HIV care cascade in Ontario:

Linkage to care, in care, on antiretroviral treatment, and virally suppressed, 2018

About OHESI

The Ontario HIV Epidemiology and Surveillance Initiative (OHESI) is a collaboration involving the AIDS and HepC Programs, Ministry of Health (MOH), Public Health Ontario (PHO), the Public Health Agency of Canada (PHAC), and the Ontario HIV Treatment Network (OHTN) Applied Epidemiology Unit (AEU). The objectives of OHESI are to analyze, monitor and disseminate knowledge products on the epidemiology of HIV in Ontario. OHESI is a vital partnership that supports Ontario's ongoing ability to assess the impact of policy directions and HIV related program initiatives.

The success of the partnership would not be possible without the strategic, technical and resource contributions of all the partners. OHESI also receives ongoing advice from a community advisory committee: people working in the community-based HIV service sector and HIV clinics whose input helps ensure that OHESI reports and other products support collective efforts and impact in neighborhoods, communities and organizations across the province.

Background

In 2013-2014, the OHTN set up the OHTN Applied Epidemiology Unit (AEU), under a funding agreement with the MOH, to support ongoing production of epidemiological information to support Ontario's response to HIV.

In 2014-2015, the OHTN AEU initiated the Ontario HIV Epidemiology and Surveillance Initiative (OHESI) and continues to provide administrative and technical support for the partnership.

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Summary

The most effective way to improve the health of people living with HIV and reduce new transmissions is to diagnose HIV infection as early as possible, and engage them in care and treatment. Highly effective antiretroviral therapy (ART) can suppress HIV viral load to the point where it is undetectable, cannot cause as much damage to the person's immune system, and cannot be passed to a sexual partner (undetectable = untransmittable).

In 2018, of the estimated 22,439 people living with HIV in Ontario (20,600 – 27,000), about 85.2% or 19,128 had been diagnosed, 85% were on ART, and 97% of those on ART were virally suppressed.

In the 19 years from 2000 to 2018, the number of people in Ontario living with diagnosed HIV almost doubled due to ongoing transmission and the fact that people with HIV are living longer. Over that same period, the number of people living with HIV who are engaged in Ontario's HIV care cascade has improved.

- The percent of people who were in care of those diagnosed with HIV increased from 73% to 88%
- The percent of people who were on ART of those diagnosed with HIV increased from 49 to 85%
- The percent of people who were virally suppressed of those diagnosed with HIV more than doubled from 35% to 82%.

Time from HIV diagnosis to linkage to care and viral suppression has also improved over time. Among those people diagnosed in 2017, we allow a minimum of 12 months of follow-up up until December 2018.

- The percent of newly diagnosed individuals who linked to care within one month of diagnosis increased from 35% in 2000 to 68% in 2017.
- The percent of newly diagnosed individuals who achieved viral suppression within three months of diagnosis increased from 6% in 2000 to 33% in 2017.

This report provides the most complete province-wide cascade estimates for people with diagnosed HIV living in Ontario. These findings demonstrate increased engagement in the HIV cascade as well as improved survival, likely due to changes to treatment guidelines to recommend earlier initiation of ART after diagnosis, ART regimens that are more effective and easier to take, and the success of testing, linkage to care, services and treatment initiatives.

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Introduction

For people living with HIV, being on antiretroviral treatment (ART) and having a suppressed viral load improves health and prevents HIV transmission. To achieve and maintain a suppressed viral load, people living with HIV need to be diagnosed, linked to and retained in high quality HIV clinical care[1], and have sustained access to and adhere to ART. These successive steps are known collectively as the HIV care cascade.

In 2014, UNAIDS made supporting people with HIV through the stages of the care cascade a global priority. To measure progress towards this goal, UNAIDS recommended the 90-90-90 targets: by 2020, 90% of all people living with HIV would be diagnosed, 90% of all people diagnosed with HIV infection would be on ART, and 90% of all people receiving ART would be virally suppressed. If all three 90-90-90 targets were met, then 81% of all people living with HIV would be on ART and 73% would be virally suppressed. As of 2020, fourteen countries achieved the targets[2]. In response, the UNAIDS Global AIDS Strategy 2021-2026 set more ambitious 95-95-95 targets, with a focus on reducing inequities among people living with HIV[3].

Ontario measures the HIV care cascade as a means to monitor health outcomes for people living with HIV and HIV transmission. The data used to report on the HIV care cascade comes from two sources:

- The Public Health Ontario Laboratory built an HIV datamart to support the linkage of diagnostic and viral load data, essential to produce cascade indicators. These data allow us to estimate the total number of people living with diagnosed HIV in Ontario, the number in care, the number on treatment, and the number virally suppressed.
- The Public Health Agency of Canada (PHAC) uses modelling (based on Ontario data sources) to estimate the total number of people living with HIV in Ontario (both diagnosed and undiagnosed), as well as the undiagnosed fraction.

This report includes data between 2000 and 2018 inclusive, . The analyses of time from diagnosis to linkage to care and viral suppression are for people diagnosed in 2017, whose subsequent HIV care visits and viral load tests may have occurred in 2018.

This report shows that engagement in Ontario's HIV cascade has improved over time. The percent of people with diagnosed HIV who are in care, on ART, and virally suppressed have all increased, suggesting that they are living longer and healthier lives. Viral suppression is key to preventing transmission of HIV and will lead to fewer new diagnoses in the province. While monitoring the HIV care cascade indicators for individuals living with HIV is an important way to assess progress, our larger goal includes work to monitor and optimize quality of life and broader determinants of health for this population.

[1]HIV care guidelines developed for Ontario recommend that "comprehensive HIV care should be provided by an interdisciplinary team of HIV-knowledgeable professionals who can offer integrated care and wellness as well as appropriate and timely linkage or referral to other health and social services." The guidelines also note that "physicians providing HIV care should be highly knowledgeable and experienced in the management of HIV infection" and that physicians who do not have this experience "should consult with an HIV-experienced physician."

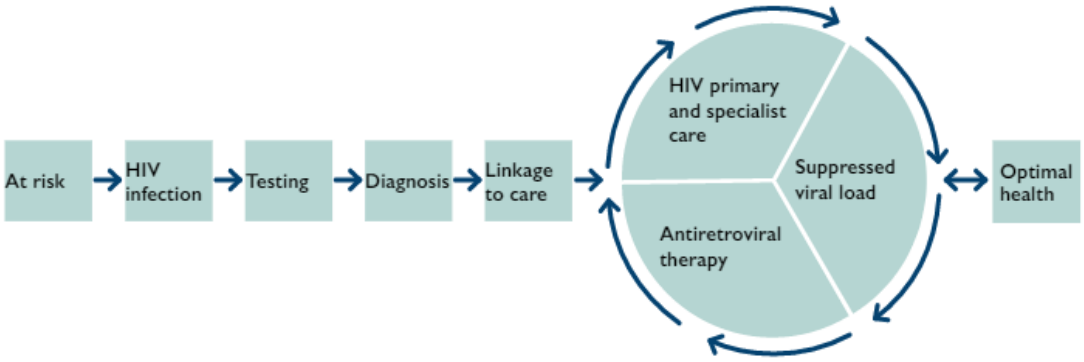
[2]2020 Global AIDS Update, UNAIDS. Accessed 3/26/2021 https://www.unaids.org/sites/default/files/media_asset/2020_global-aids-report_en.pdf

[3]Global AIDS Strategy 2021-2026; Accessed 3/26/2021 https://www.unaids.org/sites/default/files/media_asset/global-AIDS-strategy-2021-2026_en.pdf

Why look at patterns in engagement in care, antiretroviral treatment, and viral suppression?

- To maintain and improve health and reduce the risk of new HIV transmissions, it is important for people living with HIV to be diagnosed, in care, on ART, and virally suppressed (see Figure i).
- Understanding cascade trends can help measure the impact of HIV care and monitor progress toward meeting UNAIDS targets (see below).
- Identifying gaps can inform program/policy and help the care system prioritize interventions to improve engagement in the HIV care cascade.
- Although being in care, on ART, and virally suppressed are important for health and well-being, they do not necessarily reflect overall quality of life for a person living with HIV.

Figure i. *The HIV prevention, engagement, and care cascade*



2020 UNAIDS 90-90-90 Targets

- 90% of all people living with HIV will know their HIV status.
- 90% of all people diagnosed with HIV will receive ART.
- 90% of all people receiving ART will have viral suppression.

If all three 90-90-90 targets are met, 81% of **all** people living with HIV would be on ART and 73% of **all** people living with HIV would be virally suppressed.

Key Findings

Cascade Summary

- An estimated 22,439 people were living with HIV in Ontario in 2018. Of these, an estimated 3,311 people (14.8%) did not know their HIV status (i.e. were undiagnosed).
- In 2018, Ontario made progress relative to previous years on the 2nd and 3rd 90s, with 84.8% of people diagnosed on treatment, and 97.3% of people on treatment virally suppressed.
- Ontario has made progress on each of the 90-90-90 targets, but not met all three targets.

Diagnosed

- An estimated 19,128 people were living with diagnosed HIV in Ontario in 2018. The upper bound for this estimate is 20,412 people.
- The total number of people with diagnosed HIV living in Ontario has increased steadily over time, almost doubling from 2000 to 2018. A combination of factors likely contributed to this increase, including new HIV diagnoses each year and improved life expectancy of people living with HIV on successful treatment regimens.
- The total number of diagnosed includes people who were diagnosed for the first-time both in Ontario and elsewhere. In this report, we estimate the number of people diagnosed and living in Ontario as of the end of the calendar year.

Linkage to care and in care

- The number of people with diagnosed HIV in care has increased steadily over time from 8,008 in 2000 to 16,899 in 2018 (i.e. 16,899 individuals had at least one viral load test in 2018). This increase highlights a persistent and increasing demand for HIV-related services.
- The percent of people with diagnosed HIV who were in care was 73% in 2000 (lower estimate: 65%) and 88% in 2018 (lower estimate: 83%)*.
- The percent of newly diagnosed individuals who were linked to care within three months of HIV diagnosis increased from 67% in 2000 to 85% in 2017.

On antiretroviral treatment

- Use of antiretroviral treatment (ART) has increased over time. The percent of people with diagnosed HIV who were on ART increased from 49% (5,359 people) in 2000 (range: 36 to 53%) to 85% (16,214 people) in 2018 (range: 76 to 85%).

Virally suppressed

- Between 2000 and 2018, the percent of people with diagnosed HIV who were virally suppressed more than doubled from 35% (3,816 people; range: 23 to 40%) to 83% (15,775 people; range: 72 to 84%).
- The percent of newly diagnosed individuals who achieved viral suppression within 3 months of HIV diagnosis increased from 6% in 2000 to 33% in 2017 and within 6 months almost tripled from 23% to 66%.
- In 2018, 97% (range: 96 to 98%) of those on ART had a suppressed viral load (96% of individuals in care were on ART). These data suggest that when HIV-positive people in Ontario are on treatment and stay on treatment, they tend to achieve viral suppression.

*Note: The "Main" estimate represents the best estimate for that indicator. "Upper" and "Lower" estimates were calculated when possible in order to reflect the impact of different definitions (i.e. more/less conservative) and provide a range of possible values. For some indicators, there were no feasible "Upper" and/or "Lower" definitions that could be applied.

About the Data

Where do these data come from?

- Data in this report comes from the Public Health Ontario (PHO) Laboratory, which conducts all HIV diagnostic and viral load (VL) testing for the province – with a few small exceptions.
- PHO Laboratory's HIV diagnostic and VL databases were combined and used to determine people with diagnosed HIV who are living in Ontario during any calendar year. For information on how this determination is made, see the **Technical notes**.
- All information in the PHO Laboratory databases is confidential, and only de-identified aggregate data is shared with OHESI partners for inclusion in this report.
- Estimates of the undiagnosed fraction and the total number of people living with HIV were carried out by Public Health Agency of Canada (PHAC) using data obtained from PHO Laboratory.

What are some of the strengths of these data and our analytical approach?

- For each cascade indicator, a "Main" estimate is calculated, along with an "Upper" and/or "Lower" estimate, where applicable. The "Main" estimate represents the best estimate for the cohort. However, as there is no widespread consensus on how some indicators should be defined, "Upper" and "Lower" estimates are also calculated in order to reflect the impact of different definitions and create a range of possible values. These estimates are calculated using more or less conservative definitions for an indicator. For some indicators, there were no feasible "Upper" and/or "Lower" definitions that could be applied.
- Counts and proportions of individuals meeting certain metrics (being linked to care reaching an undetectable VL) within different measurements of time are reported to illustrate the efficiency of HIV care in Ontario.

What are some of the limitations of this report?

- An important limitation is that the lack of linked data to estimate prevalence among people with diagnosed HIV prevents the estimate of total prevalence and undiagnosed fraction among subpopulations by gender, age, or priority population.
- Where possible, a range of values were calculated for each cascade indicator to highlight the uncertainty involved in measuring the cascade.

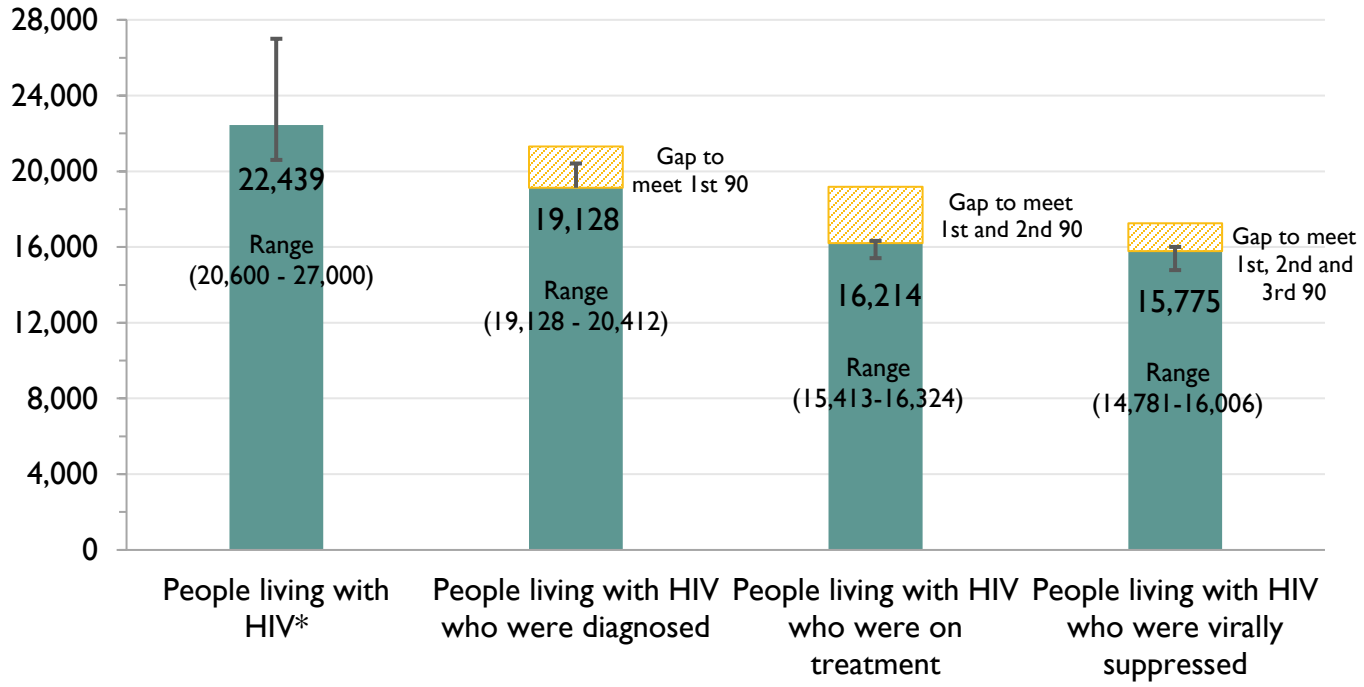
Data and Figures

This section highlights trends in cascade indicators for people in Ontario living with diagnosed HIV. Each figure is accompanied by estimates for the most recent year available, along with a brief description of trends over time. See the **Appendices** for **Indicator definitions** and **Data tables** containing the underlying data for the figures.

Note: The "Main" estimate represents the best estimate for that indicator and is displayed as a solid line in the figures. "Upper" and "Lower" estimates were calculated when possible in order to reflect the impact of different definitions (i.e. more/less conservative) and provide a range of possible values (displayed as a shaded region in the figures). For some indicators, there were no feasible "Upper" and/or "Lower" definitions that could be applied.

1. Cascade Summary

Figure 1.1 Number of people living with HIV in Ontario engaged in the steps of the care cascade, 2018

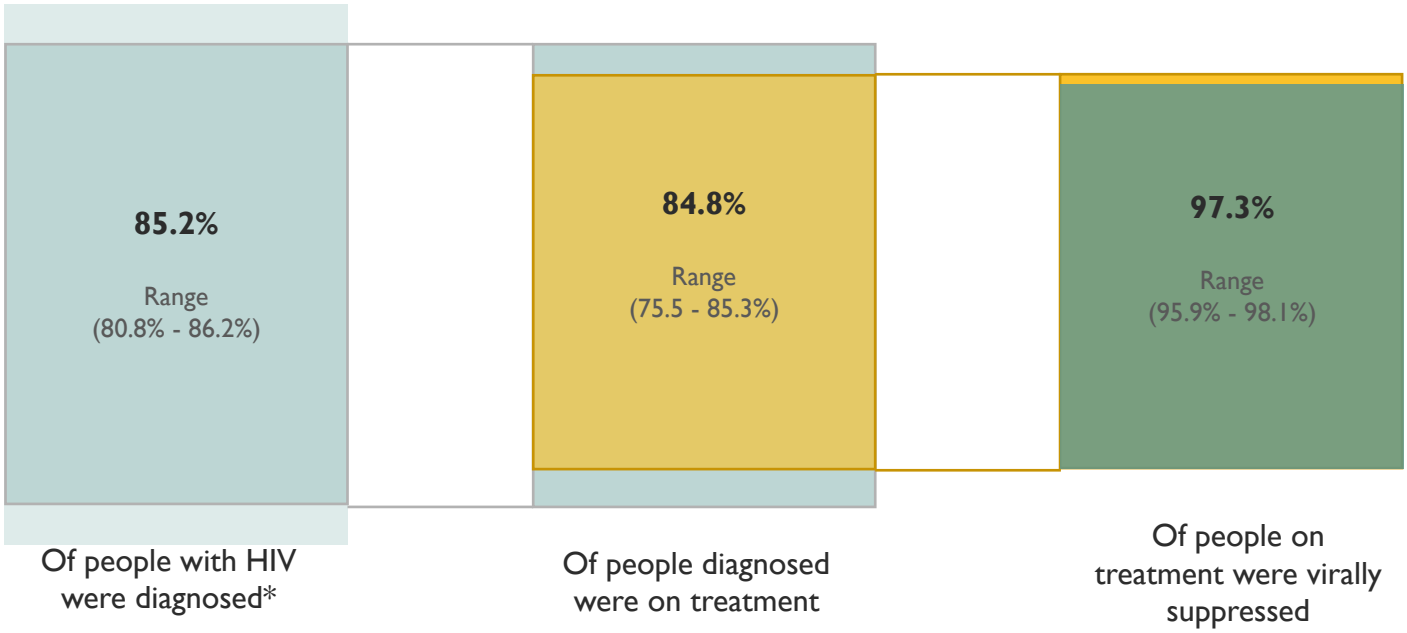


Snapshot

In 2018, the total number of people living with HIV in Ontario was estimated to be 22,439, including people who have not yet been diagnosed. An estimated 19,128 people had been diagnosed – 2,177 people short of the first 90; 16,214 people with diagnosed HIV were on treatment – 2,960 people short of meeting the first and second 90s; and 15,775 people with diagnosed HIV were virally suppressed – 1,482 people short of the first, second and third 90s.

Notes: *The number of people living with HIV was estimated by the Public Health Agency of Canada. All other estimates are provided by the Public Health Ontario Laboratory. Error bars represent the ranges possible using low and high estimates. The 90-90-90 targets are represented numerically. See **Technical notes** for definitions and more information on modelling and the Ontario Laboratory Cohort. See **Table 1.1** for underlying data.

Figure 1.2 90-90-90 Estimates, Ontario, 2018

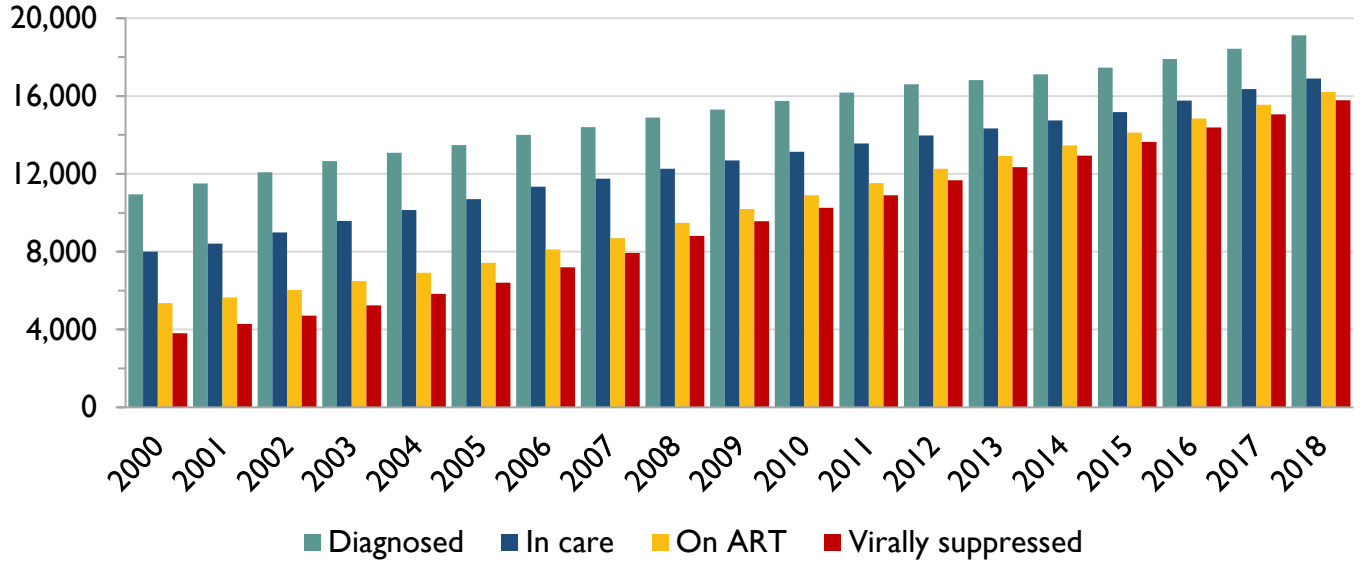


Snapshot

In 2018, the first 90, or the percentage of people living with HIV who were diagnosed was 85.2%, meaning that an estimated 14.8% of people in Ontario living with HIV were undiagnosed. The undiagnosed fraction is produced based on modelling of the prevalence of HIV, and of the estimated number of people who have been diagnosed with HIV and are living in Ontario done by the Public Health Agency of Canada. The second 90, the percentage of people diagnosed who were on treatment, was 84.8%. The third 90, the percentage of people on treatment who were virally suppressed, was 97.3%.

Notes: *The number of people living with HIV was estimated by the Public Health Agency of Canada. All other estimates are provided by the Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on modelling and the Ontario Laboratory Cohort. See **Table 1.2** for underlying data.

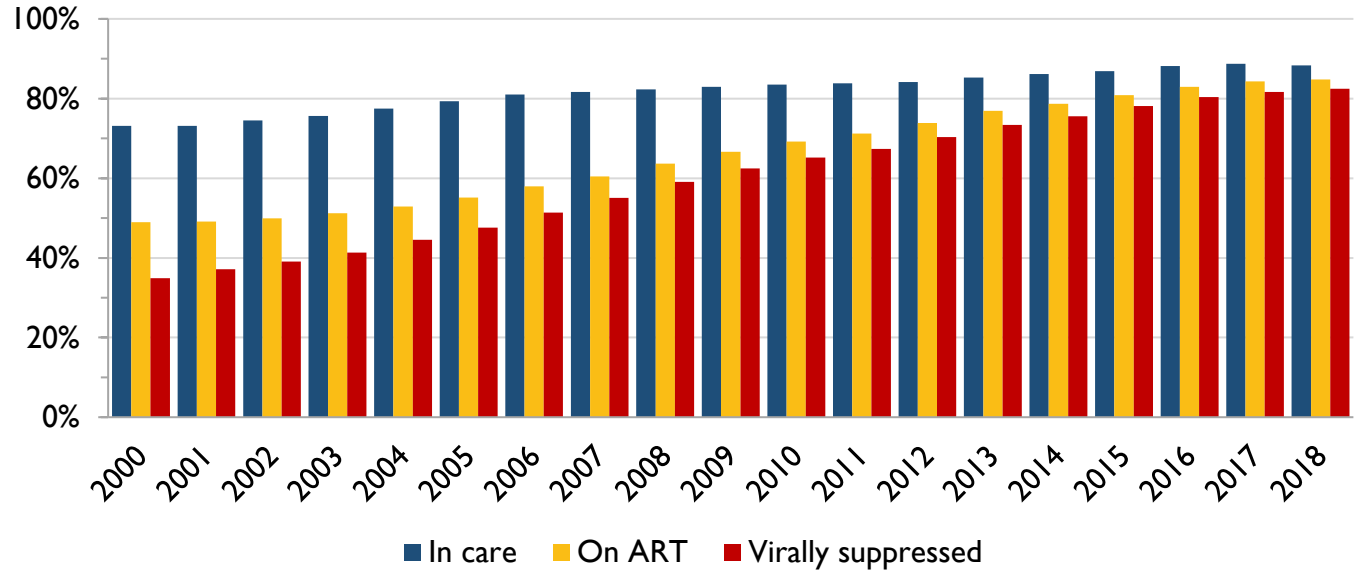
Figure 1.3 Number of people with diagnosed HIV living in Ontario engaged in the cascade, 2000 to 2018



Snapshot

The number of people engaged in each cascade step has increased over time. Between 2000 and 2018, the number who were diagnosed increased from 10,945 to 19,128, the number in care increased from 8,008 to 16,899, the number on ART increased from 5,359 to 16,214, and the number suppressed increased from 3,816 to 15,775.

Figure 1.4 Percent of people with diagnosed HIV living in Ontario engaged in the cascade, 2000 to 2018



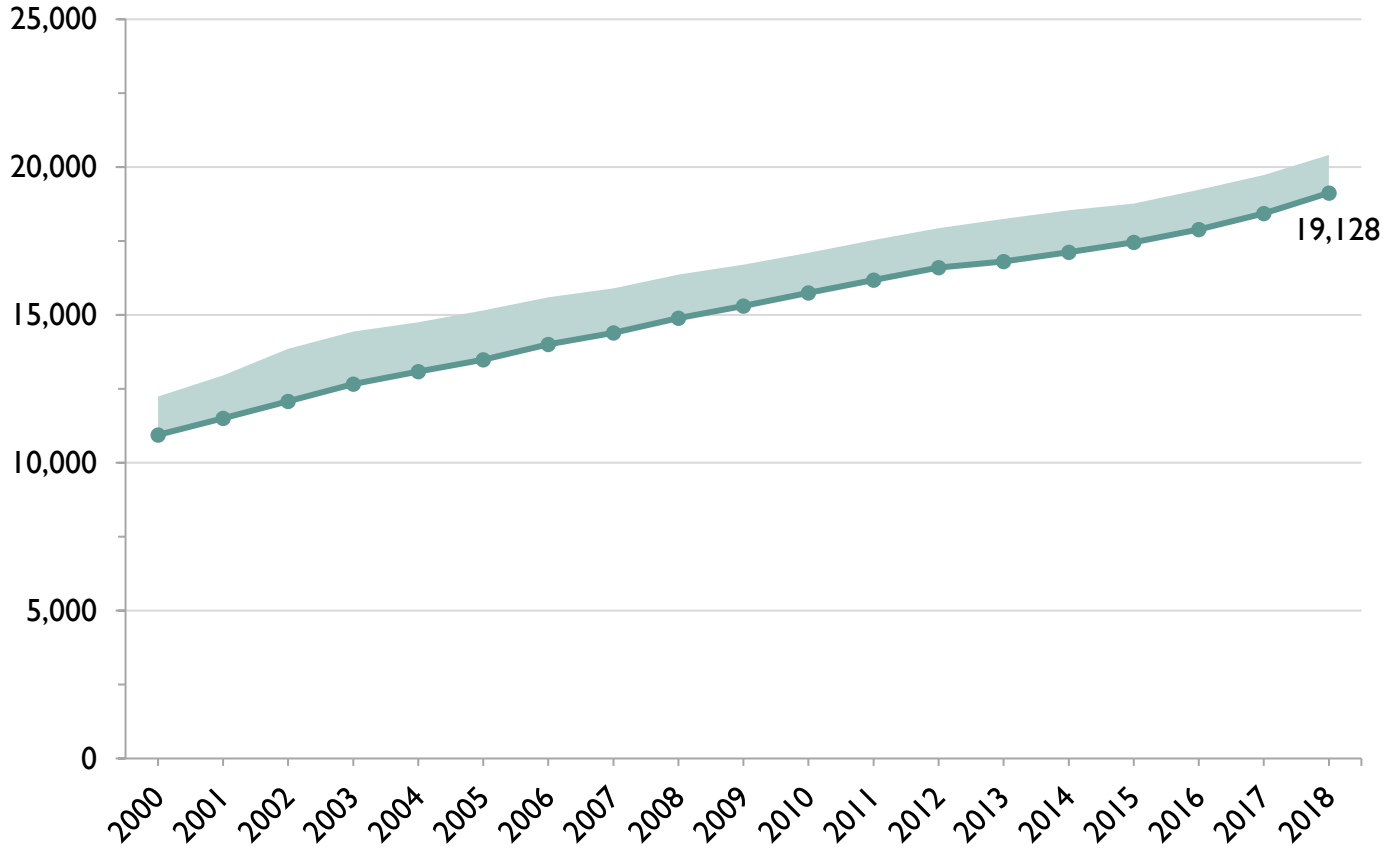
Snapshot

There has been a greater increase in the percent of people virally suppressed relative to the percent in care or on ART. Between 2000 and 2018, the percent in care increased from 73.2% to 88.3%, the percent on ART increased from 49.0% to 84.8%, and the percent virally suppressed increased from 34.9% to 82.5%.

Notes: Individuals missing ART information are assumed to be 'On ART' if virally suppressed. Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort. See **Table 2.1**, **Table 3.1**, **Table 4.1**, and **Table 5.1** for underlying data.

2. Diagnosed

Figure 2.1 Number of people with diagnosed HIV living in Ontario, 2000 to 2018



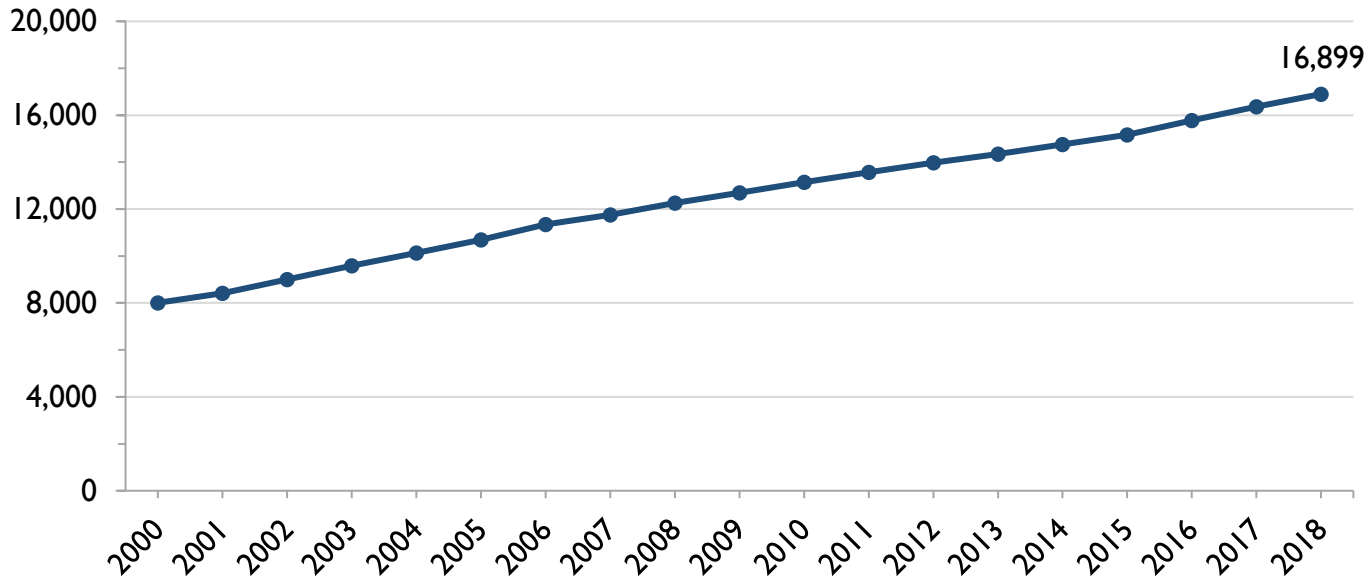
Snapshot

The number of people with diagnosed HIV living in Ontario increased from 10,945 in 2000 (upper estimate: 12,237) to 19,128 (upper estimate: 20,412) in 2018.

Notes: Solid line represents main estimate and shaded area represents range of estimates. Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort. See **Table 2.1** for underlying data.

3. Linkage to care and in care

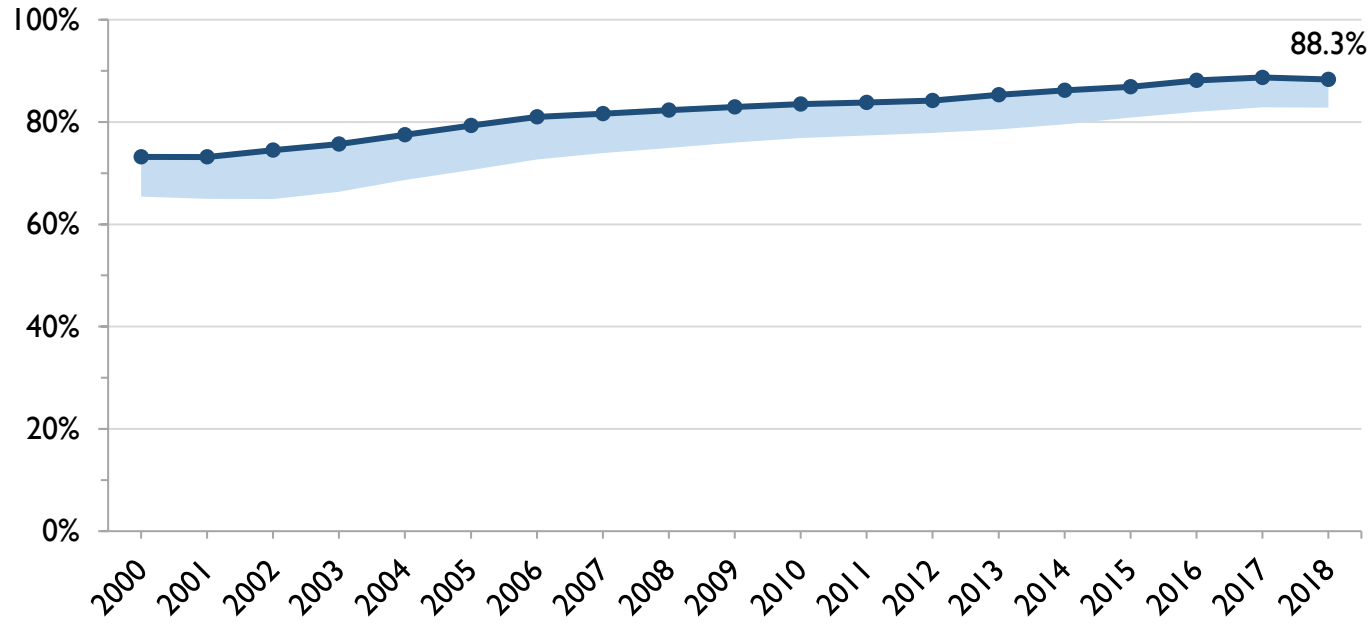
Figure 3.1 Number of people with diagnosed HIV living in Ontario who are in care, 2000 to 2018



Snapshot

The number of people in care increased from 8,008 in 2000 to 16,899 in 2018.

Figure 3.2 Percent of people with diagnosed HIV living in Ontario who are in care, 2000 to 2018

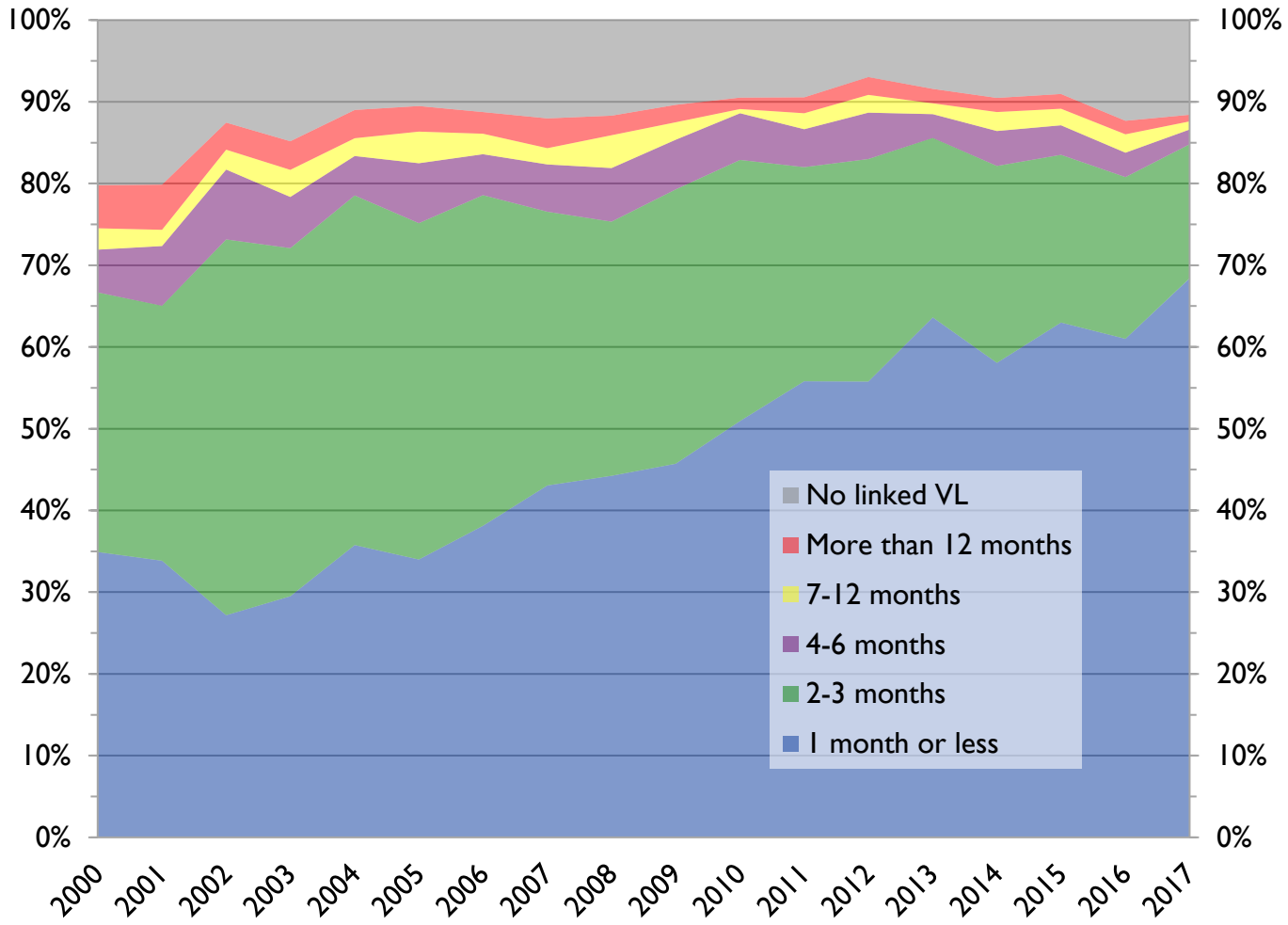


Snapshot

The percent of people with diagnosed HIV who are in care was 73.2% in 2000 (lower estimate 65.4%) and 88.3% in 2018 (lower estimate 82.8%).

Notes: Solid line represents main estimate and shaded area represents range of estimates. Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort. See **Table 3.1** for underlying data.

Figure 3.3 Time from HIV diagnosis to linkage to care for people newly diagnosed with HIV in Ontario, 2000 to 2017



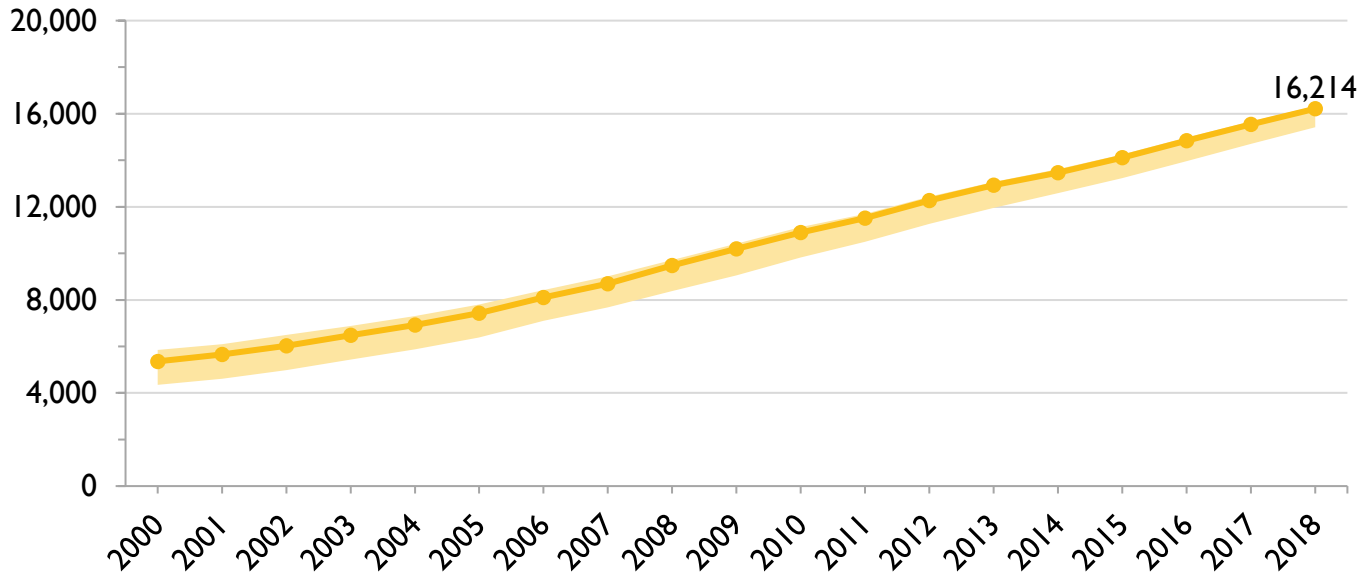
Snapshot

The percent of newly diagnosed people linked to care within one month of diagnosis increased from 34.9% in 2000 to 68.4% in 2017. In 2017, another 20% were linked to care: 16.4% within 2-3 months, 1.8% within 4-6 months, 1.0% within 7-12 months, and 0.8% more than 12 months after diagnosis. 11.6% had no linked viral load test result.

Notes: Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort. See **Table 3.2** for underlying data.

4. On antiretroviral treatment

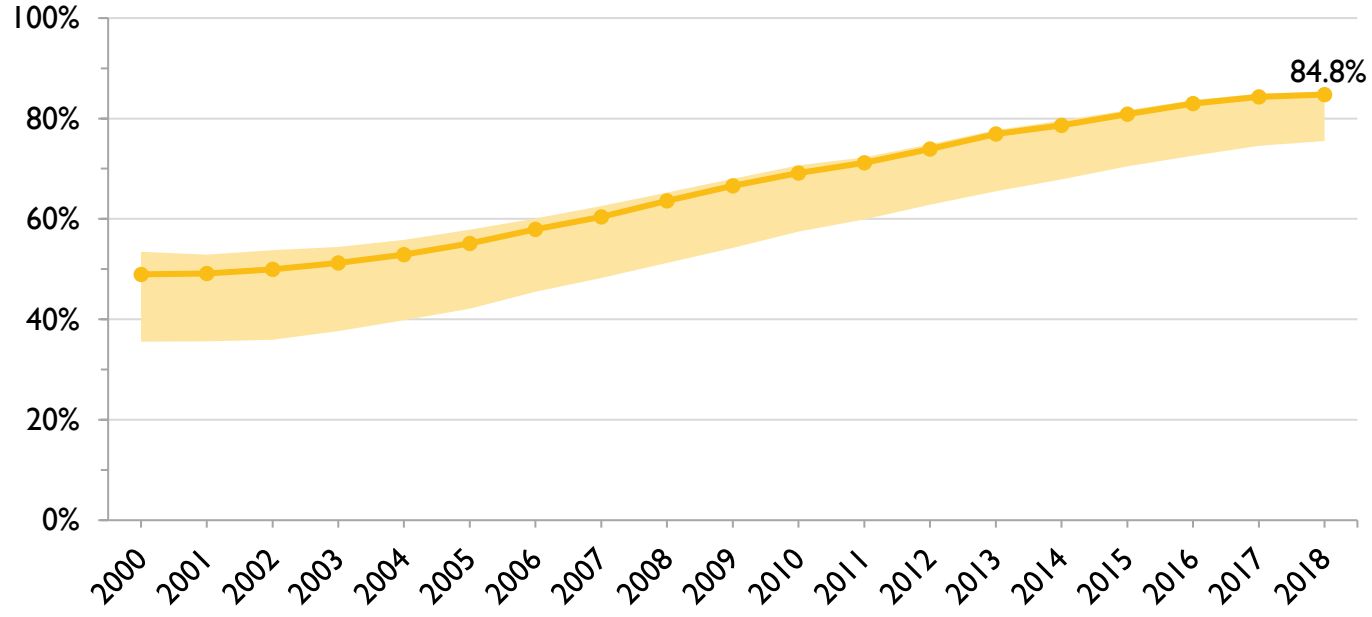
Figure 4.1 Number of people with diagnosed HIV living in Ontario who are on ART, 2000 to 2018



Snapshot

The number of people with diagnosed HIV who are on ART increased from 5,359 in 2000 (range: 4,350 to 5,850) to 16,214 (range: 15,413 to 16,324) in 2018.

Figure 4.2 Percent of people with diagnosed HIV living in Ontario who are on ART, 2000 to 2018

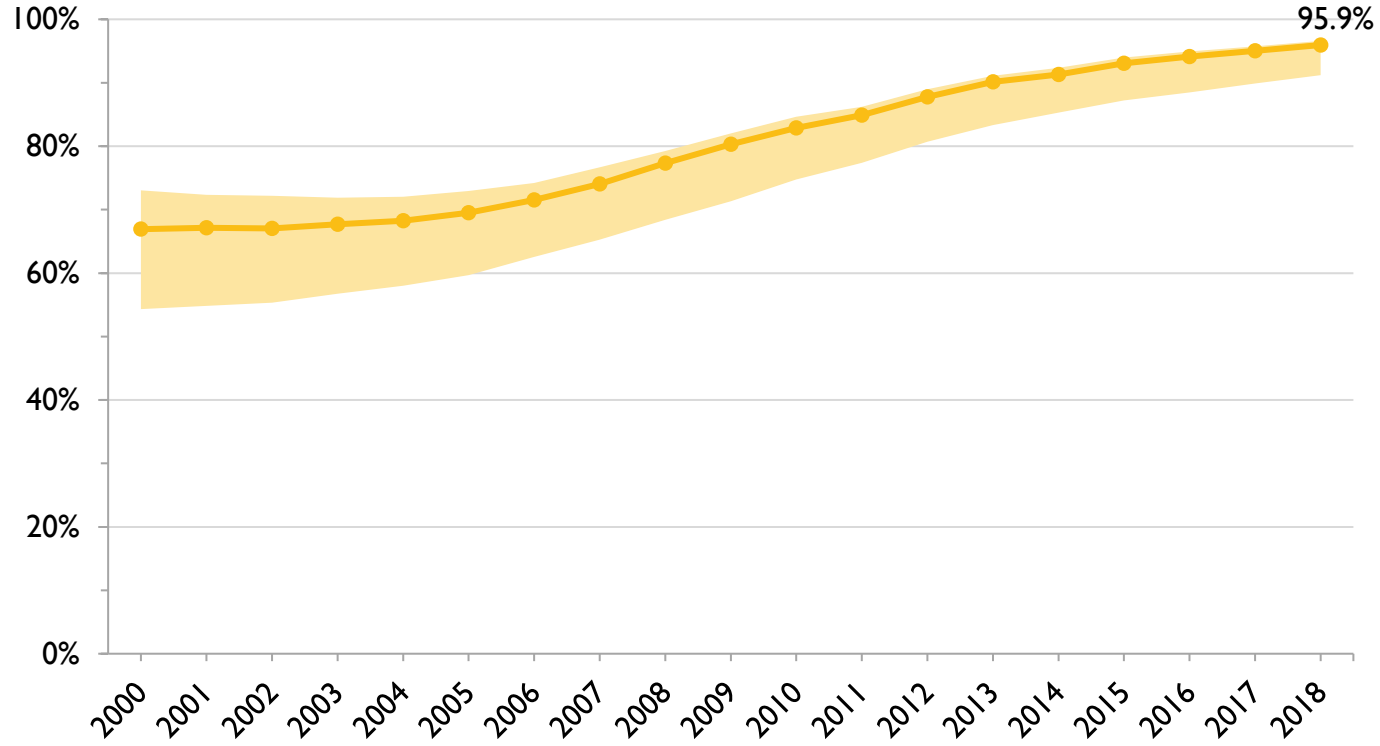


Snapshot

The percent of people with diagnosed HIV who are on ART increased from approximately 50% in the early 2000s to 84.8% in 2018.

Notes: Solid line represents main estimate and shaded area represents range of estimates. Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort. See **Table 4.1** for underlying data.

Figure 4.3 Percent of people with diagnosed HIV living in Ontario in care who are on ART, 2000 to 2018



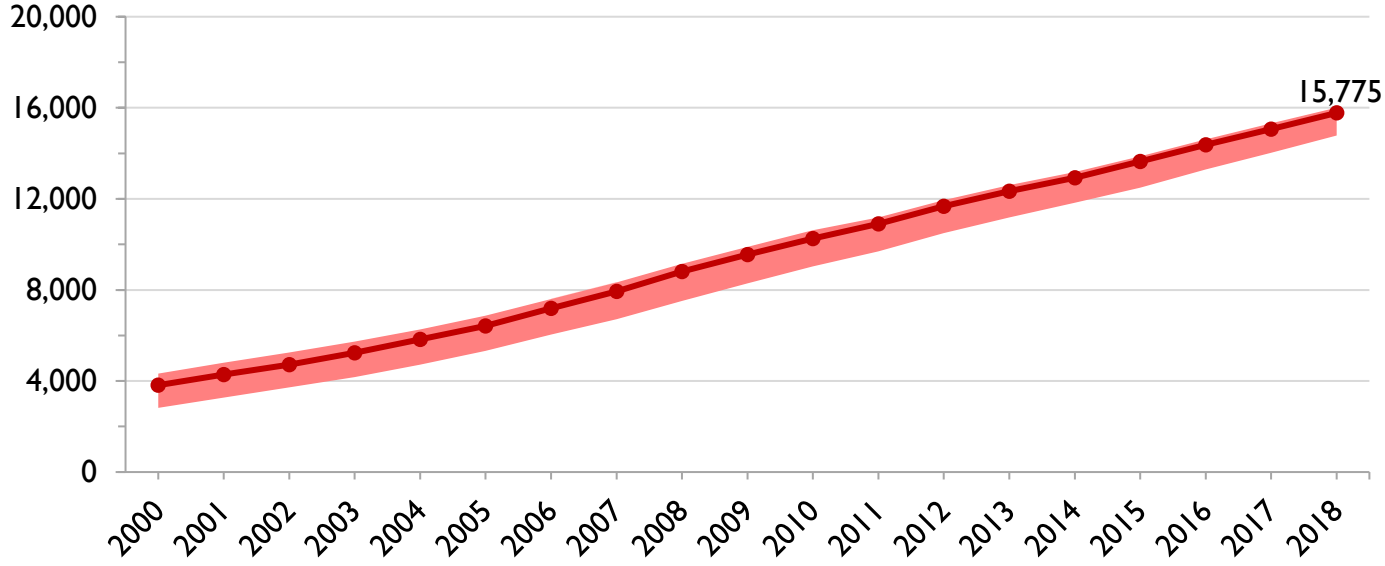
Snapshot

The percent of people in care who are on ART increased from approximately 67% in the early 2000s to 95.9% in 2018. These data indicate that, once people are engaged in care, they are highly likely to be on ART.

Notes: Solid line represents main estimate and shaded area represents range of estimates. Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort. See **Table 4.2** for underlying data.

5. Virally suppressed

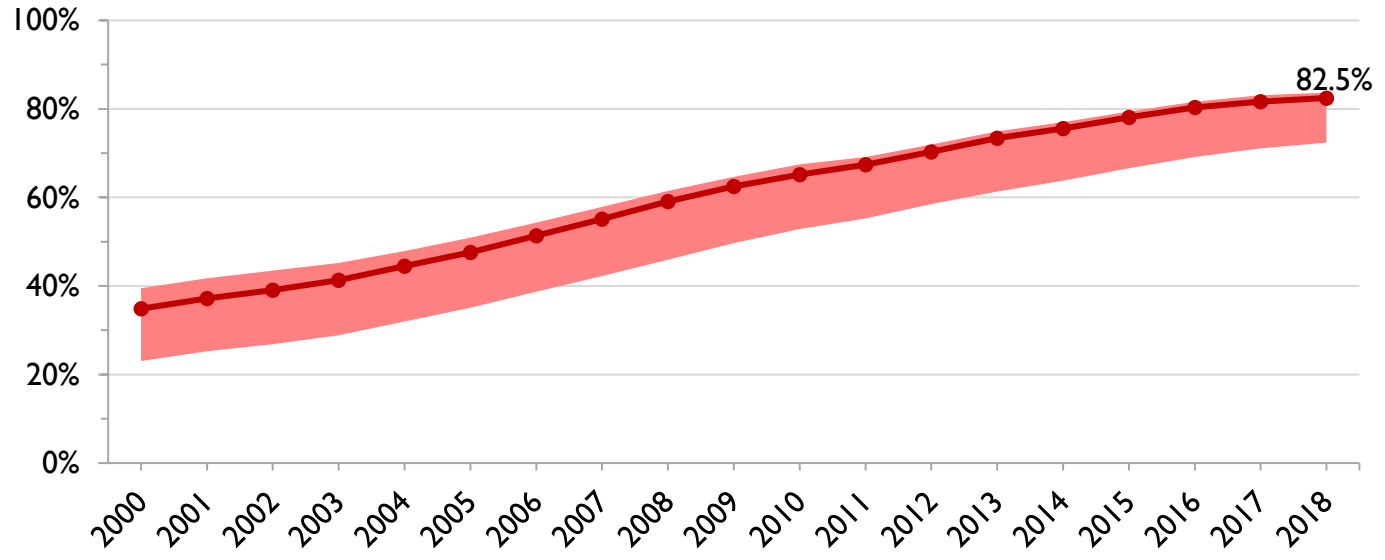
Figure 5.1 Number of people with diagnosed HIV living in Ontario who are virally suppressed, 2000 to 2018



Snapshot

The number of people who are virally suppressed increased from 3,816 in 2000 (range: 2,820 to 4,321) to 15,775 in 2018 (range: 14,781 to 16,006).

Figure 5.2 Percent of people with diagnosed HIV living in Ontario who are virally suppressed, 2000 to 2018

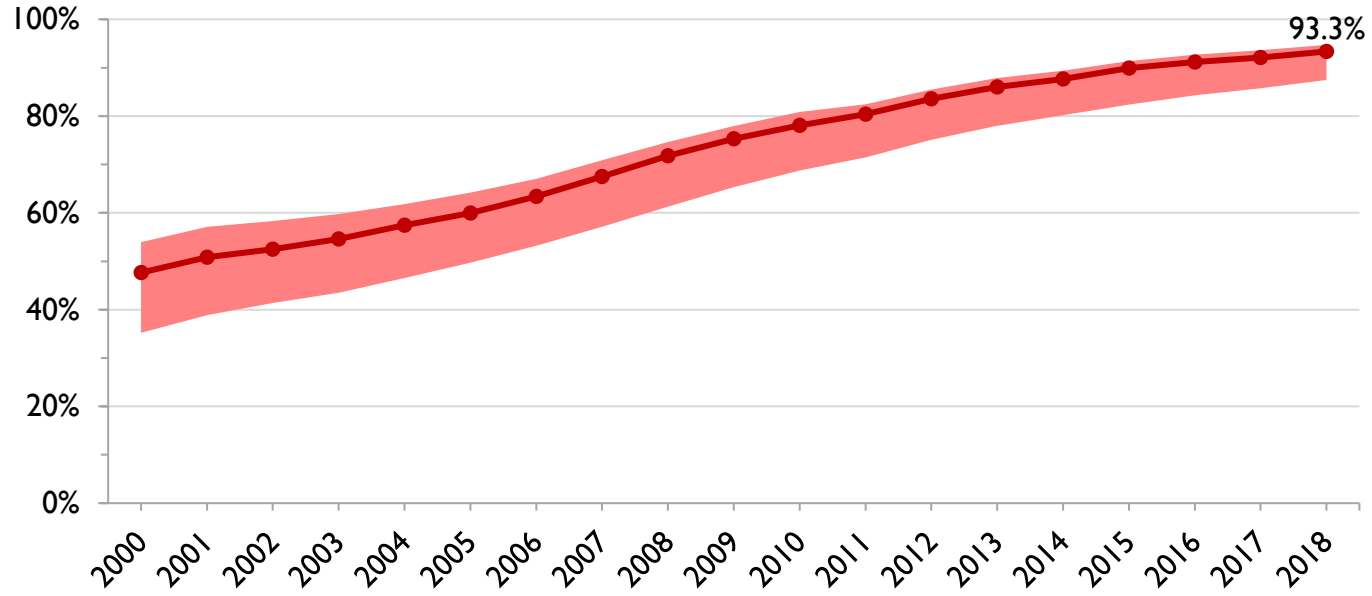


Snapshot

The percent of people with diagnosed HIV who are virally suppressed increased from 34.9% in 2000 (range: 23.0% to 39.5%) to 82.5% in 2018 (range: 72.4% to 83.7%).

Notes: Solid line represents main estimate and shaded area represents range of estimates. Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort. See **Table 5.1** for underlying data.

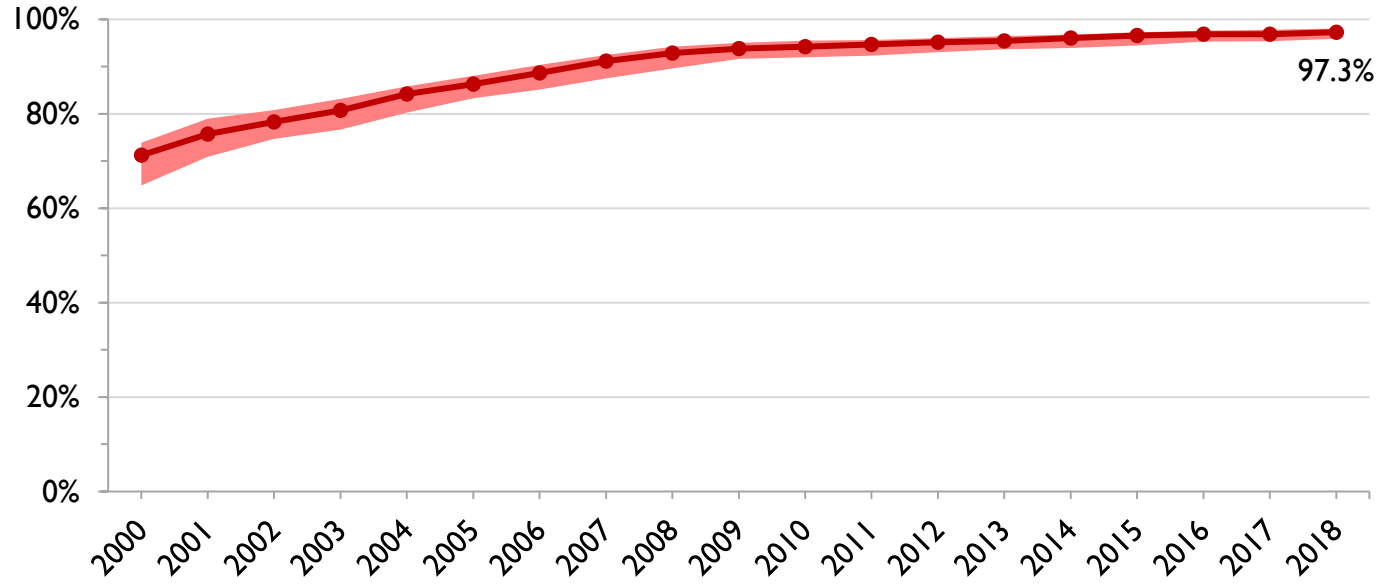
Figure 5.3 Percent of people with diagnosed HIV living in Ontario in care who are virally suppressed, 2000 to 2018



Snapshot

The percent of people in care who are virally suppressed increased from 47.7% in 2000 (range: 35.2% to 54.0%) to 93.3% in 2018 (range: 87.5% to 94.7%).

Figure 5.4 Percent of people with diagnosed HIV living in Ontario on ART who are virally suppressed, 2000 to 2018

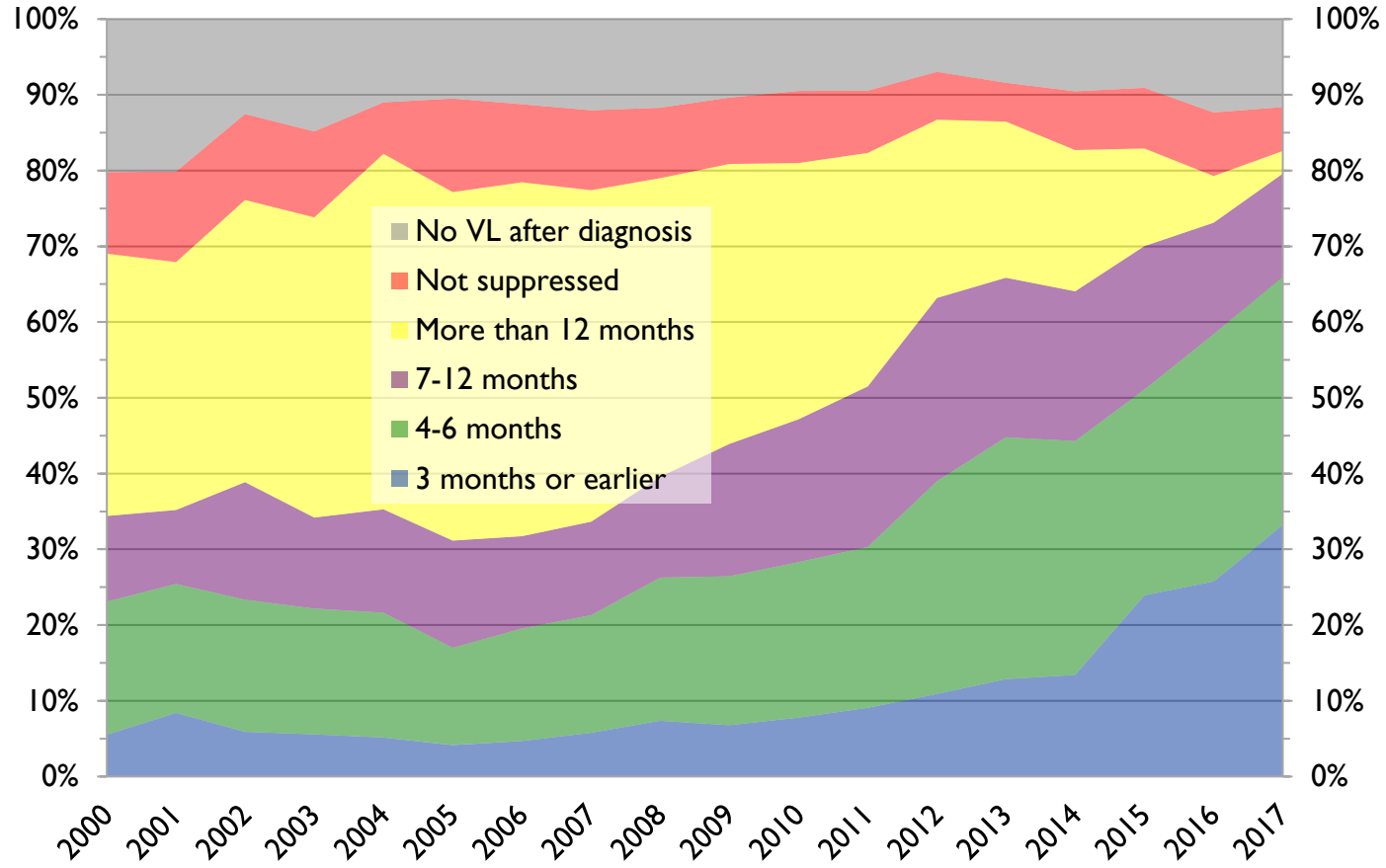


Snapshot

The percent of people on ART who are virally suppressed increased from 71.2% in 2000 (range: 64.8% to 73.9%) to 97.3% in 2018 (range: 95.9% to 98.1%).

Notes: Solid line represents main estimate and shaded area represents range of estimates. Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort. See **Table 5.2** and **Table 5.3** for underlying data.

Figure 5.5 Time from HIV diagnosis to viral suppression for people newly diagnosed with HIV in Ontario, 2000 to 2017



Snapshot

The percent of newly diagnosed people who are virally suppressed within three months of diagnosis was approximately 5% in the early and mid-2000s and increased to 33.2% in 2017. In addition, in 2017, another 32.8% of newly diagnosed people were virally suppressed within 4-6 months, 13.6% within 7-12 months, and 3.0% more than 12 months after diagnosis. An estimated 5.8% did not achieve viral suppression, and 11.6% had no viral load test after diagnosis (i.e. did not engage in care in Ontario).

Notes: Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort. See **Table 5.4** for underlying data.

Appendices

1. Technical notes on the Ontario HIV Laboratory Cohort

Data sources

Modelling of the total number of people living with HIV and the undiagnosed fraction

The Public Health Agency of Canada conducts modelling of HIV incidence and prevalence every two years for Canada, including modelling at the provincial level. For Ontario, this modelling is carried out using data obtained from Public Health Ontario on the cumulative number of diagnosed cases of HIV in Ontario, and an estimated number of deaths among people living with HIV. The Canadian modelling method is described in Estimates of HIV Incidence, Prevalence and Canada's Progress on Meeting the 90-90-90 HIV Targets, 2018, published in 2020[4]. The statistical modelling is based on a back-calculation method that combines HIV and AIDS diagnostic data, with data on proportions of recent infections from laboratory testing algorithms. This method is similar to methods used in the European Union, the USA, and Australia. In order to calculate an accurate number of people living with HIV in Ontario, alternate data sources were used to account for mortality and out-migration. Mortality estimates were calculated using data obtained from the Institute for Clinical Evaluative Sciences, and out-migration was estimated based on individuals lost to care in Ontario. The undiagnosed fraction is calculated dividing the estimated number of people who are diagnosed and alive in Ontario by the estimated prevalence estimate from the model.

HIV Datamart

Information in this report comes from the HIV Datamart housed at the Public Health Ontario (PHO) Laboratory. PHO Laboratory conducts centralized HIV diagnostic and VL testing for Ontario, and maintains databases that contain information on the vast majority of such testing in the province. These databases were integrated to form the HIV Datamart. In the datamart, a person's diagnostic and VL test records are linked using patient identifiers. However, it is not possible to link non-nominal HIV-positive diagnostic tests (coded, anonymous) to VL tests, as no identifying information is available to facilitate linkage.

All information in the HIV Datamart is confidential, and only de-identified aggregate data is shared with OHESI partners for inclusion in this report.

The HIV diagnosis and VL databases used to create the datamart are described in further detail below:

HIV diagnosis database (1985 to 2018)

The HIV diagnosis database contains records for all individuals who have had an HIV-positive diagnostic test result in Ontario. This includes people who were diagnosed with HIV for the first time in Ontario, as well as people who were diagnosed elsewhere and migrated to Ontario and tested again. PHO Laboratory conducts the vast majority of HIV testing in Ontario. In Ontario,

[4] Accessed, 3/26/2021; https://www.canada.ca/en/public-health/services/publications/diseases-conditions/summary-estimates-hiv-incidence-prevalence-canadas-progress-90-90-90.html

individuals testing for HIV may use either their full name (nominal) or a code assigned in specific primary care settings (coded), or test without a code or name at designated HIV testing clinics (anonymous). Coded and anonymous testing are both forms of non-nominal testing.

HIV viral load database (1996 to 2018)

VL testing was implemented in 1996 and the database at PHO Laboratory contains records for all individuals who have had a VL test in Ontario. In addition to VL test results, the database contains information from the VL test requisition form (completed by the provider), including most recent CD4 count and whether the patient is on ART at the time of testing. Providers complete the information on ART on approximately 81% of VL test requisition forms. All VL tests in the database were conducted nominally.

Estimation of people with diagonsed HIV living in Ontario

The determination of people diagnosed with HIV living in Ontario, was created using the integrated HIV Datamart. Individuals are included as diagnosed in Ontario if they have:

1. At least one confirmed positive HIV diagnostic test (both nominal and non-nominal) (i.e., reactive Western Blot, detection of HIV viral nucleic acid, p24 antigen confirmed by neutralization assay, Geenius [lateral flow]), **and/or**
2. At least one HIV VL test above the threshold of detection, **and/or**
3. At least one HIV VL test below the threshold of detection and no obvious evidence of being a HIV-negative person

Individuals with record of a VL test only (no linked nominal HIV-positive diagnostic test) are included in the cohort, with one exception. Individuals with no confirmed HIV-positive diagnostic test and all undetectable VL test results **do not** enter the cohort if they have evidence of being HIV-negative (i.e. record of a nominal HIV-negative diagnostic test after, on the same day as, or within 30 days before their last undetectable VL test); these individuals are likely HIV-negative people receiving a VL test for diagnostic purposes. 1,637 individuals were excluded from the cohort for this reason.

A total of 51,730 people in the HIV Datamart met at least one of the three above criteria.

4. **and** have not been administratively lost to follow-up (LTFU) after two years for VL tests and unlinked non-nominal diagnoses, seven years for unlinked nominal diagnoses.

To determine who is living in Ontario during a calendar year a number of loss to follow-up rules are applied. For individuals with confirmed diagnostic tests which are not linked to a viral load test, they are assumed in the province for 2 years if the diagnostic test was non-nominal and 7 years if the unlinked diagnostic test was nominal. For those diagnostic tests that are linked to VL tests, individuals are removed if they have no record of a VL test for more than 2 consecutive years, and no VL test at a later date (referred to as administratively LTFU). These individuals are removed to account for potential death or migration out of the province. If an LTFU individual has a subsequent VL test in later years, they re-enter the cohort and are counted as being a diagnosed person living in Ontario during the years in which they were in a gap in care. The 2-year LTFU criteria was selected given that this would include most individuals who are in a *known* gap in care (i.e. individuals with no VL test in one or more consecutive years, but a VL test in later years). Between 2000 and 2018, the median duration of known gaps in care was 1.4 years.

After application of the LTFU criteria, there were 19,128 diagnosed people living with HIV in the cohort at the end of 2018. See **Analysis** section below for more details on how the LTFU criteria was applied.

Individuals with a confirmed nominal HIV-positive diagnostic test but no linked VL test records were considered administratively LTFU after seven years.

Note: In sensitivity analyses, the LTFU criteria is extended to four years. See the **Indicator definitions** section below for more information.

Individuals with newly diagnosed HIV

The HIV Datamart was also used to identify the subset of individuals who were diagnosed with HIV for the first time in Ontario (i.e., were not individuals who were diagnosed outside the province and migrated to Ontario and tested again). This sample is used to measure time from HIV diagnosis to linkage to care and viral suppression.

Individuals are defined as newly diagnosed if they have record of a nominal HIV-positive diagnostic test and no evidence of being previously diagnosed. Individuals were considered to have evidence of being previously diagnosed if their first VL test after diagnosis was suppressed and/or their first suppressed VL test was within 30 days after diagnosis. Individuals without a VL test after a nominal HIV-positive diagnostic test were included; individuals were considered not linked to care if they did not have a VL test more than 30 days after their diagnosis. Unlike the inclusion criteria for the overall Ontario HIV Laboratory Cohort, individuals with a VL test only (no linked HIV-positive diagnostic test) are not included as being newly diagnosed, as a diagnosis date is needed to measure time to care and suppression.

Overall, 10,641 individuals had a nominal HIV-positive diagnostic test between 2000 and 2017. Of these, 852 (8.8%) were excluded because they had evidence of being previously diagnosed. The remaining 9,709 are included as individuals newly diagnosed with HIV.

Analysis

We used the cohort to calculate the number of individuals each year meeting the cascade indicator definitions for diagnosed, in care, on ART, and virally suppressed (See **Indicator definitions**). The denominator used to calculate the percent of individuals in each stage per year varied by cascade stage. We used the individuals with newly diagnosed HIV to calculate time from HIV diagnosis to linkage to care and viral suppression.

Cohort individuals are included in the analysis of annual cascade indicators until administratively LTFU (defined as no VL test for more than three consecutive years and no VL test in later years). This is done to account for possible migration or death. For example, if a diagnosed individual had a VL test in 2011, but no test for the next four years, their VL test result would be carried forward to 2012 and they are included in the analysis for the subsequent two years (i.e. 2013 and 2014), but not afterwards (i.e. 2015). However, if this individual re-engages in care in the future (e.g. 2018) and has another VL test, they would be included in the analysis for all the years in which they were in a gap in care (i.e. 2012 to 2017). During this gap in care, it is assumed that the individual is **not** in care, **not** on ART, and **not** virally suppressed.

For each cascade indicator, a "Main" estimate is calculated, along with an "Upper" and/or "Lower" estimate, where applicable. The "Main" estimate represents the best estimate for the cohort. However,

as there is no widespread consensus on how some indicators should be defined, "Upper" and "Lower" estimates are also calculated in order to reflect the impact of different definitions and create a range of possible values. These estimates are calculated using more or less conservative definitions for an indicator. For some indicators, there were no feasible "Upper" and/or "Lower" definitions that could be applied.

The analysis in this report is limited to VL tests conducted January 1st, 2000 or later. VL testing was implemented in Ontario in 1996, and took time to be scaled up and become a routine part of HIV care. Therefore, we only consider VL data from 2000 onwards to be of sufficient quality to be a good indicator of engagement in HIV care.

The analyses of time from diagnosis to linkage to care and viral suppression further exclude the year 2018, as many individuals diagnosed in this year do not have a full two years of follow-up data (i.e., until the end of 2020) for analysis.

Limitations and assumptions

HIV prevalence and undiagnosed fraction

- The modelling relies on a number of data sources and on the accuracy of the data inputs. An accurate number of annual cases due to local transmission is critical to calculating incidence. Sensitivity analyses and comparisons to other methods were done to ensure the most accurate prevalence estimate.
- Prevalence estimates require accurate mortality counts for all people living with HIV and out-migration estimates, in order to accurately estimate the number of diagnosed and living in the province at any particular moment in time.

HIV Datamart and estimation of people living with diagnosed HIV

- The datamart was generated using data extracted from laboratory information systems constructed for clinical purposes. The completion of this data is reliant on healthcare providers completing the test requisitions.
- While the estimation of people living with HIV in Ontario represents our best province-wide understanding of the cascade among diagnosed people with HIV in Ontario, representativeness may be limited by the inability to directly account for deaths and migration out of the province (see **Diagnosed** section below for more details on these limitations).

Cascade indicators

Diagnosed

- If a diagnosed individual does not have a VL test in a given year, it is not possible to determine the reason (e.g. migration out of the province, death or actual disengagement from care) from the laboratory data. To account for possible migration or death, individuals are removed from the cohort (administratively LTFU) if they had no record of a VL test for more than two consecutive years. However, it is possible that some of these individuals are still living in the province (but not connected to care), and therefore the number of individuals in the cohort may be lower than the

actual number living with diagnosed HIV in the province. If a person administratively LTFU subsequently re-engages in care, they are re-entered into the cohort and counted as being a diagnosed person living with HIV but not in care, on ART, or virally suppressed in all years since their last VL test. This may be accurate; however, it is not possible to rule out that the individual migrated out of Ontario for these years and then returned.

- The inclusion of non-nominal positive HIV diagnoses from the cohort may mean the number of people with diagnosed HIV is overestimated. Many people diagnosed non-nominally end up receiving either a nominal HIV-positive diagnostic test or a nominal VL test when they enter care and would therefore be double counted.
- We extended the LTFU criteria to four years to create an "Upper" estimate of the number diagnosed (and a "Lower" estimate of the percent of diagnosed individuals in care, on ART, and suppressed) and explore the potential impact of the above limitations.

Newly diagnosed

- The number of newly diagnosed individuals included in the analyses of time to linkage to care and viral suppression is likely an underestimate of the actual number of newly diagnosed individuals in the province. The newly diagnosed sample excludes non-nominal HIV-positive diagnostic tests and does not include individuals with record of a VL test only (no linked nominal HIV-positive diagnostic test). This means individuals diagnosed non-nominally are not included in these analyses unless they received a nominal HIV diagnostic test at entrance to care.

Linkage to and in care

- It is assumed that having a single VL test in a given calendar year means that a person is in care, and having no VL test means a person is not in care. This may not reflect an individual's actual state of engagement in care. For example, a health provider may recommend less frequent VL testing for a patient who has been virally suppressed for several years, which may lead to an underestimate of the number of people in care.

On antiretroviral treatment

- When a person receives a VL test, a provider fills out a test requisition form and sends it to the laboratory along with a blood sample for testing. The VL test form records information on whether the person getting tested is on ART. However, this information is missing for about 17 to 20% of VL tests each year. To reduce the impact of this missing data, conservative assumptions on ART status are made for requisitions with missing information. Individuals with missing treatment information are assumed to be on ART if they have a suppressed VL on their **last** test in the calendar year, while unsuppressed individuals with missing treatment data are assumed to be off. Since some unsuppressed individuals with missing treatment information may actually be on treatment, the number on ART is likely underestimated.
- We created "Upper" and "Lower" estimates of the counts of individuals on ART. Individuals with missing treatment information and a suppressed VL on **any** VL test in the calendar year were included in the "Upper" estimate, while individuals with missing treatment information and a suppressed VL on **all** VL tests in the calendar year were included in the "Lower" estimate.
- If a person in the cohort does not have a VL test in a given year, they are assumed to be **not** on ART for that year, which may also underestimate the number on ART.

Virally suppressed

- An individual is considered to be virally suppressed if they have a suppressed VL on their **last** VL in a calendar year. This may over- or underestimate the number of virally suppressed individuals. We created "Upper" and "Lower" estimates of the counts of virally suppressed individuals. Individuals with a suppressed VL on **any** VL test in the calendar year were included in the "Upper" estimate, while individuals with a suppressed VL on **all** VL tests in the calendar year were included in the "Lower" estimate.
- If a person in the cohort does not have a VL test in a given year, they are assumed to be **not** virally suppressed for that year, which may underestimate the number suppressed.
- To calculate the percent of people on ART who are virally suppressed, individuals with missing treatment information are assumed to be on ART if they have a suppressed VL on their **last** VL test in the calendar year while unsuppressed individuals with missing treatment data are assumed to be off ART. Since some unsuppressed individuals with missing treatment information may actually be on treatment, the number on ART is likely underestimated, and the proportion of them who are virally suppressed is likely overestimated. Also, people in the cohort may be better monitored than those not included in the cohort, leading to an overestimate of this percent.

Indicator definitions

Diagnosed

Estimate	"Diagnosed" definition
Main	Nominal or non-nominal HIV-positive diagnostic test **and/or** HIV viral load test*, **and not** administratively lost to follow-up after **two** years for viral load tests and unlinked non-nominal diagnoses, **seven** years for unlinked nominal diagnoses
Upper	Nominal or non-nominal HIV-positive diagnostic test **and/or** HIV viral load test*, **and not** administratively lost to follow-up after **four** years for viral load tests and unlinked non-nominal diagnoses, **seven** years for unlinked nominal diagnoses

*Individuals with no nominal HIV-positive diagnostic test and all undetectable VL tests were not included if they had evidence of being HIV-negative (i.e. record of a nominal HIV-negative diagnostic test after, on the same day as, or within 30 days before their last undetectable VL test).

Newly diagnosed

Estimate	"Newly diagnosed" definition
Main	Nominal HIV-positive diagnostic test and no evidence of being previously diagnosed (i.e. first VL after diagnosis not suppressed, or first suppressed VL test was not within 30 days after diagnosis)

In care (among people with diagnosed HIV)

Estimate	"In care" definition	"Diagnosed" denominator used for calculating percent of individuals in stage per year
Main	At least one VL test in two calendar years	Diagnosed (Main estimate)
Lower	At least one VL test in two calendar years	Diagnosed (Upper estimate)

Linkage to care (among people newly diagnosed with HIV)

Estimate	"Linkage to care" definition	"Newly diagnosed" denominator used for calculating percent of individuals in stage per year
Main	Number of months from HIV diagnosis to first VL test	Newly diagnosed (Main estimate)

On ART (among people with diagnosed HIV)

Estimate	"On ART" definition	"Diagnosed" denominator used for calculating percent of individuals in stage per year
Main	Documented on ART or VL less than 200 copies/mL **last** VL test	Diagnosed (Main estimate)
Upper	Documented on ART or VL less than 200 copies/mL **any** VL test	Diagnosed (Main estimate)
Lower	Documented on ART or VL less than 200 copies/mL **all** VL tests	Diagnosed (Upper estimate)

On ART (among people in care)

Estimate	"On ART" definition	"In care" denominator used for calculating percent of individuals in stage per year
Main	Documented on ART or VL less than 200 copies/mL **last** VL test	At least one VL test
Upper	Documented on ART or VL less than 200 copies/mL **any** VL test	At least one VL test
Lower	Documented on ART or VL less than 200 copies/mL **all** VL tests	At least one VL test

Virally suppressed (among people with diagnosed HIV)

Estimate	"Virally suppressed" definition	"Diagnosed" denominator used for calculating percent of individuals in stage per year
Main	VL less than 200 copies/mL on **last** VL test	Diagnosed (Main estimate)
Upper	VL less than 200 copies/mL on **any** VL test	Diagnosed (Main estimate)
Lower	VL less than 200 copies/mL on **all** VL tests	Diagnosed (Upper estimate)

Virally suppressed (among people with diagnosed HIV in care)

Estimate	"Virally suppressed" definition	"In care" denominator used for calculating percent of individuals in stage per year
Main	VL less than 200 copies/mL on **last** VL test	At least one VL test
Upper	VL less than 200 copies/mL on **any** VL test	At least one VL test
Lower	VL less than 200 copies/mL on **all** VL tests	At least one VL test

Virally suppressed (among people with diagnosed HIV on ART)

Estimate	"Virally suppressed" definition	"On ART" denominator used for calculating percent of individuals in stage per year
Main	VL less than 200 copies/mL on **last** VL test	Documented on ART or VL less than 200 copies/mL **last** VL test
Upper	VL less than 200 copies/mL on **any** VL test	Documented on ART or VL less than 200 copies/mL **any** VL test
Lower	VL less than 200 copies/mL on **all** VL tests	Documented on ART or VL less than 200 copies/mL **all** VL tests

*Percent of those on with diagnosed HIV on ART that were virally suppressed is calculated differently than percent of those with diagnosed HIV and the percent of those with diagnosed HIV in care.

Time to viral suppression (among people newly diagnosed with HIV)

Estimate	"Time to VL suppression" definition	"Newly diagnosed" denominator used for calculating percent of individuals in stage per year
Main	Number of months from HIV diagnosis to first suppressed VL (less than 200 copies/mL)	Newly diagnosed (main estimate)

Definitions

Administrative lost to follow-up (LTFU)

An individual in the Ontario HIV Laboratory Cohort is considered to be a person with diagnosed HIV who is living in Ontario until administratively lost to follow-up, defined as having had no viral load test for more than two consecutive years and no viral load test in later years. Individuals lost to follow-up are assumed to have died or migrated out of the province, and are removed from the cohort. Based on the constraints of this definition, a diagnosed individual who is actually living in Ontario would be removed from the cohort if they haven't had a VL test in more than two years. If this individual goes on to have a viral load test in the future, they are re-entered into the cohort. In additional analyses, the lost to follow-up criteria is increased to four years.

HIV datamart

An integrated data platform composed of Public Health Ontario Laboratory's diagnostic and viral load testing databases. Within the datamart, diagnostic and viral load test records are linked together for the same person (however, linkage is not possible for non-nominal HIV-positive diagnostic tests).

HIV-positive diagnostic test

Defined as a blood sample that has initially tested reactive on a screening test (either at the laboratory or on a point-of-care / rapid test), and has been confirmed as HIV-positive by a separate test (lateral flow immunoassay, Western Blot, p24 antigen confirmatory test, or polymerase chain reaction for children <18 months). HIV-positive diagnostic tests in the HIV Datamart include people who were diagnosed with HIV for the first ever time in Ontario, as well as people who were diagnosed HIV-positive elsewhere and moved to Ontario and tested again.

Newly HIV diagnosed

Individuals in the HIV Datamart who received their first ever HIV-positive diagnosis in Ontario (i.e. were not diagnosed elsewhere and then moved to Ontario and tested again). Individuals are considered newly diagnosed in Ontario if they have record of a nominal HIV-positive diagnostic test and no evidence of being previously diagnosed (i.e. no indication of a repeat test, no detectable viral load test or CD4 count before their diagnosis date, first VL after diagnosis not suppressed).

Nominal HIV testing

A type of HIV diagnostic testing where the test requisition form contains the name of the individual being tested. Nominal HIV tests can be linked to viral load tests in the HIV datamart using patient identifiers.

Non-nominal HIV testing

A type of HIV diagnostic testing where the test requisition form does not contain the name of the individual being tested. There are two types of non-nominal testing in Ontario: anonymous and coded. The lack of identifying information means that it is not possible to link non-nominal HIV-positive diagnostic tests to previous diagnostic tests and viral load tests within the HIV datamart.

Test requisition

Along with each HIV diagnostic and viral load test, a test requisition form is completed. It is filled out by the provider who conducted the test and collects information on the individual being tested. The viral load test requisition form collects information on whether the individual is on antiretroviral treatment at the time of testing and most recent CD4 cell count.

Abbreviations

ART = Antiretroviral therapy

LTFU = Lost to follow up

OHESI = Ontario HIV Epidemiology and Surveillance Initiative

PHO = Public Health Ontario

PWID = People who use injection drugs

VL = viral load

2. Data tables

This section of the report contains the data tables for the figures found in the **Data and Figures** section of the report.

Note: All indicators have a "Main" estimate, and some have an "Upper" and/or "Lower" estimate. The "Main" estimate represents the best estimate for that indicator. "Upper" and "Lower" estimates were calculated when possible, in order to reflect the impact of different definitions (i.e. more/less conservative) and provide a range of possible values. For some indicators, there were no feasible "Upper" and/or "Lower" definitions that could be applied.

1. Cascade Summary

Table 1.1 Number of people living with HIV in Ontario engaged in the steps of the care cascade, 2018

Indicator	Main estimate	Upper estimate	Lower estimate	Gap to meet 90-90-90 target
People living with HIV	22,439	27,000	20,600	
People living with HIV, who are diagnosed	19,128	20,412		893 - 2,177
People living with HIV, who are on treatment	16,214	16,324	15,413	2,850 - 3,761
People living with HIV, who are virally suppressed	15,775	16,006	14,781	1,250 - 2,476

Table 1.2 90-90-90 Estimates Ontario, 2018

Indicator	Main estimate	Upper estimate	Lower estimate
People living with HIV, who are diagnosed, 1st 90	85.2%	86.2%	80.8%
People diagnosed with HIV, who are on treatment, 2nd 90	84.8%	85.3%	80.6%
People on treatment who are virally suppressed, 3rd 90	97.3%	98.1%	95.9%

Notes: Estimate for people living with HIV provided by Public Health Agency of Canada, based on data from PHO. All other data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort.

2. Diagnosed

Table 2.1 Number of people with diagnosed HIV living in Ontario, 2000 to 2018

Year	Main estimate	Upper estimate
	Included until administratively lost to follow-up after **2 years** for HIV viral load tests and non-nominal confirmed HIV diagnostic test, 7 years for unlinked nominal confirmed HIV diagnostic tests	Included until administratively lost to follow-up after **4 years** for viral load tests and non-nominal confirmed HIV diagnostic test, 7 years for unlinked nominal confirmed HIV diagnostic tests
2000	10,945	12,237
2001	11,509	12,953
2002	12,076	13,853
2003	12,663	14,444
2004	13,082	14,757
2005	13,483	15,150
2006	14,001	15,600
2007	14,397	15,901
2008	14,894	16,360
2009	15,300	16,696
2010	15,745	17,098
2011	16,181	17,532
2012	16,599	17,937
2013	16,814	18,250
2014	17,119	18,536
2015	17,455	18,764
2016	17,896	19,231
2017	18,437	19,732
2018	19,128	20,412

Notes: Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort.

3. Linkage to care and in care

Table 3.1 Number and percent of people with diagnosed HIV living in Ontario who are in care, 2000 to 2018

Year	Main Estimate			Lower Estimate		
	In care (Numerator)	Diagnosed (Denominator)	%	In care (Numerator)	Diagnosed (Denominator)	%
	At least one VL	Diagnosed "Main" Estimate		At least one VL	Diagnosed "Upper" Estimate	
2000	8,008	10,945	73.2%	8,008	12,237	65.4%
2001	8,419	11,509	73.2%	8,419	12,953	65.0%
2002	8,995	12,076	74.5%	8,995	13,853	64.9%
2003	9,581	12,663	75.7%	9,581	14,444	66.3%
2004	10,134	13,082	77.5%	10,134	14,757	68.7%
2005	10,695	13,483	79.3%	10,695	15,150	70.6%
2006	11,342	14,001	81.0%	11,342	15,600	72.7%
2007	11,752	14,397	81.6%	11,752	15,901	73.9%
2008	12,257	14,894	82.3%	12,257	16,360	74.9%
2009	12,692	15,300	83.0%	12,692	16,696	76.0%
2010	13,142	15,745	83.5%	13,142	17,098	76.9%
2011	13,566	16,181	83.8%	13,566	17,532	77.4%
2012	13,972	16,599	84.2%	13,972	17,937	77.9%
2013	14,340	16,814	85.3%	14,340	18,250	78.6%
2014	14,750	17,119	86.2%	14,750	18,536	79.6%
2015	15,169	17,455	86.9%	15,169	18,764	80.8%
2016	15,772	17,896	88.1%	15,772	19,231	82.0%
2017	16,356	18,437	88.7%	16,356	19,732	82.9%
2018	16,899	19,128	88.3%	16,899	20,412	82.8%

Notes: Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort.

Table 3.2 Number and percent of people newly diagnosed with HIV in Ontario who are linked to care within a certain period of time after HIV diagnosis, 2000 to 2017

Year	Main Estimate												
	Newly diagnosed (Denominator)	Linked to care (Numerator)											
	Newly diagnosed "Main" Estimate	One months or less		Two to three months		Three to six months		Six to 12 months		More than 12 months		No linked VL	
2000	381	133	34.9%	121	31.8%	20	5.2%	10	2.6%	20	5.2%	77	20.2%
2001	452	153	33.8%	141	31.2%	33	7.3%	9	2.0%	25	5.5%	91	20.1%
2002	574	156	27.2%	264	46.0%	49	8.5%	14	2.4%	19	3.3%	72	12.5%
2003	573	169	29.5%	244	42.6%	36	6.3%	19	3.3%	20	3.5%	85	14.8%
2004	601	215	35.8%	257	42.8%	29	4.8%	13	2.2%	21	3.5%	66	11.0%
2005	600	204	34.0%	247	41.2%	44	7.3%	23	3.8%	19	3.2%	63	10.5%
2006	640	244	38.1%	259	40.5%	32	5.0%	16	2.5%	17	2.7%	72	11.3%
2007	606	261	43.1%	203	33.5%	35	5.8%	12	2.0%	22	3.6%	73	12.0%
2008	624	276	44.2%	194	31.1%	41	6.6%	25	4.0%	15	2.4%	73	11.7%
2009	560	256	45.7%	188	33.6%	34	6.1%	12	2.1%	12	2.1%	58	10.4%
2010	579	295	50.9%	185	32.0%	33	5.7%	3	0.5%	8	1.4%	55	9.5%
2011	561	313	55.8%	147	26.2%	26	4.6%	11	2.0%	11	2.0%	53	9.4%
2012	459	256	55.8%	125	27.2%	26	5.7%	10	2.2%	10	2.2%	32	7.0%
2013	451	287	63.6%	99	22.0%	13	2.9%	6	1.3%	8	1.8%	38	8.4%
2014	515	299	58.1%	124	24.1%	22	4.3%	12	2.3%	9	1.7%	49	9.5%
2015	497	313	63.0%	102	20.5%	18	3.6%	10	2.0%	9	1.8%	45	9.1%
2016	536	327	61.0%	106	19.8%	16	3.0%	12	2.2%	9	1.7%	66	12.3%
2017	500	342	68.4%	82	16.4%	9	1.8%	5	1.0%	4	0.8%	58	11.6%

Notes: Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort.

4. On antiretroviral treatment

Table 4.1 Number and percent of people with diagnosed HIV living in Ontario who are on ART, 2000 to 2018

Year	Main Estimate			Upper Estimate			Lower Estimate		
	On ART (Numerator)	Diagnosed (Denominator)	%	On ART (Numerator)	Diagnosed (Denominator)	%	On ART (Numerator)	Diagnosed (Denominator)	%
	Documented on ART or virally suppressed on **last** VL test in the calendar year	Diagnosed "Main" Estimate		Documented on ART or virally suppressed on **any** VL test in the calendar year	Diagnosed "Main" Estimate		Documented on ART or virally suppressed on **all** VL tests in the calendar year	Diagnosed "Upper" Estimate	
2000	5,359	10,945	49.0%	5,850	10,945	53.4%	4,350	12,237	35.5%
2001	5,653	11,509	49.1%	6,090	11,509	52.9%	4,616	12,953	35.6%
2002	6,029	12,076	49.9%	6,494	12,076	53.8%	4,979	13,853	35.9%
2003	6,484	12,663	51.2%	6,887	12,663	54.4%	5,437	14,444	37.6%
2004	6,916	13,082	52.9%	7,301	13,082	55.8%	5,878	14,757	39.8%
2005	7,433	13,483	55.1%	7,802	13,483	57.9%	6,382	15,150	42.1%
2006	8,110	14,001	57.9%	8,416	14,001	60.1%	7,095	15,600	45.5%
2007	8,700	14,397	60.4%	9,010	14,397	62.6%	7,672	15,901	48.2%
2008	9,476	14,894	63.6%	9,716	14,894	65.2%	8,384	16,360	51.2%
2009	10,189	15,300	66.6%	10,407	15,300	68.0%	9,052	16,696	54.2%
2010	10,890	15,745	69.2%	11,124	15,745	70.7%	9,822	17,098	57.4%
2011	11,517	16,181	71.2%	11,694	16,181	72.3%	10,500	17,532	59.9%
2012	12,266	16,599	73.9%	12,433	16,599	74.9%	11,273	17,937	62.8%
2013	12,928	16,814	76.9%	13,064	16,814	77.7%	11,949	18,250	65.5%
2014	13,466	17,119	78.7%	13,624	17,119	79.6%	12,584	18,536	67.9%
2015	14,119	17,455	80.9%	14,251	17,455	81.6%	13,227	18,764	70.5%
2016	14,848	17,896	83.0%	14,976	17,896	83.7%	13,956	19,231	72.6%
2017	15,544	18,437	84.3%	15,660	18,437	84.9%	14,705	19,732	74.5%
2018	16,214	19,128	84.8%	16,324	19,128	85.3%	15,413	20,412	75.5%

Notes: Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort.

Table 4.2 Number and percent of people with diagnosed HIV living in Ontario in care who are on ART, 2000 to 2018

Year	Main Estimate			Upper Estimate			Lower Estimate		
	On ART (Numerator)	In care (Denominator)	%	On ART (Numerator)	In care (Denominator)	%	On ART Numerator)	In care (Denominator)	%
	Documented on ART or virally suppressed on **last** VL test in the calendar year	At least one VL		Documented on ART or virally suppressed on **any** VL test in the calendar year	At least one VL		Documented on ART or virally suppressed on **all** VL tests in the calendar year	At least one VL	
2000	5,359	8,008	66.9%	5,850	8,008	73.1%	4,350	8,008	54.3%
2001	5,653	8,419	67.1%	6,090	8,419	72.3%	4,616	8,419	54.8%
2002	6,029	8,995	67.0%	6,494	8,995	72.2%	4,979	8,995	55.4%
2003	6,484	9,581	67.7%	6,887	9,581	71.9%	5,437	9,581	56.7%
2004	6,916	10,134	68.2%	7,301	10,134	72.0%	5,878	10,134	58.0%
2005	7,433	10,695	69.5%	7,802	10,695	72.9%	6,382	10,695	59.7%
2006	8,110	11,342	71.5%	8,416	11,342	74.2%	7,095	11,342	62.6%
2007	8,700	11,752	74.0%	9,010	11,752	76.7%	7,672	11,752	65.3%
2008	9,476	12,257	77.3%	9,716	12,257	79.3%	8,384	12,257	68.4%
2009	10,189	12,692	80.3%	10,407	12,692	82.0%	9,052	12,692	71.3%
2010	10,890	13,142	82.9%	11,124	13,142	84.6%	9,822	13,142	74.7%
2011	11,517	13,566	84.9%	11,694	13,566	86.2%	10,500	13,566	77.4%
2012	12,266	13,972	87.8%	12,433	13,972	89.0%	11,273	13,972	80.7%
2013	12,928	14,340	90.2%	13,064	14,340	91.1%	11,949	14,340	83.3%
2014	13,466	14,750	91.3%	13,624	14,750	92.4%	12,584	14,750	85.3%
2015	14,119	15,169	93.1%	14,251	15,169	93.9%	13,227	15,169	87.2%
2016	14,848	15,772	94.1%	14,976	15,772	95.0%	13,956	15,772	88.5%
2017	15,544	16,356	95.0%	15,660	16,356	95.7%	14,705	16,356	89.9%
2018	16,214	16,899	95.9%	16,324	16,899	96.6%	15,413	16,899	91.2%

Notes: Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort.

5. Virally suppressed

Table 5.1 Number and percent of people with diagnosed HIV living in Ontario who are virally suppressed, 2000 to 2018

Year	Main Estimate			Upper Estimate			Lower Estimate		
	VL suppressed (Numerator)	Diagnosed (Denominator)	%	VL suppressed (Numerator)	Diagnosed (Denominator)	%	VL suppressed (Numerator)	Diagnosed (Denominator)	%
	VL less than 200 copies per ml on **last** VL test in the calendar year	Diagnosed "Main" Estimate		VL less than 200 copies per ml on **any** VL test in the calendar year	Diagnosed "Main" Estimate		VL less than 200 copies per ml on **all** VL tests in the calendar year	Diagnosed "Upper" Estimate	
2000	3,816	10,945	34.9%	4,321	10,945	39.5%	2,820	12,237	23.0%
2001	4,280	11,509	37.2%	4,807	11,509	41.8%	3,273	12,953	25.3%
2002	4,719	12,076	39.1%	5,246	12,076	43.4%	3,719	13,853	26.8%
2003	5,233	12,663	41.3%	5,727	12,663	45.2%	4,168	14,444	28.9%
2004	5,824	13,082	44.5%	6,267	13,082	47.9%	4,717	14,757	32.0%
2005	6,413	13,483	47.6%	6,868	13,483	50.9%	5,317	15,150	35.1%
2006	7,192	14,001	51.4%	7,602	14,001	54.3%	6,038	15,600	38.7%
2007	7,932	14,397	55.1%	8,332	14,397	57.9%	6,712	15,901	42.2%
2008	8,802	14,894	59.1%	9,152	14,894	61.4%	7,511	16,360	45.9%
2009	9,558	15,300	62.5%	9,889	15,300	64.6%	8,293	16,696	49.7%
2010	10,263	15,745	65.2%	10,623	15,745	67.5%	9,034	17,098	52.8%
2011	10,903	16,181	67.4%	11,187	16,181	69.1%	9,693	17,532	55.3%
2012	11,672	16,599	70.3%	11,943	16,599	72.0%	10,493	17,937	58.5%
2013	12,337	16,814	73.4%	12,599	16,814	74.9%	11,189	18,250	61.3%
2014	12,933	17,119	75.5%	13,185	17,119	77.0%	11,825	18,536	63.8%
2015	13,637	17,455	78.1%	13,863	17,455	79.4%	12,498	18,764	66.6%
2016	14,376	17,896	80.3%	14,616	17,896	81.7%	13,297	19,231	69.1%
2017	15,059	18,437	81.7%	15,316	18,437	83.1%	14,023	19,732	71.1%
2018	15,775	19,128	82.5%	16,006	19,128	83.7%	14,781	20,412	72.4%

Notes: Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort.

Table 5.2 Number and percent of people with diagnosed HIV living in Ontario in care who are virally suppressed, 2000 to 2018

Year	Main Estimate			Upper Estimate			Lower Estimate		
	VL suppressed (Numerator)	In care (Denominator)	%	VL suppressed (Numerator)	In care (Denominator)	%	VL suppressed (Numerator)	In care (Denominator)	%
	VL less than 200 copies per ml on **last** VL test in the calendar year	At least one VL		VL less than 200 copies per ml on **any** VL test in the calendar year	At least one VL		VL less than 200 copies per ml on **all** VL tests in the calendar year	At least one VL	
2000	3,816	8,008	47.7%	4,321	8,008	54.0%	2,820	8,008	35.2%
2001	4,280	8,419	50.8%	4,807	8,419	57.1%	3,273	8,419	38.9%
2002	4,719	8,995	52.5%	5,246	8,995	58.3%	3,719	8,995	41.3%
2003	5,233	9,581	54.6%	5,727	9,581	59.8%	4,168	9,581	43.5%
2004	5,824	10,134	57.5%	6,267	10,134	61.8%	4,717	10,134	46.5%
2005	6,413	10,695	60.0%	6,868	10,695	64.2%	5,317	10,695	49.7%
2006	7,192	11,342	63.4%	7,602	11,342	67.0%	6,038	11,342	53.2%
2007	7,932	11,752	67.5%	8,332	11,752	70.9%	6,712	11,752	57.1%
2008	8,802	12,257	71.8%	9,152	12,257	74.7%	7,511	12,257	61.3%
2009	9,558	12,692	75.3%	9,889	12,692	77.9%	8,293	12,692	65.3%
2010	10,263	13,142	78.1%	10,623	13,142	80.8%	9,034	13,142	68.7%
2011	10,903	13,566	80.4%	11,187	13,566	82.5%	9,693	13,566	71.5%
2012	11,672	13,972	83.5%	11,943	13,972	85.5%	10,493	13,972	75.1%
2013	12,337	14,340	86.0%	12,599	14,340	87.9%	11,189	14,340	78.0%
2014	12,933	14,750	87.7%	13,185	14,750	89.4%	11,825	14,750	80.2%
2015	13,637	15,169	89.9%	13,863	15,169	91.4%	12,498	15,169	82.4%
2016	14,376	15,772	91.1%	14,616	15,772	92.7%	13,297	15,772	84.3%
2017	15,059	16,356	92.1%	15,316	16,356	93.6%	14,023	16,356	85.7%
2018	15,775	16,899	93.3%	16,006	16,899	94.7%	14,781	16,899	87.5%

Notes: Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort.

Table 5.3 Number and percent of people with diagnosed HIV living in Ontario on ART who are virally suppressed, 2000 to 2018

Year	Main Estimate			Upper Estimate			Lower Estimate		
	VL suppressed (Numerator)	On ART (Denominator)	%	VL suppressed (Numerator)	On ART (Denominator)	%	VL suppressed (Numerator)	On ART (Denominator)	%
	VL less than 200 copies per ml on **last** VL test in the calendar year	Documented on ART or virally suppressed on **last** VL test in the calendar year		VL less than 200 copies per ml on **any** VL test in the calendar year	Documented on ART or virally suppressed on **any** VL test in the calendar year		VL less than 200 copies per ml on **all** VL tests in the calendar year	Documented on ART or virally suppressed on **all** VL tests in the calendar year	
2000	3,816	5,359	71.2%	4,321	5,850	73.9%	2,820	4,350	64.8%
2001	4,280	5,653	75.7%	4,807	6,090	78.9%	3,273	4,616	70.9%
2002	4,719	6,029	78.3%	5,246	6,494	80.8%	3,719	4,979	74.7%
2003	5,233	6,484	80.7%	5,727	6,887	83.2%	4,168	5,437	76.7%
2004	5,824	6,916	84.2%	6,267	7,301	85.8%	4,717	5,878	80.2%
2005	6,413	7,433	86.3%	6,868	7,802	88.0%	5,317	6,382	83.3%
2006	7,192	8,110	88.7%	7,602	8,416	90.3%	6,038	7,095	85.1%
2007	7,932	8,700	91.2%	8,332	9,010	92.5%	6,712	7,672	87.5%
2008	8,802	9,476	92.9%	9,152	9,716	94.2%	7,511	8,384	89.6%
2009	9,558	10,189	93.8%	9,889	10,407	95.0%	8,293	9,052	91.6%
2010	10,263	10,890	94.2%	10,623	11,124	95.5%	9,034	9,822	92.0%
2011	10,903	11,517	94.7%	11,187	11,694	95.7%	9,693	10,500	92.3%
2012	11,672	12,266	95.2%	11,943	12,433	96.1%	10,493	11,273	93.1%
2013	12,337	12,928	95.4%	12,599	13,064	96.4%	11,189	11,949	93.6%
2014	12,933	13,466	96.0%	13,185	13,624	96.8%	11,825	12,584	94.0%
2015	13,637	14,119	96.6%	13,863	14,251	97.3%	12,498	13,227	94.5%
2016	14,376	14,848	96.8%	14,616	14,976	97.6%	13,297	13,956	95.3%
2017	15,059	15,544	96.9%	15,316	15,660	97.8%	14,023	14,705	95.4%
2018	15,775	16,214	97.3%	16,006	16,324	98.1%	14,781	15,413	95.9%

Notes: Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort.

Table 5.4 Number and percent of people newly diagnosed with HIV in Ontario who are virally suppressed within a certain period of time after HIV diagnosis, 2000 to 2017

Year	Main Estimate												
	Newly diagnosed (Denominator)	Time to viral suppression (VL less than 200 copies per ml) (Numerator)											
	Newly diagnosed "Main" Estimate	3 months or earlier		Three to six months		Six to 12 months		More than 12 months		No suppressed VL		No linked VL	
2000	381	21	5.5%	67	17.6%	43	11.3%	132	34.6%	41	10.8%	77	20.2%
2001	452	38	8.4%	77	17.0%	44	9.7%	148	32.7%	54	11.9%	91	20.1%
2002	574	34	5.9%	100	17.4%	89	15.5%	214	37.3%	65	11.3%	72	12.5%
2003	573	32	5.6%	95	16.6%	69	12.0%	227	39.6%	65	11.3%	85	14.8%
2004	601	31	5.2%	99	16.5%	82	13.6%	282	46.9%	41	6.8%	66	11.0%
2005	600	25	4.2%	77	12.8%	85	14.2%	276	46.0%	74	12.3%	63	10.5%
2006	640	30	4.7%	95	14.8%	78	12.2%	299	46.7%	66	10.3%	72	11.3%
2007	606	35	5.8%	94	15.5%	75	12.4%	265	43.7%	64	10.6%	73	12.0%
2008	624	46	7.4%	118	18.9%	83	13.3%	246	39.4%	58	9.3%	73	11.7%
2009	560	38	6.8%	110	19.6%	98	17.5%	207	37.0%	49	8.8%	58	10.4%
2010	579	45	7.8%	119	20.6%	109	18.8%	196	33.9%	55	9.5%	55	9.5%
2011	561	51	9.1%	119	21.2%	119	21.2%	173	30.8%	46	8.2%	53	9.4%
2012	459	50	10.9%	129	28.1%	111	24.2%	108	23.5%	29	6.3%	32	7.0%
2013	451	58	12.9%	144	31.9%	95	21.1%	93	20.6%	23	5.1%	38	8.4%
2014	515	69	13.4%	159	30.9%	102	19.8%	96	18.6%	40	7.8%	49	9.5%
2015	497	119	23.9%	135	27.2%	94	18.9%	64	12.9%	40	8.0%	45	9.1%
2016	536	138	25.7%	175	32.6%	79	14.7%	33	6.2%	45	8.4%	66	12.3%
2017	500	166	33.2%	164	32.8%	68	13.6%	15	3.0%	29	5.8%	58	11.6%

Notes: Data provided by Public Health Ontario Laboratory. See **Technical notes** for definitions and more information on the Ontario HIV Laboratory Cohort.