Vaccine Preventable Disease Monitoring Report
Pertussis, 2017

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Purpose:

The Saskatchewan Ministry of Health's Population Health Branch provides routine surveillance of notifiable diseases at the provincial, former health region, Athabasca Health Authority, First Nations and Inuit Health Branch - Saskatchewan Region (FNIHB-SK) and Northern Inter-Tribal Health Authority (NITHA) levels.

This report presents the most recent data for reportable communicable diseases as collected by the Integrated Public Health Information System (iPHIS) and immunization coverage information as collected by the Saskatchewan Immunization Management System (SIMS) and Panorama. Limitations associated with these systems have been described elsewhere.

Under *The Public Health Act, 1994* and the accompanying Disease Control Regulations, local medical health officers (MHOs) must report Categories I and II Communicable Diseases, as well as any communicable disease outbreaks to the Chief and Deputy Chief Medical Health Officers. Pertussis is a Category I disease.

Report Features:

Background
Epidemiological Summary
Surveillance Case Definition
Case Counts by Year
Case Characteristics
Vaccine Coverage

Prepared by:

Population Health Branch,
Saskatchewan Ministry of Health

Contact:

Val Mann, PhD
Chief Population Health Epidemiologist, Population Health Branch, Saskatchewan Ministry of Health
email: cdc@health.gov.sk.ca

Background

Pertussis (whooping cough) is a highly contagious bacterial disease. It often begins with mild respiratory symptoms, cough and sometimes fever, and can progress to severe coughing attacks characterized by a "whoop sound" when a breath is taken.

Infants are most vulnerable and often infected by older siblings, parents or caregivers who may not know they have the disease. One to three deaths related to pertussis occur each year in Canada, particularly in infants too young to be immunized, or in unimmunized, or partially immunized children. Deaths were not required to be reported prior to 2014, although it was common practice to do so. There was one infant death from 2011 to 2015.

Symptoms usually develop five to 10 days after exposure, but can take up to 21 days.

Pertussis is caused by the bacteria *Bordetella pertussis*. The bacteria are easily spread by droplets from the nose or mouth or through direct contact with the respiratory secretions of an infected person.

Pertussis becomes more active on a cyclical basis with increased cases being reported every two to five years. The variability in the number of pertussis cases from one year to the next and in different geographical regions is often because of outbreaks. Four hundred twenty-six (426) cases of lab-confirmed pertussis were reported in 2017. Many cases were associated with an extended outbreak in one region.

Immunization

Acellular pertussis vaccine is only available in combination vaccines. The Saskatchewan Routine Childhood Immunization Schedule recommends a four dose primary series of pertussis vaccine at two, four, six and 18 months of age, one booster at four to six years of age and a second booster in Grade 8. Adults are eligible to receive one lifetime pertussis vaccine dose. Pregnant women are eligible for pertussis vaccine in every pregnancy (implemented Oct 2017).

Transmission is less likely in or to people who are vaccinated. Adolescents and adults who have not received a booster are at risk of infection and are often the source of infection for infants. Infants too young for vaccination are at the greatest risk for serious pertussis complications and deaths.

The efficacy of acellular pertussis vaccine following the primary series is estimated to be about 85%, and approximately 90% following booster immunization.

Surveillance

Under *The Public Health Act, 1994*, Saskatchewan health care providers are required to report cases of pertussis to the local medical health officer (MHO) who then reports the case to the Chief and Deputy Chief Medical Health Officers using the case definition in the Saskatchewan Communicable Disease Manual.

Notifiable diseases may be undetected, therefore underreported, due to a number of factors including lack of contact with the health care system or inability of laboratory tests to identify the organism. Some communicable diseases occur rarely and therefore, rates are based on small numbers of cases which can fluctuate dramatically over time. In these situations, year to year comparisons should be interpreted with caution.

Surveillance case definitions ensure uniform reporting to allow comparability of surveillance data. The definitions are not intended to be used for clinical or laboratory diagnosis or management of cases.

Currently molecular epidemiology genotyping is not available for pertussis.

EPIDEMIOLOGY AND VACCINE COVERAGE SUMMARY

Pertussis in Saskatchewan: 2017

- Four hundred twenty-five (425) cases of lab-confirmed pertussis were reported in 2017. Ages ranged from 10 days old to 91 years of age.
- One protracted community outbreak in the former Five Hills Health Region (HR), declared at the end of December 2016, continued throughout the year. A large outbreak occurred in a cluster of communities in the former Prince Albert Parkland HR among a largely under-immunized preschool population. Another outbreak was declared among a group of fully immunized school aged children in the former Cypress HR.
- Twenty-six of 36 infant cases were too young to be adequately protected by immunization; eight of these were too young to begin their primary series. Eleven cases eligible for pertussis vaccine were unimmunized. The others had one or two doses of vaccine.
- Fifteen of the 32 hospitalized cases were infants (47%).
- There were no reported deaths from pertussis.

Pertussis in Saskatchewan: 2013 to 2017

- Nine hundred one (901) cases of pertussis ranging in age from ten days to 93 years were reported. The median age of cases was 12 years.
- One-quarter of the cases (26%) lived in the former Saskatoon HR and 14% each in the former Regina Qu'Appelle and Five Hills HRs. Nine percent (9%) lived in FNIHB-SK communities.
- Sixty-eight cases (8%) were reported hospitalized for pertussis illnesses, including 33 of the 87 infants.
- One-quarter of 87 cases (21 cases) were less than two months old and too young to begin their primary immunization series for pertussis. Twenty-six of the 44 cases old enough to receive one or two doses of vaccine had not been started (59%). Eleven of 24 infant cases, old enough to complete their series had not started (46%). Ten who had completed their primary series still became infected (11%).

Pertussis Coverage in Saskatchewan: 2013 to 2017

- From 2013 to 2017, provincial coverage rates steadily improved or remained stable up to and including five years of age.
- The coverage rates based on doses received, steadily declined for children older than five years until 2016.
- The 2017 rates show improvement because rates are based on up-to-date status, which adjusts for delayed or interrupted series versus a strict dose count.

Table 1: Pertussis case counts by year

	2017	2016	2015	2014	2013	Total
Saskatchewan	425	197	213	47	19	901
Canada	N/A	3936	3514	1526	1277	10253

N/A = not available

Table 2: Pertussis case characteristics, 2013-2017

Characteristics of pertussis cases – Saskatchewan 2013-2017		Cases	Percent of Cases
Total		901	100
Sex	Male	430	48
	Female	471	52
Age	Less than 1 year	87	10
	1 - 4 years	114	13
	5 - 19 years	450	50
	20 - 49 years	196	22
	50 years and over	54	6
Hospitalized	Yes	68	8
	No	833	92
	Unknown	0	0
Immunization status of infants (less than 1 year) for pertussis vaccine* (n=87)	3 doses	10	11
	2 doses	2	2
	1 dose	16	18
	0 doses	37	43
	Too young	21	24
	Unknown	1	1
Source	International	1	<1
	Canada (out of province)	7	1
	Saskatchewan	893	99
Genotype	Not applicable	901	100

*Immunization status is monitored for infant cases only, as infants are the most vulnerable for severe outcomes of pertussis infections.

Table 3: Pertussis vaccine coverage for Saskatchewan, 2013-2017

Age	Doses	2017	2016	2015	2014	2013
3 months	1	85.9%	85.0%	85.0%	84.1%	83.3%
5 months	2	77%	77.0%	76.0%	73.7%	73.7%
8 months	3	78.5%	78.8%	77.3%	76.4%	75.7%
12 months	3	86.1%	85.6%	84.9%	84.7%	84.4%
20 months	3	90.4%	89.1%	88.5%	88.8%	89.1%
	4	64.3%	60.9%	60.5%	60.1%	58.7%
24 months	3	90.9%	89.9%	89.3%	89.8%	90.4%
	4	78.4%	76.8%	74.6%	75.7%	76.3%
5 years	4	87.1%	87.7%	85.1%	87.8%	87.2%
7 years	5	N/A	76.2%	74.8%	77.8%	78.3%
	Up-to-date	83.1%	N/A	N/A	N/A	N/A
13 years	5	N/A	76.9%	77.5%	80.2%	80.7%
	Up-to-date	79%	N/A	N/A	N/A	N/A
15 years	6	N/A	67.3%	66.9%	72.2%	72.9%
	Up-to-date	81.7%	N/A	N/A	N/A	N/A
17 years	6	N/A	70.6%	71.1%	74.3%	75.0%
	Up-to-date	83.4%	N/A	N/A	N/A	N/A

N/A = not applicable

VACCINE COVERAGE SUMMARY

Table 4: Pertussis Vaccine Coverage by Former Health Region, 2017

Former Health Region, by Peer Group	Vaccine coverage (% immunized), by age and dose												
	3 months	5 months	8 months	12 months	20 months		24 months		5 years	7 years	13 years	15 years	17 years
	1 dose	2 doses	3 doses	3 doses	3 doses	4 doses	3 doses	4 doses	4 doses	up-to-date	up-to-date	up-to-date	up-to-date
Saskatchewan	**85.9**	**77**	**78.5**	**86.1**	**90.4**	**64.3**	**90.9**	**78.4**	**87.1**	**83.1**	**79**	**81.7**	**83.4**
Peer Group A													
Regina Qu'Appelle	87.1	78.2	79.6	87	90	61.9	89.9	75	86.2	84.2	76.8	82.5	84.1
Saskatoon	84.4	76	78.5	86.3	90.2	62.6	91.5	80.4	86.2	80.2	75.6	83.5	85.3
Peer Group D													
Cypress	88.9	78.7	80.1	87.9	92.7	72.1	92	82.8	92.5	91	86.1	85.2	88.1
Five Hills	88.9	82.5	82.5	86.6	92	71.7	93	82	87.2	85.3	84.8	84.6	84.8
Heartland	86.4	79.5	87.1	91.3	94	72.5	93.7	86	94.4	92.3	86	85.9	90.3
Kelsey Trail	91.2	87	90.1	94.7	96.3	77.8	97.5	87.4	91.7	89.8	85.1	83.7	85.7
Sun Country	94.1	91.6	91	94.2	95.7	87.1	95.7	92.2	94.1	94.2	86.8	89.1	89
Sunrise	85.7	79.7	81.7	86.7	92.4	72.2	92.3	82	88.2	80.9	84.5	84.3	84.9
Peer Group F													
Athabasca Health Authority	91.3	86.4	80.6	94.4	97.6	41.5	97.3	70.3	93.5	89.4	85.2	81.6	90.6
Keewatin Yatthé	77.9	58.1	50.6	71.6	85.6	41.1	84.4	61.9	85.6	78	78.6	51.8	52.7
Mamawetan Churchill River	84.3	71.8	67.4	83.7	91.9	62.8	92.6	72.6	96	78.2	74.8	59.8	59
Peer Group H													
Prairie North	84.6	72.2	72.6	81.6	87.3	60.5	87.2	72.2	83.6	79.7	78.9	73.5	74.1
Prince Albert Parkland	80.2	65	65	75.3	84.1	50.2	85.9	67.1	83.7	78	78.5	74.9	80

- One year of coverage data in 13 age-dose/up-to-date categories are provided by former HR and Athabasca Health Authority (AHA). Yellow highlight indicates rates below the provincial coverage rate.
- Pertussis vaccine is recommended at two, four, six and 18 months, with a booster dose between four and six years of age. If the primary series is delayed or interrupted, the schedule can be adjusted to bring the child up-to-date for protection. Data for three, five, eight, 12, 20, and 24 months; and five, seven, 13, 15 and 17 years are shown with seven, 13, 15 and 17 years reported as up-to-date.
- Up-to-date at seven years:
  a) Children who received the four-dose primary series at two, four, six and 18 months and a booster dose between four and six years of age AND
  b) Children who received four doses before the age of four years and one booster dose after the age of four years with at least a 24-week interval between the third and fourth doses, and the fourth and fifth doses AND
  c) Children who received four doses of vaccine with the fourth dose administered after the age of four years and at least 24 weeks after the third dose AND
  d) Children who received three doses of vaccine with the third dose at seven years and at least 24 weeks after the second dose.
- Up-to-date at 13 years:
  a) a) to b) for seven years AND
  b) Children who received five doses with the third dose administered before four years of age, the fourth dose at least 24 weeks after the third dose, and the fifth dose at or after 11 years of age and at least 24 weeks after the fourth dose AND
  c) Children who received four doses with the fourth dose administered at or after 11 years of age and a 24-week interval between the second and third doses, and third and fourth doses AND
  d) Children who received three doses with the third dose administered at or after 11 years of age and a 24-week interval between the second and third doses and a one-month-interval between first and second doses.
- Up-to-date at 15 and 17 years:
  a) Children who received the four-dose primary series at two, four, six and 18 months and two booster doses at four to six years and Grade 8 (usually between 12 and 14 years of age) AND
  b) b) to d) for 13 years.
- At eight, 12 and 24 months of age, eight of the former HRs plus AHA exceeded the provincial average for three doses and four were below. Eight former HRs plus AHA also exceeded the provincial average for up-to-date coverage at 17 years.
- Three-dose coverage rate was higher among the 20-month age group compared to the eight-month age group: 90.4% vs. 78.5%. Likewise, the four-dose coverage rate for the 24-month age group was higher than the 20-month age group: 78.4% vs. 64.3%.
- Three former HRs were below the provincial rate in all thirteen age-dose categories and one was below in ten categories.
- Five former HRs were at or above the provincial rate in all age-dose categories and one was at or above the provincial average in all but two categories.
- Coverage rates for former health regions in Peer Groups F and H should be interpreted with caution (see Data Notes).

SURVEILLANCE CASE DEFINITION: Saskatchewan CDC Manual

Respiratory and Direct Contact
Pertussis

Notification Timeline:
From Lab/Practitioner to Public Health: Immediate.
From Public Health to Ministry of Health: Within 2 weeks.
Public Health Follow-up Timeline: Immediate

Case Definition (adopted from Public Health Agency of Canada, 2008)

Confirmed Case	Laboratory confirmation of infection: • isolation of *Bordetella pertussis* from an appropriate clinical specimen **OR** • detection of *B. pertussis* DNA from an appropriate clinical specimen **AND** one or more of the following: • cough lasting 2 weeks or longer • paroxysmal cough of any duration • cough with inspiratory "whoop" • cough ending in vomiting or gagging, or associated with apnea **OR** Epidemiologic link to a laboratory-confirmed case AND one or more of the following for which there is no other known cause: • paroxysmal cough of any duration • cough with inspiratory "whoop" • cough ending in vomiting or gagging, or associated with apnea
Probable Case	Cough lasting 2 weeks or longer in the absence of appropriate laboratory tests and not epidemiologically linked to a laboratory-confirmed case **AND** one or more of the following, with no other known cause: • paroxysmal cough of any duration • cough with inspiratory "whoop" • cough ending in vomiting or gagging, or associated with apnea
Suspect Case	One or more of the following, with no other known cause: • paroxysmal cough of any duration • cough with inspiratory "whoop"

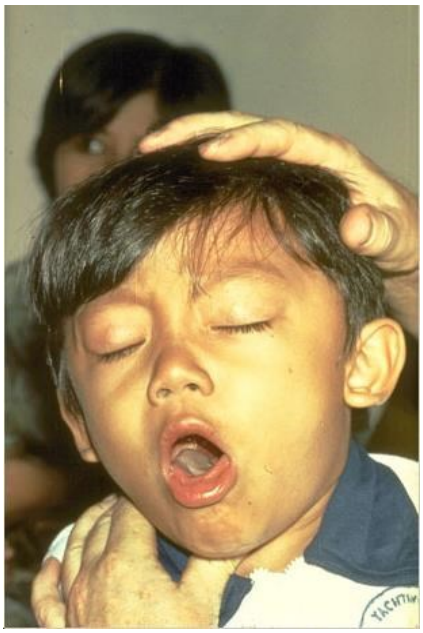

Photo Courtesy of Centers for Disease Control

DATA NOTES

Case Data Source: The Saskatchewan Integrated Public Health Information System (iPHIS) is a provincially mandated integrated client-centered case management information system that supports public health surveillance. Confirmed cases must meet the provincial surveillance case definition.

There are 10 peer groups used by Statistic Canada, each identified by a letter (A to J). A peer group consists of former health regions with similar socio-economic characteristics which facilitates comparisons within a peer group. The twelve former health regions and one health authority in Saskatchewan fall into four groups identified by letters A, D, F and H. The peer groups in this report are based on Statistics Canada 2011 peer groupings and should not be compared to current Statistics Canada peer groupings (2014).

Vaccine Coverage Data Source: The Saskatchewan Immunization Management System (SIMS) is a client-based registry recording vaccines delivered by regional public health services. It does not include vaccines delivered out of province or by First Nations communities that declined to use SIMS. Immunization data from the former Keewatin Yatthé and Mamawetan Churchill River HRs and historical data from AHA are incomplete. As a result, this report does not provide immunization coverage for the entire provincial or regional populations.

Panorama is a comprehensive, integrated public health information system: vaccine inventory, immunization, and investigation and outbreak management modules have been implemented. Panorama's immunization module replaced the former Saskatchewan Immunization Management System (SIMS), on January 27, 2015. SIMS had been used province-wide since 2001. To learn more, please visit: www.ehealthsask.ca/services/panorama/Pages/default.aspx.

Most FNIHB-SK and NITHA communities, with the exception of those in AHA, are not currently using Panorama. Therefore, immunization data for most First Nations children are missing or are incomplete. This report includes only those children with Saskatchewan health coverage and registered in Panorama under a former HR or AHA as of January 1, 2018. In other words, children with Saskatchewan health coverage and registered in Panorama under FNIHB-SK or NITHA jurisdiction are excluded (including those from FNIHB-SK and NITHA communities in AHA). This means this report does not include coverage statistics for the entire provincial or regional population.

The four-dose primary series pertussis containing vaccine is administered as diphtheria, tetanus, acellular pertussis, inactivated polio & Haemophilus influenzae type B (DTaP-IPV-Hib). The first booster at four to six years of age is DTaP-IPV vaccine and the second and final booster at Grade 8 is tetanus, diphtheria & acellular pertussis (Tdap) vaccine. Immunization coverage is based on those who turned three, five, eight, 12, 20 and 24 months, and five, seven, 13, 15 and 17 years by December 31 in 2017. For example, the immunization coverage for seven-year-old children in 2017 is based on clients who were born in 2010 and the immunization doses they received by their seventh birthdays.