

# Ontario Burden of **INFECTIOUS DISEASE** Study

## Summary



# Ontario Burden of **INFECTIOUS DISEASE** Study (ONBOIDS)



*The study looked at 51 different sources of infectious disease to estimate their impact on the life and health of Ontarians and found a few surprises. In fact, many of the infectious diseases ranked highest in terms of impact get little recognition in terms of public awareness, media attention and resource allocation.*

*You are invited to view the full report which is available for download at [www.oahpp.ca](http://www.oahpp.ca) or at [www.ices.on.ca](http://www.ices.on.ca)*

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**On behalf of the ONBOIDS investigators**



# Study Findings

*Every year Ontarians seek medical attention for more than seven million episodes of infectious diseases; nearly 5,000 people will die from these diseases, with nearly half of the impact due to the five most prevalent pathogens, or infectious agents. In all, infectious diseases have approximately 25% of the impact of all cancers in Ontario.*

The impact of infectious diseases is largely felt in terms of premature death, with less of the impact in the form of reduced functioning or poor health from the disease and its consequences.

## **ACCORDING TO THE STUDY, THE TEN MOST BURDENSOME INFECTIOUS AGENTS IN ONTARIO ARE:**

- Hepatitis C virus (HCV)
- *Streptococcus pneumoniae*
- Human papillomavirus (HPV)
- Hepatitis B virus (HBV)
- *Escherichia coli* (*E. coli*)
- Human immunodeficiency virus (HIV/AIDS)
- *Staphylococcus aureus*
- Influenza
- *Clostridium difficile*
- Rhinoviruses (common cold)

The number of infectious agents that are tied to hospital-acquired infections, however, points to the need to focus on hospital hygiene and infection control measures in order to better prevent these infections. The success of universal childhood vaccination at largely eliminating many infectious diseases, such as mumps, measles, rubella, tetanus, polio and diphtheria, points to the need to focus on similar immunization programs where vaccines exist to ensure they achieve their full potential to prevent disease (such as in the case of human papillomavirus).

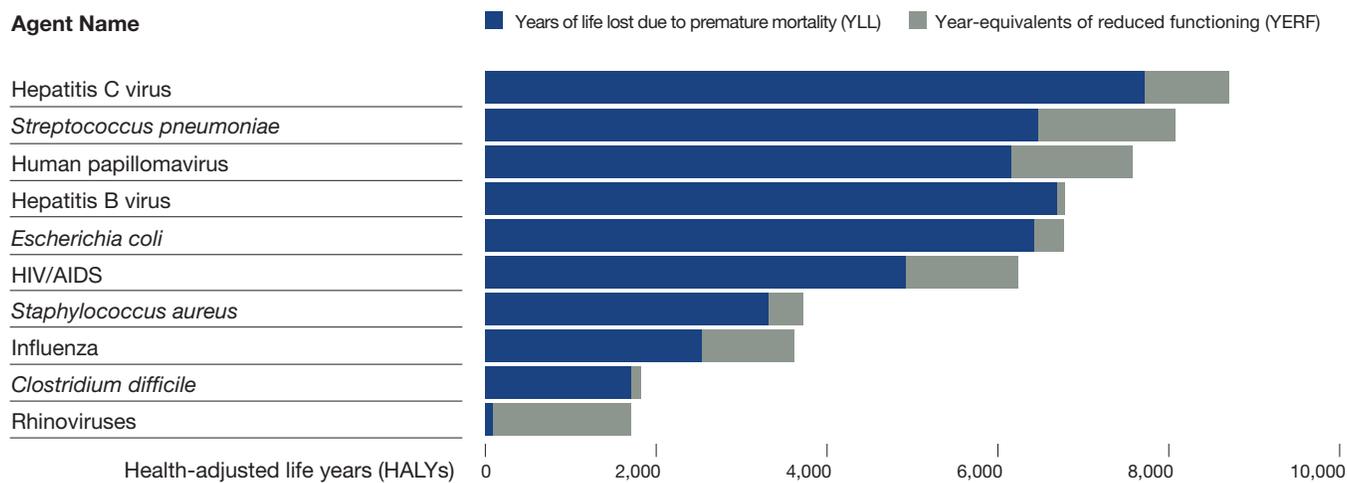
## **CONCLUSIONS AND RECOMMENDATIONS**

Based on its findings, the study calls for:

- Policies and knowledge exchange and dissemination to increase the uptake of existing means of preventing infectious diseases (e.g., vaccines, hand hygiene, and needle exchange programs).
- Increased investment in developing new ways to fight infectious diseases (e.g., new vaccines and antibiotics).
- Increased screening for diseases such as hepatitis B and C, in order to identify and support those already infected and thus help to minimize the long-term impact of these diseases.
- Improvements in data quality and availability.
- Better infrastructure required for surveillance, research and program evaluation (which could be accomplished in many cases by better linkage of existing data).

**ONBOIDS** will provide guidance in planning and policy related to public health and clinical services, as well as future research priorities in areas ranging from basic sciences to clinical services, to epidemiology and population health.

# The Most Important INFECTIOUS AGENTS in Ontario



## HEPATITIS C VIRUS (HCV)

**Hepatitis C virus (HCV)**, like other strains of viral hepatitis, causes inflammation of the liver. It is most commonly transmitted by blood-to-blood contact, such as through sharing contaminated needles. Most people with HCV do not have symptoms; however, 50–85% of people with the virus eventually develop chronic hepatitis. Over 20 years with the disease, up to 10% of people will develop cirrhosis, or scarring of the liver and loss of function. Over 30 years, 1–3% will develop liver cancer.

**Impact:** Each year, there are about 3,469 new cases of HCV and an estimated 369 deaths. The burden of HCV is greatest among men aged 44–59.

**Targeting hepatitis C:** There are no vaccines against hepatitis C. Transmission can be prevented through harm-reduction measures such as needle exchange programs. For many people, the infection can be treated with antiviral medications, but HCV remains the most common cause of liver transplants.

## STREPTOCOCCUS PNEUMONIAE

***Streptococcus pneumoniae* (*S. pneumoniae*)** is a bacterial infection that causes a range of syndromes ranging in severity from mild to fatal. It can cause upper respiratory tract infections, such as ear infections and sinusitis, as well as lower respiratory tract infections. The bacterium is the number one cause of pneumonia and meningitis.

**Impact:** *S. pneumoniae* is calculated as having the highest disease burden of the bacterial infections, accounting for an average of 632 deaths each year and 518,703 illnesses requiring medical attention. Most of the people affected by *S. pneumoniae* are aged 65 or older.

**Targeting *S. pneumoniae*:** A vaccine against 23 types of *S. pneumoniae* has been available for use in adults for many years, while newer and more effective vaccines against up to 13 types of the bacterium have been approved for use in children and high-risk groups.

## HUMAN PAPILLOMAVIRUS (HPV)

**Human papillomavirus (HPV)** is transmitted through sexual contact. Infection with HPV happens largely without symptoms. Most infections in otherwise healthy women tend to resolve spontaneously, but it remains the cause of almost all cases of cervical cancer and genital warts.

**Impact:** HPV has the greatest impact of all sexually-transmitted infections. It is estimated to cause 254 deaths each year and 1,090 new cases of cancer—of which cervical, anal canal and head and neck cancers are the most common. HPV is also responsible for over 14,000 new cases of genital

warts each year. Many more women than men suffer from HPV, which largely affects people over 20 years old and peaks in those aged 40–64 (when most cancers develop).

**Targeting HPV:** Vaccines are available that protect against two of the cancer-causing forms of HPV; one vaccine also protects against non-cancer-causing forms of HPV, which are responsible for about 90% of genital warts. Recent studies indicate, however, that uptake of the vaccines in Ontario has been relatively poor. Pap smears are routinely used to screen for abnormal cells before they progress to cervical cancer.

## HEPATITIS B VIRUS (HBV)

**Hepatitis B virus (HBV)**, like hepatitis C, infects the liver. It is transmitted by sexual contact, injection drug use, and from mother to child during childbirth or breastfeeding. People infected with HBV can have no symptoms; but can also develop acute hepatitis or liver inflammation, with symptoms such as fever, weight loss, abdominal pain, fatigue and jaundice. Nearly all (80–90%) infected infants go on to develop chronic hepatitis, but only 5% of infected adults do so. Complications of chronic hepatitis include cirrhosis (scarring of the liver and loss of function) and liver cancer.

**Impact:** There are an estimated 213 new HBV infections in Ontario each year and an estimated 346 deaths from the virus. The disease mostly affects men and people aged 40–79.

**Targeting hepatitis B:** There is a vaccine available to protect against HBV infection, which is administered through a school-based program in Ontario. In some cases, antiviral medications can clear the infection.

## ESCHERICHIA COLI (E. COLI)

**Escherichia coli (E. coli)** is one of the most common bacteria found in the human gastrointestinal tract. When it invades areas outside the gastrointestinal tract, however, it can produce infections such as cystitis (lower urinary tract infection), pyelonephritis (upper urinary tract infection) and septicemia (bloodstream infection). *E. coli* can also contribute to infections among hospitalized patients. Note that this does not include *E. coli* O157:H7, which has more serious outcomes, but is also much more rare.

**Impact:** *E. coli* is estimated to cause an average of 600 deaths per year and 451,268 cases of illness requiring medical

attention. It most significantly affects those aged 65 or older; women experience a greater impact of *E. coli* than men, mostly because their anatomy leaves them more vulnerable to urinary tract infections.

**Targeting *E. coli*:** There are no vaccines against *E. coli* infection. Hygiene measures and reducing the use of urinary catheters can contribute to a reduction in the burden of *E. coli*.

## HUMAN IMMUNODEFICIENCY VIRUS (HIV)

**Human immunodeficiency virus (HIV)** is the virus associated with Acquired Immunodeficiency Syndrome (AIDS). The virus is transmitted by sexual contact, sharing of contaminated needles, exposure to HIV-infected bodily fluids and from mother to child during childbirth or breastfeeding. HIV infects human white blood cells and gradually destroys the body's immune system so that, after a prolonged latent period, patients eventually develop infections that people with unharmed immune systems would usually be able to fight off effectively.

**Impact:** There are an estimated 133 deaths due to HIV/AIDS each year, 1,659 new cases of HIV infection and 306 new

cases of AIDS in Ontario. HIV infection occurs mostly among men and those aged 30–59.

**Targeting HIV:** While there is currently no HIV vaccine, research efforts to develop one are ongoing. Harm-reduction techniques, such as needle exchange programs and the promotion of safe sexual practices, can reduce HIV infection; antiviral medications can reduce mother-to-child transmission. There is no cure for HIV, but highly active antiviral medications can prolong life by suppressing the virus—in effect transforming HIV infection into a chronic disease.

## STAPHYLOCOCCUS AUREUS

**Staphylococcus aureus (S. aureus)** is a bacterium carried by 10–40% of the population that can produce a range of serious illnesses. It is the number one cause of hospital-associated infections, but is also a common cause of infections acquired in the community. *S. aureus* can cause infections in soft tissue, bones, joints, bloodstream, the heart and lungs. MRSA, or methicillin-resistant *S. aureus*, is a cause of significant concern in hospitals because it can be spread very easily from patient to patient, and there is a high concentration of people who are most vulnerable to infection.

**Impact:** *S. aureus* is estimated to cause an average of 268 deaths each year and is responsible for 158,443 illnesses requiring medical attention. *S. aureus* affects slightly more women than men and is most common among people aged 65 or older.

**Targeting S. aureus:** A vaccine against *S. aureus* is currently under development. Treatment is complicated because many strains of *S. aureus* are resistant to common antibiotics, including penicillin and cephalosporin. Since the majority of *S. aureus* infections are associated with in-hospital health care, the main preventive options involve hospital infection control activities.

## INFLUENZA

**Influenza** is a virus transmitted by droplets in people's breath and, possibly, through the air. It is responsible for seasonal epidemics during the winter months in temperate climates, such as Ontario's. Patients may develop fever, muscle pain, cough and sore throat, but sometimes have milder symptoms or none at all. Complications can include ear infections, bronchitis and pneumonia. While influenza epidemics occur each year, pandemics are much more rare (resulting when human, bird and/or swine strains of influenza combine to create a new virus to which the majority of people have no immunity).

**Impact:** Seasonal influenza causes an estimated 272 deaths each year, as well as 621,151 illnesses requiring medical attention. Influenza has the greatest impact on older age groups, since deaths from influenza are largely among people aged 65 or older.

**Targeting influenza:** Vaccines are available for influenza, though the rapid evolution of influenza viruses requires that a new vaccine be developed each year before the influenza season. Ontario has a universal immunization program that provides free access to influenza vaccines to everyone who lives, works or studies in the province.

## CLOSTRIDIUM DIFFICILE

*Clostridium difficile* (*C. difficile*) is a bacterium that can produce intestinal infections in patients whose normal protective bacteria have been disrupted by recent antibiotic use. It is primarily acquired in hospital. People with *C. difficile* experience watery diarrhea and can develop complications of varying severity. In a minority of patients, bowel removal is required to achieve a cure. Some 5% of people with *C. difficile* will die as a result of their infection.

**Impact:** *C. difficile* is responsible for an average of 167 deaths each year; there are 5,364 new cases.

**Targeting *C. difficile*:** There is no vaccine available against *C. difficile*. Good hygiene, infection control measures and avoidance of inappropriate antibiotic use in hospitals and other health care settings could prevent many cases of *C. difficile*. Treatment involves the use of anti-*C. difficile* antibiotics, hydration and bowel removal (rare).

## RHINOVIRUSES

**Rhinoviruses** refer to a group of viruses that are the main cause of the common cold. They are the most common viral infections in humans and are spread through droplets in the air (e.g., from a sneeze), contaminated objects (e.g., touching a doorknob an infected person has previously touched) and person-to-person contact. Symptoms include runny nose, congestion, cough and sore throat. Patients may also experience fatigue, muscle aches, fever and loss of appetite.

**Impact:** Each year, rhinoviruses cause an estimated five deaths each year and 1,615,561 illnesses requiring medical attention. Cases of rhinoviruses are spread fairly equally

among men and women and across age groups, although there are fewer cases in people over the age of 60.

**Targeting rhinoviruses:** There is no vaccine or other method for preventing the common cold. Hygiene measures, such as frequent hand washing, are the primary way to prevent colds. There is no treatment available for colds, although some people find that symptoms can be relieved through the use of over-the-counter medications.

**ONBOIDS** provides information for priority setting, planning and decision-making by those involved in public health and health promotion.



## ABOUT THE ONTARIO BURDEN OF INFECTIOUS DISEASE STUDY

The Ontario Burden of Infectious Disease Study (ONBOIDS) is the most thorough examination of the impact of infectious diseases undertaken to date in Ontario. A joint project between the Ontario Agency for Health Protection and Promotion (OAHPP) and the Institute for Clinical Evaluative Sciences (ICES), the study sought to estimate the relative impact of a wide range of infectious diseases, in order to inform priority setting, planning and decision-making by those involved in public health and health promotion.

### The objectives of the study were to:

- determine the relative contribution of select infectious diseases to the overall burden of infectious diseases in Ontario;
- inform priority setting, planning and decision-making within infectious diseases;
- establish a baseline for future evaluations of public health interventions; and,
- identify the strengths and weaknesses of existing data on infectious diseases in Ontario.

The study used health-adjusted life years (HALYs), a composite health gap measure that incorporates both premature death (mortality) and the reduced functioning or suboptimal state of health (morbidity) associated with disease or injury. HALYs quantify the amount of “healthy” life lost by estimating the difference between actual population health and some specified norm or goal. HALYs incorporate the concepts of both quality-adjusted life years (QALYs) and disability-adjusted life years (DALYs). They are calculated by combining years of life lost due to premature death (YLL) and year-equivalents of reduced functioning from living with disease (YERF).

Disease burden was estimated by pathogen (the agent causing infection) and by syndrome (the type of disease caused by the pathogen), for a total of 51 pathogens and 16 syndromes. The study focused on infections that are severe enough to require medical attention or which are reportable, adjusting for underdiagnosis and underreporting where possible. Deaths were estimated from Ontario vital statistics data between 2003 and 2005. Disease incidence was estimated during 2005–2007 from Ontario reportable disease, health care utilization and cancer registry data—supplemented by local modelling studies and national/international epidemiologic studies.



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**ABOUT OAHPP** OAHPP is an arm’s-length government agency dedicated to protecting and promoting the health of all Ontarians and reducing inequities in health. As a hub organization, OAHPP links public health practitioners, front-line health workers and researchers to the best scientific intelligence and knowledge from around the world.

OAHPP provides expert scientific and technical support to support health providers, the public health system and partner ministries in making informed decisions and taking informed action to improve the health and security of Ontarians.

**ABOUT ICES** Since its inception in 1992, ICES has played a key role in providing unique scientific insights to help policymakers, managers, planners, practitioners and other researchers shape the future direction of the Ontario health care system. Our unbiased, evidence-based knowledge and recommendations, profiled in atlases, investigative reports, and peer-reviewed journals, are used to guide decision-making and inform changes in health care delivery.