

# Opioid Use in Halton

Opioid-related emergency department  
visits and hospitalizations  
**2006-2015**



The Regional Municipality of Halton  
March 2017



## **Reference:**

Halton Region Health Department, *Halton Opioid Use Report*. Oakville, Ontario, March 2017.

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## Table of Contents

<b>Executive Summary</b> .....	1
<b>Introduction</b> .....	2
Presentation of the results .....	3
<b>Emergency department visits</b> .....	4
Halton versus Ontario .....	4
Type of opioid overdose .....	5
Overdose intentionality .....	5
Type of opioid-related mental or behavioural issue .....	6
Trends over time .....	7
Sex .....	10
Age .....	11
Municipality .....	12
Neighbourhood income .....	13
<b>Hospitalizations</b> .....	14
Halton versus Ontario .....	14
Type of opioid-related hospitalization .....	15
Trends over time .....	15
<b>Deaths</b> .....	18
<b>References</b> .....	19
<b>Appendix A: Counts of opioid-related emergency department visits in Halton</b> .....	20
<b>Appendix B: Data notes and limitations</b> .....	21
Definitions .....	21
Data sources .....	21
Coding and groupings .....	21
Statistical significance .....	24
Limitations .....	25

## List of Figures

Figure 1: Opioid-related emergency department visits, age-standardized rates (per 100,000), ages 15 and over, by type of opioid-related issue, Halton Region and Ontario, 2013-2015 combined. ....	4
Figure 2: All opioid-related emergency department visits, age-standardized rates (per 100,000), ages 15 and over, Halton Region and Ontario, 2006-2015.....	7
Figure 3: Emergency department visits involving opioid overdose, age-standardized rates (per 100,000), ages 15 and over, Halton Region and Ontario, 2006-2015.....	8
Figure 4: Emergency department visits involving an opioid-related mental or behavioural issue, age-standardized rates (per 100,000), ages 15 and over, Halton Region and Ontario, 2006-2015.....	9
Figure 5: Opioid-related emergency department visits, age-standardized rates (per 100,000), ages 15 and over, by type of opioid-related issue and sex, Halton Region and Ontario, 2013-2015 combined. ....	10
Figure 6: Opioid-related emergency department visits, age-specific rates (per 100,000), ages 15 and over, by type of opioid-related issue, Halton Region and Ontario, 2013-2015 combined. ...	11
Figure 7: Opioid-related emergency department visits, age-standardized rates (per 100,000), ages 15 and over, by type of opioid-related issue and municipality, Halton Region and Ontario, 2013-2015 combined. ....	12
Figure 8: Opioid-related emergency department visits, age-standardized rates (per 100,000), ages 15 and over, by type of opioid-related issue and neighbourhood income, Halton Region and Ontario, 2013-2015 combined. ....	13
Figure 9: Opioid-related hospitalizations, age-standardized rates (per 100,000), ages 15 and over, by type of opioid-related issue, Halton Region and Ontario, 2013-2015 combined. ....	14
Figure 10: All opioid-related hospitalizations, age-standardized rates (per 100,000), ages 15 and over, Halton Region and Ontario, 2006-2015. ....	15
Figure 11: Hospitalizations involving opioid overdose, age-standardized rates (per 100,000), ages 15 and over, Halton Region and Ontario, 2006-2015.....	16
Figure 12: Hospitalizations involving an opioid-related mental or behavioural issue, age-standardized rates (per 100,000), ages 15 and over, Halton Region and Ontario, 2006-2015...	17

## List of Tables

Table 1: Emergency department visits involving opioid overdose, average number and percent by drug type, ages 15 and over, Halton Region and Ontario, 2013-2015 combined. ....	5
Table 2: Emergency department visits involving opioid overdose, average percent by assigned intentionality, ages 15 and over, Halton Region and Ontario, 2013-2015 combined.....	5
Table 3: Emergency department visits involving opioid-related mental and behavioural issues, average number and percent by type of issue, ages 15 and over, Halton Region and Ontario, 2013-2015 combined. ....	6
Table 4: Deaths from opioid toxicity or combined opioid and alcohol toxicity, Halton Region, 2011-2015.....	18
Table 5: Average counts of opioid-related ED visits in Halton, 2013-2015 combined, by type of opioid-related issue. ....	20
Table 6: ICD-10-CA codes for opioid-related ED visits and hospitalizations .....	22
Table 7: Drugs captured by opioid overdose groupings.....	22
Table 8: Problems captured by groupings of opioid-related mental or behavioural issues.....	23

## Executive Summary

Opioid use is an important health issue that has been receiving increased attention in recent years. Opioids are a class of drugs that includes illegal drugs, such as heroin, as well as prescription drugs used to treat pain, such as codeine and morphine. Rates of opioid prescribing, especially high-dose prescribing, have been increasing in Canada.<sup>1</sup> There are also rising concerns over the presence of powerful opioids such as fentanyl in street drugs.<sup>2</sup> This report examines opioid-related emergency department (ED) visits and hospitalizations (2013-2015), as well as drug overdose deaths (2011-2015) in Halton. Trends over time in ED visits and hospitalizations since 2006 are also presented. ED visit rates are analyzed by age, sex, municipality, and neighbourhood income. However, due to the small number of opioid-related hospitalizations, it was not feasible to further disaggregate hospitalization rates by demographic factors.

Between 2013 and 2015, Halton residents made 162,731 visits to the ED per year and experienced 20,234 hospitalizations per year for any reason. On average, only 223 (0.1%) of these visits and 59 (0.3%) of these hospitalizations were opioid-related each year. Approximately 58% of the opioid-related ED visits involved opioid-related mental or behavioural issues (such as acute intoxication, dependency, or withdrawal), while 43% involved an opioid overdose. Conversely, 64% of hospitalizations involved an opioid overdose, and 37% involved an opioid-related mental or behavioural issue.

**Halton versus Ontario:** Halton had rates of opioid-related ED visits and hospitalizations that were almost half of Ontario's rates. This was true for both opioid overdoses and opioid-related mental and behavioural issues.

**Trends over time:** Between 2006 and 2015 there were increases in opioid-related ED visits and hospitalizations in both Ontario and Halton. While the rates were lower in Halton, there has been an approximate doubling of rates in both Halton and Ontario over the past ten years, bringing Halton up to the level of where Ontario was ten years ago.

**Sex:** In both Halton and Ontario, males had significantly higher rates of opioid-related ED visits. The sex difference was more pronounced for visits involving opioid-related mental and behavioural issues than it was for visits due to opioid overdose.

**Age:** Adults aged 25-44 had the highest count and rate of ED visits for opioid-related mental and behavioural issues, whereas the rate for ED visits involving opioid overdose was more similar across all age groups but highest among youth and young adults aged 15-24.

**Municipality:** Burlington had the lowest rate of ED visits involving opioid-related mental and behavioural issues. There were no significant differences between municipalities when considering the rate of ED visits for opioid overdoses.

**Neighbourhood income:** All types of opioid-related ED visits were more common among residents of low-income neighbourhoods than they were among residents of high-income neighbourhoods.

**Deaths:** Each year between 2011 and 2015, there were approximately 13 deaths in Halton involving opioid toxicity. On average, only two of these deaths per year involved fentanyl.

## Introduction

Opioid use is increasingly considered a serious health issue in Ontario and throughout Canada.<sup>3</sup> Opioids are a class of drugs that includes both illicit drugs such as heroin, as well as prescription drugs used mainly to treat pain, like codeine and morphine. Some opioids occur naturally in opium, a gummy substance produced by the opium poppy plant. Other opioids are semi-synthetic, meaning they are made by modifying the chemical structure of natural opioids, or fully synthetic, meaning they are made from chemicals without using a naturally occurring opioid to start.<sup>4</sup>

Opioid use may result in addiction and/or overdose. Addiction can begin with recreational use, as opioids may be abused (used for reasons other than their intended medical purpose) because they can create feelings of pleasure or euphoria.<sup>5</sup> However, addiction can also begin with medical use of opioids, due to issues such as inadequate management and control of chronic pain or illness. Rates of opioid prescribing, especially high-dose prescribing, have been increasing in Canada. A high-dose opioid formulation is defined as one where the strength of the tablet or patch would result in a daily dose exceeding 200 milligrams of morphine or equivalent if taken one or two times a day.<sup>1</sup> There has also been growing interest in fentanyl, a powerful synthetic opioid originally intended for use only in medical settings that is now used recreationally, and is often sold mixed into other street drugs.<sup>2</sup>

Consequently, there are concerns regarding increasing opioid-related adverse events and deaths in Ontario.<sup>6</sup> The Ontario Drug Benefit (ODB) program covers most of the cost of many prescription drugs for all Ontarians 65 years of age or older, as well as individuals living in long-term care homes or enrolled in Home Care, or who are receiving support from programs intended to benefit Ontarians requiring financial assistance, such as Ontario Works, the Ontario Disability Support Program, or the Trillium Drug Program. A recent provincial report shows that in 2015, out of 101,638 public drug plan beneficiaries in Halton, 18,661 were opioid users, 396 were receiving opioid maintenance therapy (such as methadone) to combat addiction, and 296 were using high-dose opioids. When rates for these three indicators were compared to the 48 other counties in Ontario, Halton consistently ranked among the six counties with the lowest rates across the province.<sup>7</sup>

While the provincial report provides a useful snapshot of opioid use in Halton, the purpose of this report is to explore in greater depth the health burden from opioid-related ED visits, hospitalizations, and deaths occurring in the population. Both opioid-related mental and behavioural issues as well as opioid overdoses are included, and where possible data are disaggregated by age, sex, municipality, and income. Trends in the data since 2006 are presented and provide the Halton Region Health Department and community partners further data to inform policies and programs aimed at preventing and dealing with the effects of opioid use. This report also serves to fulfil Ontario Public Health Standards (OPHS) requirements related to substance use surveillance and reporting.

Please keep in mind throughout this report that it is not possible to assess all opioid use in Halton due to lack of availability of databases that track both prescription and illicit opioid use. This report only reflects opioid use that led to an emergency department visit, hospitalization, or death, and as such only represents a portion of the opioid use actually occurring within the population. These data can still provide insight into trends over time and who may be more likely to use opioids in the region. It is also important to consider that even with any observed increases, opioid-related issues still account for only a small fraction of the many health concerns resulting in ED visits, hospitalizations, and deaths among Halton residents, such as cancer, cardiovascular disease, and injuries.

## Presentation of the results

This report summarizes counts and rates of emergency department (ED) visits and hospitalizations related to opioid use among residents of Halton and Ontario, and deaths related to opioid use occurring in Halton. Individuals may go to the ED or be hospitalized for an opioid-related overdose or for an opioid-related mental or behavioural issue. Approximately 1-2% of opioid-related ED visits and hospitalizations in both Halton and Ontario were coded as involving *both* an opioid overdose and an opioid-related mental or behavioural issue. When looking at all opioid-related issues combined, patients are counted only once (even if they experienced both an overdose and a mental or behavioural issue during the same ED visit or hospitalization).

Data presented are for incidents occurring within Ontario only. The rates for ED visits and hospitalizations shown represent opioid-related issues experienced by Halton residents, but the issue may not have occurred within Halton. The opioid-related deaths shown occurred within Halton boundaries, but the decedent may not have been a Halton resident; consequently, the opioid-related death counts do not include any Halton residents who may have died of an opioid overdose outside Halton. Except for time-trend analysis, data from 2013 to 2015 were combined for ED visits and hospitalizations. These three-year averages were used to account for unstable rates in the population that can occur when examining a single year of data. This report includes ED visit and hospitalization data for Halton residents ages 15 and over, and death data for individuals of any age dying within Halton.

Data are presented as average number of cases per year, age-standardized rates, and age-specific rates:

**Average number of cases per year** is used to display breakdowns of the different types of opioid-related issues in Halton. It is meant to determine the most common types of opioid-related issues among Halton residents, but should not be used to compare opioid-related issues between two different populations as it does not take into account the age or sex distributions, or size of the populations.

**Age-standardized rates (per 100,000)** are used to compare the different populations of Halton and Ontario and the four municipalities of Halton. The rates are standardized to the 1991 Canadian population. This ensures that any differences in rates between populations are not due to differences in the age distributions of populations. Age-standardized rates are used to provide an overall rate for all ages combined.

**Age-specific rates** are used to compare rates of opioid-related issues between age groups for both Halton and Ontario.

Please note that the upper limit of the y-axis scale used in each graph differs. Differences between groups were tested for statistical significance by calculating 95% confidence intervals. If the confidence intervals between groups did not overlap, the differences were considered statistically significant. Further data notes, definitions, and limitations can be found in [Appendix B: Data notes and limitations](#).

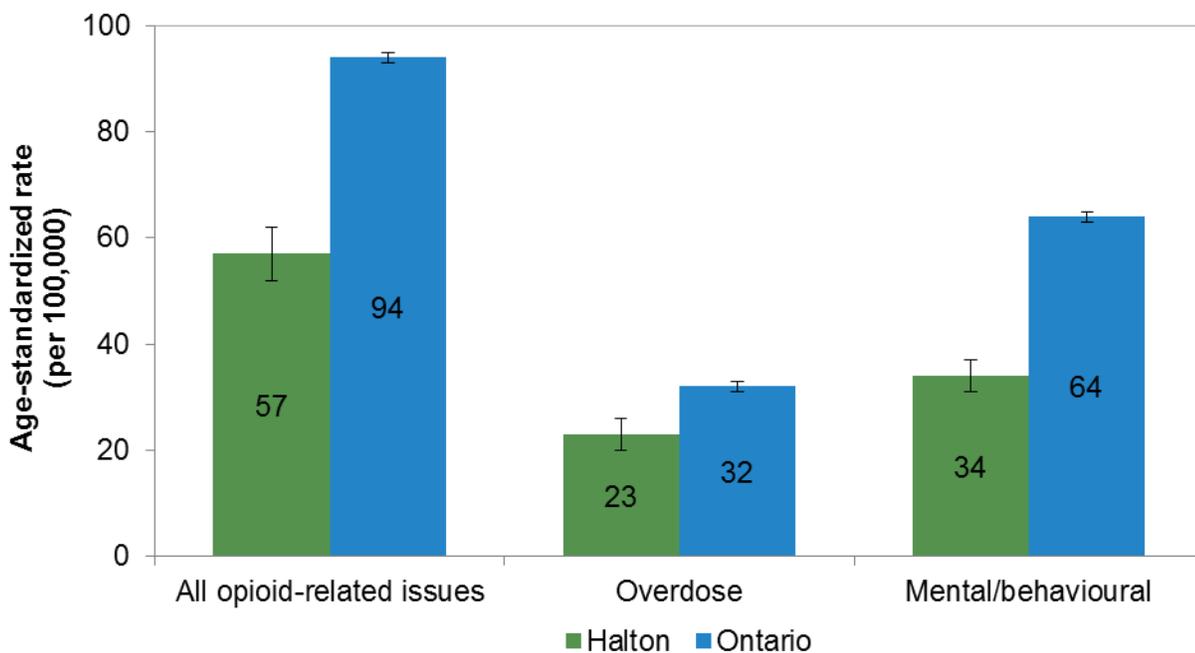
For more information on health statistics in Halton, please refer to the [Halton Health Statistics](#).

# Emergency department visits

## Halton versus Ontario

Between 2013 and 2015, there was an average of 223 opioid-related ED visits per year in Halton, and an average of 9,796 opioid-related ED visits per year in Ontario overall. Please refer to **Appendix A: Counts of opioid-related emergency department visits in Halton** for counts disaggregated by age, sex, and municipality, for each type of opioid-related issue (opioid overdose, opioid-related mental/behavioural issues, and all opioid-related issues combined).

The age-standardized rates for all opioid-related ED visits combined, ED visits involving opioid overdose specifically, and ED visits involving opioid-related mental or behavioural issues specifically for 2013-2015 were all higher in Ontario than they were in Halton. These differences were each statistically significant (see **Figure 1**).



**Figure 1: Opioid-related emergency department visits, age-standardized rates (per 100,000), ages 15 and over, by type of opioid-related issue, Halton Region and Ontario, 2013-2015 combined.**

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 22, 2016.

## Type of opioid overdose

Of the 223 opioid-related ED visits per year in Halton between 2013 and 2015, an average of 129 visits per year (58%) involved an opioid-related mental or behavioural issue, while an average of 96 visits per year (43%) involved an opioid overdose. Since 129 and 96 sum to 225, but there were only a total of 223 ED visits per year, this means that on average, only 2 visits per year (1%) involved both an opioid overdose and an opioid-related mental or behavioural issue. The division was similar provincially, with 65% of visits involving an opioid-related mental or behavioural issue and 36% involving an opioid overdose. Only 1% involved both.

Of the ED visits for opioid overdose, the majority (59%) in Halton involved opioids classified as “other opioids”, a category that includes drugs such as codeine, hydrocodone, and morphine. This was also the most common type of opioid involved in overdose-related ED visits in Ontario (see **Table 1**). By comparison, “other synthetic narcotics”, the category that includes fentanyl, accounted for only 11% of overdoses in Halton (see **Table 7** in **Appendix B** for a full list of drugs in each category).

**Table 1: Emergency department visits involving opioid overdose, average number and percent by drug type, ages 15 and over, Halton Region and Ontario, 2013-2015 combined.**

Drug type	Halton		Ontario	
	# overdoses per year (average)*	%	# overdoses per year (average)*	%
Heroin	10	11	322	9
Other opioids	57	59	2019	56
Methadone	6	6	367	10
Other synthetic narcotics	11	11	365	10
Opium or other and unspecified narcotics	13	14	531	15

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 22, 2016.

\*In both Halton and Ontario, approximately 2% of overdoses involved drugs in more than one category; these overdose visits have been counted once in each category.

## Overdose intentionality

Forty-four percent (44%) of ED visits involving opioid overdose in Halton were for overdoses classified as accidental, while 28% were considered to be intentional, meaning the individual took the opioids with the intended purpose of overdosing (intentional self-harm). An additional 16% of visits were classified as “undetermined intent”, and information on intentionality was not provided at all for 11% of ED visits involving opioid overdoses. The intentionality breakdown was similar for Ontario (see **Table 2**). Please see the **Limitations** section in **Appendix B** for a discussion of issues with assigning intentionality to overdoses.

**Table 2: Emergency department visits involving opioid overdose, average percent by assigned intentionality, ages 15 and over, Halton Region and Ontario, 2013-2015 combined.**

Assigned intentionality	Halton	Ontario
Accidental	44%	42%
Intentional	28%	29%
Undetermined	16%	20%
Information not provided	11%	10%

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 22, 2016.

## Type of opioid-related mental or behavioural issue

Of the ED visits for opioid-related mental or behavioural issues in Halton, almost half (49%) involved opioid withdrawal. Dependence syndrome (24%) and substance abuse (18%) were also common reasons to visit the ED, while acute intoxication with opioids accounted for only 6% of this type of visit (see **Table 8** in **Appendix B** for a complete description of each type of mental or behavioural issue). This was similar to Ontario (see **Table 3**).

**Table 3: Emergency department visits involving opioid-related mental and behavioural issues, average number and percent by type of issue, ages 15 and over, Halton Region and Ontario, 2013-2015 combined.**

Type of mental or behavioural issue	Halton		Ontario	
	# visits per year (average)*	%	# visits per year (average)*	%
Acute opioid intoxication	8	6	340	5
Opioid substance abuse	24	18	1541	24
Opioid dependence syndrome	32	24	1499	23
Opioid withdrawal	65	49	2921	45
Psychotic disorder due to opioid use	0	0	80	1
Other and unspecified mental and behavioural disorders	3	2	91	1

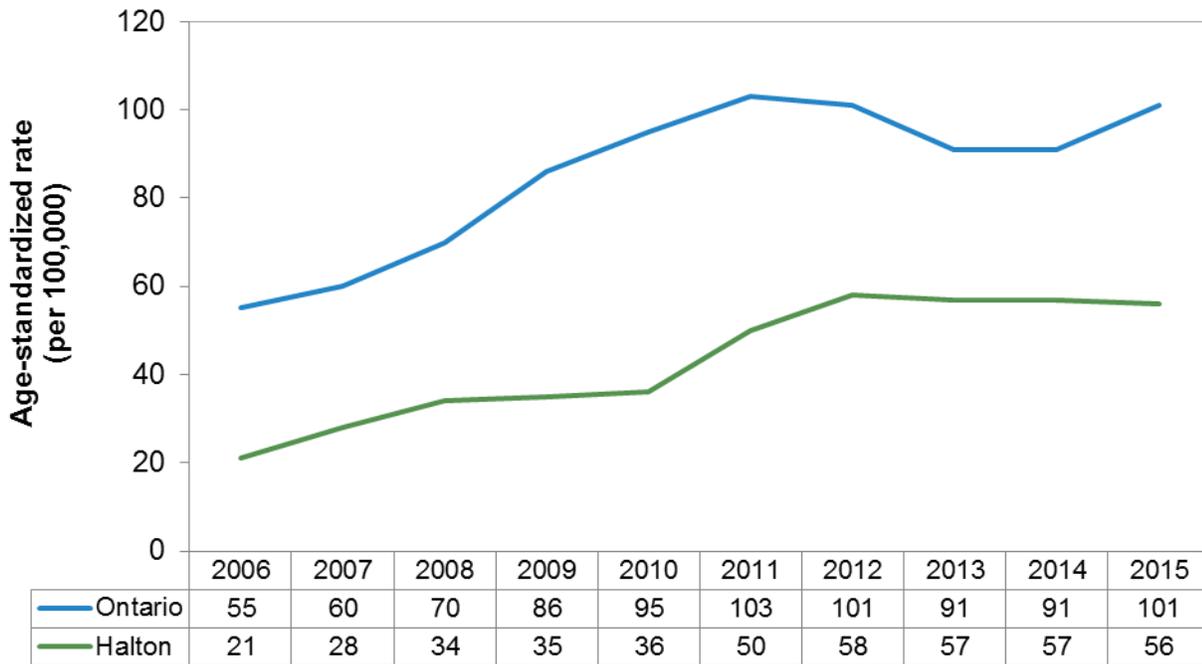
Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 22, 2016.

\*In both Halton and Ontario, roughly 2% of visits involved a mental or behavioural issue in more than one category; these visits have been counted once in each category.

## Trends over time

The Halton age-standardized rate of opioid-related ED visits increased from 21 visits per 100,000 in 2006 to 56 visits per 100,000 in 2015. The same indicator in Ontario increased from 55 visits per 100,000 in 2006 to 101 visits per 100,000 in 2015. Both increases were statistically significant.

The 2015 age-standardized rate of opioid-related ED visits in Ontario was nearly twice as high as the Halton rate, and this difference was also statistically significant (see **Figure 2**).

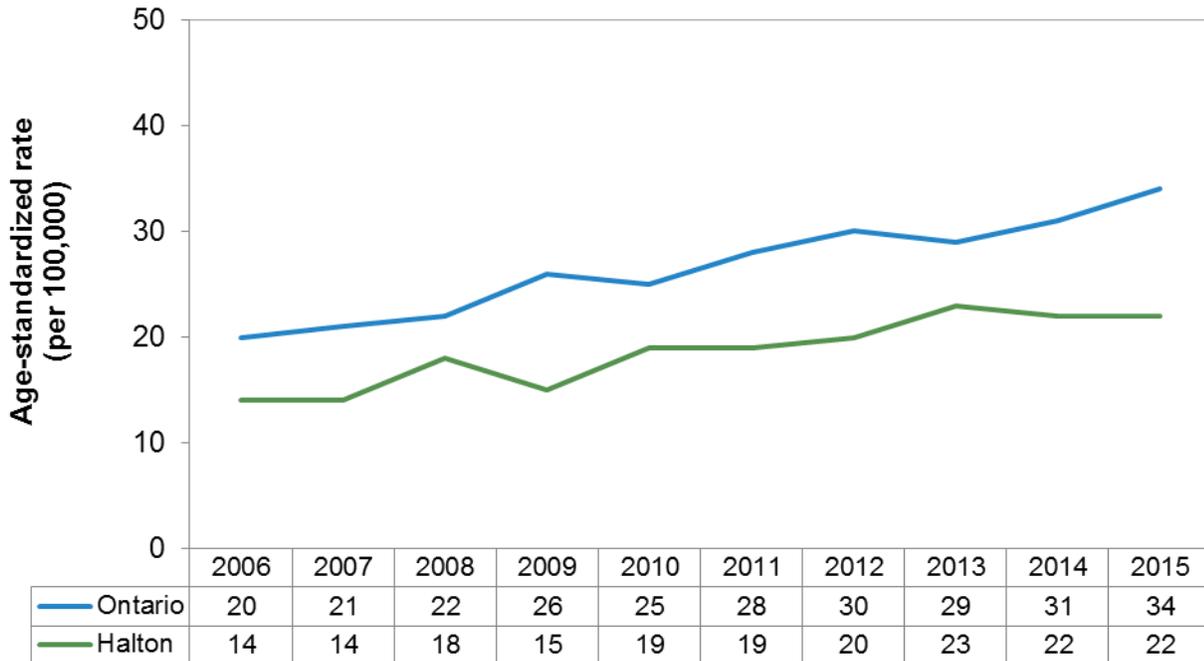


**Figure 2: All opioid-related emergency department visits, age-standardized rates (per 100,000), ages 15 and over, Halton Region and Ontario, 2006-2015.**

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 22, 2016.

The Halton age-standardized rate of ED visits involving opioid overdose increased from 14 visits per 100,000 in 2006 to 22 visits per 100,000 in 2015. From 2006 to 2015, the same indicator in Ontario increased from 20 visits per 100,000 to 34 visits per 100,000. Both increases were statistically significant.

The 2015 age-standardized rate of ED visits involving opioid overdose in Ontario was higher than the Halton rate, and this difference was statistically significant (see **Figure 3**).

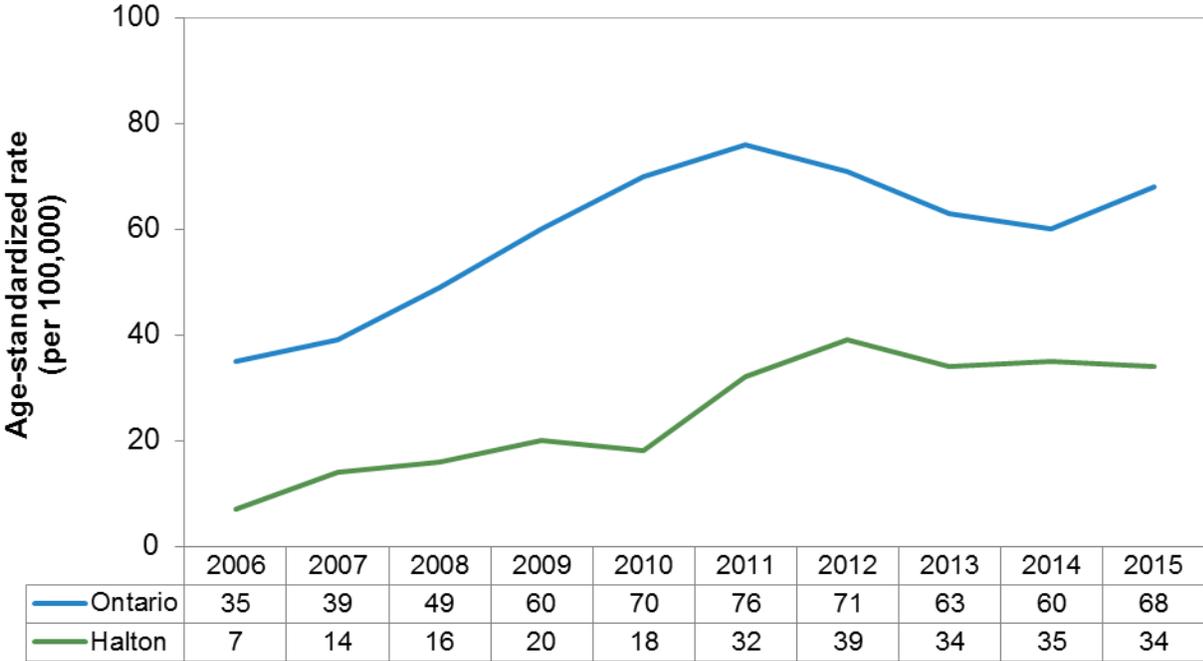


**Figure 3: Emergency department visits involving opioid overdose, age-standardized rates (per 100,000), ages 15 and over, Halton Region and Ontario, 2006-2015.**

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 22, 2016.

The Halton age-standardized rate of ED visits involving an opioid-related mental or behavioural issue increased from 7 visits per 100,000 in 2006 to 34 visits per 100,000 in 2015. From 2006 to 2015, the same indicator in Ontario increased from 35 visits per 100,000 to 68 visits per 100,000. Both increases were statistically significant.

The 2015 age-standardized rate of ED visits involving an opioid-related mental or behavioural issue in Ontario was higher than the Halton rate, and this difference was statistically significant (see **Figure 4**).



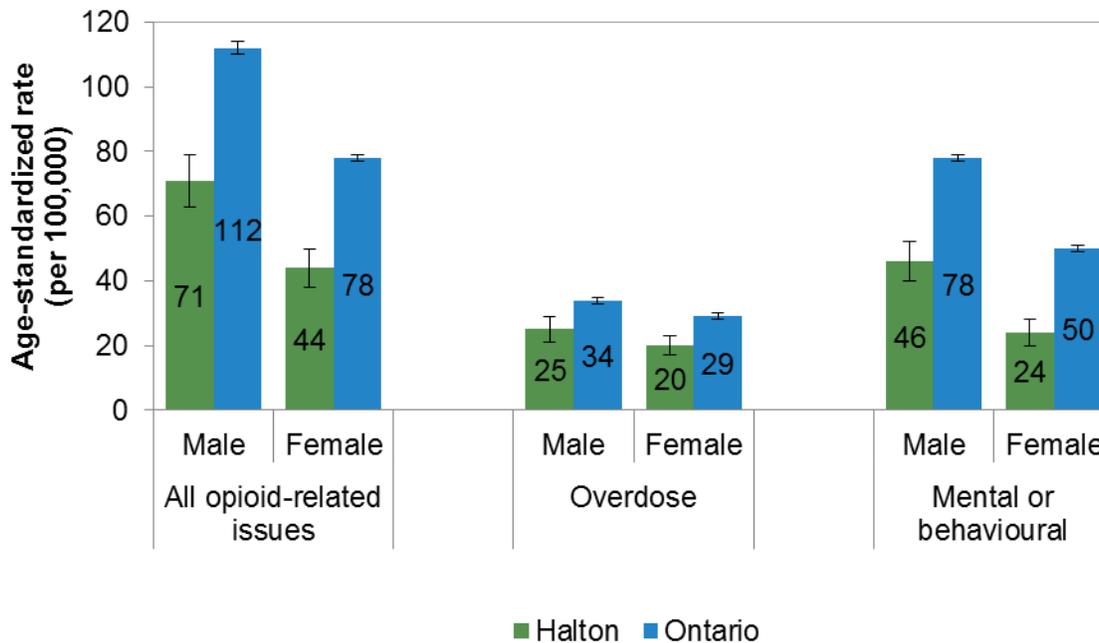
**Figure 4: Emergency department visits involving an opioid-related mental or behavioural issue, age-standardized rates (per 100,000), ages 15 and over, Halton Region and Ontario, 2006-2015.**

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 22, 2016.

## Sex

In both Halton and Ontario, the age-standardized rate of opioid-related ED visits and the age-standardized rate of ED visits for opioid-related mental or behavioural issues between 2013 and 2015 were higher among males compared to females. These sex differences were statistically significant.

The age-standardized rate of ED visits for opioid overdose was significantly higher among males compared to females in Ontario, but in Halton there was no significant sex difference in the rate of ED visits involving opioid overdose (see **Figure 5**).



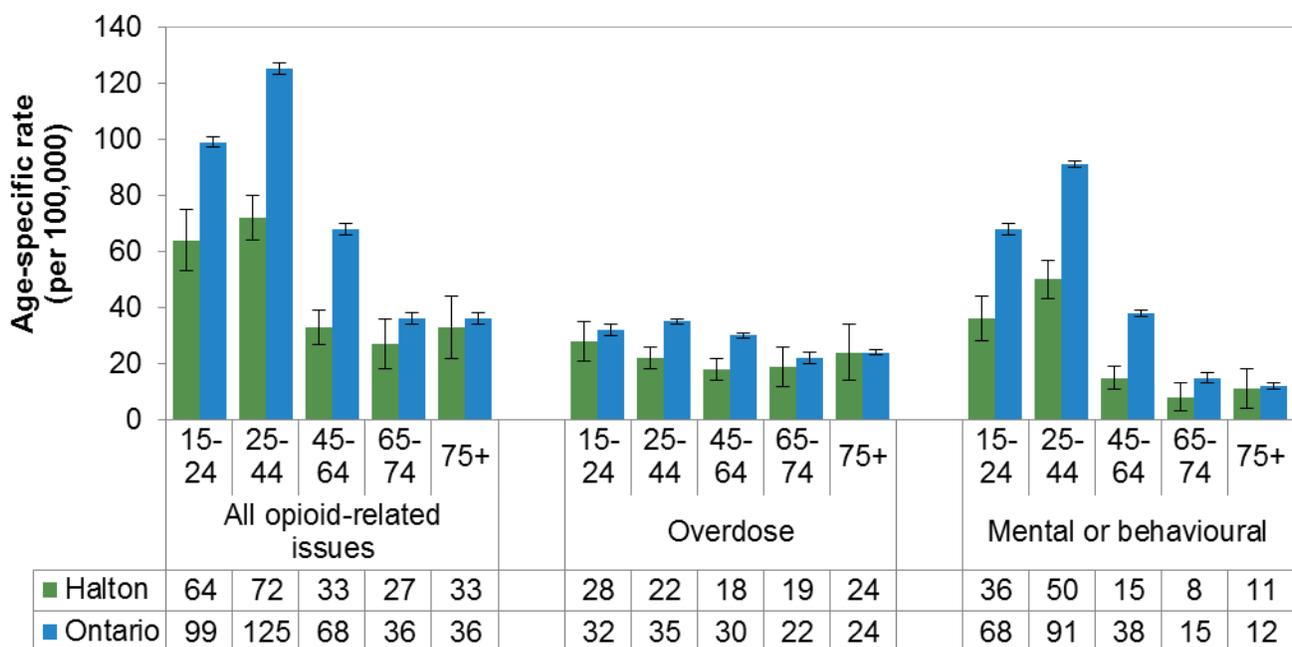
**Figure 5: Opioid-related emergency department visits, age-standardized rates (per 100,000), ages 15 and over, by type of opioid-related issue and sex, Halton Region and Ontario, 2013-2015 combined.**

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 22, 2016.

## Age

Between 2013 and 2015, the age-specific rate of opioid-related ED visits in Halton was highest among those aged 25-44, with the second highest rate among youth and young adults 15-24 and lower rates in all older age groups. A similar trend was observed for Ontario. Halton's age-specific rate was significantly lower than Ontario's among the younger age groups, but this was not true for those above age 65. The same pattern was observed among the age-specific rates of ED visits involving an opioid-related mental or behavioural issue.

Conversely, in Halton the age-specific rate of ED visits involving opioid overdose was highest among youth aged 15-24, and then decreased before rising again among those aged 75 and over. In Ontario, the age-specific rate of ED visits remained highest among those aged 25-44 even for ED visits involving opioid overdose (see **Figure 6**).



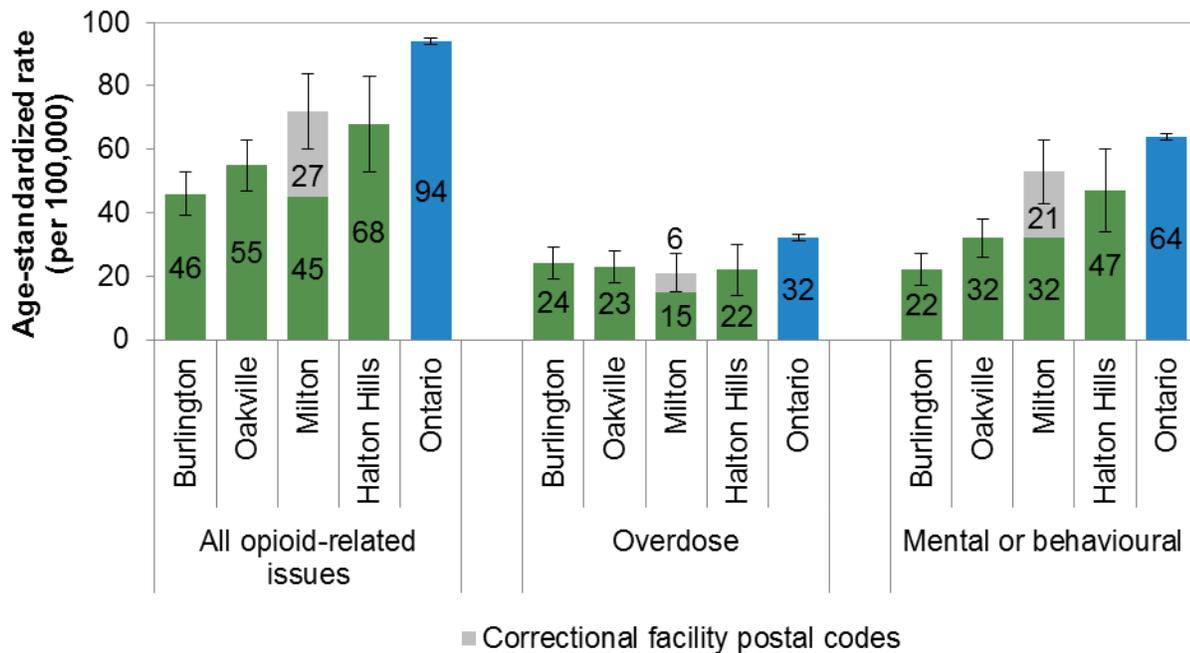
**Figure 6: Opioid-related emergency department visits, age-specific rates (per 100,000), ages 15 and over, by type of opioid-related issue, Halton Region and Ontario, 2013-2015 combined.**

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 22, 2016.

## Municipality

Between 2013 and 2015, there was an average of 67 opioid-related ED visits per year among Burlington residents, 74 ED visits by Oakville residents, 51 visits among Milton residents, and 31 visits by Halton Hills residents (see [Appendix A](#)).

All Halton municipalities had significantly lower rates compared to Ontario overall. There were no statistically significant differences in the age-standardized rate of ED visits for opioid overdose between the municipalities. The age-standardized rate of ED visits for opioid-related mental or behavioural issues was significantly lower in Burlington compared to Milton and Halton Hills, and was also significantly lower in Oakville compared to Milton (see **Figure 7**). However, it is important to note that a large number of opioid-related ED visits in Milton were made by individuals living in two correctional facilities. These individuals may not be usual residents of Milton or Halton, and are only living there during their incarceration. The portions of the age-standardized rates due to visits by residents of these correctional facilities are shown in gray in **Figure 7**.



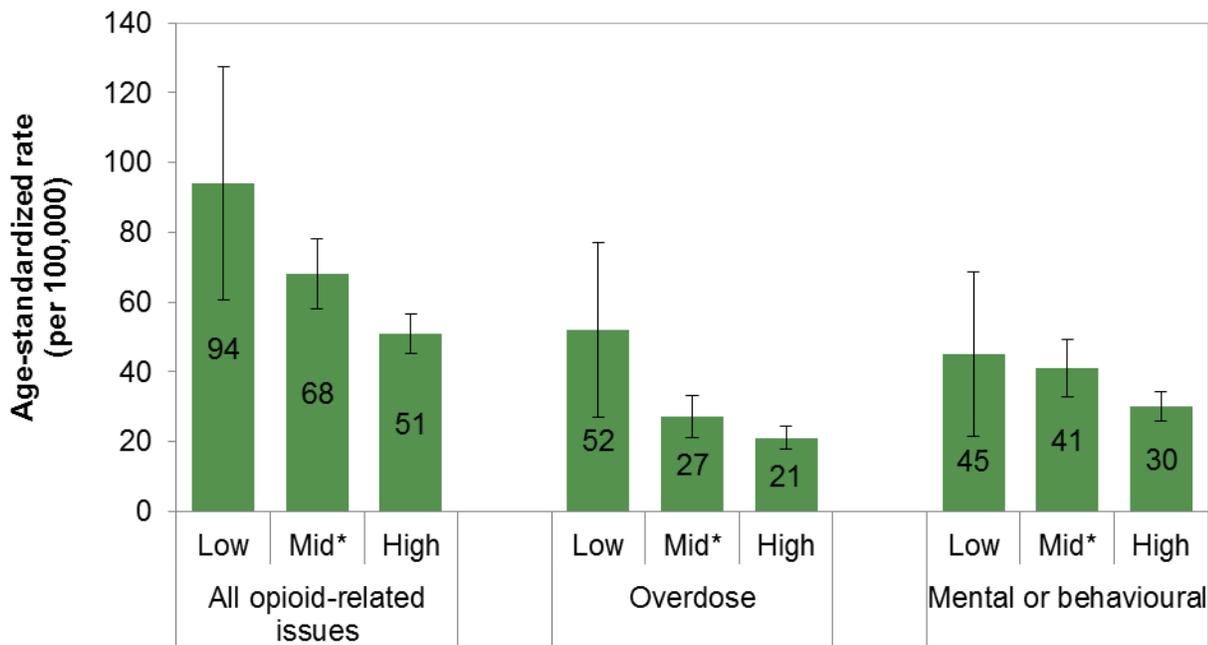
**Figure 7: Opioid-related emergency department visits, age-standardized rates (per 100,000), ages 15 and over, by type of opioid-related issue and municipality, Halton Region and Ontario, 2013-2015 combined.**

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 22, 2016.

## Neighbourhood income

Between 2013 and 2015, the age-standardized rate of opioid-related ED visits showed a gradient by neighbourhood income, with the highest rate among those living in low-income neighbourhoods and the lowest rate among those living in high-income neighbourhoods. The difference was statistically significant between the low and high groups for all opioid-related ED visits combined, and for ED visits involving opioid overdose. It was not statistically significant for ED visits involving opioid-related mental or behavioural issues (see **Figure 8**).

Please note that while rates were highest among individuals residing in low-income neighbourhoods, the majority of ED visits were made by residents of middle and high income neighbourhoods, as these populations are much larger in Halton (see **Table 5** in **Appendix A**).



**Figure 8: Opioid-related emergency department visits, age-standardized rates (per 100,000), ages 15 and over, by type of opioid-related issue and neighbourhood income, Halton Region and Ontario, 2013-2015 combined.**

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 22, 2016.

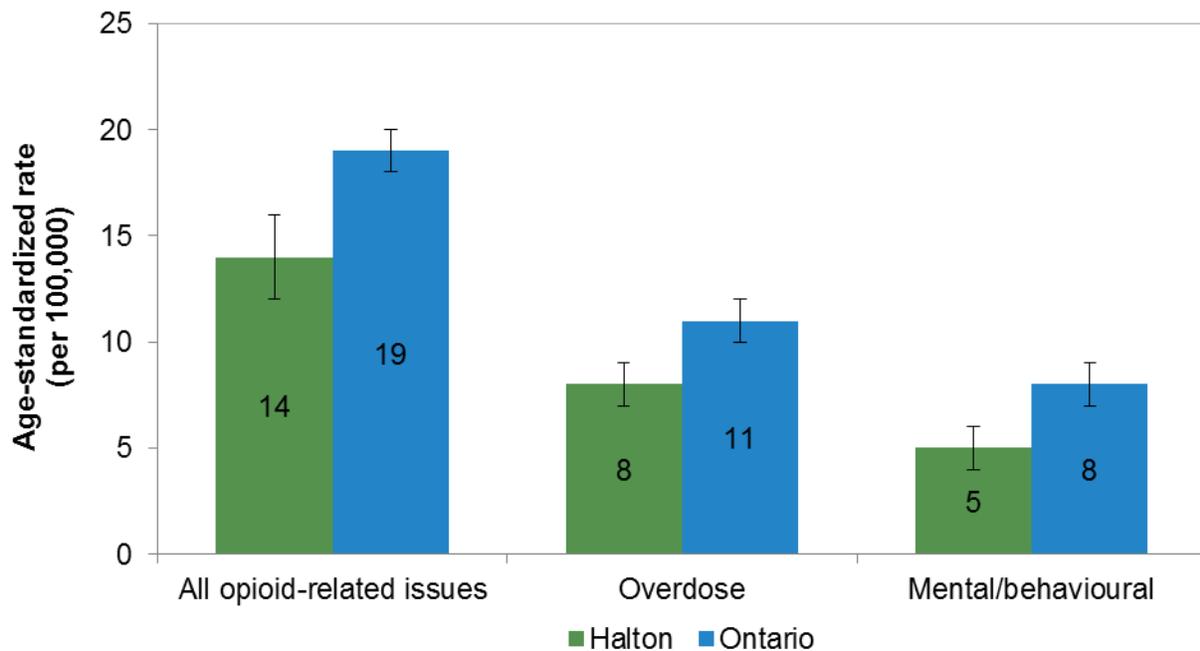
\*Individuals in Milton residing in two correctional facilities (located in a mid-income neighbourhood) have been excluded from the mid-income estimate to avoid distorting the association between income and opioid-related ED visits in Halton.

# Hospitalizations

## Halton versus Ontario

Between 2013 and 2015, there was an average of 59 opioid-related hospitalizations per year in Halton, while there was an average of 2,143 opioid-related hospitalizations per year in Ontario overall. As there was an average of 223 opioid-related ED visits per year between 2013 and 2015, this number indicates that approximately 26% of opioid-related ED visits per year by Halton residents resulted in hospitalization.

The age-standardized rates for all opioid-related hospitalizations combined, hospitalizations involving opioid overdose, and hospitalizations involving opioid-related mental or behavioural issues specifically for 2013-2015 were all higher in Ontario than they were in Halton. These differences were each statistically significant (see **Figure 9**).



**Figure 9: Opioid-related hospitalizations, age-standardized rates (per 100,000), ages 15 and over, by type of opioid-related issue, Halton Region and Ontario, 2013-2015 combined.**

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 24, 2016.

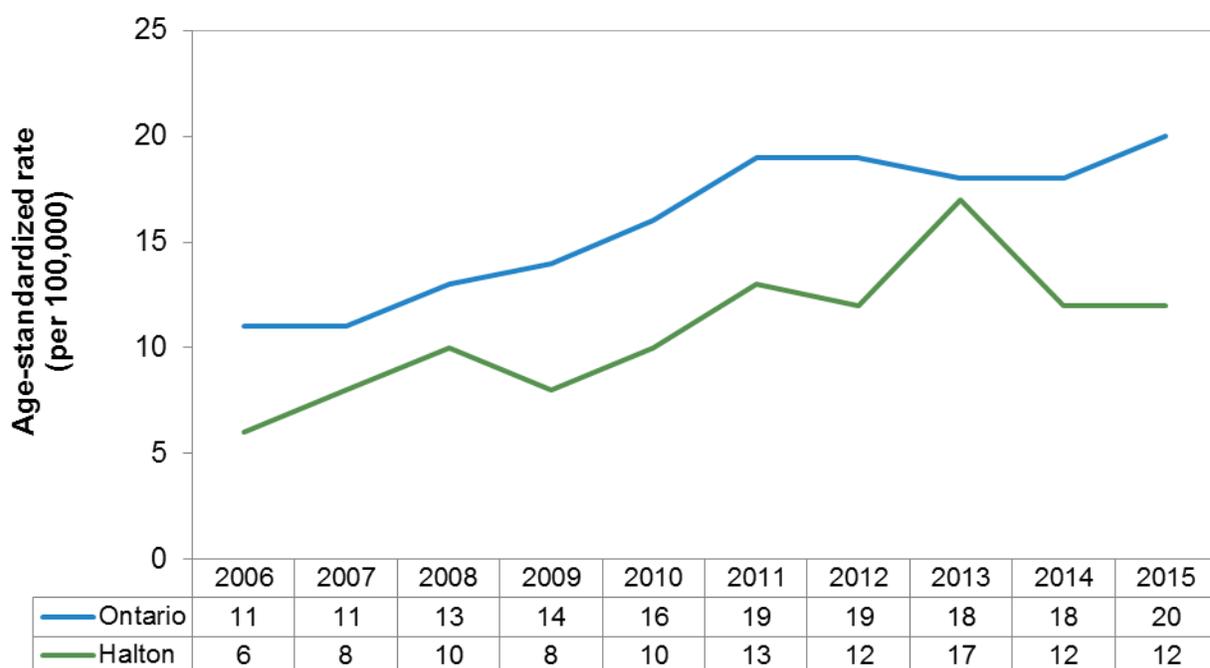
## Type of opioid-related hospitalization

Of the 59 opioid-related hospitalizations per year, an average of 22 hospitalizations per year (37%) involved an opioid-related mental or behavioural issue, while an average of 38 hospitalizations per year (64%) involved an opioid overdose. Since 22 and 38 sum to 60, but there were only a total of 59 hospitalizations per year, this means that on average, 1 hospitalization per year (2%) involved both an opioid overdose and an opioid-related mental or behavioural issue. Although opioid-related mental or behavioural issues accounted for the majority of opioid-related ED visits (see **Type of opioid overdose** in the **Emergency department visits** section), opioid overdoses accounted for the majority of opioid-related hospitalizations, indicating that visits involving an opioid overdose are more likely to lead to a hospitalization than visits involving an opioid-related mental or behavioural issue. The division was similar provincially, with 38% of hospitalizations involving an opioid-related mental or behavioural issue, 63% involving an opioid overdose, and 1% involving both.

Please note that due to the small number of opioid-related hospitalizations, hospitalization rates are not further disaggregated in this report (e.g. by sex, age, municipality, or neighbourhood income).

## Trends over time

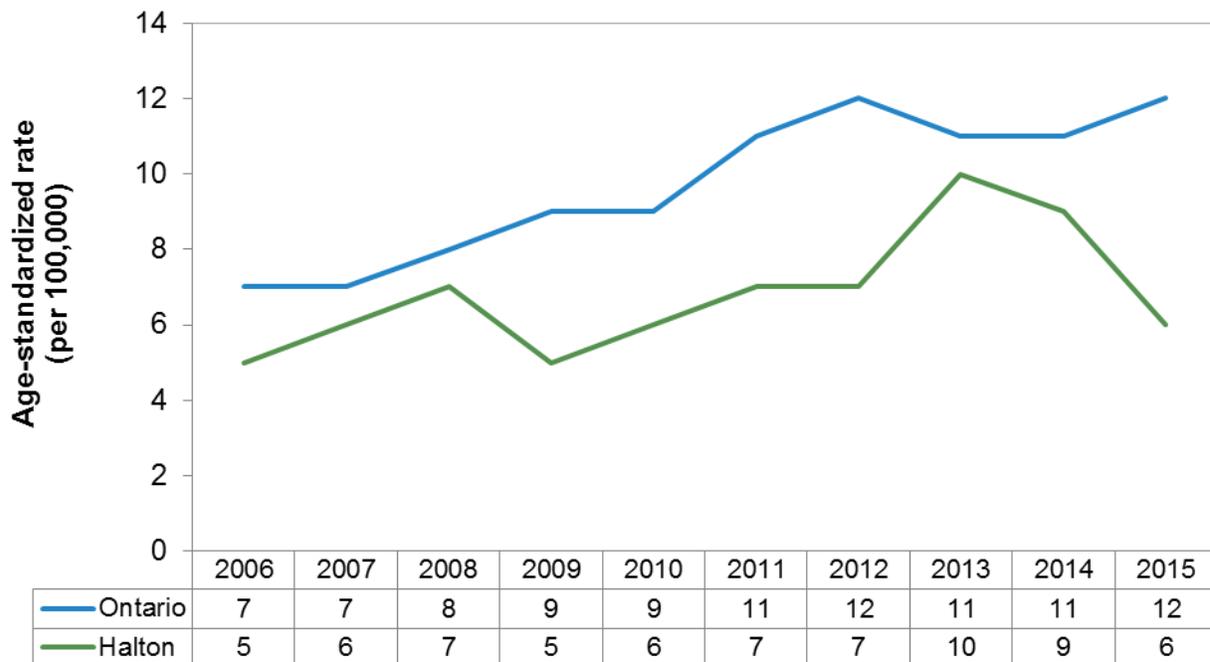
The Halton age-standardized rate of opioid-related hospitalizations increased from 6 hospitalizations per 100,000 in 2006 to 12 hospitalizations per 100,000 in 2015. From 2006 to 2015, the same indicator in Ontario increased from 11 hospitalizations per 100,000 to 20 hospitalizations per 100,000 (see **Figure 10**). Both increases were statistically significant.



**Figure 10: All opioid-related hospitalizations, age-standardized rates (per 100,000), ages 15 and over, Halton Region and Ontario, 2006-2015.**

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 24, 2016.

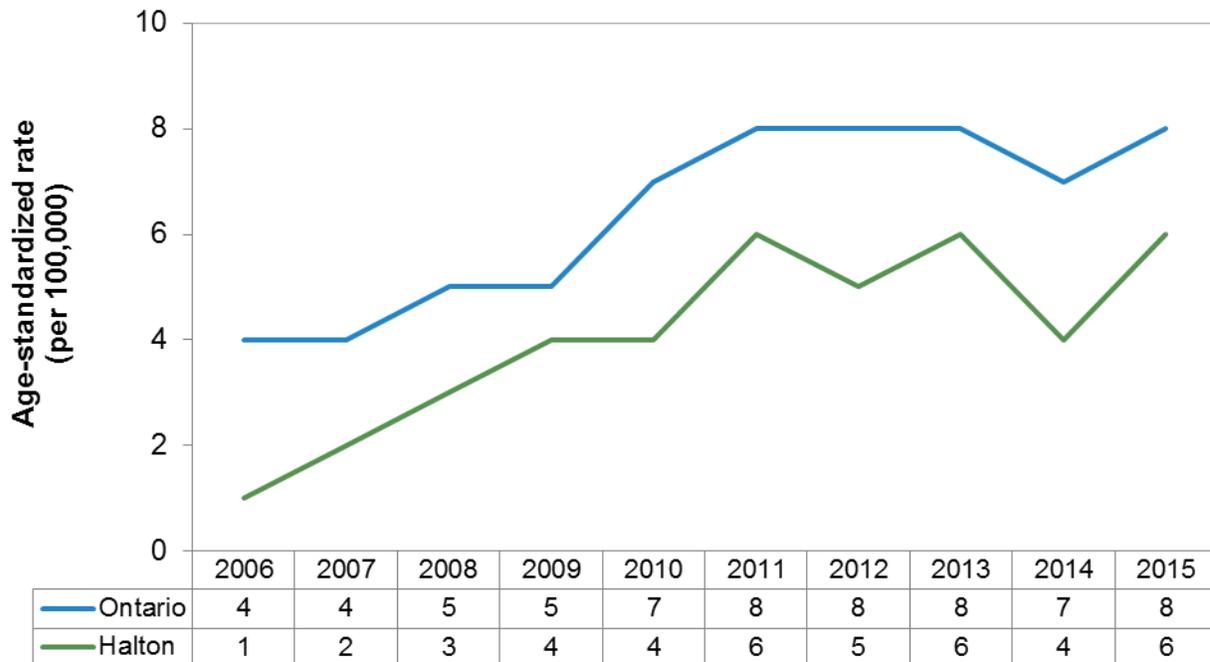
From 2006 to 2015, the age-standardized rate of hospitalizations involving opioid overdose in Ontario increased from 7 hospitalizations per 100,000 to 12 hospitalizations per 100,000. This increase was statistically significant. The Halton age-standardized rate has fluctuated due to small numbers (see **Figure 11**).



**Figure 11: Hospitalizations involving opioid overdose, age-standardized rates (per 100,000), ages 15 and over, Halton Region and Ontario, 2006-2015.**

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 24, 2016.

From 2006 to 2015, the age-standardized rate of hospitalizations involving an opioid-related mental or behavioural issue in Ontario increased from 4 hospitalizations per 100,000 to 8 hospitalizations per 100,000. This difference was statistically significant. The Halton rate has fluctuated due to small numbers, but overall has also significantly increased (see **Figure 12**).



**Figure 12: Hospitalizations involving an opioid-related mental or behavioural issue, age-standardized rates (per 100,000), ages 15 and over, Halton Region and Ontario, 2006-2015.**

Source: IntelliHEALTH, Ontario Ministry of Health and Long-Term Care, extracted August 24, 2016.

## Deaths

On average, about 2,800 Halton residents die each year from all causes (see the [Halton Mortality Report](#) for more information). According to the Office of the Chief Coroner of Ontario, between 2011 and 2015, there was an average of 13 deaths involving opioid toxicity per year in Halton (see **Table 4**). This includes deaths due to opioid toxicity alone, as well as deaths due to combined opioid and alcohol toxicity. Approximately 12 of the total 63 deaths (19%), or on average 2 per year, involved fentanyl.

**Table 4: Deaths from opioid toxicity or combined opioid and alcohol toxicity, Halton Region, 2011-2015.**

Year	Decedents
2011	14
2012	14
2013	9
2014	11
2015	15*
<b>Total</b>	<b>63</b>

Source: Office of the Chief Coroner of Ontario, personal communication, November 8, 2016.

\*Preliminary figure, which is subject to change.

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## Appendix A: Counts of opioid-related emergency department visits in Halton

**Table 5: Average counts of opioid-related ED visits in Halton, 2013-2015 combined, by type of opioid-related issue.**

		All opioid-related issues	Opioid overdose	Opioid-related mental or behavioural issues
<b>All Halton</b>		223	96	129
<b>Sex</b>	Male	131	51	82
	Female	92	45	47
<b>Age</b>	15-24	46	20	26
	25-44	106	33	74
	45-64	49	27	22
	65-74	12	8	4
	75+	11	8	4
<b>Municipality</b>	Burlington	67	37	30
	Oakville	74	33	42
	Milton	51	14	37
	Halton Hills	31	12	19
<b>Neighbourhood income</b>	Low	32	18	15
	Mid*	183	95	102
	High	368	159	211

\*Individuals in Milton residing in two correctional facilities (located in a mid-income neighbourhood) have been excluded from the mid-income counts.

## Appendix B: Data notes and limitations

### Definitions

**Emergency department (ED) visit:** includes only unscheduled visits to the ED.

**Hospitalization:** patient admission to a hospital following an unscheduled visit to the ED.

**Dissemination areas (DAs):** small geographic units with a population of 400 to 700 persons. DAs are the smallest standard geographic area for which all census data are released. All of Canada is divided into DAs. In 2011, Halton had 734 DAs.

**Neighbourhood income groups:** The National Household Survey (NHS) indicator “in the bottom half of the Canadian distribution” was used as a basis for our neighbourhood income groups. The term neighbourhood refers to a single DA. This indicator provides the percent of households per DA that were in the bottom half of the Canadian distribution based on adjusted household income. Using this value, we ranked all of the DAs in Canada into 10 equal groups (deciles), and then ranked them as low (deciles 1-3), middle (deciles 4-7), or high (deciles 8-10). When looking at Halton alone, this resulted in an unequal number of DAs in each income group since the deciles are based on the national ranking. Each ED record extracted from IntelliHEALTH was assigned to the appropriate DA by using the provided postal code along with the postal code conversion file (2011, PCCF). Since the actual income of individuals is not known, and may vary from their neighbourhood income, misclassification of individuals based on their neighbourhood income instead of household income may diminish the association between income and opioid-related ED visits. Approximately 4% of ED records were not included in the income analysis due to no postal code being provided, incomplete postal codes, postal codes not matching the PCCF file, or DAs being suppressed due to low response to the NHS.

### Data sources

#### **ED and Hospital data:**

Vital Statistics: Ambulatory All Visit Problem Dx and External Cause [2006-2015], Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, Dates Extracted: August 22, 2016 (ED visit data) & August 24, 2016 (hospitalization data).

#### **Mortality data:**

Office of the Chief Coroner for Ontario, Date Received: November 8, 2016.

**Population estimates for Halton and municipalities:** Population Estimates [2006-2015], Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, Date Extracted: August 26, 2016.

### Coding and groupings

#### **Coding for ED and hospital data (ICD-10-CA):**

Canadian Institute for Health Information. (2009). *International classification of diseases and related health problems: Tenth revision*. Ottawa: Canadian Institute for Health Information.

Opioid-related issues resulting in emergency department visits or hospitalizations in this report were coded using the ICD-10-CA classification system. The codes used to define all opioid-related issues combined, opioid overdoses, and opioid-related mental and behavioural issues are listed in **Table 6**.

**Table 6: ICD-10-CA codes for opioid-related ED visits and hospitalizations**

	Grouping Used in Halton Report	ICD-10-CA Codes
<b>All Opioid-Related Issues Combined</b>	Opioid Overdoses	<ul style="list-style-type: none"> <li>• T40.0: Poisoning by opium</li> <li>• T40.1: Poisoning by heroin</li> <li>• T40.2: Poisoning by other opioids</li> <li>• T40.3: Poisoning by methadone</li> <li>• T40.4: Poisoning by other synthetic narcotics</li> <li>• T40.6: Poisoning by other and unspecified narcotics</li> </ul>
	Opioid-Related Mental and Behavioural Issues	<ul style="list-style-type: none"> <li>• F11.0: Mental and behavioural disorders due to use of opioids, acute intoxication</li> <li>• F11.1: Mental and behavioural disorders due to use of opioids, harmful use</li> <li>• F11.2: Mental and behavioural disorders due to use of opioids, dependence syndrome</li> <li>• F11.3: Mental and behavioural disorders due to use of opioids, withdrawal state</li> <li>• F11.4: Mental and behavioural disorders due to use of opioids, withdrawal state with delirium</li> <li>• F11.5: Mental and behavioural disorders due to use of opioids, psychotic disorder</li> <li>• F11.6: Mental and behavioural disorders due to use of opioids, amnesic syndrome</li> <li>• F11.7: Mental and behavioural disorders due to use of opioids, residual and late-onset psychotic disorder</li> <li>• F11.8: Mental and behavioural disorders due to use of opioids, other mental and behavioural disorders</li> <li>• F11.9: Mental and behavioural disorders due to use of opioids, unspecified mental and behavioural disorder</li> </ul>

The ICD-10-CA codes included in each overdose-related grouping in this report and the drugs captured by these ICD-10-CA codes are listed in **Table 7**.

**Table 7: Drugs captured by opioid overdose groupings**

Grouping used in Halton Report	ICD-10-CA Codes Included in Grouping	Drugs Captured by ICD-10-CA Code
<b>Heroin</b>	T40.1: Poisoning by heroin	Diacetylmorphine; diamorphine; heroin
<b>Other opioids</b>	T40.2: Poisoning by other opioids	Acemorphan; Antitussive NEC* - codeine mixture; Antitussive NEC - opiate; codeine; dihydrocodeine; dihydrocodeinone; dihydrohydroxycodone; dihydromorphinone; drocode; ethylmorphine; hydrocodone; hydromorphone; methylmorphine; morfin; morphine; nicomorphine; opioid NEC; oxycodone; oxymorphone
<b>Methadone</b>	T40.3: Poisoning by methadone	Amidone; methadone
<b>Other synthetic narcotics</b>	T40.4: Poisoning by other synthetic narcotics	Alfentanil; alphaprodine; anileridine; bezitramide; buprenorphine; butorphanol; dextromoramide; dextropropoxyphene; dipipanone; eptazocine; ethoheptazine; fentanyl; isonipecaine; ketobemidone; levopropoxyphene; levorphanol; meperidine; nalbuphine; Narcotic NEC - synthetic NEC; pentazocine; pethidine; phenazocine; phenoperidine; piritramide; profadol; propoxyphene; sufentanil; tilidine; tramadol;
<b>Opium or other and unspecified narcotics</b>	T40.0: Poisoning by opium T40.6: Poisoning by other and unspecified narcotics	Laudanum; opium alkaloids; papaveretum; paregoric Analgesic NEC - narcotic NEC; Narcotic NEC; Opiate NEC

\*NEC: "Not Elsewhere Classified"

The ICD-10-CA codes falling into each grouping of opioid-related mental or behavioural issues and a description of the problem(s) captured by these ICD-10 codes are provided in **Table 8**.

**Table 8: Problems captured by groupings of opioid-related mental or behavioural issues**

Grouping used in Halton Report	ICD-10-CA Codes Included in Grouping	Description of Issue in ICD-10-CA Code <sup>8</sup>
<b>Acute opioid intoxication</b>	F11.0: Mental and behavioural disorders due to use of opioids, acute intoxication	<p>“A condition that follows the administration of a psychoactive substance resulting in disturbances in level of consciousness, cognition, perception, affect or behaviour, or other psychophysiological functions and responses. The disturbances are directly related to the acute pharmacological effects of the substance and resolve with time, with complete recovery, except where tissue damage or other complications have arisen. Complications may include trauma, inhalation of vomitus, delirium, coma, convulsions, and other medical complications. The nature of these complications depends on the pharmacological class of substance and mode of administration.</p> <p>Includes: “Bad trips” (drugs); pathological intoxication; trance and possession disorders in psychoactive substance intoxication Excludes: intoxication meaning poisoning”</p>
<b>Opioid substance abuse</b>	F11.1: Mental and behavioural disorders due to use of opioids, harmful use	<p>“A pattern of psychoactive substance use that is causing damage to health. The damage may be physical (as in cases of hepatitis from the self-administration of injected psychoactive substances) or mental (e.g. episodes of depressive disorder secondary to heavy consumption of alcohol). Includes: Psychoactive substance abuse”</p>
<b>Opioid dependence syndrome</b>	F11.2: Mental and behavioural disorders due to use of opioids, dependence syndrome	<p>“A cluster of behavioural, cognitive, and physiological phenomena that develop after repeated substance use and that typically include a strong desire to take the drug, difficulties in controlling its use, persisting in its use despite harmful consequences, a higher priority given to drug use than to other activities and obligations, increased tolerance, and sometimes a physical withdrawal state. The dependence syndrome may be present for a specific psychoactive substance (e.g. tobacco, alcohol, or diazepam), for a class of substances (e.g. opioid drugs), or for a wider range of pharmacologically different psychoactive substances. Includes: Drug addiction”</p>
<b>Opioid withdrawal</b>	F11.3: Mental and behavioural disorders due to use of opioids, withdrawal state	<p>“A group of symptoms of variable clustering and severity occurring on absolute or relative withdrawal of a psychoactive substance after persistent use of that substance. The onset and course of the withdrawal state are time-limited and are related to the type of psychoactive substance and dose being used immediately before cessation or reduction of use. The withdrawal state may be complicated by convulsions.”</p>
	F11.4: Mental and behavioural disorders due to use of opioids, withdrawal state with delirium	<p>“A condition where the withdrawal state as defined in the common fourth character .3 is complicated by delirium as defined in F05.-. Convulsions may also occur...”</p>
<b>Psychotic disorder due to opioid use</b>	F11.5: Mental and behavioural disorders due to use of opioids, psychotic disorder	<p>“A cluster of psychotic phenomena that occur during or following psychoactive substance use but that are not explained on the basis of acute intoxication alone and do not form part of a withdrawal state. The disorder is characterized by hallucinations (typically auditory, but often in more than one sensory modality), perceptual distortions, delusions (often of a paranoid or persecutory nature), psychomotor disturbances (excitement or stupor), and an abnormal affect, which may range from intense fear to ecstasy. The sensorium is usually clear but some degree of clouding of consciousness, though not severe confusion, may be present. Excludes: alcohol- or other psychoactive substance-induced residual and late-onset psychotic disorder (F10-F19 with common fourth character .7)”</p>

<b>Other and unspecified mental and behavioural disorders</b>	F11.6: Mental and behavioural disorders due to use of opioids, amnesic syndrome	“Includes: Amnesic disorder, alcohol- or drug-induced Korsakov's psychosis or syndrome, alcohol- or other psychoactive substance induced or unspecified. Use additional code, (E51.2 †G32.8*) when associated with Wernicke's disease or syndrome. Excludes: nonalcoholic Korsakov's psychosis or syndrome (F04)”
	F11.7: Mental and behavioural disorders due to use of opioids, residual and late-onset psychotic disorder	“A disorder in which alcohol- or psychoactive substance-induced changes of cognition, affect, personality, or behaviour persist beyond the period during which a direct psychoactive substance-related effect might reasonably be assumed to be operating. Onset of the disorder should be directly related to the use of the psychoactive substance. Cases in which initial onset of the state occurs later than episode(s) of such substance use should be coded here only where clear and strong evidence is available to attribute the state to the residual effect of the psychoactive substance. Flashbacks may be distinguished from psychotic state partly by their episodic nature, frequently of very short duration, and by their duplication of previous alcohol or other psychoactive substance-related experiences. Includes: Dementia and other milder forms of persisting impairment of cognitive functions; Flashbacks; Late-onset psychoactive substance-induced psychotic disorder; Post-hallucinogen perception disorder. Residual: affective disorder; disorder of personality and behaviour. Excludes: alcohol- or psychoactive substance-induced: Korsakov's syndrome (F10-F19 with common fourth character .6); psychotic state (F10-F19 with common fourth character .5)”
	F11.8: Mental and behavioural disorders due to use of opioids, other mental and behavioural disorders	N/A
	F11.9: Mental and behavioural disorders due to use of opioids, unspecified	N/A

### Statistical significance

95% confidence intervals were calculated for rates. A 95% confidence interval (CI) refers to the range of values that has a 95% chance of including the true estimate. 95% CIs are reported in brackets or presented as “I” shaped bars in the graphs. When CIs do not overlap between 2 or more groups (e.g., when comparing Halton and Ontario rates) it means that the differences between the groups are **statistically significant** and unlikely to be due to chance alone. Since overlapping confidence intervals are used to determine statistical significance, p-values are not calculated. This is a conservative approach ( $\alpha < 0.01$ ), which is more appropriate when multiple comparisons are being made, such as in this report. In other words, there is only a 1% chance that any statistically significant findings in this report were found due to chance alone and not true differences in the population. Although this is population-level data, and not survey responses, confidence intervals were calculated in this report to account for changes in the population, human error, and misclassification.

Rounded estimates and CIs are used for the presentation of data; however, non-rounded CIs were used to determine statistically significant differences.

Trends over time were tested for significance using linear regression and autocorrelation.

## Limitations

For overall rates, hospital and ED data are related to the number of visits to the hospital/ED, not the number of people. However, when broken down by type of opioid-related issue, the same visit can be classified as more than one type if the person presented to the ED/hospital with both an opioid overdose and an opioid-related mental or behavioural issue, or with an overdose involving more than one drug category, or with opioid-related mental or behavioural issues from more than one category. Individuals may visit an ED several times for the same opioid-related issue, or may visit or be transferred to more than one hospital for the same issue.

The diagnosis codes used to classify ED visits and hospitalizations as opioid-related have not been validated in Ontario databases; therefore, it is possible that there is misclassification.

ED visits and hospitalization data reflect only a portion of opioid use within the population, as individuals who do not visit the ED for opioid-related issues are not captured in this report.

ED visit and hospitalization data do not include opioid-related issues experienced by Halton residents outside of Ontario. Halton residents who died due to opioid overdose outside of Halton are also not included, and the death counts may include individuals who died in Halton but who resided elsewhere.

Ontario counts and rates exclude individuals from out of province, or with unknown residence.

All ED visit and hospitalization counts and rates reflect only individuals ages 15 and over, because opioid use involving children 14 and under is likely to reflect accidental ingestion or medical issues. Individuals with unknown age have also been excluded from both counts and rates.

Overdoses, whether intentional, unintentional, or of undetermined intent, are prone to misclassification. Studies have suggested that intentional poisonings may be under-reported.<sup>9</sup> It is possible that some overdoses classified as accidental or undetermined intent may have been better classified as intentional, and information on intentionality was entirely missing for a large number of overdoses. Thus, the breakdown of overdoses by intentionality should be treated with caution.

ED visits and hospitalizations involving individuals living in two Milton correctional facilities were included except in the income analysis, where they were excluded, in order to obtain a true representation of the association between neighbourhood income and opioid-related ED visits in Halton. The portion of the age-standardized rates due to visits involving individuals living in these correctional facilities is also shown separately in the municipality analysis in order to convey what portion of the age-standardized rate is likely due to individuals residing in Milton simply due to incarceration, as opposed to more permanent residents of Milton.

