

# Ontario Prescription Opioid Tool

## Technical Appendix

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## Background

Monitoring trends and patterns of opioid prescriptions and the associated risks has become a provincial and national priority. Public Health Ontario, in collaboration with other provincial partners, developed an [interactive surveillance tool](#) in 2017 to describe the magnitude and distribution of opioid-related emergency department visits, hospitalizations, and deaths in Ontario. To complement this, the ODPRN has developed an interactive tool to provide public access to indicators of opioid prescription dispensing in Ontario. This tool and associated indicators were developed in collaboration with Public Health Ontario, with input from a variety of stakeholders including the Ontario Ministry of Health and Long-Term Care, Public Health Units (PHUs), and Local Health Integration Networks (LHINs). Using data from the Narcotics Monitoring System (NMS), which captures all opioid prescriptions dispensed from community pharmacies in Ontario, the tool presents trends in the number and rate of people dispensed various types of opioid prescriptions, the number and rate of people receiving high daily dose opioid prescriptions, the volume of opioid prescriptions dispensed, as well as trends in the number and rate of prescribers for opioid agonist therapy (OAT). In addition, information from the Ontario Drug Benefit (ODB) program was leveraged to provide estimates on publicly-funded pharmacy-dispensed naloxone. We aimed to present patterns in the distribution of these indicators by age, sex, LHIN, and PHU. However, due to privacy requirements, in some circumstances we were restricted in the age and sex stratifications we were able to report.

## Indicators

### Individuals dispensed an opioid for pain

$$\frac{\text{\# of individuals dispensed an opioid for pain}}{\text{Population}} \times 1000$$

- **Numerator:** Total number of unique individuals who were dispensed a prescription opioid with an indication to treat pain. This includes opioids administered through oral and transdermal routes as well as injectables and suppositories. This excludes opioids indicated for OAT, and opioids indicated to treat cough, diarrhea, or for medical assistance in dying. This excludes over-the-counter medications for pain that contain opioids, which are not captured in the NMS database.
- **Denominator:** Population for the time period, geographic region, and age group or sex of interest.

### Individuals dispensed an opioid for cough

$$\frac{\text{\# of individuals dispensed an opioid for cough}}{\text{Population}} \times 1000$$

- **Numerator:** Total number of unique individuals who were dispensed a prescription opioid with an indication to treat cough. This excludes over-the-counter cough medications that contain opioids, which are not captured in the NMS database. This excludes opioids indicated for OAT and opioids used to treat pain.
- **Denominator:** Population for the time period and geographic region of interest.

## Volume of opioids dispensed for pain

$$\frac{\text{Total volume of opioids dispensed (in milligrams of morphine equivalents)}}{\text{Population}}$$

- **Numerator:** Total volume of prescription opioids dispensed with an indication to treat pain, in milligrams of morphine equivalents (MMEs; see [Methodological Notes](#) section for definition and calculation). Total volume is calculated as the sum of the dose on each opioid prescription dispensed to treat pain. This indicator is restricted to prescription opioids that have a valid milligram morphine equivalent conversion factor. This excludes opioids indicated for OAT, and opioids indicated to treat cough, diarrhea, or for medical assistance in dying. This excludes over-the-counter medications for pain that contain opioids, which are not captured in the NMS database.
- **Denominator:** Population for the time period, geographic region, and age group or sex of interest.

## Prevalence of people dispensed a long-acting opioid with a high daily dose

$$\frac{\text{\# of individuals dispensed a long-acting opioid with a high average daily dose}}{\text{Total number of individuals dispensed a long-acting opioid}} \times 100$$

- **Numerator:** Total number of unique individuals who were dispensed a long-acting prescription opioid with an average daily dose that exceeds 50 MME, 90 MME, or 200 MME. Average daily dose is calculated as the total dose of an opioid prescription divided by the days' supply (see [Methodological Notes](#) section for definition and calculation). This indicator does not consider overlapping opioid prescriptions in the calculation of average daily dose for an individual, and therefore may underestimate the actual dose a person is receiving if they are taking more than one opioid prescription at a time. This indicator is restricted to prescription opioids indicated to treat pain with a valid morphine equivalent conversion factor (as described above).
- **Denominator:** Total number of unique individuals dispensed a long-acting prescription opioid with an indication to treat pain and a valid morphine equivalent conversion factor.

## Opioid drug and formulation dispensed to treat pain

$$\frac{\text{\# of individuals dispensed an opioid for pain, by drug and formulation}}{\text{Population}} \times 1000$$

- **Numerator:** Total number of unique individuals who were dispensed a prescription opioid with an indication to treat pain, by drug and formulation (see [Methodological Notes](#) section for definition). These data are not mutually exclusive. Individuals who received more than one opioid prescription in a given year for different opioid drugs would be counted in each applicable drug category. This indicator excludes opioids indicated for OAT, and opioids indicated to treat cough, diarrhea, or for medical assistance in dying. This excludes over-the-counter medications for pain that contain opioids, which are not captured in the NMS database.
- **Denominator:** Population for the time period and geographic region of interest.

### Individuals dispensed an opioid for OAT (methadone or buprenorphine/naloxone)

$$\frac{\text{\# of individuals dispensed methadone or buprenorphine/naloxone}}{\text{Population}} \times 1000$$

- **Numerator:** Total number of unique individuals who were dispensed a prescription opioid with an indication for OAT (methadone or buprenorphine/naloxone). This indicator excludes methadone and buprenorphine products that are indicated to treat pain. We used product identification numbers specific to OAT to make this distinction.
- **Denominator:** Population for the time period, geographic region, and age group or sex of interest.

### Individuals dispensed an opioid for OAT (methadone)

$$\frac{\text{\# of individuals dispensed methadone}}{\text{Population}} \times 1000$$

- **Numerator:** Total number of unique individuals who were dispensed a methadone prescription indicated for OAT. This indicator excludes methadone products that are indicated to treat pain.
- **Denominator:** Population for the time period, geographic region, and age group or sex of interest.

### Individuals dispensed an opioid for OAT (buprenorphine/naloxone)

$$\frac{\text{\# of individuals dispensed buprenorphine/naloxone}}{\text{Population}} \times 1000$$

- **Numerator:** Total number of unique individuals who were dispensed a buprenorphine/naloxone prescription. This indicator excludes buprenorphine products that are indicated to treat pain.
- **Denominator:** Population for the time period, geographic region, and age group or sex of interest.

### Prescribers for OAT

$$\frac{\text{\# of prescribers who wrote prescriptions for methadone or buprenorphine/naloxone}}{\text{\# of individuals dispensed methadone or buprenorphine/naloxone}} \times 100$$

- **Numerator:** Total number of unique prescribers (restricted to physicians and nurse practitioners) who wrote prescriptions for methadone or buprenorphine/naloxone. This indicator excludes methadone and buprenorphine products that are indicated to treat pain.
- **Denominator:** Total number of unique individuals who were dispensed an opioid with an indication for OAT (methadone or buprenorphine/naloxone).

### Prescribers for OAT (methadone)

$$\frac{\text{\# of prescribers who only wrote prescriptions for methadone}}{\text{\# of prescribers who wrote prescriptions for methadone or buprenorphine/naloxone}} \times 100$$

- **Numerator:** Total number of unique prescribers (restricted to physicians and nurse practitioners) who only wrote prescriptions for methadone. This excludes methadone products that are indicated to treat pain.
- **Denominator:** Total number of unique prescribers who wrote prescriptions for methadone or buprenorphine/naloxone.

### Prescribers for OAT (buprenorphine/naloxone)

$$\frac{\text{\# of prescribers who only wrote prescriptions for buprenorphine/naloxone}}{\text{\# of prescribers who wrote prescriptions for methadone or buprenorphine/naloxone}} \times 100$$

- **Numerator:** Total number of unique prescribers (restricted to physicians and nurse practitioners) who only wrote prescriptions for buprenorphine/naloxone. This excludes buprenorphine products that are indicated to treat pain.
- **Denominator:** Total number of unique prescribers who wrote prescriptions for methadone or buprenorphine/naloxone.

### Prescribers for OAT (methadone and buprenorphine/naloxone)

$$\frac{\text{\# of prescribers who wrote prescriptions for both methadone and buprenorphine/naloxone}}{\text{\# of prescribers who wrote prescriptions for methadone or buprenorphine/naloxone}} \times 100$$

- **Numerator:** Total number of unique prescribers (restricted to physicians and nurse practitioners) who wrote prescriptions for both methadone and buprenorphine/naloxone. This excludes methadone and buprenorphine products that are indicated to treat pain.
- **Denominator:** Total number of unique prescribers who wrote prescriptions for methadone or buprenorphine/naloxone.

### Pharmacy-dispensed Naloxone

$$\frac{\text{\# of pharmacy-dispensed naloxone kits}}{\text{Population}} \times 1000$$

- **Numerator:** Total number of pharmacy-dispensed naloxone kits, including both injectable and intranasal naloxone. This is restricted to naloxone kits dispensed from pharmacies participating in the Ontario Naloxone Program for Pharmacies.
- **Denominator:** Population for the time period and geographic region of interest.

## Data Sources

These datasets were linked using unique encoded identifiers and analyzed at ICES ([www.ices.on.ca](http://www.ices.on.ca)). The use of data in this project was authorized under section 45 of Ontario's Personal Health Information Protection Act, which does not require review by a Research Ethics Board.

### Opioid Prescriptions Dispensed

#### The Narcotics Monitoring System (NMS), 2012-2018

The NMS captures data on all prescriptions for opioids and other controlled substances dispensed from community pharmacies in Ontario, regardless of payment type (i.e. cash, public drug program, private insurance).

**Important note:** Prescription reversals can occur when a prescription is initially filled by the pharmacist but not actually dispensed to the patient. Prescription reversals can be submitted to the NMS up to 365 days from the date of service. Generally, about 36% of prescriptions that are reversed are submitted within 7 days, and 95% of prescriptions that are reversed are submitted within 3 months of the service date. At ICES, submitted reversals are stored in a separate database from the filled prescriptions. However, the most recent 3 months of filled prescription data may include some reversed prescriptions if they are not processed within the period that ICES receives the data. Overall, about 0.7% of the NMS records will be identified as a reversal and removed from the database in each subsequent data update.

### Pharmacy-dispensed Naloxone

#### The Ontario Drug Benefit (ODB) Database, 2016-2018

The ODB database contains claims for dispensed drugs that are received through the [Ontario Drug Benefit](#) program, which are funded by the Ontario government. This includes drugs listed on the ODB formulary, drugs covered under the Exceptional Access Program, and products and services such as diabetic test strips, influenza vaccination, and naloxone kits. The [Ontario Naloxone Program for Pharmacies](#) was introduced on June 3, 2016, and provides government funding for naloxone, a medication that can counter the effects of an opioid overdose, at community pharmacies in Ontario. Through this program, individuals in Ontario can receive a free naloxone kit from participating pharmacies without a prescription. As of March 27, 2018, individuals do not need to present an Ontario health card to receive a naloxone kit.

### Drug Information Database

#### The drug list file, 2012-2018

The drug master list file contains drug identification numbers for drugs used in Canada from 1990 forward. This file was used to determine characteristics of dispensed opioid prescriptions (e.g., opioid drug, formulation, and strength).

### Demographics

#### The Ontario Health Insurance Plan Registered Persons Database (RPDB), 2012-2017

The RPDB provides basic demographic information about individuals with an Ontario health card number, including age, sex, and place of residence.

### Population

- LHIN:
  - Population Estimates, 2011-2016, Ontario Ministry of Health and Long-Term Care: IntelliHEALTH ONTARIO
  - Population Projections, 2017-2018, Ontario Ministry of Health and Long-Term Care: IntelliHEALTH ONTARIO
- PHU:
  - Population Estimates, 2011-2016, Ontario Ministry of Health and Long-Term Care: IntelliHEALTH ONTARIO

- Population Projections, 2017-2018, Ontario Ministry of Health and Long-Term Care: IntelliHEALTH ONTARIO

These files provide estimates and projections of the Ontario population by age, sex, and LHIN or PHU. Population estimates were available up to 2016. Beginning in 2017, only population projections are available. To determine the provincial population, population estimates or projections were summed across LHINs for each given year.

## Methodological Notes

- Monthly data are reported from July 2012 onwards whenever possible.
- Yearly data are reported from 2013 onwards.
- Data are reported at the provincial, LHIN, and PHU levels whenever possible. LHIN or PHU is based on the individual's location of residence. For the prescribers for OAT indicator, prescribers are also assigned to a LHIN or PHU based on the individual's location of residence. Therefore, a single OAT prescriber could be counted in multiple LHINs or PHUs.
- Data reported by age use the following age groups, whenever possible: 0-14, 15-24, 25-44, 45-64, 65+.
- Data reported by age group are not mutually exclusive. For each individual, age was measured on the date that each opioid prescription was dispensed. Therefore, if an individual received more than one opioid prescription in a given year, and had a birthday between prescriptions where they moved into a subsequent age group, they would contribute to the numerator for both age groups.
- Monthly population data for each LHIN and PHU was calculated by interpolating the change in the annual population counts between the calendar year before and after each given year. Annual estimates were assumed to be for July. Monthly population data for all LHINs were summed to determine monthly population for the province.
- For each indicator, except pharmacy-dispensed naloxone, approximately 2% to 7% of dispensed opioid prescription records were excluded because they were unable to be linked to the Registered Persons Database to determine demographic characteristics and location of residence. The specific exclusion criteria applied to the dispensed prescription records were as follows:
  - Records in which the individual used identification other than an Ontario Health Card
  - Records in which the individual resided outside of Ontario
- On March 27, 2018, a change was made to the Ontario Naloxone Program for Pharmacies allowing pharmacists to provide naloxone kits to individuals who do not present an Ontario health card. As a result, approximately 11% of naloxone claims beyond this date could not be linked to the Registered Persons Database to determine the location of residence of the recipient. To try to preserve as much information as possible in reporting, the following method was used to report pharmacy-dispensed naloxone by LHIN or PHU:
  - For records that could be linked to the Registered Persons Database, geography was based on the recipient's LHIN or PHU of residence
  - For records that could not be linked to the Registered Persons Database, geography was based on the LHIN or PHU of the pharmacy from which the naloxone kit was dispensed
- Records where the census subdivision or residence code was shared between more than one LHIN were not included in results stratified by LHIN. However, this was extremely rare (<10 records overall).
- Records without a recorded LHIN or PHU were not included in results stratified by each respective region, but were included in the provincial-level estimates. However, this was extremely rare (<0.01% of records).
- See the following pages for a list of opioids by drug and formulation, definitions and formulas for calculating milligrams of morphine equivalents, and information regarding small cell suppression.

## List of opioids by drug and formulation

Opioid Drug	Opioid Formulations	Notes
<b>Opioids indicated to treat pain</b>		
Codeine	Immediate release Long-acting	
Codeine combination	Immediate release	
Fentanyl	Immediate release* Long-acting	*Immediate release fentanyl is rarely prescribed in Ontario. Immediate release fentanyl prescriptions accounted for less than 1% of all fentanyl prescriptions between 2013 and 2017, and less than 3% of all individuals dispensed a fentanyl prescription in Ontario between 2013 and 2017 received the immediate release formulation. <b>Therefore, for the opioid drug and formulation indicator, immediate release fentanyl was grouped into the “Other” category, and the overall fentanyl metric only contains long-acting fentanyl products.</b>
Hydromorphone	Immediate release Long-acting	
Morphine	Immediate release Long-acting	
Oxycodone	Immediate release Long-acting	
Oxycodone combination	Immediate release	
Tramadol	Immediate release Long-acting	
Other	Immediate release Long-acting	This category is comprised of opioids indicated to treat pain that are used less frequently in Ontario. This includes, for example, meperidine, levorphanol, and methadone and buprenorphine products that are indicated to treat pain. <b>For the purpose of the opioid drug and formulation indicator, this category also includes immediate release fentanyl, as specified above.</b>
<b>Opioids indicated for opioid agonist therapy</b>		
Methadone		
Buprenorphine/naloxone		Buprenorphine/naloxone is a combination product that includes buprenorphine and naloxone. This combination product is used for the management of opioid use disorder and to help withdraw from opioid use. This does not capture the use of naloxone alone, which is used to reverse the effects of opioids and associated overdoses.
<b>Opioids indicated to treat cough</b>		
Codeine		Opioids indicated to treat cough were not reported by specific drug type in the Ontario Prescription Opioid Tool.
Hydrocodone		
Normethadone		
<b>Opioids used to reverse the effects of opioid overdose</b>		
Naloxone		Naloxone is an opioid antagonist that is used to reverse the effects of opioids and associated overdoses. Specifically, naloxone can restore normal breathing to someone whose breathing has slowed or stopped due to an opioid overdose. Naloxone is available as injectable and nasal spray forms.



## Milligrams of morphine equivalents

Opioids are comprised of a number of different drugs with different formulations that vary on a chemical level. These differences affect how much of the drug an individual needs to take to reach a particular desired analgesic effect (i.e., how potent each drug is). To compare all opioid drugs, we calculate milligrams of morphine equivalents, which is a standardized measure of the total amount of opioid dispensed on a single prescription.

Milligrams of morphine equivalents are calculated by determining the total milligrams of each opioid an individual was dispensed, and then converting this into an equivalent morphine dose using a conversion factor. Opioid dose in milligrams of morphine equivalents is calculated using the following equation:

$$dose = quantity * strength * conversion\ factor$$

For transdermal fentanyl, the formula is slightly different. Generally, a single transdermal fentanyl patch is used over a 3 day period, however sometimes individuals may use a fentanyl patch for only 2 days. If an individual is using a patch for 3 days, they receive three times the dose on the patch (the same dose for 3 days). If they use the patch for 2 days, they receive two times the dose on the patch. Using the quantity and days' supply values of the transdermal fentanyl claim from the NMS database, we can determine whether an individual is using a patch for 2 or 3 days. We then use the following formula to calculate the fentanyl dose in milligrams of morphine equivalents:

$$dose = quantity * days\ of\ patch\ use * conversion\ factor$$

Once the total dose of the dispensed opioid prescription is calculated, the average daily dose (i.e., the amount of the drug that an individual is consuming each day) in milligrams of morphine equivalents can be calculated by dividing the total dose by the days' supply on the claim.

Some opioids, such as injectables, suppositories, and opioids used for OAT, do not have valid milligram morphine equivalent conversion factors. Therefore, these opioids are excluded from dose calculations. The table on the following page shows the dose equivalence and conversion factors for opioids that have valid conversions:

Opioid	Dose equivalence to morphine	To convert to oral morphine, multiply by
<b>Morphine</b>	30 mg	1
<b>Codeine</b>	200 mg	0.15
<b>Oxycodone</b>	15-20 mg	1.5
<b>Hydrocodone</b>	30 mg	1
<b>Hydromorphone</b>	6-7.5 mg	5
<b>Meperidine</b>	300 mg	0.1
<b>Tramadol</b>	300 mg	0.1
<b>Transdermal fentanyl</b>	12.5 mcg/h → 30-67 mg morphine 25 mcg/h → 60-134 mg morphine 37.5 mcg/h → 135-179 mg morphine 50 mcg/h → 180-224 mg morphine 75 mcg/h → 270-314 mg morphine 100 mcg/h → 360-404 mg morphine	If 12.5 mcg/h then conversion factor = 48 If 25 mcg/h then conversion factor = 97 If 37.5 mcg/h then conversion factor = 157 If 50 mcg/h then conversion factor = 202 If 75 mcg/h then conversion factor = 292 If 100 mcg/h then conversion factor = 382
<b>Other Fentanyl Formulations</b>	<b>Fentanyl buccal or SL tablets, or lozenge</b>	0.13
	<b>Fentanyl film or oral spray</b>	0.18
	<b>Fentanyl nasal spray</b>	0.16

## Small cell censoring and suppression

In accordance with ICES' commitments in data sharing agreements and in order to minimize risk of re-identification, ICES prohibits the presence of small cells (counts less than 6) in any output or report. The following approaches have been taken to prevent small cell disclosure in the Ontario Prescription Opioid Tool:

- Annual data has been suppressed for the following indicators:
  - **Opioid drug type and formulation to treat pain**
    - At the PHU level, counts and rates have been suppressed for the long-acting and immediate release formulations of the "Other" drug group category for Timiskaming and Huron County Health Units in 2013, 2016, and 2017.
  - **Prescribers for OAT (by treatment)**
    - At the PHU level, counts and rates have been suppressed for Huron County Health Unit in 2013 and 2014, Perth District Health Unit in 2015, and Timiskaming Health Unit between 2013 and 2015.
  - **Pharmacy-dispensed naloxone**
    - At the PHU level, counts and rates have been suppressed for Huron County Health Unit and Timiskaming Health Unit in 2016.
- Monthly data has been suppressed for the following indicators:
  - **Individuals dispensed an opioid for OAT (by treatment)**
    - At the PHU level, counts and rates have been suppressed for each month between July 2012 and December 2013.
  - **Pharmacy-dispensed naloxone**
    - At the LHIN and PHU levels, counts and rates have been suppressed between July and September 2016. Additional small cells were censored as necessary, and in some cases, residual suppression of other cells was required to avoid re-identification. Regions impacted by this include Chatham-Kent, Elgin-St. Thomas, Grey Bruce, Huron County, Leeds, Grenville and Lanark District, Northwestern, Perth District, Porcupine, and Timiskaming Health Units.
- Age/sex data has been suppressed for the following indicators:
  - **Individuals dispensed an opioid for OAT (by treatment)**
    - At the LHIN level, counts and rates have been suppressed for the 0-14 and 65+ age groups when these data are presented by age group. In addition, for the Central West and North Simcoe Muskoka LHINs, counts and rates for the 15-24 age group have been suppressed from 2013 to 2015 when these data are stratified by sex.
    - At the PHU level, counts and rates have been suppressed when presented by age group.
  - **Individuals dispensed an opioid for OAT (by treatment)**
    - At the provincial level, counts and rates have been suppressed for the 0-14 and 65+ age groups when these data are presented by age group.
    - At the LHIN and PHU levels, counts and rates have been suppressed when presented by age group.
    - For Timiskaming Health Unit, the count and rate of females and males who received buprenorphine/naloxone in 2013 has been censored. Residual suppression of the count and rate of males and females who received methadone in 2013 was required to avoid re-identification, as was residual suppression of the same indicators for Huron County Health Unit in 2013.
  - **Prevalence of people dispensed a long-acting opioid with a high daily dose**
    - At the provincial level, counts and rates have been suppressed for the 0-14 and 15-24 age groups.

- At the LHIN and PHU levels, counts and rates have been suppressed for all age groups and by sex.

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