Public Health Ontario | Santé publique Ontario

Factors affecting Reportable Diseases in Ontario

Case definition changes and associated trends 1991-2016

Technical Report

October 2018

Public Health Ontario

Public Health Ontario is a Crown corporation dedicated to protecting and promoting the health of all Ontarians and reducing inequities in health. Public Health Ontario links public health practitioners, frontline health workers and researchers to the best scientific intelligence and knowledge from around the world.

Public Health Ontario provides expert scientific and technical support to government, local public health units and health care providers relating to the following:

- communicable and infectious diseases
- infection prevention and control
- environmental and occupational health
- emergency preparedness
- health promotion, chronic disease and injury prevention
- public health laboratory services

Public Health Ontario's work also includes surveillance, epidemiology, research, professional development and knowledge services. For more information, visit publichealthontario.ca.

How to cite this document:

Ontario Agency for Health Protection and Promotion (Public Health Ontario). Factors affecting reportable diseases in Ontario (1991-2016). Toronto, ON: Queen's Printer for Ontario; 2018.

ISSN: 2561-5599
ISBN: 978-1-4868-1592-0

Public Health Ontario acknowledges the financial support of the Ontario Government.

Contributing Authors

The production of the Factors affecting Reportable Diseases in Ontario report was made possible by a collaboration of highly skilled and dedicated staff of the Communicable Disease Emergency Preparedness and Response (CDEPR) department and the Public Health Ontario Laboratory (PHOL) at Public Health Ontario (PHO). Production of the report was led by CDEPR, with contributions from the following teams: Communicable Diseases; Enteric, Zoonotic and Vector-borne Diseases; Immunization and Vaccine-Preventable Diseases; and Laboratory Surveillance and Data Management at PHOL.

Acknowledgements

Public Health Ontario wishes to express their sincere appreciation to the Ontario Ministry of Health and Long-Term Care (MOHLTC) for providing archived Appendices of the Infectious Diseases Protocol. We also thank our PHO colleagues from CDEPR, Communications, Library Services, and PHOL for their collaboration in the development, review, and interpretation of the reportable disease timeline and trends presented here.

Disclaimer

This document was developed by Public Health Ontario (PHO). PHO provides scientific and technical advice to Ontario's government, public health organizations and health care providers. PHO's work is guided by the current best available evidence at the time of publication.

The application and use of this document is the responsibility of the user. PHO assumes no liability resulting from any such application or use.

Contents

About this report

The purpose of this report is to document major changes to reportable disease status, case definitions, and other factors or events, such as outbreaks and changes to laboratory testing, which impacted reportable disease trends in Ontario from 1991 to 2016. Understanding these historical changes allows for a more meaningful comparison of reportable disease trends over time.

The scope of the report is limited to select diseases designated as reportable under the *Ontario Health Protection and Promotion Act*, R.S.O. 1990, c. H.71.[1]

The reportable diseases are presented as chapters showing annual case counts, symbols to point out major factors that may have had an impact on trends, and summary points describing these factors in more detail. For all included reportable diseases, tables detailing case definition changes from 1991 to 2016 are available in the Appendix: Factors affecting case definition changes in Ontario (1991-2016) document.

Introduction: Reportable diseases in Ontario

In Ontario, over 70 diseases have been specified as reportable under Regulation 559/91 of the *Health Protection and Promotion Act* (HPPA), R.S.O 1990[1]. Health care providers, laboratories, and other individuals (including school principals and superintendents of institutions) in Ontario must report the occurrence of these notifiable diseases to the medical officer of health of their local Public Health Unit (PHU). Data captured through reporting, investigation and case management activities are essential for accurately monitoring reportable disease trends, detecting unusual occurrences of diseases, and evaluating the effectiveness of interventions.

Reportable disease information systems in Ontario

From 1989 to 2005, PHUs used the decentralized electronic system, Reportable Diseases Information System (RDIS), to report information on cases of reportable diseases to the Ministry of Health and Long-term Care (MOHLTC). Currently, the main source of reportable diseases data is the integrated Public Health Information System (iPHIS). It replaced RDIS as the centralized reporting system for Ontario, and was implemented in phases throughout 2005 starting on April 1, with full implementation by all 36 local PHUs by the end of that year. Key data fields for cases stored in RDIS were carried over to iPHIS. The implementation of iPHIS streamlined the local PHUs' ability to input reportable disease data into a common database and to have the information available for reporting in near real time.

Reportable disease case definitions

Prior to 1992, the use of reportable diseases data was limited by the lack of uniform case definitions for public health surveillance. It was only in 1992 that more standardized case definitions were introduced

in Ontario. Cases were reported using the RDIS Guidelines[2], published that year, which contained surveillance case definitions of all diseases specified as reportable in Ontario at the time. The guidelines were subsequently revised at least four times and were used as a source for surveillance case definitions until 2005.

In 2005, the iPHIS Manual[3] was published as part of the iPHIS implementation and included new case definitions for reportable diseases. Case definitions presented in the iPHIS Manual were in effect until 2009, when the MOHLTC updated the provincial case definitions for most reportable diseases. This was part of the update to the provincial standards and protocols, including to the Infectious Diseases Protocol.[4]

For most diseases, additional changes to provincial surveillance case definitions and disease classifications have occurred over the years to reflect the changing epidemiology of infectious diseases and changes in laboratory diagnostic practices and technology. Case definitions may have been available prior to 1992, however documenting this information was beyond the scope of this product. For the most current case definitions in effect, refer to the appendices in the Infectious Diseases Protocol. Most recent appendices briefly outline the history of revisions made since 2013 in the "Document History" section.

Legislation, regulations and protocols

The last amendments to the specification of reportable diseases under the Ontario Regulation 559/91 of the HPPA that impact the information in this report occurred in 2013, when certain diseases were removed and others added to the list of reportable diseases. Currently, the reporting of these diseases is dependent on provincial surveillance case definitions stipulated by the MOHLTC in Appendix B[4] of the Infectious Diseases Protocol. Regulations occurring after 2017 are not reflected in this document.

Methods

Case definition changes

Changes in case definitions were documented for all included reportable diseases from 1991 to 2016 based on the RDIS Guidelines[2], iPHIS Manual[3], and the Infectious Diseases Protocol[4]. These changes were recorded in a timeline format, showing years in which important changes occurred (see "Appendix: Factors affecting case definition changes in Ontario (1991-2016)"). A guide to use the case definition tables is also available in the Appendix of this document.

Annual case counts

Graphs showing annual case counts for each reportable disease from 1991 to 2016 were created using Microsoft Excel 2010. Annual case counts from 1991 to 2004 were based on data extracted from iPHIS between January 22, 2013 and March 15, 2013. Case counts for the years 2005 onwards were based on

data extracted from iPHIS between May 16, 2017 and May 26, 2017, as reported in the Reportable Disease Trends in Ontario tool. Unless otherwise stated, case counts include only the confirmed case classification. Please note that the graphs in specific disease chapters have different y-axis scales for case counts.

Probable cases are included in the total counts presented in this product for:

- Amebiasis
- Invasive haemophilus influenzae B (Hib)
- Invasive meningococcal disease (IMD)
- Lyme disease
- Mumps
- Pertussis
- West Nile Virus (WNV) illness

Reporting on probable cases for these diseases was instituted following case definition changes in 2009 because cases that previously met the confirmed case definition were subsequently required to be reported as probable. As a result, probable case counts reported since 2009 are included in total counts for these diseases to ensure valid comparisons over time.

Some exceptions to the data extraction criteria apply to chickenpox (varicella) and influenza. Chickenpox cases are reported provincially as both individual and aggregate cases. This report only presents aggregate counts, which represent the total number of cases occurring in a PHU jurisdiction without individual case details. Individually reported counts, which represent the more severe spectrum of disease, were excluded from this product; however, the data can be found in the Reportable Disease Trends in Ontario interactive tool.

Influenza counts[12] were extracted from iPHIS based on respiratory virus seasons, rather than the calendar year. In addition, cases from iPHIS during the H1N1 pandemic seasons were extracted separately from other seasons. Additional exceptions are noted in disease-specific chapters throughout the report.

For hepatitis B, confirmed acute cases are captured under the confirmed Classification Description in iPHIS. The confirmed chronic hepatitis B cases described in this product are those reported in iPHIS with the carrier Classification Description. When a case progresses from acute to chronic infection, PHUs create a chronic carrier case, in addition to the existing acute confirmed case. Therefore, counts of acute and chronic hepatitis B cases are not mutually exclusive and should not be summed as this would result in double-counting of some cases. Acute and carrier hepatitis B cases are presented in separate graphs in this report.

Both AIDS and HIV cases are reported under the Disease field in iPHIS as HIV/AIDS. HIV cases that have not progressed to AIDS have an Encounter Type and a Diagnosis Status of carrier. HIV cases that progress to AIDS have an updated Encounter Type of case and an updated Diagnosis Status of confirmed. To determine accurate counts, cases of HIV/AIDS with either an Encounter Type of carrier

and a Diagnosis Status of carrier or an Encounter Type of case and a Diagnosis Status of confirmed are counted as HIV cases using the Encounter Date (the date the HIV encounter was reported). HIV/AIDS encounters with an Encounter Type of case and a Diagnosis Status of confirmed are counted as AIDS cases based on the Diagnosis Status Date (the date the case was diagnosed with AIDS). Therefore, counts of AIDS and HIV cases are not mutually exclusive and should not be summed as this would result in double-counting of cases. Reported case counts of AIDS and HIV are presented in separate graphs in this report.

For measles, rubella and congenital rubella syndrome (CRS), probable cases are excluded from the historical temporal trend despite being reportable at the provincial level, since these diseases have been eliminated from Canada and strict criteria are required to identify cases. Despite elimination, Ontario continues to have cases due to importation from parts of the world where the diseases remain endemic. Users should also be aware that enhanced surveillance activities to document the elimination of measles and rubella commenced in 2012 which may impact trend analyses.

Literature search

We searched for information on major factors that had an impact on reportable disease trends for diseases included in this report, such as relevant outbreaks, changes in incidence, vaccine developments, changes in awareness and reporting, or major studies that affected the number of reported cases. Primary sources included:

- Historical immunization schedules
- MOHLTC documents
    - RDIS guidelines (1996, 2002, 2004)
    - 2005 iPHIS Manual[3]
    - Infectious Diseases Protocols
    - Ontario Annual Infectious Diseases Epidemiology Report, 2009[5]
- PHO documents
    - Monthly Infectious Disease Surveillance Reports
    - Reportable Disease Trends in Ontario reports (2011[6], 2012[7], 2013[8], 2014[9])
    - Reportable Disease Trends in Ontario Technical Notes[10]
- Public Health Agency of Canada (PHAC) documents
- “Timing of Communicable Reportable Diseases under HPPA” internal MOHLTC document
- Toronto Public Health “Communicable Diseases in Toronto 2002 and Trends 1992 to 2002” report[11]

Consultations

Internal consultations were arranged with experts from PHO to gather information about reportable diseases that is otherwise not documented. This included experts in enteric diseases, vectorborne diseases, zoonotic diseases, sexually-transmitted and bloodborne infections, respiratory infections,

tuberculosis (TB), immunization and vaccine-preventable diseases and microbiology. The case definition changes, graphs with annual case counts, and research results were shared for review and discussion.

Disease-specific chapters

A compilation of all research and analysis was summarized into chapters for each reportable disease. These chapters include graphs with annual case counts along with various markers to indicate key events and changes. This includes when the disease became first reportable according to the HPPA and when changes occurred in:

- Case definitions
- Case counts due to outbreaks
- Laboratory testing methods
- Vaccine programs
- Any other relevant factors

Events for each disease and any comments interpreting their impact on trends were included below the graphs by year, in chronological order. Details on case definition changes can be found in the Appendix of this document.

The scope of the report is limited to select diseases currently designated as reportable under the Ontario Health Protection and Promotion Act, R.S.O. 1990, c. H.7[1]. For certain reportable diseases, graphs for annual case counts and a summary of major factors were excluded; the following diseases are only included in the Appendix of this document:

- Accute flaccid paralysis
- Anthrax
- Chancroid
- Congenital cytomegalovirus
- Diphtheria
- Food poisoning
- Gastroenteritis, institutional outbreaks
- Hantavirus Pulmonary Syndrome
- Hemorrhagic fevers
- Hepatitis D
- Herpes, neonatal
- Lassa fever
- Opthalmia neonatorum
- Paralytic shellfish poisoning
- Plague
- Poliomyelitis, acute
- Rabies
- Respiratory infection outbreaks in institutions

- Severe Acute Respiratory Syndrome (SARS)
- Smallpox
- Yellow fever

The following diseases are excluded from this product:

- Adverse Events Following Immunization (AEFIs)
- Clostridium difficile Infection (CDI) outbreaks in public hospitals
- Creutzfeldt-Jakob Disease, all types
- Encephalitis, including: i) Primary, viral; ii) Post-infectious; iii) Vaccine-related; iv) Subacute sclerosing panencephalitis, and v) Unspecified
- Leprosy
- Meningitis, acute: i) bacterial; ii) viral, and iii) other

Data Limitations

Consideration of changes to provincial case definitions and associated case classifications over time must be considered to ensure valid interpretations of trends and comparisons to historical counts. External factors beyond reportable disease status and case definition changes, such as outbreaks and changes to food safety controls, must also be considered when interpreting trends.

RDIS and iPHIS data

The quality of reportable disease data while RDIS was in place in Ontario was limited by the decentralized nature of the system. Major data quality issues with the reporting structure included duplicates and incomplete case reporting. With the implementation of iPHIS in 2005, PHUs were able to systematically report cases in a centralized system. Many of the changes in case counts observed between 2004 and 2005 may be related to the transition between reporting systems.

In general, changes in case counts may vary from one report to another due to the dynamic nature of iPHIS. iPHIS allows for ongoing updates to data previously entered. As a result, data extracted from iPHIS represents a snap shot at the time of extraction and may differ from previous or subsequent reports.

Under-reporting

Passive surveillance systems such as iPHIS that primarily rely on mandatory physician and laboratory reports of illness can be characterized by under-reporting of the true burden of illness. Case counts only represent known cases reported to PHUs and recorded in iPHIS. The degree of under-reporting may vary from disease to disease due to a variety of factors such as:

- disease awareness
- health care seeking behaviours
- availability of health care
- severity of illness
- clinical practice
- methods of laboratory testing
- reporting behaviours

The extent of under-reporting for individual reportable diseases has not been fully assessed in Ontario.

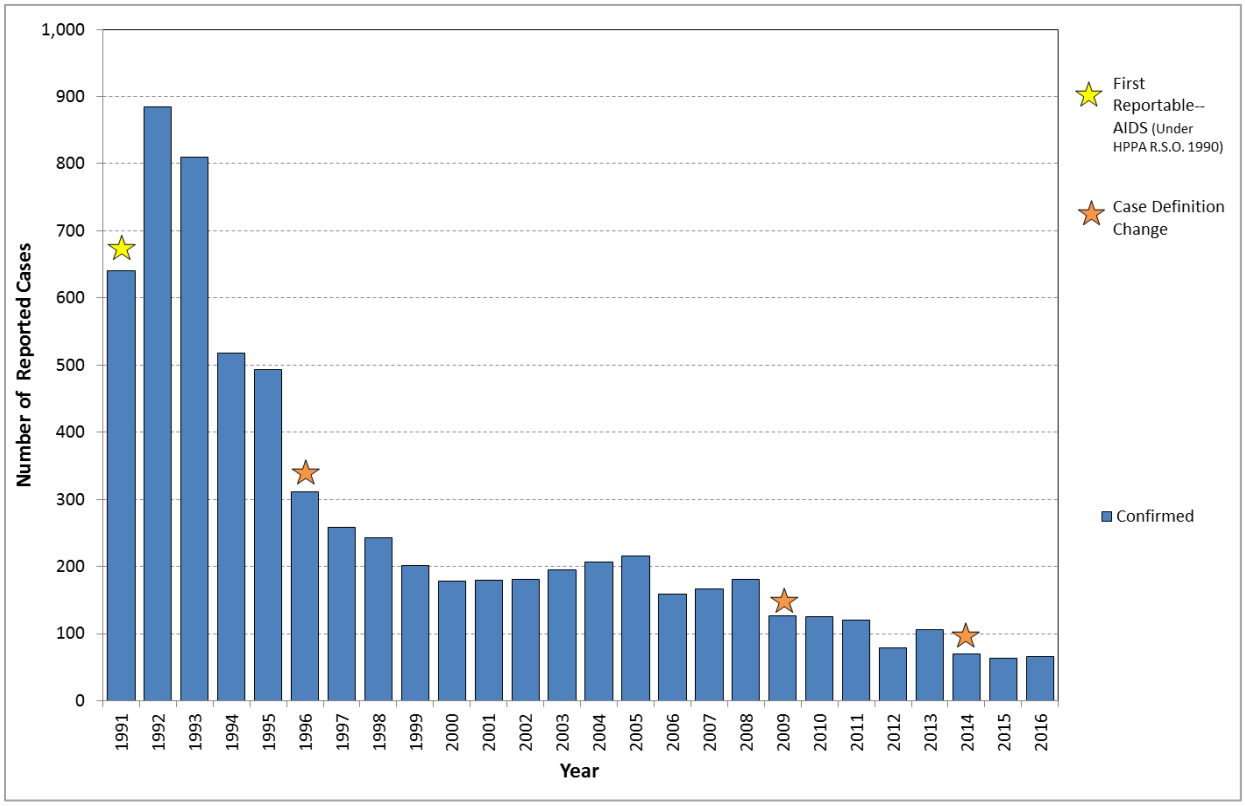
Consultations

Internal consultations were carried out to capture corporate memory and other information that may have been missing from sources used in the research process. However, most attendees did not have experience dating back to 1991. Thus, there was better documentation of corporate memory in recent years as opposed to the earlier years covered. In addition, through internal collaborative meetings, it

was found that changes in laboratory techniques and interpretations of results were implemented prior to actual updates to the case definitions. Some of these changes were not systematically documented and are therefore not accounted for in this document.

Acquired Immunodeficiency Syndrome (AIDS)

Figure 1. Number of reported cases of AIDS by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on [2013/02/12] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- The number of AIDS cases has dropped since the early 1990s. This is due to a variety of factors, including access to and improvements in HIV anti-retroviral treatment that helps to slow the progression of HIV to AIDS.[13]

1986

- Clinical trials for antiretroviral therapy (ART) began.

1992

- Anonymous testing for HIV became available in Ontario with expansion of the program in 2006. The availability of anonymous testing may have led to more individuals who were at higher risk of HIV/AIDS accessing testing.[14,15]

1996

- Highly Active Antiretroviral Therapy (HAART) became available for the treatment of HIV.[16]

2007

- Point of Care Testing became available in Ontario and may have led to more individuals accessing testing.[15]

2009

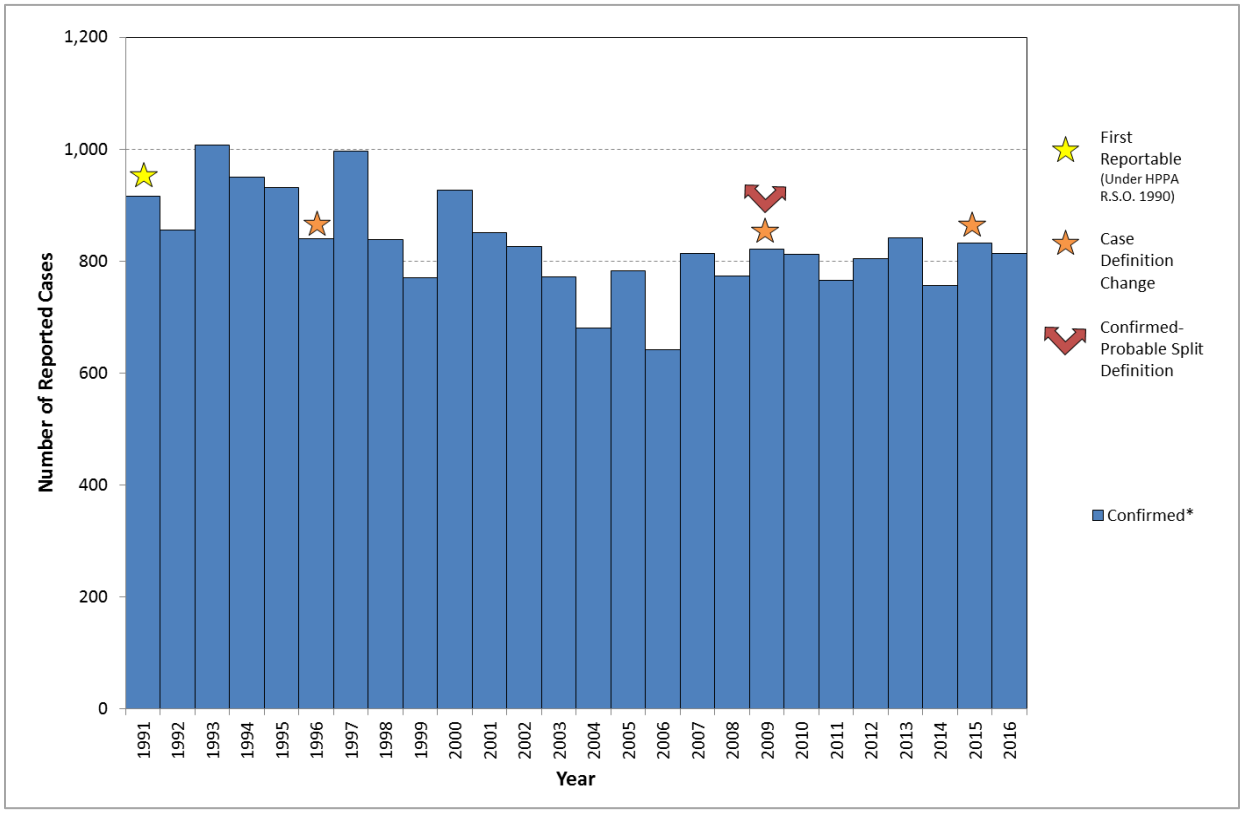
- An HIV positive test became necessary for AIDS case confirmation, improving the specificity of the case definition; HIV and AIDS case definitions were separated.[4] These changes may have led to a decrease in AIDS cases.

2014

- Isolation of HIV in culture was added to the case definition as a new method of testing.

Amebiasis

Figure 2. Number of reported cases of Amebiasis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/23] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

*** Probable cases have been included in total counts since 2009 in order to ensure valid comparisons over time.**

OVERVIEW

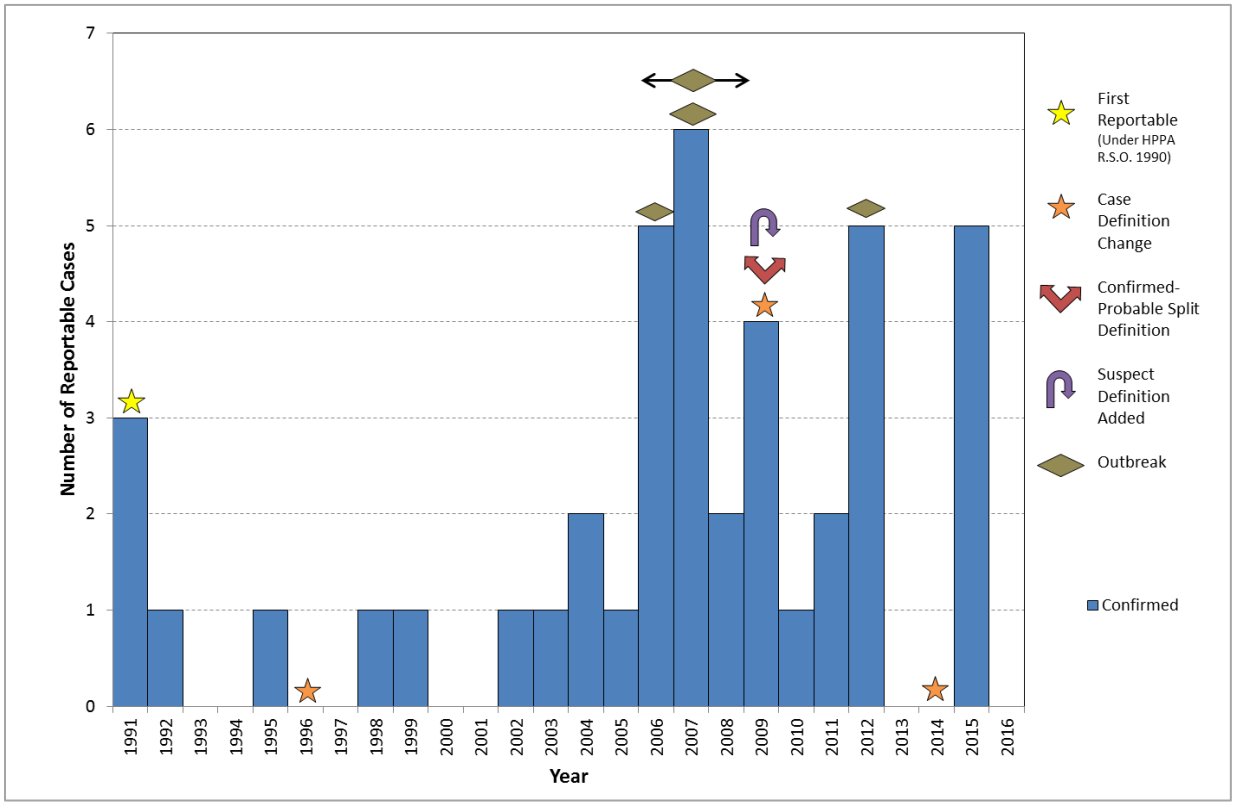
- Probable cases of amebiasis have been included in total counts since January 1, 2009 owing to the change in interpretation of laboratory test results that previously reported the causative agent as *Entamoeba histolytica/E. dispar* with no distinction between the two. Cases with test results that do not differentiate between the non-pathogenic *E. dispar* and the pathogenic *E. histolytica* have been counted as probable since 2009, whereas they were previously counted as confirmed. The impact of this change was significant and as a result, probable cases have been included in total counts since 2009 to ensure valid comparisons over time for amebiasis.[17]

2009

- The case definition was split into confirmed and probable cases.[4]
- More laboratory methods (e.g., ELISA) were added to the case definition, improving its sensitivity.

Botulism

Figure 3. Number of reported cases of Botulism by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- A single case of botulism is considered an outbreak. Several multi-case outbreaks of botulism have occurred in Ontario since 1991.

2006

- The increase in reported cases was due in part to an outbreak of two cases linked to the consumption of unpasteurized carrot juice.

2007

- The increase in reported cases was due in part to an outbreak of infant botulism. The source of this outbreak was not identified.

2009

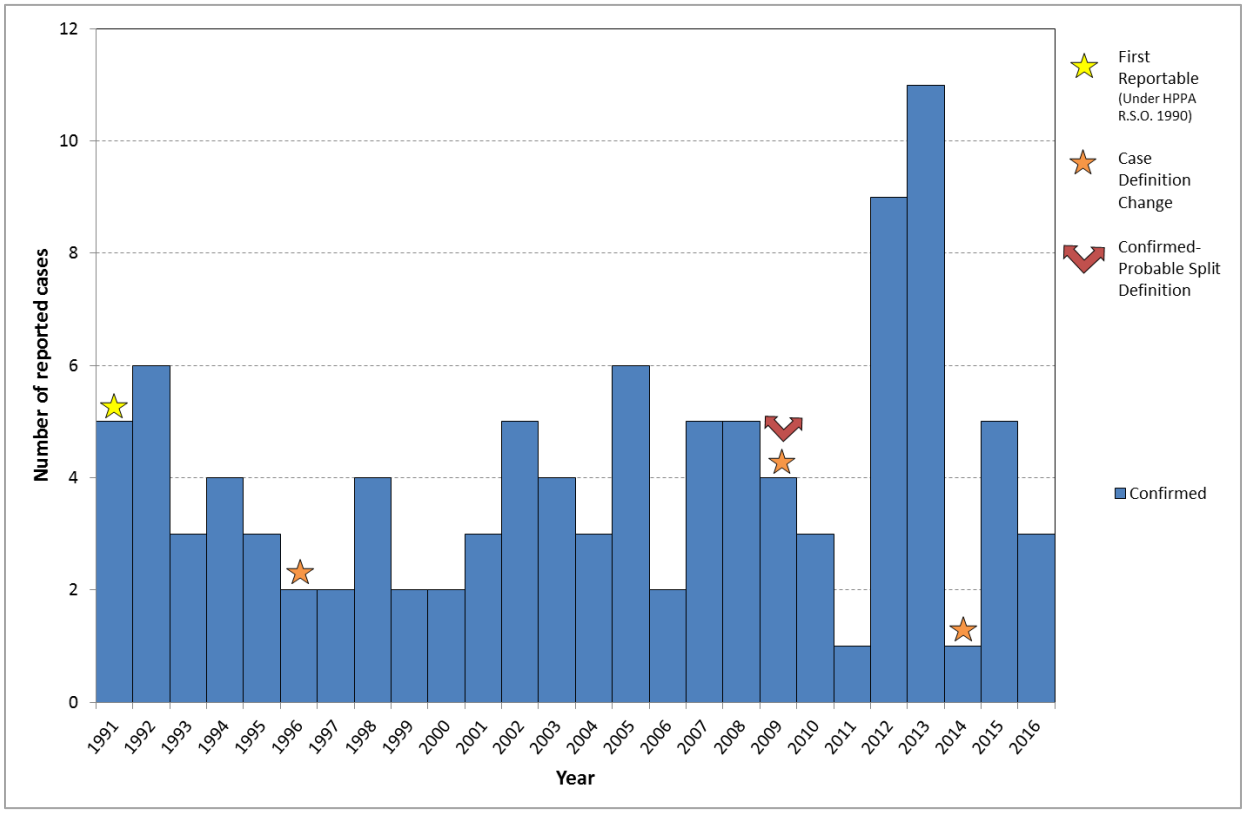
- Probable and suspect case definitions were added.
- A new category for confirmed cases, “intestinal/colonization botulism,” was added to capture adults who are diagnosed with intestinal/colonization botulism.

2012

- The increase in reported cases was in part due to an outbreak of three cases linked to the consumption of a traditionally prepared salted fish, fesikh.

Brucellosis

Figure 4. Number of reported cases of Brucellosis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

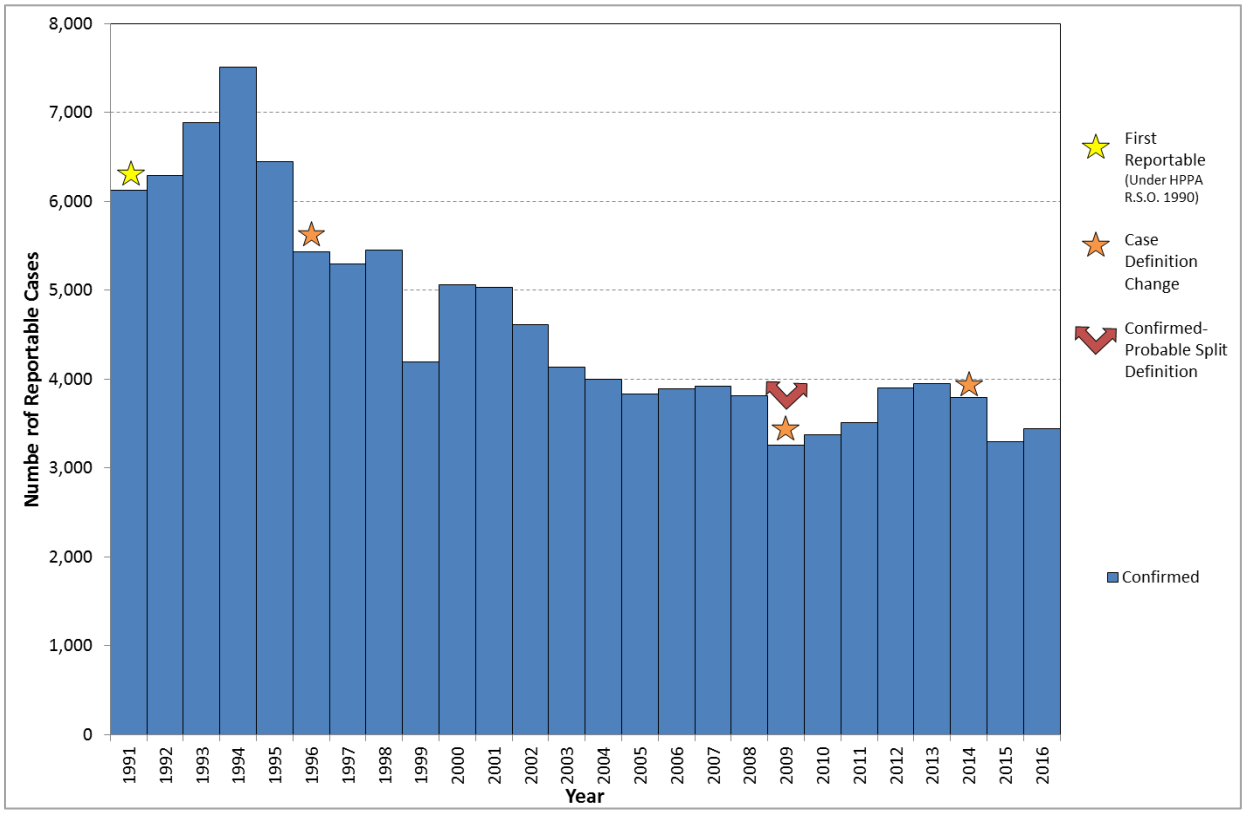
- Livestock in Canada have been declared brucellosis-free since 1985.[18]
- In Ontario, the number of brucellosis human cases has remained stable over the years, with most cases being attributed to travel to Mediterranean countries, Middle East, Africa, Asia, and Central and South America.[18]
- The increase in reported cases in 2012 and 2013 was attributed to an increase in travel-associated cases to endemic areas outside of Canada.[19]

2009

- The case definition was split into confirmed and probable cases.[4] The impact of this change was not substantial given that probable cases constituted a small proportion of total case counts since 2009.

Campylobacter enteritis

Figure 5. Number of reported cases of *Campylobacter* enteritis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

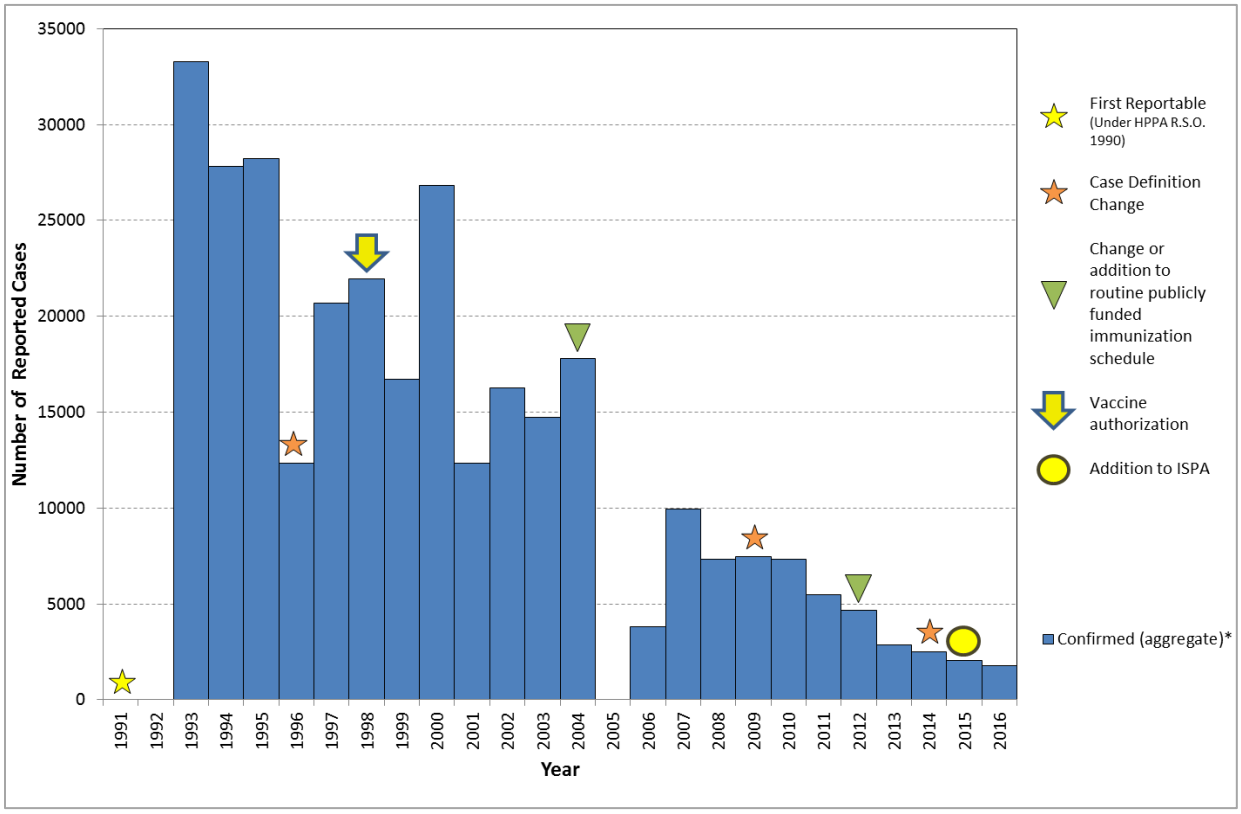
- Incidence of reported cases has been declining since 1994.
- The decrease in reported cases may be partly due to the introduction of control efforts in Canada by industry, federal and provincial/territorial governments, and the general population. In response to the increasing introduction and spread of contaminants, there have been changes to legislative frameworks and improvements in the safety of food commodities, including the introduction of the Canadian Food Inspection Agency (CFIA) in 1997. These interventions include meat processing changes, public awareness campaigns on food handling practices, and the introduction and enforcement of food safety standards and policies by Health Canada and the CFIA which help minimize risks of foodborne illness.[20,21]

2009

- The case definition was split into confirmed and probable cases.[4] The impact of this change was not substantial given that probable cases have constituted a small proportion of total case counts since 2009.

Chickenpox (Varicella)

Figure 6. Number of reported cases of Chickenpox by year, Ontario, 1991-2016



Data Source (Aggregate cases, 1993-2005): MOHLTC- Ontario Public Health Portal. Online: https://www.publichealthontario.ca/portal/server.pt?open=512&objID=1184&PageID=0&cached=true&mode=2. Downloaded [2012/05/24].
Data Source (Aggregate cases, 2006-2016): MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2017/07/20].

*** Data for aggregate reporting are incomplete for 2005 and 2006 due to transition from the Reportable Disease Information System (RDIS) to iPHIS, and delayed implementation of aggregate reporting in iPHIS. Individual counts for chickenpox were excluded from this product, however data on individual counts can be found in the Reportable Disease Trends in Ontario interactive tool.**

OVERVIEW

- In Ontario, chickenpox is reported at both individual and aggregate-level. Following individual reporting for chickenpox in 1991, aggregate reporting began in 1993 and likely provides a better estimate of the burden of disease than the confirmed cases that are reported individually. Individually-reported cases represent those that are laboratory-confirmed as well as cases of greater severity such as those that are hospitalized or have complications, including death.
- Data for aggregate reporting are incomplete for 2005 and 2006 due to the transition from the Reportable Disease Information System (RDIS) to iPHIS, and delayed implementation of aggregate reporting in iPHIS.

1998

- Varicella vaccine was first authorized for use in Canada in 1998[22], available for private purchase.

2004

- In September 2004, a single dose of varicella vaccine became publicly funded for children at 15 months, after which aggregate cases of chickenpox have dropped dramatically.[23] A catch-up program for 5-year-olds born on or after January 1, 2005 with no history of chickenpox was also introduced.

2009

- NAT testing was included as one of the methods of laboratory confirmation for confirmed cases.[4]

2011

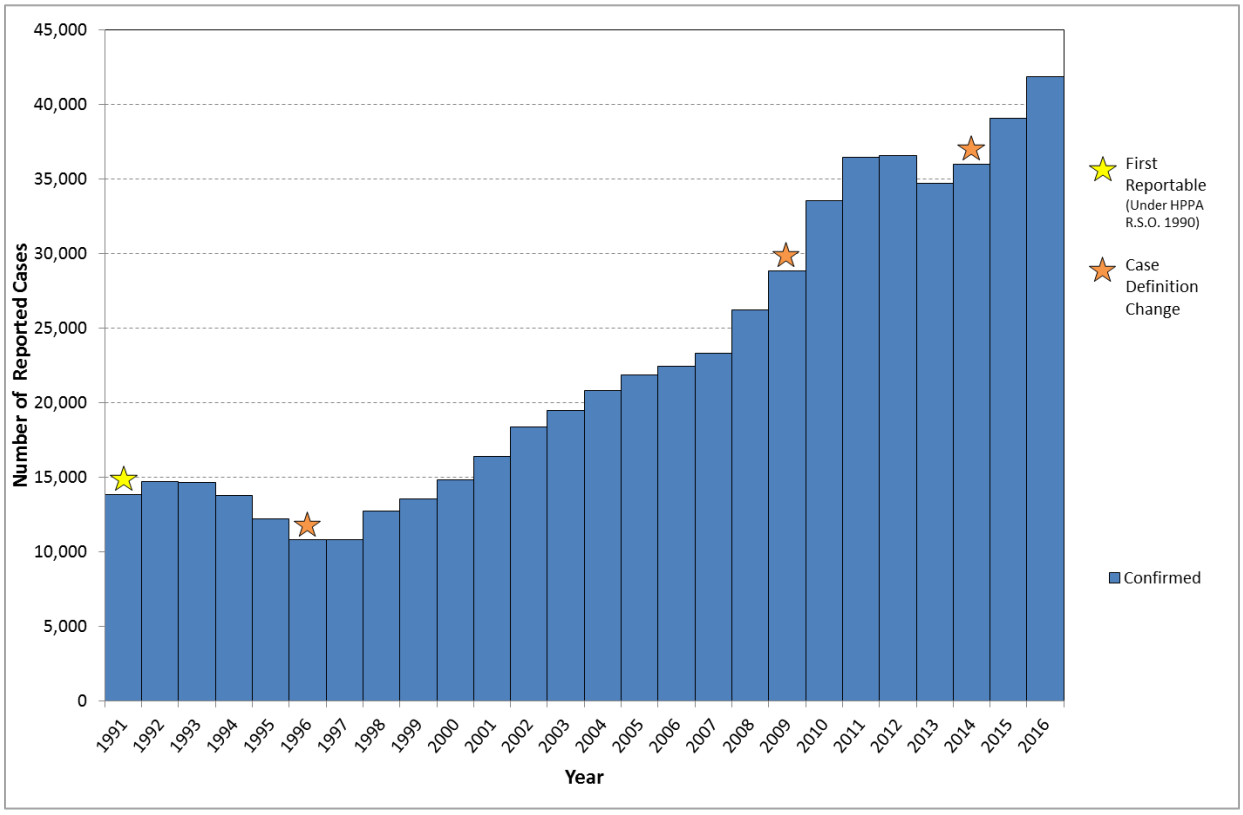
- In August 2011, a second dose of varicella-containing vaccine was added to the publicly funded schedule as MMRV vaccine for children at 4-6 years. In addition, children born on or after January 1, 2000 who were at least one year of age were eligible for a second dose of varicella.[24]

2014

- Varicella was added as a designated disease under the Immunization of School Pupils Act. Since the 2014-15 school year, children born in 2010 or later were required to be immunized against varicella (two doses) or provide documentation of medical exemption or religious/conscientious objection.[25]

Chlamydia trachomatis infections

Figure 7. Number of reported cases of *Chlamydia trachomatis* by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/02/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- There has been an increase in chlamydia cases since 1996. This may be in part due to changes in screening practices, an increase in testing and more sensitive, less invasive testing methods.[26]
- Most chlamydia infections in females are asymptomatic; therefore most cases of chlamydia are identified through screening. Females are often screened for chlamydia when their Papanicolaou (Pap) testing is completed.
- Although the overall increasing trend of chlamydia cases is multifactorial, the decrease in 2013 is likely attributed to the cervical cancer screening guideline change in 2012 (see below).[27]

2009

- Chlamydia pneumonia was removed from the case definition.

2012

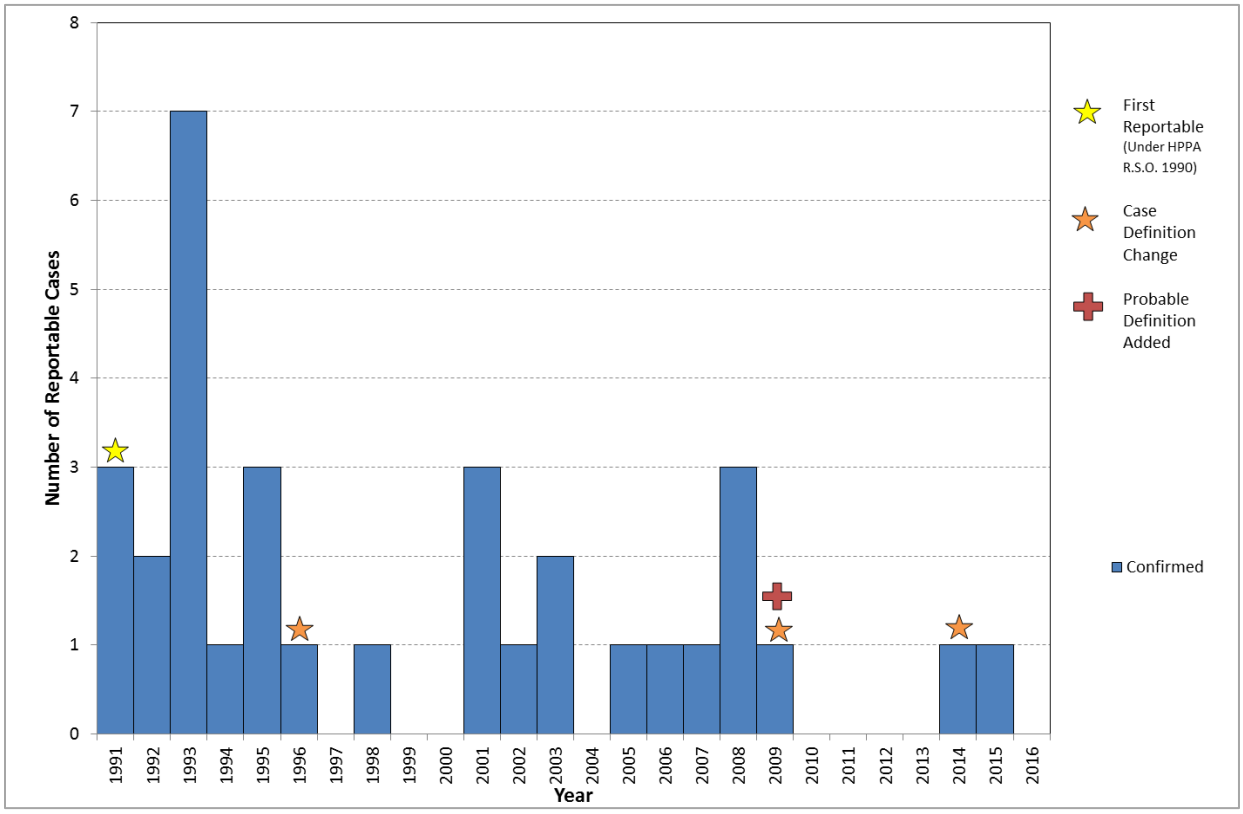
- The Ontario cervical cancer screening guidelines underwent a change in 2012. Previously, Pap testing was recommended within three years of the initiation of sexual activity, and annually thereafter until several normal results were received. Pap smears are no longer recommended for the 15 to 19 age group. Current screening guidelines by the Ontario Cervical Screening Program recommend for women who are or have been sexually active to be screened every 3 years at age 21. Therefore screening for chlamydia among those under 21 years of age would no longer be occurring routinely with their annual Pap testing and would lead to underdiagnoses in those under 21.[27]

2014

- Pharyngeal specimen was added to the case definition as a laboratory specimen source.

Cholera

Figure 8. Number of reported cases of Cholera by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

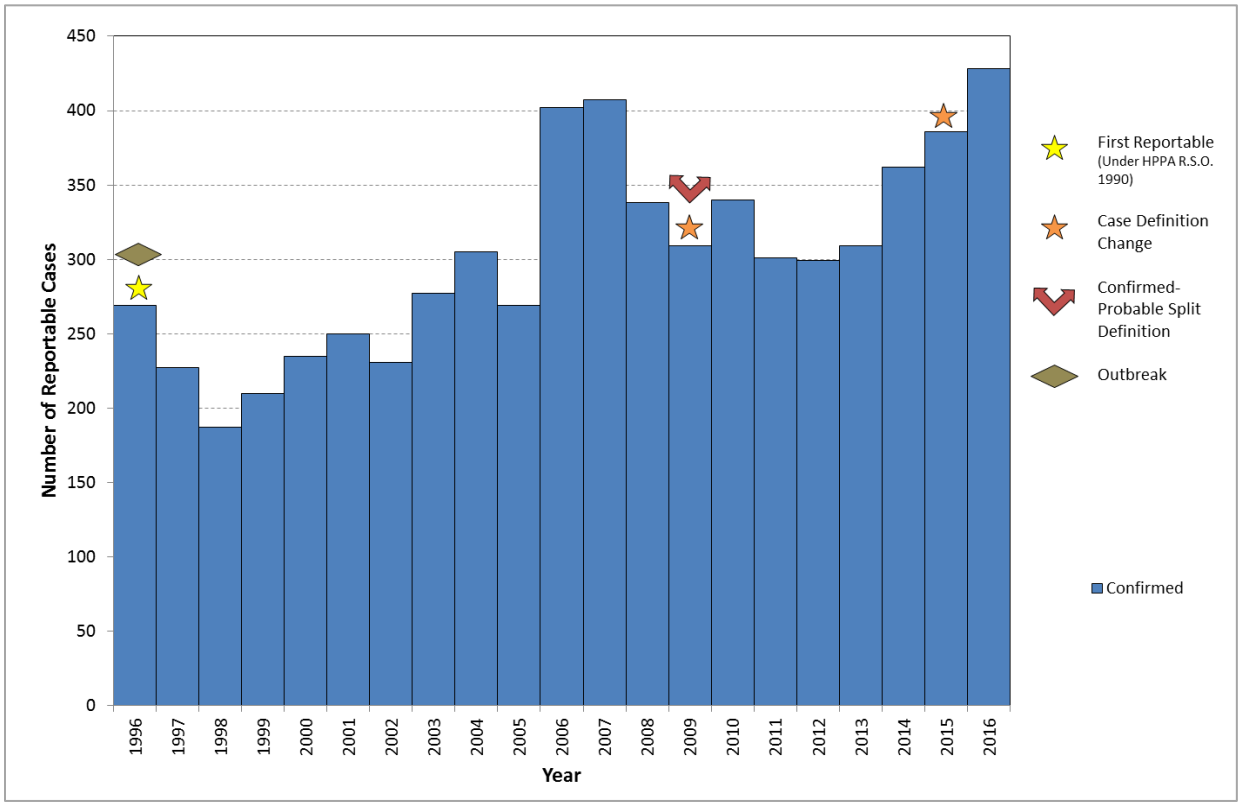
- Cholera is not endemic in Canada, and cases in Ontario are directly or indirectly associated with travel to endemic regions of the world.[18]

2009

- A probable case definition was added, which includes an epidemiologic link to a laboratory-confirmed case.[4]

Cryptosporidiosis

Figure 9. Number of reported cases of Cryptosporidiosis by year, Ontario, 1996-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- There was an increase in reported cases in 2006 and 2007, although no common exposures were identified to explain this increase. A potential contributing factor to the increase in cases in 2007 may have been a provincial outbreak linked to exposure to contaminated recreational water in different parts of the province.

1996

- The increase in cases can be attributed to a community-wide outbreak of cryptosporidiosis in the Simcoe County Health Unit during March 1996, with four clusters associated with exposures to the parasites contaminating the municipal water supply.[28,29]

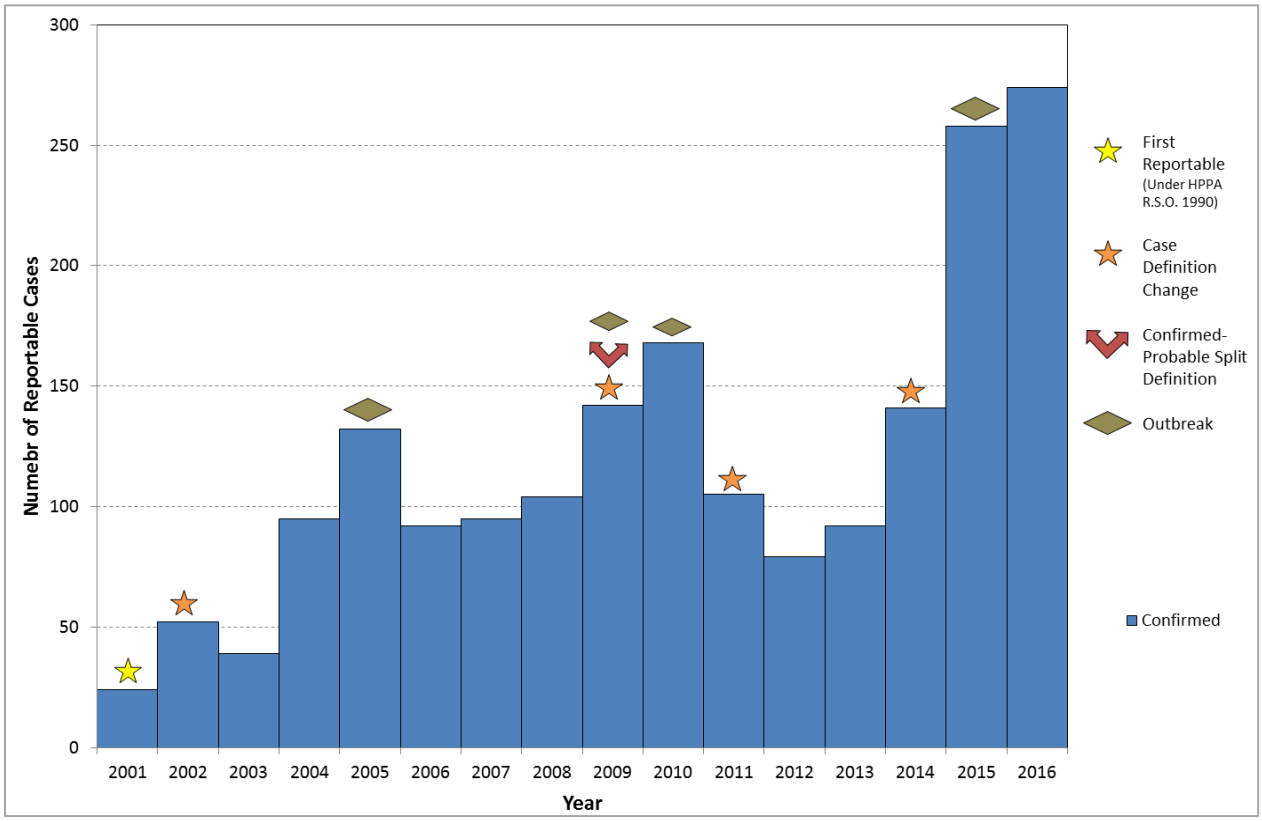
- One of the four clusters occurred in a nursing home and private residences for which the source of drinking water was unfiltered municipal surface water. It accounted for 53 cases of cryptosporidiosis that year.[30]
- Another cluster involved a day-care setting in which person-to-person transmission was implicated.[30]

2009

- The case definition was split into confirmed and probable cases.[4] However, there have not been any probable cases since 2009.

Cyclosporiasis

Figure 10. Number of reported cases of Cyclosporiasis by year, Ontario, 2001-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- Cyclosporiasis first became reportable in 2001.
- Cyclospora is not endemic to Ontario. As a result, all reported cases in the province are either travel-related or associated with an imported food source.
- Outbreaks of cyclosporiasis occurred in Ontario from 1996 to 1999 and were mainly associated with imported raspberries from Guatemala. [31] This resulted in a ban by the Canadian Food Inspection Agency to prohibit importation of select Guatemalan raspberries into Canada starting in 2000.[32]

2001

- Cyclosporiasis was listed as reportable under the Health Protection and Promotion Act.

2005

- The increase in reported cases was attributed to a local outbreak linked to the consumption of fresh basil used to make pesto.[33]

2009

- The case definition was split into confirmed and probable cases.[4] The impact of this change was not substantial given that probable cases have constituted a small proportion of total case counts since 2009.
- The increase in reported cases was attributed to two local outbreaks, one of which was linked to a restaurant where berries were suspected, but not confirmed, as the source.[33]

2010

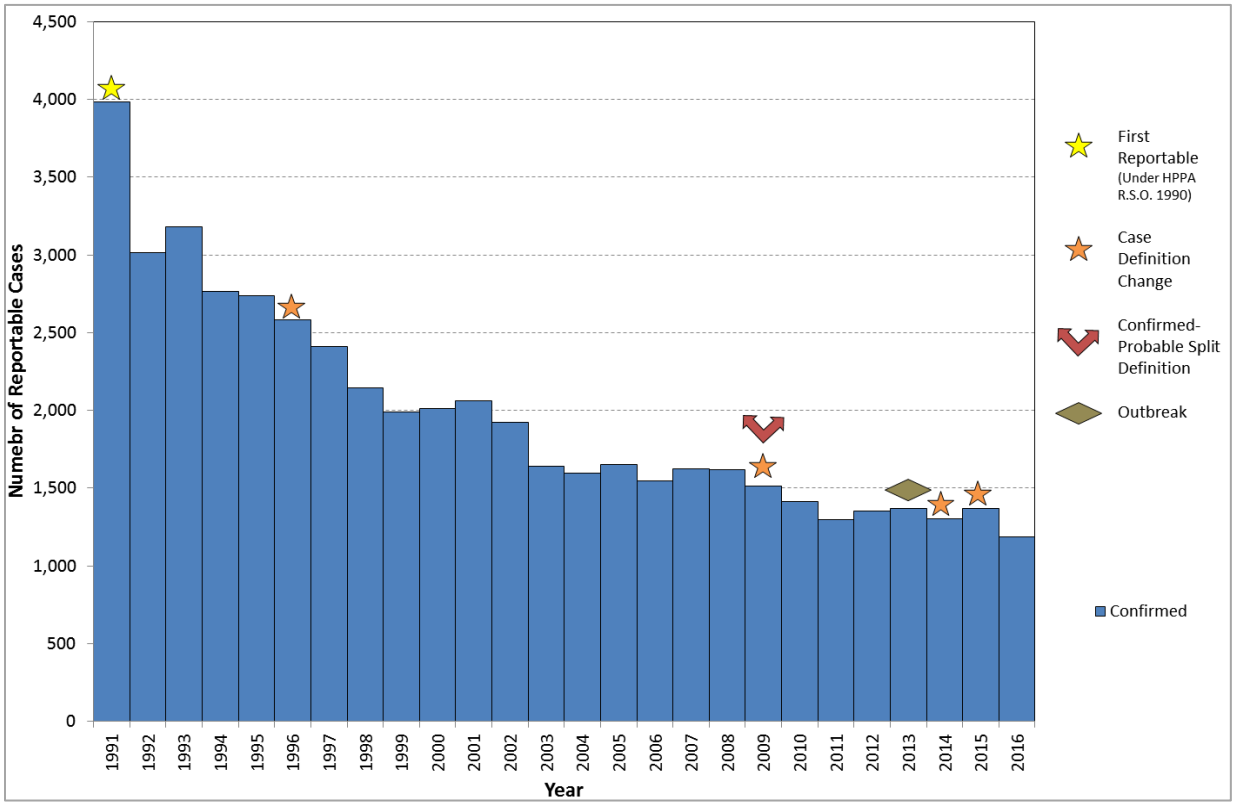
- The increase in reported cases was attributed to a local outbreak linked to fresh basil used in a pesto dish and served at a special event.[33]

2015

- The increase in reported cases was attributed to an outbreak related to consumption of sugar snap peas imported from Guatemala.[34]

Giardiasis

Figure 11. Number of reported cases of Giardiasis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- Incidence for reported cases has been declining since 1991.

2009

- The case definition was split into confirmed and probable cases.[4] The impact of this change was not substantial given that probable cases have constituted a small proportion of total case counts since 2009.

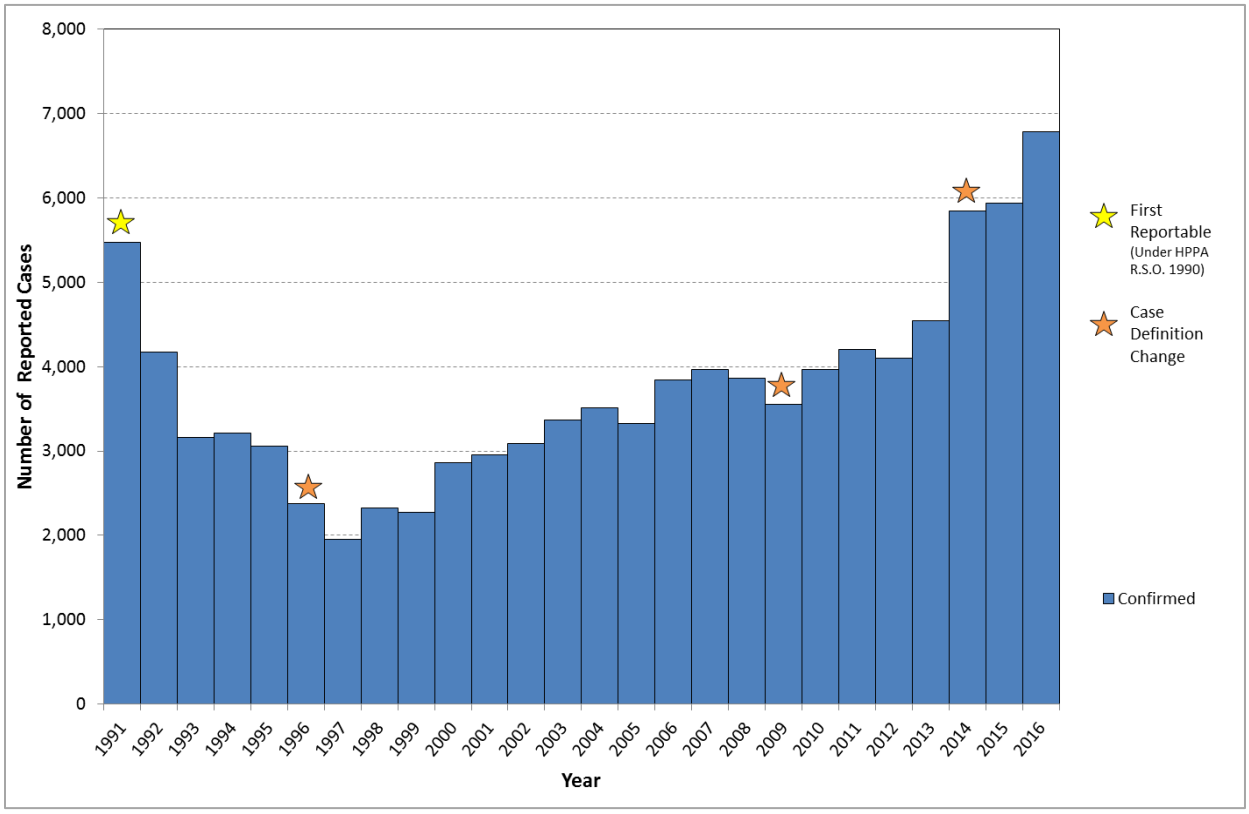
- More laboratory methods (e.g., EIA) were added to the case definition, improving its sensitivity.

2013

- An outbreak of 75 cases linked to exposure to a contaminated swimming pool occured in Niagara.

Gonorrhoea

Figure 12. Number of reported cases of Gonorrhoea by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/02/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- There has been an increase in gonorrhea cases since 1997. This may be in part due to changes in screening practices, an increase in testing and more sensitive, less invasive testing methods.
- An additional factor that may influence the reported incidence of gonorrhea includes increasing resistance to antibiotics available to treat gonorrhea infections.[7]
- Historically, *Neisseria gonorrhoea* has developed resistance to recommended first-line treatment resulting in changes to first-line treatment to ensure provision of effective empiric treatment. Fluctuations in the incidence of gonorrhea may be related to the development of antibiotic resistance to a first-line treatment followed by implementation of new, effective, first-line treatment recommendations.

- Since 2013 there was a marked increase in gonorrhea cases. The cause of this increase is not fully understood, although it is likely multifactorial.

2012

- Females are often screened for gonorrhea when their Papanicolaou (Pap) testing is completed. Previously, Pap testing was recommended within three years of the initiation of sexual activity, and completely annually thereafter until several normal results were received.

  The Ontario cervical cancer screening guidelines underwent a change in 2012. Pap smears are no longer recommended for the 15 to 19 age group. Current screening guidelines by the Ontario Cervical Screening Program recommend for women who are or have been sexually active to be screened every 3 years at age 21. Therefore screening for gonorrhea among females aged 21 years or under would no longer be occurring routinely with their annual Pap testing.

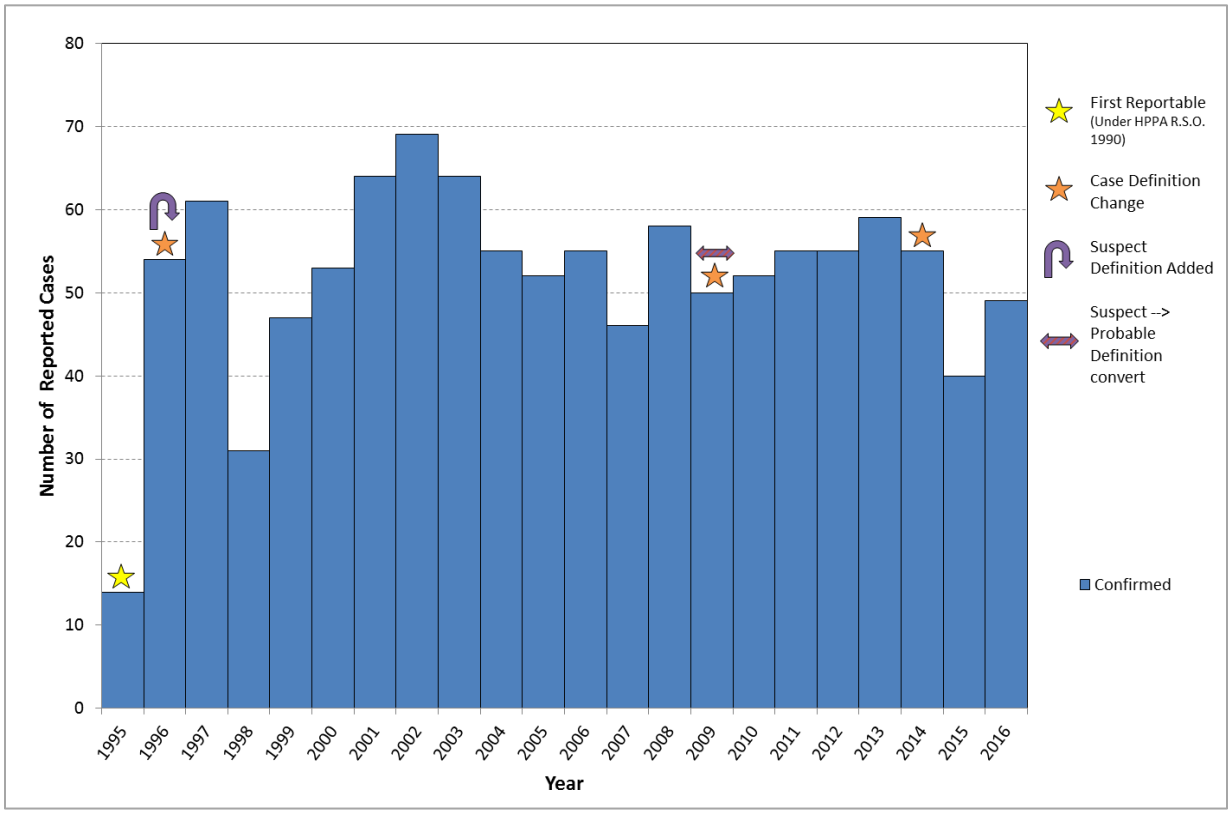
  Additionally, individuals who were previously screened annually with their Pap test are now being screened once every three years.[27] This change would not have as large an impact on gonorrhea cases in Ontario in comparison to chlamydia cases given gonorrhea is more common among males and in an older age group compared to chlamydia.

2013

- Ontario guidelines for gonorrhea treatment were released by Public Health Ontario.[7] These guidelines detail susceptibility of Neisseria gonorrhea in Ontario and recommend changes in first-line treatment provision including duel therapy and provision of an intramuscular injection. Receipt of the recommended first-line treatment in Ontario has improved since the release of the guidelines, but full compliance with treatment recommendations remains less than ideal, which may have an impact on reported cases due to inadequately treated cases continuing to transmit gonorrhea.

Group B Streptococcal disease, neonatal

Figure 13. Number of reported cases of Group B Streptococccal Disease (neonatal) by year, Ontario, 1995-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/02/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

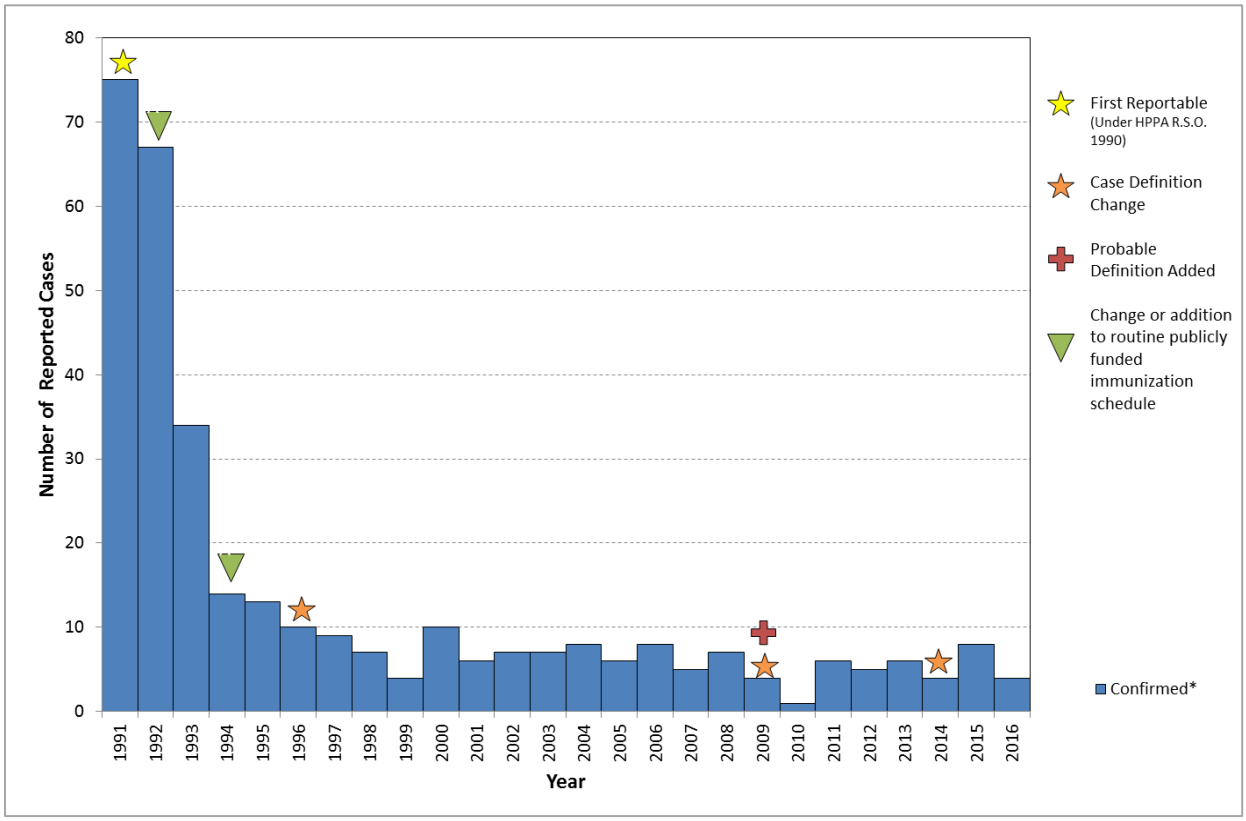
- Screening for group B streptococcus is recommended in pregnant females. Treatment is recommended for pregnant females who are found to be colonized with group B streptococcus to reduce the likelihood of group B streptococcus in newborns.

2009

- The previous suspect case definition became the new probable case definition.[4]

Haemophilus influenza B, invasive

Figure 14. Number of reported cases of Haemophilus Influenzae B (invasive), Ontario, 1991-2012



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/03/15] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

*** Probable cases have been included in total counts since 2009 in order to ensure valid comparisons over time.**

OVERVIEW

- Given that probable cases constituted a significant proportion of total case counts since 2009, they have been included in total counts in order to ensure valid comparisons over time.
- Following the introduction of the infant invasive haemophilus influenza B (Hib) vaccination programs, there has been a dramatic and sustained decline in disease incidence in Ontario.

1987

- A single dose of polysaccharide vaccine was introduced in Ontario as a routine program for children two-years of age.

1988

- A more effective conjugate vaccine replaced the polysaccharide vaccine for the routine program (one dose at 18 months of age).[23]

1992

- A 4-dose schedule was initiated in Ontario for infants at 2, 4, 6 and 18 months in 1992.

1997

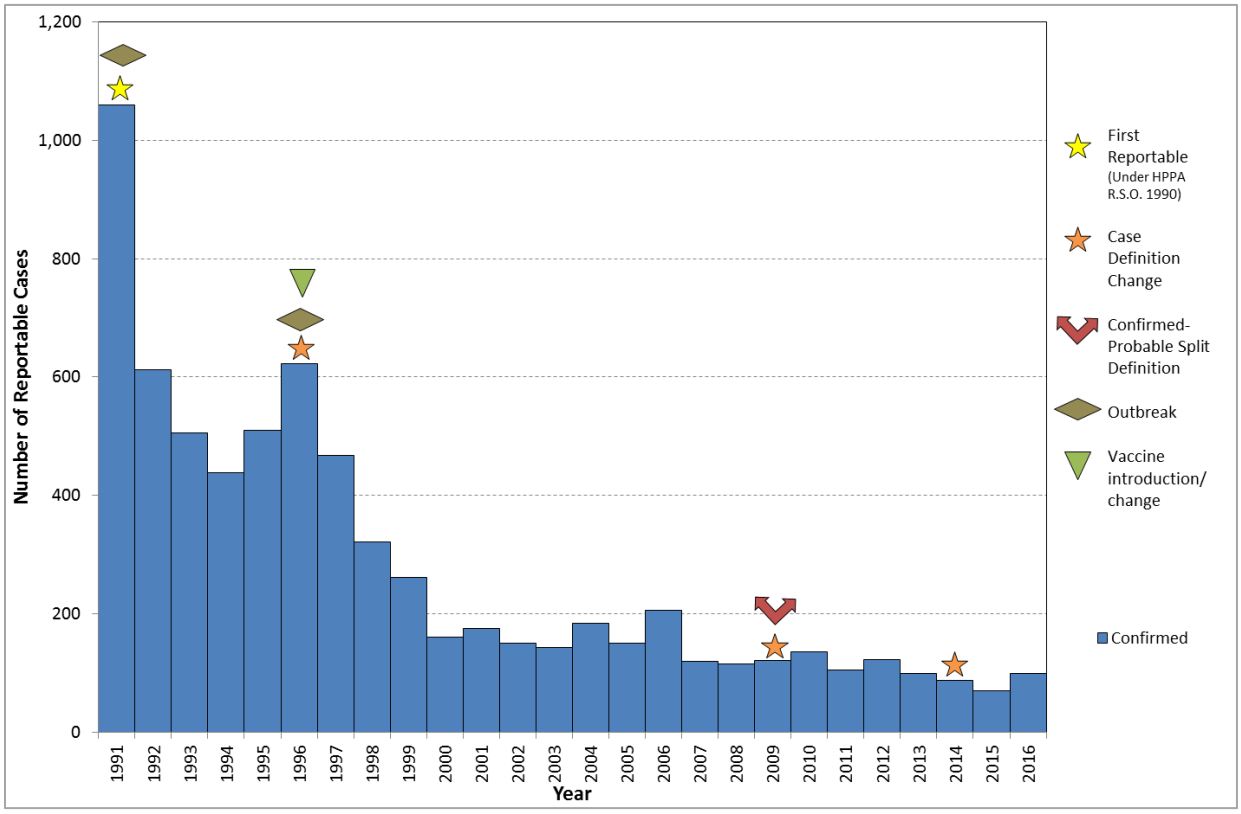
- Since 1997, Hib has been given as a combined diphtheria, tetanus, pertussis, polio and Hib-vaccine at 2, 4, 6 and 18 months.

2009

- A probable case definition was added.[4]

Hepatitis A

Figure 15. Number of reported cases of Hepatitis A by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- The incidence of reported cases has been declining since 1996. The introduction of the hepatitis A virus (HAV) vaccine in 1996 is a key contributor to the decline of HAV incidence.[35]

- Since 2003, hepatitis A vaccination became more accessible and publicly funded in Ontario for groups at increased risk for HAV infection, including men who have sex with men (MSM). This has further contributed to the decline of HAV incidence.[36]

1991

- The increase in reported cases was attributed to a large outbreak of 274 cases in Toronto among the MSM community. In this outbreak, 234 (85%) cases were males aged 20 to 49 years.[36]

1996

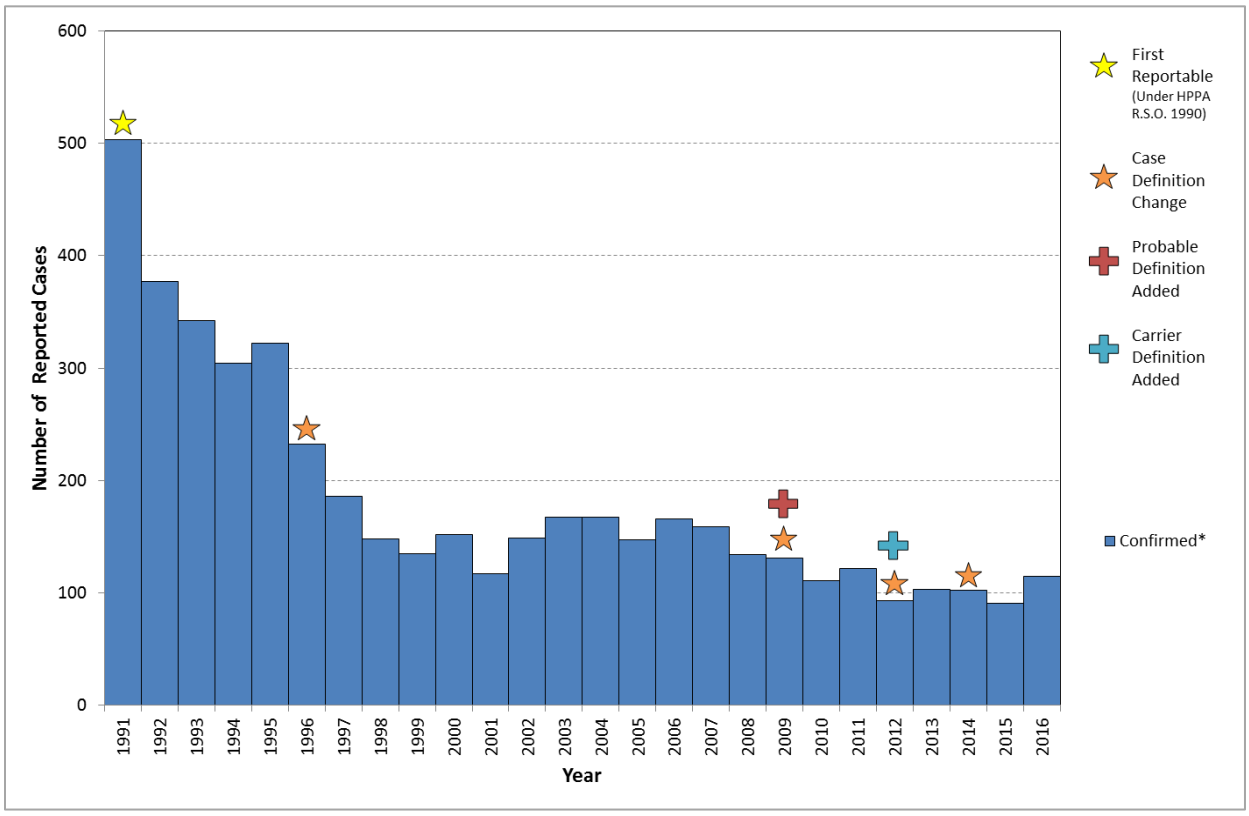
- The increase in reported cases was attributed to an outbreak of 68 cases in Toronto, 64 (94%) of which were males.[36]
- The HAV vaccine was licensed in Canada.[35]

2009

- A probable case definition was added, which includes an epidemiologic link to a laboratory-confirmed case. However, there have not been a substantial number of reported probable cases since 2009.[4]

Hepatitis B, acute

Figure 16. Number of reported cases of Acute Hepatitis B by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/02/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

*** Acute and carrier hepatitis B cases are presented in separate graphs in this report because counts of acute and chronic hepatitis B cases are not mutually exclusive and should not be summed as this would result in double-counting of some cases. For information on chronic Hepatitis B, see "Hepatitis B (chronic)".**

OVERVIEW

- Since the 1990s, there has been a decreasing trend of reported acute hepatitis B cases which may be due to a variety of factors, including a universal HBV immunization program that began in schools in 1994/1995 and the introduction of a publicly funded HBV vaccine for high-risk individuals.[37]
- Publicly funded high-risk HBV immunization has been available for individuals meeting high-risk criteria since 1983 with expansion of risk groups several times since then.[37]

1994

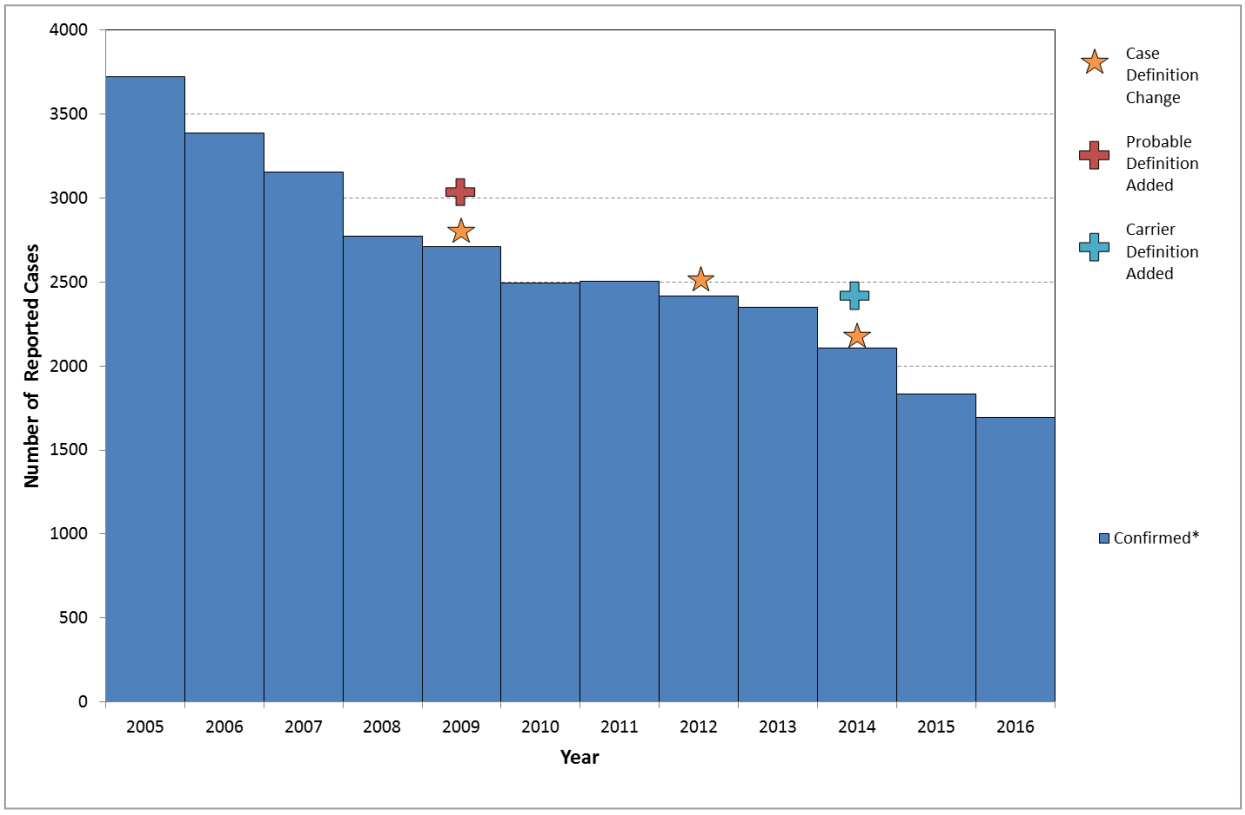
- The school-based grade seven HBV immunization program was added as a publicly funded vaccination program.

2009

- A probable case definition was added.[4]
- Detection of hepatitis B surface antigen (HBsAg) was added to the case definition as a method of laboratory confirmation for acute cases. The improved specificity of the case definition may have led to a decrease in Hepatitis B confirmed cases.

Hepatitis B, chronic

Figure 17. Number of reported cases of Chronic Hepatitis B by year, Ontario, 2005-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/02/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

*** Acute and carrier hepatitis B cases are presented in separate graphs in this report because counts of acute and chronic hepatitis B cases are not mutually exclusive and should not be summed as this would result in double-counting of some cases. For information on chronic Hepatitis B, see "Hepatitis B (chronic)".**

OVERVIEW

- Since the 1990s, there has been a decreasing trend of reported chronic hepatitis B cases which may be due to a variety of factors, including a universal HBV immunization program that began in schools in 1994/1995 and the introduction of a publicly funded HBV vaccine for high-risk individuals.[37]
- Publicly funded high-risk HBV immunization has been available for individuals meeting high-risk criteria since 1983 with expansion of risk groups several times since then.[37]

1994

- The school-based grade seven HBV immunization program was added as a publicly funded program.

2009

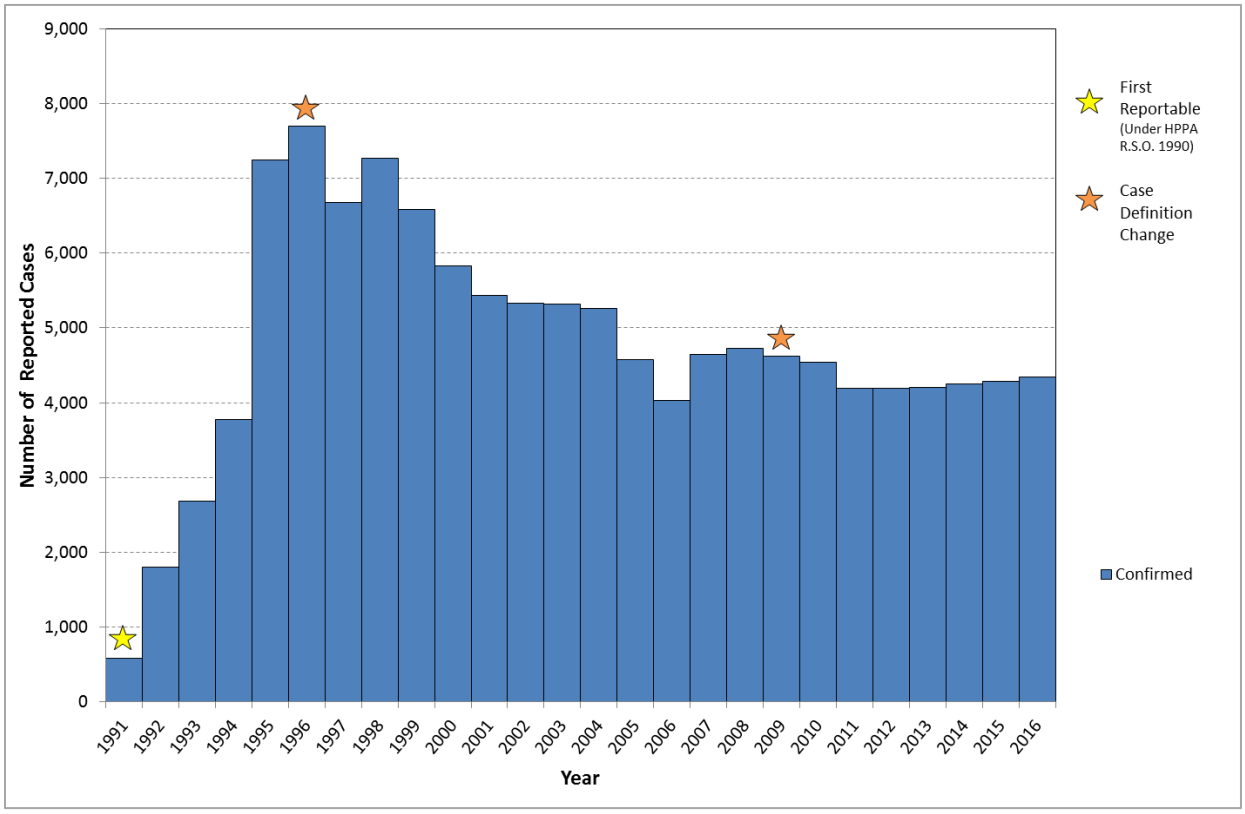
- A probable case definition was added.[4]

2012

- A carrier case definition was added, which accounts for chronic cases of hepatitis B.[4]

Hepatitis C

Figure 18. Number of reported cases of Hepatitis C by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/02/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- In the early 1990s, there was an increase in cases of hepatitis C, which may be due to a variety of factors, including awareness of risks associated with hepatitis C transmission.[38]
- Screening of blood products for hepatitis C began in 1990.[39] Health care providers were encouraged to screen any individual who received a blood product prior to 1990 due to the risk of exposure to hepatitis C.
- Improved understanding of risk factors for the transmission of hepatitis C including factors leading to co-infection with HIV and potential sexual transmission with blood to blood exposure has likely increased screening for hepatitis C.

- Individuals with hepatitis C may remain asymptomatic for many years after acquiring the infection and therefore may go undiagnosed for many years. Considering this, cases identified annually may have acquired hepatitis C years earlier.

- The current case definition for hepatitis C does not distinguish between acute, resolved and chronic infections. This may lead to reporting of cases that have chronic infection from previous exposures rather than being incident cases.

- Treatment for HCV has evolved and is now more effective with a much higher rate of cure and less side effects. This could impact testing rates, improve treatment as prevention and in the long term will have an impact on the incidence of HCV as more cases are cured and transmission is reduced. Due to limited access to the more effective treatments, current impact of more effective treatment on trends is minimal.

2009

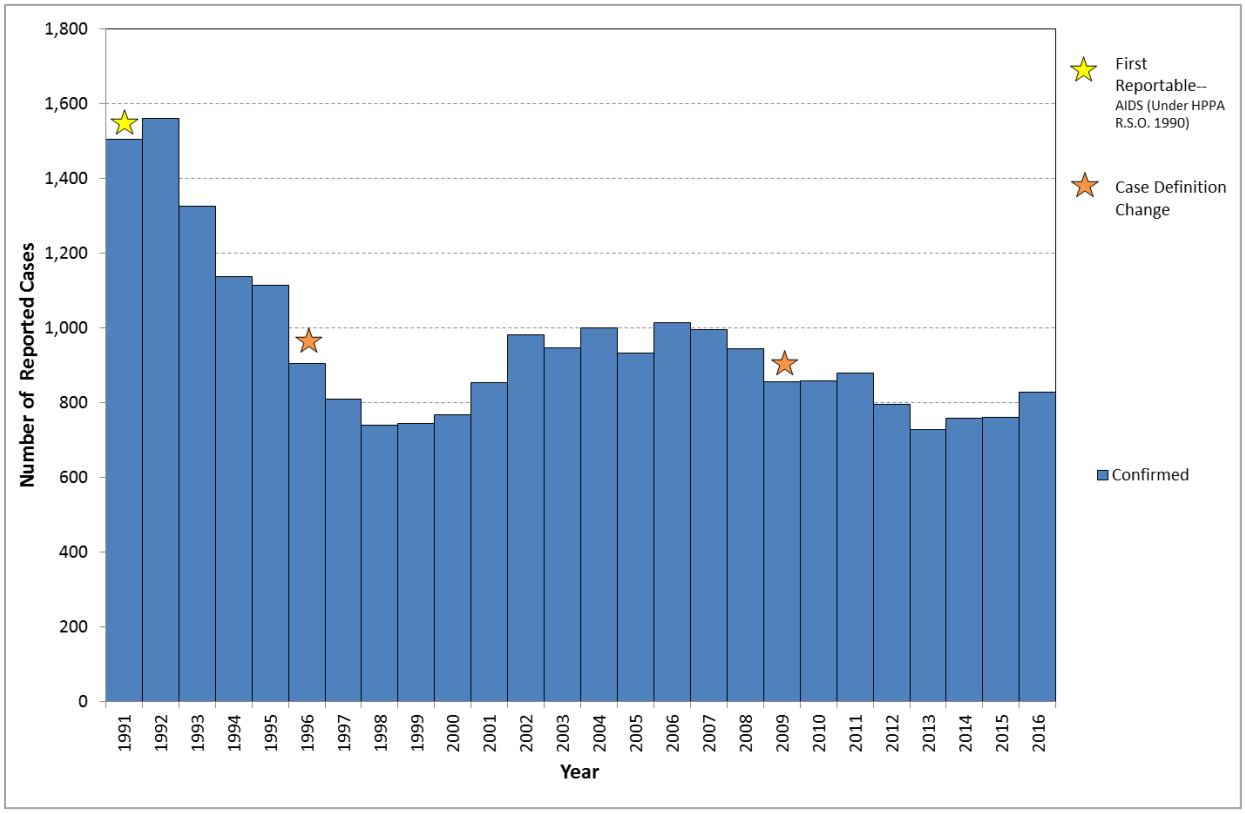
- NAT testing, a more sensitive diagnostic methodology, was added to the case definition.
- Detection of hepatitis C virus (HCV) antibodies was restricted to individuals older than 18 months of age, improving the specificity of the case definition.

2015

- The Centers for Disease Control and Prevention recommended screening of adults born from 1945 through 1965. Although these recommendations were made in the United States, this may have led to increased testing and, consequently, identification of cases in Ontario.[40]

Human Immunodeficiency Virus (HIV)

Figure 19. Number of reported cases of HIV by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/02/12] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- Numerous factors may contribute to the temporal changes in the epidemiology of HIV including the following:
    - Evolution of HAART treatment reducing transmission
    - Promotion of treatment as prevention
    - Development of the cascade of care analyses with their emphasis on the promotion of diagnostic testing, access to/retention in care and anti-retroviral treatment adherence/viral suppression
    - Promotion of/access to post-exposure prophylaxis
    - Promotion of/access to pre-exposure prophylaxis
    - Harm reduction/needle exchange program development and expansion
    - Views on HIV seen as a treatable, chronic disease potentially impacting safer sex practices such as condom use

- HIV is currently reported in Ontario as an "agent of a communicable disease" as it is the virus that causes AIDS.
- Although reported AIDS cases have decreased since the early 1990s, HIV cases decreased from 1991 to 1998 and have fluctuated since then.
- HIV anonymous testing, introduced in Ontario in 1992, may have led to more HIV testing.[13]
- Point of Care testing, introduced in Ontario in 2007, may have led to more individuals accessing testing.[14]
- Campaigns have been completed in different regions of Ontario that promoted testing for HIV, especially among men who have sex with men (MSM).

1992

- Anonymous testing for HIV became available in Ontario with expansion of the program in 2006. The availability of anonymous testing may have led to more individuals who were at higher risk of HIV/AIDS accessing testing.[14,15]

2007

- Point of Care Testing became available in Ontario and may have led to more individuals accessing testing.[15]

2009

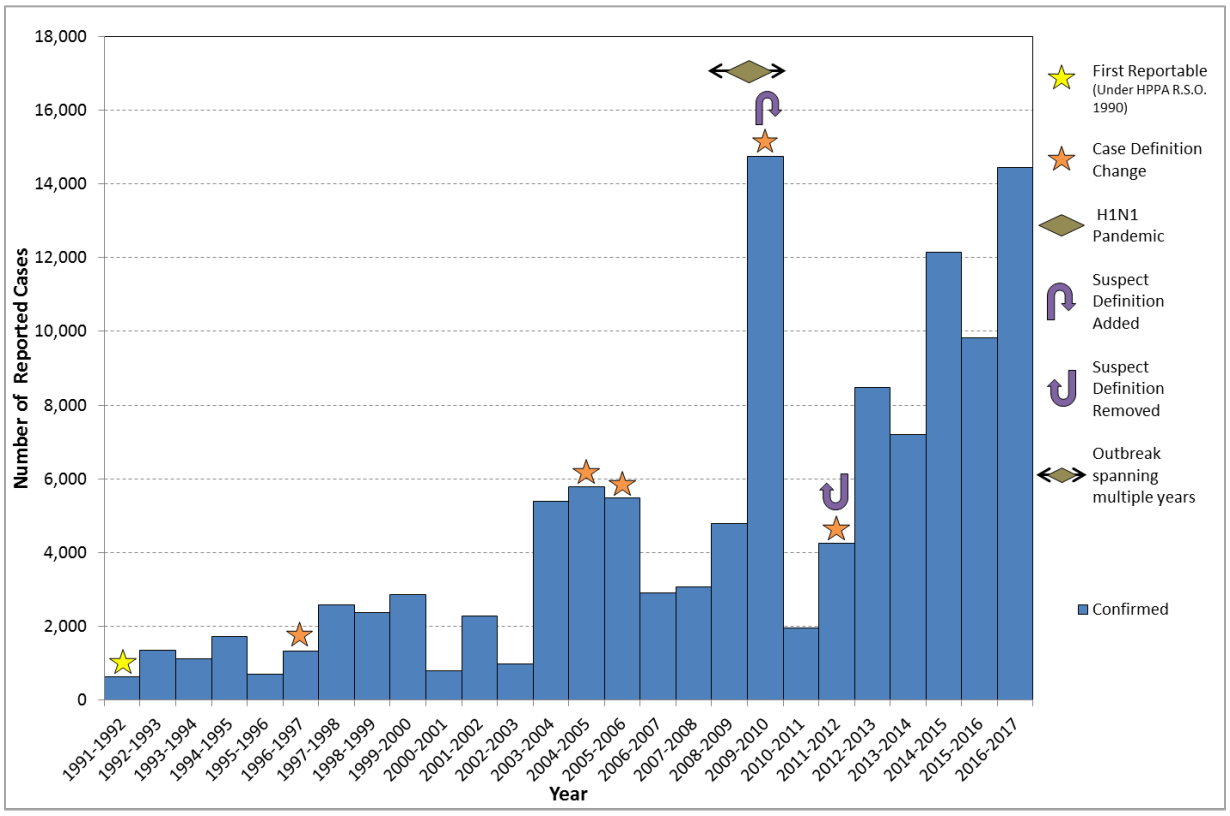
- An HIV positive test became necessary for AIDS case confirmation, improving the specificity of the case definition; HIV and AIDS case definitions were separated.[4] These changes may have led to a decrease in AIDS cases.

2014

- Isolation of HIV in culture was added to the case definition as a new method of testing.

Influenza

Figure 20. Number of reported cases of laboratory-confirmed influenza by season, Ontario, 1991/1992 – 2016/2017



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/03/07] for 1991-2004 data; [2017/05/16] for 2005-2016 data; [2010/09/09] for pH1N1 counts for the 2009-2010 season; [2009/09/03] for pH1N1 counts for the 2008-2009 season; [2011/08/10] for seasonal influenza counts for the 2008-2009 and 2009-2010 seasons.

OVERVIEW

- Unlike other reportable diseases, surveillance for influenza is conducted by season which occurs from September 1st to August 31st for the relevant year(s) (instead of the calendar year).[18]
- An epidemiologic link was added to the case definition in 2005. However, from 2012, the epidemiologic link was only applicable to institutional outbreaks.[4]
- A global pandemic of influenza A(H1N1) occurred in 2009, with the first wave of pandemic influenza beginning in the spring, 2009 and the second was in the fall of 2009 with extension of cases into 2010, with minimal seasonal influenza activity during the 2009-2010 influenza season.[41]

- In addition to the factors above, influenza case counts/incidence are impacted by: (i) variation in annual circulating strains of influenza, with case counts being higher in respiratory seasons dominated by influenza A(H3N2) activity vs. influenza A(H1N1)/influenza B seasons; (ii) the development of more sensitive and specific laboratory diagnostic technologies, especially current multiplex NAT respiratory virus diagnostic tests; (iii) annual PHOL respiratory testing algorithms that can impact on the priorities given to the testing of respiratory specimens from outbreak vs. hospital vs. ambulatory settings; (iv) influenza seasons where vaccines strains are well-matched or mis-matched with circulating influenza strains.

2008/2009 AND 2009/2010

- The increase in reported cases in these seasons was mainly attributed to the first (April-July) and second (October-December) waves of the influenza A(H1N1)pdm09 global pandemic.[6]

2009/2010

- The increase in reported cases may be attributed in part to the use of more sensitive laboratory tests which started during the pandemic seasons.[6]

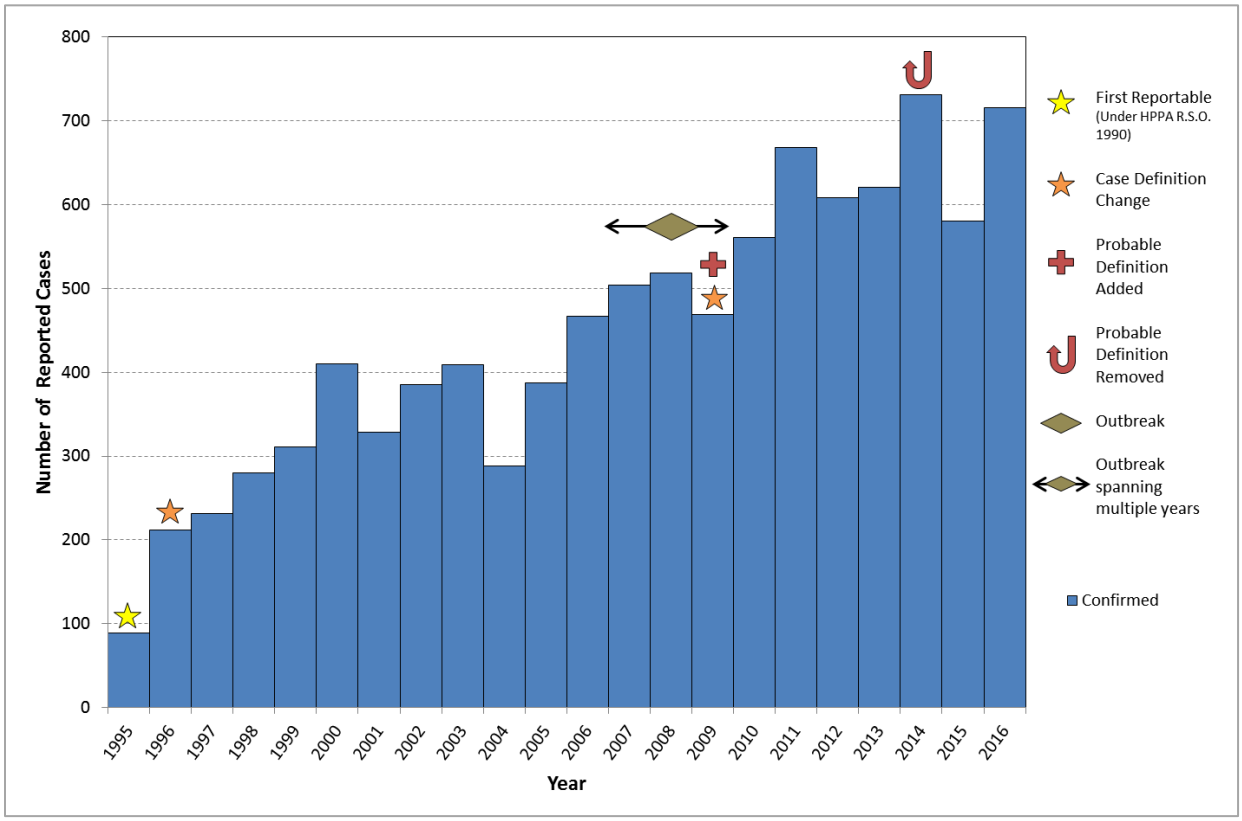
2009

- A suspect case definition was added, which was only based on having clinical symptoms of influenza-like illness (ILI). Given that the definition was too broad, it was subsequently removed in 2012.[4]

- NAT testing was introduced at the Public Health Ontario Laboratories for routine testing for influenza virus. This test is easier, quicker, and more sensitive, thus more subsequent testing has occurred after its introduction. In the years following 2009, more hospital laboratories have utilized NAT testing as well.[4]

Group A Streptococcal disease, invasive (iGAS)

Figure 21. Number of reported cases of Group A Streptococcal Disease (invasive) by year, Ontario, 1995-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/03/05] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- There has been an overall increase in the incidence of invasive group A streptococcal disease (iGAS). While the reasons for this increase are not fully understood, it is possibly due to a combination of factors including the circulation of more virulent strains[42] and an aging population with increasing prevalence of co-morbidities.[4]

2007

- The increase in cases from 2007 to 2009 is in part attributed to an outbreak of iGAS in the Thunder Bay District Health Unit. Reported cases were found among the Indigenous population, intravenous drug users, and individuals with hepatitis C.[4]

2009

- A probable case definition was added. It was subsequently removed in 2014 to align with other jurisdictions.[18]

2013

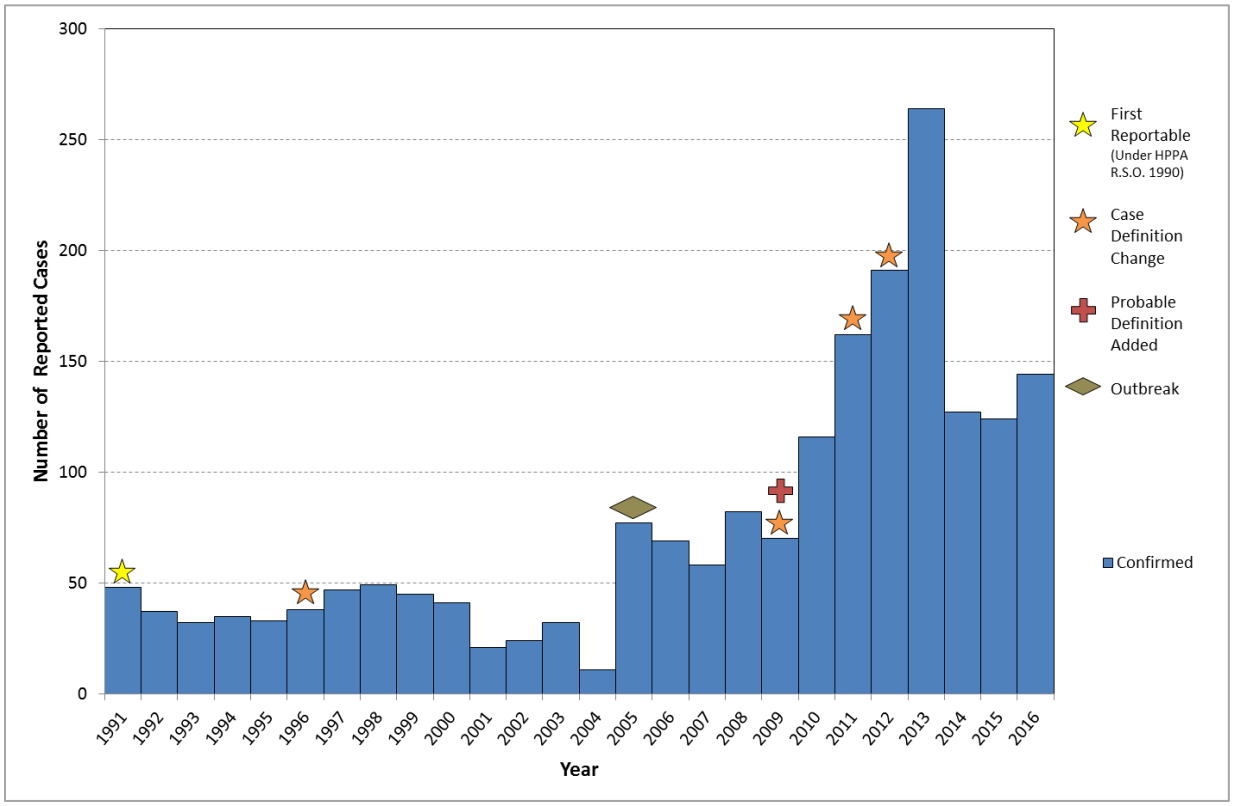
- NAT testing, a more sensitive diagnostic methodology, was added to the case definition.

2014

- The probable case definition was removed.[4]

Legionellosis

Figure 22. Number of reported cases of Legionellosis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/03/05] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- There was an increase in reported cases of legionellosis from 2005 to 2013. Although the exact cause of the increase has not been conclusively determined, increases in legionellosis may more generally be explained by several factors including:[43]
    - Increased awareness, reporting, and testing for the disease, likely due to the long-term care facility outbreak in 2005.[6]
    - The introduction of less invasive testing methods (i.e. urine antigen test).
    - Changes in the natural and built environments, such as changes in weather patterns and local watersheds, as well as changes in use of plumbing materials that promote biofilm growth and a likely increase in other sources of potential aerosol exposures.[44]

2005

- The increase in reported cases was attributed to an outbreak of 135 cases at a Toronto long-term care facility. The release of Legionella from a cooling tower of the facility was a likely source for this outbreak.[45]

2009

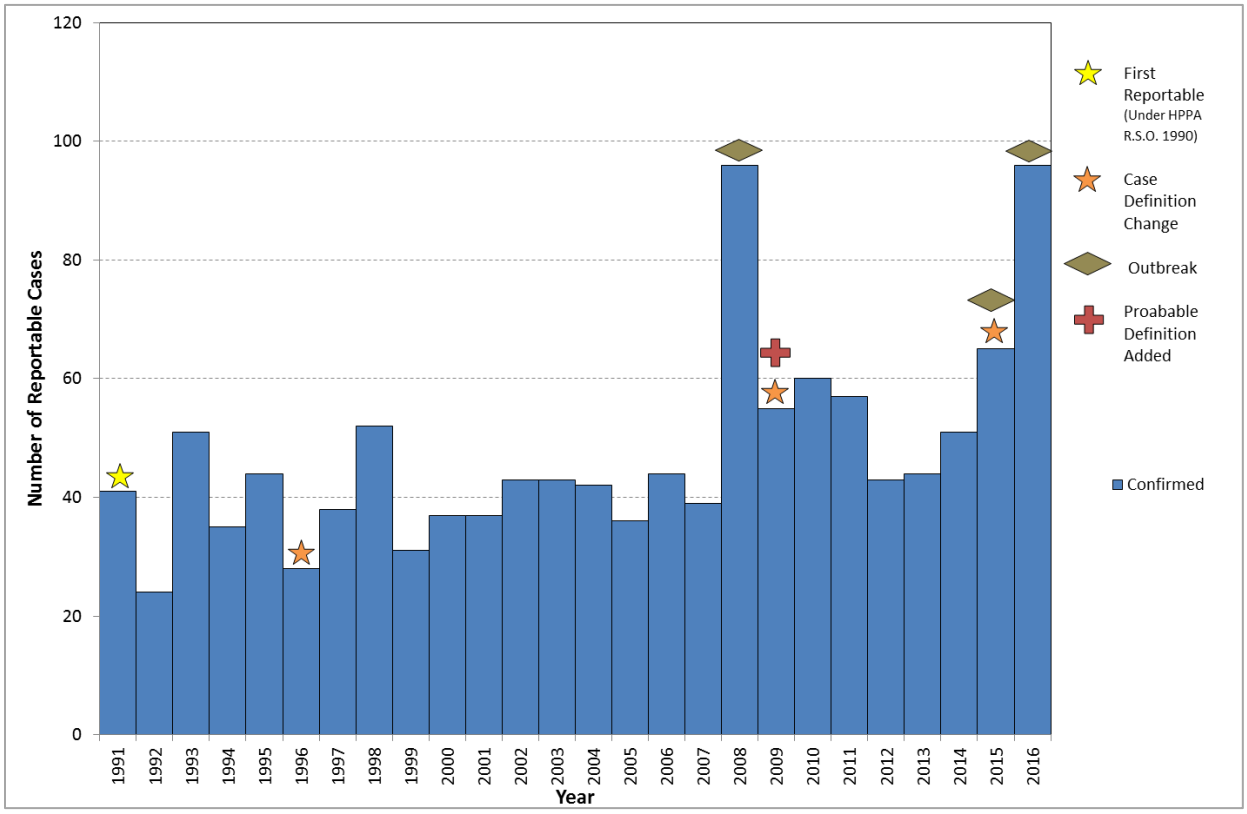
- A probable case definition was added.[4]
- The case definition became more sensitive due to the addition of NAT testing, the introduction of urine testing, and the broadening of the case definition to include all *Legionella* subspecies.

2013

- There was an increase in Ontario reported legionellosis cases in 2013, with cases concentrated in the Golden Horseshoe Area. An Enhanced Surveillance Directive was issued to increase the likelihood of identifying a common source of exposure. A common exposure source was not conclusively identified.

Listeriosis

Figure 23. Number of reported cases of Listeriosis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- Incidence of reported cases has increased since the 1990s.

2008

- The increase in reported cases was attributed to a national outbreak linked to the consumption of ready-to-eat deli meats from Maple Leaf Foods. This outbreak affected 56 persons in seven provinces, 75% (42 cases) of which were in Ontario.[6,46]

2009

- A probable case definition was added, which includes an epidemiologic link to a laboratory-confirmed case or a confirmed source of illness.[4] The impact of this change was not substantial given that probable cases have constituted a small proportion of total case counts since 2009.

2015

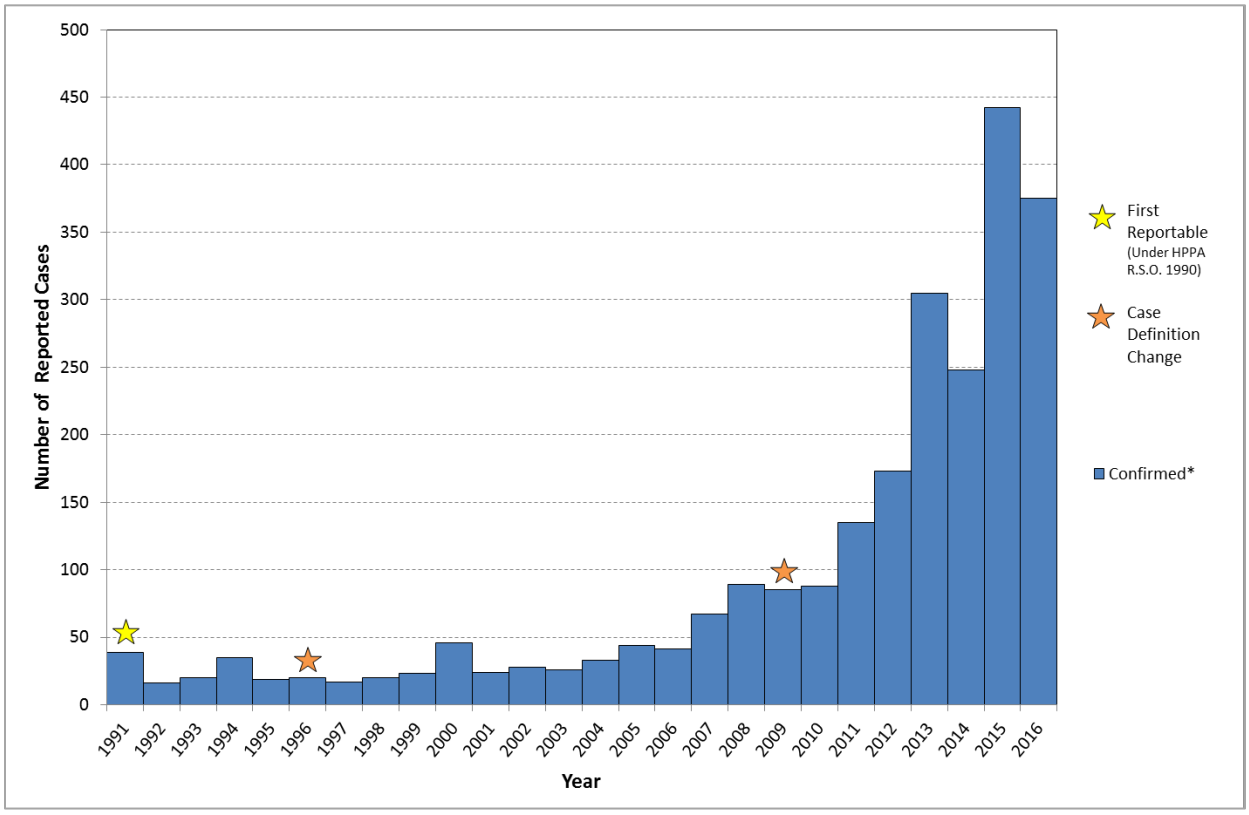
- The increase in reported cases from 2015 to 2016 was due in part to a national outbreak of 14 cases, 9 of which were in Ontario, linked to the consumption of pre-packaged leafy greens, chopped salads, salad blends and kits produced at the Dole Fresh Vegetables Inc. processing facility in Springfield, Ohio.[47]

2016

- The increase in reported cases was due in part to an outbreak with a total of 34 cases from 16 public health units in Ontario linked to the consumption of Neilson brand partly skimmed chocolate milk.[48]

Lyme Disease

Figure 24. Number of reported cases of Lyme Disease by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

*** Probable cases have been included in total counts since 2009 in order to ensure valid comparisons over time.**

OVERVIEW

- Given that probable cases constituted a significant proportion of total case counts since 2009, they have been included in total counts in order to ensure valid comparisons over time.
- There has been an overall increase in incidence of Lyme disease since 2007.
- Populations of the tick vector have expanded, with an increase in ticks carrying *Borrelia burgdorferi* (agent of Lyme disease), mainly as a consequence of increased availability of suitable habitat and hosts, along with climate change.[49,50]

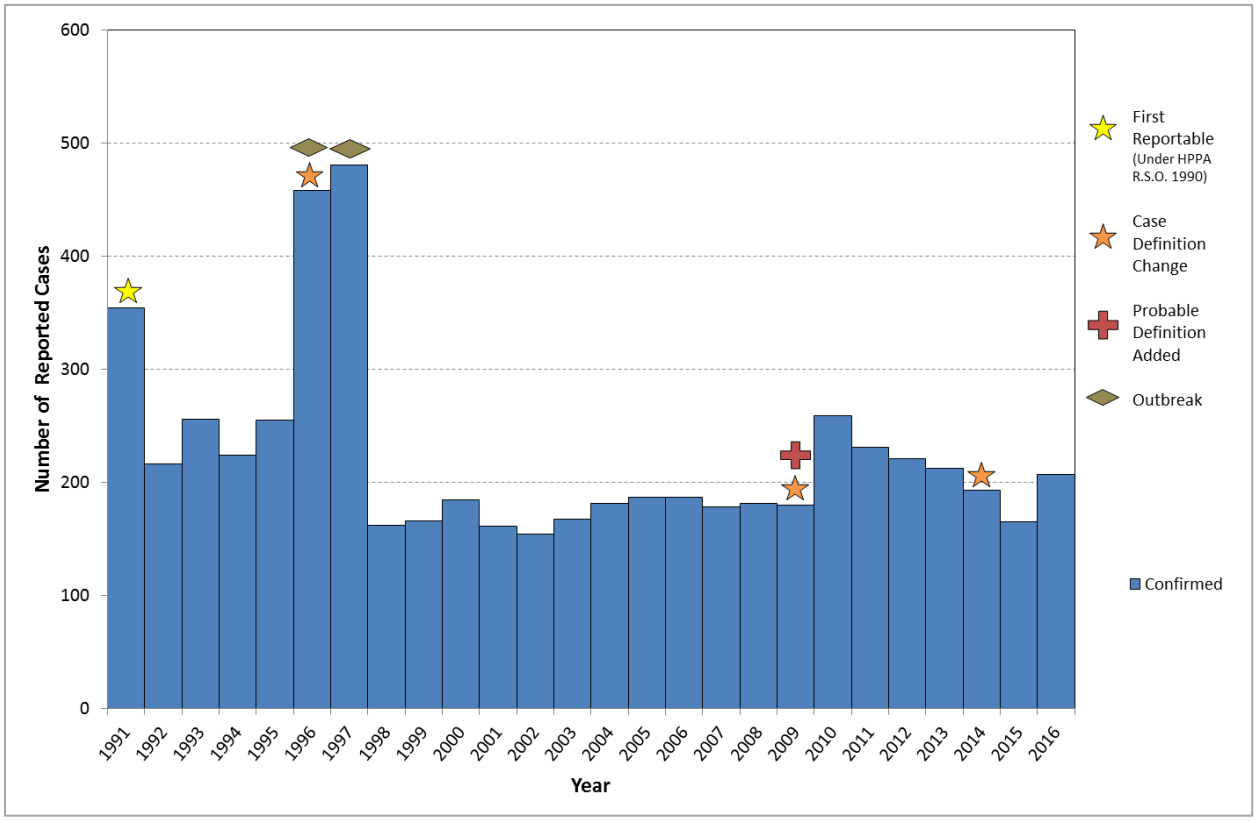
- Growing awareness via public and clinician education and outreach as well as improved warnings/signage in endemic areas has likely enhanced the detection and reporting of Lyme disease.[51,52]

2009

- Following a case definition change in 2009, confirmed cases were required to have a history or residence in, or visit to, an endemic area. Since many areas in Ontario with increased tick populations did not meet specific criteria for being classified as "endemic," increased numbers of cases did not meet the criteria for a confirmed case, resulting in increases in probable case counts.[4]

Malaria

Figure 25. Number of reported cases of Malaria by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- Malaria is not endemic to Ontario. As a result, all reported cases in the province are travel-related.
- There was a slight increase in cases in 2010 (likely a result of the case definition change in 2009), but the number of reported cases has decreased since then.

1996-1997

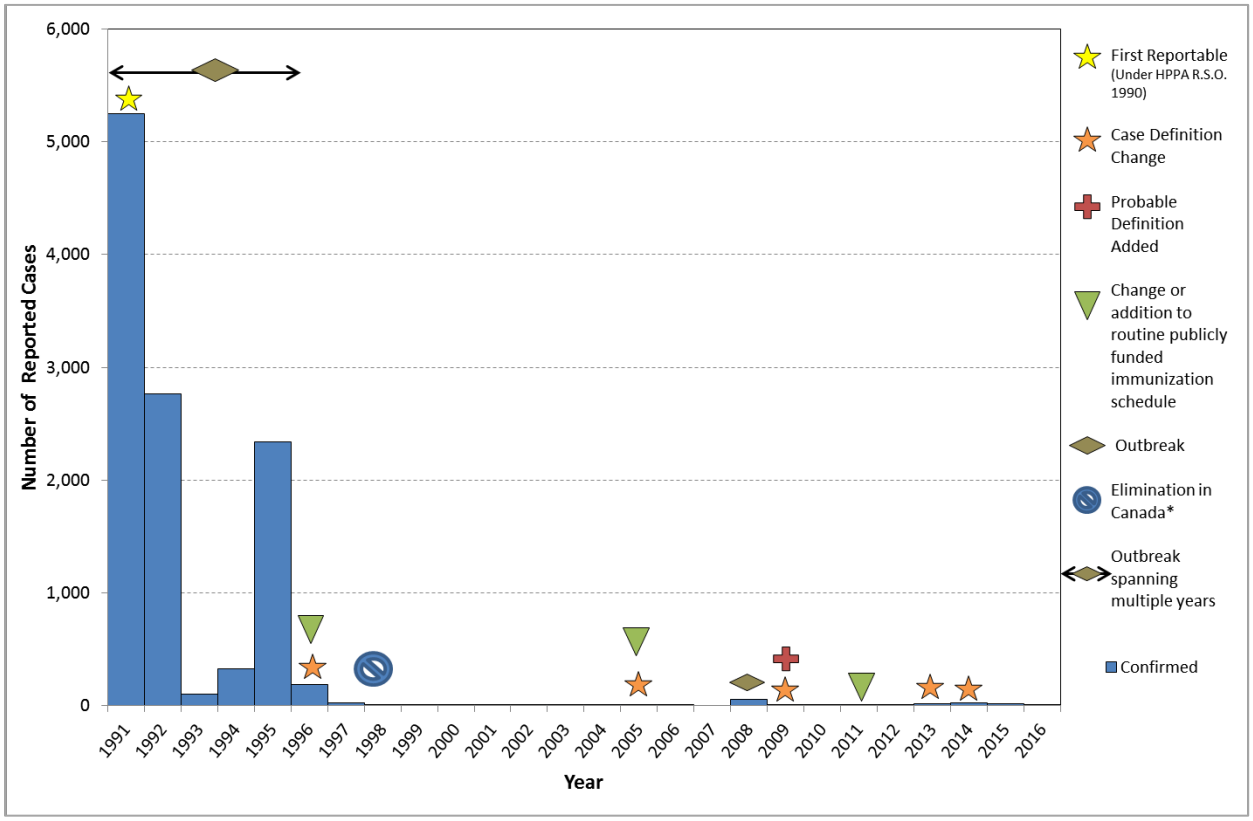
- There was an increase in malaria incidence in Ontario, likely due to a heightened risk during travel to India, where an outbreak was ongoing.[53-55]

2009

- A probable case definition was added, which included antigen detection.[4]
- Both probable and confirmed case definitions now stipulated that clinical signs and symptoms were not required criteria for either classification.[4]

Measles

Figure 26. Number of reported cases of Measles by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

*** The interruption of endemic measles/rubella virus transmission in a defined geographic area for a period ≥12 months in the presence of high-quality surveillance**

OVERVIEW

- For measles, rubella and congenital rubella syndrome (CRS), probable cases are excluded from the historical temporal trend despite being reportable at the provincial level, since these diseases have been eliminated from Canada and strict criteria are required to identify cases. Enhanced surveillance activities to document the elimination of measles and rubella commenced in 2012 which may impact trend analyses.

- The last reported case of endemic measles in Canada was in 1997. Despite measles elimination, importations continue to occur in Ontario due to endemic transmission in many other parts of the world. Due to the elimination status of measles in Canada, a single confirmed case of measles constitutes an outbreak.

1975

- A single dose of MMR vaccine was introduced in Ontario as a routine program.

1982

- Since 1982, under the Immunization of School Pupils Act, all students must have documented receipt of measles-containing vaccine or provide documentation of medical exemption or religious/conscientious objection.[25]

1991

- From 1991 to 1995, large outbreaks of measles occurred, in particular among school-aged children. The efficacy of a single dose of measles containing vaccine at 12 to 15 months is 85 to 95%. Given the infectiousness of measles, this allowed continued transmission of the virus.[23,56]

1996

- A second dose of MMR vaccine was added to the program at 4 to 6 years of age in Ontario. A measles catch-up program was also implemented in 1996, targeting children in JK to grade 13 using monovalent measles vaccine.

2005

- In 2005, the age of administration of the second dose of MMR was moved to 18 months (previously at 4-6 years).

2008

- Reported cases are attributed to a large outbreak of 54 confirmed cases which were linked to a popular tourist destination in Toronto and suspected to be acquired from an importation of measles.

2009

- A probable case definition was added to capture clinically compatible cases with an epidemiologic link or travel.[4]
- NAT testing, a more sensitive diagnostic methodology, was added to the case definition.

2011:

- MMRV was introduced as the vaccine product to provide the second dose for measles and moved to 4 to 6 years (previously administered at 18 months of age using MMR vaccine).

2012

- In Ontario, enhanced surveillance activities for measles commenced in 2012 to contribute towards documentation of measles and rubella elimination.

2014

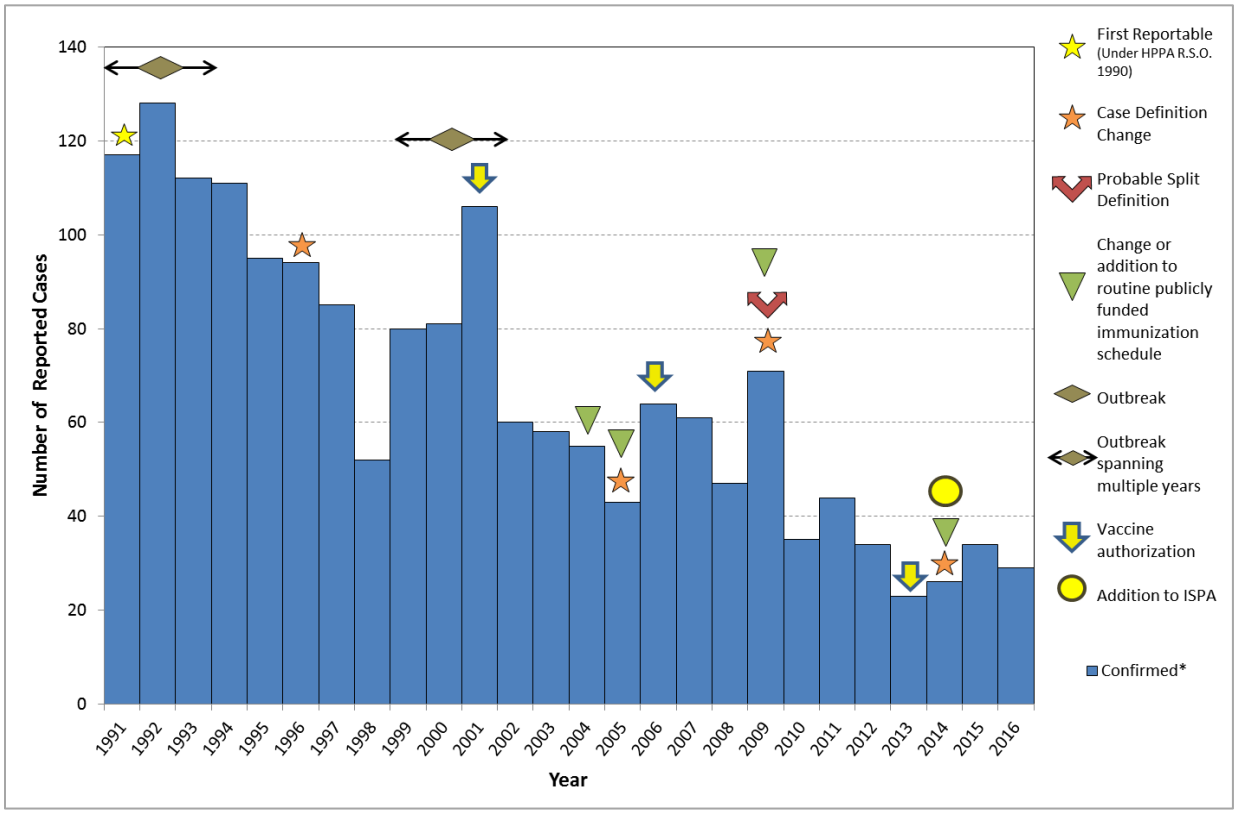
- Confirmed and probable case definitions now included serological tests for measles IgM antibody using a recommended assay.

2016

- In September 2016, the Pan American Health Organization (PAHO) declared the elimination of measles from the region of the Americas.

Meningococcal Disease, invasive

Figure 27. Number of reported cases of Meningococcal disease (invasive) by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/03/15] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

*** Probable cases have been included in total counts since 2009 in order to ensure valid comparisons over time.**

OVERVIEW

- Given that probable cases constituted a significant proportion of total case counts since 2009, they have been included in total counts in order to ensure valid comparisons over time.
- The figure for invasive meningococcal disease (IMD) in this product does not display the proportion of cases that represent distinct serogroups. Serogroup information should be considered when conducting an epidemiological analysis of IMD in Ontario as vaccine programs have impacted serogroup distribution.
- Between 1989-1993 and 1999-2001, there were sporadic localized outbreaks of IMD serogroup C in Canada.

2001

- Meningococcal serogroup C conjugate vaccines were first authorized for use in Canada.[57]

2004

- In September 2004, a single dose of meningococcal serogroup C conjugate vaccine (MCC) became publicly funded in Ontario for one-year-olds.

2005

- NAT testing, a more sensitive diagnostic methodology, was added to the case definition.[4]
- A catch-up program using MCC vaccine was initiated for students between 15 and 19 years of age (born between 1986 and 1996). Later in 2005, a routine school-based single dose of MCC vaccine was introduced for Grade 7 students.

2006

- A quadrivalent (serogroups A, C, Y and W135) meningococcal vaccine was authorized for use.5

2009

- The case definition was split into confirmed and probable cases.[4]
- Quadrivalent meningococcal conjugate vaccine (MCV4) against serogroups A, C, Y and W replaced MCC vaccine within the grade seven school-based program.
- Specimen collection from a normally sterile site became a requirement for NAT testing, improving the specificity of the case definition.

2013

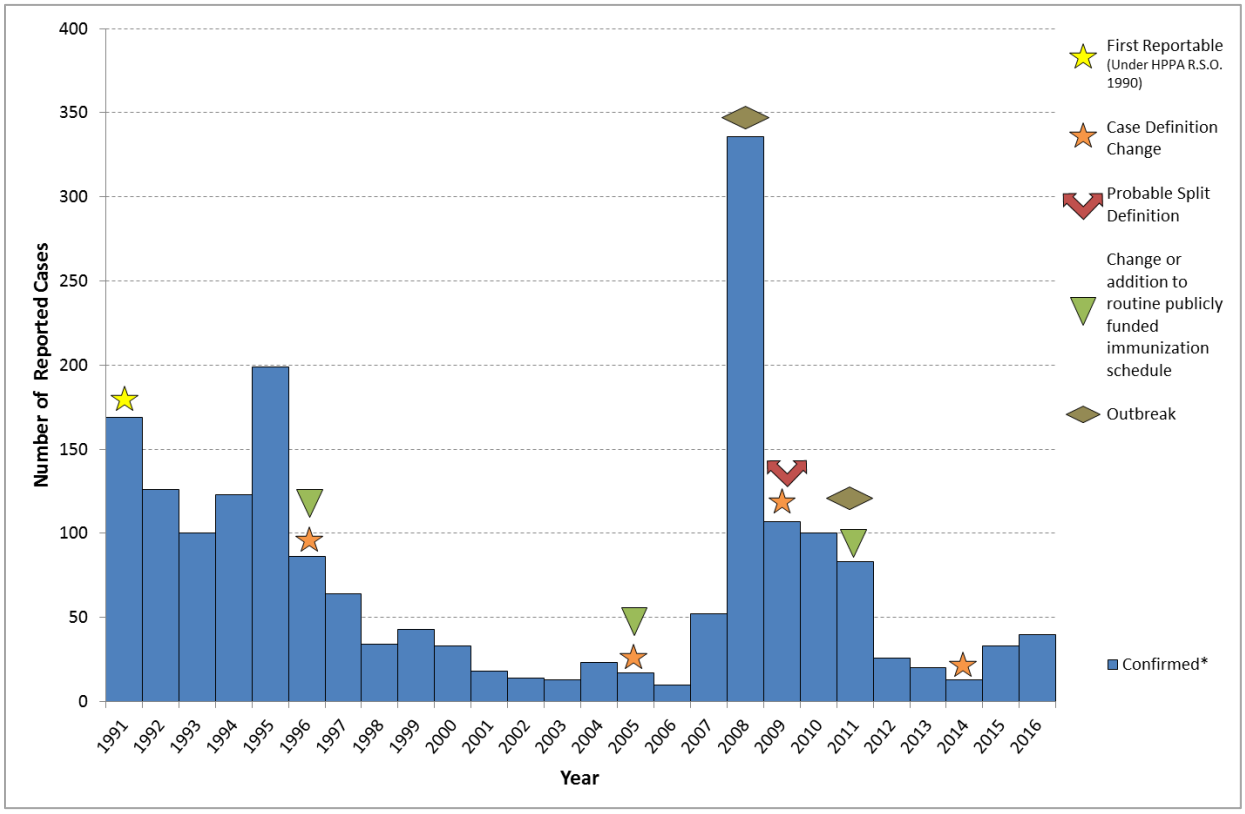
- A meningococcal B vaccine (Bexsero®) was approved for use in Canada in December 2013.

2014

- In December 2014, a meningococcal B vaccine (Bexsero®) was added to the publicly funded immunization schedule in Ontario for individuals 2 months to 17 years of age with specific high risk conditions.[24]
- In 2014, meningococcal disease was added as a designated disease under the Immunization of School Pupils Act. Since the 2014-15 school year, children are required to be immunized against meningococcal disease or provide documentation of medical exemption or religious/conscientious objection.

Mumps

Figure 28. Number of reported cases of Mumps by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/03/15] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

*** Probable cases have been included in total counts since 2009 in order to ensure valid comparisons over time.**

OVERVIEW

- Given that probable cases constituted a significant proportion of total case counts since 2009, they have been included in total counts in order to ensure valid comparisons over time.
- The increase in reported cases between 2007 and 2011 were largely outbreak driven, with 82.2% of cases being linked to four separate outbreaks.[8]
- Due to historical changes in Ontario's vaccine programs, individuals born between approximately 1970 and 1992 likely received only one dose of mumps-containing vaccine and are unlikely to have acquired natural immunity through infection.

1969

- A live attenuated mumps vaccine was licensed in Canada, followed by a combined MMR vaccine in the 1970s.

1975

- A single dose of MMR vaccine was introduced in Ontario as a routine program.

1982

- Since 1982, under the ISPA, all students must have documented receipt of mumps-containing vaccine or provide documentation of medical exemption or religious/conscientious objection.

1996

- A second dose of MMR vaccine was added to the program at 4 to 6 years of age in Ontario. A measles catch-up program implemented in 1996 used a monovalent measles vaccine, which led to those in the catch-up program receiving two doses of measles protection but only one dose of mumps protection.

2005

- Starting in 2005, the age of administration of the second dose of MMR was moved to 18 months (previously at 4-6 years).

2007

- The increase in reported cases was attributed in part to 29 cases connected to outbreaks in Nova Scotia and New Brunswick.[8]

2008

- The increase in reported cases was attributed to 324 mumps cases associated with an under-immunized religious community linked to concurrent outbreaks in the Netherlands and British Columbia.[8]

2009

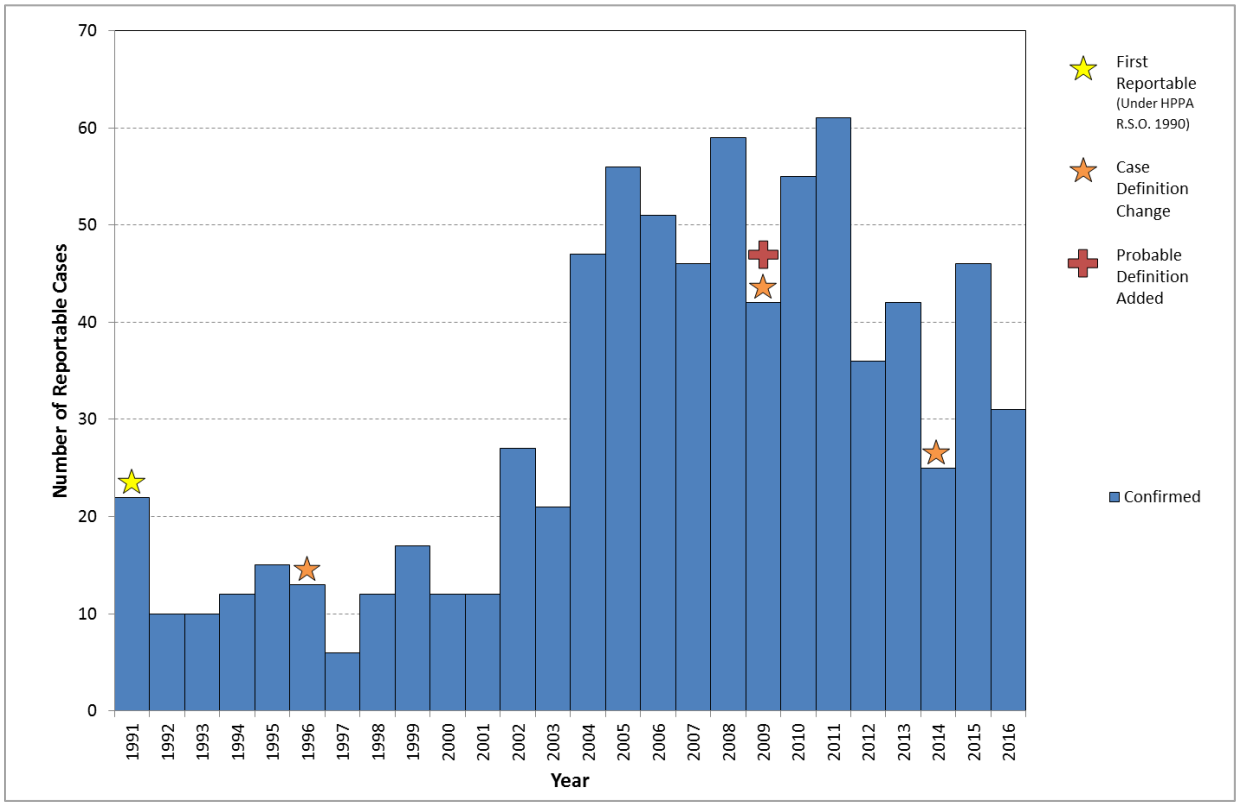
- The case definition was split into confirmed and probable cases.[4] The impact of this change was substantial given that probable cases since 2009 constituted a significant proportion of total case counts.
- NAT testing, a more sensitive diagnostic methodology, was added to the case definition.
- The increase in reported cases between 2009 and 2010 was attributed in part to 166 cases that occurred across multiple public health units (PHU) with links to outbreaks in the United States and Quebec.[8]

2011

- The increase in reported cases was attributed in part to an outbreak of 38 cases linked to a Toronto cluster.[58]
- The MMRV vaccine product was introduced to provide a second dose of mumps protection and moved to 4 to 6 years (previously administered at 18 months of age using MMR vaccine).

Paratyphoid Fever

Figure 29. Number of reported cases of Paratyphoid Fever by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- Paratyphoid fever is not endemic to Ontario. Ontario has had cases due to importation from parts of the world where paratyphoid fever remains endemic, such as South Asia.[59]
- There has been an overall increase in incidence of paratyphoid fever since 2004, although the reasons for this increase are not fully understood. It may be related to an increase in travel to endemic areas.

2009

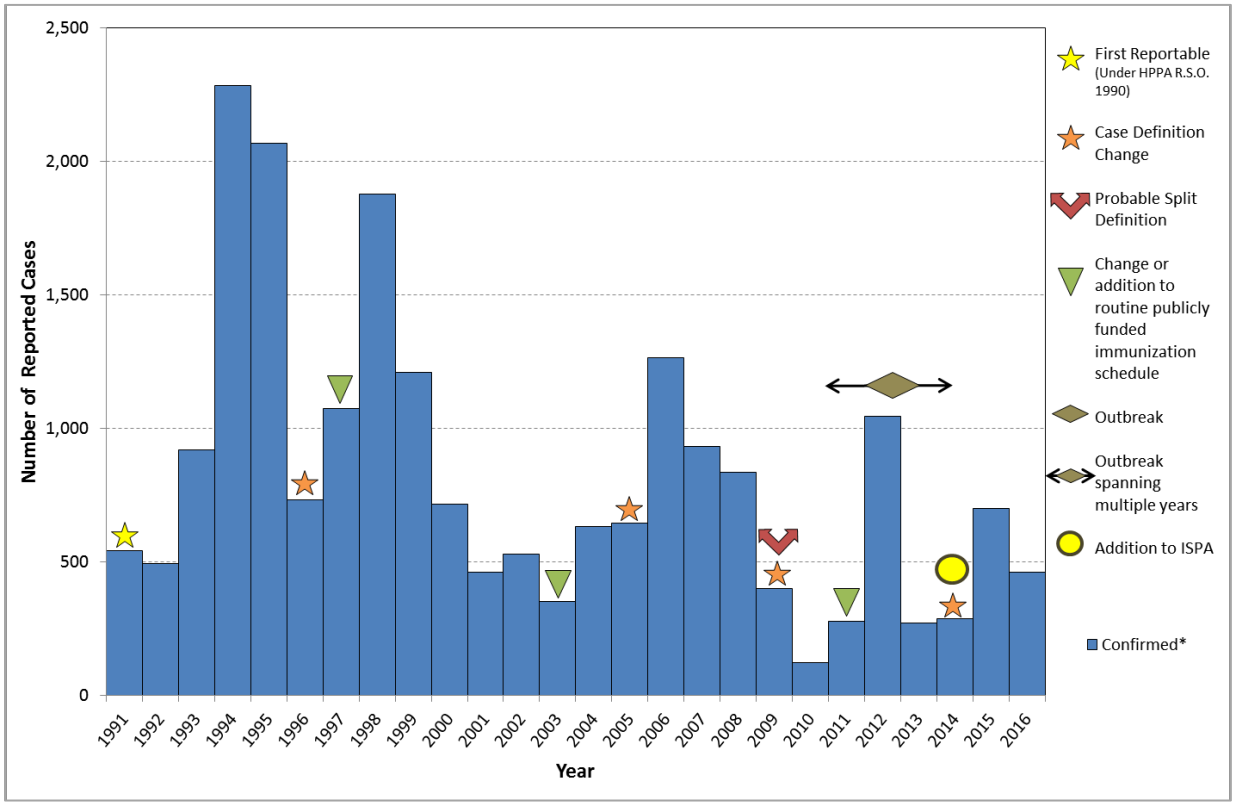
- A probable case definition was added, which includes an epidemiologic link to a laboratory-confirmed case.[4]

2013

- *Salmonella* Paratyphi B var. Java was now part of the salmonellosis case definition instead of the paratyphoid fever case definition.

Pertussis

Figure 30. Number of reported cases of Pertussis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/03/15] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

*** Probable cases have been included in total counts since 2009 in order to ensure valid comparisons over time.**

OVERVIEW

- Given that probable cases constituted a significant proportion of total case counts since 2009, they have been included in total counts in order to ensure valid comparisons over time.
- In Ontario, outbreaks of pertussis occur periodically, many of which involve under-immunized populations; however, waning immunity in the vaccinated population is also a contributing factor.[18]

1943

- A whole-cell fluid vaccine for pertussis was introduced in Canada.[23]

1984

- An adsorbed whole cell vaccine replaced the whole cell fluid pertussis vaccine in Ontario.

1997

- Acellular vaccine replaced the adsorbed whole cell vaccine and a combined vaccine was introduced for children at 2, 4, 6 and 18 months, as well as a booster at 4 to 6 years of age.

2003

- An adolescent booster (Tdap) for 14-16 year olds was introduced within the routine, publicly-funded program.

2005

- Although NAT testing, a more sensitive diagnostic methodology, became available in 1998, it was added into the case definition in 2005.

2009

- The case definition was split into confirmed and probable cases. The impact of this change was substantial given that probable cases since 2009 constituted a significant proportion of total case counts.

- The minimum threshold value used to determine a positive NAT result was increased, leading to a reduction in the number of positive cases of pertussis identified via NAT.[10]

2011

- A single lifetime booster dose of pertussis-containing vaccine was introduced for adults 19-65 years of age who did not previously receive a dose of the vaccine in adolescence.

2012

- The increase in cases was attributed in part to a prolonged pertussis outbreak between November 2011 and April 2013 that originated in an under-immunized religious community.

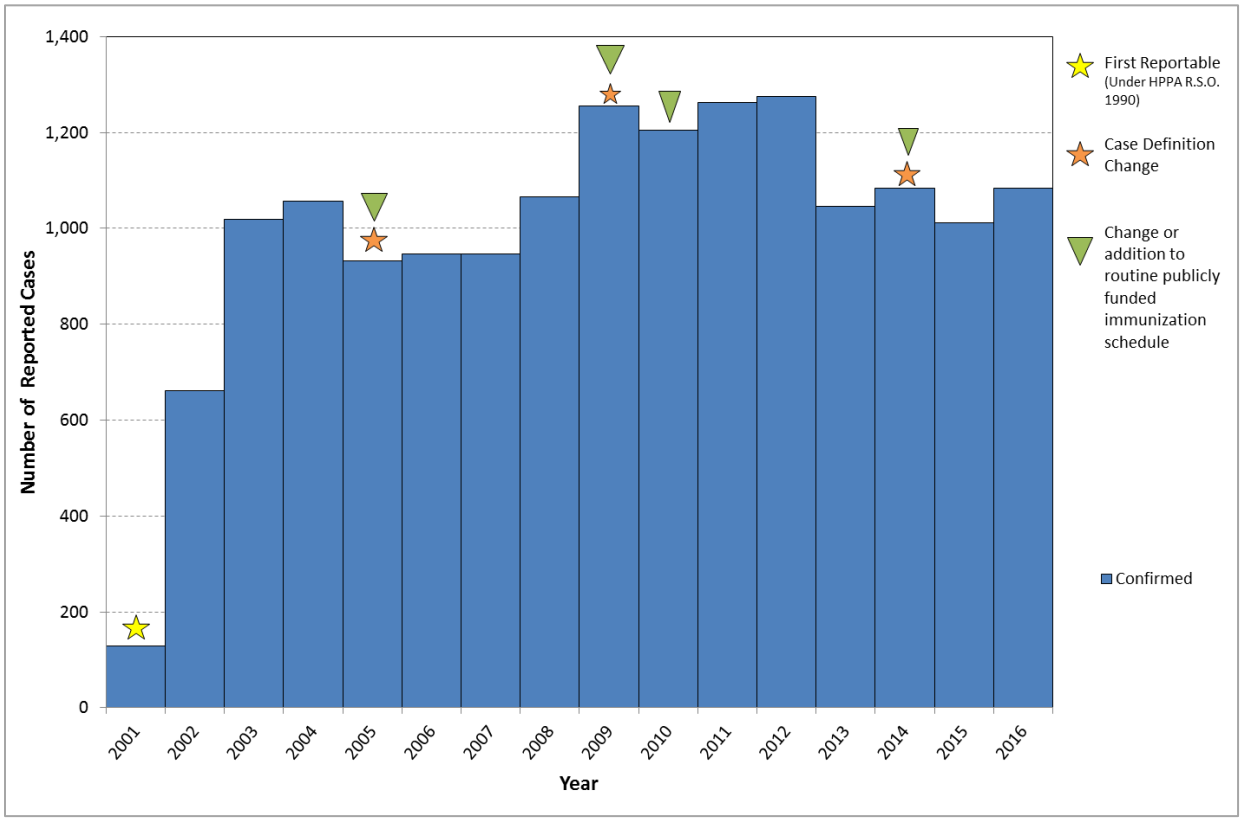
2014

- Effective December 2014, all adults 19 years of age and older became eligible to receive a single dose of the vaccine, irrespective of receiving a prior adolescent dose.

- Pertussis was added as a designated disease under the Immunization of School Pupils Act. Starting in 2014-15 school year, children may face suspension from school if children are not immunized against pertussis or if documentation of medical exemption or religious/conscientious objection is not provided.[25]

Pneumococcal disease, invasive

Figure 31. Number of reported cases of Pneumococcal disease (invasive) by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/03/15] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- Invasive pneumococcal disease first became reportable in 2001.
- The figure for invasive pneumococcal disease (IPD) in this product does not display the proportion of cases that represent distinct serotypes. Serotype information should be considered when conducting an epidemiological analysis of IPD in Ontario.

1996

- Before the disease was reportable, a single dose 23-valent pneumococcal polysaccharide vaccine was publicly-funded for individuals 65 years or older, in addition to individuals aged two years of age or older with specific high risk medical conditions.[23]

2001

- Invasive pneumococcal disease first became reportable.

2005

- In January 2005, a four-dose 7-valent pneumococcal conjugate vaccine (PCV7) program was introduced as part of Ontario's publicly funded immunization program for infants at 2, 4, 6 and 15 months of age.

2009

- A probable case definition was added, which assisted with case finding and management.
- NAT testing, a more sensitive diagnostic methodology, was added to the case definition.
- The 10-valent pneumococcal conjugate vaccine (PCV10) replaced PCV7.

2010

- A three-dose 13-valent pneumococcal conjugate vaccine (PCV13) replaced PCV10 and the routine schedule was adjusted to 3 doses instead of 4 (infants at 2, 4 and 12 months of age).

2011

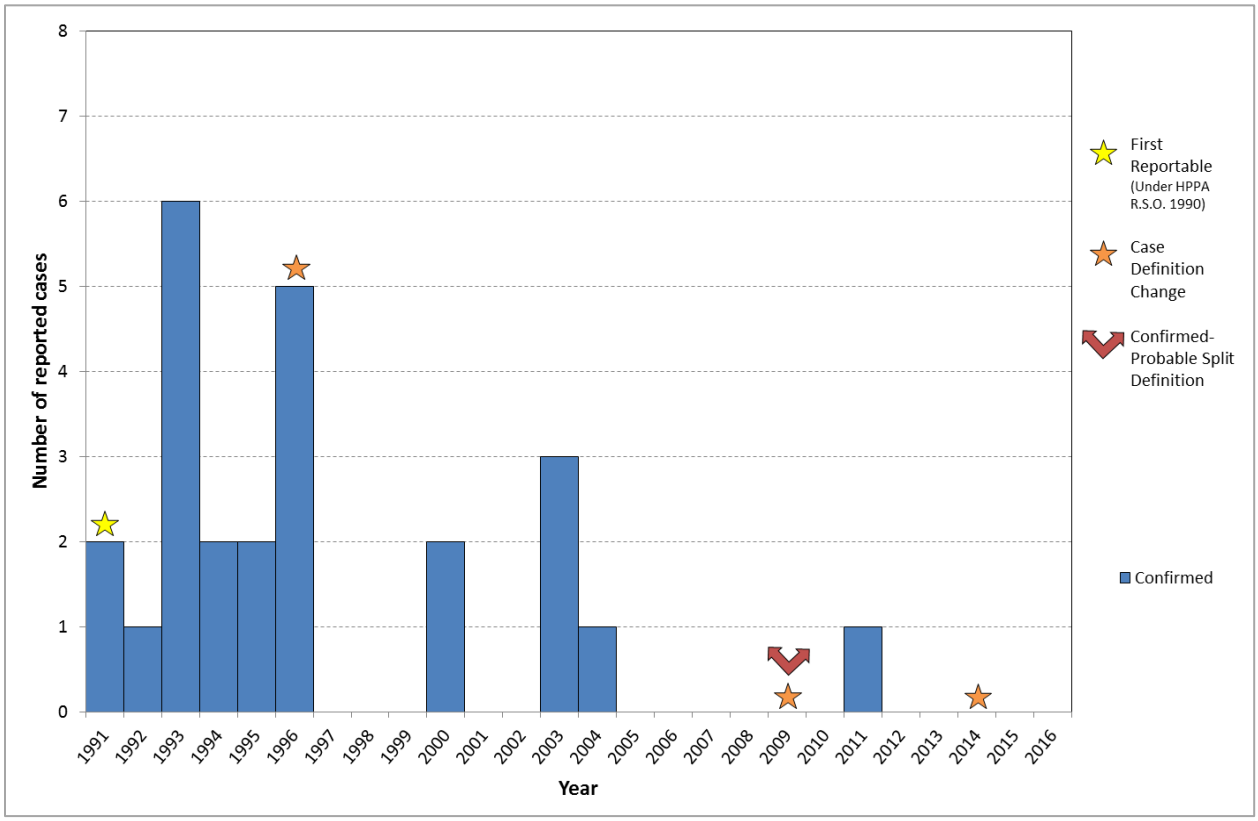
- A one-time catch-up dose of PCV13 was implemented for healthy children under three years and for children at higher risk for IPD under five years.

2014

- PCV13 was publicly funded for specific high risk individuals over 50 years of age.

Psittacosis/Ornithosis

Figure 32. Number of reported cases of Psittacosis-Ornithosis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

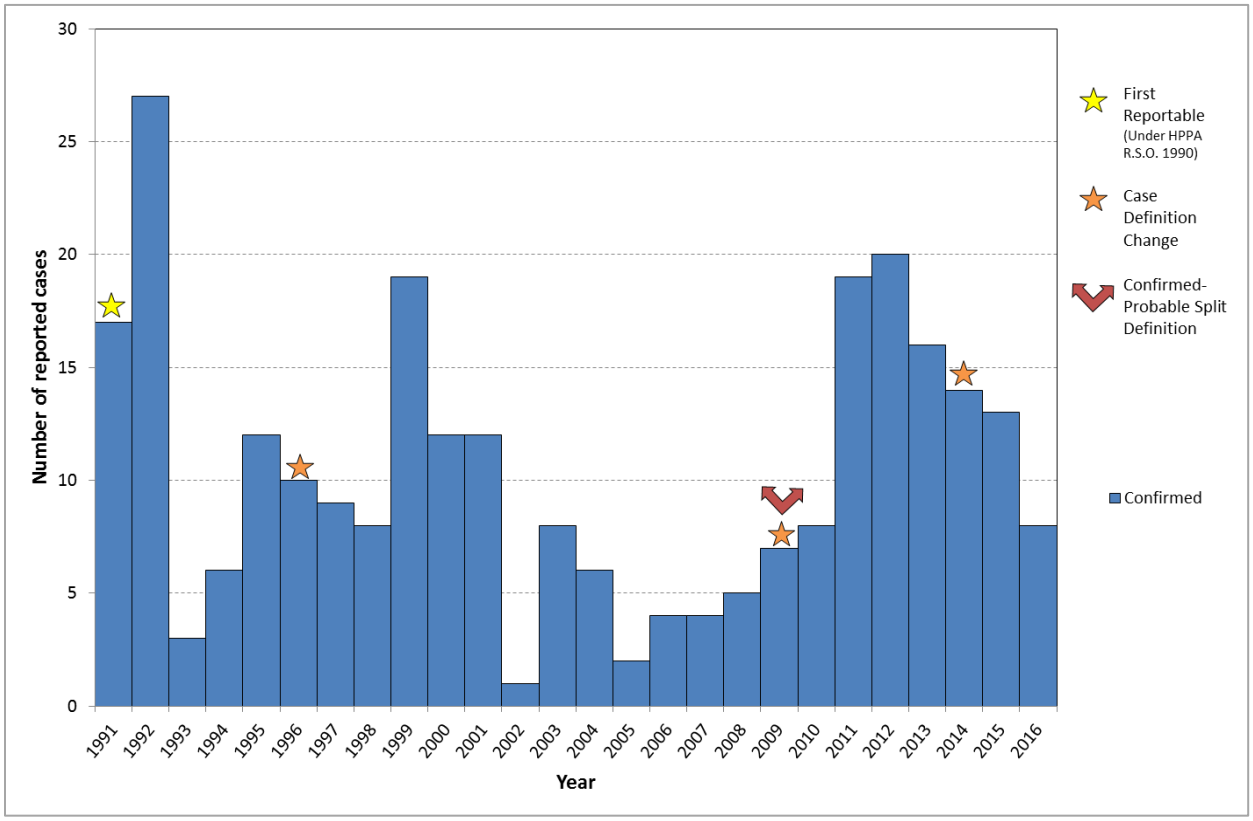
- Psittacosis/ornithosis occurs worldwide, and most cases are sporadic. Cases occurred more frequently in the 1990s. Only one case has been reported since 2004.[18]

2009

- The case definition was split into confirmed and probable cases.[4]

Q Fever

Figure 33. Number of reported cases of Q fever by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- The increase in incidence since 2011 may be attributed in part to sustained increases in the recognition, diagnosis and reporting of Q fever among a highly susceptible population of farmers taking part in the Ontario Q fever study, which started in 2010 and ended in 2012.[6,60]

1992

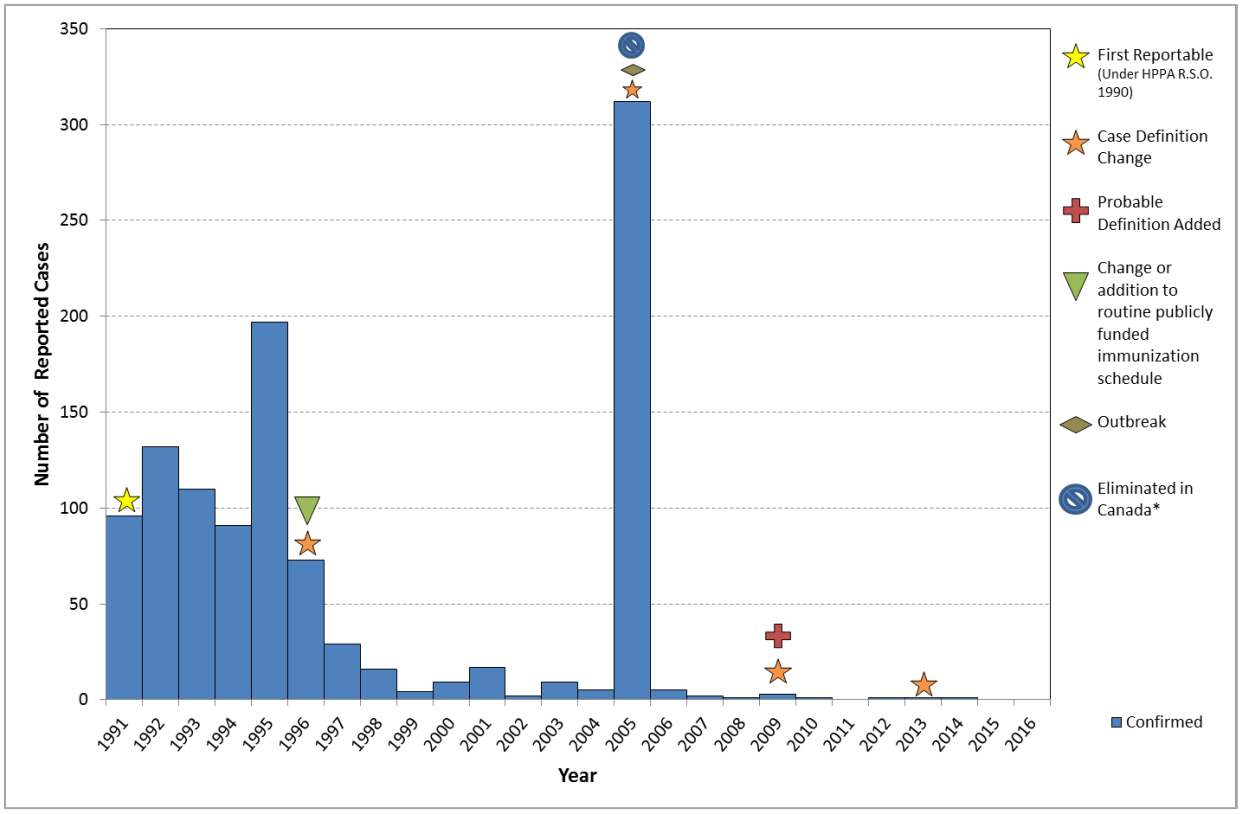
- In 1991, abortions caused by Q fever occurred in four Ontario and one New Brunswick goat herds that were exposed to parturient goats at the 1991 Royal Winter Fair (RWF) in Toronto. As Q fever is an infectious disease that can spread from animals to humans, the increase in reported cases in 1992 may be in part attributed to increases in the recognition, diagnosis and reporting of Q fever following the RWF event.[61,62]

2009

- The case definition was split into confirmed and probable cases.[4] The impact of this change was not substantial given that probable cases constituted a small proportion of total case counts since 2009.

Rubella

Figure 34. Number of reported cases of Rubella by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/03/15] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

*** The interruption of endemic measles/rubella virus transmission in a defined geographic area for a period ≥12 months in the presence of high-quality surveillance**

OVERVIEW

- Rubella has been eliminated in Canada since 2005. Since then, Ontario has had rare sporadic cases due to importation from parts of the world where rubella remains endemic.

- For measles, rubella and congenital rubella syndrome (CRS), probable cases are excluded from the historical temporal trend despite being reportable at the provincial level, since these diseases have been eliminated from Canada and strict criteria are required to identify cases. Enhanced surveillance activities to document the elimination of measles and rubella commenced in 2012 which may impact trend analyses.

1975

- A single dose MMR vaccine program was introduced into the publicly-funded routine immunization program.

1982:

- Since 1982, under the ISPA, all students must have documented receipt of rubella-containing vaccine or provide documentation of medical exemption or religious/conscientious objection.

1996

- A two dose MMR vaccine program was implemented to achieve measles control. Only one dose of rubella vaccine is required for long-lasting immunity.[23]

2005

- NAT testing, a more sensitive diagnostic methodology, was added to the case definition.
- A large outbreak of over 200 cases in an unvaccinated community in southwestern Ontario was responsible for the increase in cases in 2005.

2009

- A probable case definition was added.[4]

2012:

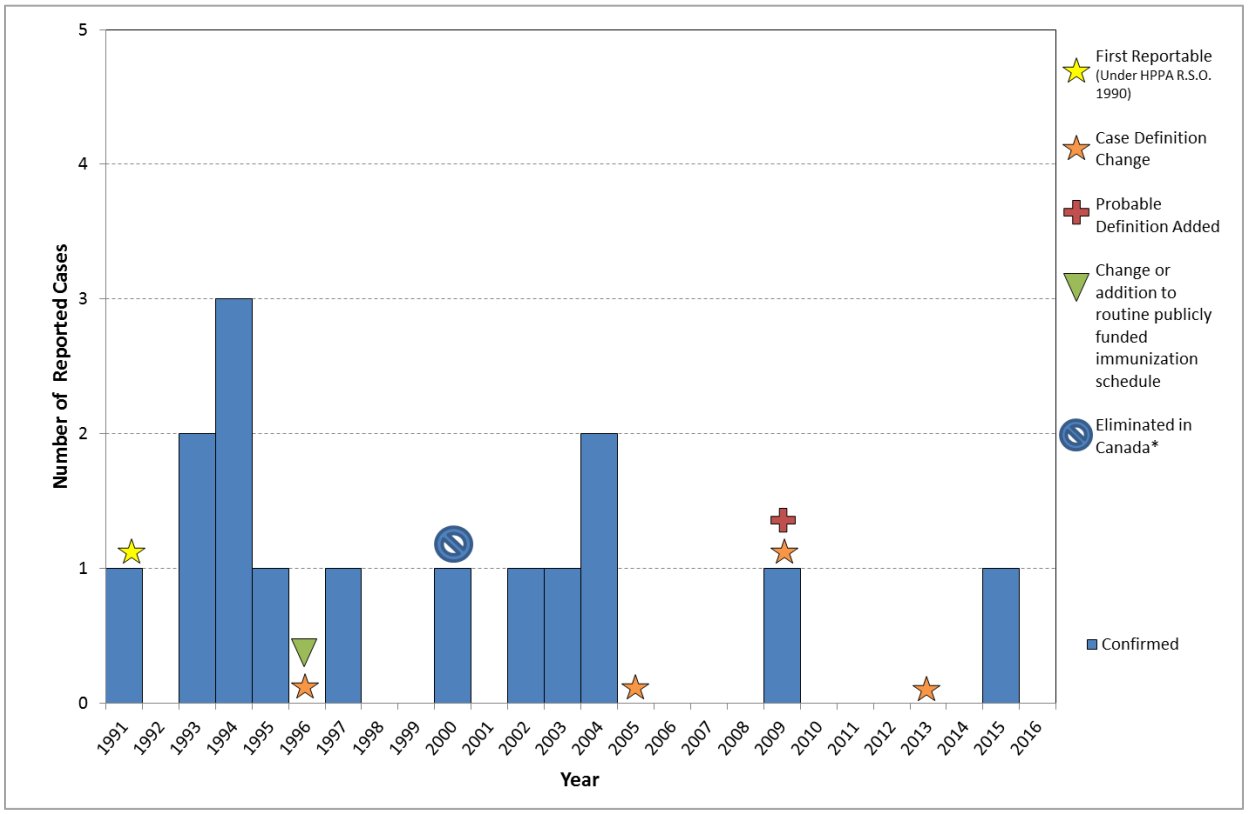
- In Ontario, enhanced surveillance activities for rubella commenced in 2012 to document the elimination of measles and rubella.

2015

- The region of the Americas was declared as the world's first to eliminate rubella and CRS by the Pan American Health Organization/World Health Organization (PAHO/WHO).

Rubella, congenital syndrome

Figure 35. Number of reported cases of Congenital rubella syndrome by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/03/15] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

*** The interruption of endemic measles/rubella virus transmission in a defined geographic area for a period ≥12 months in the presence of high-quality surveillance**

OVERVIEW

- Congenital syndrome rubella (CRS) has been eliminated from Canada since 2000. Despite elimination, Ontario has had rare imported cases. An imported case is one whose mother was outside Canada during the period when she may have had exposure to rubella that affected her pregnancy (from 23 days prior to conception or until week 24 of gestation).

- For measles, rubella and CRS, probable cases are excluded from the historical temporal trend despite being reportable at the provincial level, since these diseases have been eliminated from Canada and strict criteria are required to identify cases.

1975

- A single dose MMR vaccine program was introduced into the publicly-funded routine immunization program.

1982

- Since 1982, under the ISPA, all students must have documented receipt of rubella-containing vaccine or provide documentation of medical exemption or religious/conscientious objection.

1996

- A two dose MMR vaccine program was implemented to achieve measles control. Only one dose of rubella vaccine is required for long-lasting immunity.[23]

2009

- A probable case definition was added.[4]
- NAT testing, a more sensitive diagnostic methodology, was added to the case definition.
- A distinction was made between live birth and still birth definitions for confirmed cases.

2012

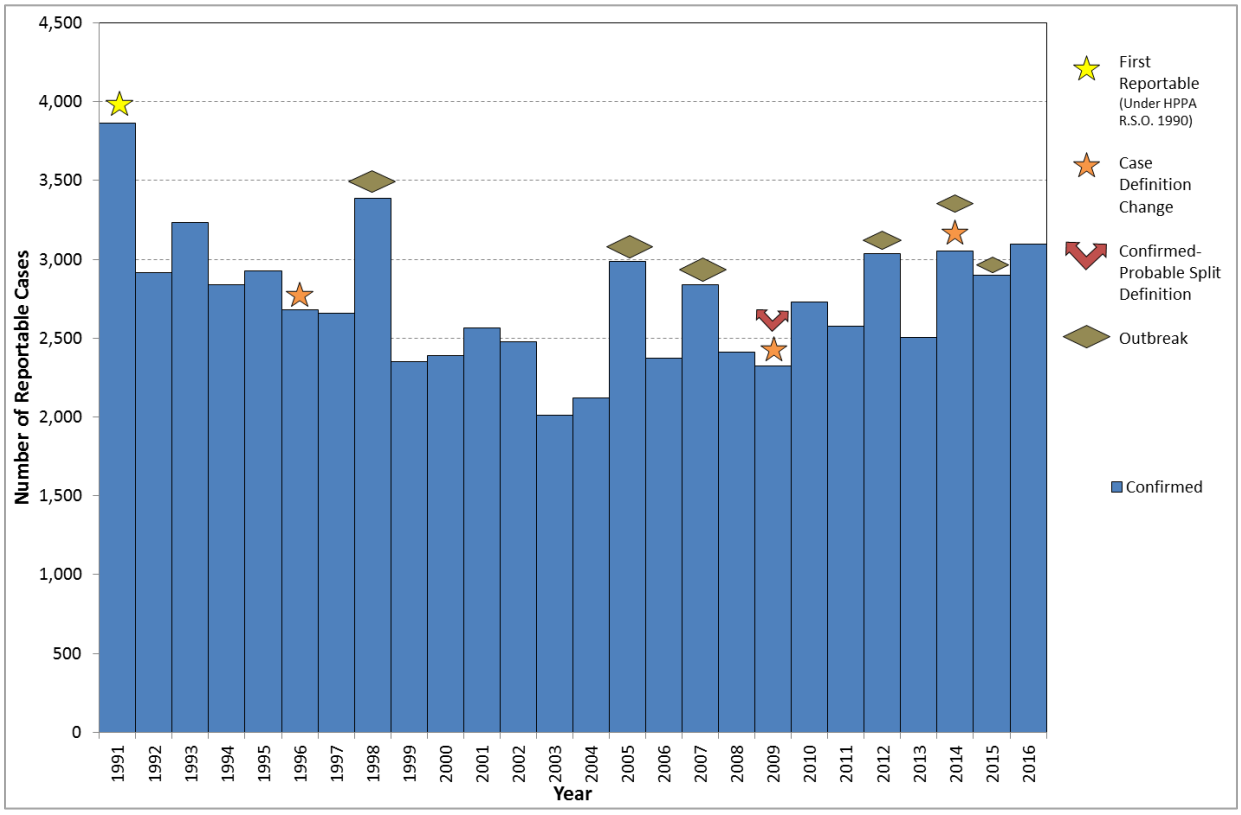
- In Ontario, enhanced surveillance activities for CRS commenced in 2012 to document the elimination of measles and rubella.

2015

- The region of the Americas was declared the world's first to eliminate rubella and CRS by the Pan American Health Organization/World Health Organization (PAHO/WHO).

Salmonellosis

Figure 36. Number of reported cases of Salmonellosis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- The graph for salmonellosis does not display the proportion of cases that represent distinct serotypes. Serotype information for Salmonella should be considered when conducting an epidemiological analysis.

1998

- The increase in reported cases was attributed to a national outbreak of 805 S. Enteritidis cases across Canada, 531 of which were from Ontario, linked to the consumption of shredded cheese in Schneider luncheon snacks.[63]

2005

- The increase in reported cases was attributed to a provincial outbreak of more than 500 S. Enteritidis cases in Ontario linked to the consumption of contaminated mung bean sprouts.[64]

2007

- The increase in reported cases was due in part to an outbreak of 90 S. Typhimurium cases at the University of Western Ontario. The source of this outbreak was not identified.[65]

2009

- The case definition was split into confirmed and probable cases.[4] The impact of this change was not substantial given that probable cases have constituted a small proportion of total case counts since 2009.

2012:

- The increase in reported cases can be attributed to a number of outbreaks involving various serotypes of Salmonella. This increase in reported cases was in part due to:
    - A national outbreak of S. Thompson, with 60 reported cases from Ontario. The source of this outbreak was not identified.[7]
    - A provincial outbreak of 75 S. Heidelberg cases. The increase was comprised of a number of sub-clusters including an outbreak related to a Valentine's Day event at a banquet hall in Woodbridge, Ontario.[66]
    - A provincial outbreak of 61 cases of S. Typhimurium linked to the consumption of ground beef burger meat mix.[65,66]
    - A local outbreak of 51 cases, with 13 cases serotyped as S. Thompson and one case as S. Isangi, investigated by the Hamilton Public Health Services. The outbreak was likely the result of poor food handling.[66]

2014

- The increase in reported cases can be attributed to a number of outbreaks involving various serotypes of Salmonella. This increase in reported cases was due in part to:
    - A national investigation of several Salmonella serotypes, with 35 reported cases from Ontario, linked to the consumption of various chia seed products.
    - An outbreak of 21 S. Typhimurium cases in Ontario, most of whom reported being exposed to reptiles and/or rodents. The cases were part of a national investigation and originated from an increase that began in 2012.
    - A provincial outbreak of 156 S. Thompson cases. The definitive source of this outbreak was not identified, however, chicken was suspected.[9]

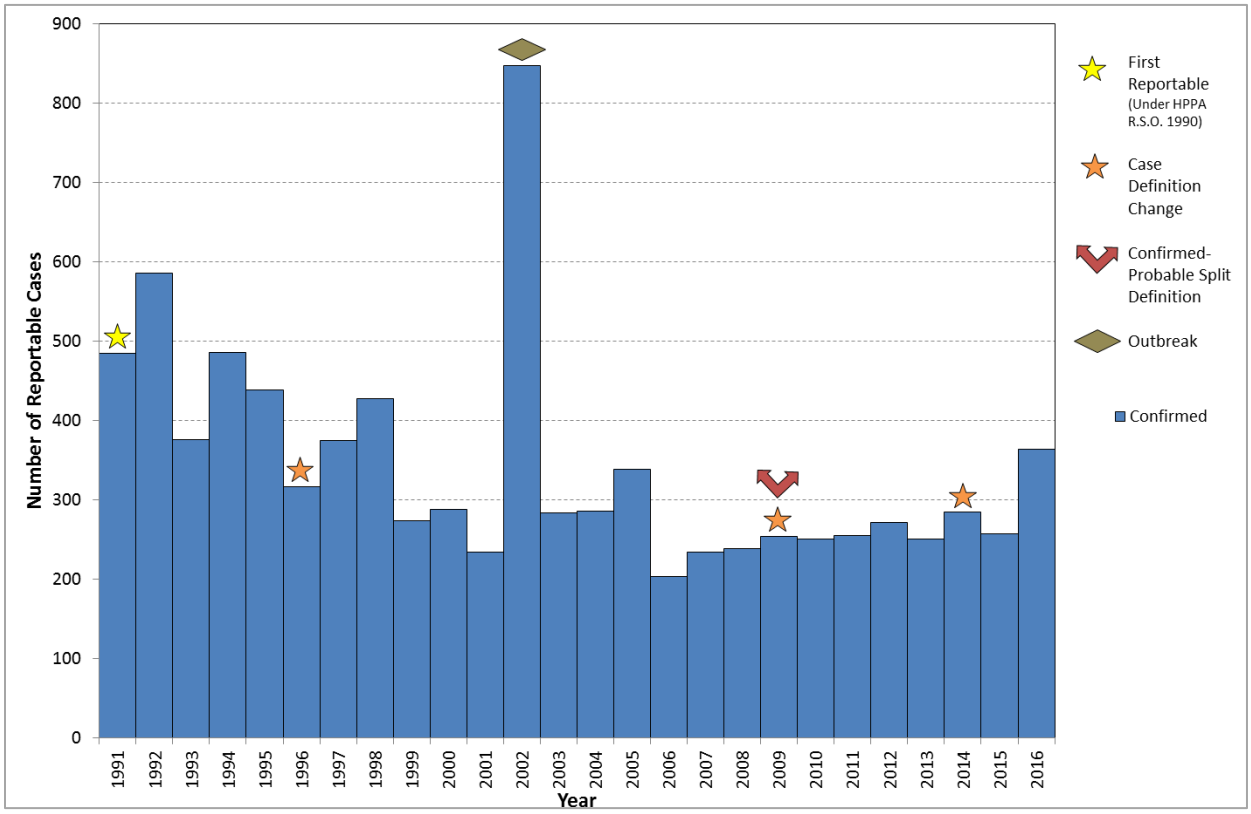
- An increase in cases of S. Enteritidis that were not travel-related. Store-bought, frozen, processed, breaded chicken was identified as a risk factor that likely contributed to the observed increase.[9]

2015

- There was an increase in reported cases during this year; however this increase is not attributed to a large outbreak(s), but rather to several separate outbreaks of small size involving various serotypes of Salmonella.

Shigellosis

Figure 37. Number of reported cases of Shigellosis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- Over the period 1991 to 2016, the highest number of shigellosis cases was reported in 2002, due to a provincial outbreak.

2002

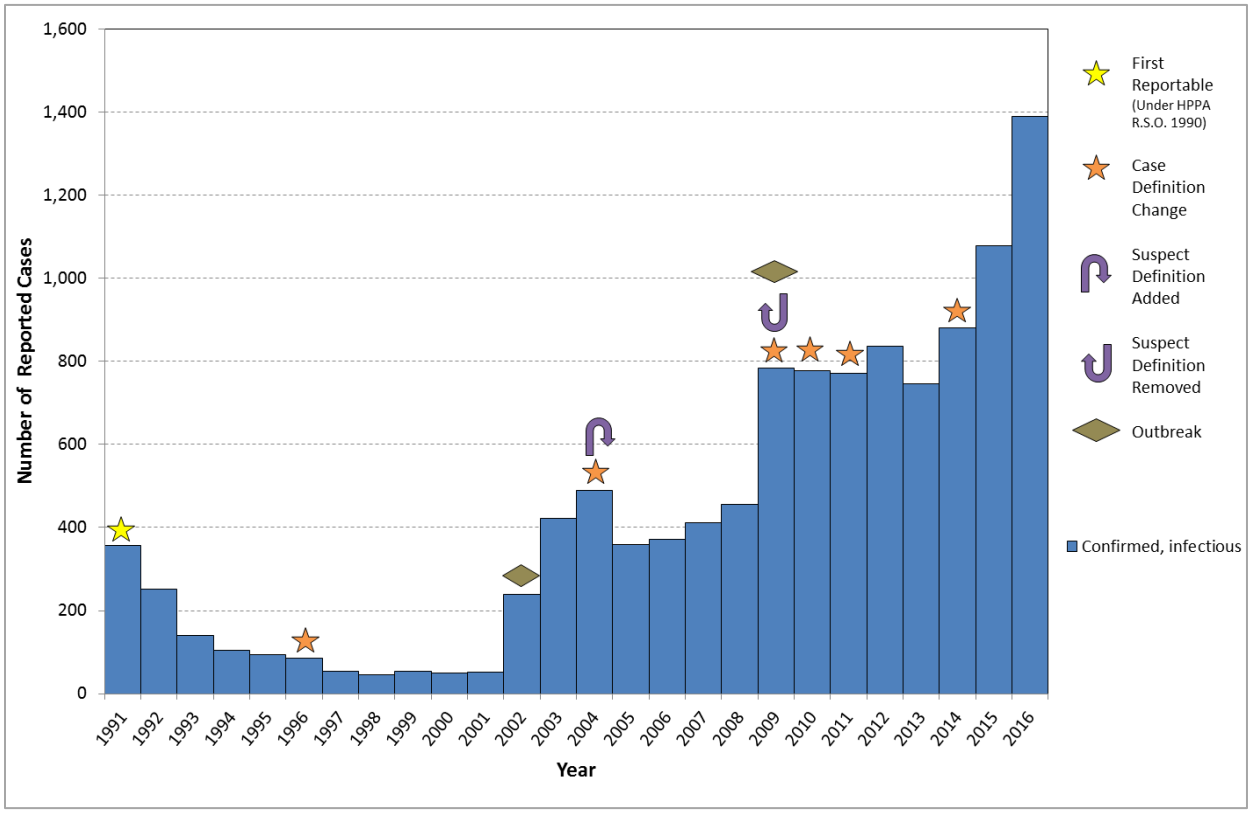
- The increase in reported cases was attributed to a large provincial outbreak of over 600 cases in Ontario linked to the consumption of Greek-style pasta salad.[6]

2009

- The case definition was split into confirmed and probable cases.[4] The impact of this change was not substantial given that probable cases have constituted a small proportion of total case counts since 2009.

Syphilis

Figure 38. Number of reported cases of Syphilis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/02/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- Three notable increases in the incidence of infectious syphilis in Ontario were observed. The first two increases from 2002 to 2004 and 2008 to 2009 were primarily attributable to outbreaks in Toronto and Ottawa among men who have sex with men (MSM).[6] The increase from 2015 to 2016 can be attributed in part to the ongoing increases in the number of reported cases among MSM in both the greater Toronto area and Ottawa.Media campaigns have been completed encouraging testing among MSM in Toronto and Ottawa in 2002 and 2009 and may have impacted the number of individuals being tested and diagnosed.

- There is evidence that, in some cases, once a syphilis outbreak occurs, a new baseline is established and case counts do not return to their pre-outbreak level. This may be related to establishment of the infection in hard-to-reach groups.[67]

2002

- The increase in reported cases can be in part attributed to outbreaks among MSM in both Toronto and Ottawa.[68]

2009

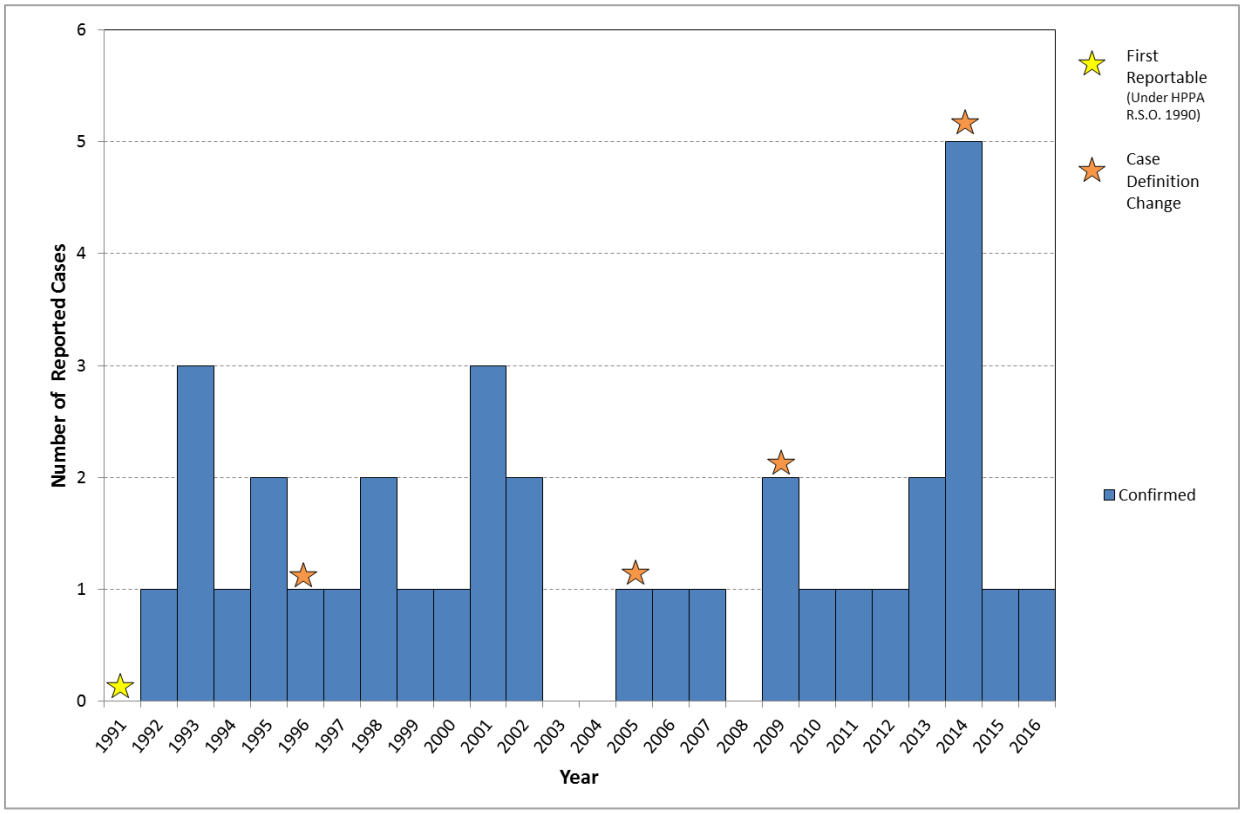
- NAT testing, a more sensitive diagnostic methodology, was added to the case definition.
- The increase in reported cases can be in part attributed to outbreaks among MSM in both Toronto and Ottawa.[68]

2016

- The increase in reported cases can be in part attributed to the ongoing increases in the number of reported cases among MSM in both the greater Toronto area and Ottawa.

Tetanus

Figure 39. Number of reported cases of Tetanus by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/03/15] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- The highest number of reported cases of tetanus occurred in 2014, when five cases were reported from four different public health units, with Lambton County reporting two cases.

1940

- Tetanus toxoid was introduced in Canada, which contributed to a large decrease of cases and deaths from tetanus.[23]

1947

- A four-dose program of combined tetanus, diphtheria, and whole cell pertussis (DwPT) vaccine was implemented in 1947 for young children.

1981

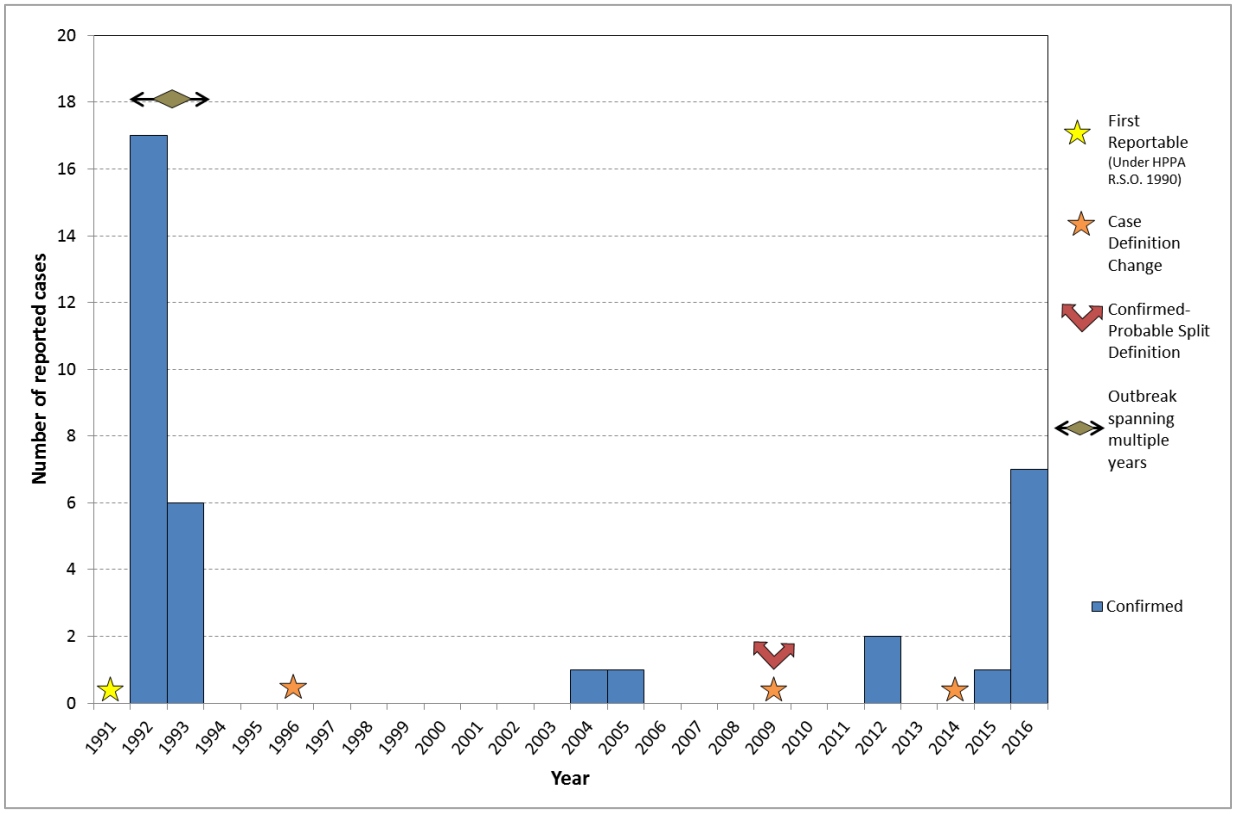
- A combined tetanus and diphtheria (Td) vaccine was added to the publicly-funded program as booster doses given at 14-16 years and every 10 years for adults.

1982

- Since 1982, all students must have documented receipt of tetanus toxoid-containing vaccine under the ISPA.

Trichinosis

Figure 40. Number of reported cases of Trichinosis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

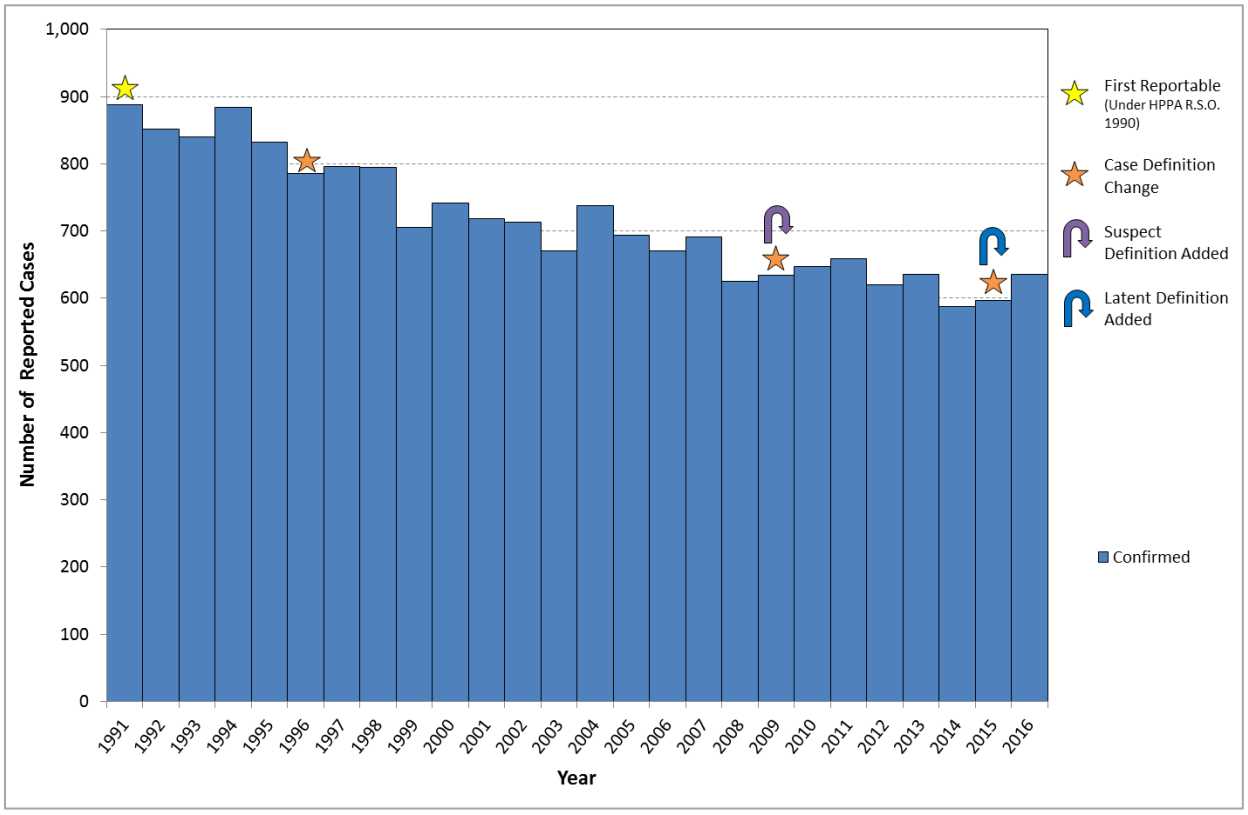
- Trichinosis is infrequently reported in Ontario.[18]
- The increase in reported cases in 1992-1993 was attributed to a large outbreak of 23 confirmed cases linked to the consumption of contaminated smoked wild boar meat from a farm in Dufferin County, Ontario.[69]

2009

- The case definition was split into confirmed and probable cases. The impact of this change was not substantial.[4]

Tuberculosis

Figure 41. Number of reported cases of Tuberculosis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/03/14] for 1991-2004 data; [2017/05/16] for 2005-2016 data. TB counts are based on diagnosis date; not episode date. 2012 counts may not be completely accurate on iPHIS since cleanup of the data is ongoing.

OVERVIEW

- Overall, the number of TB cases reported in Ontario decreased by approximately 30% between 1991 and 2016.
- In Ontario, as in most low-incidence settings, the majority of TB cases result from the reactivation of latent TB infection (LTBI), particularly among those born in high TB burden countries.[70]
- Between 2005 and 2016, persons born outside of Canada accounted for 88.0% of all TB cases reported in the province; of these, almost 50% were from just three high TB burden countries: India, China, and the Philippines.[71]

- During this same time period, however, the total number of immigrants and refugees arriving in Ontario decreased by 18% [72], which may subsequently account for the overall decrease in TB cases observed during this time.

2009

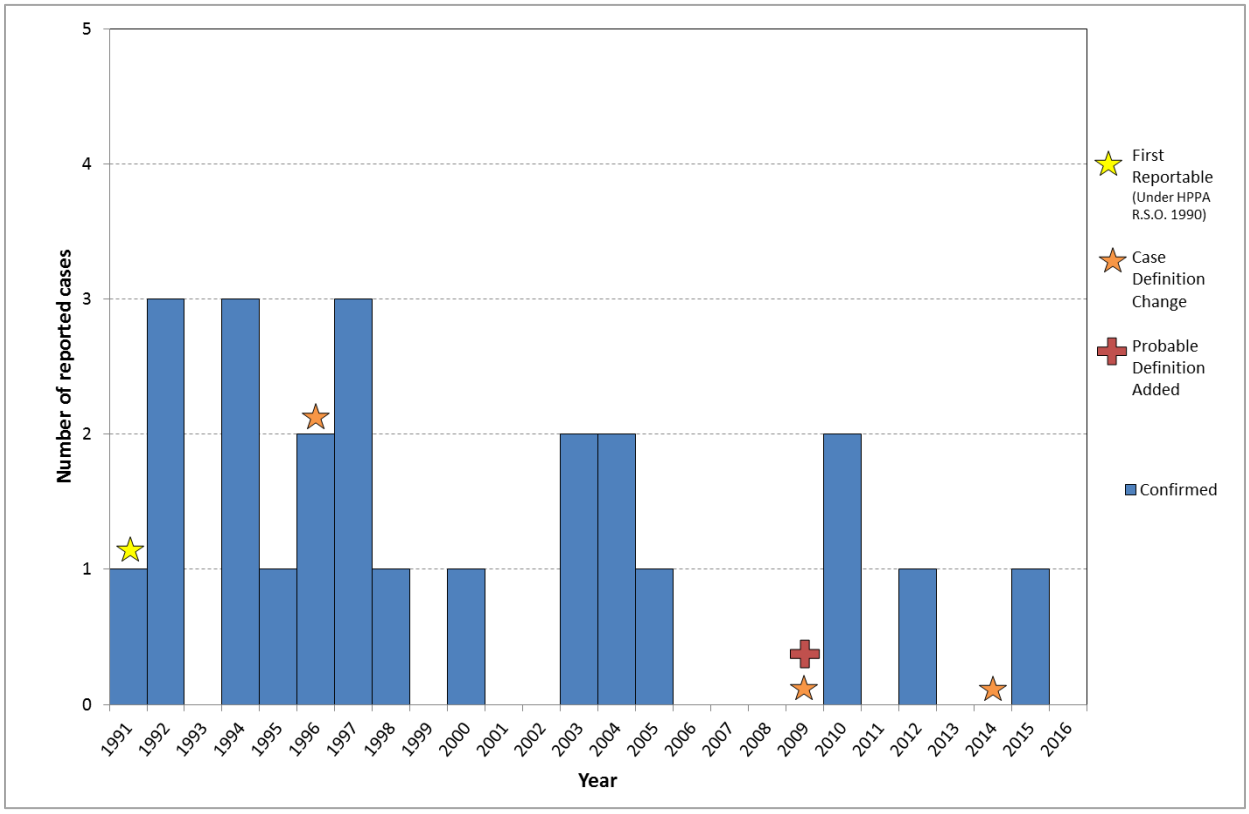
- A suspect case definition was added.[4]

2015

- A latent case definition was added.[4]
- Microscopy and NAT testing, more sensitive diagnostic methodologies, were added to the case definition.

Tularemia

Figure 42. Number of reported cases of Tularemia by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

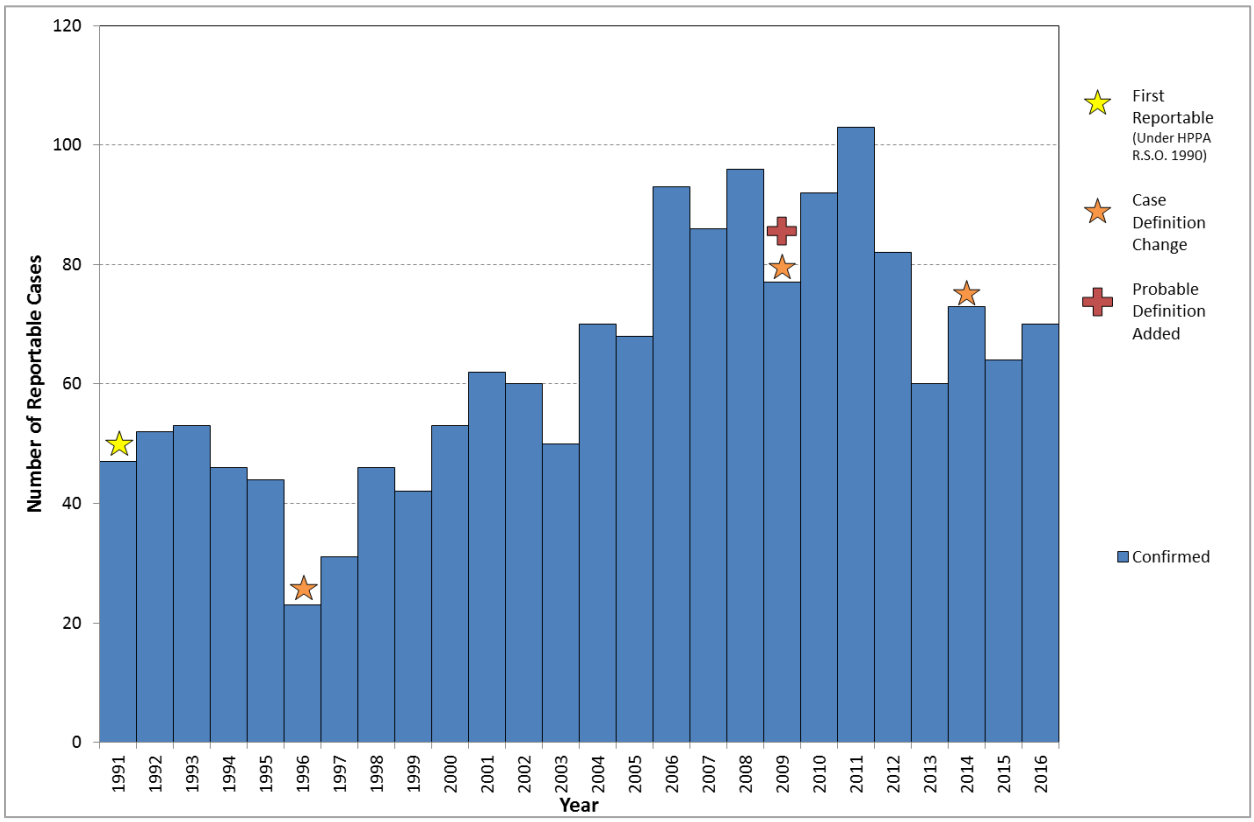
- Only nine cases of tularemia have been reported since 2002.

2009

- A probable case definition was added.[4]

Typhoid Fever

Figure 43. Number of reported cases of Typhoid Fever by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

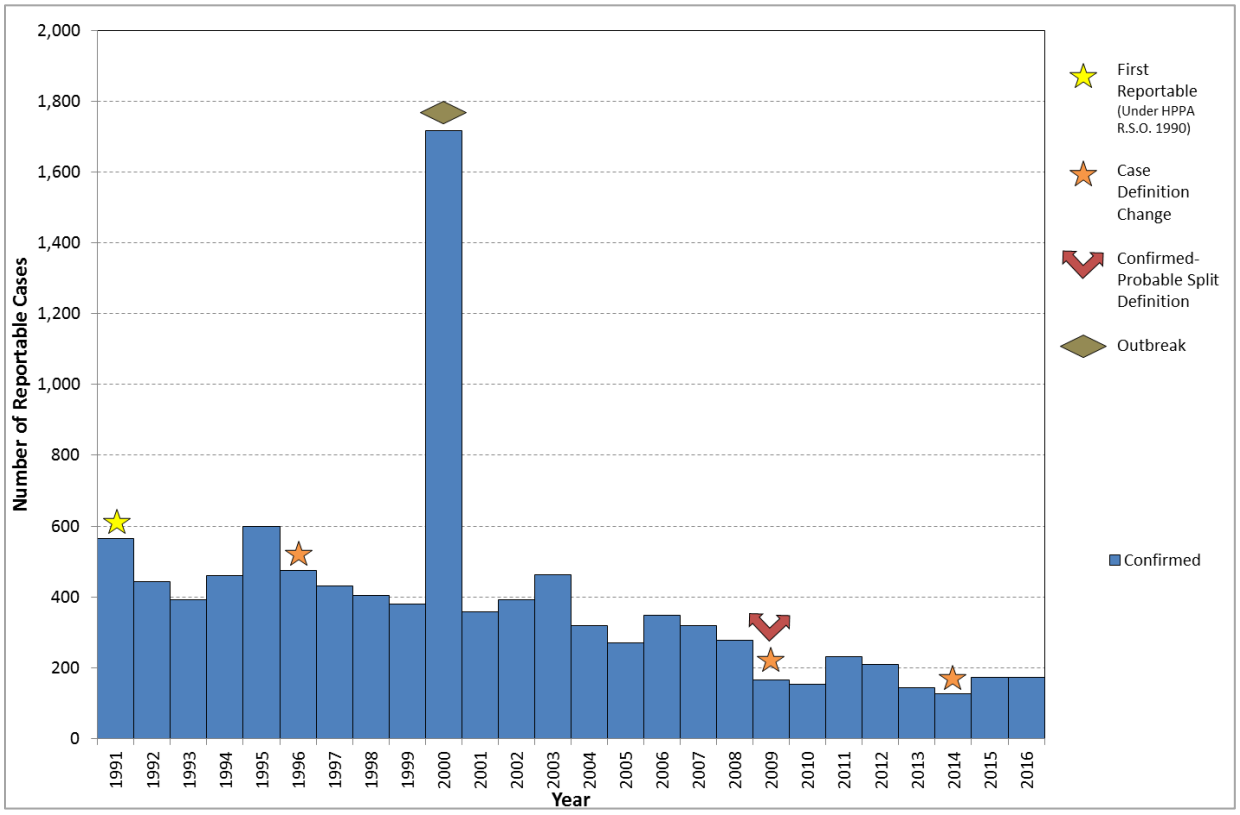
- Typhoid fever is not endemic to Ontario. Ontario has had cases due to importation from parts of the world where typhoid fever remains endemic, such as South Asia.[59]
- There has been an overall increase in incidence of typhoid fever since 2004, although the reasons for this increase are not fully understood. It may be related to an increase in travel to endemic areas.

2009

- A probable case definition was added, which includes an epidemiologic link to a laboratory-confirmed case.[4]

Verotoxin producing *E.coli* (VTEC)

Figure 44. Number of reported cases of Verotoxin-producing *E. coli* by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- Incidence of reported cases has been declining since 1991, with the exception of an increase in cases in 2000 due to a large Ontario outbreak.

- The decrease in reported cases may be partly due to the introduction of control efforts in Canada by industry, federal and provincial/territorial governments, and the general population. In response to the increasing introduction and spread of contaminants, there have been changes to legislative frameworks and improvements in the safety of food commodities, including the introduction of the Canadian Food Inspection Agency (CFIA) in 1997. These interventions included meat processing changes, public awareness campaigns on food handling practices, and the introduction and enforcement of food safety standards and policies by Health Canada and the CFIA which help minimize risks of foodborne illness.[20]

2000

- The increase in reported cases was attributed to a large waterborne outbreak in Walkerton, Ontario linked to the bacterial contamination of municipal water. Grey-Bruce reported 75% of the total cases that year.[73]

2003

- The increase in reported cases was attributed to separate outbreaks in the City of Hamilton and Halton Region.[20]

2009

- The case definition was split into confirmed and probable cases. Cases with hemolytic uremic syndrome (HUS) and epidemiologically linked cases were moved to the probable definition.[4] The impact of this change was not substantial given that probable cases have constituted a small proportion of total case counts since 2009.

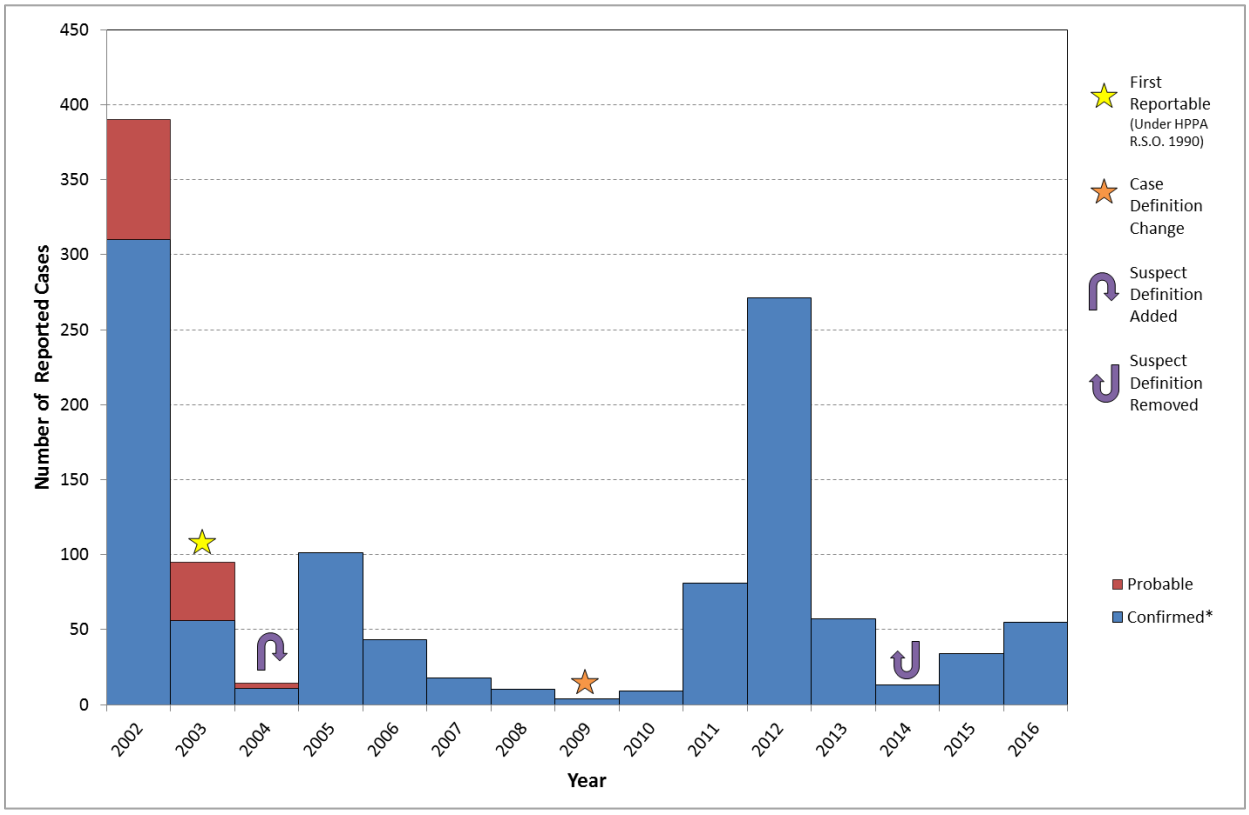
2013

- NAT testing, a more sensitive diagnostic methodology, was added to the case definition.

- Laboratory confirmation without clinically compatible signs and symptoms was added to the case definition, which may have led to an increase in VTEC cases.

West Nile Virus Illness

Figure 45. Number of reported cases of West Nile Virus Illness by year, Ontario, 2002-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

*** Probable cases have been included in total counts since 2009 in order to ensure valid comparisons over time.**

OVERVIEW

- WNV illness first became reportable in 2003.
- Both symptomatic and asymptomatic (with only lab confirmation) case definitions are being used for WNV. The suspect case definition includes clinical symptoms without requiring laboratory confirmation.[4]
- Given that probable cases constituted a significant proportion of total case counts since 2009, they have been included in total counts in order to ensure valid comparisons over time.

2002

- The first confirmed human cases in Ontario were detected.[18]
- There was a large peak of cases due to the introduction of WNV.
- A large number of WNV illness cases were reported by public health units in 2002, although it was not officially reportable until 2003.[74]

2003

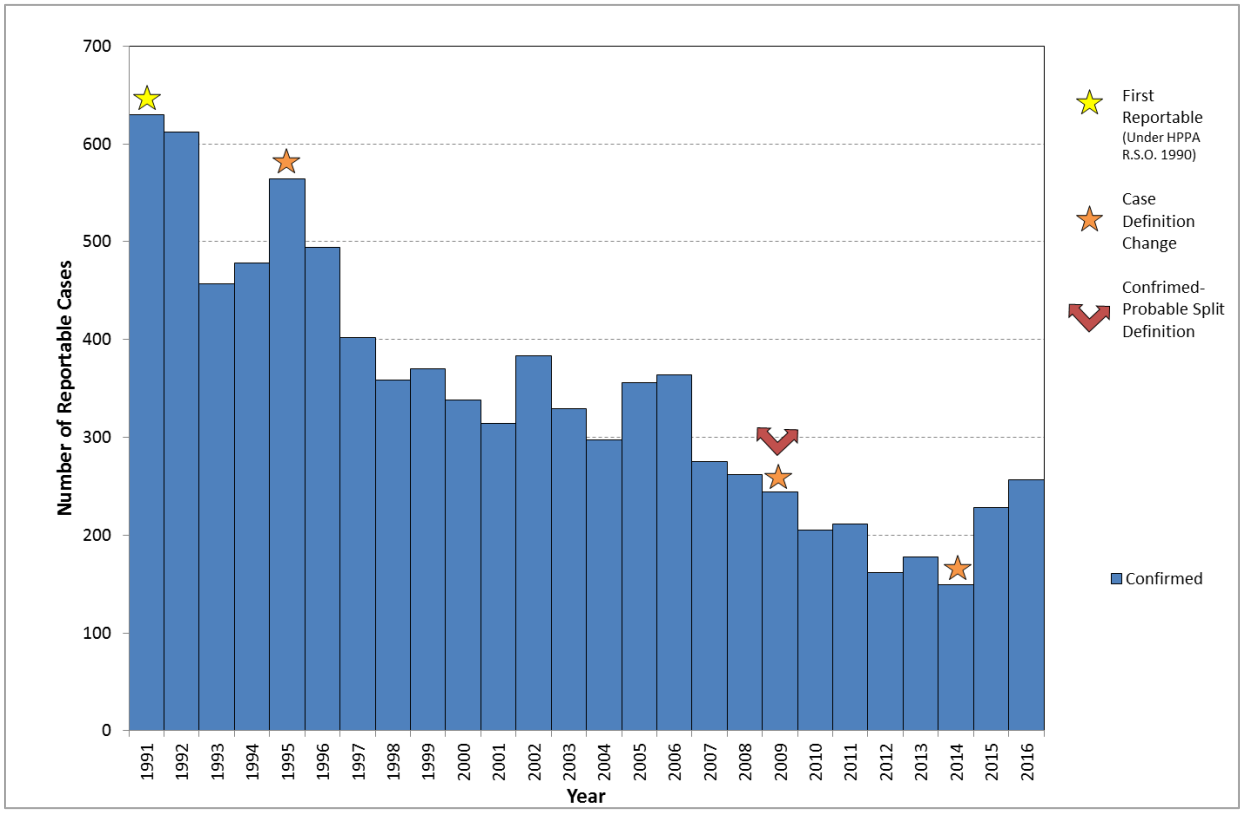
- WNV was listed as reportable under the Health Protection and Promotion Act.[74]

2012

- The increase in reported cases was likely influenced by a combination of a mild winter, higher summer temperatures and low rainfall, conditions which favour the mosquito vector, allowing them to have shorter and quicker life cycles and faster viral replication.[75]

Yesiniosis

Figure 46. Number of reported cases of Yersiniosis by year, Ontario, 1991-2016



Data Source: MOHLTC, iPHIS database, extracted by Public Health Ontario on: [2013/01/22] for 1991-2004 data; [2017/05/16] for 2005-2016 data.

OVERVIEW

- Incidence for reported cases has been declining since 1991.

2009

- The case definition was split into confirmed and probable cases.[4] The impact of this change was not substantial given that probable cases have constituted a small proportion of total case counts since 2009.

2013

- NAT testing, a more sensitive diagnostic methodology, was added to the case definition.

Conclusion

This report contributes to the interpretation of provincial infectious diseases surveillance data, serving as a knowledge product for the dissemination of information on reportable diseases in Ontario. It is the first report produced by Public Health Ontario (PHO) that summarizes external factors that may have had an impact on reportable disease trends. Ongoing documentation of major changes to reportable disease status, case definitions, and other factors or events, such as outbreaks and changes to laboratory testing, which impact reportable disease trends in Ontario is needed for understanding and interpreting changes in trends. The historical changes and interpretation of trends obtained through this product will allow for a more meaningful comparison of reportable disease trends over time.

References

1. *Health Protection and Promotion Act*, RSO 1990, c H7. Available from: http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90h07_e.htm

2. Ontario. Ministry of Health, Public Health Branch. Mandatory health programs and services: reportable disease information system: guidelines and procedures. Toronto, ON: Queen's Printer for Ontario; 1992.

3. Ontario. Ministry of Health and Long-Term Care, Public Health Division. iPHIS manual. Toronto, ON: Queen's Printer for Ontario; 2005.

4. Ontario. Ministry of Health and Long-Term Care. Infectious diseases protocol, 2009. Appendix B: Provincial case definitions for reportable diseases. Toronto, ON: Queen's Printer for Ontario; 2009 [cited 2017 Jul 12]. Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/infdispro.aspx

5. Ontario. Ministry of Health and Long-Term Care. Ontario annual infectious diseases epidemiology report, 2009. Toronto, ON: Queen's Printer for Ontario; 2011.

6. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Reportable disease trends in Ontario, 2011. Toronto, ON: Queen's Printer for Ontario; 2014. Available from: https://www.publichealthontario.ca/en/eRepository/Reportable_Disease_Trends_in_Ontario_2011.pdf

7. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Reportable disease trends in Ontario, 2012: technical notes [Internet]. Toronto, ON: Queen's Printer for Ontario; 2014 [cited 2017 Aug 1]. Available from: http://www.publichealthontario.ca/en/eRepository/Reportable_Disease_Trends_Technical_Notes_2012.pdf

8. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Reportable disease trends in Ontario, 2013: technical notes [Internet]. Toronto, ON: Queen's Printer for Ontario; 2013 [cited 2017 Aug 3]. Available from: http://www.publichealthontario.ca/en/eRepository/Reportable_Disease_Trends_Technical_Notes_2013.pdf

9. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Reportable disease trends in Ontario, 2014. Toronto, ON: Queen's Printer for Ontario; 2016. Available from: http://www.publichealthontario.ca/en/eRepository/Reportable_disease_trends_in_Ontario_2014.pdf

10. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Reportable disease trends in Ontario, 2015: technical notes [Internet]. Toronto, ON: Queen's Printer for Ontario; 2017 [cited 2017 Aug 4]. Available from:

http://www.publichealthontario.ca/en/DataAndAnalytics/Documents/Reportable%20Disease%20Trends%20Technical%20Notes%202015.pdf

11. Toronto Public Health. Communicable diseases in Toronto 2002 and trends 1992 to 2002. Toronto, ON: City of Toronto; 2004.

12. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Ontario respiratory pathogen bulletin [Internet]. Toronto, ON: Queen's Printer for Ontario; 2017 [updated 2017 May 8; cited 2017 Aug 16]. Available from: http://www.publichealthontario.ca/en/ServicesAndTools/SurveillanceServices/Pages/Ontario-Respiratory-Virus-Bulletin.aspx#/reporting

13. Public Health Agency of Canada. HIV/AIDS epi updates [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2010 [cited 2017 Aug 3]. Chapter 3, HIV testing and surveillance systems in Canada. Available from: http://www.phac-aspc.gc.ca/aids-sida/publication/epi/2010/3-eng.php

14. Remis RS, Swantee C, Liu J. Report on HIV/AIDS in Ontario [Internet]. Toronto, ON: Ontario HIV Epidemiologic Monitoring Unit; 2007 [cited 2017 Aug 2]. Available from: http://www.ohemu.utoronto.ca/doc/PHERO2009_report_final.pdf

15. English K (Ontario. Ministry of Health and Long-Term Care). Ontario's HIV testing strategy. Presented at: Ontario Harm Reduction Distribution Program (OHRDP) Conference. 2013 Feb 12; Toronto, ON. Available from: http://www.ohrdp.ca/wp-content/uploads/pdf/2013English.pdf

16. Bartlett JG. Ten years of HAART: foundation for the future [Internet]. New York, NY: Medscape; 2006 [cited 2017 Aug 2]. Available from: http://www.medscape.org/viewarticle/523119

17. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Reportable disease trends in Ontario, 2015: technical notes [Internet]. Toronto, ON: Queen's Printer for Ontario; 2017. Available from: http://www.publichealthontario.ca/en/DataAndAnalytics/Documents/Reportable%20Disease%20Trends%20Technical%20Notes%202015.pdf

18. Ontario. Ministry of Health and Long-Term Care. Infectious diseases protocol, 2009. Appendix A: Disease-specific chapters [Internet]. Toronto, ON: Queen's Printer for Ontario; 2009 [cited 2017 Aug 2]. Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/infdispro.aspx

19. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: October 2012 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2012 [cited 2017 Aug 1]. Available from: https://www.publichealthontario.ca/en/DataAndAnalytics/Documents/2012_October_PHO_Monthly_Report.pdf

20. Canadian Food Inspection Agency. A new regulatory framework for federal food inspection: overview of proposed regulations [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2014 [cited 2017 Jul 13]. Available from: http://www.inspection.gc.ca/about-the-cfia/accountability/consultations-and-engagement/federal-food-inspection/overview-of-proposed-regulations/eng/1400451508255/1400451811916

21. Government of Canada. Campylobacter jejuni [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2012 [cited 2017 Aug 1]. Available from: https://www.canada.ca/en/public-health/services/food-poisoning/campylobacter-jejuni.html

22. National Advisory Committee on Immunization (NACI). Varicella vaccination two-dose recommendations. An Advisory Committee Statement (ACS). Can Commun Dis Rep. 2010;36(ACS-8):1-26. Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/10vol36/acs-8/index-eng.php

23. Government of Canada. Vaccine preventable diseases [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2012 [cited 2017 Aug 4]. Available from: http://www.phac-aspc.gc.ca/im/vpd-mev/index-eng.php

24. Ontario. Ministry of Health and Long-Term Care. Publicly funded immunization schedules for Ontario - December 2016 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2016 [cited 2018 Feb 2] Available from: http://www.health.gov.on.ca/en/pro/programs/immunization/docs/immunization_schedule.pdf

25. *General,* RRO 1990, Reg 645 under the *Immunization of School Pupils Act*. Available from: https://www.ontario.ca/laws/regulation/900645

26. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: July 2012 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2012 [cited 2017 Aug 3]. Available from: https://www.publichealthontario.ca/en/DataAndAnalytics/Documents/2012_July_PHO_Monthly_Report.pdf

27. Naimer MS, Kwong JC, Bhatia D, Moineddin R, Whelan M, Campitelli MA, et al. The effects of changes in cervical cancer screening guidelines on chlamydia testing. Ann Fam Med. 2017;15(4):329-34. Available from: http://www.annfammed.org/content/15/4/329.full.pdf

28. Ontario. Ministry of Health and Long-Term Care. Cryptosporidiosis [Internet]. Toronto, ON: Queen's Printer for Ontario; 2012 [cited 2013 Mar 12]. Available from: http://www.health.gov.on.ca/en/public/publications/disease/cryptosporidiosis.aspx

29. Stein D, Middleton D. Reportable waterborne enteric disease in Ontario, 1996 to 2000. PHERO. 2001;12(7):219-25. Available from: http://www.health.gov.on.ca/english/providers/pub/phero/pdf/2001/phero_073001_083001.pdf

30. Ontario. Ministry of Health and Long-Term Care. Communicable disease control: summary of reportable diseases 1996. Toronto, ON: Queen's Printer for Ontario; 2001.

31.Middleton D, Naus M. Cyclospora case surveillance in Ontario, 2000. PHERO. 2000;11(10):227-9. Available from: http://health.gov.on.ca/english/providers/pub/phero/pdf/2000/phero_112800.pdf

32. Canadian Food Inspection Agency. Import requirements for fresh Guatemalan raspberries and blackberries. Ottawa, ON: Government of Canada; 2013. Available from: http://www.inspection.gc.ca/food/fresh-fruits-and-vegetables/imports-and-interprovincial-trade/guatemala-raspberries-and-blackberries/eng/1374597858728/1374597935222?chap=6

33. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: June 2014 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2014 [cited 2017 Jul 12]. Available from: http://www.publichealthontario.ca/en/DataAndAnalytics/Documents/PHO_Monthly_Infectious_Diseases_Surveillance_Report_-_June_2014.pdf

34. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: December 2015 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2015 [cited 2017 Jul 12]. Available from: http://www.publichealthontario.ca/en/DataAndAnalytics/Documents/PHO_Monthly_Infectious_Diseases_Surveillance_Report_-_December_2015.pdf

35. National Advisory Committee on Immunization; Public Health Agency of Canada. Canadian immunization guide [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2016 [cited 2017 Jul 13]. Part 4: active vaccines. Available from: https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-6-hepatitis-a-vaccine.html

36.Uhlmann S, Buxton JA. A provincial and territorial review of hepatitis A in men who have sex with men. Can Commun Dis Rep. 2007;33(11):1-11. Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/07vol33/dr3311a-eng.php

37. Ontario. Ministry of Health and Long-Term Care. Hepatitis B school immunization program 1994/95 to 1997/98. Toronto, ON: Queen’s Printer for Ontario; 1999.

38. Ontario Hepatitis C Task Force. A proposed strategy to address hepatitis C in Ontario 2009-2014 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2009 [cited 2017 Aug 2]. Available from: http://www.health.gov.on.ca/en/common/ministry/publications/reports/hepc/hepc_strategy.pdf

39. Norris S. Canada's blood supply ten years after the Krever Commission [Internet]. Ottawa, ON: Library of Parliament; 2008 [cited 2017 Aug 2]. Available from: https://lop.parl.ca/content/lop/researchpublications/prb0814-e.pdf

40. Centers for Disease Control and Prevention. Testing recommendations for hepatitis C virus infection [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2015 [cited 2017 Aug 2]. Available from: https://www.cdc.gov/hepatitis/hcv/guidelinesc.htm

41. World Health Organization. What is the pandemic (H1N1) 2009 virus? [Internet]. Geneva: World Health Organization; 2009 [cited 2017 Aug 2]. Available from: http://www.who.int/csr/disease/swineflu/frequently_asked_questions/about_disease/en/

42. Athey TB, Teatero S, Sieswerda LE, Gubbay JB, Marchand-Austin A, Li A, et al. High incidence of invasive group A Streptococcus disease caused by strains of uncommon emm types in Thunder Bay, Ontario, Canada. J Clin Microbiol. 2016;54(1):83-92. Available from: http://jcm.asm.org/content/54/1/83.long

43. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: December 2011 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2011 [cited 2017 Aug 3]. Available from: https://www.publichealthontario.ca/en/DataAndAnalytics/Documents/2011_November_PHO_Monthly_Report_final_Dec%2023.pdf

44. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Epidemiology of legionellosis in Ontario, 2013 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2014 [cited 2017 Aug 2]. Available from: http://www.publichealthontario.ca/en/eRepository/Epidemiology_Legionellosis_Ontario_Report_2013.pdf

45. Henry B, Young JG, Walker DM. Report card: progress in protecting the public's health. Report of the Expert Panel on the Legionnaires' Disease Outbreak in the City of Toronto--September/October 2005 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2005 [cited 2017 Aug 3]. Available from: http://www.health.gov.on.ca/en/common/ministry/publications/reports/walker_legion/rep_final_120505.pdf

46. Birk-Urovitz E. The 2008 Canadian Listeriosis outbreak: a result of knowledge ignored McMaster University Medical Journal. 2011;8:65-7. Available from: http://mdprogram.mcmaster.ca/docs/default-source/MUMJ-Library/v8_65.pdf?sfvrsn=0

47. Public Health Agency of Canada. Public health notice update - outbreak of Listeria infections linked to packaged salad products produced at the Dole processing facility in Springfield, Ohio [Internet]. Ottawa, ON: Government of Canada; 2016 [cited 2017 Jul 13]. Available from: http://www.phac-aspc.gc.ca/phn-asp/2016/listeria-eng.php

48. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Outbreak investigation: listeriosis (2016) [Internet]. Toronto, ON: Queen's Printer for Ontario; 2016 [cited 2017 Jul 13]. Available from: https://www.publichealthontario.ca/en/BrowseByTopic/InfectiousDiseases/Pages/Listeriosis-Update.aspx

49. Leighton PA, Koffi JK, Pelcat Y, Lindsay LR, Ogden NH. Predicting the speed of tick invasion: an empirical model of range expansion for the Lyme disease vector *Ixodes scapularis* in Canada. J Appl Ecol.

2012;49(2):457-64. Available from: http://resolver.scholarsportal.info/resolve/00218901/v49i0002/457_ptsotidvisic

50. Ogden NH, Maarouf A, Barker IK, Bigras-Poulin M, Lindsay LR, Morshed MG, et al. Climate change and the potential for range expansion of the Lyme disease vector *Ixodes scapularis* in Canada. Int J Parasitol;2006;36(1):63-70.

51. Government of Ontario. Lyme disease [Internet]. Toronto, ON: Queen's Printer for Ontario; 2010 Available from: http://www.health.gov.on.ca/en/public/publications/disease/lyme.aspx

52. Nelder MP, Russell C, Lindsay LR, Dhar B, Patel SN, Johnson S, et al. Population-based passive tick surveillance and detection of expanding foci of blacklegged ticks *Ixodes scapularis* and the Lyme disease agent *Borrelia burgdorferi* in Ontario, Canada. United States: PLoS One. 2014;9(8):e105358. Available from: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0105358

53. MacLean JD, Demers AM, Ndao M, Kokoskin E, Ward BJ, Gyorkos TW. Malaria epidemics and surveillance systems in Canada. Emerg Infect Dis. 2004;10(7):1195-201. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3323336

54. Baqi M, Gamble K, Keystone Jay S, Kain KC. Malaria: Probably locally acquired in Toronto, Ontario. Can J Infetc Dis. 1998;9(3):183-4. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3250910

55. Nelder MP, Russell C, Williams D, Johnson K, Li L, Baker SL, et al. Spatiotemporal dynamics and demographic profiles of imported *Plasmodium falciparum* and *Plasmodium vivax* infections in Ontario, Canada (1990-2009):e76208. PloS One. 2013;8(9):e76208. Available from: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0076208

56.National Advisory Committee on Immunization; Public Health Agency of Canada. Canadian immunization guide [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2016 [cited 2017 Aug 2]. Part 4: active vaccines: hepatitis A vaccine. Available from: https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-6-hepatitis-a-vaccine.html

57.National Advisory Committee on Immunization (NACI). Update on the use of quadrivalent conjugate meningococcal vaccines. An Advisory Committee Statement (ACS). Can Comm Dis Rep. 2013;39(ACS-1). Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/13vol39/acs-dcc-1/index-eng.php

58. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: September 2014 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2014 [cited 2017 Aug 2]. Available from: https://www.publichealthontario.ca/en/DataAndAnalytics/Documents/PHO_Monthly_Infectious_Diseases_Surveillance_Report_-_September_2014.pdf

59. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: February 2013 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2013 [cited 2017 Aug 1]. Available from: https://www.publichealthontario.ca/en/DataAndAnalytics/Documents/2013_February_PHO_Monthly_Report.pdf

60. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: June 2012 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2012 [cited 2017 Aug 1]. Available from: http://www.oahpp.ca/resources/documents/2012%2006%20PHO%20Monthly%20Report.pdf

61. Sanford SE, Josephson GKA, MacDonald A. *Coxiella burnetti* (Q fever) abortion storms in goat herds after attendance at an annual fair. Can Vet J. 1994;35(6):376. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1686282/pdf/canvetj00355-0058.pdf

62. Hatchette T, Campbell N, Whitney H, Hudson R, Marrie TJ. Seroprevalence of *Coxiella burnetii* in selected populations of domestic ruminants in Newfoundland. Can Vet J. 2002;43(5):363. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC339270/

63. LeBer CL. Ontario outbreak of *S. enteritidis* associated with cheese in a commercially manufactured lunch product. PHERO. 1998;9:172-7.

64. Health Canada. Risks associated with sprouts [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Ontario; 2011 [cited 2017 Aug 1]. Available from: http://www.hc-sc.gc.ca/hl-vs/alt_formats/pdf/iyh-vsv/food-aliment/sprouts-germes-eng.pdf

65. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: May 2012 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2012 [cited 2017 Aug 1]. Available from: https://www.publichealthontario.ca/en/DataAndAnalytics/Documents/2012_May_PHO_Monthly_Report.pdf

66. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: April 2012 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2012 [cited 2017 Aug 1]. Available from: https://www.publichealthontario.ca/en/DataAndAnalytics/Documents/2012_April_PHO_Monthly_Report.pdf

67. Health Protection Surveillance Centre. Guidance on management of outbreaks of sexually transmitted infections (STIs). Dublin, Ireland: Health Protection Surveillance Centre; 2016 [cited 2017 Aug 2]. Available from: http://www.hpsc.ie/a-z/hivstis/sexuallytransmittedinfections/publications/STI%20Outbreak%20July%202016.pdf

68. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: September 2015 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2015

[cited 2017 Aug 2]. Available from: https://www.publichealthontario.ca/en/DataAndAnalytics/Documents/PHO_Monthly_Infectious_Diseases_Surveillance_Report_-_September_2015.pdf

69. Greenbloom SL, Martin-Smith P, Isaacs S, Marshall B, Kittle DC, Kain KC, et al. Outbreak of trichinosis in Ontario secondary to the ingestion of wild boar meat. Can J Public Health. 1997;88(1):52-6. Available from: journal.cpha.ca/index.php/cjph/article/download/903/903

70. Lönnroth K, Migliori GB, Abubakar I, D'Ambrosio L, De Vries G, Diel R, et al. Towards tuberculosis elimination: an action framework for low-incidence countries. Eur Respir J. 2015;45(4):928-52. Available from: http://erj.ersjournals.com/content/45/4/928.long

71. Ontario. Ministry of Health and Long-Term Care. integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario, [extracted 2017 May 31].

72. Government of Canada. Facts & figures 2015: immigration overview - permanent residents – annual IRCC updates [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2017 [cited 2017 Aug 2]. Available from: http://open.canada.ca/data/en/dataset/2fbb56bd-eae7-4582-af7d-a197d185fc93

73. Ontario. Ministry of Health and Long-Term Care. Communicable disease control: summary of Reportable Diseases, 2000. Toronto, ON: Queen's Printer; 2004.

74. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: December 2012 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2012 [cited 2017 Aug 1]. Available from: http://www.publichealthontario.ca/en/DataAndAnalytics/Documents/2012_December_PHO_Monthly_Report.pdf

75. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Monthly infectious diseases surveillance report: November 2012 [Internet]. Toronto, ON: Queen's Printer for Ontario; 2014 [cited 2017 Jul 12]. Available from: http://www.publichealthontario.ca/en/DataAndAnalytics/Documents/2012_November_PHO_Monthly_Report.pdf

Public Health Ontario
480 University Avenue, Suite 300
Toronto, Ontario
M5G 1V2
647.260.7100
communications@oahpp.ca
publichealthontario.ca