

Appendix 4:

Data Sources and Population Health Indicators Limitations

An Appendix to the Initial Report on Public Health (2009)
Public Health Division
Ministry of Health and Long-Term Care



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Data Sources

The purpose of this appendix is to further discuss the data sources used for the indicators presented in the *Initial Report* as well as to describe the indicator methodology in more detail to complement the narratives in the *Initial Report*. Below is a brief description of the data sources used in this report. The indicator methods and definitions provide further technical information including data sources and formulas used to calculate each indicator.

Data Sources used in the report:

1. Census 2006
2. Provincial Health Planning Database (PHPDB)
3. Integrated Services for Children Information System (ISCIS)
4. Canadian Community Health Survey (CCHS)
5. Integrated Public Health Information System (iPHIS)
6. Immunization Records Information System (IRIS)
7. Adverse Water Quality Incidents
8. Survey of Boards of Health, 2008

Each indicator was developed with the participation of the members of the *Public Health Performance Management Working Group* as well as through feedback from subject matter experts. In addition to the methodology described under each indicator definition and analysis description, where appropriate, specific indicators have been age-standardized.

As many prevalence estimates and rates vary greatly by age, (weighted) estimates were directly age-standardized to the 1991 Canadian Population. (Appendix 3 of this report) Presentations of age-specific rates can be cumbersome, and age-standardized rates have the advantage of providing a single summary number that allows different populations to be compared; however, they present an “artificial” picture of the health outcomes in a community, and will vary from crude rates (i.e., not age-standardized) often presented in local health status reports.

1. Census 2006

The Canadian Census is conducted by Statistics Canada every five years to provide a reliable source for describing the characteristics of Canada's people, dwellings and agricultural operations. The most recent Census of Canada took place on Tuesday, May 16, 2006. The data from this Census was released in stages during 2007 and 2008. Where available, 2006 data are used. Information is supplemented with 2001 data where necessary.

The Census provides the population and dwelling counts not only for Canada but also for each province and territory, and for smaller geographic units such as cities or districts within cities. The Census also provides information about Canada's demographic, social and economic characteristics.^{1,2}

2. Provincial Health Planning Database (PHPDB)

The Provincial Health Planning Database (PHPDB) is a standardized database of health-related demographic, clinical, and statistical data derived from a variety of internal and external sources. The PHPDB is an information resource provided by the Health Data Branch of the Ontario Ministry of Health and Long-Term Care (MOHLTC). Queries on PHPDB are completed via an online portal called Intellihealth.

The PHPDB is one of the primary sources of morbidity and mortality data in Ontario. It is designed to make vast data holdings accessible to a variety of users, such as analysts, epidemiologists, planners, policy and decision makers and researchers. Data warehouse technology is used to store, manage and provide access to health-related information that has been consolidated from a range of sources. The end result is a database of standardized health information that can be collated and manipulated to satisfy specific needs.

The information holding includes selected hospital information, home care information, vital statistics (births and deaths), and population information. Key characteristics are patient location (geography) including public health unit and Local Health Integration Network (LHIN), hospital location, age, sex, birth date, newborn birth weights, admission/discharge information, triage (Emergency Room (ER) only), patient diagnoses, interventions performed when applicable, case groups and resource weighting. A feature of the database is the value-added attributes, not present in the original sources, designed to make querying easier and more "foolproof" for the end user.³

3. Integrated Services for Children Information System (ISCIS)

The Integrated Services for Children Information System (ISCIS) encompasses three different provincial information systems that support five service delivery programs for children and youth. These programs are: Healthy Babies Healthy Children, Preschool Speech and Language, Infant Hearing, Blind Low Vision and the Autism Intervention Program. ISCIS was funded and developed by the Ministry of Health and Long-Term Care, and was transferred to the Ministry of Children and Youth Services when the programs were transferred.

The ISCIS data are the responsibility of the public health units. Individual health units are responsible for the accuracy and completeness of the data, including information provided by health professionals in the field.

There is potential for duplicate records for children or families in the Healthy Babies Healthy Children (HBHC) ISCIS. For example, the number of total live births can be extracted from the Reporting Statistics that are manually entered into ISCIS by the health unit. This number is obtained from hospitals and should reflect the number of live births for the health unit jurisdiction only. Home births would likely not be included in the total number of live births, unless they were forwarded to the health unit. Other databases can also routinely provide estimates on the number of live births in Ontario via hospital delivery records, or through birth registration records from ServiceOntario.

Generally, the ISCIS data are of good quality. Data comparisons across health units should not be made unless the data collection methodology between health units is deemed comparable.

4. Canadian Community Health Survey (CCHS)

The Canadian Community Health Survey (CCHS) is conducted by Statistics Canada. The survey provides cross-sectional (at one point in time) estimates of the factors that influence the population's health status and their use of the health system for 126 health regions across Canada. It relies upon a large sample of respondents and is designed to provide reliable estimates at the health region level. The target population of the CCHS includes household residents in all provinces and territories, with the exclusion of populations on Indian Reserves, Canadian Forces Bases, and some remote areas. Sampling design is multi-stage. A single respondent within a household is randomly selected, and is asked questions on a wide range of health topics, including: physical activity, height and weight, smoking, exposure to secondhand smoke, alcohol consumption, general health, chronic health conditions, injuries, use of health care services and related socio-demographic information.

The CCHS has four content components: the core content, the theme content, the optional content and the rapid response content. The core content is collected from all survey respondents and will remain relatively unchanged over several years. The theme content, also collected from the entire sample, varies from year to year. The optional content fulfils the need for data at the health region level. This content, while often harmonized across the province, is unique to each region or province and may vary from year to year. Lastly, the rapid response component is offered to organizations interested in national estimates on an emerging or specific issue related to the population's health. The rapid response content may be included in the survey in each collection period, that is, in every two month period. The vast majority of indicators presented in this report are specific to the core content.

Prior to 2007, data collection occurred every two years on an annual period. Data are available for the 2001, 2003 and 2005 periods. Each cycle comprised two distinct surveys:

- Cycle x.1 – a large sample survey in the first year designed to provide estimates at the sub-provincial level (Health Regions or combinations of Health Regions).
- Cycle x.2 – a smaller in-depth survey focused on a particular topic in the second year that provides estimates at the provincial and national levels.

In 2007, major changes were made to the survey design with the goal of improving its effectiveness and flexibility through data collection on an ongoing basis. Data collection now occurs every year. The CCHS produces an annual microdata file and a file combining two years of data. The CCHS collection years can also be combined by users to examine populations or rare characteristics. The majority of indicators included in this report are from CCHS 2007, with the exception of breastfeeding duration which uses data spanning three survey files.

Before any estimate is released, the number of respondents that contributed to the calculation of the estimate must be determined. It is recommended that if the number of respondents that contributed to the calculation of the estimate is less than 30, it should not be released regardless of the value of the coefficient of variation. Statistics Canada release guidelines for the CCHS survey were followed. Where the coefficient of variation exceeded 33.3, it was denoted with an ^F and the estimate was suppressed due to unacceptable data quality. Where the coefficient of variation was between 16.6 and 33.2, estimates were denoted with ^F indicating that high sampling variability is associated with the estimates. Lastly, estimates with a coefficient of variation between 0.0 and 16.5 required no special notation as they are considered acceptable for a general unrestricted release.

Sampling and non-sampling errors are two of the types of errors related to the CCHS.

Because the CCHS is a sample survey, rather than a census of the population under similar conditions, estimates are subject to sampling error. Sampling errors for CCHS estimates are calculated using the “bootstrap” re-sampling technique. Errors not related to sampling are called non-sampling errors (e.g., a respondent may misunderstand a question or a response may be recorded incorrectly). These types of errors may be present in any survey although much effort is expended to minimize these types of errors in the CCHS. Non-response (either item non-response or total non-response) is another potential source of non-sampling error. Total non-response occurs when a respondent either refused to participate in the survey or because the interviewer could not contact the selected respondent. Social desirability and recall bias are potential sources of bias in the CCHS.⁴

5. Immunization Records Information System (IRIS)

The Immunization Records Information System (IRIS) is a DOS-based system that was developed for public health departments in 1993 to maintain the immunization and tuberculin testing records of all school-aged children within their jurisdictions. Immunization levels are calculated for each of the six diseases (diphtheria, tetanus, polio, measles, mumps and rubella) for which immunization is required under the *Immunization of School Pupils Act (1982)*. Under the *Immunization of School Pupils Amendment Act, 1984*, parents are directly responsible for the immunization status of their children. Parents are obligated to report any vaccinations that their children receive in a doctor’s office to the public health unit and it is then entered into IRIS. At the moment, measles, mumps, rubella, diphtheria, tetanus, and polio vaccines are the only mandatory vaccines required under the Act. In addition to mandatory vaccines, IRIS also has the capacity to record most childhood vaccines, especially those that are publicly funded, including Hepatitis B, Varicella, Haemophilus, Pneumococcal Conjugate, Meningococcal Conjugate C, and human papillomavirus. This information belongs to the public health units and they are responsible for producing reports on the immunization status of their areas. Medical Officers of Health also use IRIS data to suspend pupils who have not completed the prescribed

program of immunization and do not have a medical or other exemption to these vaccinations, as outlined in the *Immunization of School Pupils Act*. In this report, data for Hepatitis B immunization is not necessarily from iPHIS; it is dependant on how the individual health unit has recorded Hepatitis B immunization information, and what information had been sent to the MOHLTC through survey.

Demographic, parent/guardian contact and school information for school-aged children is imported into IRIS from the Boards of Education and private schools within the boundaries of each health unit. The quality of demographic information in IRIS is largely dependent on the quality of this data and the import process. This data is used by IRIS as the denominator for generating vaccine coverage reports.¹

The Ministry of Health and Long-Term Care is the facilitator for data transfer and provides the architecture for the application. There is a two-way exchange of data between the Ministry's central immunization database and the individual public health units' databases, to ensure information is correct and available when a child moves between public health units. The system information is aggregated at a high level to be used by policy analysts at the MOHLTC to support annual business planning. Occasionally, the information is shared with outside health organizations and is published in medical journals and reports.

Low immunization coverage levels may appear in some years, mainly because children are at the age where their booster for a particular vaccine becomes overdue. In most cases, the child has been appropriately immunized, but due to the reporting lag in the IRIS model, the information may not be available for analysis. IRIS data is entered retrospectively when a child enters the school system or daycare. Early childhood vaccine information is not available in real time.⁵ As such, the criteria used to generate vaccine coverage reports from IRIS should be examined carefully before making comparisons across health units. IRIS vaccine coverage reports may report children who have complete vaccinations for their age based on a specified date or based on reference to the child's date of birth. Reports are based on data available at the time the report is generated. Any updates to the data will change the output of subsequent reports.^{6,7}

6. Integrated Public Health Information System (iPHIS)

In Ontario, the integrated Public Health Information System (iPHIS) is the information system used for reporting case information on all reportable communicable diseases for provincial and national surveillance, as described in Regulation 559 of the *Health Protection and Promotion Act* (HPPA). The HPPA requires that each public health unit in Ontario collect information about people with reportable diseases in their jurisdiction and report it to the Ministry of Health and Long-Term Care. This information is used for local, provincial and national surveillance.

In 2005, iPHIS replaced the Reportable Disease Information System (RDIS) and linked all Ontario health units into a common database. This was a major step in public health practice, as 36 standalone systems were integrated into one central, provincially managed, database. iPHIS uses an associated reporting tool called Cognos ReportNet to support the creation of provincial summaries and allows comparisons of rates of disease between health units. Upon implementation of the iPHIS system, each health unit converted selected variables associated with each RDIS case into iPHIS.

The most common source of case identification is through laboratory notification of confirmed test results (serology, microbiology cultures, etc.). Physicians are required to report cases that fulfill laboratory or clinical case definitions. The numbers of cases of reportable diseases included in iPHIS are an underestimate of the actual numbers since not all people with a reportable disease seek medical treatment, and therefore the disease goes unreported. Comparisons with other health units can be problematic because of inconsistencies with respect to data entry and case management across health units. In addition, it is possible that cases may be double-counted as people may interact with public health in more than one health unit for work or recreational purposes, or may move.

Rates and proportions based on counts less than 5 may be suppressed, depending upon circumstances.⁸

7. Adverse Water Quality Incidents

Regular water sampling occurs on the water source, the sample is analyzed by an accredited lab, and results are shared with the Ministry of the Environment through reporting to the Spills Action Centre, in addition to the local public health unit. An adverse water quality incident does not mean the drinking water supply is unsafe; it may simply indicate that on one occasion, one of the water quality standards was not met. Data quality depends on compliance with the reporting requirements contained within regulations, and relies on both operators and health units having appropriate reporting practices in place.

8. Survey of Boards of Health, 2008

A survey of Ontario's 36 boards of health was conducted in October 2008. The survey was designed to collect data on questions related to finance, human resources, and governance.

The survey was conducted as a web-based survey using Survey Monkey. A webinar was conducted to review the survey questions and technology prior to release. Public health units were then given three weeks to complete the survey. Results were downloaded from Survey Monkey and compiled in Microsoft Excel. Results were analyzed and then returned to health units for review to ensure their accuracy.

Population Health Indicator Limitations

1. Teen Pregnancy

Definition:

The teen pregnancy rate estimates the number of pregnancies (resulting in live births, still births and therapeutic abortions) per 1,000 females age 15-19 years.

Data Source(s):

*Numerator: Number of deliveries (live birth and still births): Inpatient Discharges, Provincial Health Planning Database, Ministry of Health and Long-Term Care
Therapeutic abortions: Therapeutic Abortions Summary, Provincial Health Planning Database, Ministry of Health and Long-Term Care*

Denominator: Population Estimates, Provincial Health Planning Database, Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{Total number of deliveries (live births and stillbirths) and therapeutic abortions for females age 15-19 years (2007 calendar year)}}{\text{Total number of females age 15-19 years (2007 calendar year)}} \right\} \times 1,000$$

Notes:

- *Intellihealth therapeutic abortions summary report was used to derive the number of therapeutic abortions for females ages 15-19 years*
- *IntelliHealth\20 – Ontario Special Reports\Therapeutic Abortion Summary. Report # 20-0001 was used to derive the number of therapeutic abortions*
- *Intellihealth\05 Inpatient Discharges\Hospital Births\Deliveries – Ontario x Mother's Age: Report #: 05-0004 was used to derive the number of deliveries*
- *Analyzed by mother's usual place of residence, not place of birth*
- *Analyzed by ICD 10-CA codes containing Z37 for live births and stillbirths by mother's date of discharge, and mother's age at time of delivery*
- *Excludes births and therapeutic abortions to females residing out-of-province; excludes estimates of fetal loss; excludes abortions conducted with females residing out of province*

Limitations and Comments:

Indicators for teen pregnancy vary across jurisdictions depending on the type of data used. In Ontario, teen pregnancy rate estimates are generally considered a gross underestimate of the true rate of teen pregnancies for reasons that follow.

The number of live births and still births are estimated from hospital delivery data from inpatient records. These are not derived from the Vital Statistics collected by ServiceOntario because hospital data are currently considered more complete and up-to-date than live birth registration data. Birth registration data may be less complete due to the impact of municipal fees introduced in some municipalities starting in the late 1990s, resulting in an increase in unregistered births. In this case, an “unregistered birth” refers to cases where ServiceOntario receives the required form from the attending health care practitioner, but not from the parent(s). These municipal fees may have been a barrier for lower-income persons, including teens.⁹

However, ServiceOntario has made substantial investments and progress toward eliminating potential barriers. As of July 27, 2009, the fully-electronic Newborn Registration Service (introduced in phases starting in March 2006) has been successfully implemented across the province. As a result, all birth registration documents are now submitted directly to ServiceOntario, bypassing municipalities and any associated fees. Moreover, when registering a birth using electronic or traditional channels, information provided by the parents and the attending health practitioner is corroborated. For example, significant differences between birth weights reported by the parents and by the health practitioner are investigated. Further checks are provided for clients using the electronic channel, including electronic edits and review screens throughout the application process to confirm information before proceeding. Finally, additional data quality initiatives, such as collaboration with research stakeholders, are also expected to improve the completeness and quality of Ontario vital statistics.

There are also issues of the timeliness of data with both hospitalization data and birth registration data. Physicians have a year to claim OHIP billings which supply hospital data. Similarly, a parent has up to one year to register the birth of a child.

The hospital delivery data do not include deliveries out of the hospital, although the number of at-home births for teens is likely small. The hospital delivery data also do not include out-of-province births.⁹

Therapeutic abortions conducted outside of the province are excluded from this calculation. It is important to note that the numbers of out-of-province and out-of-country abortions are likely to be higher in health units which border other provinces or the US. The number of out-of-province and out-of-country procedures for Ontario teens is also dependent on the term of the pregnancy; later term pregnancies are likely to be referred to out-of-province clinics, particularly for pregnancies with greater than 20 weeks gestation.

The type of abortion conducted also affects the reported rate of teen pregnancies. There are a number of types of procedures that are excluded from the teen pregnancy estimate. Hospital and clinic abortion data do not include spontaneous abortions, abortions conducted in private abortion clinics, incomplete therapeutic abortion procedures, medical (non-surgical) abortion procedures, and procedures to uninsured clients. Medically/pharmacologically-induced abortions are not captured in the hospital and clinic data. Moreover, the data do not include abortions that are not performed by a recognized service provider as the number is difficult to estimate.

Although the estimates include data from both in-patient and day surgery tables, not all therapeutic abortions are captured in these tables as these data do not include all clinic-based therapeutic abortions. Data is only included for the free-standing clinics that have agreements with the ministry under the Independent Health Facilities agreement to provide these services out-of-hospital.¹⁰

Estimates of fetal loss are also not included in the teen pregnancy indicator in this report; estimates of fetal loss are said to occur in approximately 10% of pregnancies in this age group.¹¹ Due to these data collection and reporting limitations, the reported teen pregnancy rate highlights only a proportion of the actual number of teen pregnancies.

Lastly, this calculation uses a count of the number of abortions that have occurred, and does not reflect the number of individuals undergoing therapeutic abortion procedures. Therefore, the number of pregnancies reported per calendar year will not reflect the number of individual teens who become pregnant more than once within a year. Teens who have been pregnant before are at greater risk for subsequent teen pregnancies.^{12,13}

Understanding the teen pregnancy indicator relies on an understanding of these data collection issues and the method used to derive the teen pregnancy indicator. Women less than 15 years of age are not included in this indicator. Some reports define teenage pregnancy for females 10 to 19, while others may use 13 to 17 years of age to define teen or adolescent pregnancy.¹⁴

Older teens are more likely to be sexually active than younger teens, and therefore, there are likely to be variations in the pregnancy rates specific to age.¹⁵ Categorizing teen pregnancies by the age group 15-19 years does not acknowledge the different implications of pregnancy at 15 years of age compared to pregnancy at 19 years of age.¹⁶ Many teenagers are sexually active, sometimes at very early ages in adolescence.¹³ Thus in the future, the teen pregnancy age range may need to reflect the decline in first sexual contact age. The sequelae of teen pregnancy (medical and social) may also be modified by the effect of age.

Teen pregnancy is a complex issue involving physical, psychological, social and economic factors.¹⁰ Adolescent pregnancy rates may vary in certain religious, cultural, and ethnic groups, particularly those where birth control is not allowed and where marriage before age twenty is common.¹⁷ The teen pregnancy rate is also influenced by access to sexual health education, counseling, and services for contraception and pregnancy options (including abortions).¹⁸

Fewer pregnancies, and a higher proportion of abortions, are experienced by teens in higher socio-economic groups.¹⁹ The inverse is true in lower socio-economic groups, where more adolescents choose to give birth than to undergo abortions.¹⁹

There has been a declining trend in teen pregnancy across Canada as well as in Ontario over the past few years.¹⁰ Although fewer teens are becoming pregnant, fewer of those who do become pregnant are giving birth.¹¹ The related increase in abortions as the outcome of teen pregnancy is a shift seen in several of the more populous provinces including Ontario.¹¹ The number of miscarriages or stillbirths is estimated to be small, although fetal loss is said to be underreported. While the number of still births is recorded in hospitalization and Vital Statistics data, estimating the number of miscarriages is difficult as they may not come to the attention of the medical system.¹¹

For a very large majority of adolescents, pregnancy is not a deliberate choice, as indicated by the high rates of abortion.¹⁹ The wide statistical variations in pregnancy rates and their outcomes originate from complex causes ranging from public policies to sociological and economic circumstances and culturally diverse conditions.¹⁹

Factors associated with teens becoming pregnant include: young age of sexual initiation, unprotected sexual activity, having friends at risk or who have become pregnant, sexual assault, violence or abuse within a couple relationship, dropping out of school, drug, alcohol or gambling dependency, having an older sexual partner, previous abortion accepted under pressure, already being an adolescent mother, having a mother who was an adolescent mother, lack of access to birth control, living in an urban area, high rates of poverty, and social acceptability of teen parenting. Other factors that have been associated with teenage pregnancy include poor school ethos, disaffection, truancy, and poor employment prospects.^{20,21}

Comparison of teen or adolescent pregnancy rates across jurisdictions is difficult due to varying data sources and definitions of teen pregnancy. Even within Ontario, some sources report teen pregnancy using Vital Statistics data, while others use hospitalization data to determine the number of live and still births for the calculation.⁹ Some teen pregnancy rates include estimates of fetal loss (spontaneous abortion and ectopic pregnancy) in their calculation while other jurisdictions may omit these data elements from their calculations. The only source for spontaneous abortion or miscarriage information is hospitalization data, which greatly underestimates spontaneous abortion.¹⁴ This underestimate has increased over time as an increasingly larger number of women have been treated by family physicians rather than in hospital.¹⁴ Statistics Canada and CIHI (1995) have included miscarriages in their published pregnancy rates, which may affect comparability across jurisdictions.¹⁴

In the past, Ontario has been criticized for the quality of Vital Statistics birth registration data; and at times Ontario data has been omitted from federal reporting.²² There are persistent concerns specific to the under-registration of live births, in particular among vulnerable populations, including teenage mothers.⁹ Additionally, there have been serious concerns about the consistent and substantial underreporting of still birth infants or infant deaths in Ontario. The Canadian Perinatal System Surveillance project found that over 40% of infant deaths in Ontario in 2003 resulted in a non-link to a corresponding birth record as compared with 1% of unlinked infant deaths in all other provinces and territories combined.²² ServiceOntario reports that they have registered an average of just over 700 infant deaths per year from 2003 to 2007, compared to over 135,000 live births per year in the same period.

As indicated above, ServiceOntario has made progress and continues to work to make it easier for parents to register the birth of their child. Electronic registration initiatives have already shown modest improvement in reducing under-registration and further improvement is expected in the near future, enabling better comparison across jurisdictions.

2. Low Birth Weight

Definition:

The low birth weight rate indicator estimates the rate of singleton live births weighing 500-2499 grams immediately upon birth, based on the mother's usual place of residence per the total for singleton live births weighing at least 500 grams per 1,000 births.

Data Source(s):

Numerator: Inpatient Services Provincial Health Planning Database, Ministry of Health and Long-Term Care

Denominator: Inpatient Services (Hospital Data), Provincial Health Planning Database, Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{Total number of singleton live births weighing between 500 and 2499 grams (2007 calendar year)}}{\text{Total number of singleton live births weighing at least 500 grams (2007 calendar year)}} \right\} \times 1,000$$

Notes:

- Excludes births with weights recorded under 500 grams due to possible entry errors with still born births
- Excludes multiple births
- PHPDB Qualifications: Newborns (entry code = N) at date of admission; Patient Diagnosis Codes (beginning with Z380, Z381, Z382) for the Calendar Year (2007). Weights for singleton live births (greater than or equal to 500); Weights for low births weights (greater than or equal to 500 grams and less than 2500 grams)
- Intellihealth\05 Inpatient Discharges\Hospital Births\Low Birth Weight, Singleton Births: Report # 05-0004 was used to derive both the numerator and denominator
- The indicator is not limited to full-term births and also includes pre-term births
- Analyzed by mother's usual place of residence, not place of birth
- Excludes births to mothers who reside out of province

Limitations and Comments:

There are numerous types and ways to define low birth weight, and indicators vary across Ontario. Compounding this variation are the different data sources that can be used to derive birth weight estimates.

The Association of Public Health Epidemiologists in Ontario (APHEO) presents several different ways of calculating birth weight including: Very Low Birth Weight Rate; Extremely Low Birth Weight Rate; Rate of High Live Birth Weight or Large for Gestational Age; and Low Birth Weight Rate for Full-term Singleton Live Births.²³ Other sources may also include a calculation for Low Birth Weight for Gestational Age in their reporting.

The low birth weight indicator in this report is calculated by including both full-term and pre-term singleton births. Other reports often limit the calculation to only include singleton full-term births as most premature infants are born with low birth weights.

This indicator includes births to women who are less than 15 years of age and is not restricted to the population of women formally defined as of childbearing age. This method of calculation also includes only live births with a known birth weight. Multiple births (i.e. twins, triplets, etc) have been excluded due to the higher likelihood of low birth weights. Thus, the indicator is independent of temporal changes in the proportion of births that are multiples.

The number of live births and still births are estimated from hospital delivery data from inpatient records. These are not derived from the Vital Statistics records administered by ServiceOntario because hospital data are currently considered more complete and up-to-date than live birth registration data. Birth registration data may be less complete due to the impact of municipal fees introduced in some municipalities starting in the late 1990s, resulting in an increase in unregistered births. In this case, an “unregistered birth” refers to cases where ServiceOntario receives the required form from the attending health care practitioner, but not from the parent(s). These municipal fees may be a barrier for lower-income persons, including teens.

There are also issues of the timeliness of data with both hospitalization data and birth registration data. Physicians have a year to claim OHIP billings which supply hospital data. Similarly, a complete year of birth registration data can be delayed up to 12 to 15 months from the end of a calendar year due to delayed registrations (a parent has up to one year to register the birth of a child).

The inpatient data do not include deliveries out of the hospital, although the number of at-home deliveries is estimated to be currently less than 5% of all births in Ontario. The hospital delivery data also do not include out-of-province births.

In addition to Vital Statistics and Inpatient Hospital data, low birth weight data can also be obtained from other databases. Data can be obtained from the Integrated Services for Children Information System (ISCIS). ISCIS data reflects only information obtained from consenting parents for all live births (including preterm births and multiples) and may not include midwife data for all home delivered births. Data is also available through the Niday Perinatal Database, but it is not fully available for all 36 health units in Ontario. Hospital participation in using Niday has increased in all areas of the province, and in the future, this may offer another data source of comparable health indicators in the province. Improvements made following the transition from Niday to the Ontario Perinatal Surveillance System are expected to further increase the coverage of the surveillance to all hospitals in Ontario.

The Ontario midwifery database also collects data on births and birth outcomes from all registered midwives in Ontario. Midwifery services are usually specific to low-risk births for a small population of women giving births, and thus the proportion of low birth weight infants in this population may be smaller than in the total Ontario population.

Low birth weight rates must be interpreted with caution as a result of several data quality issues pertaining to Ontario. Changes to Ontario law in 1996 allowed municipalities to introduce an administrative fee for processing birth registration documents. The implementation of this fee was associated with a rise in unregistered births. In particular, the administrative fee may have affected vulnerable populations (low-income populations, adolescent mothers, parents of multiples) which are also populations associated with higher risk of low birth weight births. Therefore, low birth weight rates are likely underestimated in Ontario using historical Vital Statistics data. Issues related to how birth weight and gestational age values are recorded have also been noted in Ontario, and appear to have been resolved as of 2002.^{24,25,26} The inclusion of pre-term singleton births is a likely contributor to a higher rate of low birth weights as pre-term births are more likely to be a lower birth weight.

Despite historical issue with birth registration data, ServiceOntario has made substantial investments and progress toward eliminating registration fees as a potential barrier. As of July 27, 2009, the fully-electronic Newborn Registration Service (introduced in phases starting in March 2006) has been successfully implemented across the entire province. Birth registration documents, both from the parents and the attending health care practitioner, are now submitted directly to ServiceOntario, bypassing municipalities and any associated fees. Moreover, other initiatives, including outreach to remote communities, streamlining of registration processes and collaboration with the Ontario Perinatal Surveillance System, are also expected to improve the completeness and quality of Ontario vital statistics.

In developed countries, such as Canada, the majority of low birth weight infants are the result of prematurity rather than growth retardation so it is important to consider gestational age when examining birth weight. Consideration of whether the children were born preterm or at term gestation, and the conditions associated with the low birth weight are important due to their different contributing factors and outcomes.^{27,28,29} However, the low birth weight indicator in this report has the advantage of estimating the burden of low birth weights.

Length of gestation is subject to inaccuracies in reporting as length of gestation can be determined from several factors including: recall of date of sexual intercourse; menstrual cycles of the mother; physician examination and ultrasound. In particular, when length of gestation is based on menstrual dates, there is more likely to be an error, in part due to recall, post-conception bleeding, irregular or long/short menstrual cycles, delayed ovulation, and unrecognized fetal loss. These inaccuracies may result in variations in the rate of preterm birth due to errors in the reporting of gestational age. However, errors have diminished in recent decades because ultrasound, which can more accurately confirm gestational age, is now widely used in Canada.^{30,31}

Small for gestational age (SGA) babies are more likely to be delayed in subsequent development and to remain small.^{32,33} SGA data can also be used to further refine low birth weight information. Many low birth weight indicators now refer to “small for gestational age” rather than “low birth weight.”²³ In Canada, most low birth weight infants are due to pre-term births, as opposed to delayed intrauterine growth.³⁴

Some factors thought to be related to the recent increase in the preterm birth rate include higher numbers of multiple births from reproductive technology, medically indicated preterm birth for pregnancy complications, the trend of Canadian women becoming pregnant at older ages, increases in the number of unmarried mothers, and more accurate estimates of gestational age through the use of ultrasound.^{23,13}

There is a large difference in perinatal and infant mortality by birth weight.³⁵ Much of this is attributable to access to health services with dedicated technology and services, which tends to result in lower mortality rates. The trend in Canada has been for decreasing infant and perinatal mortality rates.³⁶ While infant mortality rates may be declining due to improved access to medical care, low birth weight rates may increase as pregnancies that would not previously have been viable are now able to continue to a live birth. However, the importance of socio-environmental factors cannot be underestimated, as demonstrated by the fact that in urban Canada, the incidence of low birth weight and infant mortality rates are relatively higher in the lowest income neighborhoods.³⁷

Lastly, the comparison of birth weights between jurisdictions may vary based on the limitations listed above. In Ontario alone, there are several standard birth weight calculations and data sources. The population of a jurisdiction or other country may have even greater variation in their definition of birth weight. For example, as registration of stillbirths and live births varies internationally, OECD data include all live births weighing less than 2500 grams.³⁸ Therefore, interpretation of low birth weights should be approached with caution.

3. Breastfeeding Duration

Definition:

The breastfeeding duration rate indicator estimates the proportion of mothers age 15-55 years who breastfed (not exclusively) their last baby (born within the past five years) for a duration of six months or more.

Data Source(s):

Numerator: Canadian Community Health Survey Cycles 2.1, 3.1 and Canadian Community Health Survey 2007, Statistics Canada, Ontario Share Files distributed by the Ministry of Health and Long-Term Care

Denominator: Canadian Community Health Survey Cycles 2.1, 3.1 and Canadian Community Health Survey 2007, Statistics Canada, Ontario Share Files distributed by the Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\begin{array}{l} \text{Total weighted number of female respondents age 15-55 years} \\ \text{who gave birth in the past five years and who} \\ \text{breastfed (non-exclusively) their child for at least six months} \end{array}}{\begin{array}{l} \text{Total weighted number of female respondents age 15-55 years} \\ \text{who gave birth in the past five years} \end{array}} \right\} \times 100$$

Notes:

- This indicator was derived by combining three cycles of the Canadian Community Health Survey (CCHS) in order to obtain reportable and stable data for breastfeeding duration estimates at the public health unit level in Ontario. Simply using one survey to estimate for breastfeeding duration resulted in unstable estimates for the majority of public health units in Ontario, and in many cases the data was unreportable
- Numerator: MEX_06 = Six Months (9), Seven to Nine Months(10), Ten to Twelve Months (11), One year or more (12)
- Denominator: MEX_01 = Has given birth in the last five years (1)
- Excluded not applicable (96) and not stated (99) responses to MEX_01. Exclusion of women who are currently breastfeeding (MEXC_05 = 2)
- PHU 3545 was dropped, 3547 = North Bay, and 3560 = Simcoe in CCHS 2.1 due to amalgamations of public health units
- There was insufficient sample size to stratify the data for each public health unit for CCHS 2007, and therefore cycles 2.1, 3.1, and CCHS 2007 of the CCHS were combined according to methods outlined by Thomas and Wannell. Both the separate and pooled approaches to combining cycles of the CCHS were considered. The separate approach to combining cycles of CCHS was used in the report
- As there were not consistent trends over time over the three individual estimates for breastfeeding duration, combining the 3 cycles of the CCHS did not diminish the data output in any way

Limitations and Comments:

The survey designed for estimating breastfeeding uptake asks women if and how long they have breastfed their last child (born within the past 5 years). Thus in CCHS 2007, a woman may describe the breastfeeding patterns with her last child born in 2002; in Cycle 2.1 (2002-2003) a woman may be describing breastfeeding patterns with a child born as early as 1997. The combination of three cycles incorporates behaviours over an 11-year time span, which will obscure the changes in breastfeeding patterns that occurred over this time period.

Although breastfeeding initiation rates are quite high, breastfeeding duration rates are much lower. Breastfeeding uptake is influenced by a variety of factors, including the use of general anesthetic at birth, multiparity, marital status, having previously breastfed, being a smoker,^{40,41} completing post-secondary education, decision to breastfeed early on in pregnancy,^{42,43} and having attended prenatal classes.^{44,45}

It may be difficult to sustain the duration of breastfeeding for a number of reasons: physical problems with lactation; return to work; lack of support; and feelings of depression are associated with lower breastfeeding duration.⁴⁶ Other factors that may influence breastfeeding uptake and duration include: maternal age; income; and socio-cultural norms.⁴² Breastfeeding rates may also be affected by access to professional support, such as registered nurses or lactation consultants, whether in-hospital or through at-home visits such as through the Healthy Babies Healthy Children Program.

The term breastfeeding may encompass many definitions. Breastfeeding uptake or initiation is the attempt to breastfeed. Exclusive breastfeeding usually entails the exclusive use of breast milk, but will vary, depending on whether the inclusion of vitamin drops is considered within the definition of exclusivity. Non-exclusive breastfeeding may entail a range of behaviours including occasional supplementation for medical reasons, a combined mixture of breast milk and formula, and regular supplements of formula. In this use, the indicator includes responses of mothers who have breastfed both exclusively and non-exclusively.

In 2001, the World Health Organization (WHO) recommended that infants should be exclusively breastfed for six months.⁴⁷ Exclusive breastfeeding is defined by the WHO as only breast milk, including expressed breast milk and medicines or vitamins but excluding any artificial breast milk substitute, water, solid foods, or other liquids.^{48,49}

In 2004, Health Canada adopted WHO's recommendation of exclusive breastfeeding for the first six months as the best method for feeding full term healthy infants.⁵⁰ The Canadian Pediatric Society followed with the same recommendation shortly after in March 2005.⁵¹ The Health Canada and WHO recommendation is that breast milk should be the only food or drink for the first 6 months of life and after that breastfeeding should continue along with the gradual introduction of solid foods for 2 years and older.^{47,50}

Prior to 2001, it was recommended that mothers exclusively breastfeed for four to six months. Given that this recommendation may be more recent than a proportion of the surveyed mother's who likely breastfed, rates may be somewhat lower than expected when compared to the more recent guideline. These estimates may be somewhat higher in the future due to the increased adoption of the WHO and Health Canada's recommendations, as well as with more recent data collection.

Lastly, due to the survey design in the Canadian Community Health Survey, we cannot estimate how long mothers who are currently breastfeeding have breastfed. The survey questionnaire does not ask currently breastfeeding mothers how long they have been breastfeeding. Therefore, it is possible that mother may be currently breastfeeding for a duration of greater than 6 months, but would not be included in this breastfeeding duration estimate.

The lack of consistency among many studies and surveillance systems in the definition of breastfeeding, coupled with differing study or system design, may lead to contradictory results. In Ontario, public health units can obtain breastfeeding estimates from a variety of sources such as the Canadian Community Health Survey, the Rapid Risk Factor Surveillance System, the Niday Perinatal Database, the Integrated Services for Children Information System (ISCIS), as well as any other local surveillance systems or studies in place.

At the time of this report, the Canadian Community Health Survey had available data to derive breastfeeding duration estimates at the public health unit level and the ability to combine cycles in order to derive stable estimates. In the future there may be additional comparable data sources to derive stable rates of breastfeeding duration across public health units in Ontario.

Breastfeeding has been a difficult health-related behaviour to quantify. Many surveys lack sufficient sample size to provide stable estimates or have an inappropriate study design to capture the range of breastfeeding behaviours. Despite these difficulties, breastfeeding duration estimates have been calculated through combing CCHS survey cycles for the purpose of this report, with the caution that there may be many interpretation points specific to this indicator.

4. Postpartum Contact

Definition:

The postpartum contact indicator is defined as the percentage of new mothers who were contacted and who consented to a post-partum phone call under the Healthy Babies Healthy Children (HBHC) program who received a post-partum phone call or contact within 48 hours of release from hospital after giving birth.

Data Source(s):

*Numerator: Integrated Services for Children Information System,
Ministry of Children and Youth Services*

*Denominator: Integrated Services for Children Information System,
Ministry of Children and Youth Services*

Formula:

$$\left\{ \frac{\begin{array}{l} \text{\# of families who were contacted by the Healthy Babies} \\ \text{and Healthy Children public health nurse within 48 hours} \\ \text{of hospital discharge (2007 calendar year)} \end{array}}{\begin{array}{l} \text{\# of families who were contacted and who consented to} \\ \text{being contacted by the HBHC program (2007 calendar year)} \end{array}} \right\} \times 100$$

Notes:

- *Data extracted on July 27, 2008*
- *Not based on all live births. Families must have consented to receiving an HBHC phone call*
- *Items 21.1/21.0 on the ISCIS extract report were used*

Limitations and Comments:

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5. Smoking Prevalence

Definition:

The smoking prevalence indicator estimates the age-standardized proportion of people age 12 years and older who are current smokers (daily or occasional cigarette smokers).

- *Current smoker – daily smoker or occasional smoker*
- *Daily smoker – smoking at least one cigarette per day*
- *Occasional smoker – does not have at least one cigarette per day*

Data Source(s):

Numerator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Denominator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{Weighted number of respondents age 12+ years who are current (daily + occasional) cigarette smokers}}{\text{Weighted total number of respondents age 12+ years}} \right\} \times 100$$

Notes:

- *Numerator: SMK_DSTY = Daily Smoker (1) or Occasional Smoker (former daily smoker) (2) and Occasional Smoker (3)*
- *Denominator: SMK_DSTY = Daily (1), Occasional (2) Occasional (3) Former Daily Smoker (4) Former Occasional Smoker (5) and Never Smoker (6)*
- *Not Answered ((99), based on Don't Know, Refusals, and Not Stated to at least one of the questions) responses were excluded*
- *Age groups in years used for direct age-standardization: 12-19, 20-34, 35-49, 50-64, 65-74, 75+*
- *Direct age-standardization to the 1991 Canadian population*

Limitations and Comments:

There are multiple important surveillance indicators related to tobacco use. The calculation used for this indicator is specific to current smokers, including both those that smoke daily and those that smoke occasionally. This indicator does not describe the full picture and changing patterns of tobacco use in Ontario. Other important indicators related to tobacco use include: smoking initiation; smoking experimentation; age at smoking initiation; daily smoking; occasional smoking; frequency of cigarette consumption; smoking cessation; smoking cessation attempts, and environmental tobacco exposure.⁵²

The definition of 'smoker' has many different variations. For the purposes of this report, current smoking prevalence for both daily and occasional smokers is used. This definition is consistent with both indicators developed by Statistics Canada, and the Association of Public Health Epidemiologists in Ontario.^{53,54}

This indicator definition fails to account for type of smoker (daily or occasional), the length of time an individual has smoked, the amount or types of tobacco smoked, any attempts to quit, or exposure to second-hand smoke. However, current smoking prevalence is an important indicator that defines current smoking patterns in the population which measures one of the outcomes of tobacco control programming and policies, and outlines a priority population for continued tobacco control programming.

There are numerous surveys that collect tobacco use data across Ontario and at the federal level, including the Ontario Tobacco Survey, Rapid Risk Factor Surveillance System, and the General Social Survey to name a few.⁵⁵ However, the CCHS is a valid tool that allows measurement of tobacco use at the level of the public health units, which is an important factor in selecting a data source for this report.

Not all of the sources that collect tobacco use data necessarily have a focus on health or on tobacco use itself. Although the General Social Survey collects smoking prevalence data, it is not aimed at tobacco research or even at health outcomes. The Youth Smoking Survey tracks smoking behaviors in youth grades 5 to 9, and more recently up to grade 12, but does not allow for measuring smoking at the larger population level for each health unit.

The Canadian Tobacco Use Monitoring Survey (CTUMS) has a near-exclusive focus on tobacco use. The survey is designed to track changes in smoking status, particularly for populations most at risk such as 15- to 24-year-olds. It allows for estimates of smoking prevalence for the 15- to 24-year-old and the 25-and-older groups by province and by gender on a semi-annual basis.⁵⁶

The data source used for this indicator is the Canadian Community Health Survey, in contrast with CTUMS data, which is often used by Smoke Free Ontario for provincial estimates reported by the Ministry of Health Promotion. CTUMS data are timelier with semi-annual estimates. However the CCHS allows for measuring smoking prevalence at a local level on an annual basis for public health units, which is not available in CTUMS. Based on a review by the Canadian Tobacco Control Research Initiative, 2006, it was concluded that both CTUMS and CCHS are suitable sources for smoking indicators. While CTUMS may be considered the most appropriate choice for provincial-level data, the large sample size of CCHS makes it most suitable for examining data at a health unit level.^{57,58}

Understanding the CCHS survey design related to measuring tobacco use is of importance when interpreting the results of this indicator. Of note, tobacco use questions are based on self-reported data and estimates are not validated via biochemical testing. However, self-reported population-based data on current smoking status have high validity when compared with measured serum cotinine levels.⁵⁹ Self-reported data are subject to recall bias which may underestimate the proportion of current smokers in the community. Respondents may be unable to accurately report the regularity of their smoking habit. Underreporting may also occur due to social desirability bias as an associated stigma of smoking, i.e., individuals may be reluctant to identify themselves as smokers. In particular, underreporting may be relevant among pregnant women, youth, parents of small children, and young adults.⁵²

The prevalence of current cigarette smoking varies substantially among population subgroups. Factors associated with smoking prevalence include age, sex, education, socio-economic status, income, occupation, and smoking bans in the household.^{60,61,62} Other factors that have an impact on tobacco-use behaviors include social marketing campaigns, tobacco control programs, and policies regarding the taxation of tobacco, accessibility, and environmental and occupational exposure.

In the last decade, there have been reports of a decline in smoking prevalence as well as a decline of cigarette consumption in daily smokers. Smoking bans in the household have been associated with drops in smoking prevalence rates. However, while the percentage of people who smoked daily declined, the rate for occasional smoking did not. Ontario is one of lowest prevalence provinces in Canada for smoking. Although the prevalence of smoking in Canada continues to decline, these declines have been achieved through substantial effort, and there are significant gains yet to be made.⁶³

As tobacco control activities move towards their goals of reducing smoking prevalence rates, surveillance efforts may need to focus on subgroups of smokers to evaluate specific priority populations. There has been a concern expressed over the increasing challenge of obtaining sufficient sample sizes, and of justifying the larger samples necessary, to obtain sufficient statistical power to measure these trends.⁵² A focused survey of non-daily smokers would be a difficult and expensive undertaking to obtain a sufficiently robust sample size.⁵²

Comparing smoking prevalence rates between jurisdictions requires a careful examination of the methods used to define the type of smoking and the methods used to obtain this information. This indicator is consistent with Health Indicators produced by CIHI and Statistics Canada in that smoking is defined the same way and both use the Canadian Community Health Survey as a data source. In addition, the comparable health indicator for Healthy Canadians also uses the CCHS as the data source and the same calculations specific to teens ages 12 to 19 years for their reporting.³⁰

6. Youth Lifetime Smoking Abstinence

Definition:

The youth lifetime smoking abstinence indicator estimates the proportion of young people age 12-19 years who have never smoked a whole cigarette.

Data Source(s):

Numerator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care
Denominator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{Weighted number of respondents age 12-19 years who have never smoked at least one whole cigarette}}{\text{Weighted total number of respondents age 12-19 years}} \right\} \times 100$$

Notes:

- Based on CCHS Question SMK_01B “Have you ever smoked a whole cigarette?”
- Numerator: SMK_01 = No (2)
- Denominator: SMK_01 = Yes (1), No (2) or Not Applicable (6)
- Refusals (8) and Not Stated (9) responses were excluded

Limitations and Comments:

In addition to the several types of smoking, there are also several corresponding types of behaviours and definitions of non-smokers. The U.S. CDC defines a “never-smoker” as someone who has smoked <100 cigarettes per lifetime.⁶⁴ A “puffer” is an individual who has just tried a few puffs of a cigarette, yet has never smoked a whole cigarette. Someone who has ever smoked a cigarette, even a few puffs, may be classified as an individual who has ever tried a cigarette. Someone who has never smoked or puffed a cigarette would be classified as a “never-smoker.” The term “lifetime smoker” refers to anyone who has ever tried a cigarette.⁶⁵

The indicator presented in this report is specific to those individuals who have never smoked a whole cigarette. Therefore this calculation also includes those who may be classified as “puffers”. Those classified as “abstainers” in this indicator who are “puffers” could also be characterized as “lifetime ever smokers”. Other relevant indicators can further examine smoking abstinence in terms of “never smokers” who have seriously thought about smoking, and those “never smokers” who have never seriously thought about smoking.⁶⁵

The data source for this indicator is consistent with the smoking prevalence indicators, i.e., the Canadian Community Health Survey. However, there are numerous surveys that collect tobacco use and abstinence data across Ontario and at federal levels, such as the Ontario Tobacco Survey, Rapid Risk Factor Surveillance

System (RRFSS), and the Youth Smoking Survey.⁵⁵ They might be the data sources for this indicator as well but the CCHS is a valid tool that allows measurement of tobacco use at the level of the public health units, which is an important factor in selecting a data source for this report.

The RRFSS, and CTUMS all require respondents to have smoked at least 100 cigarettes in their lifetime to be considered a smoker; this is not a requirement in CCHS.⁵⁴ If including a 100 cigarette condition in a youth smoking indicator, the reporting would be specific to the inclusion of established smokers to smoking prevalence; and would include various types of smoking behaviours in youth not specific to abstinence. This combination of smoking behaviours would not provide the most benefit to public health tobacco programming. Never smokers, triers, and current smokers form three separate and distinct groups for public health interventions.⁶⁶ For tobacco control programming for youth, focusing on smoking abstinence is a more appropriate indicator to aid in program development and monitoring.

The data source used for this indicator (CCHS) is in contrast to the Canadian Tobacco Use Monitoring Survey often used by Smoke Free Ontario and provincial estimates reported by the Ministry of Health Promotion. CTUMS are more timely data with semi-annual estimates, however the CCHS allows for measuring smoking prevalence at a sub-provincial level on an annual basis for public health units. Based on a review by the Canadian Tobacco Control Research Initiative, 2006, it was concluded that both CTUMS and CCHS are suitable for sources of smoking indicators.^{57,67} CTUMS may be considered the most appropriate choice for provincial-level data, while the large sample size of CCHS makes it most suitable for examining data at a health unit level.⁵⁸

However, this indicator simply measures cigarette use and does not measure other types of tobacco products which may be applicable to tobacco use. In addition to cigarettes, other tobacco products may include cigars, pipes, chewing tobacco and snuff. Some youth may try other tobacco products in addition to cigarettes, whereas other youth may exclusively use or experiment with these non-cigarette tobacco products.

Tobacco use prevention is an important component of tobacco control strategies. Given that the CCHS is a general health survey, the questions aimed at abstinence or delayed onset of tobacco use may not be as comprehensive as surveys dedicated specifically to tobacco use. Preventing experimentation with tobacco products during adolescence is therefore very likely to result in non-smoking during adulthood. Delayed initiation of smoking is also likely to result in reduced nicotine dependency and severity of smoking during adulthood. While abstinence rates are inversely correlated with age and school grade, sample size often requires the grouping of the age groups from ages 12 to 19 in order to have a statistically significant sample size by health unit.

The CCHS survey design, in which tobacco use is measured, is of importance to its interpretation. In addition to how the measure is calculated the survey design is of importance when interpreting the results of this indicator. The tobacco use questions are based on self-reported data. Estimates of cigarette smoking are not validated via biochemical testing; however, self-reported population-based data on current smoking status have high validity when compared with measured serum cotinine levels.^{68,59} Self-reported data is subject to recall bias, which may underestimate the proportion of current smokers in the community. Respondents may be unable to accurately report the regularity of their smoking habit. Underreporting may also occur due to social desirability bias as given the associated stigma of smoking, individuals may be reluctant to identify themselves as smokers. Underreporting may be particularly relevant among pregnant women, youth, parents of small children, and young adults.⁵²

Tobacco use prevention is a key pillar of Ontario's Smoke-Free Ontario (SFO) Strategy and is focused on preventing children and youth from starting to use tobacco industry products. Adolescence is often a time of experimentation and risk-taking. Nearly all first use of tobacco occurs before high school graduation; this finding suggests that if adolescents can be kept tobacco-free, most will never start using tobacco.⁶⁹ People typically begin smoking during their teenage years, so the percentage of Canadians who have not started by age 20 is an indicator of future smoking rates.⁷⁰ The onset of tobacco use generally occurs before age 18; therefore, prevention of smoking initiation among children and adolescents is a powerful strategy for preventing much of the illness and mortality associated with tobacco use.

Youth tobacco use is associated with a variety of personal, behavioural, environmental, and socio-demographic factors, including: lower self esteem,⁷¹ lower academic achievement⁷² lower socio-economic status,⁷³ peer⁷⁴ and parental⁷³ smoking, use of alcohol and marijuana,⁷⁵ living in homes with smoking bans,⁷³ and access to tobacco products.⁷⁶ Longitudinal data has indicated that Canadian youth living in smoke-free homes are much less likely to start smoking.⁷³ Smoking status is also associated with increasing age in youth; younger youth are more likely to abstain from smoking (include puffing) than older youth.⁷³

In the past decade there have been significant downturns in youth smoking rates. There was a decrease in smoking trends in Canada.⁷⁰ Increases in smoking abstinence may account for these decreases in addition to other factors like increased cessation and relapse in youth smokers.⁷³

There are several types of youth smoking and non-smoking indicators in addition to multiple sources of data that can be used to examine tobacco-related behaviours in youth. Although this indicator is not used in other comparable federal or national health indicator reporting, it is consistent with the Canadian Tobacco Control Research Initiatives framework for monitoring youth tobacco use. The comparable Health Indicators for Healthy Canadians use teen smoking prevalence which is an often reported indicator on teen tobacco use. In addition many other indicator reporting agencies and groups use a variety of tobacco use-related indicators. Given that the data source for the youth smoking abstinence indicator is the CCHS, there would be readily comparable data across both health units in Ontario, between provinces/territories, and federally. This indicator is a part of a suite of metrics that examine patterns of tobacco use across youth and the larger population.

7. Adult Heavy Drinking Episodes

Definition:

The adult heavy drinking episode indicator estimates the age-standardized proportion of people age 20 years and older who reported consuming five or more drinks on at least one occasion during the previous 12 months.

Data Source(s):

Numerator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Denominator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{Weighted number of respondents who are age 20+ years who reported consuming 5 or more drinks, on at least one occasion during the previous 12 months}}{\text{Weighted number of respondents age 20+ years who did or did not drink}} \right\} \times 100$$

Notes:

- Numerator ALC_3 = Less than once per month(2), Once per month(3), 2-3 times per month(4), Once per week(5), More than once per week (6)
- Denominator: ALC_1 = Yes (1), No (2)
- Don't Know (97), Refusal (98), Not Stated (99) responses were excluded
- Age groups in years used for direct age-standardization: 20-34, 35-49, 50-64, 65-74, 75+
- Direct age-standardization to the 1991 Canadian population

Limitations and Comments:

The heavy drinking episodes indicator is based on self-reported survey results of alcohol drinking habits in adults. Binge drinking is defined as five or more standard drinks for men, and four or more standard drinks for women, on a single occasion. However, the CCHS survey question specifically asks about drinking five or more drinks on one occasion. The CCHS data would therefore not be able to assess binge drinking in women using the definition of four or more drinks.

Several alcohol-use indicators are commonly used to describe population based alcohol use patterns. Indicators can include following low-risk drinking guidelines, current drinkers, former drinkers, abstainers from alcohol use, alcohol use during pregnancy, per capita alcohol consumption, drinking frequency patterns (occasionally, monthly, weekly, daily) and prevalence of alcohol-related harms (e.g., impact of drinking on relationships, injury, unplanned sexual intercourse) and characteristics of problem drinkers (e.g., age, gender, socio-economic status).⁷⁷

There are some criticisms of using the term heavy drinking.^{78,79} In particular, there are criticisms of using an alcohol-related indicator that does not measure many of the factors that may confound or be an effect modifier to the results of this heavy drinking episode. For example, there is no differentiation to other factors that may affect the effects of alcohol consumption such as time component of consumption, body size, individual tolerance, and whether or not food has been consumed.^{80,81} This indicator definition also does not differentiate between social drinking, drinking alone, or for self-medication, or the length of time over which drinks have been consumed.

The CCHS states the measure of one standard unit of alcoholic drink as one bottle or can of beer or glass of draft, one glass of wine or wine cooler, or one drink or cocktail with one and a half ounces of liquor. However, despite this clarification of how a standard unit of an alcoholic drink is measured, an individual may have difficulty recalling the number of units of alcoholic drinks consumed. This method of capturing units of alcohol consumption may also underestimate the magnitude of alcohol consumption as this may not account for the varying measures of alcohol in the unit of a drink.

CCHS respondents are asked about their alcohol consumption by asking if they have had 5 or more drinks in one sitting. This data is subject to recall and social desirability bias; respondents may not remember the exact details of their alcohol consumption, and may feel reluctant to report the true number of alcoholic drinks consumed, or the true number of drinking occasions. This measure therefore, likely underestimates the proportion of the population engaging in heavy drinking episodes. In addition, it is generally believed that surveys underestimate the proportion of heavy drinkers in the population due to the difficulty in reaching this population.⁸² The CCHS relies on self-reported data and does not complete any screening tests for alcohol dependence or validate responses by performing biochemical tests (such as urine and blood tests); however, for alcohol use patterns over the last 12 months it may be inappropriate to conduct these tests.

It may be the case that surveys underestimate the proportions of heavy drinkers more than they do the proportions of infrequent drinkers. Surveys identify relatively few drinkers who consume five or more drinks in one sitting; usually the figure is less than 10% of those surveyed. This measure may therefore be insufficient to accurately identify the numbers of very heavy drinkers, for example those who drink 10 or more drinks per day.^{81,82}

There are other population-based surveys where heavy drinking use can be measured. The Rapid Risk Factor Surveillance System (RRFSS) measures alcohol use with estimates available at the health unit level. However, the questionnaire structure does not allow for a comparable heavy drinking episodes indicator. The CAMH (Centre for Addiction and Mental Health) Monitor measures both heavy drinking episodes and binge drinking episodes; however, these results are not available at the health unit level. The Canadian Addiction Survey completed in 2004 also measured heavy drinking episodes; however it was only conducted once in 2004 and is not available at the health unit level.

Alcohol is influenced by a range of social, cultural, economic, and environmental factors.^{83,84} Both population level influences and individual risk factors are important considerations in understanding alcohol use patterns.⁸⁵ There are several risk factors associated with heavy drinking episodes including: age, sex, income, education, family history of alcohol use, and peer influences. Attendance at post-secondary education institution and year in college/university has also been a focus of research.

Almost 8 out of 10 Canadians drink alcohol which indicates that although alcohol use is wide-spread, there is a large difference between alcohol use and heavy drinking episodes.⁸⁵ Heavy drinking is more likely to occur in younger adults and in men in their forties.⁹⁴ Heavy drinking rates peak among young adults between the ages of 20 and 35 and then decline with increasing age.⁸⁶ There is also a marked difference in heavy drinking episodes between males and females across most age groups; men are more likely to engage in heavy drinking episodes and do so more frequently than women.⁹⁴

Some of the sequelae (direct and indirect) associated with heavy drinking include chronic disease, injuries/and accidents, acute health conditions, and both acute and chronic social behaviour patterns. In particular, heavy drinking is associated with increases in drinking and driving, fall-related injuries, drowning, unprotected sex, unplanned pregnancy, sexual assault, and in the longer-term, chronic diseases such as high blood pressure, stroke, liver disease, and neurological damage.^{87,88}

The patterns of alcohol use (quantity, frequency and regularity) required to develop alcoholism vary greatly from person to person. Drinking patterns have been suggested to be more important than the total consumption of alcohol as important indicators for alcohol dependence, thus the saliency of heavy drinking episodes for alcohol-related problems.^{89,90,91,92}

Given that there are several alcohol use-related indicators and data sources the examination of comparable indicators will enable the comparison of different publications and jurisdictions that report on heavy drinking episodes. Previous Statistics Canada Health Indicators reports have been consistent with the definition of heavy drinking as used here; consuming 5 or more alcohol drinks in one occasion at least once in the last 12 months.⁹³ Previously, Statistics Canada considered 'heavy drinking' to be drinking five or more drinks on one occasion, while 'regular heavy drinking' was defined as drinking heavily at least 12 times in the previous 12 months.^{94,95} The current indicator definition differs from both of these earlier indicators with respect to the "frequency" of consuming five or more drinks.

Changes over time in how the indicator is defined makes it difficult to carry out a temporal comparison. The most recent *Health Indicators* report,⁹⁶ released during the production of this report, reports heavy drinking episodes as having five or more drinks per occasion at least 12 times a year; this is consistent with the recently revised indicator as developed by APHEO. However, because the data source for this indicator is the CCHS, and because the questions asked can be used for either calculation of various indicators, it is possible to reproduce indicators for all health units in Ontario and health regions in Canada using either definition provided here.

8. Youth Heavy Drinking Episodes

Definition:

The youth heavy drinking episode indicator identifies the proportion of people age 12-19 years who reported consuming five or more drinks on at least one occasion during the previous 12 months.

Data Source(s):

Numerator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Denominator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{Weighted number of respondents age 12-19 years who reported consuming 5 or more drinks on at least one occasion during the previous 12 months}}{\text{Weighted number of respondents age 12-19 years who did or did not drink}} \right\} \times 100$$

Notes:

- *Numerator:* ALC_3 = Less than once per month(2), Once per month(3), 2-3 times per month(4), Once per week(5), More than once per week (6)
- *Denominator:* ALC_1 = Yes (1) No (2)
- Don't Know (97), Refusal (98), Not Stated (99) responses were excluded

Limitations and Comments:

The youth heavy drinking indicator is calculated in much the same way as the adult heavy drinking indicator with the exception of the age range of the survey respondents. Other salient indicators related to youth heavy drinking include abstainers from alcohol use, average number of drinks per day, number of drinks per week, binge drinking, underage drinking, drinking and driving, prevalence of alcohol-related harms (e.g., impact of drinking on relationships, injury, unplanned sexual intercourse) and characteristics of problem drinkers (e.g., age, gender, socio-economic status (SES)).⁷⁷

Although binge drinking is an important clinical measure, this indicator is specific to heavy drinking episodes. Binge drinking is defined as five or more standard drinks for men, or four or more for women on one occasion. However, because the survey question in the CCHS asks specifically about drinking five or more drinks on one occasion, it is not possible to assess binge drinking in women using the definition of four or more drinks. Previously, Statistics Canada considered 'heavy drinking' to be drinking five or more drinks on one occasion while 'regular heavy drinking' was defined as drinking heavily at least 12 times in the previous 12 months.⁹⁷ The Ontario Student Drug Use Survey defines heavy episodic drinking as having consumed five or more drinks on one occasion in the last four weeks.⁹⁸ The CAMH Monitor and the Canadian Campus Survey define it as having five or more drinks on one occasion at least once in the past 12 months.^{99,100}

There are some criticisms of using the term heavy drinking.^{78,79} In particular, there are criticisms of using an alcohol-related indicator that does not measure many of the factors that may confound or be an effect modifier to the results of this heavy drinking episode; this may be especially pertinent for examining heavy drinking episodes in youth. For example, there is no differentiation to other factors that may affect the effects of alcohol consumption such as time component of consumption, body size, individual tolerance, and whether or not food has been consumed.^{80,81} In youth, these factors may be more pronounced due to smaller body sizes and less tolerance to alcohol. This indicator definition also does not differentiate between social drinking, drinking alone or for self-medication or the length of time in which a person has been drinking.

The CCHS states the measure of consumption of one standard unit of an alcoholic drink as one bottle or can of beer or glass of draft, one glass of wine or wine cooler, or one drink or cocktail with one and a half ounces of liquor. However, despite this clarification of how a standard unit of an alcoholic drink is measured, an individual may have difficulty recalling the number of units of alcoholic drinks consumed. This method of capturing units of alcohol consumption may also underestimate the magnitude of alcohol consumption as this may not account for the varying measures of alcohol in the unit of a drink.

CCHS respondents are asked about their alcohol consumption by asking if they have had 5 or more drinks on one occasion. This data is subject to recall and social desirability bias; respondents may not remember the exact details of their alcohol consumption, and may feel reluctant to report the true number of alcoholic drinks consumed, or the true number of drinking occasions. This measure, therefore, likely underestimates the proportion of the population engaging in heavy drinking episodes. Moreover, in youth, there may be additional reluctance to disclose alcohol use if it is related to underage drinking. Alternately, depending on the peer subculture, youth may exaggerate their drinking behaviour. In addition, it is generally believed that surveys also underestimate the proportion of heavy drinkers in the population due to the difficulty in reaching this population.⁸² The CCHS relies on self-reported data and does not complete any screening tests for alcohol dependence or validate responses by performing biochemical tests (such as urine and blood tests); however, for alcohol use patterns within the last 12 months it may be inappropriate to conduct these tests.

It may be the case that surveys underestimate the proportions of heavy drinkers more than they do the proportions of infrequent drinkers. Surveys identify relatively few drinkers who consume five or more drinks on one occasion; usually the figure is less than 10% of those surveyed. This measure may therefore be insufficient to identify large numbers of very heavy drinkers, for example those who drink 10 or more drinks per day.^{81,82}

There are other population-based surveys where heavy drinking use can be measured. The Rapid Risk Factor Surveillance System (RRFSS) measures alcohol use, with estimates available at the health unit level. However, the questionnaire structure does not allow for a comparable heavy drinking episodes indicator. The Canadian Campus Survey also includes information on heavy drinking episodes in youth; however it was last completed in 2004 and focused on the population attending college or university, that is, not all youth ages 12 to 19 years.¹⁰⁰ The CAMH Monitor measures both heavy drinking episodes and binge drinking episodes; however, these results are not available at the health unit level and the sampling frame is specific to adults 18 years of age and older.⁹⁹ The Canadian Addiction Survey completed in 2004 also measured heavy drinking episodes; however it only sampled Canadians ages 15 years and over was only conducted once in 2004 and is not available at the health unit level.¹⁰¹ The Ontario Student Drug Use Survey samples Ontario youth from grades 7 to 12; however this data is not available at the health unit level.⁹⁸

Similar to adults, the majority of youth use alcohol. Many adolescents experiment with alcohol, and its use escalates over the teenage years. Underage drinking is not uncommon. Those who consume alcohol at an early age, by age 16 or younger, are at a higher risk of alcohol dependence or abuse.^{102,103}

Factors predicting heavy drinking in youth include experimentation with alcohol or cigarettes, having a majority of one's friends drink and having had poor behavioral self-control in early adolescence. In boys, positive alcohol expectancies predicted greater levels of heavy drinking later in adolescence, while in girls, friends' smoking predicted greater levels of heavy drinking later in adolescence.¹⁰⁴ Other factors reported to be associated with binge drinking include: sex, attendance at college/university and year of study, and family history of alcohol use.⁸⁰ It is also reported by Health Canada that Aboriginal youth are at two to six times greater risk for every alcohol-related problem than their counterparts in the general population, and that they begin using alcohol at a much earlier age than non-Aboriginal youth.¹⁰⁵

Binge drinking rates increase with age and school grade. Students who binge drink are more likely than both nondrinkers and current drinkers who did not binge to report poor school performance and involvement in other health risk behaviors such as riding with a driver who had been drinking, being currently sexually active, smoking cigarettes or cigars, being a victim of dating violence, attempting suicide, using illicit drugs, as well as being at-risk for delayed physical development. A strong dose-response relationship has been found between the frequency of binge drinking and the prevalence of other health risk behaviors.^{106,107,108} Individuals who were heavy episodic drinkers in adolescence were more likely to experience negative health effects (such as obesity and high blood pressure), and to have poor health practices (such as unsafe driving practices), at age 24.⁸⁰ Moreover, patterns of youth heavy drinking and alcohol use may carry over into adulthood alcohol use patterns.¹⁰⁹

The transition between school levels for youth has also been an area of interest for examining patterns of substance use and misuse. Epidemiological research has shown that binge drinking increases in the late teens before peaking in the early 20s, and then decreasing again.^{110,111} College/university students are at the age with the highest prevalence of most heavy drinking and those attending post-secondary institutions are more likely to engage in heavy drinking more often than most non-attending counterparts.¹¹²

Patterns of heavy drinking in high school youth predict heavy alcohol use in college; approximately 80% of high school heavy drinkers are likely to be post-secondary student heavy drinkers. Heavy drinking in college/university has been shown to be a continuation or escalation of earlier established drinking patterns.¹¹³ Approximately 80% of high school heavy drinkers are likely to be post-secondary student heavy drinkers.¹¹⁴ In post-secondary studies, heavy drinking is much more common, in particular early in the semester and orientation (i.e. "frosh week").^{111,113} Although rates of daily drinking are low, when these youth do drink, heavy drinking episodes are common.¹¹⁵ The time during secondary and post-secondary education is an important time for education, career trajectory and self-mastery; adverse consequences of heavy drinking may jeopardize these aspects of development into adulthood.^{116,117}

Previous Statistics Canada Health Indicators reports have been consistent with the definition of heavy drinking as used here; consuming 5 or more alcohol drinks on one occasion at least once in the last 12 months.¹¹⁸ This is what Statistics Canada previously referred to as regular heavy drinking. However, this indicator is reported for heavy drinking episodes for the population ages 12 years and older, and not specific to youth. The most recent Health Indicators report released during the production of this report now reports on heavy drinking episodes being defined as having five or more drinks per occasion at least 12 times a year.⁹⁶ Previously, APHEO had an indicator specific to youth heavy drinking, however now the recommended indicator is similar to that as reported by Statistics Canada.⁸¹ However, because the data source for this indicator is the CCHS, it is therefore theoretically possible to reproduce the same indicator for all health units in Ontario and health regions in Canada using either definition, provided that there is sufficient sample size for the jurisdiction. One of the issues of reporting youth heavy drinking at the local health unit level is insufficient sample size that often requires suppression due to reporting standards. In addition, some of the estimates that are published should be interpreted with caution due to variability in sampling.

9. Physical Activity Index

Definition:

The physical activity index indicator estimates the age-standardized proportion of the population age 12 years and older by level of energy expenditure in the categories active and moderately active in their leisure time physical activity.

- Active = respondents who average 3.0+ kcal/kg/day of energy expenditure
- Moderately active = respondents who average 1.5-2.9 kcal/kg/day
- Inactive = respondents with energy expenditure levels less than 1.5 kcal/kg/day

Data Source(s):

Numerator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Denominator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{Weighted number of respondents age 12+ years by physical activity index categories active and moderately active}}{\text{Weighted number of respondents age 12+ years}} \right\} \times 100$$

Notes:

- Numerator: PACDPAI = active (1) or moderately active (2)
- Denominator: PACDPAI = active (1) and moderately active (2) and inactive (3)
- Excluded not stated responses (9) from denominator
- Age groups in years used for direct age-standardization: 12-19, 20-34, 35-49, 50-64, 65-74, 75+
- Direct age-standardization to the 1991 Canadian population
- Respondents were asked about their participation in various types of physical activities in the previous three-month period, as well as the frequency and duration of each activity

Limitations and Comments:

The physical activity index indicator is based on a series of questions assessing type and duration of physical activity for the previous three-month period. Those considered “physically active” are individuals who report active or moderately active levels of physical activity. These categories of activity, as well as inactive levels of physical activity are calculated by assessing Energy Expenditure (EE). Average EE per day is assessed using frequency and duration of each session of physical activity and the metabolic equivalent (i.e. how much energy is burned during the activity). Those with a total EE between 1.5 and 2.9 kcal/kg/day are considered “moderately active,” and those individuals with a total EE of 3.0 kcal/kg/day or more are considered “active.” Those individuals with a total EE of less than 1.5 kcal/kg/day are considered “inactive.”^{30,119,120}

Through presenting an overall EE there is information on the amount or level of physical activity yet no information on frequency, duration, intensity, and type of physical activity.¹²¹ This overall level of energy expenditure does not describe the prevalence of physical activity. Using a physical activity index defines the number of individuals who are active within each category. This method is also advantageous as it may be better to detect changes in prevalence; as well, being a population-based measure allows for estimated levels of physical activity in large populations. However, the physical activity index values as presented in this indicator may not necessarily correspond to the Public Health Agency of Canada's physical activity recommendations. The Public Health Agency of Canada's *Physical Activity Guide to Healthy Active Living* recommends engaging in endurance activities 4-7 days a week, flexibility activities 4-7 days a week, and strength activities 2-4 days a week, accumulating 60 minutes of physical activity per day.¹²² The time needed depends on effort – as one progresses to moderate activities, the time can be cut down to 30 minutes, 4 days per week.¹²²

The types of activities included in the suite of survey questions used to assess physical activity are: walking for exercise, gardening or yard work, swimming, cycling, popular or social dance, home exercise, ice hockey, ice-skating, in-line skating or rollerblading, jogging or running, golfing, exercise class or aerobics, downhill skiing or snowboarding, bowling, baseball or softball, tennis, weight-training, fishing, volleyball, basketball, soccer, and any other physical activity.¹²³ Since the survey question asks for reported physical activity in the past three months, results may be affected by the time of the survey as responses may not capture the variation of physical activity between seasons.¹²⁴

This indicator only captures leisure-time physical activity and does not capture occupational physical activity. Some individuals may expend a considerable amount of energy in their non-leisure time from occupational activities, school, commuting to work, or from carrying out household chores.^{125,126} In particular, occupational-related physical activity plays a large part of variation in health outcomes due to the substantial variation in the energy expended to earn a living.¹²⁷

Several different surveys assess physical activity. This indicator is based on information from the CCHS. The CCHS has replaced the cross-sectional component of the National Population Health Survey, which previously assessed physical activity comparably to the CCHS methodology. The Physical Activity Monitor (PAM), conducted by the Canadian Fitness and Lifestyle Research Institute, is a survey series that assesses physical activity in detail. Although the PAM is national, the most recent results of this survey are from 2006 and results are not available at the health unit level. RRFSS also assesses physical activity within the past week, but it is not comparable to the way physical activity is assessed in the CCHS.^{127,121} Both the National Longitudinal Survey of Children and Youth (NLSCY) and the Health Behaviour in School-Aged Children (HBSC) surveys include information on physical activity participation among children, additionally, the PAM also often reports on the physical activity levels of children.¹²¹ The Canadian General Social Survey also measures aspects of physical activity.¹²⁸ Lastly, Statistics Canada is currently developing the Canadian Health Measures Survey which will include measures related to physical activity.¹²⁹ Currently, the CCHS is administered every year with stable and publishable estimates available at the health unit level.

Leisure-time physical activity is based on self-reporting in the CCHS. There may be several types of bias that may affect the reported physical activity levels by the survey respondents. Recall bias may be introduced as survey respondents may have difficulty accurately recalling their activities in the past three months. Respondent and social desirability bias may also occur, as individuals may feel compelled to overestimate their physical

activity levels, in particular due to the widely publicized benefits and importance of physical activity. This increased awareness of physical activity has also promoted other activities of daily living such as walking, gardening and yard work that may not have always previously been viewed as exercise. When comparing results to previous cycles, this may account for an artificial increase in reporting physical activity levels.¹²¹

The types of physical activity questions have changed between CCHS cycles. In previous CCHS cycles, soccer was not included in the suite of physical activity prompts, and in more current survey cycles it is. All activities in the “other” category (i.e., those that do not have specific prompts) are assigned an average intensity value; now that soccer is one of the prompted activities with a high intensity activity score, there may be artefactual increases in physical activity index values.¹²⁷ Direct assessment of physical fitness would likely have higher accuracy and reliability than estimates based on self-report, however that may be too resource-intensive for valid population estimates.

There are a number of socio-economic characteristics associated with active leisure-time physical activity. Participation in active leisure is influenced by cultural and social attitudes.¹²⁴ Individuals with more leisure time are more likely to participate in active leisure; more available time means more opportunity to do something active.¹²⁴

Studies show that Canadians who engage in leisure-time physical activity are more likely to be women, be university-educated, born in Canada, living with a partner in a married or common-law relationship, to have an income of \$60,000 and over, and to report that their lives had a relatively low level of time stress.^{124,130} Canadians living in the most urban centres are more likely to be the most active versus Canadians living in sub-urban and rural areas.¹³¹

Although leisure-time physical activity has increased in the last 20 years, it is only one small component of total waking-time activity.^{132,130} The trend toward automation of tasks may affect physical activity rates, as does the built environment. The volume and type of physical activity is dependant on the built environment. Although Canadians living in highly-central areas were more likely to be physically active than their counterparts, their types of physical activity have been due to active travel during their daily activities.¹³¹ In contrast, residents of suburban areas are much more apt to get their exercise by performing outside work (gardening, yard work and cleaning). The built environment, and neighbourhoods that encourage physical activity may be an important factor to encourage activity in those individuals who are less inclined to play organized sports or consciously exercise.¹³¹ It is also important to consider factors that may affect uptake or sustaining physical activity in order to meet public health goals for physical activity to combat obesity, to promote physical fitness and to improve public health.^{30,133} Many predictors of starting or sustaining activity were the same: sex, age, educational attainment, smoking, and sense of mastery. However, some factors were significant for one sex only. For women, deterrent factors included being overweight and the presence of children, yet not for men. Social involvement and smoking status were significant deterrents for men, but not for women.¹³³

The physical activity index indicator is reported identically across many different reports and jurisdictions. Self-reported physical activity is one of the comparable healthy indicators in Health Canada’s *Healthy Canadians: a federal report on comparable health indicators*.³⁰ This indicator is reported identically in the *Health Indicators* as Physical Activity during leisure time.¹¹⁹ Additionally, APHEO also has the Leisure Time Physical Activity Indicator (previously known as Physical Activity Index) as one of its Core Indicators.¹²⁷ Lastly, the data source for this indicator is the CCHS, and therefore it is possible to reproduce the same indicator using either definition for all health units in Ontario and health regions in Canada.

10. Healthy Body Mass Index

Definition:

The healthy body mass index indicator estimates the age-standardized proportion of people age 18 years and older whose self reported height and weight denote a healthy body mass index (BMI). BMI is calculated using the person's weight in kilograms divided by their height in metres squared. The International Standard for BMI is: <18.5 (underweight), 18.5-24.9 (acceptable weight), 25-29.9 (overweight), and 30 or higher (obese). The World Health Organization considers a BMI in the range of 18.5-24.9 to be healthy for most adults.

Classification	BMI Category	Risk of developing health problems
Underweight	<18.5	Increased
"Normal or Healthy" Weight, Acceptable Weight Range	18.5 – 24.9	Least
Overweight	25.0 – 29.9	Increased
Obese		
Class I	30.0 – 34.9	High
Class II	35.0 – 39.9	Very high
Class III	≥ 40.0	Extremely high

Data Source(s):

Numerator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Denominator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{Weighted number of respondents age 18+ years (excluding pregnant women and breastfeeding women) with BMI of 18.5-24.9}}{\text{Weighted number of respondents age 18+ years (excluding pregnant women and breastfeeding women)}} \right\} \times 100$$

Notes:

- CCHS excludes pregnant women, as well as women age 18-49 years who did not answer the pregnancy question. The index is calculated for those age 18 years and over, excluding pregnant and lactating women, as well as persons less than 3 feet tall or greater than 6 feet 11 inches. There was an additional exclusion of women who were currently breastfeeding (MEX_05 = 1), and respondents who chose 'Not applicable' (96) or Not Stated (99) responses in the indicator calculation

- *Numerator: HWTDISW = Normal or healthy weight (2)*
- *Denominator: HWTDISW = Underweight (1), Normal or healthy weight (2), Overweight (3), and Obese (4-6)*
- *Age groups in years used for direct age-standardization: 18-34, 35-49, 50-64, 65-74, 75+*
- *Direct age-standardization to the 1991 Canadian population*

Limitations and Comments:

BMI is the most common method for determining whether an adult's weight is healthy. The BMI is not a direct measure of body fat, but it is the most widely investigated and most useful indicator, to date, of health risk associated with being under and overweight. BMI classifies weight into health risk categories. The system is recommended for use among Canadian adults aged 18+ years.¹³⁴ The BMI is not applicable to pregnant or breastfeeding women, however, most tabulations of BMI include breastfeeding women because in surveys, women are generally not asked if they are currently breastfeeding. Pregnant women are not included in the BMI variable from the CCHS survey results, and therefore are not included in this indicator.

Other indicators specific to healthy weights can include waist circumference, waist-to-hip ratio to measure body fat distribution, and measures of % body fat.¹³⁵ However, these measures are not collected for all public health units or at the population level for the province of Ontario. Prevalence of underweight, overweight and/or obese population are also other options of presenting BMI data as collected for the adult healthy BMI indicator.

Some research suggests that health risks may differ in seniors, specifically that the “normal” or healthy range may begin slightly above BMI 18.5 and extend into the “overweight” range.¹³⁶ As such, when used in the assessment of individual seniors, BMI categories should be used with some flexibility. Special considerations are also required for young adults who have not reached full growth; adults who are naturally very lean; adults with a very muscular body build; and certain ethnic or racial groups. BMI estimates for Aboriginal people are generally higher than for the Canadian population as a whole. A study of Aboriginal people aged 19 to 50 in Ontario and the western provinces (excluding reserves) found that, in 2004, they were 2.5 times more likely to be obese or overweight as their non-Aboriginal contemporaries.¹³⁷

The adult BMI categories should not be used for children and adolescents. Instead, BMI-for-age is plotted on gender specific growth curves. For example, growth curves are used by health professionals to determine whether the growth of a child or a foetus is within normal limits. The growth charts currently used in Canada for height, weight and body mass index (BMI) are based on US data.¹³⁸

For most Canadian Community Health Survey (CCHS) cycles, BMI is based on heights and weights as reported by respondents themselves. Since people tend to underestimate their weight and overestimate their height, the values likely over-estimate the prevalence of healthy body weights (and under-estimate overweight and obesity) in the population. Healthy Body Mass Index prevalence data based on physical measures would likely be lower. Self-reported weights may also differ from true weights due to a lack of information at the time of the survey (e.g., not weighed recently, poorly adjusted scale in the home). In addition, recall bias may mean that the survey participants differ from those who did not respond. BMI does not take bone density into account. BMI measures

body weight at one point in time and may not capture the risk for people whose weight has changed (a sudden increase or decrease in weight may be a signal of additional health problems). Studies estimate that obesity rates would likely be higher if calculations were based on observed data.^{139,140}

Healthy weight is influenced by the interaction of biological, lifestyle, social, cultural and environmental factors.

Biological factors include genetic predisposition, prenatal determinants, metabolic susceptibility, appetite control and satiety, childhood obesity, race/ethnicity, gender, and age. Another factor, low birth weight, has been associated with high BMI rates later in life.¹⁴¹

Lifestyle factors that are known to have an impact on healthy weights include dietary intake and pattern, physical activity pattern, alcohol consumption and stress. Social and cultural factors are also implicated, including family life style (e.g., excessive television viewing, physical inactivity, use of labour-saving household appliances, excessive use of internet and computer games); socio-economic status; and education. Environmental factors associated with changes in BMI include the community environment, workplace, schools and food industry influences. Urban areas may limit living space and provide fewer parks, walking paths and bicycling opportunities. Urban sprawl may increase dependence on use of vehicles and positioning of elevators/escalators relative to stair access can either enhance or decrease opportunity for physical activity during daily routines. Workplace and school environments may limit access to nutritious food by providing insufficient time for lunch or by promoting use of pre-packaged lunch kits. Many workplaces involve limited physical activity. Reduced time for physical activity during school hours and increased access to vending machines, cafeterias and tuck shops also influence BMI.

Data for this indicator can also be obtained using the Rapid Risk Factor Surveillance System (RRFSS), however, it should be noted that RRFSS recommends different age categories for analysis and the survey methodology does not exclude women who are breastfeeding.¹⁴² In addition, RRFSS data is not currently available for every public health unit in Ontario. Ultimately, CCHS was chosen for this report in order to support reporting across all health units. The Canadian Health Measures Survey (CHMS) began in 2007 and, once completed, will provide physical measures of height and weight to be used to calculate actual BMI of the Canadian population. This information will complement physical measures of height and weight taken for the Canadian Community Health Survey Cycle 2.2 (2004), and will provide important baseline data and insight into the assumptions identified earlier regarding reporting biases in the CCHS. This will enable more accurate analysis of future survey data. Waist circumference (WC) is another indicator being measured by the CHMS that is often used in combination with BMI.¹⁴³

Other health indicator reports that report BMI data include *Health Indicators 2009* and *Healthy Canadians*.^{30,144} Health Indicators reports both adult and youth BMI indicators, presented as overweight, obese, or overweight and obese in their data tables.¹⁴⁴ *Healthy Canadians* also reports the adult BMI indicator presented as all index categories, including obesity classes I to III.³⁰

11. Fruit and Vegetable Consumption

Definition:

The fruit and vegetable consumption indicator estimates the age-standardized proportion of the population age 12 years and older that reported consuming fruits and vegetables five or more times per day.

Data Source(s):

Numerator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Denominator: Canadian Community Health Survey 2007, Statistics Canada, Ontario Share File distributed by the Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{Weighted number of respondents age 12+ years who Consumed fruit and vegetables five or more times per day}}{\text{Weighted number of respondents age 12+ years}} \right\} \times 100$$

Notes:

- Numerator: FVCGTOT = 5 to 10 “servings” of fruit and vegetables (2) and more than 10 “servings” of vegetables (3)
- Denominator: FVCGTOT = less than 5 “servings” (1), 5 to 10 “servings” of fruit and vegetables (2) and more than 10 “servings” of vegetables (3)
- Excluded if answer was not stated
- Age groups in years used for direct age-standardization: 12-19, 20-34, 35-49, 50-64, 65-74, 75+
- Direct age-standardization to the 1991 Canadian population

Limitations and Comments:

The measure assessing consumption of fruits and vegetables was established based on *Canada's Food Guide to Healthy Eating* which was in use from 1992 to 2007.¹⁴⁵ A revised guide, *Eating Well with Canada's Food Guide* was released in 2007 and recommends between 4 and 10 food guide servings of vegetables and fruit per day, depending on age and gender.¹⁴⁶ It is important to note that the indicator is reflective of the earlier guideline which recommended 5 to 10 servings of vegetables and fruit each day for people aged four years and older without age and gender differences.¹⁴⁷

Other examples of fruit and vegetable consumption indicators may include deriving the number of times per day fruit and vegetables are consumed in relation to the Canada Food Guide based on age and sex of the respondents. Also, fruit and vegetable consumption may be presented in percentiles to determine the distribution of fruit and vegetable consumption across the population of interest.

Five of the six Canadian Community Health Survey (CCHS) survey questions ask respondents to identify how many times in a day they have consumed fruits and/or vegetables. These questions are used as a proxy to determine the number of servings consumed. This assumption may result in an under or over estimate of the consumption of fruits and vegetables.

Although this indicator estimates the number of servings of vegetables and fruits consumed per day, it is not possible to assess the appropriateness of nutrient intake based on the questions asked of respondents and the survey design.

Individuals may have consumed several servings of vegetables at one time or only a portion of a serving and yet would still be accurate in their response to the survey question. Dietary recall has additional challenges as individuals are often unclear of their actual consumption when questioned. Estimates of fruit and vegetable intake may also be overestimated due to the social desirability of maintaining a healthy lifestyle, including diet. Also, dietary intake varies significantly on a daily, weekly and seasonal basis. The timing of the survey in conjunction with seasonal availability of fruits and vegetables or weekly schedule variations (i.e., weekend versus week day menu planning) may have significant impacts on fruit and vegetable consumption. Increased costs associated with seasonal availability of food products may also be a prohibitive factor to food security (i.e., consumption) as costs increase in autumn and winter.^{148,149,150}

Ethnicity is another factor that may influence the consumption of fruits and vegetables. Studies in the U.S. using the Behaviour Risk Factor Surveillance System (BRFSS) have shown significant variations amongst various ethnic populations.¹⁵¹ A limitation for analysis is that sample size for many ethnic groups is not large enough to yield acceptably precise estimates. Interpretation of the results for ethnic or cultural subgroups should be done with basic understandings of the respective ethnic group and culture.

Factors that have been shown to influence this indicator include age, sex, socioeconomic status (income and education levels), not smoking and healthy weights. Access to affordable and acceptable (e.g., culturally appropriate, of acceptable quality) fruits and vegetables are also a consideration when interpreting this indicator. Access to affordable fruits and vegetables has been associated with location (e.g., difficulties in very Northern and remote areas). Individuals with lower income and/or education demonstrate lower levels of fruit and vegetable consumption.¹⁵² Men consistently eat fewer fruits and vegetables than women in all age groups.¹⁵³ Additional important factors associated with this indicator are BMI and rates of physical activity. Individuals with high BMIs are less likely to consume fruits and vegetables than those with low or normal BMIs. Research has also demonstrated that increased physical activity is related to increased fruit and vegetable consumption.¹⁵⁴

The Rapid Risk Factor Surveillance System (RRFSS) also collects information on the consumption of fruits and vegetables for some health units in the province. There are slight variations in the questions between the CCHS and RRFSS surveys. Caution is required when comparing results. *Health Indicators* also includes fruit and vegetable consumption in their report. Statistics Canada's Health Indicators uses the same definition of fruit and vegetable consumption, (i.e., at least 5 times per day).¹⁵⁵

CCHS data was chosen for this report as information was available for all 36 health units and it is the most commonly reported data across jurisdictions in Canada.

12. Fall-Related Hospitalizations Among Seniors

Definition:

The fall-related hospitalization rate indicator estimates the age-standardized number of injury-related hospital separations that are due to falls in seniors age 65 years and older per 100,000 population.

Data Source(s):

*Numerator: Discharge Abstract Database, Canadian Institute for Health Information
Distributed by Population Health Planning Database,
Ministry of Health and Long-Term Care*

*Denominator: Population Estimates, Population Health Planning Database,
Ministry of Health and Long-Term Care*

Formula:

$$\left\{ \frac{\text{Number of hospital separations due to falls
In those age 65+ years (2007 calendar year)}}{\text{Total population age 65+ years (2007 calendar year)}} \right\} \times 100,000$$

Notes:

- *Age groups in years for direct age-standardization: 65-74, 75-85, and 85+*
- *Direct age-standardization to the 1991 Canadian population*
- *Includes Accidental Falls (ICD-10-CA: W00-W19) with external causes*
- *PHPDB Qualifications: Calendar Year (2007); Ages (greater than or equal to 65);
Patient diagnosis beginning with W0 or W1 in ICD-10-CA Block Codes including diagnosis
with external cause diagnoses*
- *IntelliHealth\Shared Reports\PHU\Fall Related Hospitalizations 65120*

Limitations and Comments:

Fall-related hospitalizations for a specific population are a good estimate of all falls resulting in serious injury for that population. However, this data source does not capture information on injurious falls of lesser severity, which may be treated at hospital emergency departments or physicians' offices, or falls for which medical treatment was not sought.¹⁵⁶ In summary, it does not capture data for injury-related deaths occurring outside of the hospital in-patient setting.¹⁵⁷ It should also be noted that an individual can be admitted to hospital more than once for the treatment of the same injury and that injury separation data are simply the numbers of discharges or deaths following admission where the primary diagnosis was coded as injury. They do not represent either the number of injuries that led to the separations or the number of injured people who separated from the hospital (i.e., a person may be hospitalized for more than one occurrence of the same injury classification or discharged from more than one hospital for the same injury event in a given period). Although the aim of this

indicator is to include only falls in the community, a very small number of falls that occurred during hospital inpatient stays are included in this indicator. Other related indicators specific to fall-related events in seniors include fall-related mortality and fall-related emergency department visits.

In addition to the above mentioned challenges, the Discharge Abstract Database (DAD)¹⁵⁸ captures all hospitalization discharges where the primary diagnosis is injury, however, in instances where there is no external cause to describe the circumstances of the event that caused the injury, the data cannot be included in this calculation (i.e., only if a fall has been identified as the external cause for the injury does the discharge contribute to the calculation of this indicator). Given the confluence of circumstances identified above, it is assumed that estimates based on data taken from the DAD will be low relative to actual rates of fall-related injuries in seniors 65 years and older.

Revisions to codes in the International Classification of Disease (changes from ICD-9 to ICD-10) greatly affected the coding of data in hospitals around the world and affected data on fall injuries.^{159,160} There is an important difference in the classification of falls between ICD-9 and ICD-10. In ICD-9 the 'Falls' section includes cases where the external cause of injury is specified as "Fracture, cause unspecified (E887)." These cases, which account for a large proportion of fatal falls among the elderly, are not classified as 'Falls' in ICD-10, or in the U.S. recommended framework for presenting injury mortality data.¹⁶¹ Additionally, ICD-10 has a greater specificity than ICD-9. Therefore, care must be taken in comparisons of data based on the two different classifications. Other data sources for fall-related injuries include self-reported data from the CCHS as well as from the Rapid Risk Factor Surveillance System (RRFSS) which is currently only available for participating health units.

In Ontario, females are more likely to be admitted to hospital due to injury than males, amongst those aged 65 years or older.^{162,163} The majority of injuries resulting in hospitalization in seniors are falls.¹⁶⁴ There are many factors that may influence this indicator including biological/medical, behavioural, environmental and socio-economic factors.

As people age, there are many changes to the musculoskeletal system that might predispose an individual to falls including reductions in flexibility, strength, balance and coordination. Maintaining balance is also dependant on neurological input which may be affected by disorders such as Parkinson's or visual changes which alter depth perception. Corrective lenses for visual changes may require individuals to learn to adjust to the change in their visual acuity. Chronic conditions such as arthritis, osteoporosis, hypotension, etc. may create challenges in meeting activities of daily living, resulting in a fall. Acute illness is often accompanied by increased fatigue and fever which may result in dizziness, postural hypotension and confusion, thereby increasing risk of falls. Physical disability, including recovery from a previous fall, diminishing touch and sensation in limbs resulting from diabetes and gait disorders can contribute to a rise in this indicator. Cognitive impairment such as dementia and memory loss also increases risks for falls.¹⁶⁵

The ability to perform activities of daily living is often taken for granted until an individual finds he or she is not able to perform the activities safely due to other factors such as biological or medical changes. In many instances, these activities result in falls before changes to behaviours can be adopted to modify the risk. These activities can include housekeeping chores such as vacuuming or dusting a ceiling fan by standing on a chair; home maintenance such as painting, or pruning hedges; or, something as simple as getting dressed in the morning without the aid of a chair or assistive device for balance support. Any of these activities can become risk-taking and are considered factors contributing to falls in individuals over 65 years of

age. Prescribed or over-the-counter medications designed to address illnesses may also cause dizziness or confusion and result in an increased number of falls in seniors. The interaction between medications (both prescribed and over-the-counter) may further exacerbate symptoms and create the conditions for a fall. Poor diet, inadequate physical activity and alcohol consumption also contribute to increased falls in seniors over 65 years of age.¹⁶⁶

The built environment is another factor that influences the results of this indicator. Accessibility both within and outside the home is a challenge for seniors as they age and experience increased mobility limitations. Within and around the home, stairways without railings, bathrooms without bars and loose rugs or carpets are all potential fall hazards. Clutter, storage spaces built high and furniture that is too low can create conditions that might increase the risk of fall-related hospitalizations. Inadequate lighting, uneven garden paths and slippery walkways are also high risk environments. Away from the home environment are faulty sidewalks, limited accessibility to buildings, poor lighting and long distances between sitting areas and facilities, which can create problems for individuals over 65 years. Finally, improper or inadequate use of assistive devices including canes, walkers, etc., can contribute to falls.¹⁶⁷

People who live in less affluent neighbourhoods are also at increased risk of injury due to falls than those in more affluent neighbourhoods. It is difficult to determine whether socioeconomic factors directly result in increased falls or if these factors affect the risk of falls indirectly. Indirect factors may contribute to other factors that result in increased falls. Either way, seniors experiencing socioeconomic challenges experience an increased number of falls compared to their counterparts.¹⁶⁸

The issue of falls among seniors and the impact falls have on the health care system is captured in many different ways across various health system reports. Fall-related injuries are a significant component of seniors' well-being, independence, and the impact on their quality of life and life course. Injuries are a gateway and risk for other health conditions (hospitalizations, infections, onset of dementia), and loss of independence. Falls contribute to half of all injury-related deaths in seniors.

Fall-related mortality rates are monitored by many jurisdictions as a means of monitoring outcomes of prevention strategies. In its 2009 report, the Ontario Health Quality Council used the rate of falls among seniors (aged 65+) resulting in an emergency department visit or inpatient hospitalization (per 100 resident-years in long-term care homes in Ontario for 2002/2003 to 2007/2008) as a means of assessing the quality of care in institutions.¹⁶⁹ They also assessed in-hospital hip fracture event rates, which is another related indicator. This indicator is the risk-adjusted rate of in-hospital hip fractures among acute care in-patients age 65 and older per 1,000 discharges. This indicator is often expanded in other reports, including the *Health Indicators 2009* report, to assess overall hospitalization due to hip fracture events.¹⁷⁰ Specifically, a fall-related indicator would include the age-standardized rate of new hip fractures admitted to an acute care hospital per 100,000 population age 65 and older.

CIHI and Statistics Canada include injury hospitalization rates and self-reported injury rates under the *Health Indicators* for health conditions. CIHI supports the measurement of age-standardized rates of acute care hospitalization due to injury resulting from the transfer of energy (excluding poisoning and other non-traumatic injuries), per 100,000 population using the National Trauma Registry. Statistics Canada uses the Canadian Community Health Survey (CCHS) to assess the population aged 12 and over who sustained injuries in the past 12 months serious enough to limit one's normal activities, but not including repetitive strain injury as another population-based measure of assessing the burden of injury.

13. Enteric Illnesses Incidence

Definition:

The enteric illnesses age-standardized incidence rate estimates the total number of reported cases of selected enteric illnesses per 100,000 population.

Selected reporting fields include:

- Amebiasis
- Botulism
- Campylobacter Enteritis
- Cholera
- Cryptosporidiosis
- Cyclosporariasis
- Food Poisoning, All Causes
- Gastroenteritis, Institutional Outbreaks
- Giardiasis
- Hepatitis A
- Listeriosis
- Paratyphoid fever
- Typhoid Fever
- Salmonellosis
- Shigellosis
- Trichinosis
- Verotoxin producing E.coli including Hemolytic Uremic syndrome (HUS)
- Yersiniosis

Data Source(s):

Numerator: Integrated Public Health Information System, Ministry of Health and Long-Term Care

Denominator: Population Estimates, Provincial Health Planning Database, Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{Total number of new reported cases of selected enteric illnesses (2007 Calendar year)}}{\text{Total population (2007 Calendar year)}} \right\} \times 100,000$$

Notes:

- Data was extracted on February 3, 2009 from the Integrated Public Health Information System
- Includes both sporadic and outbreak reportable enteric cases that met the provincial surveillance case definition
- Age groups in years used for direct age-standardization: 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, 85-89, 90+
- Direct age-standardization to the 1991 Canadian population

Limitations and Comments:

The enteric illnesses incidence rate is a composite indicator that includes reporting on the incidence of a group of reportable diseases. Using the suite of enteric illnesses for reporting allows for much more stable rates.

There may be considerable under-reporting of actual cases for some enteric illnesses.^{171,172,173} Individuals with mild symptoms may not seek medical care or, for those who do consult physicians, laboratory testing may not be performed.¹⁷¹ Age-standardized incidence rates may be most appropriate in order to compare health units amongst peer groups or to provide comparisons to the Ontario rate due to the varying age structures of the population and due to the clinical nature of enteric illnesses having greater incidence in specific age groups.¹⁷⁴

Enteric illnesses are reported by health units using the integrated Public Health Information System (iPHIS), which was implemented in Ontario in 2005. Prior to this, data was captured by the Reportable Disease Information System (RDIS) which was first implemented in 1990. Over time, some of the disease case definitions changed, resulting in data integrity issues with time series data.¹⁷⁴ With respect to enteric illnesses, new case definitions were implemented in 2009, and as such, comparisons to future enteric-related indicators should take changing case definitions under consideration.

Data comparisons across health units can be problematic because of inconsistencies in data collection and entry, and due to differing interpretations of case definitions in use across the province. Data quality is further compromised by possible duplication of cases as individuals move across various health unit boundaries. It is also possible to double count cases that have not been resolved as information is transferred between health units.¹⁷⁴ However, the duplicate management system in iPHIS is expected to reduce the duplicates both within and between health units. Despite the risk of duplication of some cases, it is thought that the under reporting of enteric illnesses is of greater concern.¹⁷¹

Factors that influence the rate of enteric illnesses include changes in population demographics and behaviours, changes in industry/technology, globalization and economic development, and changes in land use.¹⁷⁵ Increased reliance on prepared foods, a proliferation of globally accessible produce and increased use of fast food are behaviours that can be linked to increases in enteric illnesses. Large scale farming and food processing, along with the impacts of globalization which provide consumers with access to foods from around the world, all contribute to increased opportunities for contamination. These same trends make it harder to trace the source of a foodborne illness than in the past, when outbreaks were usually linked to local food sources.¹⁷⁶ Changes in farming practices including expanding technology and land use issues also impact on the prevalence of diseases known to cause foodborne illnesses. Higher density of animals in smaller, more condensed spaces may create opportunities for increased disease transmission between animals or humans.¹⁷⁵ This increased land use density may also result in cross-contamination from other land uses such as disposal of farm refuse, other forms of farming or industrial lands that may now exist in closer proximity to each other.¹⁷⁵

Coupled with increasingly virulent strains of bacteria for some diseases, some specific groups or sectors of the population are at higher risk for becoming ill. Increases in chronic diseases and an aging population contribute to increased numbers of immuno-compromised individuals who are more susceptible to enteric illnesses and their complications.¹⁷⁵ The peak incidence of enteric diseases is typically highest among children under the age of four.^{172,174} Young children may have higher risks because their immune systems are not be fully developed, their lower body weight may require a smaller amount of pathogens to make them ill, they have limited control over food-safety risks, and may not practice appropriate hand washing.¹⁷⁷ Young children

are also at-risk for contracting enteric illnesses through transmission of pathogens during play by sharing of toys, touching play surfaces, and sharing food. This is particularly the case where groups of young children are in close proximity to each other such as in daycare settings, nursery schools, and day camps. Reported enteric rates for young children may also peak due to the susceptibility to first exposure, incidents being reported, and partly that medical care is quickly sought for this population.¹⁷⁷

Enteric illnesses incidence rates have been found to be sensitive to seasonal variations with the majority of cases occurring in the summer months.^{172,178} This fact is particularly important for public health units that see large increases in the population over these months and may likely impact their rates. Incidence rates of Verotoxogenic E. Coli are monitored and reported across Canada as one of the key comparable indicators, however this specific indicator grouping enteric-illnesses disease incidence is not reported.³⁰ While enteric diseases are under reported, enteric diseases incidence rates are good indicators of risk within the community and are often used to assess the effectiveness of prevention efforts.¹⁷⁹

14. Respiratory Infection Outbreaks in Long-Term Care Homes

Definition:

The respiratory infection outbreak indicator estimates the number of confirmed respiratory infection outbreaks in long-term care homes between September 1, 2006 and August 31, 2007.

Data Source(s):

Integrated Public Health Information System, Ministry of Health and Long-Term Care

Formula:

Number of confirmed respiratory infection outbreaks in Long-Term Care homes for the 2006/2007 respiratory virus surveillance season.

Notes:

- *Data was extracted on February 2, 2009 from the Integrated Public Health Information System.*
- *Indicated by selecting Long-Term Care Home option in the Exposure Setting Type Field for outbreaks in iPHIS*
- *Outbreaks that do not meet the case definition for a confirmed respiratory infection outbreak in a long-term care home were removed*
- *The report is called: List of created Outbreaks - Child Care Facilities Highlighted – for HU use*
- *Cognos ReportNet path: Public Folders > CRN 1.0 > Shared Communicable Diseases Reports > Management Reports > QA Reports*

Limitations and Comments:

Respiratory infections resulting in outbreaks can be caused by many different pathogens. The number of respiratory infection outbreaks in long-term care homes is a measure of the absolute number of reported outbreaks. This indicator does not take into account the following factors: the size of the population within the facility; the demography of the population; the concentration of long-term care and acute care facilities in the geographic area; the scope of practice of the facility; types of residents; the distinction between staff and resident infections; or the number of individuals affected beyond the minimum requirements of the case definition; the number and severity of circulating respiratory pathogens in the home's community.

This indicator does not measure the frequency of individual long-term care home outbreaks, or more importantly, the impact an outbreak may have in terms of morbidity and mortality, nor does it measure the appropriateness of response to the outbreaks. These are all important factors to consider when comparing the number of outbreaks. The validity of presenting a standardized respiratory outbreak indicator is largely dependent on the confluence of locally-driven factors. Nonetheless, this indicator does demonstrate the volume and incidence of respiratory infections and underscores the capacity needed to manage these outbreaks in a timely manner.

Respiratory infections resulting in outbreaks are reported by health units using the Integrated Public Health Information System (iPHIS), which was implemented in Ontario in 2005. Prior to this, data was captured by the Reportable Disease Information System (RDIS) which was first implemented in 1990. Over time, some of the disease case definitions changed, resulting in data integrity issues with time series data.¹⁷⁴

Data comparisons across health units can be problematic because of inconsistencies in data collection and entry, and due to differing case definitions in use across the province. Data quality is further compromised by possible duplication of cases as individuals move across various health unit boundaries; however this is less likely with a long-term care homes resident, than a staff member. It is also possible to double count cases that have not been resolved as information is transferred between health units.¹⁷⁴ However, the duplicate management system in iPHIS is expected to reduce the duplicates both within and between health units. Despite the risk of duplication of some cases, it is thought that the underreporting of respiratory illnesses is of greater concern.¹⁸⁰

Factors impacting this indicator include proper notification of health units by long-term care homes of a possible outbreak, the control measures implemented in the facility upon suspicion of an outbreak and inconsistencies in the application of case definitions regarding what constitutes an outbreak.

The virulence of a particular strain of disease may create an atypical rate of respiratory outbreaks in a region.¹⁸⁰ Although respiratory illnesses occur all year, there are seasonal influences when some pathogens are more prevalent, such as with influenza viruses in the winter months.

Influenza immunization may decrease the number of influenza-related respiratory infections and complications, however this change may be impacted by the degree of match between the influenza vaccine strains and the circulating strains within a flu season. Another influencing factor is the immune response of certain populations. Vaccine efficacy in the elderly can be lower than for other populations. Therefore, timing of doses provided to elderly and immuno-compromised populations in combination with the duration of circulating strains can also impact institutional outbreaks.¹⁸¹ This disease burden is also impacted by staff immunization rates.

While this indicator is not included in other Ontario or Canadian population health reports, other indicators that assess the incidence rates of the various pathogens that cause respiratory illness, morbidity and mortality rates associated with related diseases and rates of hospitalization as a result of respiratory disease are monitored and reported regularly within Ontario by health units, hospitals and academic institutions as a means of assessing population health.^{182,183}

While there are no other reports that identify this particular indicator, other indicators assessing the incidence rates of the various pathogens that cause respiratory illness, morbidity and mortality rates associated with related diseases and rates of hospitalization as a result of respiratory disease are monitored and reported regularly as a means of assessing population health.^{182,183} Other related indicator may include Emergency Room wait times for respiratory illness; seniors living in long-term care homes with co-morbidities; influenza vaccination rates for seniors; and, influenza vaccination rates for health professionals working in long-term care homes. If this indicator were to be measured across the jurisdictions in the future, it would largely be dependant on comparable legislative requirements for reporting infectious diseases and outbreaks, case definitions, data quality and the systems that integrate this information.

15. Chlamydia Incidence

Definition:

The age-standardized chlamydia incidence rate indicator estimates the total number of reported chlamydia cases per 100,000 population.

Data Source(s):

Numerator: Integrated Public Health Information System,
Ministry of Health and Long-Term Care

Denominator: Provincial Health Planning Database, Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{Total number of new reported cases of chlamydia (2007 calendar year)}}{\text{Total population (2007 calendar year)}} \right\} \times 100,000$$

Notes:

- Data was extracted on February 3, 2009 from iPHIS.
- Age groups in years used for direct age-standardization: <10, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65+
- Direct age-standardization to the 1991 Canadian population

Limitations and Comments:

The calculation of the chlamydia incidence rate is based on reported cases of chlamydia. Reported cases of chlamydia must be confirmed through detection of *C trachomatis* by appropriate laboratory techniques in genitourinary specimens. This indicator is specific to new reported cases of chlamydia and does not differentiate between repeat infections or describe co-infections with other sexually transmitted infections. Other related sexual health indicators are total sexually transmitted infections (STI) incidence, co-infections with other sexually transmitted or bloodborne infections, and patients who return for treatment. Screening for chlamydia and the extent of contact tracing may be considered as adjunct indicators.

Although provincial reportable disease legislation^{184,185} requires all cases of chlamydia to be reported to local public health units, it is thought that the number of reported cases underestimates the true burden of disease due to underreporting.¹⁸⁶ Ontario's surveillance system only captures cases of chlamydia that are diagnosed and confirmed through laboratory testing and reported to the health unit.

Chlamydia infections can occur in individuals without symptoms and therefore asymptomatic cases are unlikely to be tested.¹⁸⁷ Individuals that seek treatment may be more likely to present with symptoms. However, asymptomatic individuals may be diagnosed when seeking medical care for other issues (e.g. oral contraceptives, pre-natal consultations) or through opportunistic screening for chlamydia. Asymptomatic individuals may also present for testing through contact tracing performed by the public health unit.

Other factors that may affect the rates of chlamydia detection and reporting include: adolescents who may be reluctant to seek care due to embarrassment or concerns about their confidentiality; health care providers may have limited awareness of chlamydia as an issue; providers that may lack the time, knowledge and skills to manage and discuss sexual health issues.¹⁸⁸

The data source for this indicator is iPHIS. There is a legislated requirement that local public health units report all cases of chlamydia and enter case information into iPHIS in a timely manner. Comparisons across health units can be problematic because of inconsistencies in data collection and entry. Data quality is further compromised by possible duplication of cases as individuals move between health units. It is also possible to double count cases that have not been resolved as information is transferred between health units. However, the duplicate management system in iPHIS may reduce duplicates both within and across health unit boundaries.¹⁷⁴ In addition, the ministry undertook an initiative to clean iPHIS data in the Fall of 2008 for STI cases reported for 2007, thereby further improving the data quality of the indicator.

Chlamydia is the most commonly reported STI in Ontario and Canada.¹⁸⁶ If left untreated in women, it can cause complications such as pelvic inflammatory disease, which can lead to ectopic pregnancies and infertility.¹⁸⁶ Other possible complications include transmission to newborns which may result in longer-term ocular and respiratory infections.¹⁸⁹ In men, untreated infections can cause inflammation of the testicles and prostate which can also lead to infertility.¹⁸⁷

The highest incidence rate of chlamydia infections is found in young adults aged 15-24.¹⁸⁶ There may be a confluence of factors for increased risk in younger adults: increased numbers of sexual partners, high-risk sexual behaviours that contribute to susceptibility, age and physiological development (in adolescence, particularly females, cervical epithelial cells are developmentally immature thus increasing susceptibility to infection).¹⁹⁰ Women of childbearing age may also be screened for chlamydia while seeking medical treatment for reproductive-related care or access to oral contraceptives.¹⁸⁷ Men are more likely to present for testing due to symptomatic infection.¹⁹¹

Risk factors for chlamydia infection include new or multiple sex partners, greater number of sexual partners, inconsistent condom use, past STI infection, and presence of another STI.^{190,192} Other factors that may be associated with seeking treatment include the severity of symptoms¹⁹³ and increased awareness on testing for chlamydia.¹⁹⁴ Barriers to seeking treatment may be access to care locations (i.e., sexual health clinics, or primary care services), lack of information, and perceived stigma with accessing services.¹⁹⁴

In recent years, the number of reported cases of chlamydia has been increasing. The relatively higher incidence rates for chlamydia than other STI may be because chlamydia is a more sensitive indicator of change in risk behaviours and reflects the effectiveness of increased awareness of screening and testing.¹⁹⁵

Although the increase in the incidence rate may be partly due to improved detection through the use of a more sensitive diagnostic test for chlamydia that was introduced in 2001 (nucleic acid amplification test or NAAT), it is believed that the true incidence of chlamydia and other sexually transmitted infections have continued to increase.^{190,195} There has also been an increase in awareness of screening and testing for chlamydia which may lead to further case finding of infections.¹⁹⁶ Other factors that may also be contributing to increased incidence rates are believed to include an increase in rates of partner notification and expanded screening efforts.

Most jurisdictions report on chlamydia incidence. It is one of the Comparable Health Indicators reported across Canada.¹⁹⁵ The Ontario Health Quality Council also reports on age-standardized chlamydia rates for the province.^{197,198} There will be minor variations in reported rates of chlamydia across public health units and other jurisdictions due to several factors including data entry delays, differing cut-off dates, updates to data, the use of standardization or age-specific rates, and date of access to Statistics Canada's population estimates.

16. Immunization Coverage for Hepatitis B

Definition:

The immunization coverage for hepatitis B indicator estimates the proportion of grade 7 students who have completed the immunization series against hepatitis B by the end of grade 7.

Data Source(s):

Numerator: As reported by public health units to Public Health Division, Ministry of Health and Long-Term Care

Denominator: As reported by public health units to Public Health Division, Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{\# of grade 7 students who have completed the immunization series against hepatitis B by the end of grade 7 (vaccinated before or during grade 7 by physician or public health) (2007/2008 school year)}}{\text{Total number of Grade 7 students (2007/2008 school year)}} \right\} \times 100$$

Notes:

- *Data as complete as of June 30, 2008 (2007/2008 school year) for grade 7 students (birth year 1995)*
- *Hepatitis B immunization is not a designated disease under the ISPA (Immunization of School Pupils Act) and therefore health units are not required to report Hepatitis B immunization rates; reporting is voluntary*
- *All public health units are required to report Hepatitis B coverage rates to the Ministry of Health and Long-Term Care. Some public health units also record Hepatitis B coverage rates in the IRIS reporting data system; use of this system is voluntary*
- *This indicator is specific to the school-based immunization program, and does not include all immunizations against Hepatitis B as administered by the public health unit (e.g., doses administered in other setting or populations/age groups, such as sexual health clinics)*

Limitations and Comments:

This is the first time these figures have been available publicly. This indicator reflects the Hepatitis B vaccination rate that occurs through school-based immunization programs undertaken by public health units. This service delivery model is in contrast to other immunization activities in Ontario where the majority of childhood immunizations are administered by primary care professionals.

This indicator calculates the immunization status of grade 7 students, as that is the age when the public health program administers the 2 doses to students. Students who miss one or more doses in grade 7 are usually “caught-up” in grade 8 when public health nurses are visiting to immunize the next year’s grade 7 students.

However, this model produces a variance in reporting structures. Some health units choose to measure coverage at the end of the school year at grade 7, where other health units may measure coverage at the end of grade 8 in order to capture students who complete the immunization cycle in this grade. This difference in practice impacts the comparability of the data across health units.

Some groups of students are underrepresented in these coverage rates, including home-schooled students, students who are immunized due to disease contact or as a travel requirement and students from communities where immunization is not culturally acceptable. Other students may refuse immunization due to the anti-immunization movement.¹⁹⁹ Health units with large populations of these student groups are likely to have lower immunization rates irrespective of their effectiveness at delivering the Hepatitis B vaccine program.

At present, hepatitis B vaccination policies vary by province/territory across Canada. All provinces include some form of universal immunization, offered to all newborns or to adolescents, as well as to individuals at high risk of acquiring hepatitis B. Therefore, hepatitis B immunization rates cannot be compared to jurisdictions outside of Ontario. Along with Ontario, the provinces that offer adolescent hepatitis B immunization programs are Alberta, Saskatchewan, Manitoba, Quebec, Nova Scotia and Newfoundland and Labrador.²⁰⁰

It should be noted that it is possible to have high immunization uptake rates and still have low immunization coverage or efficacy rates. This may be due to factors that affect the effectiveness of the immunization program, such as incomplete vaccination series, cold chain failures or vaccine that was improperly administered.^{201,202}

Methods to confirm immunity conferred through immunization are possible and include methods such as measuring the seroprevalence of hepatitis B in a representative population. However, this method requires significant laboratory capacity and is expensive to conduct. Another possible confirmatory method would be to estimate the rate of seromarkers in the population prior to immunization, although this method is not well suited for young children.²⁰³

The coverage data used in this indicator has not been independently verified. Health unit reporting on hepatitis B immunization rates is voluntary, since hepatitis B is not a designated disease under the *Immunization of School Pupils Act (ISPA)*.²⁰⁴ Health units report hepatitis B immunization data to the ministry in a number of ways, including through the Immunization Records Information System (IRIS) and through ministry surveys.

The decentralized nature of this reporting increases the likelihood of variable data quality due to the inconsistent and incomplete reporting. Therefore, caution should be used when comparing coverage rates across health units and with other jurisdictions.

Because this indicator is not reported in other performance reports, such as the *Comparable Health Indicators*, or within *Health Indicators*, there is no comparable data that can be used to compare the figures reported here. This may also be a function of the varying types of hepatitis B immunization programs implemented across other provinces and territories. Other possible public health indicators related to hepatitis B include incidence of hepatitis B, which is a reportable disease in Ontario; hepatitis B-related morbidity and mortality incidence and prevalence rates (i.e. acute viral hepatitis, liver disease); initiation and drop-out of hepatitis B immunization series; hepatitis B immunization-related adverse events; and, hepatitis B vaccine wastage.

17. Immunization Coverage for Measles, Mumps, and Rubella

Definition:

The immunization coverage for measles, mumps and rubella indicator estimates the proportion of school children age 7 years who are known to be complete for age for vaccination against measles, mumps and rubella.

Data Source(s):

Numerator: Immunization Record Information System, 36 locally maintained databases shared with the Public Health Division, Ministry of Health and Long-Term Care

Denominator: Immunization Record Information System, 36 locally maintained databases shared with the Public Health Division, Ministry of Health and Long-Term Care

Formula:

$$\left\{ \frac{\text{Number of school children age seven years who are known by the health unit to be complete for age for vaccination against measles, mumps and rubella (2007/2008 school year)}}{\text{Number of children enrolled in school (2007/2008 school year)}} \right\} \times 100$$

Notes:

- *Data as complete on June 30, 2008 (2007/2008 school year) for 7 year olds (birth year 2000)*
- *Data was extracted from IRIS, August 2008 to January 2009*
- *Vaccination information is collected only for children attending schools that public health units have screened*
- *Some children/students may not be eligible for a vaccine due to medical contraindication. This information may be collected and recorded in IRIS. However, ineligible children are not excluded from the denominator of vaccine coverage calculations since not all IRIS vaccine coverage reports summarize this information*
- *Children/students with exemptions (medical, philosophical, conscience or religious) or with no information are treated as incomplete*

Limitation and Comments:

Under the *Immunization of School Pupils Act*,²⁰⁴ all children are required to have the MMR vaccine to attend a licensed school in Ontario. Children who are not immunized can be suspended from school, however enforcement of this varies across health units. Immunization information is collected only for children attending schools that the public health units screen and have jurisdiction to screen and therefore will not accurately reflect the true immunization coverage rate for the community. For example, health units only screen 'licensed' schools. Health units with high rates of unlicensed schools (home schooling, some private religious schools) may appear to have especially low vaccination rates.

Some children are not eligible for this vaccine because of medical contraindication²⁰⁵ and are considered 'ineligible'. This information can be recorded in IRIS. Because this data is not always provided, ineligible children are included in the denominator value for immunization coverage. However, this group of children is likely to be very small²⁰⁶ and thus will have limited impact on immunization coverage estimates. Other children receive exemptions from the MMR vaccine because of parental philosophical or religious objections.^{207,208} Health units with high rates of ineligible children or children who receive exemptions will also have lower vaccination coverage rates.

Data on MMR vaccine uptake is reported by health units into the IRIS system. Data collection is conducted retrospectively at age 7 as part of school enrolment. Thus, data for this indicator is not available in real time and reflects the children who have been immunized by age 7 only, and does not capture the children younger than age 7 who are currently immunized. As well, because IRIS is individually maintained by each health unit, time delays in records entry can also impact the validity of the data and the comparability of data across health units. Vaccination coverage data is faxed to the Ministry from the health unit, which may also cause an additional lag in the timeliness in data.

Factors that influence MMR vaccine uptake include:

- Access to care;²⁰⁹
- The acceptability of the MMR vaccine or of vaccination within certain communities;²¹⁰
- High profile outbreaks of measles in the community;²¹¹
- High profile media campaigns linking the MMR vaccine to autism and irritable bowel syndrome may penetrate communities differently based on access to media material;²¹² and
- Outbreaks of vaccine preventable disease can occur when immunization rates decline.^{213,214,215}

Coverage against MMR immunization is not currently included in other major health indicator reports such as *Healthy Canadians*³⁰ and *Health Indicators*.²¹⁶ However, MMR coverage is regularly reported by health units for several purposes including program reach and effectiveness, health status, program planning, and for enforcement of school suspension. Other relevant immunization specific indicators may include incidence of measles, mumps and rubella, which are reportable diseases in Ontario; measles, mumps, rubella related morbidity and mortality incidence and prevalence rates; adverse events following immunization (AEFI) with MMR vaccine; MMR vaccine wastage rate; Diphtheria, Polio and Tetanus (DPT) immunization rates in children; influenza immunization rate; and vaccine wastage.

18. Adverse Water Quality Incidents

Definition:

Number of Adverse Water Quality Incidents from Drinking Water Systems subject to O.Reg 170/03/O. Reg 252/05 and unregistered Drinking Water Systems for the 2007 Calendar year.

Data Source(s):

Drinking Water Programs Branch, Ministry of the Environment

Formula:

Number of Adverse Water Quality Incidents from Drinking Water Systems subject to O.Reg 170/03/O. Reg 252/05 and unregistered Drinking Water Systems for the 2007 Calendar year

Notes:

- *Exceedences from schools and day cares subject to O.Reg 243/07 not included in this summary*
- *O. Reg 170/03 is specific to Drinking Water Systems included year round residential systems as well as designated facilities including schools, daycares and nursing homes*
- *O. Reg 252/05 is specific to Non-Residential and Non-Municipal Seasonal Residential Systems that do not serve Designated Facilities. These are also considered small drinking water systems*

Limitations and Comments:

The adverse water quality incidents (AWQI) indicator is based on the reported number of AWQI in regulated drinking water systems, as reported by licensed laboratories to local public health units and the Ministry of the Environment.

There are several regulations that relate to different types of drinking water systems in Ontario, under the *Drinking Water Systems* regulation (O.Reg. 170/03)²¹⁷ and the *Non-Residential and Non-Municipal Seasonal Residential Systems That Do Not Serve Designated Facilities* regulation (O. Reg. 252/05).²¹⁸ These two regulations apply to the majority of drinking water systems in the province, and require the reporting of adverse water quality incidents.

O. Reg. 170/03 regulates municipal and private water systems that provide water to year-round residential developments and designated facilities that serve vulnerable populations such as children and the elderly. Designated facilities include children's camps, child and youth care facilities, health care and social care facilities, and schools (including private schools).

Non-Residential and Non-Municipal Seasonal Residential Systems That Do Not Serve Designated Facilities
Regulation O. Reg 252/05 is specific to primarily smaller water systems including non-residential systems in municipal and public facilities as well as seasonal residential systems (e.g., campgrounds and trailer parks).

The indicator data is reported by licensed laboratories to the operator, their local public health unit and to the Ministry of the Environment through the Spills Action Centre (SAC). Data quality depends on compliance with the reporting requirements contained within these regulations, and relies on both operators and health units having appropriate reporting practices in place.

O. Reg 170/03 specifies that when adverse test results are obtained from a licensed laboratory, immediate verbal and written notice must be provided to the owner/operator, the local Medical Officer of Health and the Ministry of the Environment. This reporting obligation is imposed upon the owner/operator of the drinking water system, as well as upon the laboratory that performed the testing. When there is receipt of a report of an adverse drinking water quality incident, there are specific tools and processes in place to address the issue.

The purpose of reporting adverse drinking water incidents is to protect users from being exposed to unsafe water, as well as to provide information on the quality of drinking water. There are wide variations in the size and complexity of the drinking water systems that fall under the drinking water regulations. These variations have a direct bearing on the frequency of water sampling and testing.

The Chief Drinking Water Inspector's Annual Report for 2007-2008 reports that Ontario's drinking water regulations require testing based on a strict set of health-based standards which provides Ontario with a drinking water safety net.²¹⁹ Most jurisdictions do report on various drinking water quality measures, and although the regulatory framework is not identical, the data from different jurisdictions may be somewhat comparable.

An alternative indicator would be to report on the number of adverse drinking water notifications. However this approach would require the development of a consistent approach to data collection and reporting to the ministry.



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