HIV care cascade in Ontario:

Linkage to care, in care, on antiretroviral treatment, and virally suppressed, 2015

About OHESI

The Ontario HIV Epidemiology and Surveillance Initiative (OHESI) is a collaboration involving the AIDS Bureau of the Ontario Ministry of Health and Long-Term Care (MOHLTC), 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 program initiatives in the provincial "HIV/AIDS Strategy to 2026: Focusing Our Efforts - Changing the Course of the HIV Prevention, Engagement and Care Cascade in Ontario."

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

In 2014 and 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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This applied research study was approved by the Research Ethics Board at Public Health Ontario.

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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 established the support of people with HIV through the stages of the care cascade as a global priority. To measure progress towards this end, UNAIDS recommends the 90-90-90 targets: by 2020, 90% of all people living with HIV will be diagnosed, 90% of all people diagnosed with HIV infection will be on ART, and 90% of all people receiving ART will be virally suppressed. If all three 90-90-90 targets are met, then 81% of all people living with HIV will be on ART and 73% will be virally suppressed.

Ontario joins jurisdictions around the world in re-orienting HIV policies and programming to focus on measuring the HIV care cascade as a means to monitor health outcomes for people living with HIV and HIV transmission. Previous efforts to generate a comprehensive picture of the care cascade and 90-90-90 targets in Ontario were limited by reliance on information from separate and unlinked data sets. Recently, Public Health Ontario integrated provincial HIV laboratory and surveillance data to develop a novel data platform, and subsequently used this platform to generate the Ontario HIV Laboratory Cohort of people with **diagnosed HIV living in Ontario**. This cohort has allowed us to further our understanding of Ontario's HIV cascade among people living with HIV who are diagnosed.

This report summarizes the most recent data from the laboratory cohort and shows that engagement in Ontario's HIV cascade has improved over time. The percent of diagnosed individuals in the cohort who are in care, on ART, and virally suppressed have all increased, suggesting that people living with diagnosed HIV in Ontario are living longer and healthier lives. The analysis reported here is limited to a cohort of diagnosed individuals, and OHESI is currently working with mathematical modelers to develop a reliable and accurate way to estimate the total number of people living with HIV in the province (diagnosed and undiagnosed). This modeling will improve our ability to assess Ontario's progress towards meeting the UNAIDS 90-90-90 targets. However, the analysis presented here already demonstrates progress towards these targets.

[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 knowledgable and experienced in the management of HIV infection" and that physicians who do not have this experience "should consult with an HIV-experienced physician."

Take-home messages

- In 2015, there were 16,110 people living with diagnosed HIV in the Ontario HIV Laboratory Cohort. This represents the cohort's estimate of the number of people with diagnosed HIV who are living in the province (upper estimate: 17,423).
- The number of people with diagnosed HIV in Ontario has almost doubled compared to the 8,859 estimated to be living with diagnosed HIV in 2000 (upper estimate: 11,389).
- Engagement in Ontario's cascade has improved over time, with the percent of diagnosed people who are in care, on ART and virally suppressed all increasing from 2000 to 2015. Over this 15-year time period:
    - The percent of diagnosed people who are in care increased from 81% (lower estimate: 63%) to 87% (lower estimate: 81%).
    - The percent of diagnosed people who are on ART increased from 55% (range: 34 to 60%) to 81% (range: 70 to 82%).
    - The percent of diagnosed people who are virally suppressed doubled from 41% (range: 23 to 46%) to 80% (range: 67 to 81%).
- Time from HIV diagnosis to linkage to care and viral suppression has also improved over time.
    - The percent of newly diagnosed individuals who link to care within three months of diagnosis increased from 67% in 2000 to 82% in 2014.
    - The percent of newly diagnosed individuals who achieve viral suppression within six months of diagnosis increased from 22% in 2000 to 41% in 2013.
- Estimates for 2015 suggest that the majority of people with diagnosed HIV living in Ontario are currently on ART (81%, range: 70 to 82%), and over 90% of people on ART are virally suppressed.
- The results from the Ontario HIV Laboratory Cohort represent the most complete province-wide cascade estimates for people with diagnosed HIV living in Ontario.
    - These estimates complement other data sources exploring cascade engagement among diagnosed people who have already entered HIV care in Ontario, including the Ontario HIV Treatment Network Cohort Study (OCS) and the Institute of Clinical Evaluative Sciences (ICES) administrative HIV cohort.
- Overall, the Ontario HIV Laboratory Cohort demonstrates improved survival and cascade engagement among diagnosed people living with HIV, likely reflecting the availability of ART regimens that are more effective and easier to take, changes to treatment guidelines to recommend earlier initiation of ART after diagnosis, and the success of care and treatment initiatives.

Definitions

Administrative lost to follow-up

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 three years.

Anonymous HIV testing

A type of non-nominal HIV diagnostic testing where no identifying information on the individual being tested is collected on the test requisition form. The lack of identifying information means that it is not possible to link anonymous HIV-positive diagnostic tests to viral load tests within the HIV Datamart.

Coded HIV testing

A type of non-nominal HIV diagnostic testing where a code, instead of the name of the individual being tested, is collected on the test requisition form. The lack of identifying information means that it is not possible to link coded HIV-positive diagnostic tests to viral load tests within the HIV Datamart.

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 (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 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 viral load tests within the HIV Datamart.

Ontario HIV Laboratory Cohort

A population-based, retrospective cohort of people with diagnosed HIV living in Ontario created using Public Health Ontario Laboratory's HIV Datamart. It includes people in the datamart who have record of a nominal HIV-positive diagnostic test and/or at least 1 viral load test, and who have not been administratively lost to follow-up. In additional analyses, non-nominal HIV-positive diagnoses are also included in the cohort.

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 treatment

LTFU = Lost to follow-up

OHESI = Ontario HIV Epidemiology and Surveillance Initiative

PHOL = Public Health Ontario Laboratory

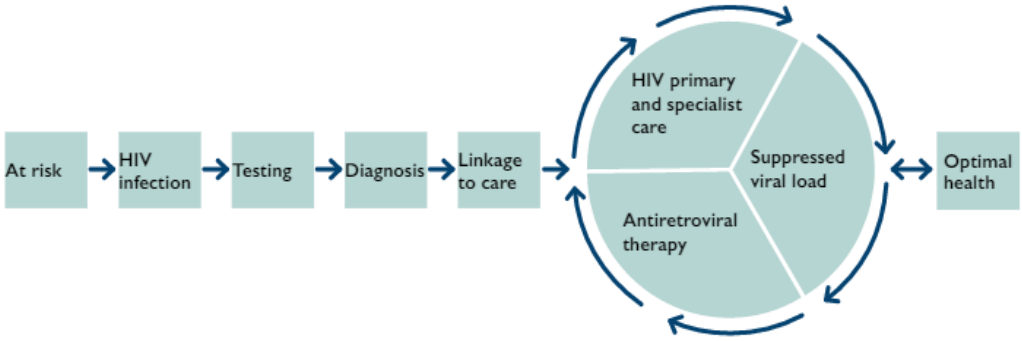
VL = Viral load

Background

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 the UNAIDS 90-90-90 targets (see below).
- Identifying gaps in the cascade can help the care system prioritize interventions and inform program/policy changes to improve engagement.
- 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



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.

Where does this data come from?

- Data in this report comes from the Public Health Ontario Laboratory (PHOL), which conducts all HIV diagnostic and viral load (VL) testing for the province – with a few small exceptions.
- PHOL's HIV diagnostic and VL databases were combined and used to create a group (also known as a cohort) of people with diagnosed HIV living in Ontario – referred to as the Ontario HIV Laboratory Cohort – whose cascade engagement can be monitored over time. For information on who is and isn't included in this cohort, see the Appendices.
- All information in the PHOL databases is confidential, and only de-identified aggregate data is shared with OHESI partners for inclusion in this report.

What are some of the limitations of this data?

- As with all analyses, there are limitations and some caution is needed when interpreting the estimates in this report (see Appendices).
- One important limitation is the inability to determine who in the cohort has died or migrated out of the province when estimating the number of people with diagnosed HIV living in Ontario.
- Where possible, a range of values were calculated for each cascade indicator to highlight the uncertainty involved in measuring the cascade.

Key trends

Diagnosed

- An individual in the Ontario HIV Laboratory Cohort is considered to be a person with diagnosed HIV living in the province if they have record of a nominal HIV-positive diagnostic test **and/or** at least one VL test (anytime between 1985 and 2015), **and** have not been administratively lost to follow-up (LTFU).
    - An individual is considered LTFU if they haven't had a VL test for more than two consecutive years, and have no VL test in later years, based on the assumption that they died or migrated out of the province.
- Based on this definition, an estimated 16,110 people were living with diagnosed HIV in Ontario in 2015. This number increases to 17,423 if non-nominal HIV-positive diagnostic tests are included and the LTFU criteria is extended to three years.
- The total number of people with diagnosed HIV living in Ontario has increased steadily over time and almost doubled from 2000 to 2015. A combination of factors has likely contributed to this increase, including ongoing new HIV diagnoses each year and improved life expectancy of people living with HIV due to successful treatment regimens.
- While the 16,110 individuals represent the majority of people with diagnosed HIV living in Ontario, it may not include everyone because we are not able to completely account for deaths and migration. Based on the constraints of the LTFU definition, a diagnosed individual who is actually living in Ontario would **not** be considered a person with diagnosed HIV living in the province if they haven't had a VL test in more than two years. This means that 16,110 may be an underestimate of the total number of people with diagnosed HIV living in Ontario.

Linkage to care and in care

- Individuals in the cohort are considered to be in care if they received at least one VL test in a given year.
- The number in care has increased steadily over time from 7,203 in 2000 to 14,065 in 2015 (i.e. 14,065 individuals had at least one VL test in 2015). This increase highlights a persistent and increasing demand for HIV-related services.
- The percent of people with diagnosed HIV living in Ontario who are in care was 81% in 2000 (lower estimate: 63%) and 87% in 2015 (lower estimate: 81%). Further, the percent of newly diagnosed individuals who are linked to care within three months of HIV diagnosis increased from 67% in 2000 to 82% in 2014.
- These improvements may be due to several factors, including better access to care, greater incentives for entering and staying in care (e.g. more effective treatments), and interventions that link individuals to care after diagnosis and retain them in care.

- Changes to provider practices with regards to frequency of VL testing may have also influenced these trends. For example, some providers may conduct less frequent VL monitoring for people living with HIV who are healthy and consistently adhering to ART.

On antiretroviral treatment

- Use of ART has increased over time, with the percent of people with diagnosed HIV living in Ontario who are on ART increasing from 55% in 2000 (range: 34 to 60%) to 81% in 2015 (range: 70 to 82%).
- This increase may be due to several factors, including improved access to ART, changes to guidelines to recommend earlier initiation of ART after diagnosis and to warn against treatment interruptions, and interventions to support people to start and remain on ART.
- See Appendices for details on how 'on ART' is defined and the assumptions necessary to perform this analysis.

Virally suppressed

- Viral suppression (defined as a VL less than 200 copies of HIV per milliliter of blood) has improved over time. Between 2000 and 2015, the percent of people with diagnosed HIV living in Ontario who are virally suppressed doubled from 41% (range: 23 to 46%) to 80% (range: 67 to 81%). Further, the percent of newly diagnosed individuals who achieved viral suppression within 6 months of HIV diagnosis increased from 22% in 2000 to 41% in 2013.
- In 2015, 91% (range: 84 to 93%) of individuals in care were virally suppressed and 94% (range: 91 to 95%) of those on ART were suppressed. These data suggest that when HIV-positive people in Ontario are on treatment and stay on treatment, they tend to achieve viral suppression.
- The doubling in viral suppression over the past 15 years is likely due to a combination of factors, such as the availability of more effective treatments that are easier to take, adherence support interventions, increases in ART use, and improvements in linkage to care.

Note: All cascade 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. See Appendices for more information on Indicator definitions.

Future directions

- Future OHESI reports will include cascade estimates by sex, age, region and priority population (i.e. gay, bisexual, and other men who have sex with men; African, Caribbean, and Black communities; Indigenous peoples; people who use injection drugs; and at-risk women) in order to better inform the prioritization of interventions to improve cascade engagement.
- OHESI is working with mathematical modelers, as well as the Public Health Agency of Canada, to estimate the total number of people living with HIV in Ontario (both diagnosed and undiagnosed). This modeling will help us understand how close we are to reaching the UNAIDS 90-90-90 targets.

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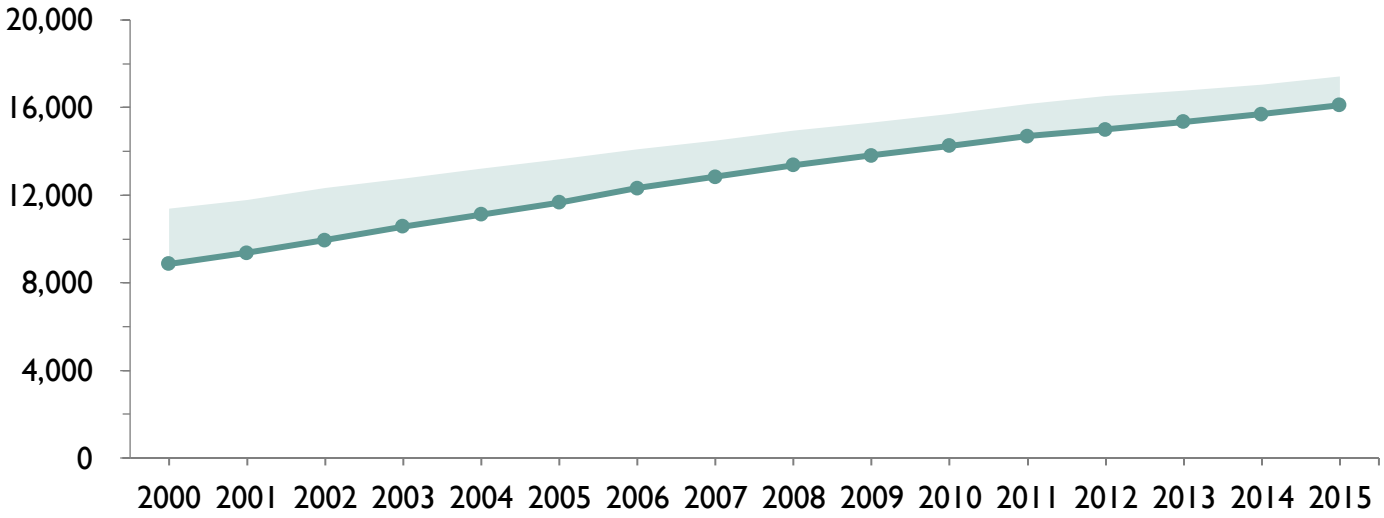
Data and figures

The data and figures in this section show trends in cascade indicators over time among people with diagnosed HIV in the Ontario HIV Laboratory Cohort. 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: All cascade indicators have a "Main" estimate, and some have an "Upper" and/or "Lower" estimate. 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. Diagnosed

Figure 1.1 Number of people with diagnosed HIV living in Ontario, 2000 to 2015



Number diagnosed 2015	
Main	16,110
Upper	17,423

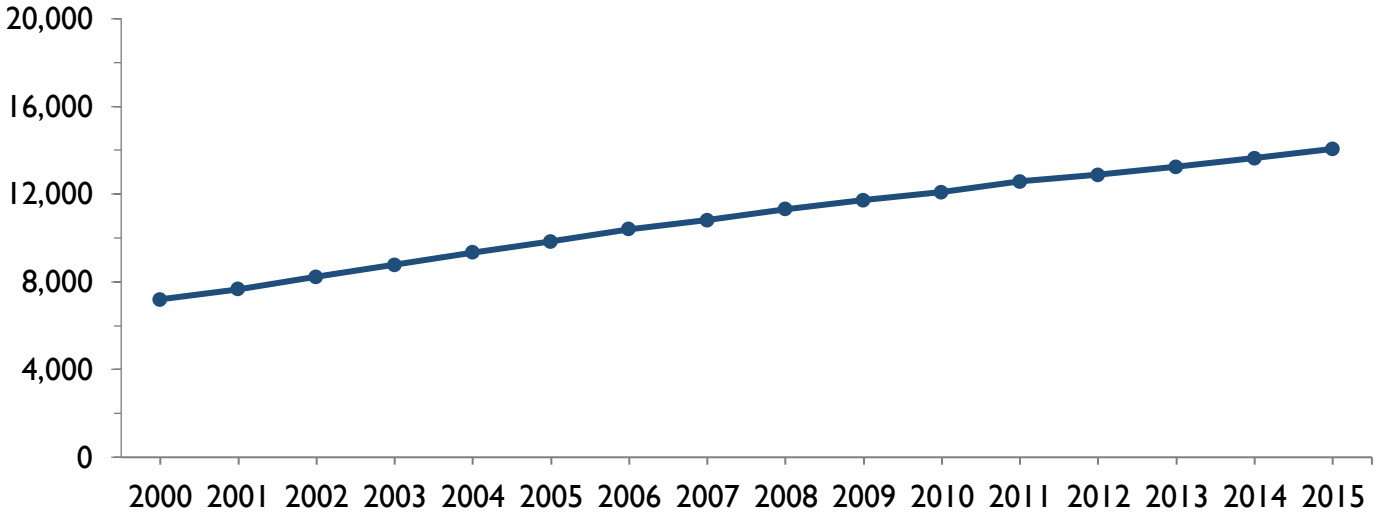
Trends

The number of people with diagnosed HIV living in Ontario increased from 8,859 in 2000 (upper estimate: 11,389) to 16,110 in 2015.

Notes: Solid line represents main estimate and shaded area represents range of estimates. Data provided by PHOL; source = Ontario HIV Laboratory Cohort. See Appendices for more information on the laboratory cohort and indicator definitions. See Table 1.1 for data.

2. Linkage to care and in care

Figure 2.1 Number of people with diagnosed HIV living in Ontario who are in care, 2000 to 2015

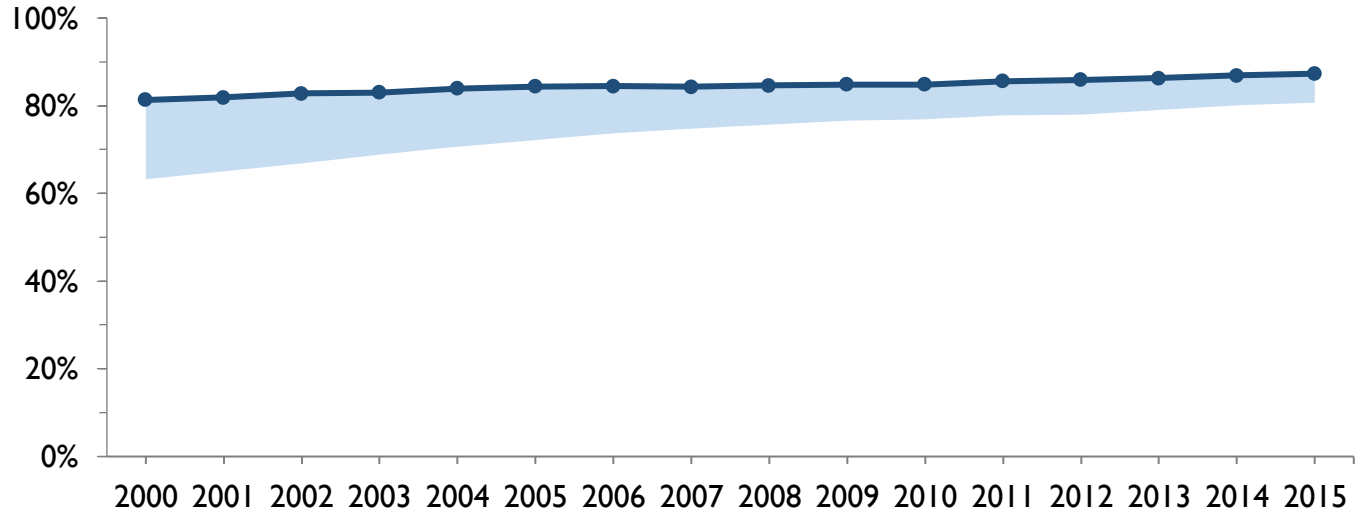


Number in care 2015	
Main	14,065

Trends

The number of people in care increased from 7,203 in 2000 to 14,065 in 2015.

Figure 2.2 Percent of people with diagnosed HIV living in Ontario who are in care, 2000 to 2015



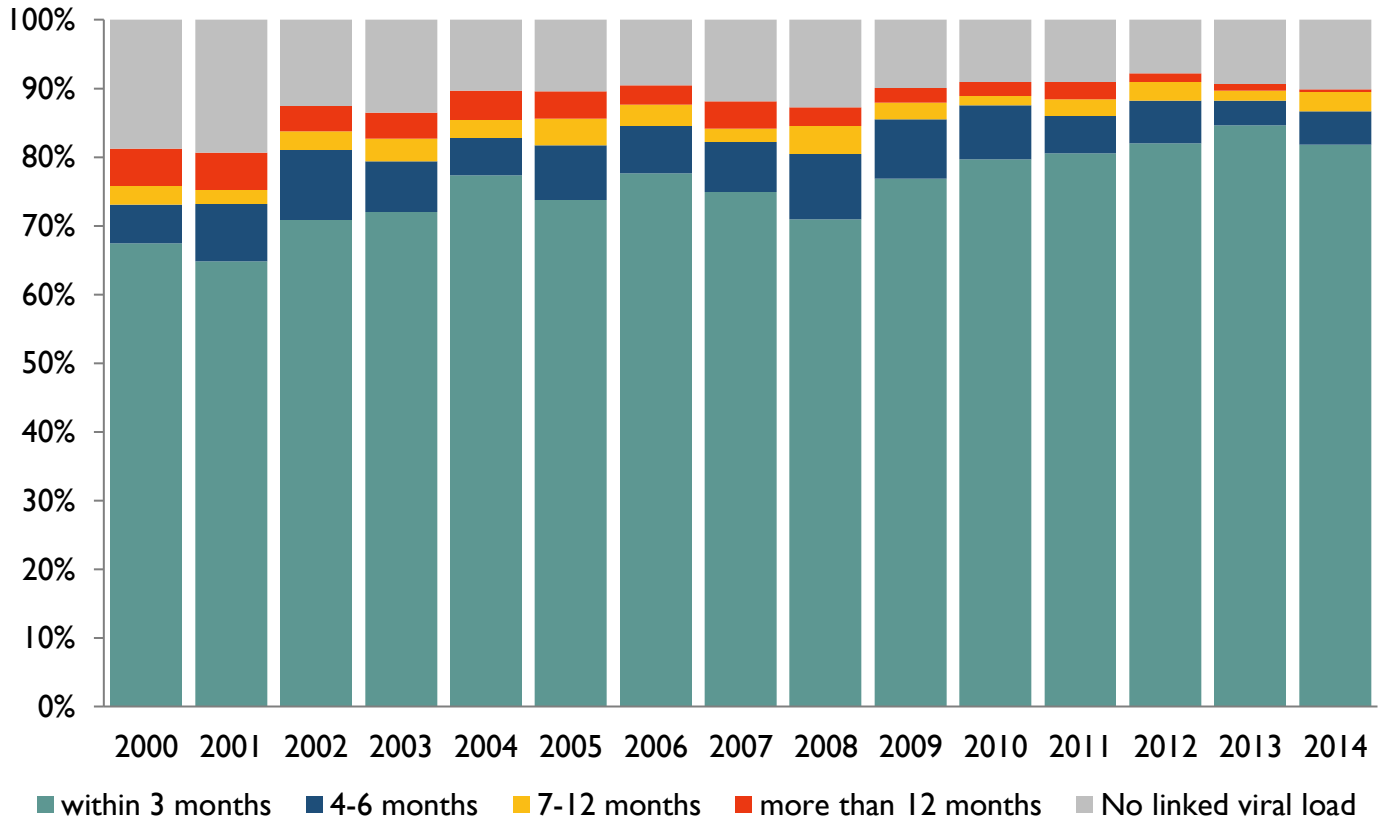
Percent in care 2015	
Main	87.3%
Lower	80.7%

Trends

The percent of people with diagnosed HIV who are in care was 81.3% in 2000 (lower estimate: 63.2%) and 87.3% in 2015.

Notes: Solid line represents main estimate and shaded area represents range of estimates. Data provided by PHOL; source = Ontario HIV Laboratory Cohort. See Appendices for more information on the laboratory cohort and indicator definitions. See Table 2.1 for data.

Figure 2.3 Time from HIV diagnosis to linkage to care for people newly diagnosed with HIV in Ontario, 2000 to 2014



Percent linked to care 2014	
Within 3 months	81.8%
4 to 6 months	4.9%
7 to 12 months	2.7%
More than 12 months	0.4%
No linked VL	10.1%

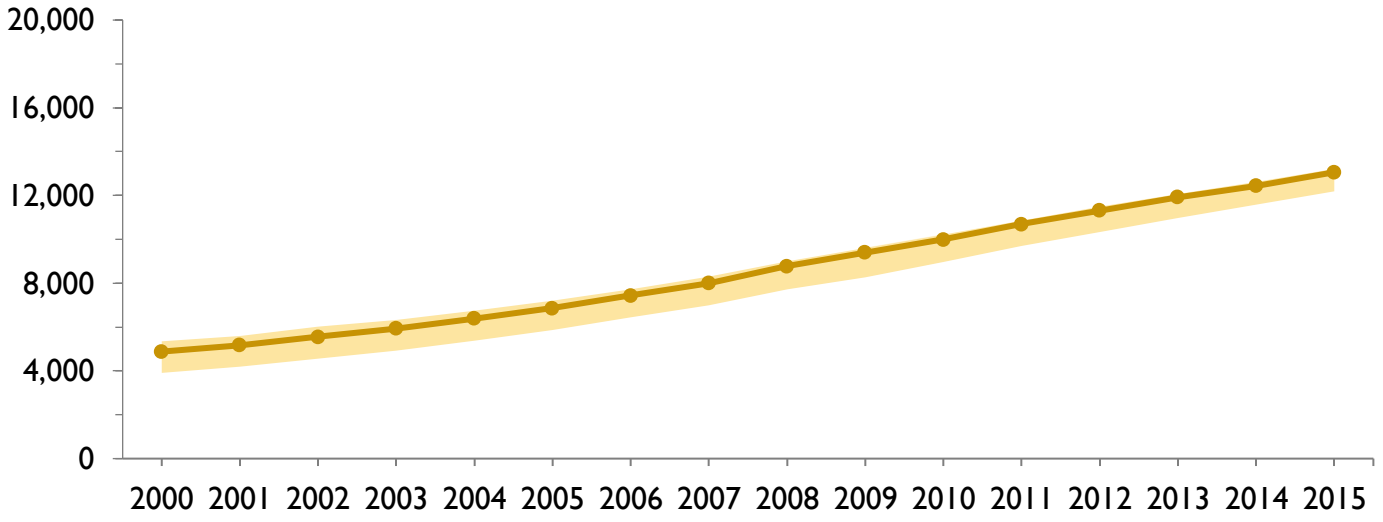
Trends

The percent of newly diagnosed people linked to care within three months of diagnosis increased from 67.4% in 2000 to 81.8% in 2014.

Notes: Data provided by PHOL; source = Newly Diagnosed Sample from the HIV Datamart. See Appendices for more information on the newly diagnosed sample and indicator definitions. The year 2015 is not included as many individuals diagnosed in this year may not have had sufficient time to link to care. VL = viral load. See Table 2.2 for data.

3. On antiretroviral treatment

Figure 3.1 Number of people with diagnosed HIV living in Ontario who are on ART, 2000 to 2015

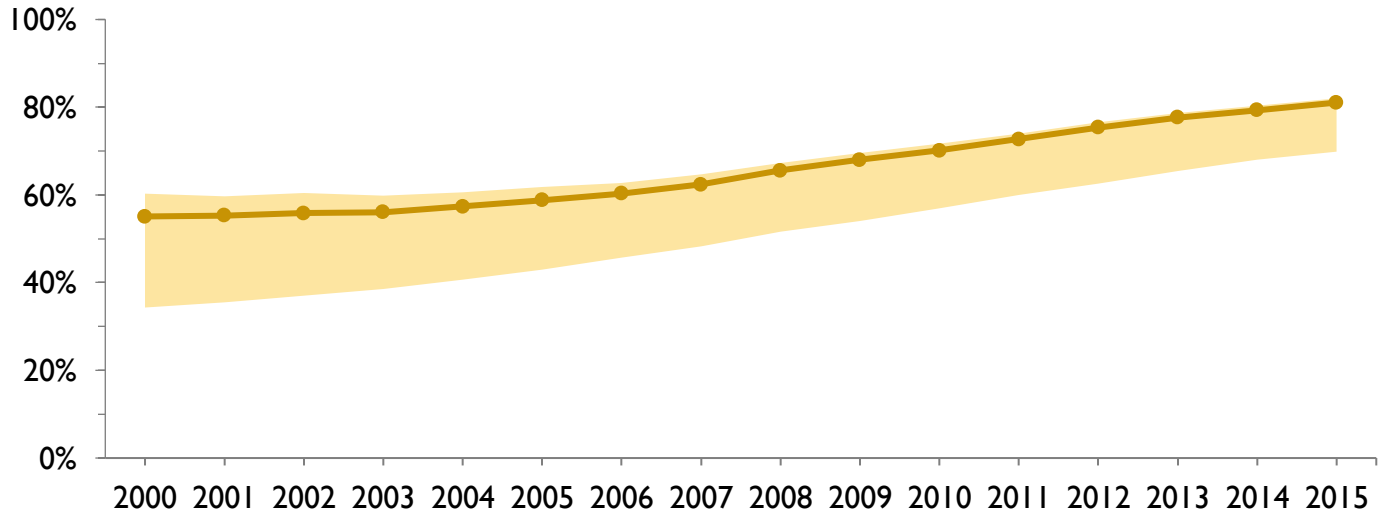


Number on ART 2015	
Main	13,059
Upper	13,212
Lower	12,181

Trends

The number of people with diagnosed HIV who are on ART increased from 4,880 in 2000 (range: 3,909 to 5,335) to 13,059 in 2015.

Figure 3.2 Percent of people with diagnosed HIV living in Ontario who are on ART, 2000 to 2015



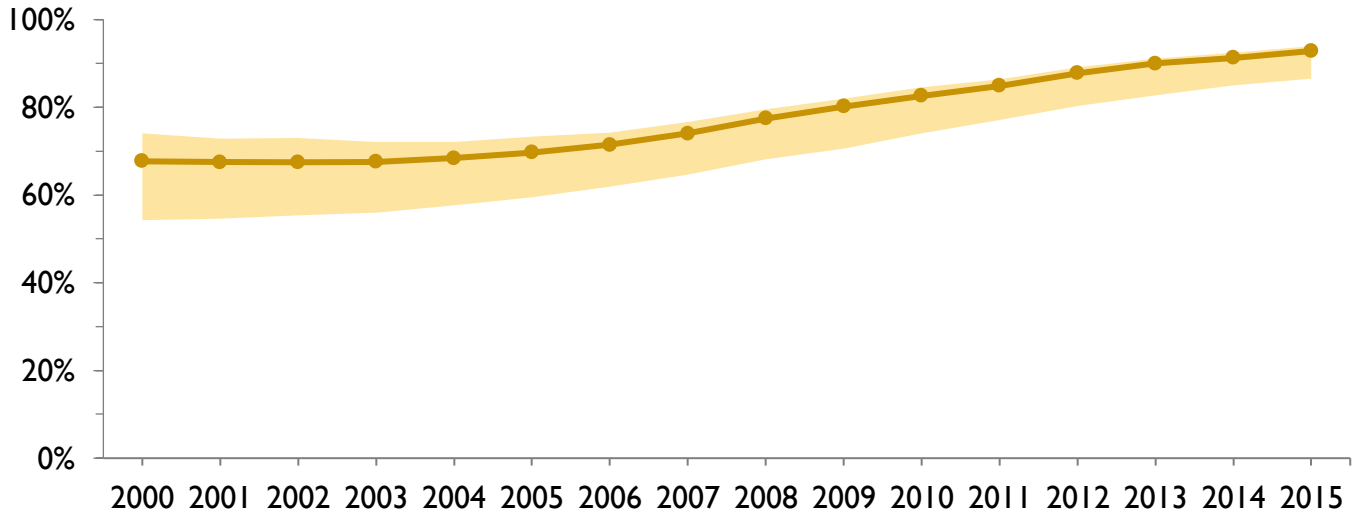
Percent on ART 2015	
Main	81.1%
Upper	82.0%
Lower	69.9%

Trends

The percent of people with diagnosed HIV who are on ART increased from approximately 55% in the early 2000s to 81.1% in 2015.

Notes: Solid line represents main estimate and shaded area represents range of estimates. Data provided by PHOL; source = Ontario HIV Laboratory Cohort. See Appendices for more information on the laboratory cohort and indicator definitions. ART = antiretroviral treatment. See Table 3.1 for data.

Figure 3.3 Percent of people with diagnosed HIV living in Ontario in care who are on ART, 2000 to 2015



Percent on ART 2015	
Main	92.8%
Upper	93.9%
Lower	86.6%

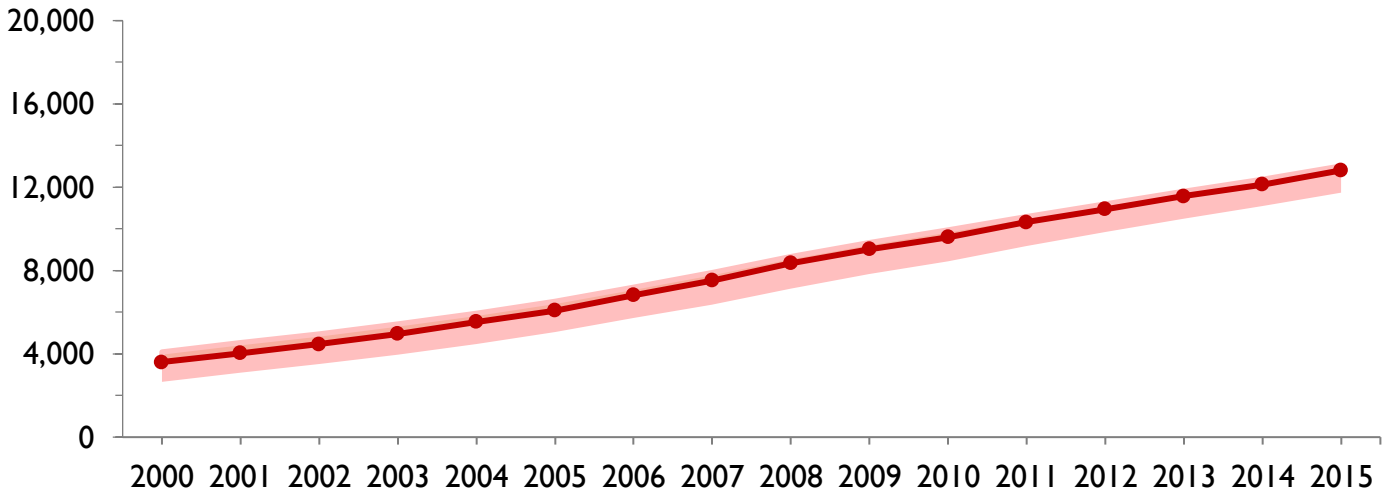
Trends

The percent of people in care who are on ART increased from approximately 68% in the early 2000s to 92.8% in 2015.

Notes: Solid line represents main estimate and shaded area represents range of estimates. Data provided by PHOL; source = Ontario HIV Laboratory Cohort. See Appendices for more information on the laboratory cohort and indicator definitions. ART = antiretroviral treatment. See Table 3.2 for data.

4. Virally suppressed

Figure 4.1 Number of people with diagnosed HIV living in Ontario who are virally suppressed, 2000 to 2015

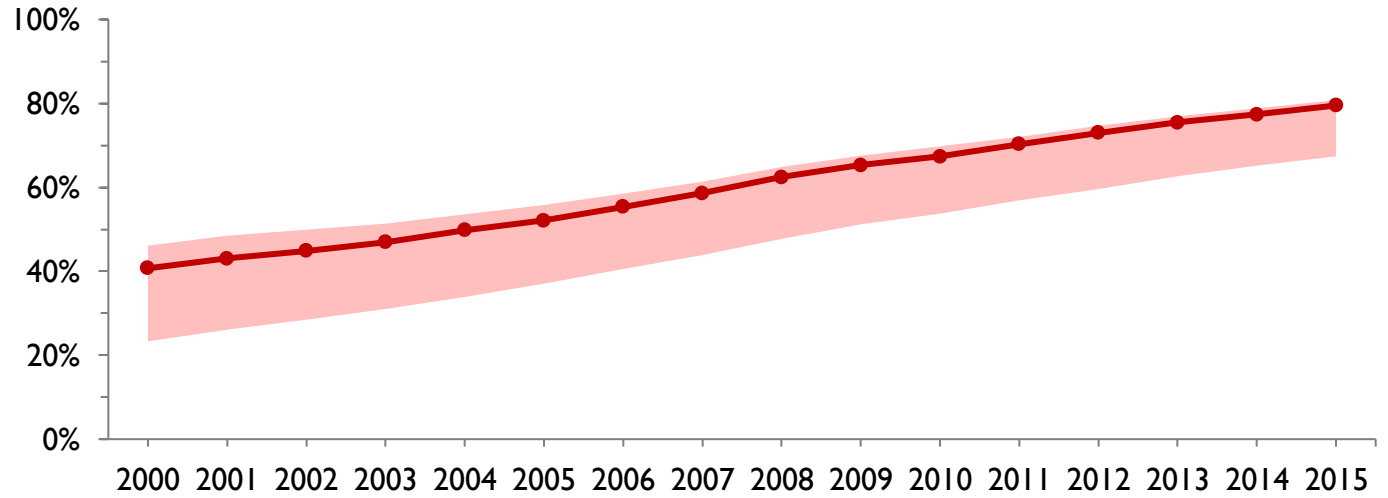


Number suppressed 2015	
Main	12,809
Upper	13,016
Lower	11,742

Trends

The number of people who are virally suppressed increased from 3,607 in 2000 (range: 2,655 to 4,087) to 12,809 in 2015.

Figure 4.2 Percent of people with diagnosed HIV living in Ontario who are virally suppressed, 2000 to 2015



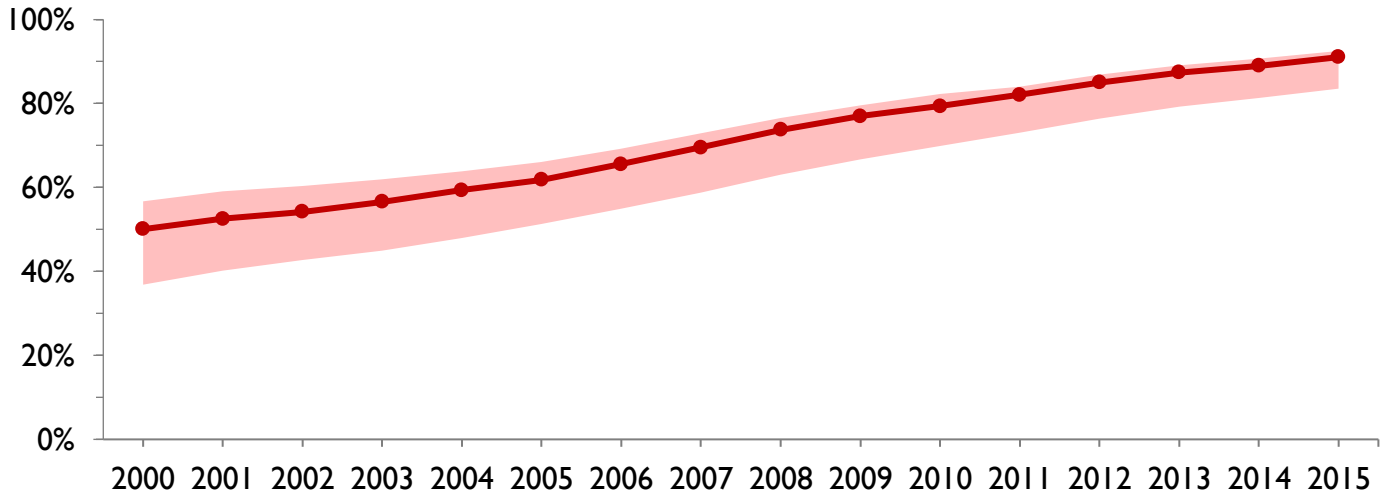
Percent suppressed 2015	
Main	79.5%
Upper	80.8%
Lower	67.4%

Trends

The percent of people with diagnosed HIV who are virally suppressed increased from 40.7% in 2000 (range: 23.3 to 46.1%) to 79.5% in 2015.

Notes: Solid line represents main estimate and shaded area represents range of estimates. Data provided by PHOL; source = Ontario HIV Laboratory Cohort. See Appendices for more information on the laboratory cohort data source and indicator definitions. See Table 4.1 for data.

Figure 4.3 Percent of people with diagnosed HIV living in Ontario in care who are virally suppressed, 2000 to 2015

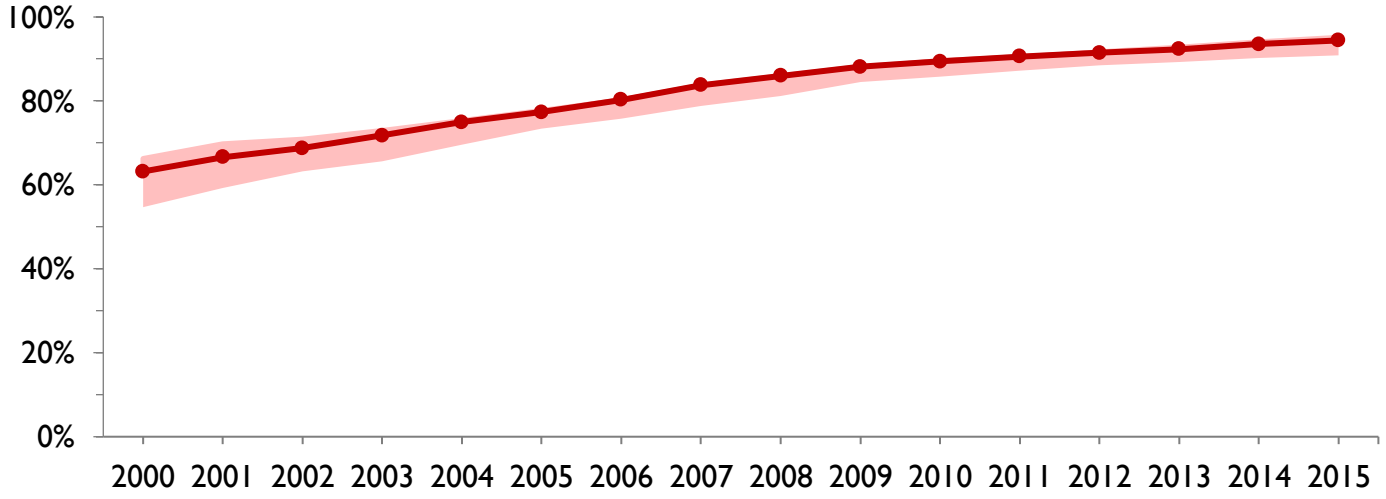


Percent suppressed 2015	
Main	91.1%
Upper	92.5%
Lower	83.5%

Trends

The percent of people in care who are virally suppressed increased from 50.1% in 2000 (range: 36.9 to 56.7%) to 91.1%.

Figure 4.4 Percent of people with diagnosed HIV living in Ontario on ART who are virally suppressed, 2000 to 2015



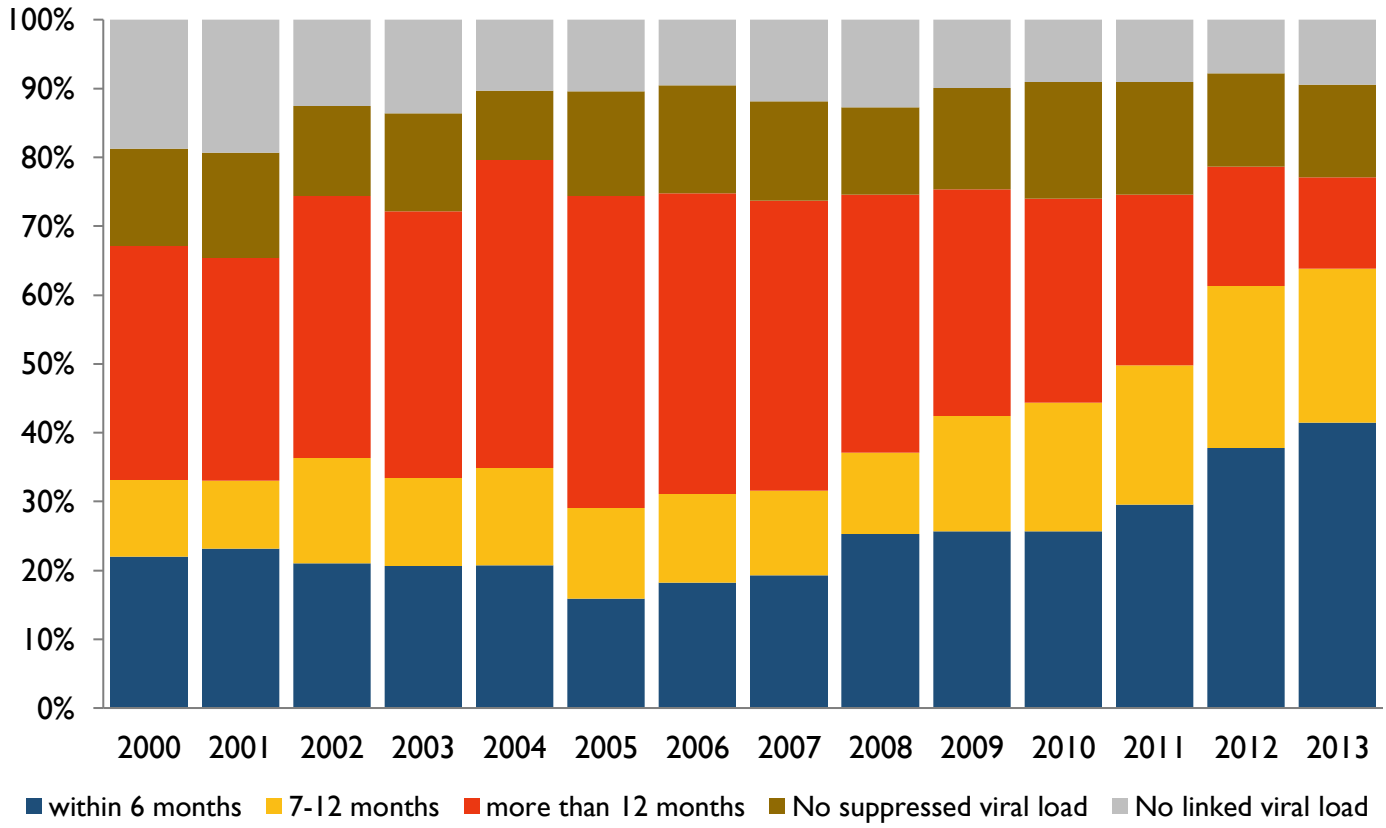
Percent suppressed 2015	
Main	94.4%
Upper	95.1%
Lower	90.9%

Trends

The percent of people on ART who are virally suppressed increased from 63.2% in 2000 to 89.4% in 2010 (main estimates). Since 2010, the percent increased to 94.4% in 2015.

Notes: Solid line represents main estimate and shaded area represents range of estimates. Data provided by PHOL; source = Ontario HIV Laboratory Cohort. See Appendices for more information on the laboratory cohort data source and indicator definitions. ART = antiretroviral treatment. See Tables 4.2 and 4.3 for data.

Figure 4.5 Time from HIV diagnosis to viral suppression for people newly diagnosed with HIV in Ontario, 2000 to 2013



Percent suppressed 2013	
Within 6 months	41.4%
7 to 12 months	22.4%
More than 12 months	13.3%
No suppressed VL	13.5%
No linked VL	9.4%

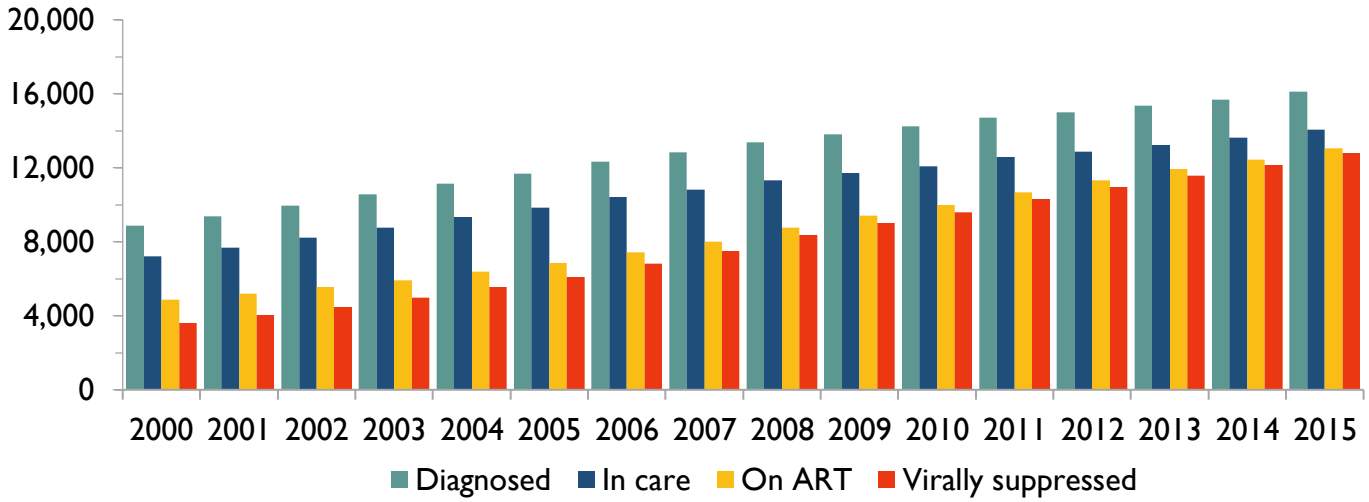
Trends

The percent of newly diagnosed people who are virally suppressed within six months of diagnosis was approximately 20% in the early and mid-2000s and increased to 41.4% in 2013.

Notes: Data provided by PHOL; source = Newly Diagnosed Sample from HIV Datamart. See Appendices for more information on the newly diagnosed sample and indicator definitions. The years 2014 and 2015 are not included as many individuals diagnosed in these years may not have had sufficient time to achieve a suppressed VL. VL = viral load. See Table 4.4 for data.

5. Cascade summary

Figure 5.1 Number of people living with HIV in Ontario engaged in the cascade, 2000 to 2015

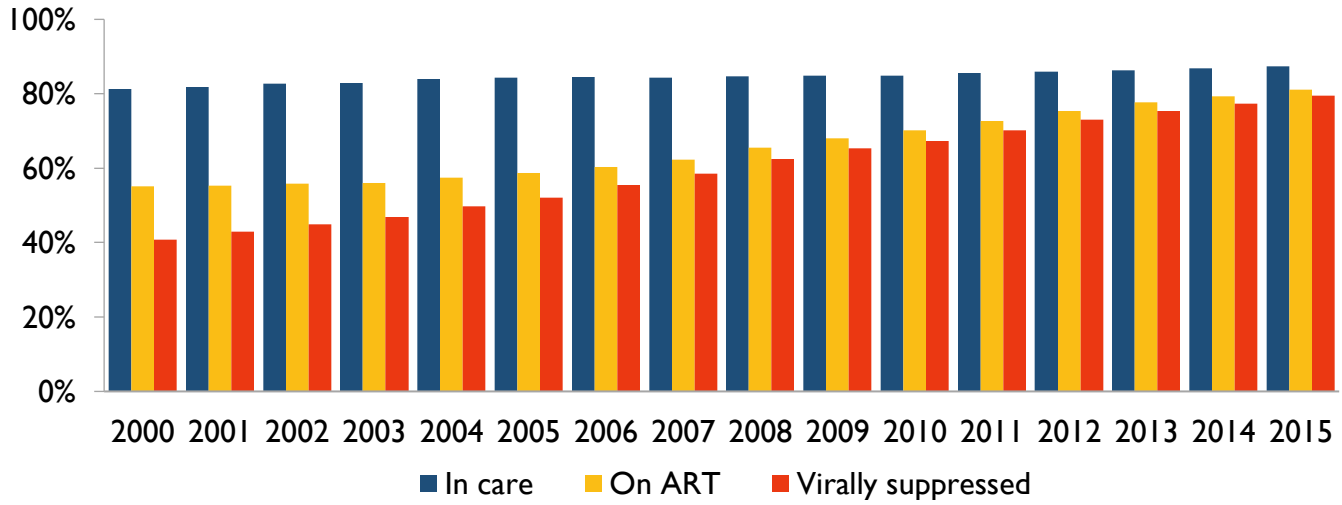


Number of individuals 2015	
Diagnosed	16,110
In care	14,065
On ART	13,059*
Virally suppressed	12,809

Trends

The number of people engaged in each cascade step has increased. In 2000, the number who were diagnosed, in care, on ART, and suppressed was 8,859, 7,203*, 4,880, and 3,607, respectively.

Figure 5.2 Percent of people with diagnosed HIV living in Ontario engaged in the cascade, 2000 to 2015



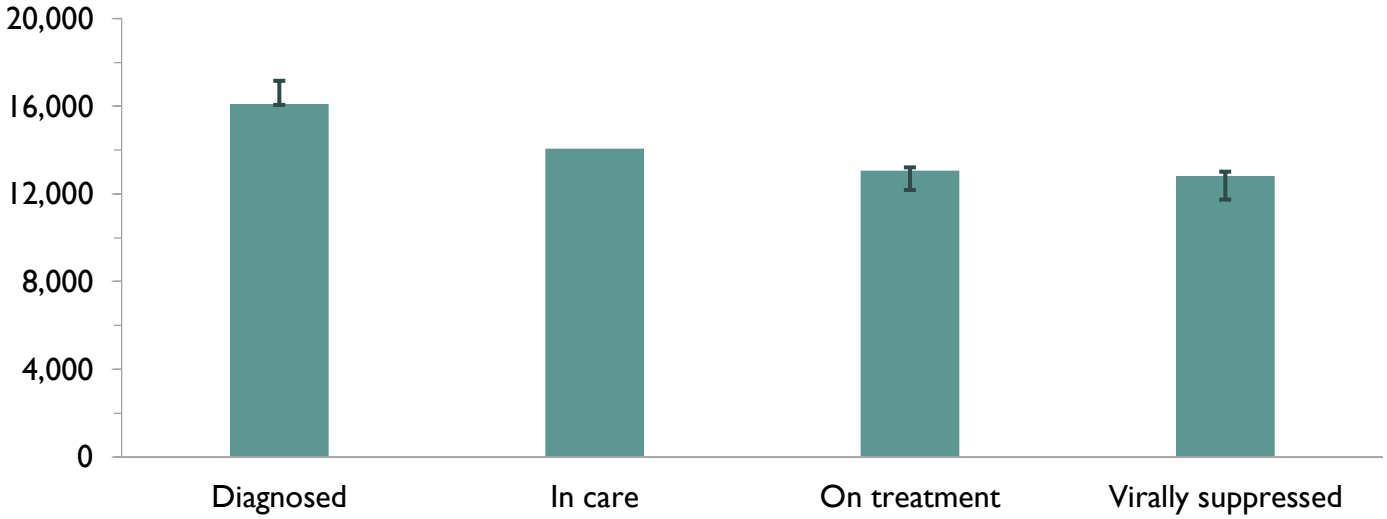
Percent of individuals 2015	
In care	87.3%
On ART	81.1%*
Virally suppressed	79.5%

Trends

There has been a greater increase in the percent of people who are virally suppressed relative to the percent in care or on ART. In 2000, the percent in care, on ART, and virally suppressed was 81.3%, 55.1%*, and 40.7%, respectively.

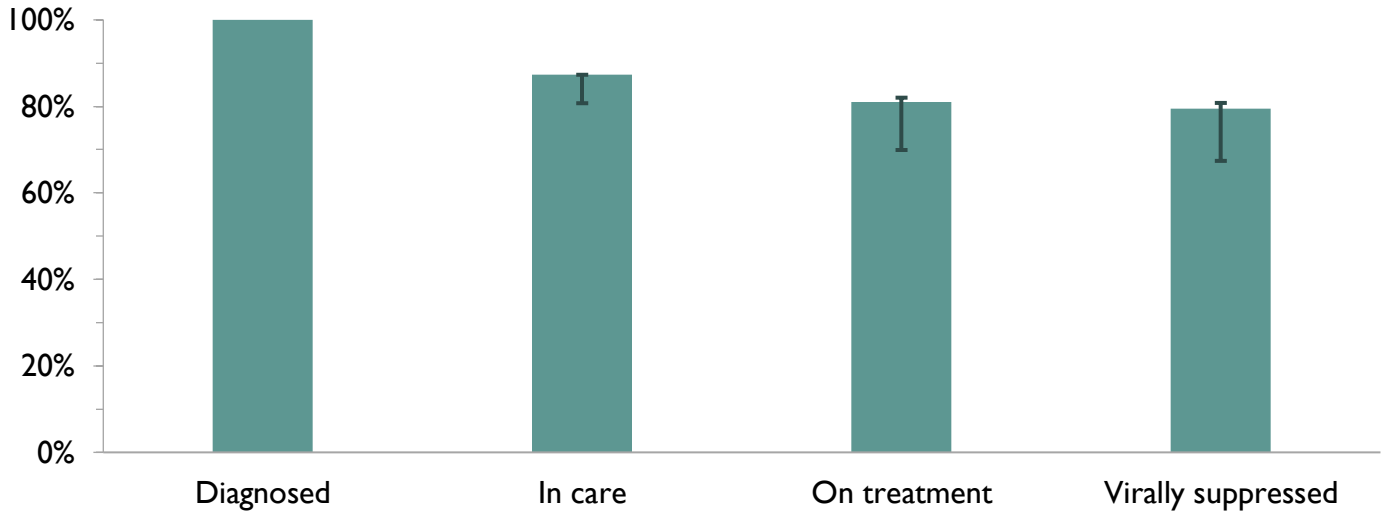
Notes: Figures show main estimates only. Data provided by PHOL; source = Ontario HIV Laboratory Cohort. * Individuals missing ART information are assumed to be 'On ART' if virally suppressed (a different assumption is made to calculate the percent suppressed among those 'on ART'). See Appendices for more information on cohort and indicator definitions. ART = antiretroviral treatment.

Figure 5.3 Number of people living with HIV in Ontario engaged in the cascade, 2015



Number of people (range) 2015	
Diagnosed	16,110 to 17,423
In care	14,065
On ART	12,181 to 13,212*
Virally suppressed	11,742 to 13,016

Figure 5.4 Percent of people with diagnosed HIV living in Ontario engaged in the cascade, 2015



Percent of people (range) 2015	
In care	80.7 to 87.3%
On ART	69.9 to 82.0%*
Virally suppressed	67.4 to 80.8%

Notes: Range represented by bracketed lines superimposed on bars. Bars represent main estimates. Data provided by PHOL; source = Ontario HIV Laboratory Cohort. * Individuals missing ART information are assumed to be 'On ART' if virally suppressed (a different assumption is made to calculate the percent suppressed among those 'on ART'). See Appendices for more information on the laboratory cohort and indicator definitions. ART = antiretroviral treatment.

Appendices

I. Technical notes

Data sources

HIV Datamart

Information in this report comes from the HIV Datamart housed at the Public Health Ontario Laboratory (PHOL). PHOL 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 2015)

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. PHOL conducts the vast majority of HIV testing in Ontario. The database does not include information on tests conducted by other laboratories for the purposes of life insurance and screening blood donations and organ/tissue donors. In Ontario, 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 2015)

VL testing was implemented in 1996 and the database at PHOL 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 80% of VL test requisition forms. All VL tests in the database were conducted nominally.

Ontario HIV Laboratory Cohort

A cohort of people with diagnosed HIV living in Ontario, referred to as the Ontario HIV Laboratory Cohort, was created using the integrated HIV Datamart. Individuals are included in the cohort if they have either;

1. a nominal HIV-positive diagnostic test (1985 to 2015), **and/or**
2. at least one viral load test (1996 to 2015)

Non-nominal HIV-positive diagnostic tests (i.e., tests conducted anonymously or using coded identifiers) are **excluded** from the cohort. The lack of identifying information on non-nominal tests means that it is not possible to link these tests to subsequent VL tests and monitor engagement in HIV care. However, individuals diagnosed non-nominally are included in the cohort when they receive a nominal HIV diagnostic or VL test at entrance to care.

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 nominal 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.

Overall (1985 to 2015), the HIV Datamart includes 40,372 HIV-positive diagnostic test records and 23,851 individuals with record of at least 1 VL test. Of the HIV-positive diagnostic tests, 18,683 (46.3%) are non-nominal and were excluded from the cohort (note: the proportion of HIV-positive diagnostic tests that are non-nominal has decreased over time, from 50% in 1996 to 15% in 2015). A further 947 individuals were excluded because they had no nominal HIV-positive diagnostic test, all undetectable VL tests, and evidence of being HIV-negative. A total of 29,587 people in the HIV Datamart have record of a nominal HIV-positive diagnostic test **and/or** at least one VL test and were included in the cohort.

3. **and** have not been administratively lost to follow-up after two years.

After entering the cohort, individuals are removed if they have no record of a VL test for more than two 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 two-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 2014, the median duration of known gaps in care was 1.4 years. After application of the two-year LTFU criteria, there were 16,110 diagnosed people living with HIV in the cohort at the end of 2015. See Analysis section below for more details on how the LTFU criteria was applied.

Note: In sensitivity analyses, non-nominal diagnoses were included in the cohort and the LTFU criteria extended to three years. See the Indicator definitions section below for more information.

Newly HIV diagnosed sample

The HIV Datamart was also used to create a sample of individuals who were diagnosed with HIV for the first time in Ontario (ie. 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 (ie. no detectable VL test or CD4 count before their diagnosis date, first VL after diagnosis not suppressed). Unlike the inclusion criteria for the Ontario HIV Laboratory Cohort, individuals with a VL test only (no linked HIV-positive diagnostic test) are not included in the newly diagnosed sample, as a diagnosis date is needed to measure time to care and suppression.

Overall, 13,410 individuals had a nominal HIV-positive diagnostic test between 1996 and 2015. Of these, 3,797 (28.3%) were excluded because they had evidence of being previously diagnosed. The remaining 9,613 are included in the newly diagnosed sample.

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 newly diagnosed sample 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 two 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, they are included in the analysis for two years after their last VL test (ie. 2012 and 2013), but not afterwards (i.e. 2014 and 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 years 2015 and 2014 to 2015, respectively, as many individuals diagnosed in these years may not have had time to achieve these outcomes.

Limitations and assumptions

HIV Datamart and Ontario HIV Laboratory Cohort

- The datamart and laboratory cohort were generated using data extracted from laboratory information systems constructed for clinical purposes The completion of this data is reliant on clinicians and other providers completing the test requisitions.
- While the Ontario HIV Laboratory Cohort represents our best province-wide understanding of the cascade among diagnosed people with HIV in Ontario, it is unclear to what extent the cohort represents all people with an HIV-positive diagnosis who are currently living in the province. Representativeness may be limited by the exclusion of over 18,000 non-nominal HIV-positive diagnostic tests (although individuals diagnosed non-nominally are included in the cohort when they receive a VL test) and 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 in the province in all years since their last VL test.
- The exclusion of non-nominal positive HIV diagnoses from the cohort may mean the number of people with diagnosed HIV is underestimated. However, 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 included in the cohort.
- We included non-nominal diagnoses and extended the LTFU criteria to three 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. To calculate the percent of diagnosed individuals who are on ART, individuals with missing treatment information are assumed to be on ART if they have a suppressed VL, while unsuppressed individuals with missing treatment data are assumed to be off ART (note: a different assumption is made to calculate the percent of people on ART who are virally suppressed – see Virally suppressed limitations below). Since some unsuppressed individuals with missing treatment information may actually be on treatment, the number on ART is likely underestimated.
- 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

- To calculate the percent of people on ART who are virally suppressed, we conservatively assume all people with missing treatment information to be on ART. This likely leads to an underestimation of the percent of people on ART who are suppressed. On the other hand, people in the cohort may be better monitored than those not included in the cohort, leading to an overestimate of this percent.
- 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.

Indicator Definitions

Diagnosed

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

* 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. no record of a detectable VL test or CD4 count before diagnosis, and first VL after diagnosis not suppressed)

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	Diagnosed (Main estimate)
Lower	At least one VL test	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 ART status missing and suppressed, on **last** VL test	Diagnosed (Main estimate)
Upper	Documented on ART, or ART status missing and suppressed, on **any** VL test	Diagnosed (Main estimate)
Lower	Documented on ART, or ART status missing and suppressed, on **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 ART status missing and suppressed, on **last** VL test	At least one VL test
Upper	Documented on ART, or ART status missing and suppressed, on **any** VL test	At least one VL test
Lower	Documented on ART, or ART status missing and suppressed, on **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, and known on ART or ART status missing, on **last** VL test	Documented on ART, or ART status missing, on **last** VL test
Upper	VL less than 200 copies/mL, and known on ART or ART status missing, on **any** VL test	Documented on ART, or ART status missing, on **any** VL test
Lower	VL less than 200 copies/mL, and known on ART or ART status missing, on **all** VL tests	Documented on ART, or ART status missing, on **all** VL tests

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)

II. 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. Diagnosed

Table 1.1 Number of people with diagnosed HIV living in Ontario, 2000 to 2015

Year	Main estimate	Upper estimate
	Nominal HIV-positive diagnostic test **and/or** HIV viral load test*, **and not** administratively lost to follow-up after two years	Nominal or non-nominal HIV-positive diagnostic test **and/or** HIV viral load test*, **and not** administratively lost to follow-up after three years
2000	8,859	11,389
2001	9,367	11,787
2002	9,945	12,317
2003	10,574	12,742
2004	11,125	13,219
2005	11,672	13,648
2006	12,318	14,104
2007	12,832	14,477
2008	13,377	14,951
2009	13,819	15,298
2010	14,255	15,712
2011	14,699	16,162
2012	14,999	16,527
2013	15,346	16,764
2014	15,694	17,035
2015	16,110	17,423

Notes: Data provided to the Ontario HIV Epidemiology and Surveillance Initiative (OHESI) by the Public Health Ontario Laboratory (PHOL). Data source = Ontario HIV Laboratory Cohort. * Individuals with no nominal HIV-positive diagnostic test, and all undetectable VL tests, were not included if there was evidence of being HIV-negative.

2. In care

Table 2.1 Number and percent of people with diagnosed HIV living in Ontario who are in care, 2000 to 2015

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	7,203	8,859	81.3%	7,203	11,389	63.2%
2001	7,669	9,367	81.9%	7,669	11,787	65.1%
2002	8,232	9,945	82.8%	8,232	12,317	66.8%
2003	8,775	10,574	83.0%	8,775	12,742	68.9%
2004	9,336	11,125	83.9%	9,336	13,219	70.6%
2005	9,848	11,672	84.4%	9,848	13,648	72.2%
2006	10,402	12,318	84.4%	10,402	14,104	73.8%
2007	10,814	12,832	84.3%	10,814	14,477	74.7%
2008	11,317	13,377	84.6%	11,317	14,951	75.7%
2009	11,721	13,819	84.8%	11,721	15,298	76.6%
2010	12,094	14,255	84.8%	12,094	15,712	77.0%
2011	12,581	14,699	85.6%	12,581	16,162	77.8%
2012	12,883	14,999	85.9%	12,883	16,527	78.0%
2013	13,246	15,346	86.3%	13,246	16,764	79.0%
2014	13,635	15,694	86.9%	13,635	17,035	80.0%
2015	14,065	16,110	87.3%	14,065	17,423	80.7%

Notes: Data provided to the Ontario HIV Epidemiology and Surveillance Initiative (OHESI) by the Public Health Ontario Laboratory (PHOL). Data source = Ontario HIV Laboratory Cohort. VL = viral load.

Table 2.2 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 2014

Year	Main Estimate										
	Newly diagnosed (Denominator)	Linked to care (Numerator)									
	Newly diagnosed "Main" Estimate	Within three months of diagnosis		Four to six months		Seven to 12 months		More than 12 months		No linked VL	
2000	368	248	67.4%	21	5.7%	10	2.7%	20	5.4%	69	18.8%
2001	424	275	64.9%	35	8.3%	9	2.1%	23	5.4%	82	19.3%
2002	542	384	70.8%	55	10.1%	15	2.8%	20	3.7%	68	12.5%
2003	553	398	72.0%	41	7.4%	18	3.3%	21	3.8%	75	13.6%
2004	570	441	77.4%	31	5.4%	15	2.6%	24	4.2%	59	10.4%
2005	567	418	73.7%	45	7.9%	22	3.9%	23	4.1%	59	10.4%
2006	599	465	77.6%	41	6.8%	19	3.2%	17	2.8%	57	9.5%
2007	555	416	75.0%	40	7.2%	11	2.0%	22	4.0%	66	11.9%
2008	574	407	70.9%	55	9.6%	23	4.0%	16	2.8%	73	12.7%
2009	523	402	76.9%	45	8.6%	13	2.5%	11	2.1%	52	9.9%
2010	530	422	79.6%	42	7.9%	7	1.3%	11	2.1%	48	9.1%
2011	528	425	80.5%	29	5.5%	13	2.5%	13	2.5%	48	9.1%
2012	450	369	82.0%	28	6.2%	12	2.7%	6	1.3%	35	7.8%
2013	415	351	84.6%	15	3.6%	6	1.4%	4	1.0%	39	9.4%
2014	473	387	81.8%	23	4.9%	13	2.7%	2	0.4%	48	10.1%

Notes: Data provided to the Ontario HIV Epidemiology and Surveillance Initiative (OHESI) by the Public Health Ontario Laboratory (PHOL). Data source = Newly Diagnosed Sample from HIV Datamart. VL = viral load. The year 2014 is not included as many individuals diagnosed in this year may not have had sufficient time to link to care.

3. On antiretroviral treatment

Table 3.1 Number and percent of people with diagnosed HIV living in Ontario who are on ART, 2000 to 2015

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 ART status missing and suppressed, on **last** VL test	Diagnosed "Main" Estimate		Documented on ART, or ART status missing and suppressed, on **any** VL test	Diagnosed "Main" Estimate		Documented on ART, or ART status missing and suppressed, on **all** VL tests	Diagnosed "Upper" Estimate	
2000	4,880	8,859	55.1%	5,335	8,859	60.2%	3,909	11,389	34.3%
2001	5,178	9,367	55.3%	5,585	9,367	59.6%	4,183	11,787	35.5%
2002	5,555	9,945	55.9%	6,012	9,945	60.5%	4,556	12,317	37.0%
2003	5,932	10,574	56.1%	6,333	10,574	59.9%	4,914	12,742	38.6%
2004	6,385	11,125	57.4%	6,735	11,125	60.5%	5,376	13,219	40.7%
2005	6,861	11,672	58.8%	7,213	11,672	61.8%	5,853	13,648	42.9%
2006	7,432	12,318	60.3%	7,723	12,318	62.7%	6,446	14,104	45.7%
2007	8,003	12,832	62.4%	8,294	12,832	64.6%	6,997	14,477	48.3%
2008	8,769	13,377	65.6%	9,006	13,377	67.3%	7,712	14,951	51.6%
2009	9,397	13,819	68.0%	9,618	13,819	69.6%	8,276	15,298	54.1%
2010	9,994	14,255	70.1%	10,220	14,255	71.7%	8,955	15,712	57.0%
2011	10,685	14,699	72.7%	10,864	14,699	73.9%	9,699	16,162	60.0%
2012	11,310	14,999	75.4%	11,489	14,999	76.6%	10,350	16,527	62.6%
2013	11,920	15,346	77.7%	12,064	15,346	78.6%	10,970	16,764	65.4%
2014	12,447	15,694	79.3%	12,602	15,694	80.3%	11,584	17,035	68.0%
2015	13,059	16,110	81.1%	13,212	16,110	82.0%	12,181	17,423	69.9%

Notes: Data provided to the Ontario HIV Epidemiology and Surveillance Initiative (OHESI) by the Public Health Ontario Laboratory (PHOL). Data source = Ontario HIV Laboratory Cohort. ART = antiretroviral treatment. VL = viral load.

Table 3.2 Number and percent of people with diagnosed HIV living in Ontario in care who are on ART, 2000 to 2015

Year	Main Estimate			Upper Estimate			Lower Estimate		
	On ART (Numerator) Documented on ART, or ART status missing and suppressed, on **last** VL test	In care (Denominator) At least one VL	%	On ART (Numerator) Documented on ART, or ART status missing and suppressed, on **any** VL test	In care (Denominator) At least one VL	%	On ART (Numerator) Documented on ART, or ART status missing and suppressed, on **all** VL tests	In care (Denominator) At least one VL	%
2000	4,880	7,203	67.7%	5,335	7,203	74.1%	3,909	7,203	54.3%
2001	5,178	7,669	67.5%	5,585	7,669	72.8%	4,183	7,669	54.5%
2002	5,555	8,232	67.5%	6,012	8,232	73.0%	4,556	8,232	55.3%
2003	5,932	8,775	67.6%	6,333	8,775	72.2%	4,914	8,775	56.0%
2004	6,385	9,336	68.4%	6,735	9,336	72.1%	5,376	9,336	57.6%
2005	6,861	9,848	69.7%	7,213	9,848	73.2%	5,853	9,848	59.4%
2006	7,432	10,402	71.4%	7,723	10,402	74.2%	6,446	10,402	62.0%
2007	8,003	10,814	74.0%	8,294	10,814	76.7%	6,997	10,814	64.7%
2008	8,769	11,317	77.5%	9,006	11,317	79.6%	7,712	11,317	68.1%
2009	9,397	11,721	80.2%	9,618	11,721	82.1%	8,276	11,721	70.6%
2010	9,994	12,094	82.6%	10,220	12,094	84.5%	8,955	12,094	74.0%
2011	10,685	12,581	84.9%	10,864	12,581	86.4%	9,699	12,581	77.1%
2012	11,310	12,883	87.8%	11,489	12,883	89.2%	10,350	12,883	80.3%
2013	11,920	13,246	90.0%	12,064	13,246	91.1%	10,970	13,246	82.8%
2014	12,447	13,635	91.3%	12,602	13,635	92.4%	11,584	13,635	85.0%
2015	13,059	14,065	92.8%	13,212	14,065	93.9%	12,181	14,065	86.6%

Notes: Data provided to the Ontario HIV Epidemiology and Surveillance Initiative (OHESI) by the Public Health Ontario Laboratory (PHOL). Data source = Ontario HIV Laboratory Cohort. ART = antiretroviral treatment. VL = viral load. Suppressed = VL less than 200 copies/ml.

4. Virally suppressed

Table 4.1 Number and percent of people with diagnosed HIV living in Ontario who are virally suppressed, 2000 to 2015

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	Diagnosed "Main" Estimate		VL less than 200 copies per ml on **any** VL test	Diagnosed "Main" Estimate		VL less than 200 copies per ml on **all** VL tests	Diagnosed "Upper" Estimate	
2000	3,607	8,859	40.7%	4,087	8,859	46.1%	2,655	11,389	23.3%
2001	4,029	9,367	43.0%	4,537	9,367	48.4%	3,081	11,787	26.1%
2002	4,464	9,945	44.9%	4,966	9,945	49.9%	3,516	12,317	28.5%
2003	4,966	10,574	47.0%	5,432	10,574	51.4%	3,944	12,742	31.0%
2004	5,544	11,125	49.8%	5,955	11,125	53.5%	4,480	13,219	33.9%
2005	6,086	11,672	52.1%	6,514	11,672	55.8%	5,053	13,648	37.0%
2006	6,824	12,318	55.4%	7,201	12,318	58.5%	5,712	14,104	40.5%
2007	7,518	12,832	58.6%	7,883	12,832	61.4%	6,363	14,477	44.0%
2008	8,349	13,377	62.4%	8,671	13,377	64.8%	7,130	14,951	47.7%
2009	9,024	13,819	65.3%	9,327	13,819	67.5%	7,823	15,298	51.1%
2010	9,606	14,255	67.4%	9,946	14,255	69.8%	8,452	15,712	53.8%
2011	10,328	14,699	70.3%	10,580	14,699	72.0%	9,189	16,162	56.9%
2012	10,952	14,999	73.0%	11,202	14,999	74.7%	9,849	16,527	59.6%
2013	11,574	15,346	75.4%	11,807	15,346	76.9%	10,502	16,764	62.6%
2014	12,136	15,694	77.3%	12,364	15,694	78.8%	11,100	17,035	65.2%
2015	12,809	16,110	79.5%	13,016	16,110	80.8%	11,742	17,423	67.4%

Notes: Data provided to the Ontario HIV Epidemiology and Surveillance Initiative (OHESI) by the Public Health Ontario Laboratory (PHOL). Data source = Ontario HIV Laboratory Cohort. VL = viral load.

Table 4.2 Number and percent of people with diagnosed HIV living in Ontario in care who are virally suppressed, 2000 to 2015

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	At least one VL		VL less than 200 copies per ml on **any** VL test	At least one VL		VL less than 200 copies per ml on **all** VL tests	At least one VL	
2000	3,607	7,203	50.1%	4,087	7,203	56.7%	2,655	7,203	36.9%
2001	4,029	7,669	52.5%	4,537	7,669	59.2%	3,081	7,669	40.2%
2002	4,464	8,232	54.2%	4,966	8,232	60.3%	3,516	8,232	42.7%
2003	4,966	8,775	56.6%	5,432	8,775	61.9%	3,944	8,775	44.9%
2004	5,544	9,336	59.4%	5,955	9,336	63.8%	4,480	9,336	48.0%
2005	6,086	9,848	61.8%	6,514	9,848	66.1%	5,053	9,848	51.3%
2006	6,824	10,402	65.6%	7,201	10,402	69.2%	5,712	10,402	54.9%
2007	7,518	10,814	69.5%	7,883	10,814	72.9%	6,363	10,814	58.8%
2008	8,349	11,317	73.8%	8,671	11,317	76.6%	7,130	11,317	63.0%
2009	9,024	11,721	77.0%	9,327	11,721	79.6%	7,823	11,721	66.7%
2010	9,606	12,094	79.4%	9,946	12,094	82.2%	8,452	12,094	69.9%
2011	10,328	12,581	82.1%	10,580	12,581	84.1%	9,189	12,581	73.0%
2012	10,952	12,883	85.0%	11,202	12,883	87.0%	9,849	12,883	76.4%
2013	11,574	13,246	87.4%	11,807	13,246	89.1%	10,502	13,246	79.3%
2014	12,136	13,635	89.0%	12,364	13,635	90.7%	11,100	13,635	81.4%
2015	12,809	14,065	91.1%	13,016	14,065	92.5%	11,742	14,065	83.5%

Notes: Data provided to the Ontario HIV Epidemiology and Surveillance Initiative (OHESI) by the Public Health Ontario Laboratory (PHOL). Data source = Ontario HIV Laboratory Cohort. VL = viral load.

Table 4.3 Number and percent of people with diagnosed HIV living in Ontario on ART who are virally suppressed, 2000 to 2015

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, and known on ART or ART status missing, on **last** VL test	Known on ART, or ART status missing, on **last** VL test		VL less than 200 copies per ml, and known on ART or ART status missing, on **any** VL test	Known on ART, or ART status missing, on **any** VL test		VL less than 200 copies per ml, and known on ART or ART status missing, on **all** VL tests	Known on ART, or ART status missing, on **all** VL tests	
2000	3,495	5,530	63.2%	3,974	6,004	66.2%	2,527	4,620	54.7%
2001	3,921	5,888	66.6%	4,423	6,340	69.8%	2,950	4,979	59.2%
2002	4,340	6,310	68.8%	4,855	6,857	70.8%	3,385	5,351	63.3%
2003	4,810	6,701	71.8%	5,299	7,267	72.9%	3,763	5,741	65.5%
2004	5,414	7,220	75.0%	5,830	7,740	75.3%	4,322	6,216	69.5%
2005	5,928	7,663	77.4%	6,362	8,184	77.7%	4,879	6,650	73.4%
2006	6,620	8,248	80.3%	7,009	8,743	80.2%	5,487	7,234	75.9%
2007	7,336	8,759	83.8%	7,712	9,222	83.6%	6,149	7,796	78.9%
2008	8,170	9,500	86.0%	8,517	9,953	85.6%	6,925	8,535	81.1%
2009	8,847	10,036	88.2%	9,168	10,438	87.8%	7,603	8,998	84.5%
2010	9,433	10,552	89.4%	9,781	10,913	89.6%	8,245	9,610	85.8%
2011	10,149	11,204	90.6%	10,417	11,516	90.5%	8,981	10,297	87.2%
2012	10,788	11,795	91.5%	11,055	12,053	91.7%	9,663	10,929	88.4%
2013	11,415	12,366	92.3%	11,663	12,566	92.8%	10,305	11,552	89.2%
2014	11,992	12,821	93.5%	12,233	13,010	94.0%	10,912	12,103	90.2%
2015	12,647	13,395	94.4%	12,882	13,543	95.1%	11,544	12,706	90.9%

Notes: Data provided to the Ontario HIV Epidemiology and Surveillance Initiative (OHESI) by the Public Health Ontario Laboratory (PHOL). Data source = Ontario HIV Laboratory Cohort. ART = antiretroviral treatment. VL = viral load.

Table 4.4 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 2013

Year	Main Estimate										
	Newly diagnosed (Denominator)	Time to viral suppression (VL less than 200 copies per ml) (Numerator)									
	Newly diagnosed "Main" Estimate	Within six months of diagnosis		Seven to 12 months		More than 12 months		No suppressed VL		No linked VL	
2000	368	81	22.0%	41	11.1%	125	34.0%	52	14.1%	69	18.8%
2001	424	98	23.1%	42	9.9%	137	32.3%	65	15.3%	82	19.3%
2002	542	114	21.0%	83	15.3%	206	38.0%	71	13.1%	68	12.5%
2003	553	114	20.6%	71	12.8%	214	38.7%	79	14.3%	75	13.6%
2004	570	118	20.7%	81	14.2%	255	44.7%	57	10.0%	59	10.4%
2005	567	90	15.9%	75	13.2%	257	45.3%	86	15.2%	59	10.4%
2006	599	109	18.2%	77	12.9%	262	43.7%	94	15.7%	57	9.5%
2007	555	107	19.3%	68	12.3%	234	42.2%	80	14.4%	66	11.9%
2008	574	145	25.3%	68	11.8%	215	37.5%	73	12.7%	73	12.7%
2009	523	134	25.6%	88	16.8%	172	32.9%	77	14.7%	52	9.9%
2010	530	136	25.7%	99	18.7%	157	29.6%	90	17.0%	48	9.1%
2011	528	156	29.5%	107	20.3%	131	24.8%	86	16.3%	48	9.1%
2012	450	170	37.8%	106	23.6%	78	17.3%	61	13.6%	35	7.8%
2013	415	172	41.4%	93	22.4%	55	13.3%	56	13.5%	39	9.4%

Notes: Data provided to the Ontario HIV Epidemiology and Surveillance Initiative (OHESI) by the Public Health Ontario Laboratory (PHOL). Data source = Newly Diagnosed Sample from HIV Datamart. VL = viral load. The years 2014 and 2015 are not included as many individuals diagnosed in these years may not have had sufficient time to achieve a suppressed VL.