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The Monthly Infectious Diseases Surveillance Report is produced by Public Health Ontario (PHO) for the public health community of Ontario. We welcome feedback by email to: SurveillanceServices@oahpp.ca. Past issues and additional information are available online.

INFECTIOUS DISEASE IN FOCUS

MALARIA

Malaria is a parasitic disease transmitted by the bite of an infected mosquito and occurs in many tropical and sub-tropical areas. There are five species of the parasite that cause infection in humans: *Plasmodium falciparum*, *P. vivax*, *P. ovale*, *P. malariae,* and *P. knowlesi*. *Plasmodium* species are known to vary by region. *P. falciparum* and *P. ovale* are most common in Africa, while *P. vivax* is found mostly in Asia, Latin America, and certain parts of Africa.[1] Once

Ontario
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infected with the parasite, the incubation period in humans varies with the strain, generally being nine to 40 days but at times as long as eight to ten months. Humans are the primary reservoir of malaria and can infect mosquitoes as long as infective gametocytes are present in the blood.[2] Malaria can also be transmitted through blood transfusions, organ transplant, and from a mother to child during pregnancy, either before or during delivery.[3]

Infection can be asymptomatic. Symptomatic infection can range from mild to severe disease, and even result in death. Disease severity varies with *Plasmodium* species. For example, infection with *P. falciparum* can be fatal, while infection with *P. vivax* or *P. ovale* are very rarely fatal; however, in these latter two infections the parasites can remain dormant in the liver for months after acute infection.[4] The symptoms of malaria are often similar to influenza or other febrile illnesses and include fever, sweats, chills, nausea, headache, joint and muscle pain, cough, and diarrhea. Severe malaria, which most often occurs in infections with *P. falciparum*, may occur if not treated properly and can include cerebral malaria, severe anemia, acute kidney failure, hypoglycemia, and respiratory distress. Malaria is treatable and the parasites can be eliminated from an infected person. Treatment for malaria depends on many factors such as disease severity, the species of malaria parasite, and given the constantly evolving resistance of *P. falciparum*, where the infection was acquired.

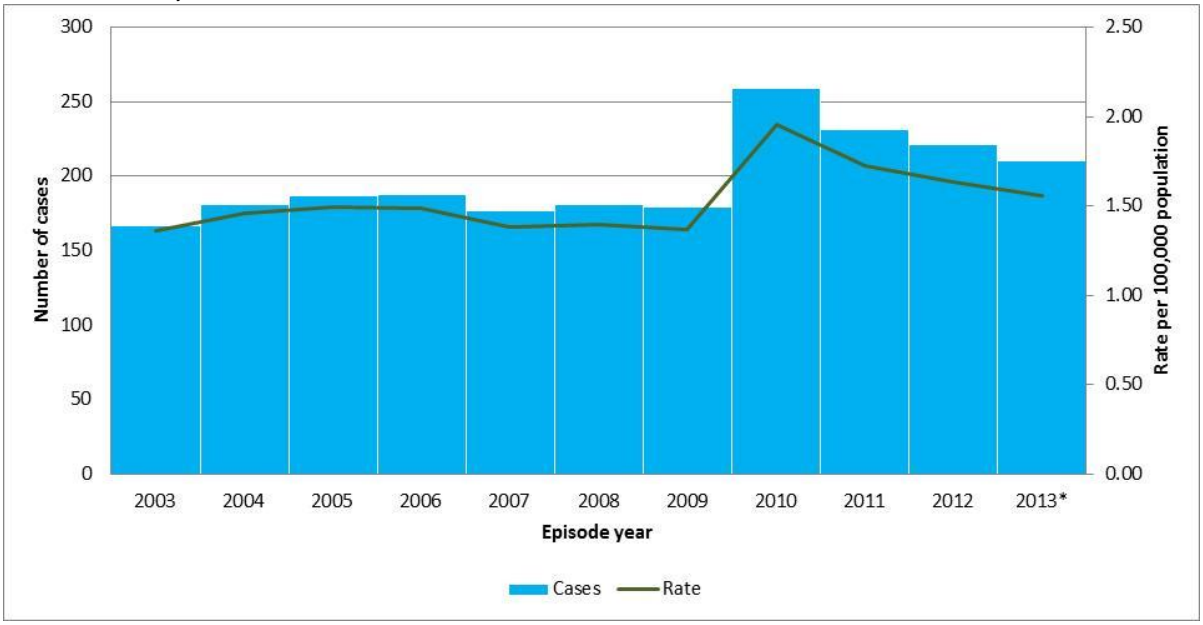
Malaria is a major cause of morbidity and mortality worldwide and often affects the poorest regions.[3] The latest numbers reported by the World Health Organization (WHO) show that in 2012 there were an estimated 207 million cases of malaria (with an uncertainty range of 135 million to 287 million) and an estimated 627,000 deaths (with an uncertainty range of 473,000 to 789,000). Malaria mortality rates have fallen by 42% globally since 2000, and by 49% in the WHO African Region.[5] Anyone residing in or visiting malaria endemic areas are at risk of infection. Many cases occur in travellers to malaria-endemic regions, often individuals who visit their home countries and do not take preventive measures. These individuals may believe that they still have some level of immunity to malaria but that is often not the case, especially if they have not resided in or visited their country-of-origin in a number of years.[6] Immunocompromised individuals, children under five, pregnant women, and those without access to health care are at the most risk of serious complications and death.

Malaria can be prevented by taking antimalarial prophylaxis and by taking measures to avoid getting bitten by mosquitoes. Personal protection measures include using insect repellents, avoiding going out at dusk and dawn, using screens on windows and doors, sleeping under a long-lasting insecticidal bed net, ensuring bed nets are free of holes, and wearing long pants and long-sleeved shirts. Local public health protection measures may include eliminating or larviciding mosquito larval development sites and indoor residual spraying.

In 2013, a total of 210 confirmed cases of malaria were reported in Ontario in the integrated Public Health Information System (iPHIS), with an incidence rate of 1.4 cases per 100,000 population. Figure 1 shows the provincial incidence rates of malaria from 2003 to 2013. The incidence rate increased in 2010 to 2.0 per 100,000 population, but has since declined. In 2013, the majority of malaria cases reported (n = 126, 60.0%) were attributed to the parasite *P. falciparum*, followed by *P. vivax* (n = 59, 28.1%) (Table

1). However, the proportion of malaria species reported by public health unit may vary from the provincial distribution. This variation may be due to differences in the most common travel destinations.

Figure 1. Reported number of cases and incidence rate (per 100,000 population) of confirmed malaria cases: Ontario, 2003 to 2013



Ontario cases: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/02/21].
Population Estimates [2009-2012]: Ontario Ministry of Health and Long-Term Care, intelliHEALTH Ontario, extracted [2013/09/16].
*Population estimates for 2012 were used to estimate provincial population counts for 2013.

Table 1: Number and proportion of confirmed malaria cases by *Plasmodium* parasite species: Ontario, 2013

***Plasmodium* species**	**Number of cases**	**Proportion**
P. falciparum	126	60.0
P. vivax	59	28.1
P. ovale	8	3.8
P. malariae	2	1.0
Unspecified species	15	7.1
Total	**210**	**100.0**

Data source: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/02/21].

Of the 210 confirmed cases reported in 2013, 139 (66.2%) were male. Cases ranged in age from one to 84 years, with a median age of 34 years. Age-specific incidence rates were highest among adults 20 to 29 (n = 47, 2.5 cases per 100,000 population) and 30 to 39 (n = 46, 2.6 cases per 100,000 population) years of age. Among all public health units, incidence rates were highest in the City of Hamilton (n = 18, 3.3 per 100,000 population), followed by the City of Toronto (n = 80, 2.9 per 100,000 population), Peel Region (n = 36, 2.6 per 100,000 population), and the City of Ottawa (n = 18, 2.0 per 100,000 population).

Eighty-seven cases reported hospitalization and no cases reported malaria as a contributing or underlying cause of death.

Exposure location was known for 183 (87.4%) of the 210 confirmed cases reported in 2013 (Table 2). The most frequently reported regions of exposure included travel to Africa (n = 122 or 58.1%) and the Indian sub-continent (n = 51 or 24.3%). A more detailed analysis of the spatiotemporal dynamics and demographic profiles of imported malaria infections in Ontario are described by Nelder *et al*.[6]

Table 2: Number and proportion of confirmed malaria cases by region of exposure: Ontario, 2013

Region of exposure	Number of cases	Proportion
Africa	122	58.1
Indian sub-continent	51	24.3
South America	5	2.4
Caribbean	3	1.4
Asia	2	1.0
Unknown	8	3.8
Missing	19	9.0
Total	**210**	**100.0**

Data source: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/02/21].

At the Public Health Ontario Laboratories (PHOL), blood specimens are tested using standard microscopy techniques for the detection of malaria parasites. However, if a person tests negative but their exposure history and clinical signs and symptoms suggest a malaria infection, a real time Polymerase Chain Reaction (PCR) assay is available. Genotyping to determine drug resistance is also available for infections with *P. falciparum*, to allow for the rapid detection and identification of markers of resistance to anti-malarial drugs including chloroquine, mefloquine, and malarone. For additional information on testing, refer to PHOL's Labstracts on real time PCR and genotyping of drug resistant markers.

SIGNIFICANT REPORTABLE DISEASE ACTIVITY

Table 1 provides a list of reportable diseases for which incidence in 2014 was significantly higher than expected compared to the five-year historical average (2009-2013). Both monthly and year-to-month (YTM) comparisons were made for each of the reportable diseases listed in Appendix 1.

Table 1. Summary of significant increases in reportable disease incidence: Ontario, January 1 to February 28, 2014

Reportable disease	2014				Historical comparisons						5-year avg annual count (2009-2013)
	Feb	Feb rate ŧ	YTM	YTM rate ŧ	Current month 5-year avg (2009-2013)	Current month 5-year avg (2009-2013) rate ŧ	% difference in rates (current month minus 5-year avg)†	YTM 5-year avg (2009-2013)	YTM 5-year avg (2009-2013) rate ŧ	% difference in rates (YTM 2014 minus YTM 5-year avg)†	
Gonorrhoea (All Types)[1,2]	388	28.0	871	62.9	284	21.3	31.8	652	48.7	29.1	4,067

Ontario Cases: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/03/19].
Population Estimates [2009-2012], Ontario Ministry of Health and Long-Term Care, IntelliHEALTH Ontario, Date Extracted: [2013/09/16].
Population Projections [2013-2014], Ontario Ministry of Health and Long-Term Care, IntelliHEALTH Ontario, Date Extracted: [2014/04/11].
ŧ Rates listed are cases per 1,000,000 population.
† Percent (%) difference is calculated using unrounded rates; numbers displayed in these columns may vary from calculations using rounded rates.
[1] Statistically significant difference ($p<0.05$) in incidence reported in year-to-month (January 1 to February 28, 2014) compared to the five-year historical average (January 1 to February 28, 2009-2013).
[2] Statistically significant difference ($p<0.05$) in incidence reported in current month (February 2014) compared to the five-year historical average (February 2009-2013).

GONORRHOEA (ALL TYPES)

Statistically significant increases in the monthly and/or YTM incidence of laboratory-confirmed gonorrhea in Ontario, in comparison to corresponding monthly/YTM historical five-year averages, have been reported since October 2013. The March 2014 issue of this report provides a summary of possible reasons for this increase.

INFECTIOUS DISEASE ACTIVITY IN OTHER JURISDICTIONS

This section of the report provides a snapshot of current activity related to infectious diseases across Canada and/or globally. The items included in this section are selected based on ongoing or potential implications for public health in Ontario.

EBOLA OUTBREAK IN WEST AFRICA: IMPLICATIONS FOR TRAVELLERS

Summary:

Little is known about the transmission of Ebola virus to humans. Scientists believe that the natural reservoirs for the virus are wildlife species including bats and non-human primates such as monkeys, gorillas, and chimpanzees. The virus is transmitted to humans through direct contact with an infected animal or the consumption of meat of an infected animal. Human-to-human transmission occurs through direct contact with infected bodily fluids including blood, secretions, organs, or semen.

As of April 4, 2014, Guinea has reported 143 clinically compatible cases of Ebola virus disease (EVD), of which 54 are laboratory confirmed by PCR and 86 have been fatal (case fatality rate (CFR) = 60%). Since March 24, 2014, Liberia has reported 18 suspected and two confirmed cases of EVD, including seven deaths. Four new clinically compatible cases were reported in Liberia on April 4, 2014. Suspected cases in Sierra Leone and Mali continue to be investigated. WHO does not recommend that any travel or trade restrictions be applied to Guinea, Liberia, Sierra Leone or Mali as a result of the ongoing outbreak.

Implications:

As of April 2, 2014, there have been no confirmed cases of EVD in Canada. The risk of infection is considered low for most travellers, but is considered higher for healthcare professionals with direct contact with patients in high-risk regions. The Public Health Agency of Canada recommends travellers avoid all direct contact with individuals or animals suspected of being infected with the Ebola virus. Although the mortality rate for EVD is high, the incidence of EVD globally is very low compared to other diseases such as malaria, dengue fever, and typhoid. In Ontario, vector-borne diseases, gastrointestinal diseases, and vaccine-preventable disease acquired overseas account for considerably more morbidity and mortality in travellers returning home. In addition, some of these infections can lead to localized secondary transmission, putting the local population at risk. While Ontarians travelling outside of Canada are advised to review travel advisories and consult a travel physician for specific health concerns and precautions related to their travel destination, the current Ebola outbreak in West Africa is of low risk to Canadians compared to other common travel-related diseases.

Sources:

1. http://www.afro.who.int/en/clusters-a-programmes/dpc/epidemic-a-pandemic-alert-and-response/outbreak-news/4079-ebola-virus-disease-west-africa-5-april-2014.html
2. http://www.cbc.ca/news/health/guinea-s-ebola-outbreak-there-are-far-worse-diseases-out-there-1.2585797
3. http://www.phac-aspc.gc.ca/tmp-pmv/notices-avis/notices-avis-eng.php?id=125
4. http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/11vol37/acs-3/index-eng.php

RECENTLY DISCONTINUED ENHANCED SURVEILLANCE DIRECTIVES

There have been no recently discontinued Enhanced Surveillance Directives to report.

References

In Focus – Malaria

1. U. S. Centers for Disease Control and Prevention. Atlanta, GA: US CDC; c 2012. Malaria parasites; 2012 Nov 09 [cited 2014 Apr 07]. Available from: *http://www.cdc.gov/malaria/about/biology/parasites.html*.
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6. 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). PLoS One. 2013;8(9):e76208. Available from: *http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0076208*.

Appendix – Reportable Diseases

Appendix 1. Confirmed cases of reportable diseases, and probable cases of select reportable diseases, by month: Ontario, 2009-2014*

Reportable disease	2014														Historical comparisons						5-year avg (2009-2013) annual count
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTM	YTM rate ŧ	Current month 5-year avg (2009-2013)	Current month 5-year avg (2009-2013) rate ŧ	% difference rates (current month minus 5-year avg)†	YTM 5-year avg (2009-2013)	YTM 5-year avg (2009-2013) rate ŧ	% difference rates (YTM 2014 minus YTM 5-year avg)†	
Acute Flaccid Paralysis	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
AIDS	1	3	-	-	-	-	-	-	-	-	-	-	**4**	0.3	7	0.5	-59	21	1.6	-82	105
Amebiasis	39	60	-	-	-	-	-	-	-	-	-	-	**99**	7.2	61	4.5	-5	133	9.9	-28	803
Botulism	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-	0	0.0	-100	2
Brucellosis	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-100	1	0.0	-100	5
Campylobacter Enteritis	221	176	-	-	-	-	-	-	-	-	-	-	**397**	28.7	191	14.3	-11	382	28.6	0	3,594
Chlamydial Infections	3,081	2,655	-	-	-	-	-	-	-	-	-	-	**5,736**	414.3	2,665	199.3	-4	5,629	421.0	-2	33,974
Cholera	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-100	0	0.0	-100	0
Cryptosporidiosis	14	10	-	-	-	-	-	-	-	-	-	-	**24**	1.7	14	1.1	-32	29	2.1	-19	311
Cyclosporiasis	2	1	-	-	-	-	-	-	-	-	-	-	**3**	0.2	3	0.2	-63	6	0.4	-52	117
Encephalitis	3	0	-	-	-	-	-	-	-	-	-	-	**3**	0.2	1	0.1	-100	3	0.2	3	19
Encephalitis/Meningitis	13	9	-	-	-	-	-	-	-	-	-	-	**22**	1.6	9	0.7	-6	17	1.3	26	151
Food Poisoning, All Causes	4	0	-	-	-	-	-	-	-	-	-	-	**4**	0.3	3	0.2	-100	14	1.1	-73	88
Giardiasis	80	63	-	-	-	-	-	-	-	-	-	-	**143**	10.3	103	7.7	-41	220	16.4	-37	1,382
Gonorrhoea (All Types)	483	388	-	-	-	-	-	-	-	-	-	-	**871**	62.9	284	21.3	32	652	48.7	29	4,067
Group A Streptococcal Disease, Invasive	80	73	-	-	-	-	-	-	-	-	-	-	**153**	11.1	61	4.6	15	122	9.1	22	584
Group B Streptococcal Disease, Neonatal	6	6	-	-	-	-	-	-	-	-	-	-	**12**	0.9	4	0.3	45	8	0.6	49	55
Haemophilus Influenzae B Disease, Invasive	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-100	1	0.0	-100	4
Hepatitis A	5	5	-	-	-	-	-	-	-	-	-	-	**10**	0.7	12	0.9	-60	21	1.6	-54	117
Hepatitis B	17	9	-	-	-	-	-	-	-	-	-	-	**26**	1.9	9	0.7	-6	18	1.3	43	115
Hepatitis C	346	323	-	-	-	-	-	-	-	-	-	-	**669**	48.3	339	25.3	-8	716	53.5	-10	4,324
HIV	40	46	-	-	-	-	-	-	-	-	-	-	**86**	6.2	63	4.7	-29	131	9.8	-37	813
Influenza	2,909	987	-	-	-	-	-	-	-	-	-	-	**3,896**	281.4	796	59.5	20	2,098	156.9	79	7,327
Legionellosis	7	1	-	-	-	-	-	-	-	-	-	-	**8**	0.6	5	0.4	-81	10	0.7	-20	160
Leprosy	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-	0	0.0	-100	2
Listeriosis	2	2	-	-	-	-	-	-	-	-	-	-	**4**	0.3	4	0.3	-54	7	0.6	-48	52
Lyme Disease	1	2	-	-	-	-	-	-	-	-	-	-	**3**	0.2	1	0.1	61	4	0.3	-24	172
Malaria	14	10	-	-	-	-	-	-	-	-	-	-	**24**	1.7	10	0.8	-7	27	2.0	-13	220
Measles	1	2	-	-	-	-	-	-	-	-	-	-	**3**	0.2	0	0.0	141	1	0.1	141	8
Meningitis	6	5	-	-	-	-	-	-	-	-	-	-	**11**	0.8	5	0.4	1	11	0.9	-7	115
Meningococcal Disease, Invasive	5	3	-	-	-	-	-	-	-	-	-	-	**8**	0.6	4	0.3	-34	9	0.7	-12	40
Mumps	1	0	-	-	-	-	-	-	-	-	-	-	**1**	0.1	5	0.4	-100	14	1.1	-93	67
Ophthalmia Neonatorum	0	1	-	-	-	-	-	-	-	-	-	-	**1**	0.1	0	0.0	141	0	0.0	141	3
Paralytic Shellfish Poisoning	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Paratyphoid Fever	2	1	-	-	-	-	-	-	-	-	-	-	**3**	0.2	5	0.4	-82	13	0.9	-77	48
Pertussis (Whooping Cough)	9	5	-	-	-	-	-	-	-	-	-	-	**14**	1.0	20	1.5	-76	52	3.9	-74	421
Q Fever	1	2	-	-	-	-	-	-	-	-	-	-	**3**	0.2	0	0.0	383	1	0.1	107	14
Rabies	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-	0	0.0	-	0
Rubella	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-100	1	0.0	-100	1
Rubella, Congenital Syndrome	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-	0	0.0	-	0
Salmonellosis	228	197	-	-	-	-	-	-	-	-	-	-	**425**	30.7	197	14.7	-3	376	28.1	9	2,631
Shigellosis	25	20	-	-	-	-	-	-	-	-	-	-	**45**	3.3	18	1.4	6	42	3.1	4	257
Streptococcus Pneumoniae, Invasive	113	80	-	-	-	-	-	-	-	-	-	-	**193**	13.9	106	7.9	-27	237	17.8	-21	1,205
Syphilis, Early Congenital	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-	0	0.0	-	1
Syphilis, Infectious	46	20	-	-	-	-	-	-	-	-	-	-	**66**	4.8	56	4.2	-65	127	9.5	-50	768
Syphilis, Other	30	16	-	-	-	-	-	-	-	-	-	-	**46**	3.3	59	4.4	-74	126	9.4	-65	761
Tetanus	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-100	1	0.0	-100	1
Tuberculosis	31	40	-	-	-	-	-	-	-	-	-	-	**71**	5.1	49	3.7	-21	93	7.0	-26	636
Tularemia	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-	0	0.0	-	1
Typhoid Fever	6	9	-	-	-	-	-	-	-	-	-	-	**15**	1.1	9	0.7	-3	19	1.4	-24	82
Verotoxin Producing E. Coli including HUS	7	5	-	-	-	-	-	-	-	-	-	-	**12**	0.9	5	0.4	-3	14	1.1	-18	181
West Nile Virus Illness	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-	0	0.0	-	84
Yellow Fever	0	0	-	-	-	-	-	-	-	-	-	-	**0**	0.0	0	0.0	-	0	0.0	-100	0
Yersiniosis	10	8	-	-	-	-	-	-	-	-	-	-	**18**	1.3	17	1.3	-55	36	2.7	-52	199

Ontario Cases: Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted by Public Health Ontario [2014/03/19].

Population Estimates [2009-2012], Ontario Ministry of Health and Long-Term Care, IntelliHEALTH Ontario, Date Extracted: [2013/09/16].

Population Projections [2013-2014], Ontario Ministry of Health and Long-Term Care, IntelliHEALTH Ontario, Date Extracted: [2014/04/11].

* Appendix 1 is not an exhaustive list of all reportable diseases in Ontario. Case counts for amebiasis, Lyme disease, mumps, pertussis and West Nile Virus illness are based on the sum of confirmed and probable cases as reported in iPHIS.

ŧ Rates listed are cases per 1,000,000 population.

† Percent (%) difference is calculated using unrounded rates; numbers displayed in these columns may vary from hand calculations using rounded rates.

Note 1: Does not include cases in which the Ministry of Health and Long-Term Care was selected as the Diagnosing Health Unit or cases with a Disposition Description set to 'does not meet' or 'entered in error'.

Note 2: Case counts for tuberculosis and AIDS are based on diagnosis date and not episode date. HIV case counts are based on encounter date.
Note 3: Differentials in year over year comparisons are reflective of changes in disease incidence and changes in the size of the population.
Note 4: Measles, rubella and congenital rubella syndrome have been eliminated from Canada. However, as these diseases remain endemic in other countries, imported cases continue to occur in Ontario.
Note 5: Statistical tests comparing rates were not performed when the YTM rate in previous years was zero.
Note 6: Acute flaccid paralysis and Paralytic Shellfish Poisoning became reportable in Ontario in December 2013. No historical data is available.