to you become infected with the virus, becomes an incentive to get vaccinated.

Implications & Conclusions

Peel Region has been known as one of the worst-hit regions in all of Ontario for COVID-19 infection. Thus, understanding the epidemiology of COVID-19 in the M-OHT, who reside in these high-risk areas, is essential to managing disease risk and informing planning for future infectious outbreaks. Findings from this report should be used to help guide the response to future COVID-19 waves and understand which sub-populations within the M-OHT have been most greatly affected by COVID-19. As the effects of the pandemic are likely to last for years to come, understanding the burden of COVID-19 on sub-populations is necessary to address health inequities and improve the physical and mental well-being of the community.

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Appendix

Data Sources

Case and Contact Management System (CCM)
The Ontario Ministry of Health Public Health Case and Contact Management System (CCM) is a centralized information system used by Ontario's Public Health Units for the reporting and surveillance of infectious disease including COVID-19 [1]. It contains test-confirmed case records between March 13, 2020 to June 14th, 2021, reported to the Ministry of Health and Long-Term Care (MOHLTC) by Public Health Units.

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.

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).[7] 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.

Methods

Validated data on COVID-19 cases were obtained from CCM, which provided information on the number of cases, where cases reside (which were designated as East, South West, North West, and Outside Mississauga based on postal code), demographics (age and sex), epidemiological link status, occupation, household size, COVID-19 health outcomes, and vaccination. This data was linked the census and ONMARG to include information on visible minority status and material deprivation.

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