

# Vaccine Preventable Disease Monitoring Report Diphtheria, 2015 and 2016

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## **Purpose:**

The Saskatchewan Ministry of Health's Population Health Branch provides routine surveillance of notifiable diseases at the provincial, regional health authority (RHA), First Nations and Inuit Health Branch Saskatchewan (FNIHB-SK) Region 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 Category I Communicable Diseases, as well as any communicable disease outbreaks to the provincial Chief and Deputy Chief Medical Health Officers. Diphtheria is a Category I disease.

## **Report Features:**

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

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## **Background**

Diphtheria is a contagious disease that begins with a low-grade fever and sore throat. It can progress quickly to produce a thick membrane over the tonsils and throat resulting in breathing and swallowing difficulties, particularly in infants and young children. The bacteria can also release a toxin that can cause abnormal heart rhythms or paralysis of the breathing muscles, which can lead to suffocation or even death.

Diphtheria can also cause infections of the skin, nose, larynx, eye, and vagina. These infections present as a shallow ulcer with a thick grey coating and are usually found in warmer climates or among the homeless.

Diphtheria is caused by a bacterium, *Corynebacterium diphtheria*. Diphtheria bacteria live in the mouth, throat and nose of an infected person and can be spread directly from coughing or sneezing or via contaminated articles such as clothing.

Diphtheria vaccine was introduced in Canada in 1926 resulting in a remarkable decline in the morbidity and mortality associated with the disease. In the last 20 years, fewer than five cases of diphtheria were reported each year in Canada. It continues to occur worldwide, especially in countries with limited immunization programs.

## **Immunization**

Diphtheria toxoid is only available in combination vaccines. The Saskatchewan Routine Childhood Immunization Schedule recommends a four dose primary series of diphtheria toxoid-containing 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. A booster dose of tetanus and diphtheria toxoid-containing vaccine is recommended for adults every 10 years.

Transmission is less likely among people who are vaccinated. Inadequately immunized or unimmunized travellers to areas with endemic diphtheria are at higher

risk of acquiring disease. In Canada, blood serum surveys indicate that approximately 20% of the healthy adult population does not have a protective concentration of antibodies to diphtheria; adult booster doses are required.

The efficacy of diphtheria toxoid-containing vaccine following the primary series is estimated to be about 97%, and approximately 100% following booster immunization. Antitoxin antibodies are believed to persist at protective concentrations for 10 years or more.

## **Surveillance**

Under *The Public Health Act, 1994*, Saskatchewan health care providers are required to report cases 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 Control Manual.

Notifiable diseases may be undetected, therefore underreported, due to a number of factors including lack of contact with the health care system or lack of detection related to lab methodology. All membranous pharyngitis should be cultured for diphtheria. Lab requisitions for diphtheria should be flagged since selective media is necessary for laboratory diagnosis.

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 diphtheria.

# EPIDEMIOLOGY AND VACCINE COVERAGE SUMMARIES

## Diphtheria in Saskatchewan: 2015

- No cases of lab-confirmed diphtheria were reported that met the surveillance case definition.
- Cutaneous diphtheria is no longer monitored.

## Diphtheria in Saskatchewan: 2011 to 2015

- One diphtheria case reported in the 2014 report was cutaneous and is not reported here. It was most likely acquired through environmental exposure. The vaccine produces an anti-toxin but does not eliminate the organism from the community.

Table 1: Diphtheria case counts by year

	2016*	2015	2014	2013	2012	2011	Total
Saskatchewan	0	0	0	0	0	0	0
Canada	N/A	N/A	1	0	0	1	2

\*preliminary counts to date  
N/A = not available

Table 2: Diphtheria case characteristics, 2011-2015

Characteristics of diphtheria cases – Saskatchewan 2011-2015		Cases	Percent of Cases
Total		0	0
Sex	Male	0	0
	Female	0	0
Age	Less than 1 year	0	0
	1 - 4 years	0	0
	5 - 19 years	0	0
	20 – 49 years	0	0
	50 years and over	0	0
Hospitalized	Yes	0	0
	No	0	0
	Unknown	0	0
Immunization status for diphtheria vaccine	5 doses	0	0
	4 doses	0	0
	0 dose	0	0
	Too young	0	0
Immunization status for diphtheria vaccine	Unknown	0	0
	International	0	0
	Canada	0	0
	Saskatchewan	0	0
Provincial source	Domestic Travel	0	0
	Epidemiologically-linked to travel case	0	0
	Epidemiologically-linked to case with unknown source	0	0
	No identified source	0	0
Genotype	Unknown	0	0

## Diphtheria Coverage in Saskatchewan: 2012 to 2016

- From 2012 to 2016, provincial immunization coverage rates improved up to and including 5 years of age, while the rate declined for children seven to 15 years of age.
- From 2013 to 2016, the coverage rate declined for 17-year-old teens (the 2012 rate is unreliable and should not be compared with later years).

Table 3: Diphtheria vaccine coverage for Saskatchewan, 2012-2016

Age	Doses	2016	2015	2014	2013	2012
3 months	1	85.0%	85.0%	84.2%	83.4%	83.1%
5 months	2	77.0%	76.0%	73.8%	73.9%	72.4%
8 months	3	78.8%	77.3%	76.4%	75.8%	74.8%
12 months	3	85.6%	84.9%	84.7%	84.5%	84.7%
20 months	3	89.1%	88.5%	88.8%	89.2%	88.8%
	4	60.9%	60.5%	60.2%	59.2%	59.7%
24 months	3	89.9%	89.3%	89.8%	90.5%	89.4%
	4	76.8%	74.6%	75.7%	76.4%	75.5%
5 years	4	87.7%	85.1%	87.9%	87.3%	87.2%
7 years	5	76.3%	74.9%	78.0%	78.5%	77.7%
13 years	5	77.4%	78.2%	80.8%	81.2%	83.0%
15 years	6	68.1%	67.6%	72.9%	73.8%	73.9%
17 years	6	71.3%	71.9%	75.1%	76.2%	68.7% <sup>^</sup>

<sup>^</sup>Immunization records may be incomplete for children born prior to 1996. Therefore, the 2012 coverage rate for 17-year-old adolescents may not reflect actual provincial or RHA rates.

# VACCINE COVERAGE SUMMARIES

**Table 4: Diphtheria Vaccine Coverage by Health Region, 2016**

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	5 doses	5 doses	6 doses	6 doses
<b>Saskatchewan</b>	<b>85.0</b>	<b>77.0</b>	<b>78.8</b>	<b>85.6</b>	<b>89.1</b>	<b>60.9</b>	<b>89.9</b>	<b>76.8</b>	<b>87.7</b>	<b>76.3</b>	<b>77.4</b>	<b>68.1</b>	<b>71.3</b>
<b>Peer Group A</b>													
Regina Qu'Appelle	87.0	78.5	79.8	85.3	87.4	58.4	89.0	75.0	86.4	76.1	74.6	67.4	68.5
Saskatoon	83.9	76.1	77.8	85.9	90.9	63.3	91.4	80.8	87.8	74.6	75.0	69.1	70.4
<b>Peer Group D</b>													
Cypress	87.1	80.6	82.6	88.6	93.2	71.2	94.9	87.8	92.7	82.0	84.3	76.6	78.3
Five Hills	89.1	80.0	83.2	89.2	90.5	63.6	90.2	77.2	87.3	78.4	84.0	71.6	80.2
Heartland	88.6	79.9	83.0	90.8	93.5	68.6	93.5	82.6	93.2	82.9	86.9	79.9	84.8
Kelsey Trail	86.2	77.5	82.7	88.9	90.4	66.4	90.9	76.7	87.5	80.7	82.1	72.9	75.8
Sun Country	90.3	89.6	92.0	93.8	94.3	78.3	94.4	88.8	94.4	85.0	86.4	79.9	84.0
Sunrise	87.6	82.5	83.5	86.3	88.9	60.4	90.1	73.9	89.3	81.6	81.2	76.3	78.3
<b>Peer Group F</b>													
Athabasca Health Authority	90.2	65.9	70.3	88.2	94.4	55.6	94.3	82.9	96.9	92.3	78.7	46.0	62.7
Keewatin Yatthé	66.7	55.0	56.4	70.5	79.5	35.5	82.0	54.7	83.1	72.3	82.1	35.3	55.8
Mamawetan Churchill River	74.6	63.3	61.9	77.9	86.8	42.9	89.2	66.2	85.5	71.0	76.4	43.0	50.0
<b>Peer Group H</b>													
Prairie North	83.1	74.7	76.2	80.8	85.1	52.0	86.4	69.0	83.5	71.7	72.6	56.4	62.7
Prince Albert Parkland	76.2	64.1	66.0	78.2	82.0	48.3	82.9	61.0	85.8	70.4	77.1	60.3	67.6

**Table 5: Diphtheria Vaccine Coverage by Health Region, 2015**

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	5 doses	5 doses	6 doses	6 doses
<b>Saskatchewan</b>	<b>85.0</b>	<b>76.0</b>	<b>77.3</b>	<b>84.9</b>	<b>88.5</b>	<b>60.5</b>	<b>89.3</b>	<b>74.6</b>	<b>85.1</b>	<b>74.9</b>	<b>78.2</b>	<b>67.6</b>	<b>71.9</b>
<b>Peer Group A</b>													
Regina Qu'Appelle	85.7	77.0	78.1	84.5	88.5	64.0	88.7	75.0	83.7	74.2	75.3	66.8	68.9
Saskatoon	84.8	77.7	78.4	86.0	88.9	61.2	89.8	76.6	83.7	73.9	76.1	68.5	72.8
<b>Peer Group D</b>													
Cypress	85.1	74.1	81.0	90.7	91.7	71.0	92.6	80.1	90.5	82.3	83.9	78.0	79.0
Five Hills	88.6	79.5	78.9	85.6	90.2	54.8	90.6	73.3	86.3	77.2	85.6	73.4	74.1
Heartland	86.8	80.6	84.5	91.5	91.7	66.3	92.2	80.9	92.5	85.7	86.5	79.6	80.6
Kelsey Trail	85.1	77.1	80.9	88.5	90.8	55.7	89.8	71.6	91.8	77.6	84.4	71.6	78.1
Sun Country	93.2	88.4	89.7	92.6	94.5	74.2	94.9	85.0	94.4	80.9	89.2	79.7	83.1
Sunrise	82.2	74.7	78.3	85.5	90.9	63.7	89.5	74.2	86.3	78.8	82.4	68.3	77.3
<b>Peer Group F</b>													
Athabasca Health Authority	82.4	59.0	66.7	88.6	100.0	69.7	100.0	85.3	91.5	78.9	75.5	56.6	78.8
Keewatin Yatthé	65.3	46.6	47.6	68.9	75.6	39.3	82.8	58.9	83.0	73.5	84.4	37.0	61.4
Mamawetan Churchill River	80.4	58.1	63.2	81.0	84.2	43.3	87.6	65.5	83.9	70.6	78.2	41.8	57.4
<b>Peer Group H</b>													
Prairie North	84.2	69.6	70.9	80.5	84.7	52.8	87.3	69.6	81.1	66.8	71.5	55.6	64.0
Prince Albert Parkland	78.5	63.6	64.2	73.6	81.3	43.3	83.2	60.7	84.0	72.8	75.4	64.3	66.7

- Two years of coverage data in 13 age-dose categories are provided by RHA. Yellow highlight indicates RHAs below the provincial coverage rate.
- At the provincial level, coverage from 2015 to 2016 declined at 13 years from 78.2% to 77.4% and at 17 years from 71.9% to 71.3%. Coverage remained unchanged at the age of three months.
- Other rates showed modest improvements for ages up to and including 15 years.
- At three months, 12 months and 13 years of age for 2016, eight RHAs exceeded the provincial average and five were below.
- For 2016, the four-dose coverage rate was higher among the 24-month age group compared to the 20-month age group: 76.8% vs. 60.9%. The four-dose coverage rate showed improvement at the age of five years as well (87.7%).
- In 2016 three RHAs were below the provincial rate in all thirteen age-dose categories and one was below in twelve categories.
- In 2016 three RHAs were at or above the provincial rate in all thirteen age-dose categories and one was at or above the provincial average in all but one categories.
- Coverage rates for 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 Diphtheria



Photo Courtesy of Centers for Disease Control

### Notification Timeline:

From Lab/Practitioner to Public Health: Immediate.

From Public Health to Ministry of Health: Immediate.

Public Health Follow-up Timeline: Initiate within 24-48 hours.

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

<b>Confirmed Case</b>	<p>Clinical illness* or systemic manifestations compatible with diphtheria in a person with an upper respiratory tract infection or infection at another site (e.g., wound, cutaneous) PLUS at least one of the following:</p> <ul style="list-style-type: none"> <li>Laboratory confirmation of infection: <ul style="list-style-type: none"> <li>isolation of <i>Corynebacterium diphtheriae</i> with confirmation of toxin from an appropriate clinical specimen, including the exudative membrane</li> </ul> </li> <li>OR</li> <li>isolation of other toxigenic <i>Corynebacterium</i> species (<i>C. ulcerans</i> or <i>C. pseudotuberculosis</i>) from an appropriate clinical specimen, including the exudative membrane</li> <li>OR</li> <li>histopathologic diagnosis of diphtheria.</li> </ul> <p>OR</p> <p>Epidemiologic link (contact within two weeks prior to onset of symptoms) to a laboratory-confirmed case.</p>
<b>Probable Case</b>	<ul style="list-style-type: none"> <li>Clinical illness* in the absence of laboratory confirmation or epidemiologic link to a laboratory-confirmed case.</li> </ul>
<b>Suspect Case</b>	<ul style="list-style-type: none"> <li>Upper respiratory tract infection (nasopharyngitis, laryngitis or tonsillitis) with or without a nasal, tonsillar, pharyngeal and/or laryngeal membrane.</li> </ul>

\*Clinical illness is characterized as an upper respiratory tract infection (nasopharyngitis, laryngitis or tonsillitis) with or without an adherent nasal, tonsillar, pharyngeal and/or laryngeal membrane, plus at least one of the following:

- gradually increasing stridor;
- cardiac (myocarditis) and/or neurologic involvement (motor and/or sensory palsies) one to six weeks after onset;
- death, with no known cause.

## 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 health regions with similar socio-economic characteristics which facilitates comparisons within a peer group. The twelve health regions and one health authority in Saskatchewan fall into four groups identified by letters A, D, F and H.

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 Keewatin Yatthé and Mamawetan Churchill River health regions and historical data from Athabasca Health Authority 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. Of the five modules in the system, two have been implemented: vaccine inventory and immunization. When fully functional, it will help public health professionals work together to effectively manage vaccine inventories, immunizations, investigations, outbreaks and family health. 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](http://www.ehealthsask.ca/services/panorama/Pages/default.aspx).

Most FNIHB and NITHA communities, with the exception of those in the Athabasca Health Authority (AHA), are not currently using Panorama. Therefore, immunization data for most First Nations (FN) children are missing or are incomplete. This report includes only those children with Saskatchewan health coverage and registered in Panorama under a health region jurisdiction as of January 12, 2017. In other words, children with Saskatchewan health coverage and registered in Panorama under FNIHB or NITHA jurisdiction are excluded (including those from FNIHB and NITHA communities in AHA).

Prairie North and Prince Albert Parkland health regions have higher aboriginal populations compared to Saskatchewan (Prairie North 30.3%, Prince Albert Parkland 38.9%, Saskatchewan 15.6%: National Household Survey 2011, Statistics Canada). Many FN communities do not use Panorama.

The four-dose primary series of diphtheria-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 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 2015 and 2016. For example, the immunization coverage for seven-year-old children in 2016 is based on clients who were born in 2009 and the immunization doses they received by their seventh birthdays.