

# Vaccine Preventable Disease Monitoring Report Diphtheria, 2014

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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 mucous 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.

## **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 2, 4, 6 and 18 months of age, one booster at 4 to 6 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 in or to people who are vaccinated. Inadequately immunized or unimmunized travellers to areas with endemic diphtheria are at higher

## **Surveillance**

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

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 through 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.

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 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: 2014

- No (0) cases of lab-confirmed diphtheria were reported.
- No cases were hospitalized.
- There were no deaths from diphtheria.

## Diphtheria in Saskatchewan: 2011 to 2014

- One adolescent case of cutaneous diphtheria was reported.
- The case was not hospitalized.
- The case had received five doses of diphtheria-containing antigen ten years prior to his disease episode.

**Table 1: Diphtheria case counts by year**

	2015*	2014	2013	2012	2011	Total
Saskatchewan	2**	0	0	0	1**	3
Canada	N/A	1	0	0	1	1

\*preliminary counts to date, January 2016

\*\*cutaneous diphtheria cases

**Table 2: Diphtheria case characteristics, 2011-2014**

Characteristics of diphtheria cases – Saskatchewan 2011 - 2014		Cases	Percent of Cases
Total		1	100
Sex	Male	1	100
	Female	0	0
Age	Less than 1 yr	0	0
	1 - 4 yrs	0	0
	5 - 19 yrs	1	100
	20 - 49	0	0
	50 yrs and over	0	0
Hospitalized	Yes	0	0
	No	1	100
	Unknown	0	0
Immunization for diphtheria vaccine	5 doses	1	100
	0 dose	0	0
	Too young	0	0
	Unknown	0	0
Source	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

**Table 3: Diphtheria vaccine coverage for Saskatchewan by year**

Primary Series: Infants and toddlers up to 2 years of age				
Age	Doses	2014	2013	2012
3 months	1	84.2%	83.4%	83.1%
5 months	1	91.9%	91.4%	91.8%
	2	73.8%	73.9%	72.4%
8 months	1	93.8%	93.6%	94.0%
	2	88.2%	87.8%	87.7%
	3	76.4%	75.8%	74.8%
12 months	3	84.7%	84.5%	84.7%
20 months	3	88.8%	89.2%	88.8%
	4	60.2%	59.2%	59.7%
24 months	3	89.8%	90.5%	89.4%
	4	75.7%	76.4%	75.5%
Boosters: Childre 4 to 17 years of age				
Age	Doses	2014	2013	2012
4 years	3	91.8%	92.3%	91.8%
	4	84.9%	84.9%	84.0%
7 years	4	90.6%	91.1%	91.0%
	5	78.0%	78.5%	77.7%
13 years	4	92.9%	93.4%	93.8%
	5	80.8%	81.2%	83.0%
15 years	4	95.2%	95.7%	95.6%
	5	89.9%	90.4%	90.3%
	6	72.9%	73.8%	73.9%
17 years	5	90.3%	91.1%	82.5%*
	6	75.2%	76.2%	68.8%*

\*Immunization records may be incomplete for children born prior to 1996; therefore, the coverage for 17-year-old adolescents may not reflect the actual provincial rate.

# VACCINE COVERAGE SUMMARIES

**Table 4: Diphtheria Vaccine Coverage by Health Region: 2014 (selected age & dose)**

Health Region, by Peer group	Vaccine coverage (% immunized), by age and dose												
	3 months	5 months	8 months	12 months	20 months		24 months		4 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>	84.2	73.8	76.4	84.7	88.8	60.2	89.8	75.7	84.9	78.0	80.8	72.9	75.1
<b>Peer Group A</b>													
Regina Qu'Appelle	86.3	74.8	77.9	85.3	88.7	62.9	89.2	75.0	83.3	77.3	77.8	71.0	72.6
Saskatoon	84.8	76.5	77.2	85.1	89.9	63.0	90.2	78.4	84.6	77.4	79.7	72.9	75.2
<b>Peer Group D</b>													
Cypress	88.6	75.9	79.5	88.4	89.6	66.1	92.4	80.6	89.1	82.8	87.4	80.8	85.3
Five Hills	87.4	79.1	81.6	89.0	91.0	62.2	91.4	79.9	86.3	82.9	85.3	82.4	81.7
Heartland	86.4	75.2	83.3	88.7	92.6	63.4	94.1	82.4	89.5	83.1	89.4	84.9	88.0
Kelsey Trail	85.0	70.0	74.6	84.3	87.5	50.1	91.8	73.0	88.0	80.2	86.0	76.0	79.2
Sun Country	90.7	88.3	90.1	92.3	91.8	69.0	94.2	83.8	94.1	85.8	91.4	86.2	86.3
Sunrise	82.4	72.7	78.2	86.8	88.9	61.5	88.9	73.8	87.1	82.5	86.6	77.8	77.8
<b>Peer Group F</b>													
Athabasca Health	82.8	59.4	84.2	97.8	97.7	77.3	95.7	91.3	90.9	81.5	76.9	68.5	83.1
Keewatin Yatthé	70.2	51.4	51.1	74.1	90.4	39.3	92.1	64.8	91.9	88.9	92.6	60.4	66.4
Mamawetan Churchill River	71.8	55.5	59.6	80.0	90.2	43.8	93.3	70.9	88.2	82.9	83.6	53.1	54.7
<b>Peer Group H</b>													
Prince Albert Parkland	73.2	59.3	63.2	75.1	81.3	45.0	84.6	64.8	80.2	70.9	74.0	66.3	67.5
Prairie North	79.3	66.6	69.3	78.8	85.5	52.3	85.2	66.8	78.6	68.7	76.3	62.0	66.7

Three years of coverage data in 13 age-dose categories are provided by RHA. A yellow highlighted cell means the RHA's coverage rate is below the provincial coverage rate.

Diphtheria vaccine is recommended at 2, 4, 6, 12 and 18 months, with boosters doses between ages 4 to 6 years and in grade eight. Data for 3, 5, 8, 12, 18, 20 and 24 months, along with 4, 7, 13, 15, and 17 years, are shown.

At a provincial level, coverage at 8 months and 17 years improved by 2% and 6%, respectively, from 2012 to 2014.

**Table 5: Diphtheria Vaccine Coverage by Health Region: 2013 (selected age & dose)**

Health Region, by Peer Group	Vaccine Coverage (% immunized), by age and dose												
	3 months	5 months	8 months	12 months	20 months		24 months		4 years	7 years	13 years	15 years	17 years
	1 dose	2 doses	3doses	3 doses	3 doses	4 doses	3 doses	4 doses	4 doses	5 doses	5 doses	6 doses	6 doses
<b>Saskatchewan</b>	83.4	73.9	75.8	84.5	89.2	59.2	90.5	76.4	84.9	78.5	81.2	73.8	76.2
<b>Peer group A</b>													
Regina Qu'Appelle	84.6	76.2	78.3	85.4	89.3	64.2	89.9	76.9	84.5	78.2	78.3	71.1	73.7
Saskatoon	84.1	76.3	77.4	84.9	89.4	59.9	91.2	79.5	84.2	78.7	80.3	75.6	77.8
<b>Peer Group D</b>													
Cypress	81.6	70.5	74.1	86.5	91.9	57.6	91.8	76.5	88.9	82.7	87.0	80.1	82.8
Five Hills	86.7	78.2	81.9	88.8	91.2	58.5	92.1	78.3	89.3	81.3	86.3	78.1	81.2
Heartland	84.7	76.1	81.1	91.3	93.6	66.5	93.2	81.4	90.3	86.3	89.8	83.9	87.3
Kelsey Trail	83.6	74.0	77.9	87.7	90.6	56.1	90.8	72.8	85.6	78.8	81.9	76.9	78.8
Sun Country	89.7	84.0	86.7	91.7	94.8	76.5	94.4	85.7	90.8	91.3	92.1	85.5	89.2
Sunrise	82.8	74.0	78.8	84.7	88.1	52.8	90.2	71.7	87.8	80.8	84.2	76.4	78.7
<b>Peer Group F</b>													
Athabasca Health	84.0	74.2	80.6	97.8	100.0	75.0	100.0	92.5	96.7	71.4	89.8	64.9	81.3
Keewatin Yatthé	72.5	59.8	59.6	81.0	85.7	48.1	92.4	77.1	89.3	80.1	89.3	62.6	66.2
Mamawetan Churchill River	78.2	53.7	53.9	79.5	91.8	43.4	93.2	70.9	79.5	69.6	78.0	56.7	53.3
<b>Peer Group H</b>													
Prince Albert Parkland	77.5	58.6	58.0	72.5	83.5	44.5	85.9	64.2	79.5	72.4	77.3	67.8	66.3
Prairie North	79.1	66.8	68.6	78.6	84.4	46.6	86.3	65.6	79.6	68.2	77.4	64.2	67.7

Rates for all other ages remained steady or showed modest increases or decreases.

In 2014, for both three doses at 8 months and four doses at 20 months, eight RHAs exceeded the provincial average and five were below.

There was substantial growth in coverage (four doses) from the 20 to 24 month age groups, an increase of 26%.

Across all years and all 13 age-dose categories, two RHAs were above the provincial rate in all age categories and one was below in all age-dose categories.

**Table 6: Diphtheria Vaccine Coverage by Health Region: 2012 (selected age & dose)**

Health Region, by Peer Group	Vaccine coverage (% immunized), by age and dose												
	3 months	5 months	8 months	12 months	20 months		24 months		4 years	7 years	13 years	15 years	17 years*
	dose 1	dose 2	dose 3	dose 3	dose 3	dose 4	dose 3	dose 4	dose 4	dose 5	dose 5	dose 6	dose 6
<b>Saskatchewan</b>	83.1	72.4	74.8	84.7	88.8	59.7	89.4	75.5	84.0	77.7	83.0	73.9	68.7
<b>Peer Group A</b>													
Regina Qu'Appelle	84.4	74.8	76.8	84.7	88.7	66.5	89.5	77.3	82.7	76.6	79.8	72.1	40.1
Saskatoon	83.6	73.4	75.8	86.1	89.5	59.3	89.7	76.0	84.1	76.8	81.4	74.9	76.2
<b>Peer Group D</b>													
Cypress	83.9	71.0	75.3	86.6	90.8	56.6	92.3	78.1	88.1	83.5	88.9	84.4	86.0
Five Hills	83.3	75.4	77.6	89.4	91.7	58.6	92.9	76.5	86.5	83.8	89.4	82.2	80.9
Heartland	84.4	76.4	81.9	90.4	92.7	65.7	91.9	80.8	91.4	85.5	91.5	88.4	86.8
Kelsey Trail	86.3	74.6	77.5	86.8	91.5	57.9	91.0	74.6	85.0	78.4	86.3	77.4	80.0
Sun Country	91.3	87.2	87.8	91.6	95.0	72.1	95.5	87.9	91.2	90.5	92.4	85.2	85.3
Sunrise	80.1	70.0	75.3	84.7	89.1	56.9	91.0	76.7	87.7	80.3	89.1	76.3	76.9
<b>Peer Group F</b>													
Athabasca Health	90.3	65.6	63.9	97.4	94.5	74.5	94.4	83.3	86.4	85.5	92.3	69.0	76.3
Keewatin Yatthé	72.7	47.9	46.7	75.0	91.4	48.5	90.9	75.3	82.9	74.4	88.6	48.5	54.2
Mamawetan Churchill River	68.6	48.4	55.3	73.1	83.3	46.9	87.5	68.0	80.4	70.8	69.3	44.3	53.3
<b>Peer Group H</b>													
Prince Albert Parkland	77.2	57.4	60.1	75.3	82.2	45.3	83.0	64.7	81.2	75.5	80.1	64.5	66.1
Prairie North	79.3	68.1	69.0	77.8	82.6	49.9	83.1	65.5	77.0	67.0	80.1	64.8	69.4

Coverage rates for health regions in Peer Groups F and H should be interpreted with caution.

Coverage rates for all age-dose categories may be found in the appendix.

\*Immunization records may be incomplete for children born prior to 1996, therefore, the immunization coverage for 17-year-old adolescents may not reflect actual provincial or RHA rates.

# SURVEILLANCE CASE DEFINITION: Saskatchewan CDC Manual

## Respiratory and Direct Contact Diphtheria

### 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 hrs.

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



Photo Courtesy of Centers for Disease Control

### Confirmed Case

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:

- Laboratory confirmation of infection:
  - isolation of *Corynebacterium diphtheriae* with confirmation of toxin from an appropriate clinical specimen, including the exudative membrane
  - OR**
  - isolation of other toxigenic *Corynebacterium* species (*C. ulcerans* or *C. pseudotuberculosis*) from an appropriate clinical specimen, including the exudative membrane
  - OR**
  - histopathologic diagnosis of diphtheria.

**OR**

Epidemiologic link (contact within two weeks prior to onset of symptoms) to a laboratory-confirmed case.

### Probable Case

- Clinical illness\* in the absence of laboratory confirmation or epidemiologic link to a laboratory-confirmed case.

### Suspect Case

- Upper respiratory tract infection (nasopharyngitis, laryngitis or tonsillitis) with or without a nasal, tonsillar, pharyngeal and/or laryngeal membrane.

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

Peer groups were created by Statistics Canada. A peer group consists of health regions with similar socio-economic characteristics so that important differences may be detected by comparing within a peer group. The thirteen health regions in Saskatchewan fall into four (identified by letters A, D, F and H) of the ten peer groups (A to J) across Canada.

Vaccine Coverage Data Source: 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.

The four-dose primary series diphtheria containing vaccine is administered as diphtheria, tetanus, acellular pertussis, inactivated polio & *Haemophilus influenzae* type B (DTaP-IPV-Hib). The first booster at 4 to 6 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 3, 5, 8, 12, 20 and 24 months, and 4, 7, 13, 15 and 17 years by December 31 in 2012, 2013 and 2014. For example, the immunization coverage for 7-year-old children in 2014 is based on clients who were born in 2007 and their immunization records up to December 31, 2014.