

SASKATCHEWAN
FIRST NATIONS

8 **HEALTH**
2011 **STATUS**
21 **REPORT**



Indigenous Services
Canada

Services aux
Autochtones Canada

Canada

Table of Contents

Message from the Regional Medical Health Officer . . .	4	Chapter 4: Communicable Diseases	38
Acknowledgments	5	Sexually Transmitted and Blood-Borne Infections . . .	39
Executive Summary	6	Chlamydia, 2007–2016	39
Demographics	6	Gonorrhea, 2007–2016	43
Opioid Overdose	6	Infectious Syphilis, 2007–2016	46
Immunization	6	Human Immunodeficiency Virus, 2007–2016	49
Communicable Diseases	7	<i>Know Your Status</i> Program	53
Social Determinants of Health	7	Hepatitis C Virus, 2007–2016	54
Diabetes	7	Tuberculosis	55
Chapter 1: Demographics	8	Use of Technology for Quicker and Timely Access to Tuberculosis Diagnosis in Remote Communities . . .	58
A Mixed Growth Trend in Canada	9	Other Notifiable Diseases	58
Over a Decade of Positive Growth, 2006–2016 . . .	9	Public Health Implications	59
A Wide Base Population Age-Sex Pyramid	10	Appendix	62
Projected Growth, 2016–2034	11	References	63
Planning for Projected Growth	12	Chapter 5: Social Determinants of Health	66
Appendix	13	Language	67
References	14	Food Security	68
Chapter 2: Opioid Overdose	15	Prince Albert Grand Council Success Story	68
Why are Opioids a Concern?	15	Housing	69
Hospitalizations: Counts and Proportions	16	Education	70
Hospitalization Rates: Age and Gender	16	Income	71
Geographic Areas	19	Employment	71
Addressing the Opioid Crisis	19	Public Health Implications	72
Appendix	20	Appendix	73
References	21	References	74
Chapter 3: Immunization	22	Chapter 6: Diabetes	75
National Immunization Coverage	22	Diabetes Mellitus	75
Saskatchewan Immunization Coverage	23	Type-2 Diabetes in Saskatchewan First Nations Population	76
Immunization Coverage Rate Averages (2007–2016) for Saskatchewan First Nations Communities	23	Increasing Burden of Diabetes Among First Nations Population	77
Immunization Coverage by Specific Vaccines, 2012–2016	27	Anti-Hyperglycemic Drugs	80
Human Papillomavirus (HPV) Vaccine for School Age Population	32	Public Health Implications	81
Increased Vaccine Preventable Disease Activities . .	34	Battle River Treaty 6 Health Centre, North Battleford, a Saskatchewan Success Story	82
Appendix	35	Appendix	83
References	36	References	84



List of Tables and Figures

Figure 1.1: First Nations (living in First Nations communities) population registered to bands in Saskatchewan, 2006-2016.....	9	Figure 2.5: Gender-specific rates of opioid-related hospitalizations among status First Nations in Saskatchewan, 2011-2012 to 2016-2017.....	18
Figure 1.2: Hypothetical examples of basic population age-sex pyramid shapes	10	Figure 2.6: Age-specific rates of opioid-related hospitalizations among status First Nations in Saskatchewan, 2011-2012 to 2016-2017.....	18
Figure 1.3: Population distribution as proportion, Saskatchewan First Nations living in First Nations communities and overall Saskatchewan, 2016.	11	Figure 2.7: Rates of opioid-related hospitalizations among status First Nations in Saskatchewan, 2016-2017.	19
Figure 2.1. Opioid overdose injury pyramid representing the varying levels of health care sectors demands	16	Table 3.1: Immunization coverage estimates for two- and seven-year-old children in Canada, 2013 and 2015.	23
Figure 2.2: Counts of opioid-related hospitalizations with breakdown by status First Nations and non-First Nations in Saskatchewan, 2011-2012 to 2016-2017.	17	Figure 3.1: Up-to-date immunization coverage rate averages for one-year-olds by Saskatchewan First Nations communities, 2007-2016	24
Figure 2.3: Proportion of opioid-related associated hospitalizations with breakdown by status First Nations and non-First Nations in Saskatchewan, 2011-2012 to 2016-2017.	17	Figure 3.2: Up-to-date immunization coverage rate averages for two-year-olds by Saskatchewan First Nations communities, 2007-2016	25
Figure 2.4: Age-standardized rates of opioid-related hospitalizations with breakdown by status First Nations and non-First Nations in Saskatchewan, 2011-2012 to 2016-2017.....	17	Figure 3.3: Up-to-date immunization coverage rate averages for seven-year-olds by Saskatchewan First Nations communities, 2007-2016	26

continued next page...



...List of Tables and Figures continued

Figure 3.4: Up-to-date Pertussis vaccine coverage rates for one-year-olds by geographical areas, 2012-2016	27	Figure 4.6: Gonorrhoea rates by jurisdiction, Saskatchewan First Nations communities, 2007-2016	44
Figure 3.5: Up-to-date Pertussis vaccine coverage rates for two-year-olds by geographical areas, 2012-2016	28	Figure 4.7: Gonorrhoea rates by gender, Saskatchewan First Nations communities, 2007-2016	44
Figure 3.6 Up-to-date Pertussis vaccine coverage rates for seven-year-olds by geographical areas, 2012-2016	29	Figure 4.8: Gonorrhoea rates by age group and gender, Saskatchewan First Nations communities, 2016	45
Figure 3.7: Up-to-date Measles vaccine coverage rates for two-year-olds by geographical areas, 2012-2016	30	Figure 4.9: Infectious syphilis rates for Saskatchewan First Nations communities, overall Saskatchewan population and Canada, 2007-2016	46
Figure 3.8: Up-to-date Measles vaccine coverage rates for seven-year-olds by geographical areas, 2012-2016	31	Figure 4.10: Infectious syphilis rates by jurisdiction, Saskatchewan First Nations communities, 2007-2016	47
Figure 3.9: Up-to-date Meningococcal serogroup C vaccine coverage rates for two-year-olds by geographical areas, 2012-2016	31	Figure 4.11: Infectious syphilis rates by gender, Saskatchewan First Nations communities, 2007-2016	48
Figure 3.10: Up-to-date Meningococcal serogroup C vaccine coverage rates for seven-year-olds by geographical areas, 2012-2016	32	Figure 4.12: Infectious syphilis rates by age group and gender, Saskatchewan First Nations communities, 2016	48
Figure 3.11: Up-to-date Rotavirus vaccine coverage rates for one-year-olds by Saskatchewan First Nations communities, 2013-2016	33	Figure 4.13: HIV rates for Saskatchewan First Nations communities, overall Saskatchewan population and Canada, 2007- 2016	49
Figure 3.12: Up-to-date HPV vaccine coverage rates for grade six female students by Saskatchewan First Nations on-reserve, 2012/13–2016/17 school years	33	Figure 4.14: HIV rates by jurisdiction, Saskatchewan First Nations communities, 2007-2016	50
Figure 4.1: Chlamydia rates for Saskatchewan First Nations communities, overall Saskatchewan population and Canada, 2007-2016	40	Figure 4.15: HIV rates by gender, Saskatchewan First Nations communities, 2007-2016	50
Figure 4.2: Chlamydia rates by jurisdiction, Saskatchewan First Nations communities, 2007-2016	40	Figure 4.16: HIV rates by age group and gender, Saskatchewan First Nations communities, 2016 ...	51
Figure 4.3: Chlamydia rates by gender, Saskatchewan First Nations communities, 2007-2016	41	Figure 4.17: Hepatitis C rates for Saskatchewan First Nations communities, overall Saskatchewan population and Canada, 2007-2016	52
Figure 4.4: Chlamydia rates by age group and gender, Saskatchewan First Nations communities, 2016	42	Figure 4.18: Hepatitis C rates by jurisdiction, Saskatchewan First Nations communities, 2007-2016	52
Figure 4.5: Gonorrhoea rates for Saskatchewan First Nations communities, overall Saskatchewan population and Canada, 2007-2016	43	Figure 4.19: Hepatitis C rates by gender, Saskatchewan First Nations communities, 2007-2016	53
		Figure 4.20: Hepatitis C rates by age group and gender, Saskatchewan First Nations communities, 2016	54

Figure 4.21: Active tuberculosis rates for Saskatchewan First Nations communities, overall Saskatchewan population and Canada, 2007-2016.	55	Figure 5.7: Employment rates among First Nations people living in Saskatchewan First Nations communities, Indigenous people in Saskatchewan and non-Indigenous people in Saskatchewan for 25 to 54 year olds, 2006 and 2016.	71
Figure 4.22: Active tuberculosis rates by jurisdiction, Saskatchewan First Nations communities, 2007-2016	56	Figure 5.8: Participation rates among First Nations people living in Saskatchewan First Nations communities, Indigenous people in Saskatchewan and non-Indigenous people in Saskatchewan for 25 to 54 year olds, 2006 and 2016.	72
Figure 4.23: Active tuberculosis rates by gender, Saskatchewan First Nations communities, 2007-2016.	56	Figure 6.1: Age-standardized diabetes prevalence in overall Saskatchewan and Saskatchewan First Nations populations, 2015	76
Figure 4.24: Active tuberculosis rates by age group and gender, Saskatchewan First Nations communities, 2016.	57	Figure 6.2: Self-perceived health among First Nations adults in Saskatchewan	77
Table 4.1: Number of notifiable diseases (excluding STBBIs and TB) by year and jurisdiction, 2007-2016.	60	Figure 6.3: Percentage of anti-hyperglycemic drug usage among First Nations in Saskatchewan by gender, 2007-2016	79
Table 5.1. Key SDOH factors identified from the Canadian societal context.	67	Figure 6.4: Percentage of anti-hyperglycemic drug usage among First Nations adults (aged 20 years and older) in Saskatchewan by gender, 2007-2016.	80
Figure 5.1: Indigenous peoples' languages spoken at home in First Nations communities in Saskatchewan, 2016	67	Figure 6.5: Percentage of anti-hyperglycemic drug usage among First Nations youth (aged 19 years and under) in Saskatchewan by gender, 2007-2016.	81
Figure 5.2: Income-related food insecurity among First Nations households in Saskatchewan First Nations communities, 2015.	68		
Figure 5.3: Proportion of households in Saskatchewan First Nations communities, Indigenous households in Saskatchewan and non-Indigenous households in Saskatchewan classified as severely overcrowded, Saskatchewan, 2006 and 2016.	69		
Figure 5.4: Proportion of households in Saskatchewan First Nations communities, Indigenous households in Saskatchewan and non-Indigenous households in Saskatchewan needing major repair, 2006 and 2016. .	69		
Figure 5.5: Highest certificate, diploma or degree attained by First Nations people aged 25 to 54 years in Saskatchewan First Nations communities, 2006 and 2016.	70		
Figure 5.6: Median income among First Nations people in Saskatchewan First Nations communities, Indigenous people in Saskatchewan and non-Indigenous people in Saskatchewan for 25 to 54 year olds, 2006 and 2016.	70		

Message from the Regional Medical Health Officer

It is my pleasure to present the Saskatchewan First Nations Health Status Report 2018. This Report is the second of its kind and a follow up to the 2012 Health Status Report, released in 2016.

This second edition continues where the last one left off. It provides a snapshot of the health conditions that have an impact on the health of Saskatchewan First Nations communities. Where possible, trends in health over the past ten years are highlighted. This report is a useful resource for Health Directors, decision makers and health care professionals, working in and with Saskatchewan First Nations communities, to use in developing health policies and programs.

In a series of stories, using surveillance data or research information, when available, this report intends to show promising practices where First Nations communities took initiatives to promote healthy behaviours.

The key report findings are presented sequentially by chapter: demographics, opioid overdose, immunization, communicable diseases, social determinants of health and diabetes.



A handwritten signature in black ink, appearing to read 'Ibrahim Khan'.

Yours sincerely,

Dr. Ibrahim Khan
Medical Health Officer
Saskatchewan Region
First Nations Inuit Health Branch
Indigenous Services Canada



Indigenous Services
Canada

Services aux
Autochtones Canada

Acknowledgments

The Health Surveillance and Assessment unit (HSA) wishes to express their appreciation to all whose efforts made the publication of this report possible. The report was created in response to requests from Indigenous Services Canada (ISC), First Nations and Inuit Health Branch Saskatchewan (FNIHB, SK) senior management team and Medical Health Officer.

We would like to offer our sincere appreciation and thanks to Saskatchewan First Nations leaders and communities for the opportunity to measure progress in the health and wellness of their communities over the last decade. Our aim is that the findings in this report will serve as a knowledge base for future community health planning.

We acknowledge the wisdom and leadership of the former Regional Executive Officer (REO) of FNIHB, SK, Alexander Campbell, current REO, Jocelyn Andrews and members of the Regional Executive team for supporting the development of this report.

We also appreciate and acknowledge representatives from the following organizations and network for reviews and suggestions provided at various stages of report development:

- Saskatchewan Ministry of Health
- Northern Inter-Tribal Health Authority
- Surveillance, Health Information Policy and Coordination Unit

Finally, the HSA unit gratefully acknowledges the financial support provided for this publication by the Health Protection Division Director.

Executive Summary

The health status of First Nations communities in Saskatchewan has shown some improvements since the release of the first Saskatchewan First Nations Health Status Report publication in 2012. However, many communities continue to experience health disparities related to the social determinants of health (SDOH). The SDOH, which is woven into every aspect of a community's health and wellness, has contributed to the majority of health challenges faced by Saskatchewan First Nations communities. Specifically, poverty, inadequate and overcrowded housing conditions and food insecurity have contributed to the persistent burden of communicable and chronic diseases, and opioid abuse and overdoses. Despite these setbacks, Saskatchewan First Nations communities have been successful in finding innovative ways to improve the health of their population.

DEMOGRAPHICS

The Demographics chapter provides information on population characteristics, distribution and projected growth of Saskatchewan First Nations communities. This chapter, as well as other chapters in the report, uses Indigenous and Northern Affairs Canada Indian Registration System (IRS) population data as the primary data source. Key highlights from this chapter are:

- The registered Saskatchewan First Nations population living in First Nations communities has increased from 61,564 in 2006 to 75,165 in 2016.
- Over 51% of the First Nations communities' population are under 25 years of age, which is a slight decrease from 2012.
- The 50 years and older age group grew by about 27% to make up 15.3% of the First Nations communities' population.
- The First Nations communities' population is projected to grow by 34% from its 2016 population of 75,165 to 100,577 in 2034.

OPIOID OVERDOSE

The Opioid Overdose chapter reports on current trends in opioid-related hospitalizations in Saskatchewan. The primary data source for this chapter was opioid discharge data provided by Acute and Emergency Service Branch of the Saskatchewan Ministry of Health. Key highlights from this chapter are:

- First Nations people represented 36% of all opioid-related hospitalizations in Saskatchewan in 2016-2017
- The age-standardized opioid-related hospitalization rates among First Nations people were significantly higher (nearly six times in 2016-2017) than the non-First Nations population in Saskatchewan. However, between 2011-2012 and 2016-2017, the rates among First Nations have slightly decreased; in contrast, rates consistently increased in the non-First Nations population.
- First Nations women were hospitalized for opioid overdose at a higher rate than First Nations men.

IMMUNIZATION

The Immunization chapter reports on routine immunization coverage rates for one, two and seven year old First Nations children living in communities. These coverage rates were then compared to the overall coverage rates for children in Saskatchewan. Key highlights from this chapter are:

- Saskatchewan First Nations communities' two and seven-year-old populations had immunization coverage rates for a select number of vaccines (pertussis, measles, and meningococcal serogroup C) that were generally higher in comparison to the coverage rates for the same age cohorts in the overall Saskatchewan population. Despite this positive upward trend in immunization coverage, some vaccine coverage rates, like those for measles and pertussis, were well below the recommended target coverage rates to prevent disease outbreaks.
- Enhanced measures and supports have been put in place by Indigenous Services Canada, First Nations Inuit Health Branch, Saskatchewan Region (ISC, FNIHB, SK) and Northern Inter-Tribal Health Authority (NITHA) to guide community-led approaches for increasing immunization coverage and reducing risks of infection.

COMMUNICABLE DISEASES

The Communicable Diseases chapter provides information on reported rates of sexually transmitted and blood-borne infections (STBBIs), tuberculosis (TB) and other notifiable diseases including: food, waterborne, and vaccine-preventable diseases, as well as diseases transmitted by respiratory routes. The data sources for this chapter are Saskatchewan Ministry of Health's IOM Panorama (formerly Integrated Public Health Information System) and Saskatchewan Health Authority's Tuberculosis Information System. Key highlights from this chapter are:

- From 2007 to 2016, rates of chlamydia, gonorrhea, human immunodeficiency virus (HIV), hepatitis C (HCV), and TB continued to be substantially higher in Saskatchewan First Nations communities than in the overall Saskatchewan and Canadian populations. Although rates of infectious syphilis were low when compared to other communicable diseases, there appears to be an increase in rates of infectious syphilis in Saskatchewan First Nations communities.
- The *Know Your Status* (KYS) program, a community-driven approach for the prevention and treatment of STBBIs in Saskatchewan First Nations communities, has led to decreased rates of HIV and HCV in communities that have implemented KYS programs.
- The increased use of technology in Saskatchewan First Nations communities has contributed to improved access to health care and to TB case management.

SOCIAL DETERMINANTS OF HEALTH

This chapter provides information on social determinants of health indicators for Indigenous health. The health indicators examined are languages, food security, housing, education, income and employment opportunities. Statistics Canada's census population data and the 2015 First Nations Food, Nutrition and Environment Study (FNFNES) are the data sources for this chapter. Key highlights from this chapter are:

- Saskatchewan First Nations communities saw an increase in the proportion of people aged 25 to 54 completing high school between 2006 and 2016 (17.1% to 26.4%).

- From 2006 to 2016, the median income in Saskatchewan First Nations communities increased by 40.2% among individuals aged 25 to 54.
- In 2015, more than a third (37%) of the households in Saskatchewan First Nations communities faced food insecurity.

DIABETES

The Diabetes chapter presents four research studies that estimate the incidence, prevalence and burden of diabetes among Saskatchewan First Nations populations. In addition, data on anti-hyperglycemic drug claims made through the Non-Insured Health Benefit (NIHB) program were used for further estimates of diabetes within the population. Key findings from this chapter are:

- Estimation of the incidence and prevalence of diabetes among Saskatchewan First Nations population is challenging due to limited availability of First Nations-specific data on diabetes.
- In 2015, the Saskatchewan FNFNES reported that the age-standardized prevalence of diabetes for the overall Saskatchewan population and First Nations adult population surveyed were 5.3% and 18.1%, respectively.
- The featured research studies showed that:
 - » First Nations adults experienced onset of type-2 diabetes at a younger age.
 - » Type-2 diabetes was the leading cause of chronic kidney disease (CKD) in Saskatchewan First Nations people, with women experiencing a higher proportion of CKD burden.
 - » Offspring of First Nations youth diagnosed with diabetes were at a higher risk for developing type-2 diabetes.
 - » First Nations females with high birth weight (HBW) were more likely than males with HBW to develop type-2 diabetes.
- The percentage of anti-hyperglycemic drug claims made by First Nations in Saskatchewan through the NIHB Program has steadily increased. From 2007 to 2016, there was a 28% and 34% increase in anti-hyperglycemic drug usage among females and males, respectively.



Chapter 1: Demographics

The sustainability of any population's growth is dependent on a number of factors, including its rate of growth, age-sex composition and health status. As stated by Berkley et al, (1) "A population cannot progress if it is burdened with ill-health. Good health is the foundation on which communities and nations can and do flourish."

The Saskatchewan First Nations Health Status Report, published by the First Nations and Inuit Health Branch (FNIHB) in 2012, noted that the provincial and Saskatchewan First Nations living in First Nations communities populations were growing. That trend continues. Between 2011 and 2016, the Saskatchewan First Nations population living in First Nations communities increased by 10.2% to 75,165 with continued growth observed in the younger than 25 years of age group, along with an increase in the 50 years and older age group. In 2016, the under 25 years of age and 50 years and older age groups made up 51.2% and 15.3% of the Saskatchewan First Nations population living in First Nations communities, respectively. During this same timeframe the Saskatchewan Ministry of Health recorded an increase of 7.6% from its 2012 provincial covered population count¹. In addition to this positive growth trend, the

Saskatchewan First Nations population living in First Nations communities continues to experience burden of diseases in areas such as infectious diseases, diabetes, injuries and disabilities, mental health and social determinants related issues, (2, 3) which will be explored in other chapters of this report.

In this chapter, information will be provided on the population characteristics, distribution and projected growth of Saskatchewan's First Nations population living in First Nations communities using the 2016 Indigenous and Northern Affairs Canada (INAC) population data as the primary data source.

Indigenous and Northern Affairs Canada's Indian Register provides a more accurate count of the registered First Nations population. The INAC data used in this report reflects unadjusted Indian Registration System (IRS) population counts registered in the system as of December 31 each year. These numbers are not adjusted for late reporting of births and deaths (refer to Demographics Methodology Section). Where possible, population comparisons for the Saskatchewan First Nations population living in First Nations communities will be made at two data periods, from 2006 to 2011 and from 2011 to 2016, to provide a comprehensive look at the changing population dynamics of the First Nations population living in First Nations communities.

¹ SK Ministry of Health covered population is a count of all persons who held Saskatchewan health coverage as of June 30, 2016.



A MIXED GROWTH TREND IN CANADA

According to Statistics Canada, Canada experienced a 5.0% population increase of approximately 1.7 million people from 2011 to 2016. (4) This growth was slightly lower than the 5.9% rate reported from 2006 to 2011. Although, the Canadian population continues to grow, this increase is not a result of high fertility rates, but rather a product of migratory increase, which accounted for two-thirds of total population growth. Migratory increase is calculated as a net migration of immigrants and emigrants to and from Canada. (4) Natural increase, calculated as a difference between the number of births and deaths, accounted for the remaining one-third due to Canada's low fertility rate and aging population. (5) Saskatchewan's population also saw an increase from approximately 1.0 million in 2006 to 1.2 million in 2016. (4)

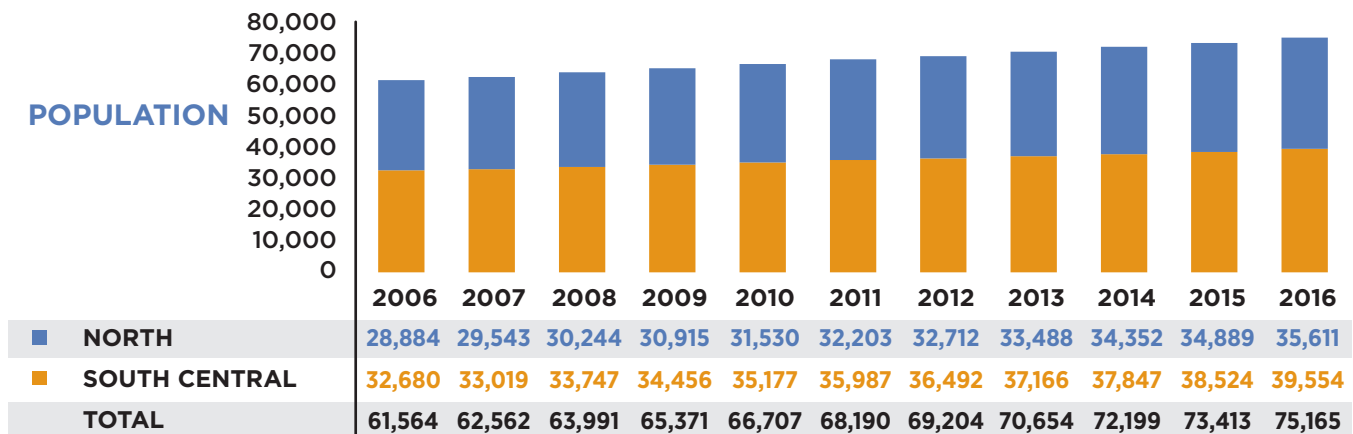
OVER A DECADE OF POSITIVE GROWTH, 2006-2016

As of December 2016, Saskatchewan's registered First Nations population, which includes both First Nations living in and out of First Nations communities, was estimated to be 153,672, of which about half (48.9%) lived in First Nations communities. The registered First Nations population living in First Nations communities has steadily increased from 61,564 in 2006 to 75,165 in 2016.

A further break-down of the Saskatchewan First Nations population living in First Nations communities (Figure 1.1) shows that in 2016, 39,554 (52.6%) resided in south and central Saskatchewan with health services provided by Indigenous Services Canada, First Nations Inuit Health Branch, Saskatchewan Region (ISC, FNIHB, SK), while the remaining 35,611 (47.4%) resided in northern Saskatchewan with health services provided by the Northern Inter-Tribal Health Authority (NITHA). In 11 years, the First Nations communities in south and central Saskatchewan experienced an overall growth of 21.0%, from its 2006 population of 32,680.

The northern Saskatchewan population had a slightly higher growth rate in the second period, averaging 23.3% over an 11 year span from its 2006 population of 28,884.

Figure 1.1: First Nations (living in First Nations communities) population registered to bands in Saskatchewan, 2006-2016

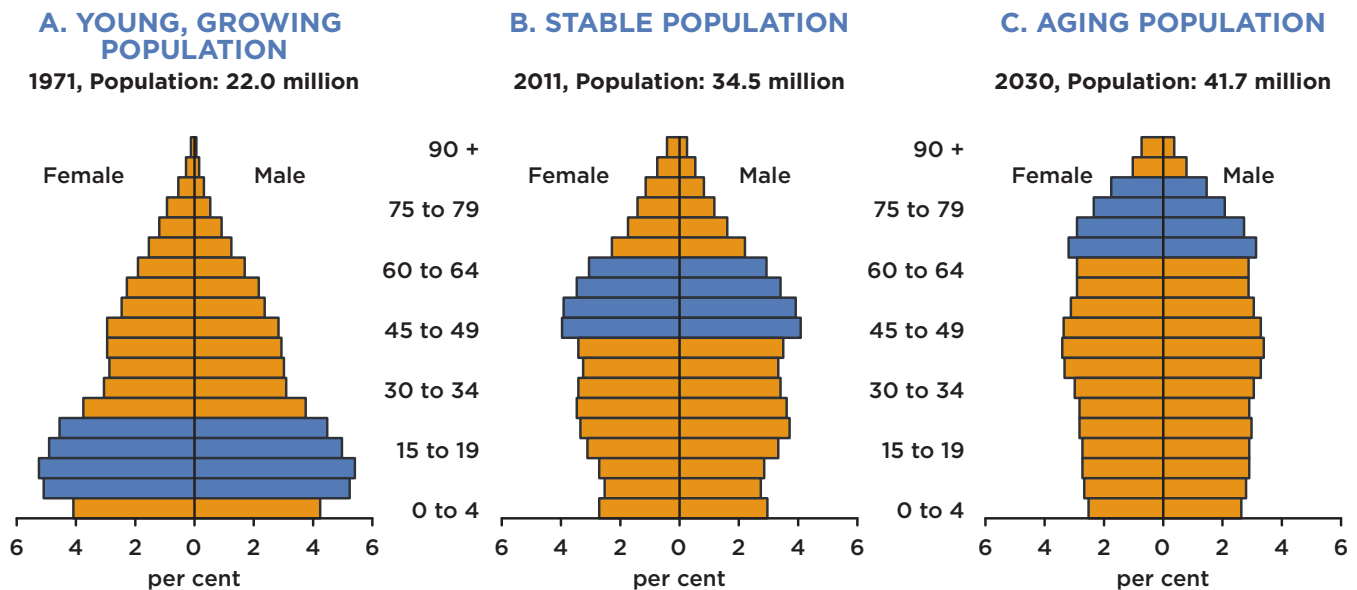


Source: Indigenous and Northern Affairs Canada (INAC) (2016)

HIGHLIGHTS

- The registered First Nations population living in First Nations communities has increased from 61,564 in 2006 to 75,165 in 2016.
- 51.2% of the First Nations population living in First Nations communities is under 25 years of age, which is a slight decrease from 2012.
- The 50 years and older age group grew by about 27% to make up 15.3% of total Saskatchewan First Nations population living in First Nations communities.
- The First Nations population living in First Nations communities is projected to grow by 34% from its 2016 population of 75,165 to 100,577 in 2034.

Figure 1.2: Hypothetical examples of basic population age-sex pyramid shapes



Source: Department of Finance Canada (2012)²

A WIDE BASE POPULATION AGE-SEX PYRAMID

A population pyramid shows the distribution of a population according to age and sex. There are three basic shapes represented by a population age-sex pyramid. (6) Figure 1.2 shows examples of these three types of pyramids: A) A pyramid that has a wide base and narrow top represents a young growing population with high birth rates and close to average life expectancy; B) A population pyramid that is shaped like a barrel, with tapering at the top and base has a smaller percentage of young people and a shrinking older population; and C) A population pyramid that is shaped like a barrel, but with almost equal age-sex distribution and a slight tapering at the top is typical of populations with low birth rates and higher life expectancy.

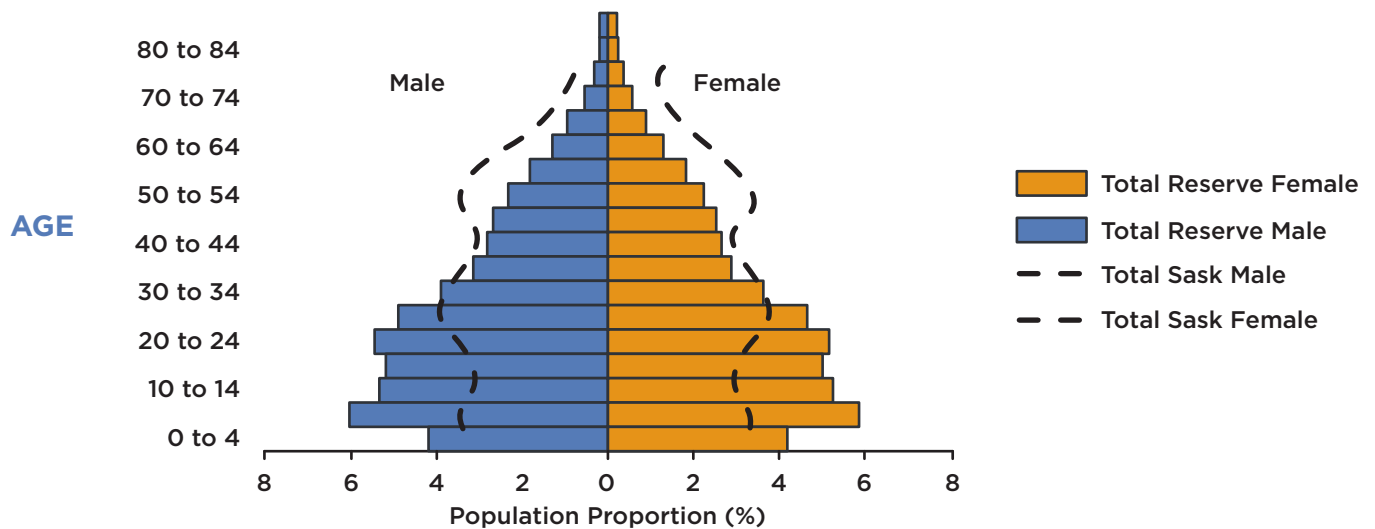
The Saskatchewan First Nations population living in First Nations communities is a growing population that is much younger than the overall Saskatchewan population. There are two main factors that have been attributed to the growth in the Indigenous population: 1) Increase in life expectancy and relatively high fertility rate; and 2) changes in self-reported identification of Indigenous ancestry. (7) The population pyramid for the Saskatchewan First Nations population living in First Nations communities displayed in Figure 1.3 is similar to shape A, a pyramid with a wide base and narrow top.

The population pyramid (Figure 1.3) shows that slightly over half of the Saskatchewan First Nations population living in First Nations communities is younger than 25 years of age. In 2016, this population group accounted for 51.2% of the First Nations communities' population, a slight decrease from 2012, when this group made up 54.5% of the population. This high percentage of young Saskatchewan First Nations population living in First Nations communities provides opportunities for decision makers to continue to target health and employment-related programs and policies toward this young population to improve Saskatchewan's future social, political, and economic outlook.

Although, a large number of the Saskatchewan First Nations population living in First Nations communities are under 25 years of age, there is smaller proportion of children in the 0–4 age group as represented by the shorter bars at the base of the pyramid. The smaller proportion of children in the 0–4 age group is likely due to underreporting in the INAC's IRS and the use of unadjusted IRS data, as the population data that was extracted since 2010 has not yet been adjusted for late reporting of births or deaths. According to INAC, approximately 70% of all births reported in any particular year actually occurred in the previous year. (8) As such, it is more common for children to be registered between ages 1 to 5 years.

² Department of Finance Canada's historical Canadian economic data: Available from: www.fin.gc.ca/pub/eficap-rebvpvc/report-rapport-eng.asp

Figure 1.3: Population distribution as proportion, Saskatchewan First Nations living in First Nations communities and overall Saskatchewan, 2016



Source: INAC (2016); Statistics Canada (2016)

In 2016, the number of people in the 50 years and older age group in the Saskatchewan First Nations population living in First Nations communities was proportionately greater than the numbers reported in the 2012 INAC IRS. This age group increased to 15.3% of the total Saskatchewan First Nations population living in First Nations communities in 2016. Whereas, the 50 years and older age population for overall Saskatchewan remained relatively stable, at 34.0%. As the Saskatchewan First Nations population living in First Nations communities ages, the health care system will face greater challenges as this population already experiences higher rates of infectious and chronic diseases, and other physical and mental health conditions than the overall Saskatchewan population. (9) However, despite these challenges many Indigenous seniors remain primary caregivers to their grandchildren, and keepers of cultural knowledge and traditions within their communities. (9)

In general, since 2012, the age-sex structure for Saskatchewan First Nations population living in First Nations communities and overall Saskatchewan populations has changed slightly, showing an increase in the 50 years and older age group for the Saskatchewan First Nations population living in First Nations communities. However, similar to the 2012 pyramid structure, there are roughly an equal proportion of males to females in each population group. For the overall Saskatchewan population, there are still nearly

two women for every man 85 years and older, which is a reflection of the difference in life expectancy between the genders (Figure 1.3). (10) Given that the majority of the Saskatchewan First Nations population living in First Nations communities is relatively younger, the distribution of males and females in the 85 years and older age group is much smaller than that of the overall Saskatchewan population.

PROJECTED GROWTH, 2016-2034

Population projections provide an estimate as to demographic trends at a future date. According to Statistics Canada, these projections are “...useful for planning future needs and developing policies in response to demographic changes”. (11)

The projected population growth for Saskatchewan First Nations population living in First Nations communities that is presented in this chapter was provided by INAC, using the baseline population data extracted from INAC’s IRS as of December 31, 2009, and adjusted for late and under reporting of births and deaths. (8) Data from the medium growth scenario are described here. Please refer to the methodology section for more details.

POPULATION PROJECTIONS FOR SASKATCHEWAN FIRST NATIONS LIVING IN FIRST NATIONS COMMUNITIES, 2016-2034

The Saskatchewan registered First Nations population living in First Nations communities is projected to increase by varying increments over the next 18 years. The medium growth scenario projects that this population will grow by 33.8% from its 2016 population of 75,165 to 100,577 in 2034. This cumulative growth for Saskatchewan registered First Nations population living in First Nations communities is based on variances in annual growth rate averaging 1.18% from 2016 to 2034.

GROWTH PROJECTIONS FOR NORTHERN FIRST NATIONS COMMUNITIES

The projected population growth rate for First Nations communities in the north, under the jurisdiction of NITHA, was similar to rate of growth for the overall Saskatchewan registered First Nations population living in First Nations communities. According to the medium growth scenario, this population will grow by 33.8% from 35,611 in 2016 to 47,650 in 2034.

GROWTH PROJECTIONS FOR SOUTHERN AND CENTRAL FIRST NATIONS COMMUNITIES

The projected medium growth rate scenario for south and central communities is slightly lower than that of northern communities. The Saskatchewan First Nations population living in southern and central communities is projected to increase by 32.3% from 39,554 in 2016 to 52,311 in 2034.

PLANNING FOR PROJECTED GROWTH

Indigenous and Northern Affairs Canada expects the age structure of the First Nations population to show signs of aging. (12) As the medium projected growth scenario provide insight into the future population count of Saskatchewan First Nations population living in First Nations communities, policies and programs should consider initiatives that will maximize socio-economic opportunities, and mitigate any unexpected consequences of population growth.

Appendix

Data Sources

1 Canadian population

- » 2011 and 2016 Canadian census population
- » Data source:
 - Statistics Canada, Canadian Socio-Economic Information Management System (CANSIM), 2011 and 2016

2 Overall Saskatchewan population

- » Total Saskatchewan population, including First Nations on- and off-reserve
- » Data source:
 - SK Ministry of Health covered population, 2006, 2012 and 2016

3 Saskatchewan registered First Nations population

- » Registered to a Saskatchewan First Nations bands, living on- and off-reserve

This population source includes only First Nations registered in Saskatchewan. Members living in Saskatchewan but registered to a band outside of Saskatchewan are not included in this count. This population count also excludes non-Saskatchewan First Nations members living in Saskatchewan First Nations communities.

- » Data source: INAC, 2012 and 2016 (unadjusted data)
Although, adjusted Indian Registry (IR) data is considered to be the most accurate, updates to the system may take up to five years, thereby limiting the availability of current data for reporting. Therefore, the breakdown for on- and off-reserve populations may not reflect the true Indigenous population in Saskatchewan as these population figures may be slightly higher or lower based on the time of reporting of births and deaths in a particular year. (8) As the same population data source was used in the years covered by this current and previous health status report, it is less likely to affect the reporting of disease trends year to year.

4 Medium growth scenario

- » The medium growth scenario is based on the following assumptions:
 - Moderate decline in female and male fertility rates;
 - Moderate improvement in life expectancy at birth;
 - Moderate decline in the volume of net migration to reserves;
 - Declining rate of status reinstatements and number of newly entitled registrations under the 1985 and 2010 *Indian Act* amendments; and
 - Constant rate of exogamous parenting. (12)

Data Limitations

- Data used is unadjusted INAC population data which has not been adjusted for late reporting of life events such as births and deaths.
- As the place of residence field on the Indian Register is optional, information provided in this chapter represents a snapshot in time on whether an individual lives on- or off-reserve. This may not be a true reflection of the proportion of First Nations individuals living in First Nations communities due to high mobility trends associated with First Nations.
- The overall Saskatchewan population also includes First Nations living in First Nations communities. Therefore, it is not possible to make a direct comparison between First Nations living in First Nations communities and the rest of the Saskatchewan population. As such, apparent differences between populations may be understated unlike when comparisons are made between two independent populations. This limitation also applies to subsequent chapters in this report.

References

- 1 Berkley S, Chan M, Dybul M, Hansen K, Lake A, Osotimehin B, Sidibé M. A healthy perspective: the post-2015 development agenda. *The Lancet*. 2013 Mar 30;381(9872):1076–1077. Available from: [http://dx.doi.org/10.1016/S0140-6736\(13\)60722-9](http://dx.doi.org/10.1016/S0140-6736(13)60722-9)
- 2 Lafonde G, Haver C, McLeod V, Clarke S, Horsburgh B, McLeod K. Characteristics and residence of First Nations patients and their use of health care services in Saskatchewan, Canada: informing First Nations and Métis health services. *Journal of Evaluation in Clinical Practice*. 2016 July 15;23(2):294–300. Available from: [doi:10.1111/jep.12601](https://doi.org/10.1111/jep.12601)
- 3 Nelson S, Wilson K. The mental health of Indigenous peoples in Canada: a critical review of research. *Social Science and Medicine*. 2017 Jan 18;176:93–112. Available from: <https://doi.org/10.1016/j.socscimed.2017.01.021>
- 4 Statistics Canada. Population size and growth in Canada: key results from the 2016 census (The Daily) [Internet]. 2017 Feb 08 [cited 2017 Aug 24]. Available from: www.statcan.gc.ca/daily-quotidien/170208/dq170208a-eng.htm
- 5 Statistics Canada. Annual demographic estimates: Canada, Provinces and Territories [Internet]. 2015 [cited 2017 Aug 24]; Catalogue no. 91-215-X. Available from: www.statcan.gc.ca/pub/91-215-x/91-215-x2015000-eng.pdf
- 6 Population Reference Bureau. Human population: population change [Internet]. 2006 [cited 2017 Aug 24]. Available from: www.prb.org/Publications/Lesson-Plans/HumanPopulation/Change.aspx
- 7 Statistics Canada. Aboriginal peoples in Canada: Key results from the 2016 Census [Internet]. 2016 [cited 2017 Oct 25]. Available from: www.statcan.gc.ca/daily-quotidien/171025/dq171025a-eng.pdf
- 8 Indigenous and Northern Affairs Canada. 2013 [Internet]. 2016 [cited 2017 Aug 24]. Available from: www.aadnc-aandc.gc.ca/eng/1394032502014/1394032901691
- 9 Health Council of Canada. Canada's most vulnerable: improving health care for First Nations, Inuit, and Métis seniors [Internet]. 2013 Nov [cited 2017 Aug 24]. Available from: www.hhr-rhs.ca/images/stories/Senior_AB_Report_2013_EN_final.pdf
- 10 Statistics Canada. A portrait of the population aged 85 and older in 2016 in Canada (Census in Brief) [Internet]. 2017 Mar 03 [cited 2017 Aug 24]. Available from: www12.statcan.gc.ca/census-recensement/2016/as-sa/98-200-x/2016004/98-200-x2016004-eng.cfm
- 11 Statistics Canada. Population projections for Canada, Provinces and Territories 2009–2036 [Internet]. 2010 [cited 2017 Aug 24]; Catalogue no. 91-520-X. Available from: www.statcan.gc.ca/pub/91-520-x/91-520-x2010001-eng.pdf
- 12 Indigenous and Northern Affairs Canada. 2007 [Internet]. 2016 [cited 2017 Aug 24]; Catalogue no. R3-62/2007. Available from: www.aadnc-aandc.gc.ca/DAM/DAM-INTER-HQ/STAGING/texte-text/ai_rs_pubs_sts_ad_ad_1309454434736_eng.pdf



Chapter 2: Opioid Overdose

Opioids are a type of drug, typically used for pain management, but also used recreationally because of its euphoria inducing properties. In high doses, opioids can cause respiratory depression, coma and death. Opioid overdose related deaths are a serious and growing issue in North America, termed as an epidemic, with rates of opioid related deaths increasing alarmingly in recent years. (1,2)

The risk factors for prescription opioid abuse and overdose are having multiple concurrent prescriptions from providers, being prescribed high daily opioid dosage levels, history of mental illness and substance abuse, residing in rural areas and living in poverty. (3) Illegally sourced opioids, such as illicitly-manufactured fentanyl, are also considered to be fueling the opioid crisis. (4)

WHY ARE OPIOIDS A CONCERN?

Opioid-related overdoses and deaths are considered a crisis in North America. (4,5) In Canada, the rates of opioid-related hospitalizations have increased by 53% in the past decade and opioid-related deaths are forecasted to be the leading cause of deaths for individuals aged 30 to 39 years. (5) The opioid crisis in Canada is being attributed to the high rates of prescription opioid use (Canada being the second highest per capita consumer) and an illegal drug supply being contaminated with fentanyl. (5) Within Canada, Kelowna (37.9 cases per 100,000) and Brantford (32.0 cases per 100,000) had the highest age-standardized opioid-related hospitalizations in fiscal year 2016–2017. (6)

HIGHLIGHTS

- In 2016–2017, First Nations people represented 36% of all opioid-related hospitalizations in Saskatchewan.
- The age-standardized opioid-related hospitalization rates among First Nations people were significantly higher (nearly six times in 2016–2017) than the non-First Nations population in Saskatchewan. However, between 2011–2012 and 2016–2017, the rates among First Nations have slightly decreased; in contrast, the rates consistently increased in the non-First Nations population.
- First Nations women were hospitalized for opioid overdose at a higher rate than First Nations men.

Figure 2.1. Opioid overdose injury pyramid representing the varying levels of health care sectors demands. (8)



Saskatchewan had the fourth highest age-adjusted rate of opioid-related hospitalizations in fiscal year 2016–2017 (21.7 cases per 100,000) compared to other provinces/territories and was 1.4 times greater than the national rate (15.5 cases per 100,000). (6) During the same period within Saskatchewan, Regina (28.2 cases per 100,000) and Saskatoon (26.1 cases per 100,000) had higher age-adjusted rates of opioid-related hospitalizations than major Canadian cities such as Vancouver and Toronto. (6) Looking at hospitalization trends among Indigenous people, the rate due to opioid overdose was over five times greater among Alberta First Nations people compared to the non-First Nations population. (7)

This report provides the current trends (using fiscal years) of opioid overdose in Saskatchewan, with a focus on the First Nations people. It is important to note that the overdoses reported in this report (hospitalization rates) only represent a fraction of all those affected as demonstrated in Figure 2.1. (8) That is because not all opioid overdoses result in emergency department visits or hospital admissions. In this report, “status” First Nations refers to people living in Saskatchewan that are registered to a First Nations band. The available data are not able to distinguish “status” and “non-status” First Nations. Therefore, “non-status” First Nations data are captured in the “Non-First Nations” population.¹

HOSPITALIZATIONS: COUNTS AND PROPORTIONS

Saskatchewan had 240 opioid-related hospitalizations in 2016–2017; averaging 20 hospitalizations per month. In 2016–2017, there was a 9% reduction in hospitalizations compared to 2015–2016. Among First Nations people, there was even a larger reduction (17%) in the number of hospitalizations in 2016–2017 compared to 2015–2016 (86 versus 103).

Overall, between 2011–2012 and 2016–2017, there was an increase in the number of opioid-related hospitalizations in Saskatchewan (see Figure 2.2), similar to trends seen nationally and in other provinces. (5) In 2016–2017, status-First Nations people represented 36% (86 hospitalizations) of all opioid-related hospitalizations in Saskatchewan, a decrease compared to 2011–2012 (41%) as demonstrated in Figure 2.3.

HOSPITALIZATION RATES: AGE AND GENDER

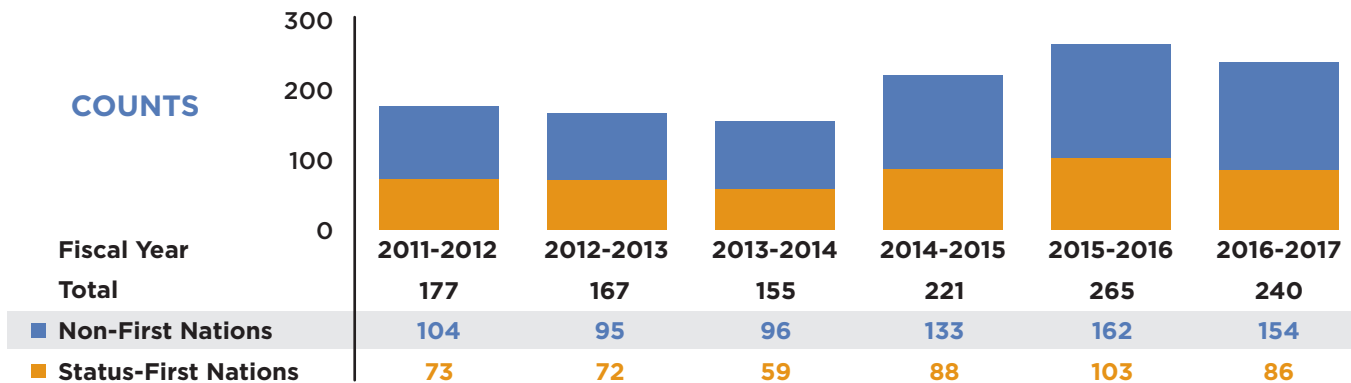
The age standardized rate of opioid-related hospitalizations among First Nations in 2016–2017 (85.9 cases per 100,000) has slightly decreased compared to 5 years earlier (2011–2012: 92.5 cases per 100,000). In contrast, the rest of the population (non-First Nations) has seen a 52% increase between 2011–2012 (9.6 cases per 100,000) and 2016–2017 (14.6 cases per 100,000). Figure 2.4 shows a wide gap between status-First Nations and non-First Nations people in Saskatchewan. In 2016–2017, the age-standardized rate of opioid-related hospitalizations among First Nations individuals was nearly 6 times greater than the non-First Nations population in Saskatchewan.

In terms of gender distribution, the crude rates of hospitalizations among females have consistently remained higher than males among the First Nations people (Figure 2.5). This trend is consistent with the First Nations people in the neighboring province of Alberta. (7)

In terms of age specific trends, the rate of opioid-related hospitalizations has increased among individuals aged 30 to 39 between 2011–2012 and 2016–2017 (Figure 2.6). The age-specific rate in 2011–2012 (99 cases per 100,000) has increased almost 50% in 2016–2017 (149 cases per 100,000). Increase in rates has also been observed during the same time period among status-First Nations individuals aged 20 to 29.

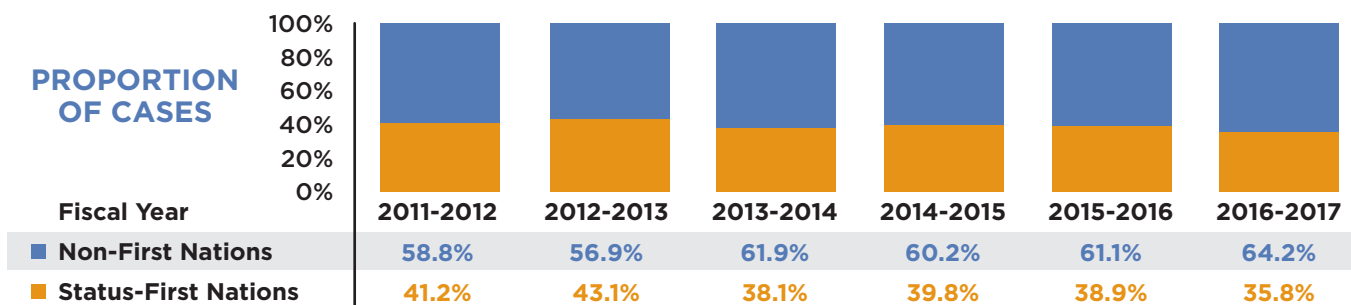
¹ See appendix for other limitations in this chapter

Figure 2.2: Counts of opioid-related hospitalizations with breakdown by status First Nations and non-First Nations in Saskatchewan, 2011-2012 to 2016-2017.



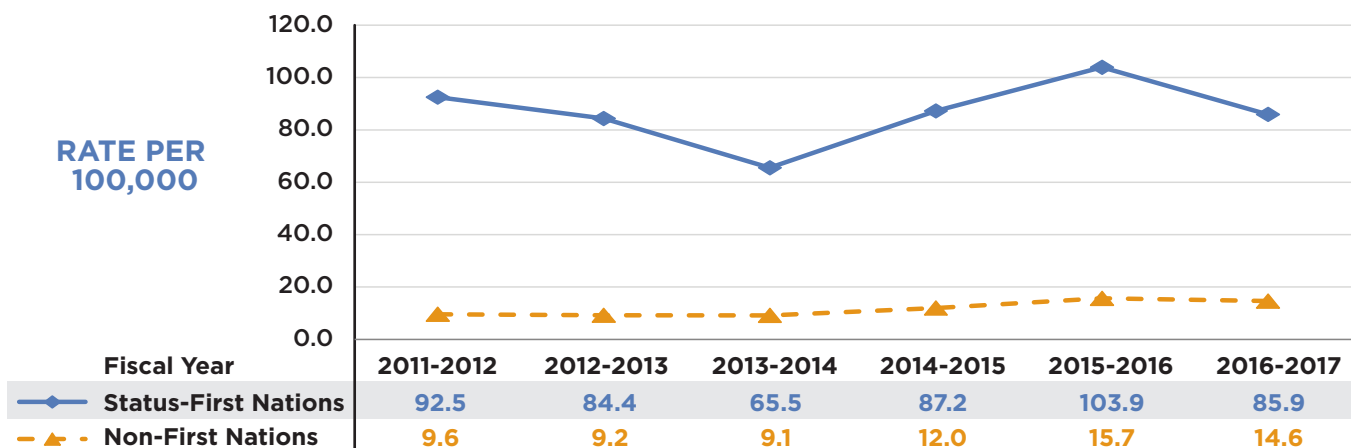
Source: Acute & Emergency Services Branch, Ministry of Health, Government of Saskatchewan

Figure 2.3: Proportion of opioid-related associated hospitalizations with breakdown by status First Nations and non-First Nations in Saskatchewan, 2011-2012 to 2016-2017.



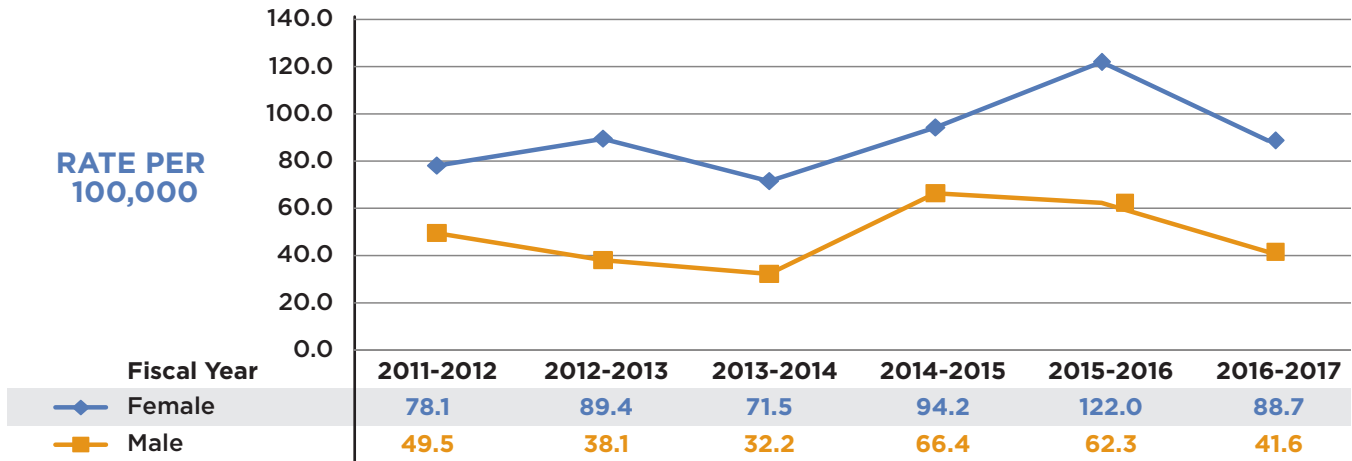
Source: Acute & Emergency Services Branch, Ministry of Health, Government of Saskatchewan

Figure 2.4: Age-standardized* rates of opioid-related hospitalizations with breakdown by status First Nations and non-First Nations in Saskatchewan, 2011-2012 to 2016-2017.



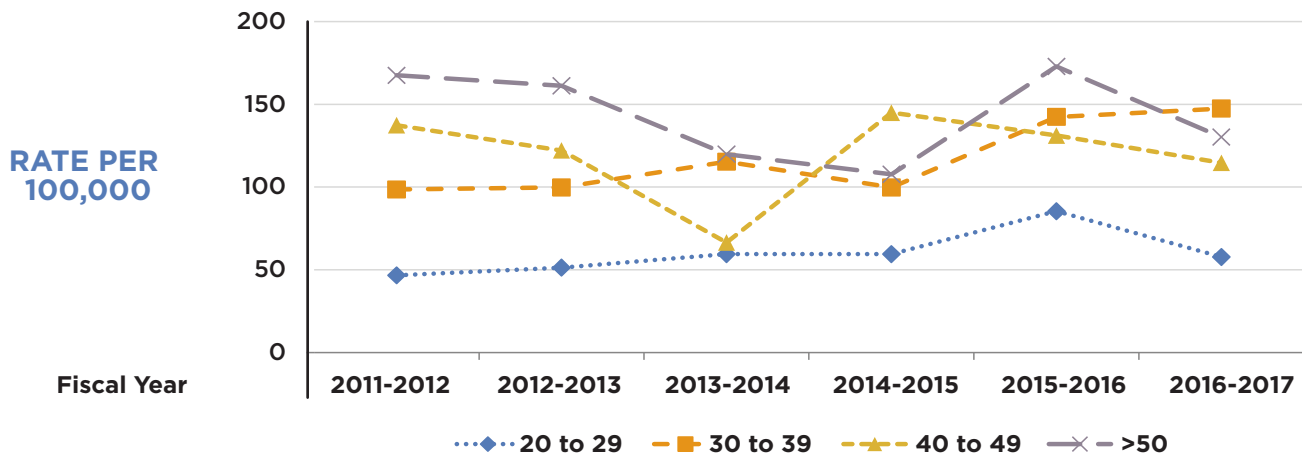
Source: Acute & Emergency Services Branch, Ministry of Health, Government of Saskatchewan
*using 1991 census population

Figure 2.5: Gender-specific rates of opioid-related hospitalizations among status First Nations in Saskatchewan, 2011-2012 to 2016-2017.



Source: Acute & Emergency Services Branch, Ministry of Health, Government of Saskatchewan

Figure 2.6: Age-specific rates of opioid-related hospitalizations among status First Nations in Saskatchewan, 2011-2012 to 2016-2017.



Source: Acute & Emergency Services Branch, Ministry of Health, Government of Saskatchewan

GEOGRAPHIC AREAS

In 2016–2017, the rates of opioid-related hospitalizations among status-First Nations people were highest in the Regina area as well as the South East area of the province (Figure 2.7). In a recent national report, Regina (28.2 cases per 100,000) and Saskatoon (26.1 cases per 100,000) were reported to have higher age-adjusted rates of opioid-related hospitalizations than major Canadian cities such as Vancouver and Toronto. (6) Overall, the rates among status-First Nations people are observed to be the highest in the southern parts of the province followed by the central region and then the north.

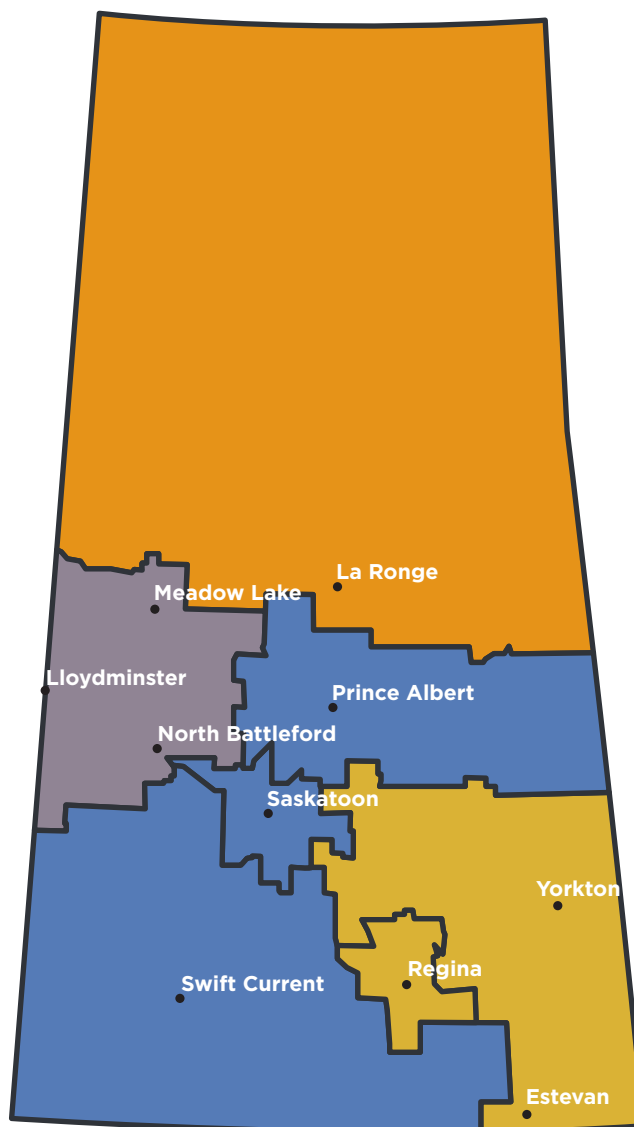
ADDRESSING THE OPIOID CRISIS

In November 2016, Government of Canada released a joint statement of action to combat the opioid crisis in Canada. (9) The key elements of this action plan included:

- better informing Canadians about the risk of opioids;
- supporting better prescribing practices;
- reducing easy access of unnecessary opioids;
- supporting better treatment options for patients;
- improving the evidence base upon which policy decisions are made, and
- reducing the availability and harms of street drugs. (9)

Addressing the opioid crisis requires and involves collective efforts and engagement activities between multiple health sectors, law enforcement agencies, community partners, and governmental and non-governmental organizations. As the trends provided in this report give an insight into the current opioid overdose trends among the Saskatchewan First Nations people, public health policies and programs should continue to provide evidence-based interventions in the form of take home naloxone training, education, opioid substitution and treatment programs, and improvement to opioid reporting.

Figure 2.7: Rates of opioid-related hospitalizations among status First Nations in Saskatchewan, 2016-2017.



LEGEND

Rates among First Nations population by area

- 20.0 to 29.9
- 30.0 to 49.9
- 50.0 to 79.9
- 80.0 to 120.0

The 2016-2017 provincial crude rate was 20.5 cases per 100,000

Source: Acute & Emergency Services Branch, Ministry of Health, Government of Saskatchewan

Appendix

Data Sources

1 Population counts

- » Status First Nations: This population source counts individuals registered to a First Nations band and have a valid health card in Saskatchewan. These data do not distinguish whether the person lives on or off reserve. Inquiries about the methodology can be directed to the Acute & Emergency Services, Ministry of Health, Government of Saskatchewan.
- » Non-First Nations: Total Saskatchewan population, excluding status First Nations.
- » Data source:
 - SK Ministry of Health covered population for 2011 to 2016

2 Opioid Overdoses

- » Discharge Abstract Database, 2011-2012 to 2016-2017
- » Data Source:
 - Acute & Emergency Services Branch, Ministry of Health, Saskatchewan

Methodology

The following ICD10CA codes with a diagnosis type of “M”, “1”, “2”, “W”, “X”, “Y”, or “6” were used to identify opioid overdoses:

- T400 - poisoning by opium
- T401 - poisoning by heroin
- T402 - poisoning by other opioids (includes Codeine, Morphine, and Oxycodone)
- T403 - poisoning by methadone
- T404 - poisoning by synthetic opioids (includes Fentanyl)
- T406 - poisoning by unspecified/other opioids

Data Limitations

- The data are not able to distinguish status and non-status First Nations. Therefore, non-status First Nations are captured in the “Non-First Nations” population.
- Emergency department and mortality statistics are not presented due to data limitations.
- Suspected opioid overdoses are excluded
- Out of province residents are excluded.
- The data for 2015-2016 and 2016-2017 are subject to change once final year-end corrections are applied.
- The numbers in this report are slightly different from CIHI reported data due to different algorithms for patient residence allocation. (6)
- The cause of the overdose was not available for further interpretation of the results.
- This report is focused on opioid-related hospitalizations. There are other drug related hospitalizations in the population that are not captured in this report.

References

- 1 Centers for Disease Control and Prevention. Opioid Overdose: Understanding the epidemic. U.S. Department of Health & Human Services. 2017 Aug 31. Available from: www.cdc.gov/drugoverdose/epidemic/index.html
- 2 Government of Canada. National report: Apparent opioid-related deaths in Canada (released March 2018). Government of Canada. 2018 Mar 27. Available from: www.canada.ca/en/public-health/services/publications/healthy-living/national-report-apparent-opioid-related-deaths-released-march-2018.html
- 3 Centers for Disease Control and Prevention. Prescription Opioids: Risk Factors for Prescription Opioid Abuse and Overdose. U.S. Department of Health & Human Services. 2017 Aug 29. Available from: www.cdc.gov/drugoverdose/opioids/prescribed.html
- 4 Centers for Disease Control and Prevention. CDC Health Advisory: Increases in Fentanyl Drug Confiscations and Fentanyl-related Overdose Fatalities. HAN Health Advisory. October 26, 2015. emergency.cdc.gov/han/han00384.asp
- 5 Health Canada. The Opioid Crisis in Canada: A Summary of the Epidemiology. Presentation from the Opioid-related Harms Team, Centre for Surveillance and Applied Research, Health Promotion and Chronic Disease Prevention Branch. Feb 15, 2018.
- 6 Canadian Institute for Health Information, Canadian Centre on Substance Abuse. Opioid-Related Harms in Canada: Data Tables. Ottawa, ON: CIHI; 2018.
- 7 Alberta Health. Opioid and Substances of Misuse among First Nations People in Alberta: Alberta Report, 2017. Edmonton, AB: November 6, 2017. <https://open.alberta.ca/dataset/cb00bdd1-5d55-485a-9953-724832f373c3/resource/31c4f309-26d4-46cf-b8b2-3a990510077c/download/Opioids-Substances-Misuse-Report-FirstNations-2017.pdf>
- 8 World Health Organization. Injuries and violence the facts 2014. http://apps.who.int/iris/bitstream/10665/149798/1/9789241508018_eng.pdf?ua=1&ua=1&ua=1
- 9 Government of Canada. Joint Statement of Action to Address the Opioid Crisis. Nov 19, 2016. www.infoway-inforoute.ca/en/component/edocman/resources/reports/3224-joint-statement-of-action-to-address-the-opioid-crisis



Chapter 3: Immunization

The proportion of children immunized is an important population health indicator. Vaccines given during childhood have been shown to be an effective way to protect children and other population groups from major and sometimes fatal diseases. (1) In this chapter we will examine immunization coverage averages for routine immunizations from 2007–2016 and immunization coverage rates from 2012 to 2016 for one- two- and seven-year-old First Nations children living in communities under the jurisdictions of FNIHB, SK and NITHA. These immunization coverage rates will be compared to overall immunization coverage rates for children in Saskatchewan for a select number of vaccines.

NATIONAL IMMUNIZATION COVERAGE

The Public Health Agency of Canada routinely monitors immunization coverage in Canada through the Childhood National Immunization Coverage Survey (CNICS). (2) The survey, which is conducted by Statistics Canada, asks parents/guardians about the vaccine a randomly selected child (2, 7, 14 or 17 years of age) has received. In 2015, 89% of parents reported that their children's immunizations were completely up-to-date. (3)

Table 3.1 provides the 2013 and 2015 coverage rates by vaccines for two- and seven-year-old children in Canada. (4) The national target coverage rate for each vaccine is 95%. (5)

HIGHLIGHTS

- Saskatchewan First Nations communities' two- and seven-year-old populations had immunization coverage rates for a select number of vaccines (pertussis, measles, and meningococcal serogroup C) that were generally higher in comparison to the coverage rates for the same age cohorts in the overall Saskatchewan population. However, despite the positive upward trend in immunization coverage, there are some vaccine coverage rates, like those for measles and pertussis that were well below the recommended target coverage rates to prevent disease outbreaks.
- Enhanced measures and supports have been put in place by Indigenous Services Canada, First Nations and Inuit Health Branch Saskatchewan (ISC, FNIHB, SK) and Northern Inter-Tribal Health Authority (NITHA) to guide community-led approaches for increasing immunization coverage and reducing risks of infection.

Table 3.1: Immunization coverage estimates for two- and seven-year-old children in Canada, 2013 and 2015

	2-Year-Old Children		7-Year-Old Children	
	2013	2015	2013	2015
Diphtheria	76.6	76.9	71.4	74.6
Pertussis (whooping cough)	76.4	77.0	70.8	74.9
Tetanus	76.4	76.7	71.0	74.6
Haemophilus influenza type b (Hib)	71.9	71.9	80.7	77.3
Measles	89.7	89.2	85.7	85.8
Mumps	89.4	88.9	85.1	86.2
Rubella	89.4	88.9	94.8	93.5
Meningococcal	88.7	87.8		

Source: Statistics Canada—Childhood National Immunization Coverage Survey (2013 and 2015)

SASKATCHEWAN IMMUNIZATION COVERAGE

The majority of public health professionals in Saskatchewan manage their client’s immunization records through Panorama, which replaced the former Saskatchewan Immunization Manual System (SIMS). Panorama is a comprehensive and integrated Pan-Canadian Public Health Communicable Disease Surveillance and Management system. (6) The system’s purpose is to help public health professionals work together more effectively to manage vaccine inventories, immunizations, investigations, outbreaks and family health. (7) Two Panorama modules are in full use in Saskatchewan: an Immunization module and Vaccine Inventory module.

The Immunization module in Panorama provides health care professionals with a number of benefits, including the ability to manage individual client immunization records, forecast upcoming immunizations, and provide immunization coverage reports for the province. (8) The Vaccine and Inventory module is used for the management of vaccine supply, to track information related to vaccine products, forecast vaccine demand, assist with vaccine recalls, manage vaccine distribution, and monitor cold chain breaks and other adverse storage issues. (9)

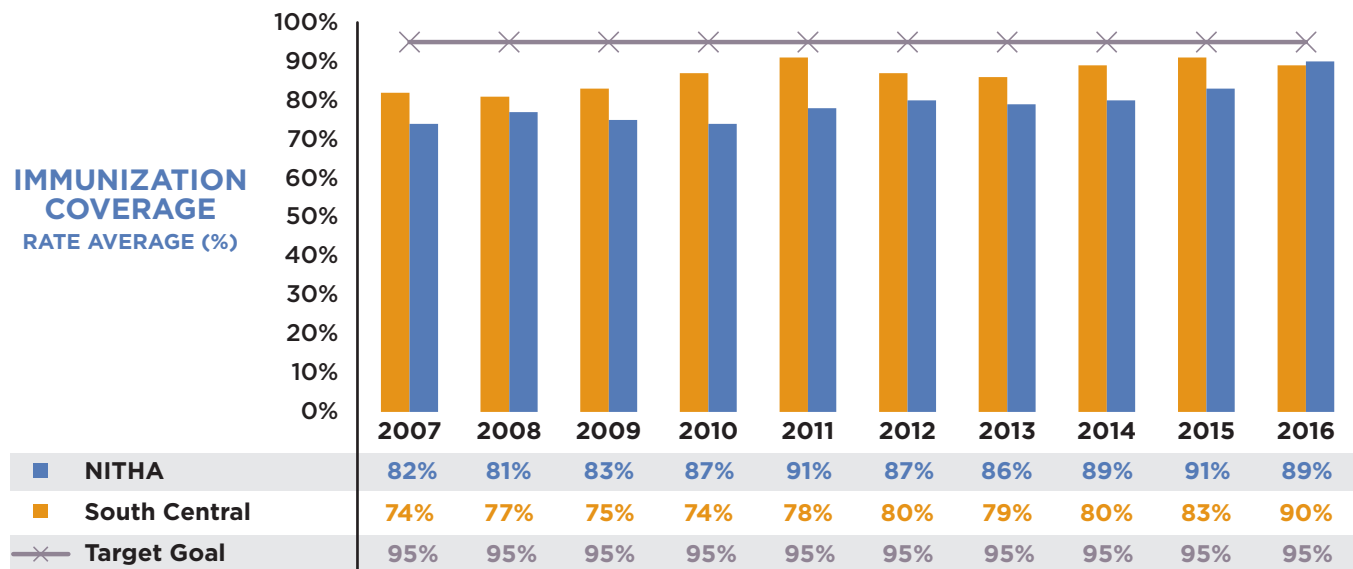
As of May 2018, only 28% of First Nations communities in Saskatchewan had their immunization records in Panorama. The goal of the First Nations Deployment of Panorama in Saskatchewan (FNDPS) Committee is to increase the number of First Nations communities with access to Panorama.

Those First Nations communities not using Panorama continue to use the paper-based Childhood Immunization Coverage Report (CICR) tool to record immunizations. Despite the limitations of paper-based tools (refer to Limitations section), community health nurses are able to manage immunization records and report on immunization coverage rates for First Nations communities in Saskatchewan.

IMMUNIZATION COVERAGE RATE AVERAGES (2007-2016) FOR SASKATCHEWAN FIRST NATIONS COMMUNITIES

This section provides information on up-to-date immunization coverage rate averages of all vaccines in the routine immunization schedule for each of the population age cohorts: one-, two- and seven-year-olds. These coverage rate averages are based on vaccine uptake as of December 31 for each of the years reported. All coverage rates in this chapter were compared to the international target immunization coverage goal. (10) The immunization program for First Nations children follows the Saskatchewan provincial immunization schedule listed in the Saskatchewan immunization manual. (11)

Figure 3.1: Up-to-date immunization coverage rate averages for one-year-olds by Saskatchewan First Nations communities, 2007-2016



Source: Indigenous Services Canada, FNIHB, SK

IMMUNIZATION SCHEDULE FOR ONE-YEAR-OLDS

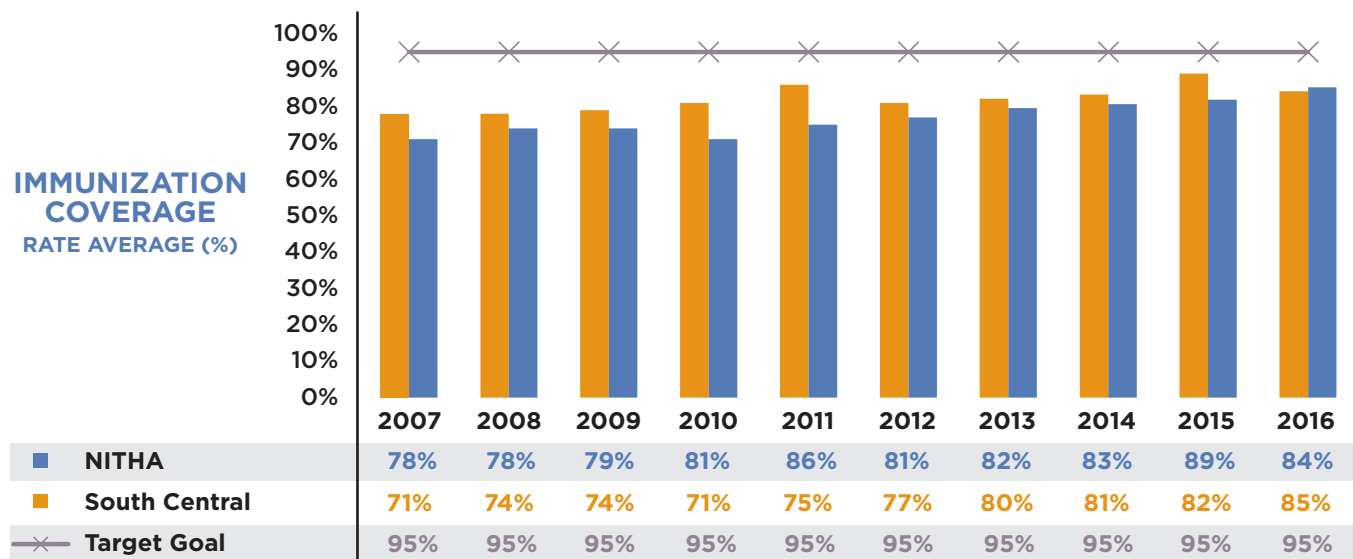
One-year-old immunization coverage rate averages are for all vaccines offered prior to one-years of age, for which a child is eligible. The routine immunization schedule for infants in Saskatchewan is listed below:

- Three doses of Diphtheria-Tetanus-Pertussis-Polio (DTaP-IPV) and Haemophilus Influenza type B (Hib) offered at 2, 4 and 6 months of age; and
- Two doses (three, if medically high risk) of Pneumococcal Conjugate-13 (Pneu-C-13) offered at 2, 4, and 6 months of age; and
- Two doses of Rotavirus (Rot-1) offered at 2 and 4 months of age.

ONE-YEAR-OLD IMMUNIZATION COVERAGE RATE AVERAGES, 2007-2016

The immunization coverage rate averages of all vaccines for one-year-olds in First Nations communities in south and central Saskatchewan under the jurisdiction of FNIHB, SK (South Central) increased from 74% in 2007 to 90% in 2016 (Figure 3.1), while one-year old coverage rate averages for First Nations communities in the north under the jurisdiction of NITHA increased slightly from 82% in 2007 to 89% in 2016, with coverage rates as high as 91% reported in 2011 and 2015.

Figure 3.2: Up-to-date immunization coverage rate averages for two-year-olds by Saskatchewan First Nations communities, 2007-2016



Source: Indigenous Services Canada, FNIHB, SK

IMMUNIZATION SCHEDULE FOR TWO-YEAR-OLDS

The routine immunization schedule for Saskatchewan children under 24 months of age are:

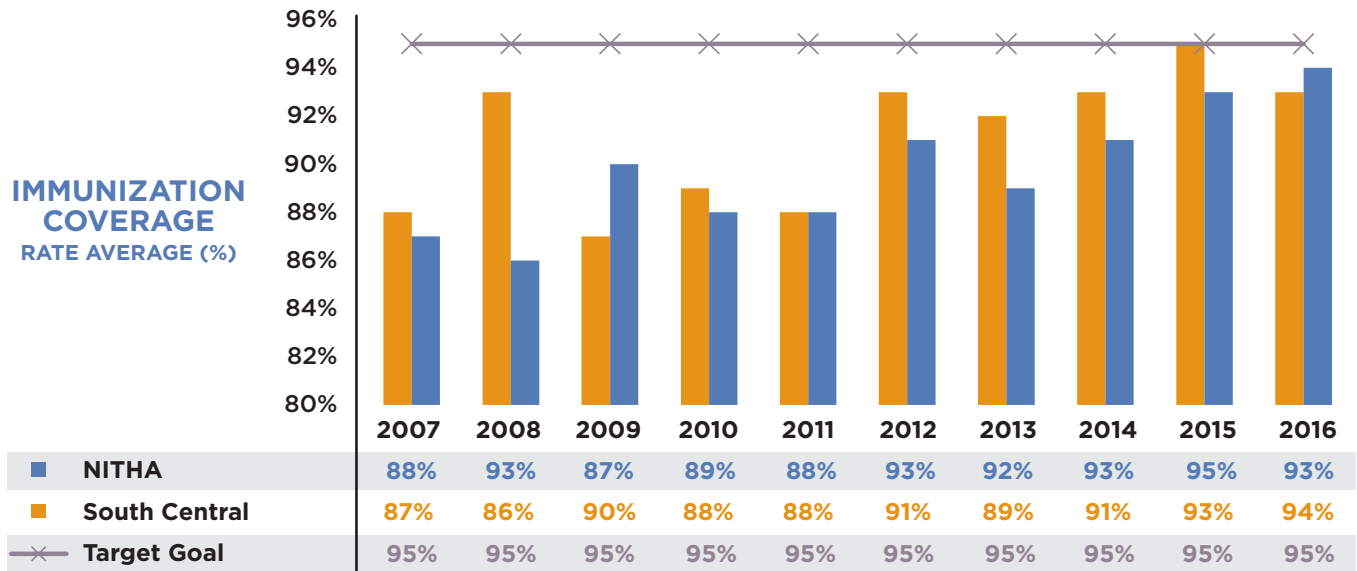
- Four doses of Diphtheria-Tetanus-Pertussis-Polio (DTaP-IPV) and Haemophilus Influenza type B (Hib) offered by 18 months of age; and
- Three doses (four, if medically high risk) of Pneumo Conjugate-13 offered at 2, 4 and 12 months of age; and
- Two doses of Measles, Mumps, Rubella and Varicella (MMRV) offered at 12 and 18 months of age; and
- One dose of Meningococcal-Conjugate-C offered at 12 months of age; and
- Two doses of Varicella offered at 12 and 18 months of age; and
- Two doses of Hepatitis A offered at 12 and 18 months of age.

Hepatitis A vaccine is only offered to children living in First Nations communities, and in selected northern communities in Saskatchewan. (12)

TWO-YEAR-OLD IMMUNIZATION COVERAGE RATE AVERAGES, 2007-2016

A general upward trend in the two-year-old immunization coverage rates was observed for South Central and NITHA populations. The South Central immunization coverage rate averages for the two-year-old population increased from 71% in 2007 to 85% in 2016 (Figure 3.2). The NITHA coverage rate averages increased from 78% in 2007 to 84% in 2016, with the highest coverage rate average, 89%, reported in 2015.

Figure 3.3: Up-to-date immunization coverage rate averages for seven-year-olds by Saskatchewan First Nations communities, 2007-2016



Source: Indigenous Services Canada, FNIHB, SK

IMMUNIZATION SCHEDULE FOR SEVEN-YEAR-OLDS

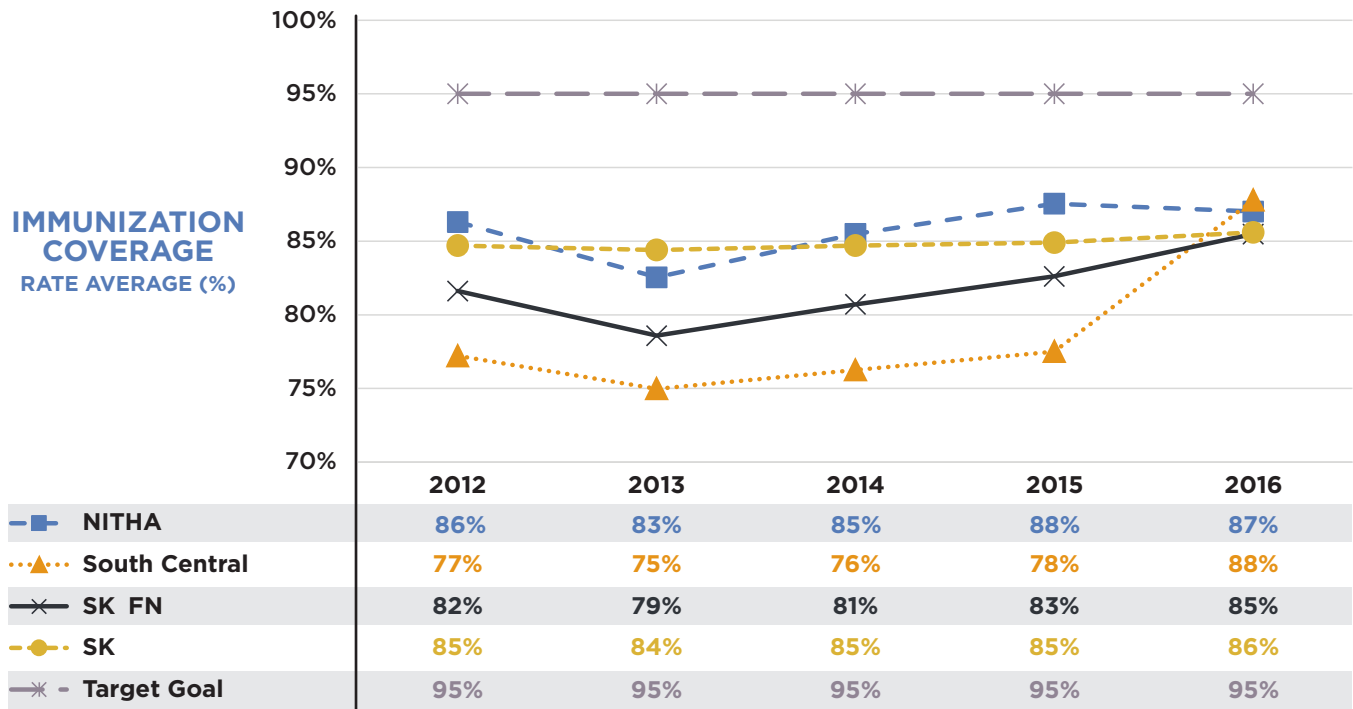
The routine vaccines offered to the seven-year-old population are:

- Five doses of Diphtheria-Tetanus-Pertussis-Polio (DTaP-IPV) and four doses of Haemophilus Influenza type B (Hib); and
- Three or four doses of Pneumo Conjugate-13; and
- Two doses of Measles, Mumps, and Rubella (MMR); and
- One dose of Meningococcal-Conjugate-C; and
- One or two doses of Varicella (depending on eligibility); and
- Two doses of Hepatitis A.

SEVEN-YEAR-OLD IMMUNIZATION COVERAGE RATE AVERAGES, 2007-2016

As Figure 3.3 shows, the immunization coverage rate averages for seven-year-olds in Saskatchewan First Nations communities were typically higher than the coverage rates presented for one- and two-year olds (see Figures 3.0 and 3.1). These coverage rates may be higher as parents have more time to get their children’s vaccinations up to date, and seven-year-olds in school are able to receive vaccines from community health nurses. The seven-year-old immunization coverage rate averages for South Central increased from 87% to 94%, from 2007 to 2016, respectively. Similarly, this upward trend was observed for NITHA, which experienced increased coverage rates from 88% in 2007 to 93% in 2016, with the highest rate of coverage, 95%, being reported in 2015.

Figure 3.4: Up-to-date Pertussis vaccine coverage rates for one-year-olds by geographical areas, 2012-2016



Source: Indigenous Services Canada, FNIHB, SK; Ministry of Health, Government of Saskatchewan

IMMUNIZATION COVERAGE BY SPECIFIC VACCINES, 2012-2016

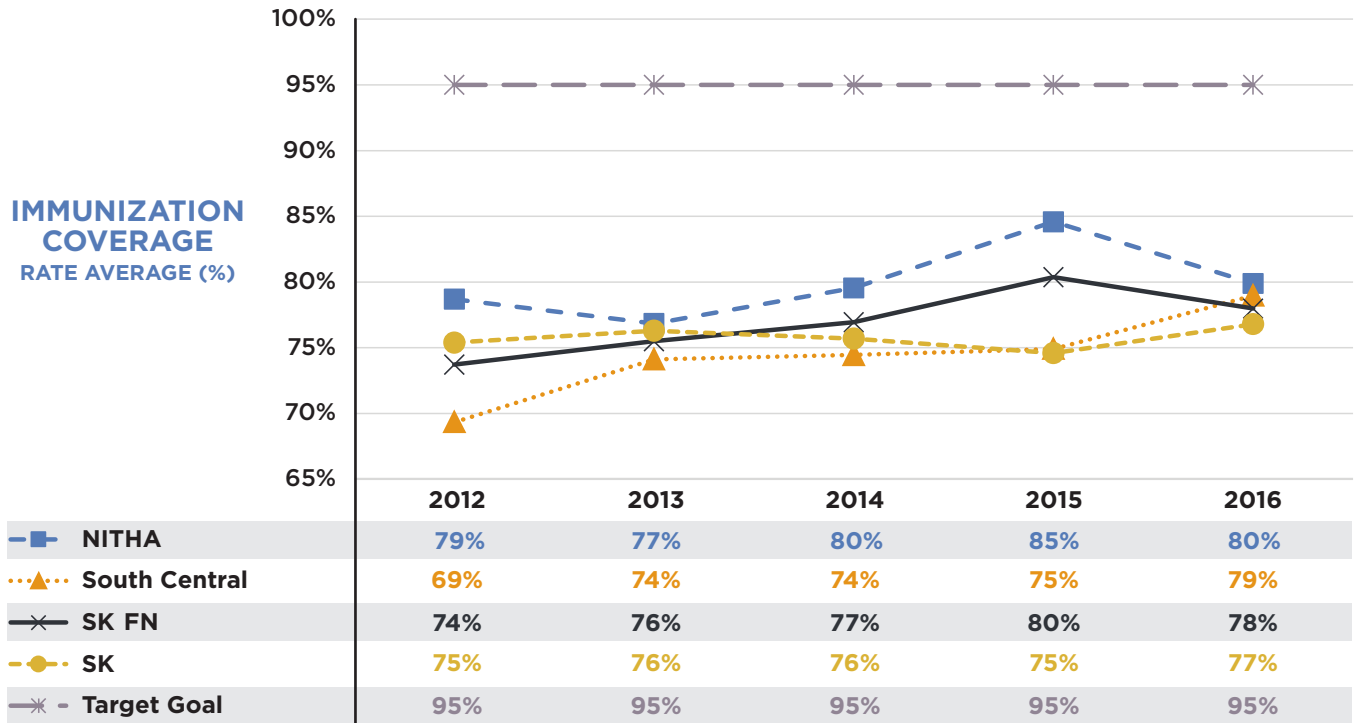
In this section, the up-to-date immunization coverage rates for pertussis, measles, and meningococcal serogroup C vaccines will be presented for South Central and NITHA for one-, two- and seven-year-olds. The consistency of data collected through the CICRs has enabled more detailed reporting of vaccine coverage for First Nations communities. The vaccines selected are those that can be compared to publicly accessible Saskatchewan childhood immunization coverage reports. These coverage rates will be compared, where possible, to the coverage rates for the same age cohorts in Saskatchewan First Nations communities (NITHA and South Central combined) and overall Saskatchewan population to provide a provincial context.

PERTUSSIS, MEASLES, MENINGOCOCCAL SEROGROUP C VACCINE COVERAGE RATES, 2012-2016

PERTUSSIS

Pertussis, or whooping cough, is a highly contagious disease that is caused by the bacteria *Bordetella pertussis*. (13) Pertussis is an endemic and cyclical disease in Canada, with peaks at two to five year intervals. (13) The disease can be very serious in infants 12 months of age or younger. The pertussis containing vaccine is administered as diphtheria, tetanus, acellular pertussis, inactivated polio & haemophilus influenza type B (DTaP-IPV-Hib). In Saskatchewan, the Ministry of Health recommends a coverage rate of 92-94% to prevent an outbreak of pertussis. (12)

Figure 3.5: Up-to-date Pertussis vaccine coverage rates for two-year-olds by geographical areas, 2012-2016



Source: Indigenous Services Canada, FNIHB, SK; Ministry of Health, Government of Saskatchewan

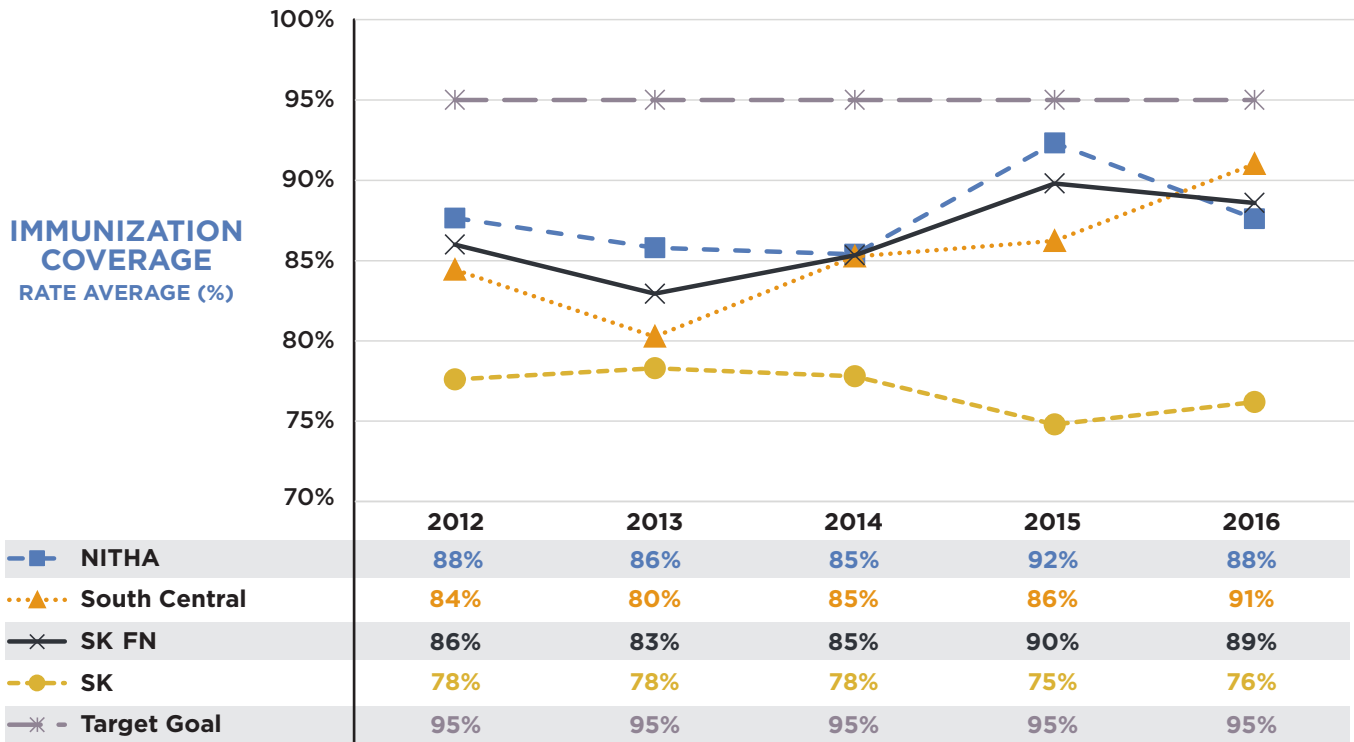
One-Year-Old immunization Coverage Rates, 2012-2016

All one-year-old coverage rates for pertussis were lower than the recommended coverage rate to prevent outbreaks. Saskatchewan First Nations communities' coverage rates increased from 82% in 2012 to 85% in 2016 (Figure 3.4). The coverage rates for South Central increased from 77% in 2012 to 88% in 2016; whereas the 2012 coverage rates for NITHA (86%) declined by 3% in 2013, peaked at 88% in 2015, and then decreased slightly to 87% in 2016. The coverage rates for the overall Saskatchewan population averaged at 85% across 2012 to 2016.

Two-Year-Old Coverage Rates, 2012-2016

Overall, the two-year old vaccine coverage rates for pertussis (Figure 3.5) were generally lower than those for one-year-olds. However, pertussis vaccine coverage rates for two-year-olds in Saskatchewan First Nations communities increased slightly from 74% in 2012 to 78% in 2016, with the highest rate of 80% being reported in 2015. The South Central coverage rates increased from 69% in 2012 to 79% in 2016. The NITHA coverage rates were comparable to the rates for South Central, increasing from 79% in 2012 to peak at 85% in 2015, before decreasing to 80% in 2016. The rates for the overall Saskatchewan two-year-old population increased slightly from 75% in 2012 to 77% 2016.

Figure 3.6 Up-to-date Pertussis vaccine coverage rates for seven-year-olds by geographical areas, 2012-2016



Source: Indigenous Services Canada, FNIHB, SK; Ministry of Health, Government of Saskatchewan

Seven-Year-Old Coverage Rates, 2012-2016

Seven-year-old coverage rates for pertussis were higher than those reported for one- and two-year olds. Coverage rates for Saskatchewan First Nations communities increased slightly from 86% in 2012 to 89% in 2016 (Figure 3.6). Coverage rates for South Central increased from 84% in 2012 to 91% in 2016, while coverage rates for NITHA hovered around 88%.

The pertussis vaccine coverage rates for First Nations communities' seven-year-old population (regardless of area) were generally higher than the rates for the overall Saskatchewan seven-year-old population which remained relatively stable at 78% from 2012 to 2014, then decreased slightly to 76% in 2016.

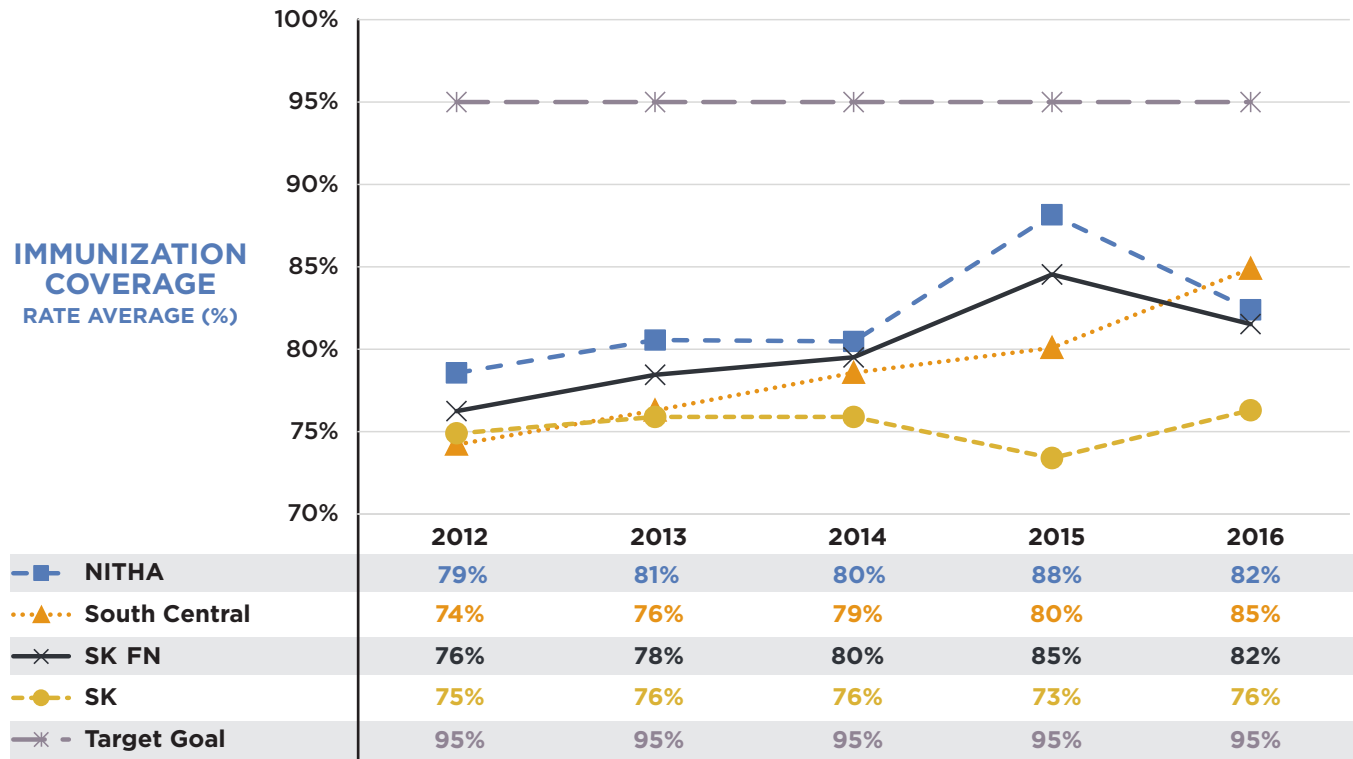
MEASLES

Measles is a highly contagious disease that is spread through the air when an infected person coughs or sneezes. (14) The disease can be prevented by the measles vaccine which is included in the measles, mumps, and rubella (MMR) combination vaccine. As with the pertussis vaccine, the Saskatchewan Ministry of Health recommends a target coverage rate of 92-94% to prevent outbreaks of measles. (12)

Two-Year-Old Coverage Rates, 2012-2016

The measles vaccine coverage rates for two-year-olds in Saskatchewan First Nations communities increased from 76% in 2012 to 82% in 2016, peaking at 85% in 2015 (Figure 3.7). In South Central, the coverage rates increased from 74% in 2012 to 85% in 2016, while rates in NITHA rose from 79% in 2012 to 88% in 2015, before decreasing to 82% in 2016. The overall Saskatchewan coverage rates for this age group increased slightly from 75% in 2012 to 76% in 2016.

Figure 3.7: Up-to-date Measles vaccine coverage rates for two-year-olds by geographical areas, 2012-2016



Source: Indigenous Services Canada, FNIHB, SK; Ministry of Health, Government of Saskatchewan

Seven-Year-Old Coverage Rates, 2012-2016

Vaccine coverage rates for measles were highest for the seven-year-old population. The coverage rates for Saskatchewan First Nations communities were close to the target rate goal (Figure 3.8), remaining relatively constant at around 94%. The 2016 coverage rates for South Central was similar to the rates for Saskatchewan First Nations communities, with a 93% coverage rate in 2012 that decreased to 89% in 2014 before climbing back to 94% in 2016. For NITHA, coverage rates remained relatively stable at the target rate goal of 95% from 2012 to 2016, despite the 1-3 % decline in rates in 2013 and 2014. For the overall Saskatchewan seven-year-old population, the measles vaccine coverage rates decreased slightly from 92% in 2012 to 90% in 2016. However, these rates of coverage were higher than the pertussis coverage rates reported for the same age group.

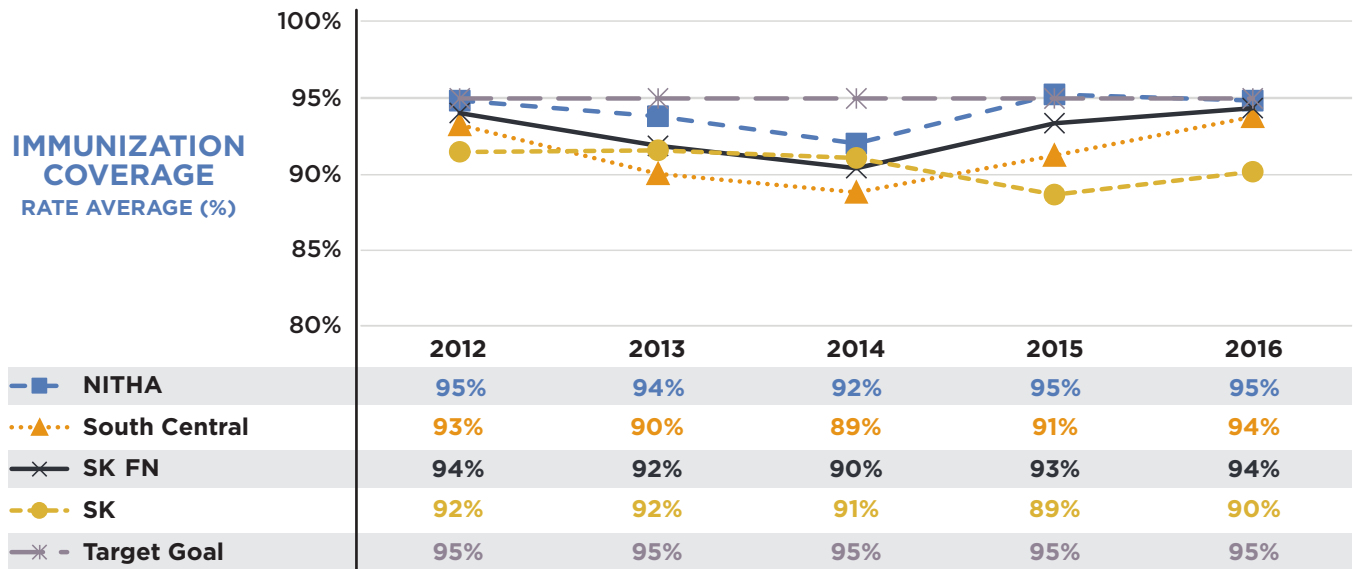
MENINGOCOCCAL SEROGROUP C

Meningococcal diseases are caused by a bacterium called *Neisseria meningitidis*. The bacteria can cause: 1) meningitis, which infects the membrane surrounding the brain and spinal cord and causes swelling, or 2) septicemia, when the bacteria enters the bloodstream and multiplies, damaging the walls of blood vessels, resulting in bleeding into the skin and organs. (12) Meningococcal diseases are very serious and can be deadly in a few hours. (12)

Two-Year-Old Coverage Rates, 2012-2016

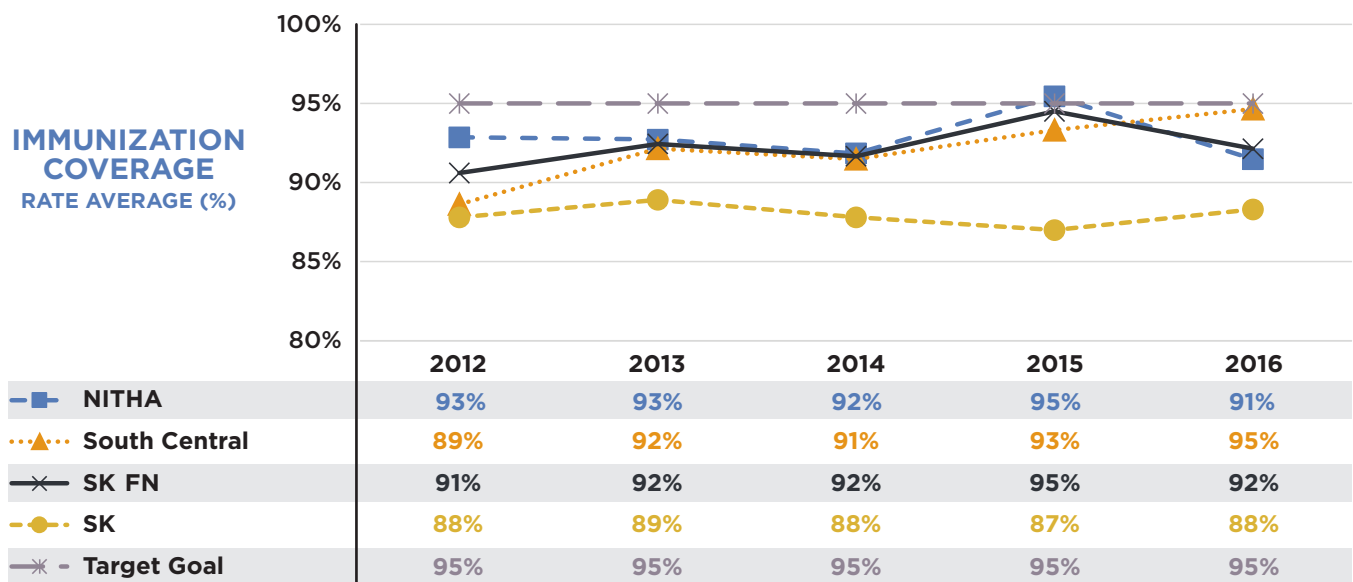
The meningococcal vaccine had the highest overall coverage rates of all the vaccines for two-year-olds. Meningococcal rates are likely higher than the rates for other vaccines as only a single dose is required for children to be up-to-date. The rates of coverage for Saskatchewan First Nations communities remained above 90% from 2012 to 2016, while the overall Saskatchewan coverage rates averaged at 88% across 2012 to 2016 (Figure 3.9).

Figure 3.8: Up-to-date Measles vaccine coverage rates for seven-year-olds by geographical areas, 2012-2016



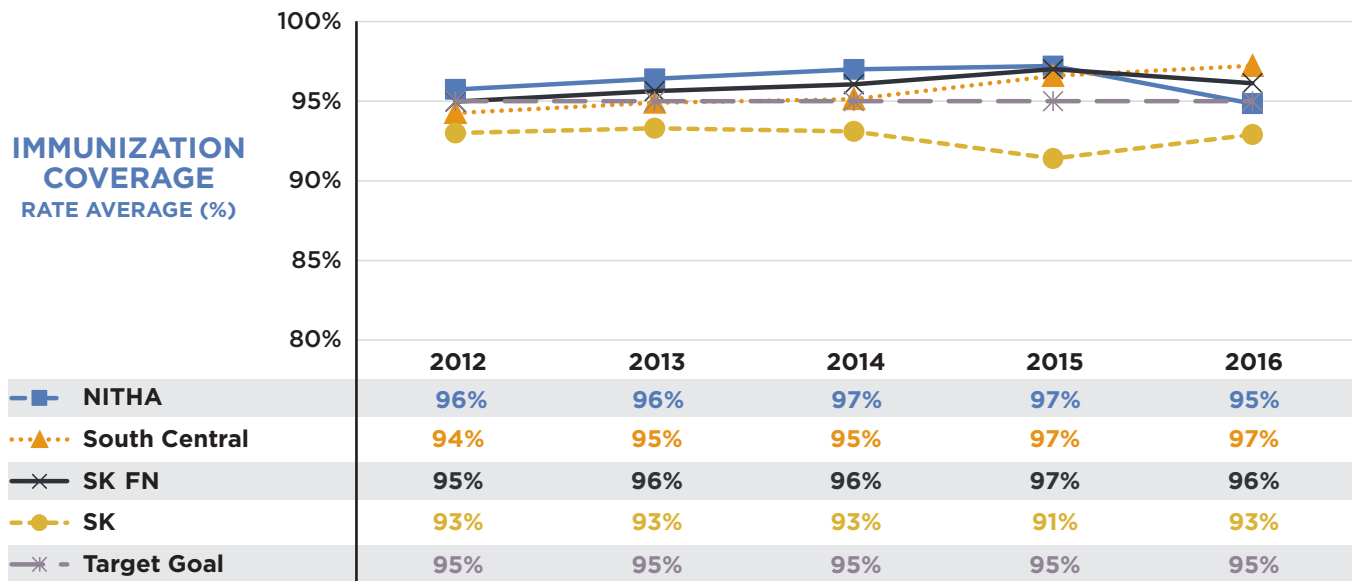
Source: Indigenous Services Canada, FNIHB, SK; Ministry of Health, Government of Saskatchewan

Figure 3.9: Up-to-date Meningococcal serogroup C vaccine coverage rates for two-year-olds by geographical areas, 2012-2016



Source: Indigenous Services Canada, FNIHB, SK; Ministry of Health, Government of Saskatchewan

Figure 3.10: Up-to-date Meningococcal serogroup C vaccine coverage rates for seven-year-olds by geographical areas, 2012-2016



Source: Indigenous Services Canada, FNIHB, SK; Ministry of Health, Government of Saskatchewan

Seven-Year-Old Coverage Rates, 2012-2016

The highest coverage rates for the meningococcal vaccine were observed among the seven-year-olds (Figure 3.10). The coverage rates for Saskatchewan First Nations communities, South Central and NITHA remained relatively stable and high, around the 95% target. The rates of coverage among the same cohort in the overall Saskatchewan population remained relatively unchanged at 93% from 2012 to 2016.

ROTAVIRUS

Rotavirus is a highly contagious virus that can cause fever, vomiting, severe diarrhea and stomach pain in infants and younger children. (15) The first dose of the vaccine must be given to infants between six weeks to about 15 weeks of age, followed by a second dose before eight months of age. The timing of doses makes it challenging to achieve the recommended national coverage target for this vaccine. The rotavirus vaccine was first included in the Saskatchewan immunization program in November 2012. (16) Although, the initial uptake of this vaccine was slow, the coverage rates for Saskatchewan First Nations communities have improved significantly since its inclusion in First Nations communities' immunization schedule in 2013.

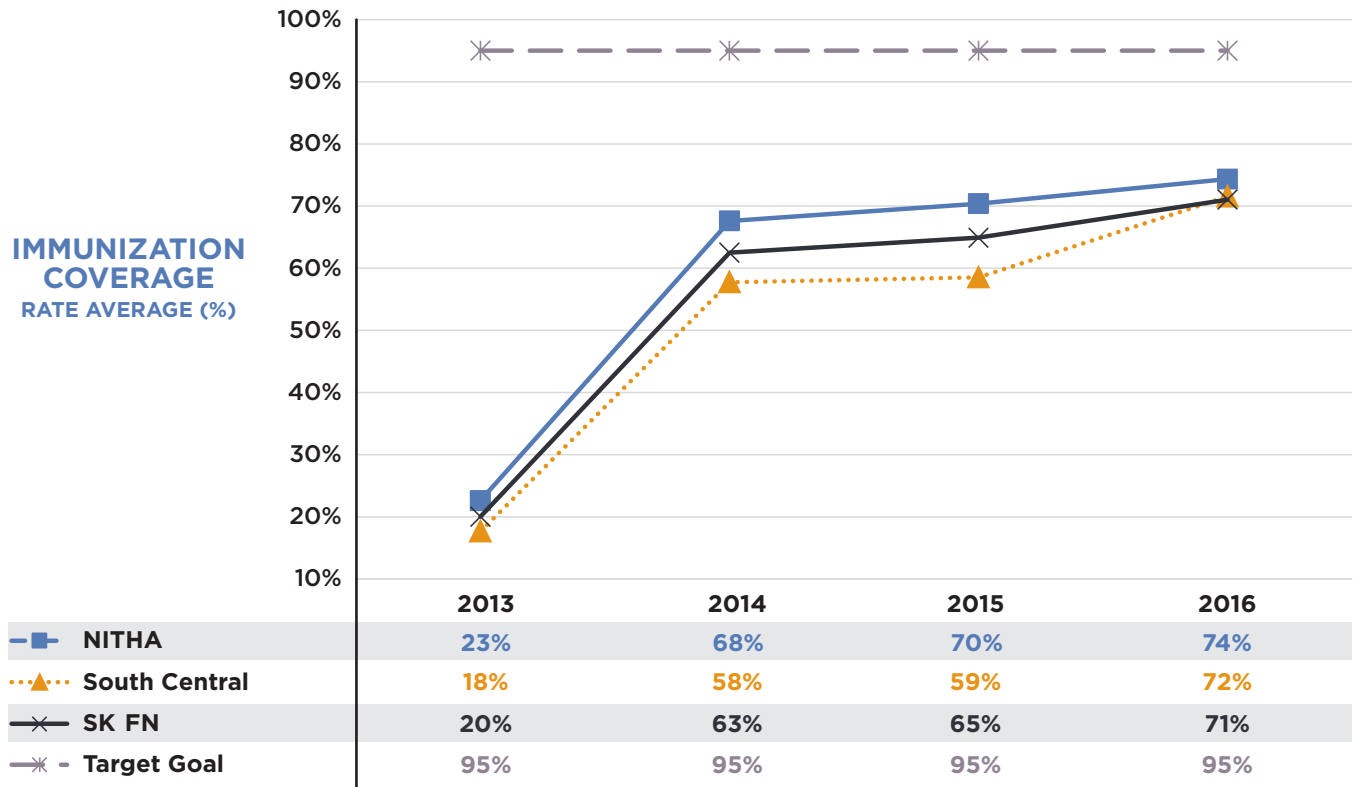
One-Year-Old Coverage Rates, 2013-2016

The rotavirus vaccine coverage rates for the overall Saskatchewan First Nations communities increased considerably from a rate of 20% in 2013 to 71% in 2016 (Figure 3.11). In South Central, the coverage rates increased from 18% in 2013 to 72% in 2016, while the rates in NITHA increased from 23% in 2013 to 74% in 2016.

HUMAN PAPILLOMAVIRUS (HPV) VACCINE FOR SCHOOL AGE POPULATION

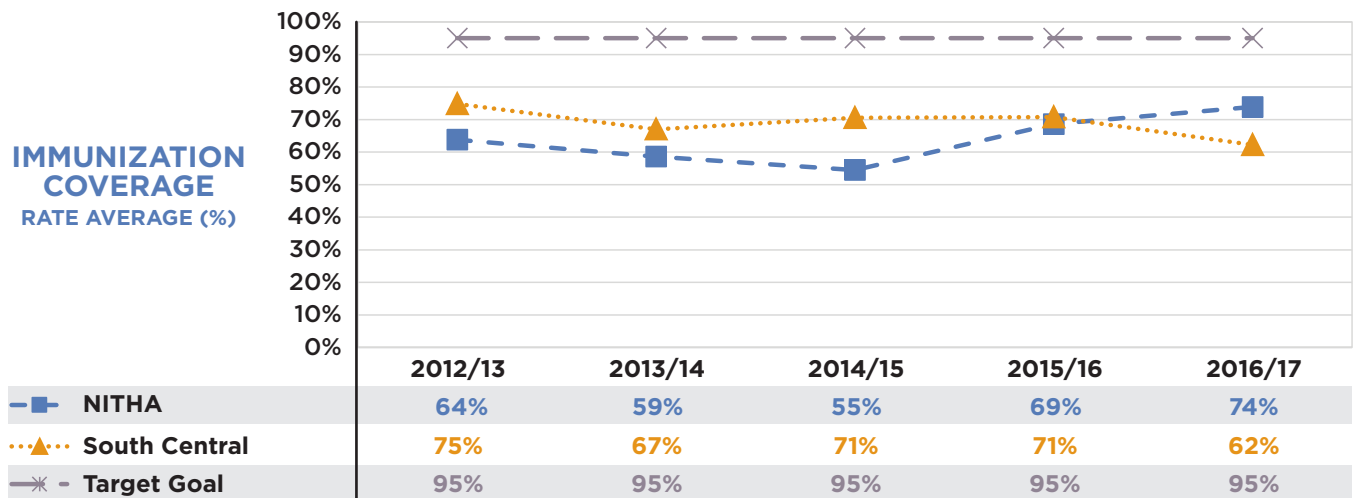
The human papillomavirus (HPV) causes genital warts and is one of the most common causes of cervical cancer. (17) The virus is generally spread during vaginal, anal or oral sex. The HPV vaccines have been found to be very effective in preventing cervical cancer associated with HPV-16 and/or HPV-18. (18) A number of studies have shown that immunization of young adolescent girls before sexual activity has a significant impact in reducing the risk of high-grade cervical abnormalities. (18-22)

Figure 3.11: Up-to-date Rotavirus vaccine coverage rates for one-year-olds by Saskatchewan First Nations communities, 2013-2016



Source: Indigenous Services Canada, FNIHB, SK; Northern Inter-Tribal Health Authority

Figure 3.12: Up-to-date HPV vaccine coverage rates for grade six female students by Saskatchewan First Nations on-reserve, 2012/13–2016/17 school years



Source: Indigenous Services Canada, FNIHB, SK; Northern Inter-Tribal Health Authority

In Saskatchewan, the HPV vaccine is offered free, as part of the school immunization program. Female students beginning grade six in 2008 were eligible for a three dose series. The second dose was given two months after the initial dose, and the third dose was given six months after the first dose. (17) Youth who missed getting vaccinated in grade six remained eligible for this publicly funded vaccine until their 27th birthday. (23) In September 2017, the HPV immunization program was expanded to include grade six male students. (23)

HPV Vaccine Coverage Rates among Grade Six Female Students, 2012/13–2016/17 School Years

The uptake of HPV vaccine for grade six students in Saskatchewan First Nations communities was low when compared to the coverage rates of the other vaccines covered in this chapter. In 2015/16, the HPV vaccine schedule was changed to a two dose series. The second dose was given six months after the initial dose. This decrease in number of doses may be one of the factors that have contributed to the increase in HPV coverage rates.

The HPV vaccine coverage rates in South Central decreased from 75% during the 2012/13 school year to 62% in the 2016/17 school year (Figure 3.12). The HPV coverage rates in NITHA during the 2016/17 school year was 74%; higher than the rate reported in South Central during the same year.

INCREASED VACCINE PREVENTABLE DISEASE ACTIVITIES

Vaccine preventable disease outbreaks usually occur when the proportion of individuals immunized against a particular disease does not meet the immunization threshold to offer protection to those that are not fully vaccinated or are unable to be vaccinated. (24) The risk of outbreaks is greatly reduced when the number of people vaccinated meets or exceeds the target immunization coverage rate of a particular disease.

As the number of doses of recommended vaccines in a series for children, adolescents and adults increases, it presents challenges as it is sometimes more difficult to locate individuals to offer subsequent doses of the vaccine. Although, Saskatchewan First Nations communities did not experience vaccine preventable disease outbreaks from 2012 to 2016, there were increased reporting of measles, pertussis and seasonal influenza. During such periods of increased disease activities, enhanced surveillance measures are put in place to help prevent, predict and control further spread of disease. FNIHB, SK and NITHA community health nurses provide support to communities with low immunization coverage rates by:

- Bringing the information to the attention of the Chief and Council of the community and reviewing their community immunization statistics with them; and
- Working with communities by providing information, education and other resources to help support community-led immunization initiatives; and
- Leading discussions on various reasons for the low immunization rates and assisting with possible solutions to increase coverage rates.

Increase in disease activities serve as early warnings of potential disease outbreaks and draw attention to the importance of childhood immunization in population health. As history has shown, these increase in disease activities occur among under and unimmunized populations. Consequently, researchers have suggested that the greatest additional gains can come from understanding the characteristics of the under immunized and unimmunized populations in order to improve immunization coverage and prevent transmission of diseases among these populations. (25)

Appendix

Immunization Methodology and Limitations

Data Sources

- 1 Canadian population
 - » Childhood National Immunization Coverage Survey (CNICS)
 - The CNICS estimates immunization coverage by assessing Canadians' knowledge, attitudes and behaviours about immunization. Survey information is randomly collected for a selected child in the household who was aged 2, 7, 14 or 17 years of age as of the data of March 2015. Coverage estimates are measured by 1) Calculating the number of people who actually received a certain vaccine and 2) comparing that number to the number of people who should have received that vaccine. (26)
 - » National Coverage Goals
 - Developed for infants, childhood, adolescent and adult vaccines that are publically funded in all provinces and territories (P/T) in Canada. This vaccine coverage monitoring at the national level take into account variations in P/T vaccination programs. (26)
- 2 Overall Saskatchewan population
 - » Total Saskatchewan population under Saskatchewan Health Authority
 - » Data source:
 - Saskatchewan Ministry of Health
 - The overall Saskatchewan immunization coverage only includes those children with Saskatchewan health coverage that are registered in Panorama and under the Saskatchewan Health Authority. Children with Saskatchewan health coverage and registered in Panorama under FNIHB, SK or NITHA jurisdiction are excluded. The immunization coverage reported for overall Saskatchewan does not include coverage statistics for the entire provincial or regional population. (12)
- 3 Saskatchewan First nations communities
 - » Reside on reserve and access immunization services on reserve
 - » Data Sources:
 - First Nations and Inuit Health Branch Saskatchewan and NITHA communities Childhood Immunization Coverage Reports (CICR) and school age coverage reports.

Approach to Data Analysis

Immunization coverage rate formula:

$$\frac{\text{Number of children, at a specific point in time, that have received the recommended number of doses, at a specific age}}{\text{Total number of children born in the same given period, at a specific age}} \times 100\%$$

Data Limitations

Limitations on the use of the CICR reporting tools:

- Although, most children receive their immunizations by seven years of age, the CICRs may not capture if these were received on time. Delayed immunizations may contribute to a decrease in vaccine effectiveness and disease outbreaks. Furthermore, immunization coverage rates may provide a false sense of herd immunity within a community, particularly within the susceptible population, such as infants less than one years of age.
- Immunization records are captured where individuals received their immunization. First Nations children that receive their immunization coverage off-reserve may not be captured in the CICRs. This could result in an underestimation of the number of immunized First Nations children reported by the CICRs.

References

- 1 Public Health Agency of Canada. Vaccines for children: Deciding to vaccinate [Internet]. Ottawa (ON): Government of Canada; 2018 Apr [cited 2018 June 8], Available from: www.canada.ca/en/public-health/services/vaccination-children.html
- 2 Public Health Agency of Canada. Vaccine coverage in Canadian children: results from the 2013 childhood national immunization coverage survey (CNICS); revised edition February 2017 [Internet]. Ottawa (ON): Government of Canada; 2017 Feb [cited 2018 June 29]. Available from: publications.gc.ca/collections/collection_2017/aspc-phac/HP40-156-2017-eng.pdf
- 3 Statistics Canada. Childhood National Immunization Coverage Survey, 2015 (The Daily) [Internet]. Ottawa (ON): Government of Canada; 2017 Jun [cited 2018 Feb 27]. Available from: www150.statcan.gc.ca/n1/en/daily-quotidien/170628/dq170628a-eng.pdf?st=EyhizcQ9
- 4 Public Health Agency of Canada. Vaccine coverage in Canadian children: Results from the 2015 childhood national immunization coverage survey (cNICS). Ottawa (ON): Government of Canada; 2018 Mar. p. 1-22. ISBN: 978-0-660-25246-9.
- 5 Government of Canada. Vaccination coverage goals and vaccine preventable disease reduction targets by 2025 [Internet]. Ottawa (ON): Government of Canada; 2018 June [cited 2018 Jul 4]. Available from: www.canada.ca/en/public-health/services/immunization-vaccine-priorities/national-immunization-strategy/vaccination-coverage-goals-vaccine-preventable-diseases-reduction-targets-2025.html
- 6 IBM. Panorama: Pan-Canadian Public Health Communicable Disease Surveillance & Management Project [Internet]. Somers (NY): IBM; 2003 [cited 2018 Feb 22]. Available from: www-03.ibm.com/industries/ca/en/healthcare/files/panorama_application_overview_final.pdf
- 7 Government of Saskatchewan. Panorama [Internet]. Regina (SK): Government of Saskatchewan; 2018 [cited 2018 July 13]. Available from: www.ehealthsask.ca/services/panorama
- 8 Government of Saskatchewan. Panorama's Immunizations Module [Internet]. Regina, SK: Government of Saskatchewan; 2018 [cited 2018 July 13]. Available from: www.ehealthsask.ca/services/panorama/Pages/Immunizations.aspx
- 9 Government of Saskatchewan. Panorama's Inventory Module [Internet]. Regina, SK: Government of Saskatchewan; 2018 [cited 2018 July 13]. Available from: www.ehealthsask.ca/services/panorama/Pages/Inventory.aspx
- 10 Government of Canada. First Nations and Inuit Health Branch Targeted immunization strategy (FNIHB-TIS) 2003-2008 [Internet]. Ottawa (ON): Government of Canada; 2007 [cited 2018 July 12]. ISBN: 978-0-662-44780-1.
- 11 Government of Saskatchewan. Saskatchewan Immunization Manual [Internet]. Regina (SK): Government of Saskatchewan; 2012 [cited 2018 June 8]. Available from: www.ehealthsask.ca/services/manuals/Documents/sim-chapter5.pdf
- 12 Government of Saskatchewan. Immunization services: Immunization rates in Saskatchewan [Internet]. Regina (SK): Government of Saskatchewan; 2018 [cited 2018 June 8]. Available from: www.saskatchewan.ca/residents/health/accessing-health-care-services/immunization-services
- 13 Government of Canada. Pertussis (whooping cough) [Internet]. Ottawa (ON): Government of Canada; 2014 [cited 2018 July 12]. Available from: www.canada.ca/en/public-health/services/immunization/vaccine-preventable-diseases/pertussis-whooping-cough/health-professionals.html
- 14 Government of Canada. Causes of measles [Internet]. Ottawa (ON): Government of Canada; 2015 [cited 2018 July 12]. Available from: www.canada.ca/en/public-health/services/diseases/measles/causes-measles.html
- 15 Government of Saskatchewan. Rotavirus vaccine [Internet]. Regina (SK): Government of Saskatchewan; 2018 Apr [cited 2018 July 12]. Available from: publications.gov.sk.ca/documents/13/74617-Rotavirus-April-2018.pdf

- 16 Government of Saskatchewan. Rotavirus vaccine will become available in Saskatchewan. [Internet]. 2012 Aug 22 [cited 2018 July 12]. Available from: www.saskatchewan.ca/government/news-and-media/2012/august/22/rotavirus-vaccine-will-become-available-in-saskatchewan
- 17 Government of Saskatchewan. Human papillomavirus vaccine [Internet]. Regina (SK): Government of Saskatchewan; 2017 Aug [cited 2018 July 12]. Available from: publications.gov.sk.ca/documents/13/76359-HPV-9%20August%202017.pdf
- 18 Apter D, Wheeler CM, Paavonen J, Castellsagué X, Garland SM, Skinner SR, Naud P, Salmerón J, Chow SN, Kitchener HC, Teixeira JC, Jaisamrarn U, Limson G. Efficacy of human papillomavirus 16 and 18 (HPV-16/18) AS04- adjuvanted vaccine against cervical infection and precancer in young women: final event-driven analysis of the randomized, double-blind PATRICIA trial. *Clin Vaccine Immunol*. 2015 Apr;22(4):361-373. [Doi:10.1128/CVI.00591-14](https://doi.org/10.1128/CVI.00591-14).
- 19 World Health Organization Report. Human papillomavirus vaccines: WHO position paper, May 2017—Recommendations [Internet]. *Vaccine*. 2017 Oct 13;35(43):5753-5755. Available from: doi.org/10.1016/j.vaccine.2017.05.069
- 20 Machalek DA, Garland SM, Brotherton JL, Bateson D, McNamee K, Stewart M, Skinner SR, Liu B, Cornall AM, Kaldor JM, Tabrizi SN. Very low prevalence of vaccine human papillomavirus types among 18- to 35-year old Australian women 9 years following implementation of vaccination. *JID* [Internet]. 2018 Feb 8;XX00:1-11. Available from: academic.oup.com/jid/advance-article-abstract/doi/10.1093/infdis/jiy075/4841780
- 21 Haghshenas MR, Mousavi T, Kheradmand M, Afshari M, Moosazadeh M. Efficacy of human papillomavirus L1 protein vaccines (Cervarix and Gardasil) in reducing the risk of cervical intraepithelial neoplasia: a meta-analysis. *Int J Prev Med* [Internet]. 2017;8:(44). Available from: doi.org/10.4103/ijpvm.IJPVM_413_16.
- 22 Lehtinen M, Lagheden C, Luostarinen T, Eriksson T, Apter D, Harjula K, Kuortti M, Natunen K, Palmroth J, Petaja T, Pukkala E et al. Ten-year follow-up of human papillomavirus vaccine efficacy against the most stringent cervical neoplasia end-point—registry-based follow-up of three cohorts from randomized trials. *BMJ Open* [Internet]. 2017;7:e015867. Available from: www.ncbi.nlm.nih.gov/pmc/articles/PMC5629648/
- 23 Government of Saskatchewan. Saskatchewan Immunization Manual [Internet]. Regina, SK: Government of Saskatchewan; 2018 Jan [cited 2018 July 12]. Available from: www.ehealthsask.ca/services/manuals/Documents/sim-chapter1.pdf
- 24 Brady M. Reemergence of 5 vaccine-preventable diseases. *Medscape* [Internet]. 2015 May [cited 2018 Feb 27]. Available from: reference.medscape.com/features/slideshow/vaccine-preventable-diseases#page=2
- 25 Government of Canada. Vaccine preventable disease: Surveillance report to December 2015 [Internet]. Ottawa (ON): Government of Canada; 2017 Nov [cited 2018 July 12]. ISBN: 2561-312X. Available from: www.canada.ca/en/public-health/services/publications/healthy-living/vaccine-preventable-disease-surveillance-report-december-31-2015.html#a31
- 26 Government of Canada. Immunization coverage registries [Internet]. Ottawa (ON): Government of Canada; 2018 [cited 2018 July 12]. Available from: www.canada.ca/en/public-health/services/immunization-coverage-registries.html



Chapter 4: Communicable Diseases

The emergence and re-emergence of communicable diseases are associated with the evolution of pathogens and changes in the way human populations interact with the environment and each other. (1) It is now known that inequities in societal resources as a result of the social determinants of health factors affect disease morbidity and mortality. (2,3)

In Canada, many communicable diseases such as HIV/AIDS, other sexually transmitted and blood-borne infections (STBBIs), tuberculosis (TB), and related co-infections affect Indigenous peoples to a greater extent. (4) Although Indigenous peoples in Canada account for 4.9% of Canada's total population (5), they experience disproportionate incidence and negative health impacts of communicable diseases.

Closing the gap in health status between Indigenous and non-Indigenous Canadians is a priority of Indigenous Services Canada, Saskatchewan Region (ISC, SK). To protect the Saskatchewan First Nations population from the negative health consequences of communicable diseases, ISC, SK Region works collaboratively with the province of Saskatchewan, other levels of government and non-governmental

organizations to prevent, control, report on, and investigate communicable diseases in Saskatchewan.

In this Communicable Diseases chapter, the reported rates of STBBIs, TB and other notifiable diseases (including food and waterborne diseases; vaccine-preventable diseases; and diseases transmitted by respiratory routes) are examined for Saskatchewan First Nations communities from 2007 to 2016. These rates are provided for the NITHA and Indigenous Services Canada, Saskatchewan Region jurisdictions and compared to rates for the overall Saskatchewan and Canadian populations. The data used in this chapter for STBBIs and other notifiable diseases were obtained from the Saskatchewan integrated Public Health Information System (iPHIS), while data for the reporting of TB rates were obtained from the Tuberculosis Prevention and Control Saskatchewan (TBPC-SK) Tuberculosis Information System (TBIS) (refer to Appendix). Certain projects and initiatives are also highlighted to show community-driven approaches for the prevention and control of communicable diseases in Saskatchewan First Nations communities.

SEXUALLY TRANSMITTED AND BLOOD-BORNE INFECTIONS

In Canada, the incidence of STBBIs, such as gonorrhea, chlamydia, and infectious syphilis have been increasing since the late 1990s. (6) The Canadian Public Health Association (CPHA) states that public health efforts to control the transmission of communicable diseases are often complicated by the stigma and discrimination individuals face when attempting to access health and social services. (7)

SEXUALLY TRANSMITTED INFECTIONS

CHLAMYDIA, GONORRHEA, and INFECTIOUS SYPHILIS

Chlamydia, gonorrhea, and syphilis are sexually transmitted infections (STIs) that can be passed on from person to person through sexual contact. (8) The Public Health Agency of Canada reported that, in general, both males and females between the ages of 20 to 24 years of age had the highest reported rates of gonorrhea and chlamydia in Canada in 2014. (9) Syphilis, which was one of the least reported STIs, has seen resurgence in numbers of infectious syphilis cases reported between 2005 and 2014. (9) Males aged 25 to 29 years had the highest rates of infectious syphilis, while rates were highest among females aged 20 to 24 years. (9)

In 2016, 51.2% of the population living in Saskatchewan First Nations communities was under 25 years of age, a slight decrease from 2012, at 54.5% (refer to Demographics Chapter). This is in comparison to the overall Saskatchewan population, where those under 25 years of age in 2016 represented approximately 32% of the population. (10) As the age groups most affected by sexually transmitted infections are under 29 years of age, age-standardized rates are needed to properly compare sexually transmitted infections among the various population groups in Saskatchewan. However, due to the lack of available and accessible provincial data, age-standardized rates cannot be calculated, and thus crude rates are reported in this chapter.

CHLAMYDIA, 2007-2016

Chlamydia, the most commonly diagnosed and reported STI in Canada, can be transmitted through all forms of sexual contact (oral, genital, anal) with an infected individual or through vertical transmission from infected mothers to their newborns. (11) The majority of individuals with chlamydia have no symptoms, which creates challenges for early detection and diagnosis. Untreated, chlamydia can potentially be infectious for years and can lead to pelvic inflammatory disorder in females. (10) Chlamydia infection also increases the risk of HIV transmission and the severity of the infection. (11) Co-infection of chlamydia with gonorrhea is common. (12)

Rates of chlamydia in Saskatchewan First Nations communities increased from 1616.0 cases per 100,000 population in 2007 to peak at 2064.9 cases per 100,000 population in 2012 before decreasing to 1770.8 cases per 100,000 population in 2016. (Figure 4.1)

HIGHLIGHTS

- From 2007 to 2016, rates of chlamydia, gonorrhea, human immunodeficiency virus (HIV), hepatitis C (HCV), and tuberculosis (TB) continue to be substantially higher in Saskatchewan First Nations communities than in the overall Saskatchewan and Canadian populations. Although rates of infectious syphilis were low when compared to other communicable diseases, there appears to be an increase in rates of infectious syphilis in Saskatchewan First Nations communities.
- The *Know Your Status* (KYS) program, a community-driven approach for the prevention and treatment of sexually transmitted and blood-borne infections (STBBIs) in Saskatchewan First Nations communities, has led to decreased rates of HIV and HCV in communities that have implemented KYS programs.
- The increased use of technology in Saskatchewan First Nations communities has contributed to improved access to health care and to TB case management.

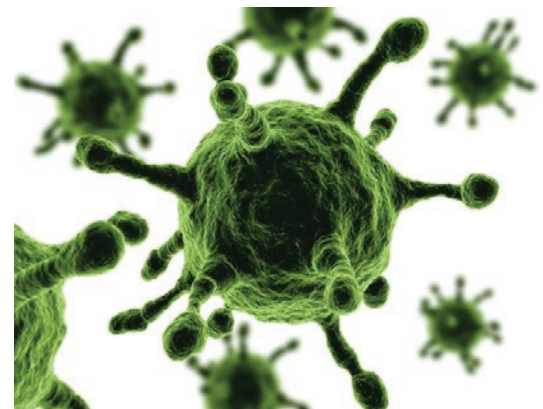
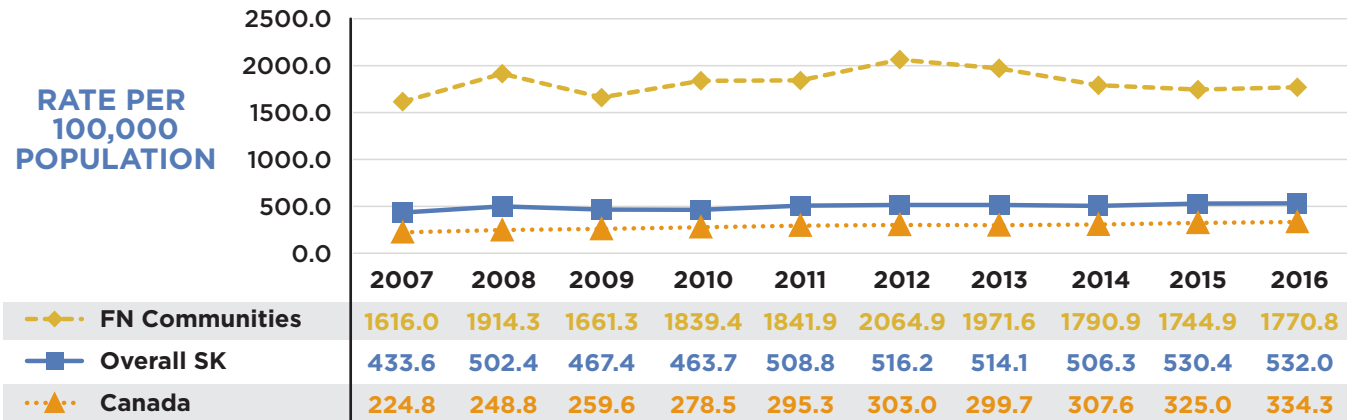
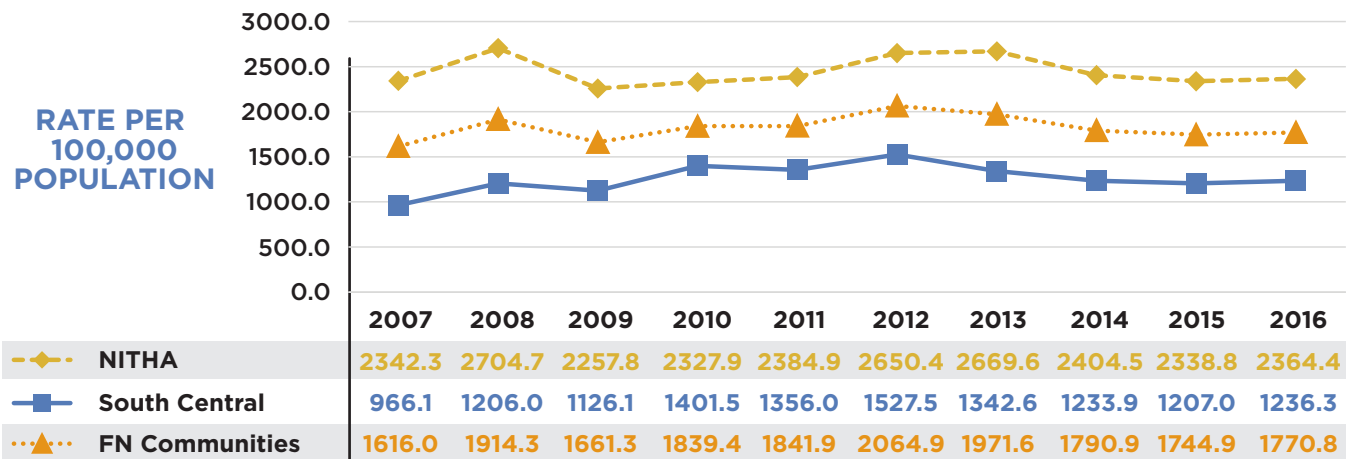


Figure 4.1: Chlamydia rates for Saskatchewan First Nations communities, overall Saskatchewan population and Canada, 2007-2016



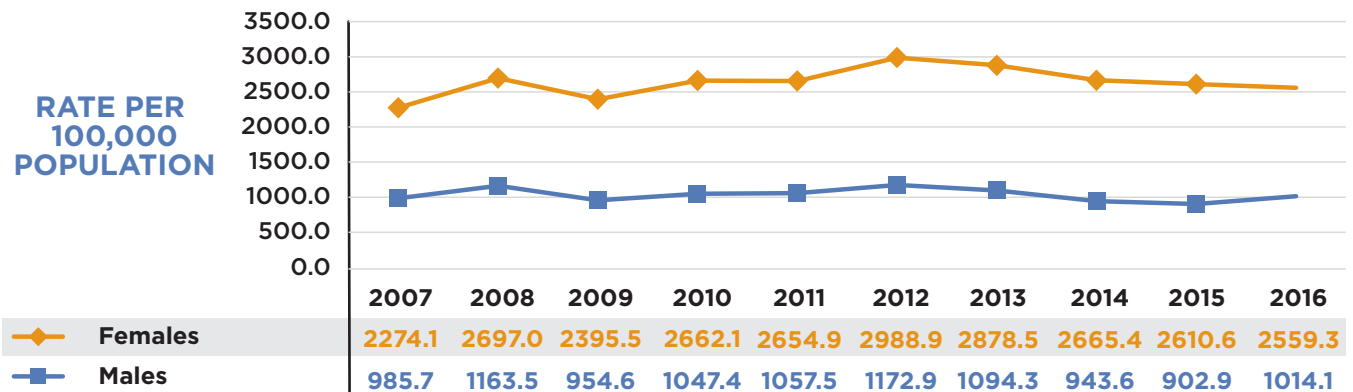
Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016), PHAC Canadian Notifiable Diseases On-line

Figure 4.2: Chlamydia rates by jurisdiction, Saskatchewan First Nations communities, 2007-2016



Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

Figure 4.3: Chlamydia rates by gender, Saskatchewan First Nations communities, 2007-2016



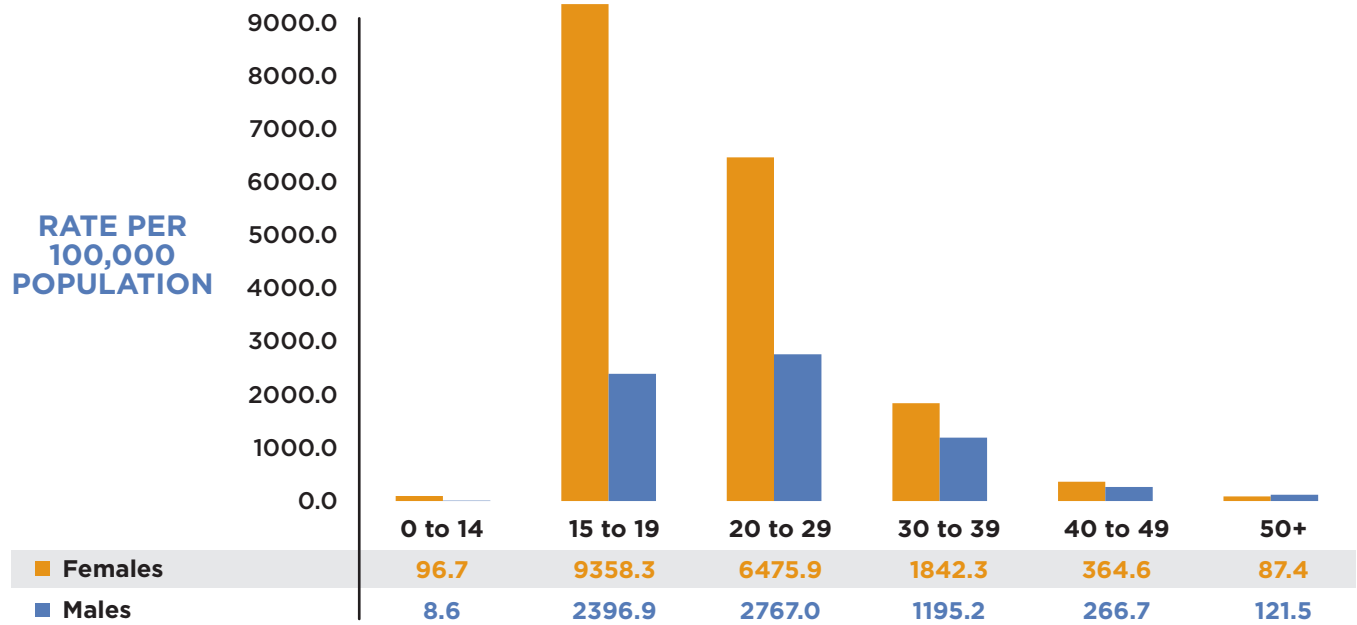
Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

The rise in rates of chlamydia among Saskatchewan First Nations communities in 2012 may in part be attributed to awareness and availability of testing, effective screening and contact tracing activities. When compared to the overall Saskatchewan and Canada rates in 2016, rates of chlamydia in First Nations communities were over three and five times higher, respectively. However, reported rates for the overall Saskatchewan and Canadian populations have increased since 2007, unlike rates in Saskatchewan First Nations communities, which have been decreasing since 2012.

In NITHA communities rates of chlamydia were on average about twice the rates reported for south and central Saskatchewan First Nations communities (South Central) (Figure 4.2). Rates of chlamydia in NITHA communities ranged from 2342.3 cases per 100,000 population in 2007 to 2364.4 cases per 100,000 population in 2016, while rates of chlamydia in South Central increased from 966.1 cases per 100,000 population in 2007 to 1236.3 cases per 100,000 population in 2016.



Figure 4.4: Chlamydia rates by age group and gender, Saskatchewan First Nations communities, 2016

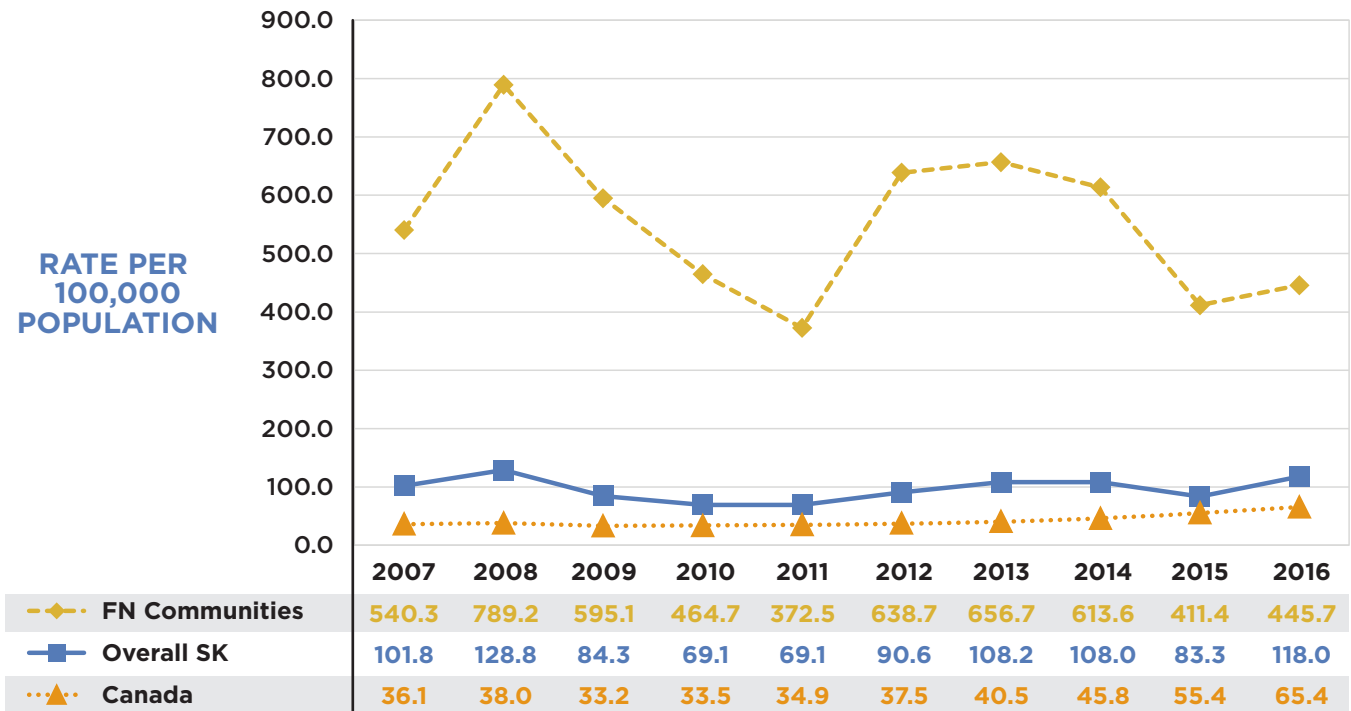


Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

Females in Saskatchewan First Nations communities were more likely to test positive for chlamydia. In general, rates of chlamydia among females were over two times higher than rates in males (Figure 4.3). Rates of chlamydia among females increased by 12.5%, from 2274.1 cases per 100,000 population in 2007 to 2559.3 cases per 100,000 population in 2016, while rates among males increased by 3%, from 985.7 cases per 100,000 population to 1014.1 cases per 100,000 population in 2016.

As shown in Figure 4.4, rates of chlamydia varied by age and gender. Higher rates of the chlamydia were observed among females in the younger age categories. The biggest difference in rates of chlamydia between females and males were among the 0 to 14 years age group. Rates of chlamydia among females in this age group were over 11 times higher than rates among males. Several studies have shown a higher prevalence of chlamydia among the under 25 years of age groups. (9,11,13,14) There was a less pronounced difference in rates of infection among the 40 to 49 age group. However, rates of chlamydia were reversed among the 50 years and older age group, with higher rates observed among males than females.

Figure 4.5: Gonorrhoea rates for Saskatchewan First Nations communities, overall Saskatchewan population and Canada, 2007-2016



Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007- 2016), PHAC Canadian Notifiable Diseases On-line

GONORRHEA, 2007-2016

Gonorrhoea is a sexually transmitted bacterial infection that can cause infertility. Gonorrhoea, if left untreated, can cause chronic pelvic pain and ectopic pregnancy in women. (15) In men, untreated gonorrhoea can result in epididymitis, an inflammation that causes pain and swelling in the testicles. (16) Gonorrhoea infection also increases a person’s risk of getting and transmitting HIV. (17)

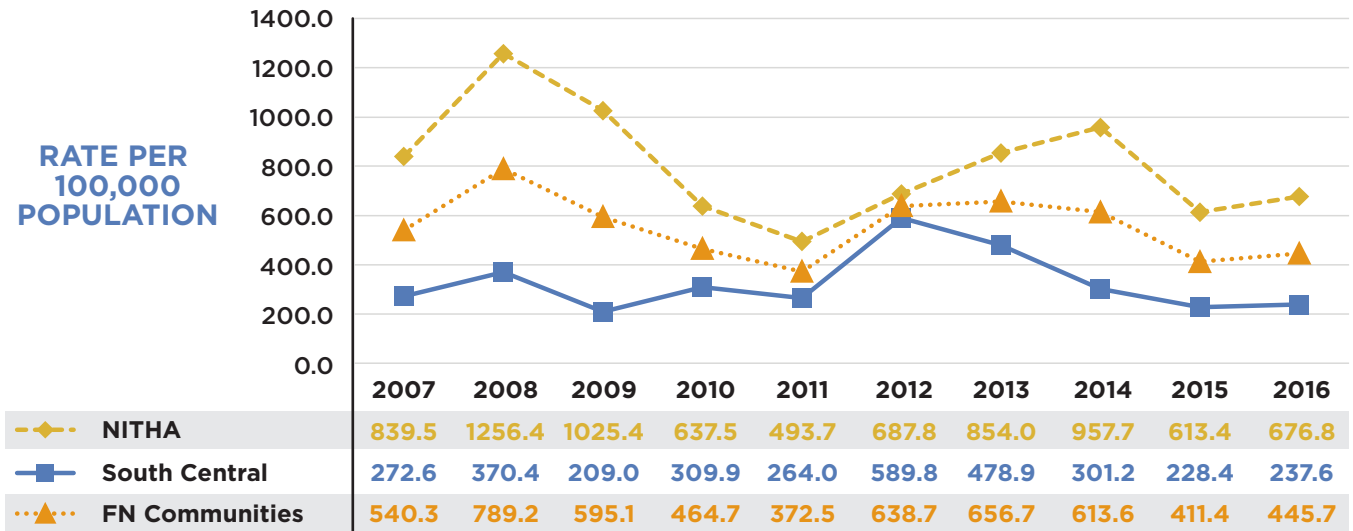
In Canada, gonorrhoea rates rose by over 65% between 2010 and 2015. (15) These recent increase in infections are associated with improvements in screening and laboratory testing/detection, growing resistance of the bacteria to antibiotics, and improper and inconsistent use of safer sex methods. (15,17)

The emergence of drug resistant strains of gonorrhoea in Canada has made the control and treatment of gonorrhoea more complex and challenging for health care professionals. (18)

Rates of gonorrhoea in Saskatchewan First Nations communities were considerably higher than rates among the overall Saskatchewan and Canadian populations (Figure 4.5). Rates of gonorrhoea in Saskatchewan First Nations communities peaked in 2008, 2012 and 2013. These increases in rates were likely due to increased screening and contract tracing activities. In 2016, the rate of gonorrhoea in Saskatchewan First Nations communities was 445.7 cases per 100,000 population; a 17.5% decrease from the 2007 rate of 540.3 cases per 100,000 population.

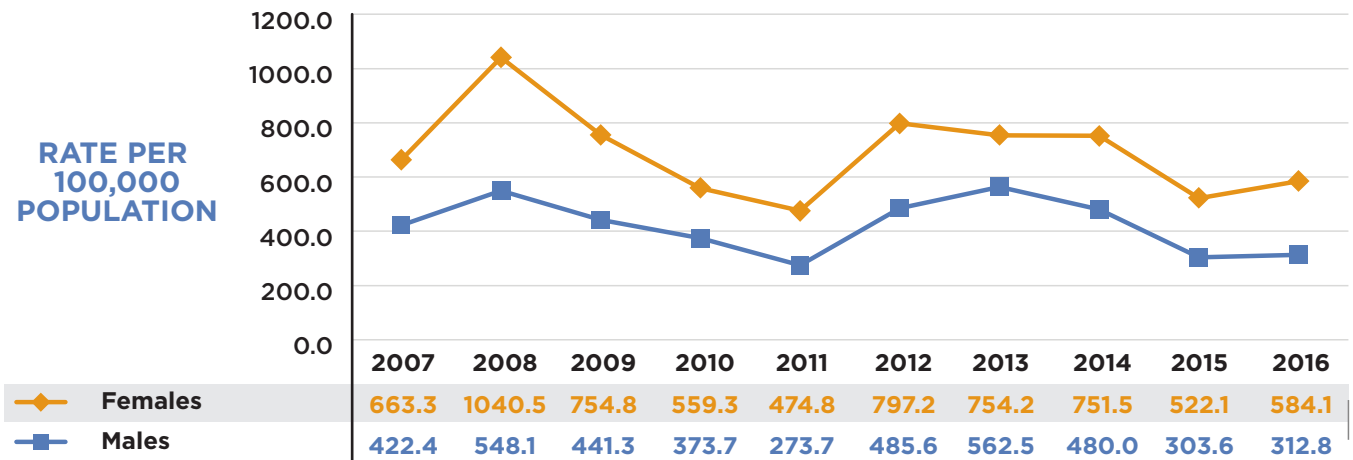
From 2007 to 2016, NITHA communities had higher rates of gonorrhoea than South Central (Figure 4.6). However, rates of gonorrhoea in NITHA communities decreased by 19% from 839.5 cases per 100,000 population in 2007 to 676.8 cases per 100,000 population in 2016, with a peak rate of 1256.4 per 100,000 population in 2008. This spike in gonorrhoea rate in NITHA communities likely contributed to increased rates shown in Figure 4.5 (and this graph) for Saskatchewan First Nations communities. Similar peaks in rates of gonorrhoea were observed in South Central. South Central communities experienced a 13% decrease in rates of gonorrhoea from 2007 to 2016, with a peak rate of 589.8 per 100,000 population in 2012.

Figure 4.6: Gonorrhoea rates by jurisdiction, Saskatchewan First Nations communities, 2007-2016



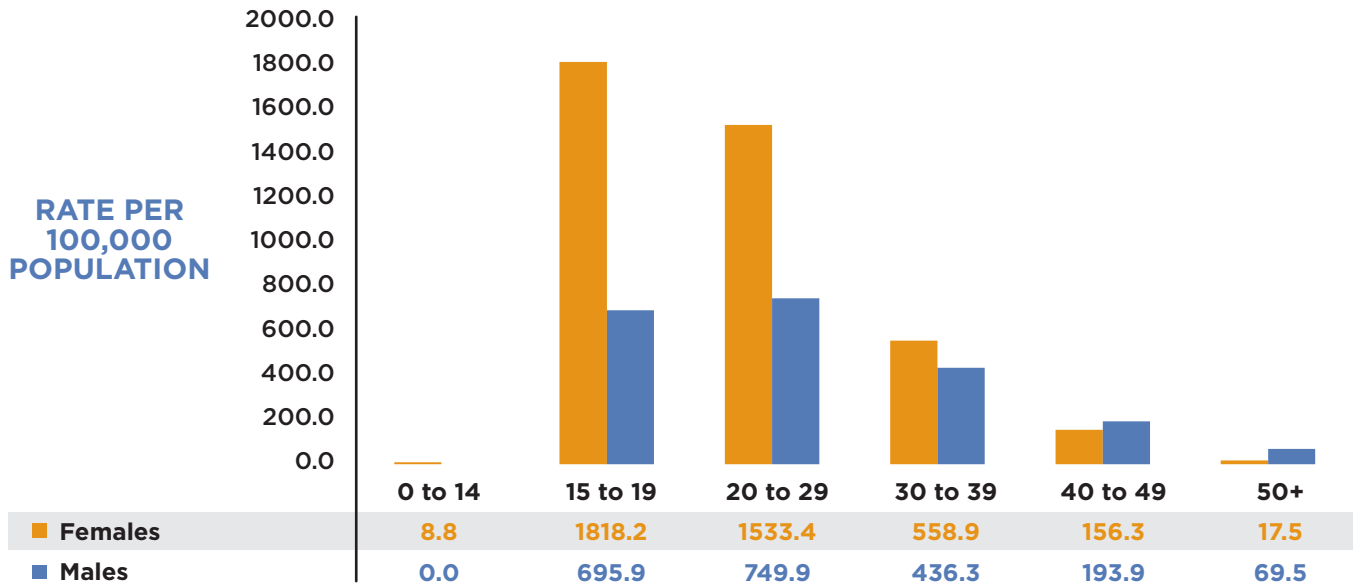
Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

Figure 4.7: Gonorrhoea rates by gender, Saskatchewan First Nations communities, 2007-2016



Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

Figure 4.8: Gonorrhoea rates by age group and gender, Saskatchewan First Nations communities, 2016



Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

Figure 4.7 shows that rates of gonorrhoea among females in Saskatchewan First Nations communities were higher than rates in males. This is unlike the pattern observed in Canada where males were found to have consistently higher rates of gonorrhoea than females, which may be due to the disproportionately higher rates observed among men who have sex with men (MSM) population. (9,16) The rates of gonorrhoea among females and males in Saskatchewan First Nations communities decreased from 2007 to 2016 by 12% and 26%, respectively. This decrease in rates may likely be due to better access to testing, including prenatal testing. In 2016, females in Saskatchewan First Nations communities were about two times more likely than males to test positive for gonorrhoea.

Like chlamydia, higher rates of gonorrhoea were reported among the younger age categories, with the highest difference in rates being reported for the 50 years and older age group (Figure 4.8). Males in the 50 years and older age group were four times more likely than females to be infected with gonorrhoea. The difference in rates of gonorrhoea infection was less pronounced among the 30 to 49 age groups.

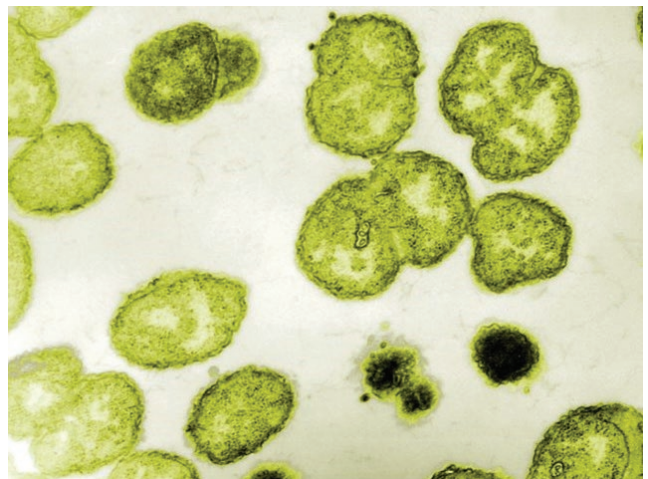
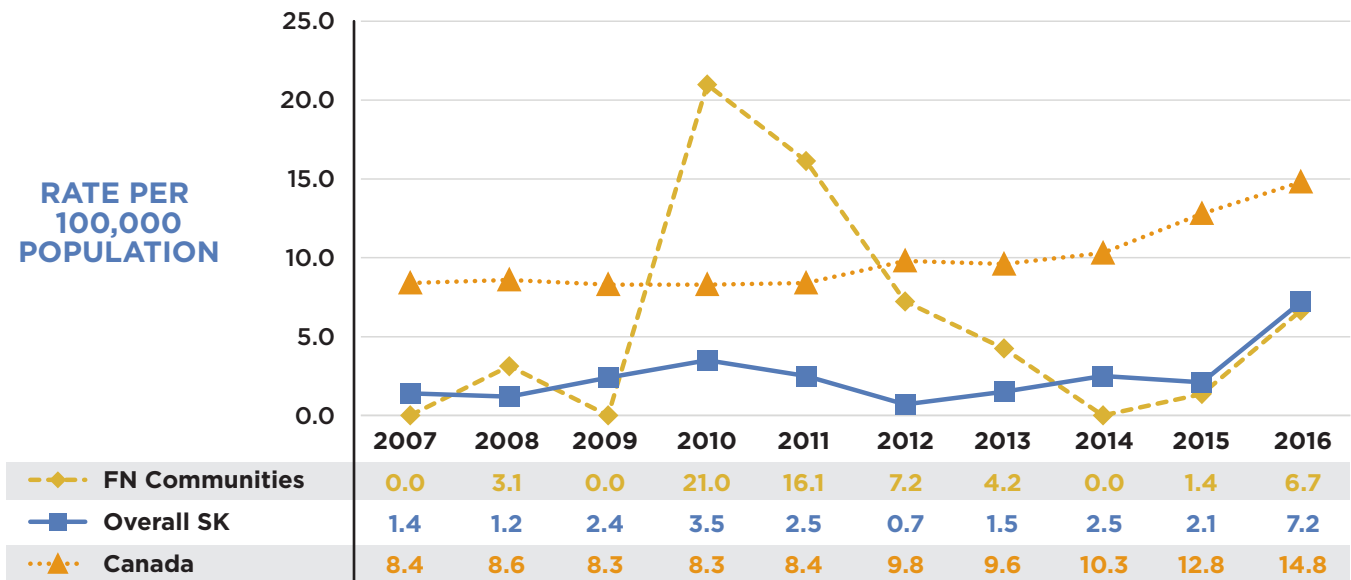


Figure 4.9: Infectious syphilis rates for Saskatchewan First Nations communities, overall Saskatchewan population and Canada, 2007-2016



Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

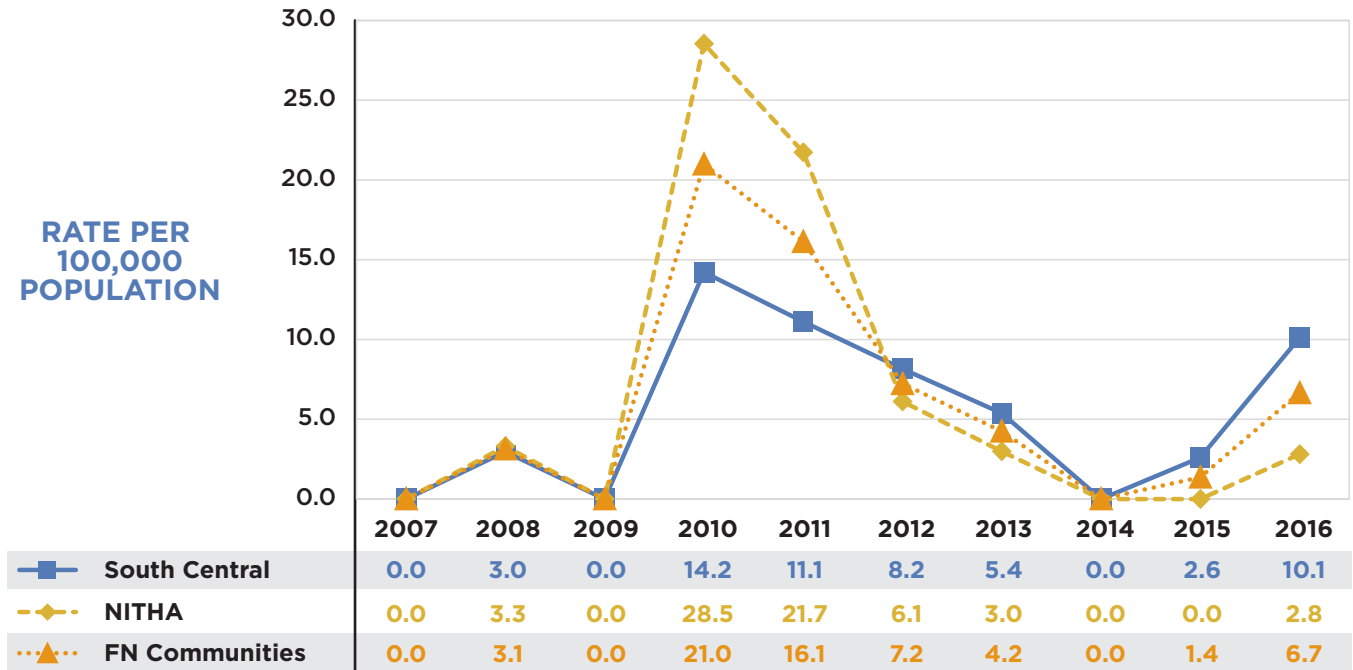
INFECTIOUS SYPHILIS, 2007-2016

Syphilis is a bacterial infection transmitted through oral, genital, or anal sex with an infectious person. (19) The bacteria can also be passed on by a pregnant woman to her unborn child. A less common mode of transmission is from sharing of needles or through contact with broken skin. (14) There are four stages of syphilis infection: primary, secondary, early latent, and late latent. (20) The tertiary stage of infection is when syphilis can do the most damage to the body and even cause death, if left untreated. (18) Syphilis transmission occurs during the primary, secondary, and early latent stages of infection. Symptoms of syphilis infection vary and can often be confused with those of other health conditions. However, not everyone infected with syphilis develops symptoms. In keeping with the Canadian Guidelines on Sexually Transmitted Infections, only infectious syphilis (primary, secondary and early latent syphilis) is reportable by all provinces and territories, and is notifiable to the Public Health Agency of Canada. (21)

A person that has syphilis is at an increased risk of contracting and spreading HIV. Syphilis and HIV co-infected individuals are more difficult to treat as HIV weakens the immune system. (19)

Rates of infectious syphilis in Saskatchewan First Nations communities were the lowest of all the STIs reported (Figure 4.9). Rates of infectious syphilis in Saskatchewan First Nations communities increased from zero cases in 2007 to 6.7 cases per 100,000 population in 2016. However, there was a spike in rates of 21.0 and 16.1 cases per 100,000 population reported in 2010 and 2011, respectively, which coincides with spikes in HIV diagnoses observed in Saskatchewan First Nations communities during the same period. Overall, rates of infectious syphilis were higher in the overall Canadian population. In 2016, infectious syphilis rates in Canada were over two times higher than rates reported for the overall Saskatchewan population and Saskatchewan First Nations communities.

Figure 4.10: Infectious syphilis rates by jurisdiction, Saskatchewan First Nations communities, 2007-2016



Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

As shown in Figure 4.10, rates of infectious syphilis in South Central increased from zero cases in 2007 to 10.1 cases per 100,000 population in 2016, while rates in NITHA communities increased from zero cases in 2007 to 2.8 cases per 100,000 population in 2016. Peaks in infectious syphilis rates was observed in 2010 and 2011 in Saskatchewan First Nations communities, and was more pronounced among NITHA communities, with the highest rate of 28.5 cases per 100,000 population being reported in 2010. Given that the numbers of infectious syphilis cases in Saskatchewan First Nations communities are small; this trend should be interpreted with caution.

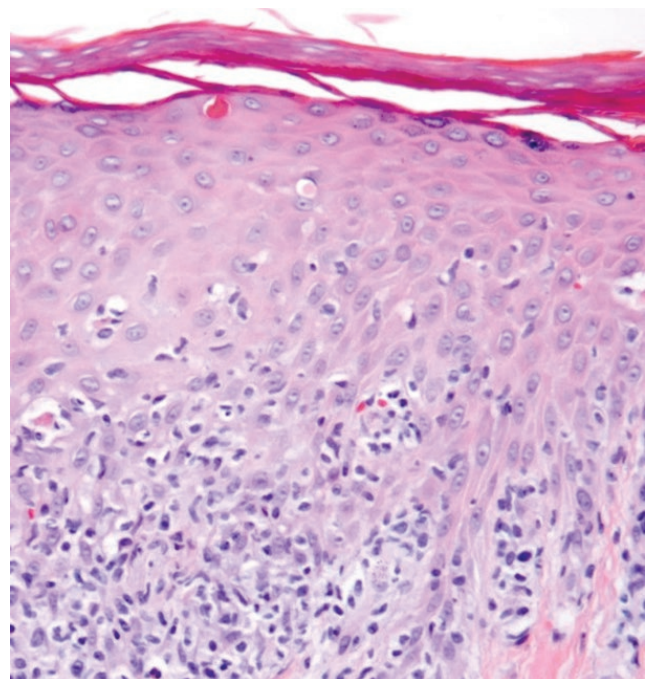
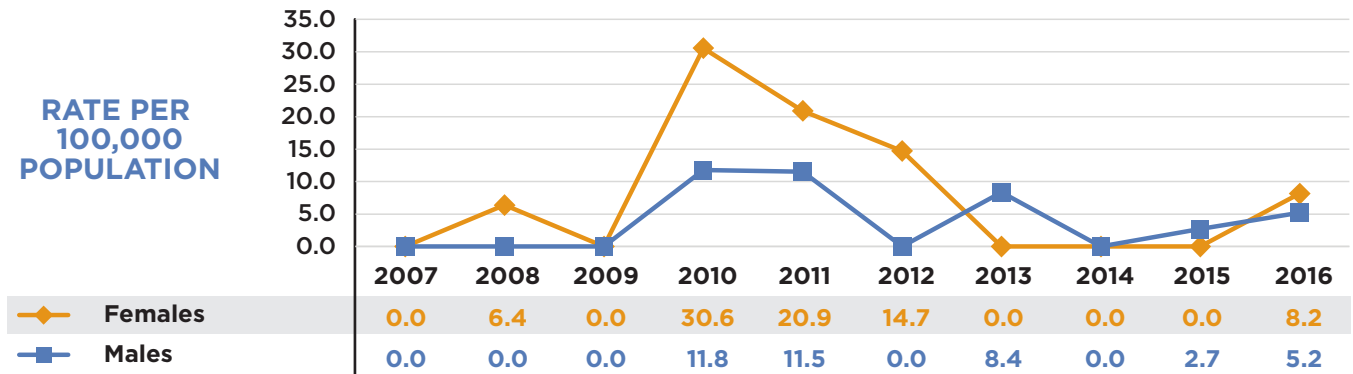
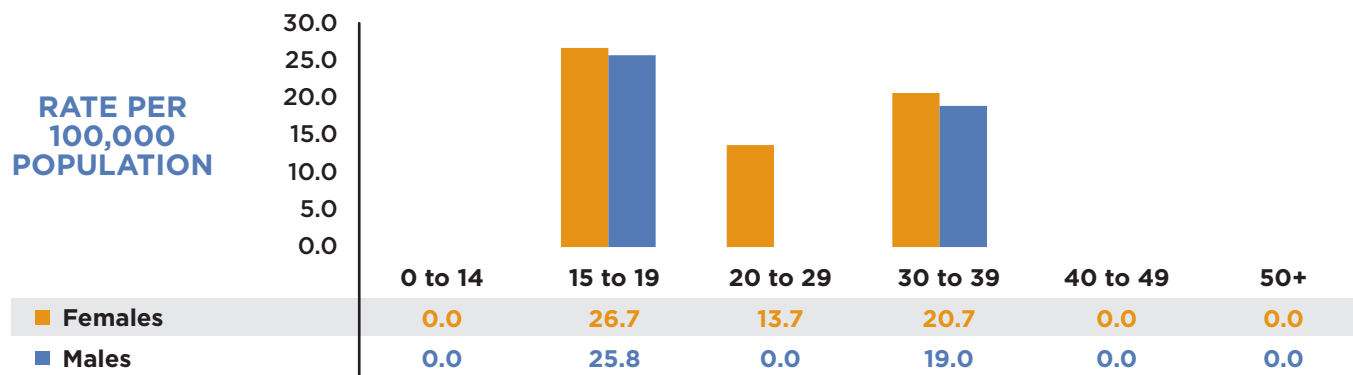


Figure 4.11: Infectious syphilis rates by gender, Saskatchewan First Nations communities, 2007-2016



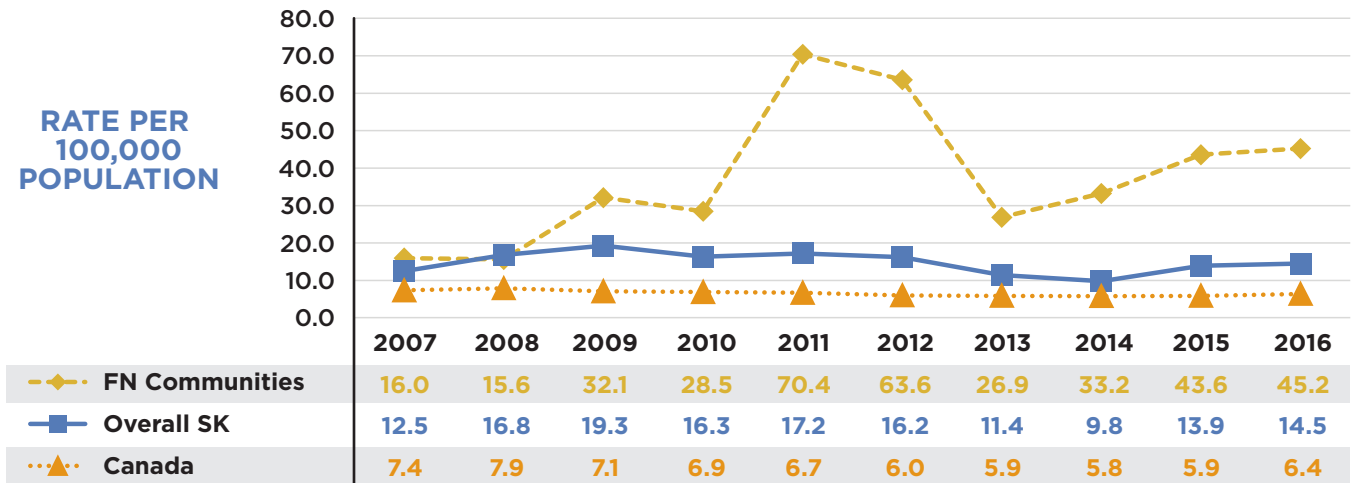
Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

Figure 4.12: Infectious syphilis rates by age group and gender, Saskatchewan First Nations communities, 2016



Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

Figure 4.13: HIV rates for Saskatchewan First Nations communities, overall Saskatchewan population and Canada, 2007- 2016



Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016) and HIV/AIDS reports, PHAC Canadian Notifiable Disease On-line (2007-2016)

From 2007 to 2016, rates of infectious syphilis among females in Saskatchewan First Nations communities were generally higher than rates reported for males (Figure 4.11). This is in contrast to the trend observed in Canada showing a much higher rate among males than females. (22,23) However, given that the numbers of infectious syphilis cases in Saskatchewan First Nations communities are small; this trend should be interpreted with caution.

In 2016, females were 1.6 times more likely than males to test positive for syphilis. These higher rates among females was more pronounced in 2010, where females were over 2.5 times more likely than males to test positive for syphilis.

Figure 4.12 shows no cases of infectious syphilis reported for the 0 to 14 and 40 and over age groups. Overall, females had higher rates of infectious syphilis than males.

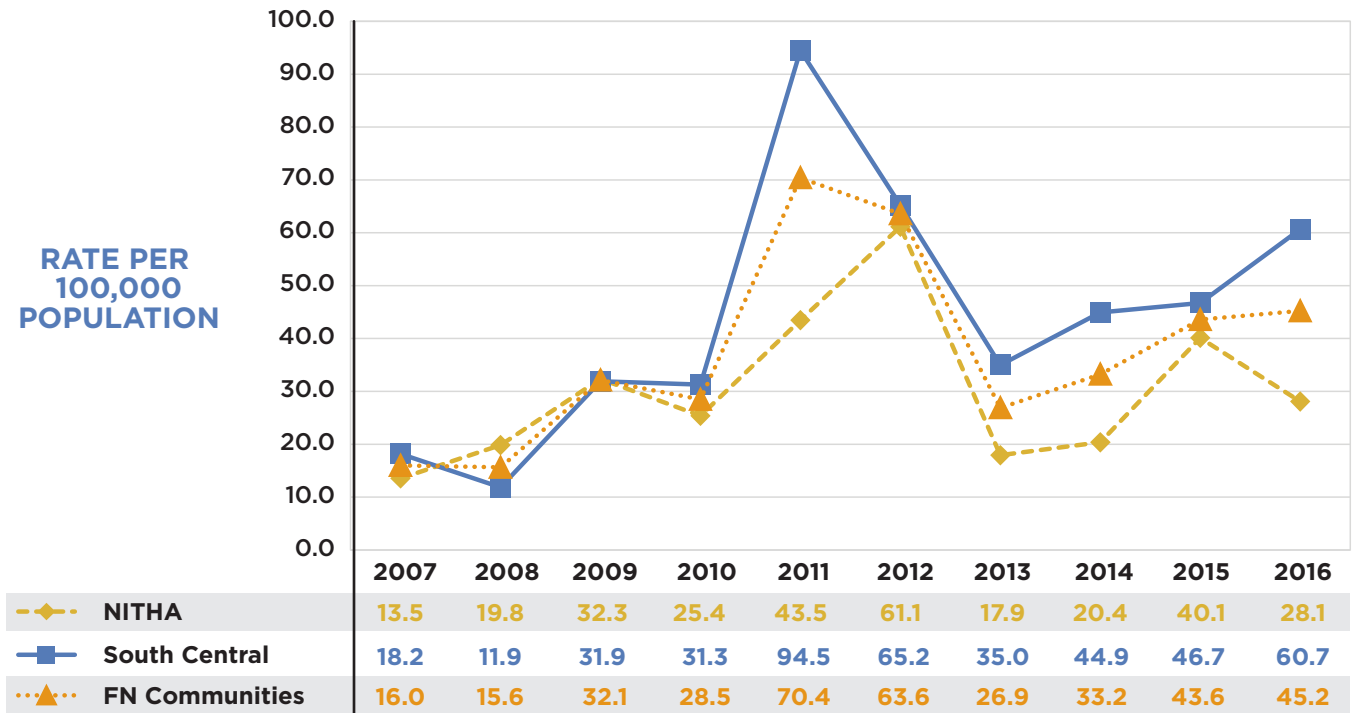
HUMAN IMMUNODEFICIENCY VIRUS AND HEPATITIS C

HUMAN IMMUNODEFICIENCY VIRUS, 2007-2016

Human immunodeficiency virus (HIV) is a sexually transmitted and blood-borne infection that affects the immune system, making it difficult for the body to fight off certain infections. (24) The virus, if left untreated can progress to acquired immunodeficiency syndrome (AIDS). However, as a result of advances in HIV treatment, HIV is now considered a chronic disease and people living with HIV can have similar life expectancy to those not infected with HIV, if they are on antiretroviral treatment. (25)

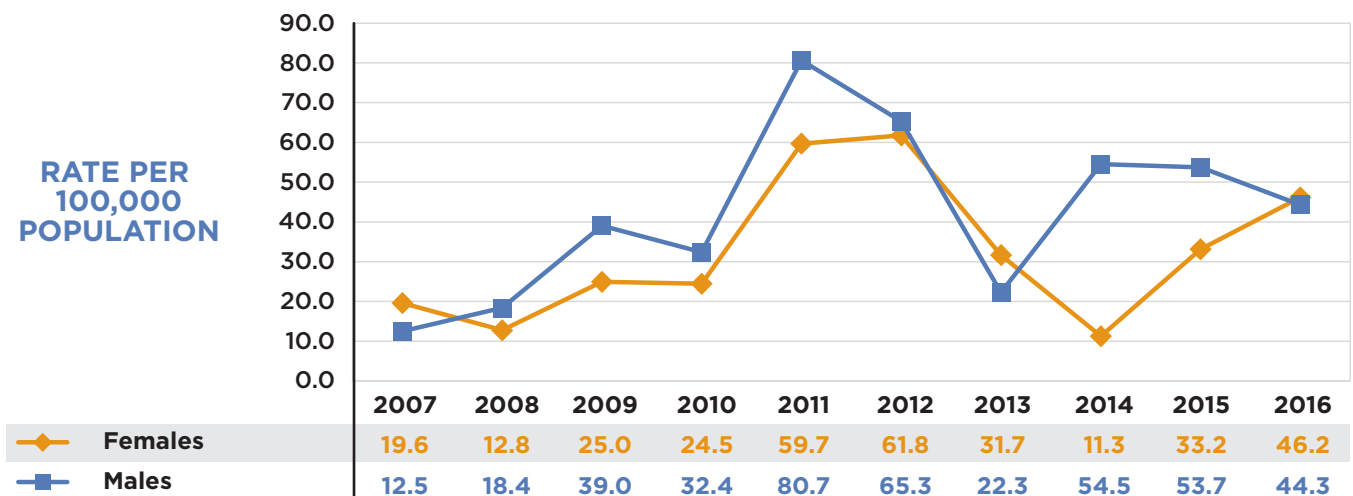
In Canada, HIV/AIDS continues to be a public health concern that is influenced by the social determinants of health, which affects an individual's ability to seek treatment, care and support and also affects risk of contracting diseases. (8) Although Canada's rate of new HIV/AIDS diagnoses are relatively low when compared to rates in other countries, variations in number of cases are seen among different population groups in Canada, with First Nations populations experiencing the largest increase in rates overall between 2015 and 2016. (26)

Figure 4.14: HIV rates by jurisdiction, Saskatchewan First Nations communities, 2007-2016



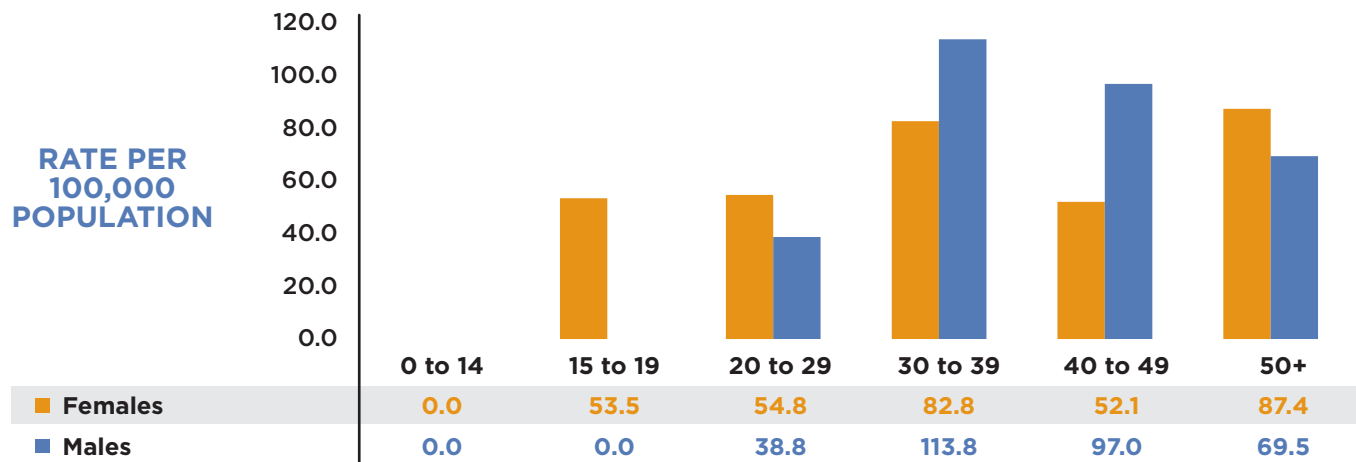
Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016) and HIV/AIDS reports, PHAC Canadian Notifiable Disease On-line (2007-2016)

Figure 4.15: HIV rates by gender, Saskatchewan First Nations communities, 2007-2016



Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

Figure 4.16: HIV rates by age group and gender, Saskatchewan First Nations communities, 2016



Sources: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2016)

A trend analysis of the overall reported HIV rates among Saskatchewan First Nations communities showed, historically, a steady increase in HIV diagnoses rates in Saskatchewan First Nations communities from rates of 16.0 cases per 100,000 population in 2007 to 45.2 cases per 100,000 population in 2016, with a peak diagnoses of 70.4 cases per 100,000 population in 2011 (Figure 4.13). Cases of HIV are often localized in specific areas or hotspots within the province. Increases in rates may be due to more normalized, standardized routine approaches to testing across Saskatchewan. The peak in diagnoses rate in 2011 is attributed in part to a localized outbreak in some Saskatchewan First Nations communities that resulted in increased HIV testing through the Know Your Status program. Additional information on the Know Your Status program is presented at the end of this section.

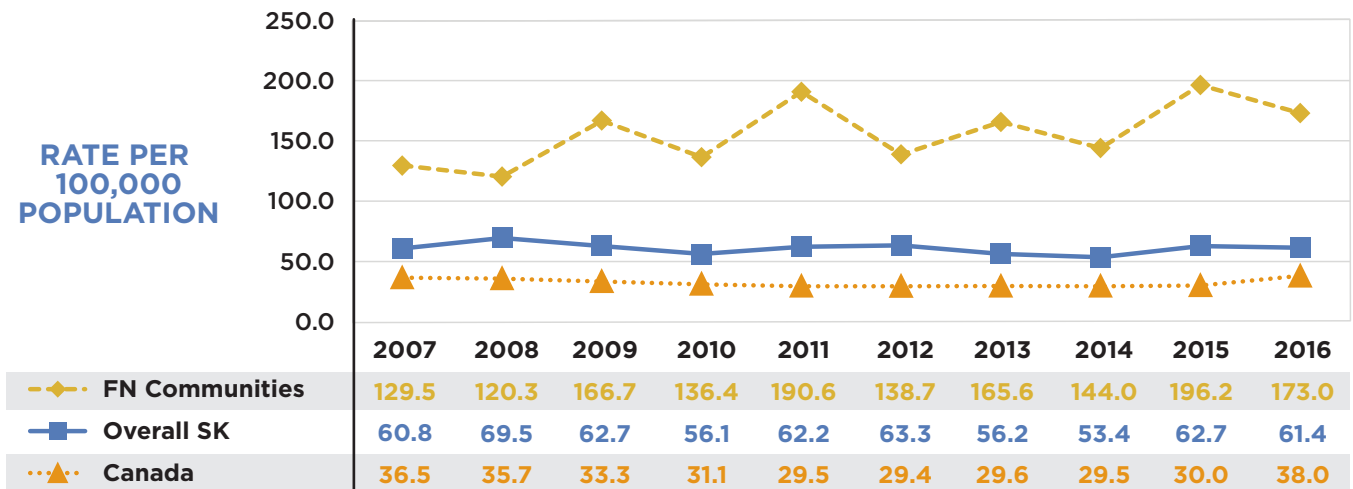
In 2016, the reported rates of HIV in Saskatchewan First Nations communities were over three and seven times higher than rates reported for the overall Saskatchewan and Canadian populations, respectively. The majority of HIV diagnoses in Saskatchewan First Nations communities were attributed to injection drug use. However, the proportion of all HIV diagnoses in Saskatchewan that were attributed to injection drug use decreased from 68% of newly diagnosed HIV cases in 2007 (27) to 60% of newly diagnosed HIV cases in 2016. (28)

Figure 4.14 shows that HIV rates in NITHA communities increased by over 108% from 2007 to 2016. However, South Central experienced a larger increase in rates of over 230% from 2007 to 2016, which in part, was attributed to increased HIV testing and contact tracing in areas experiencing localized HIV outbreaks. In 2016, rates of HIV in South Central were over two times higher than rates in NITHA communities.

On average, males in Saskatchewan First Nations communities were more likely than females to test positive for HIV (Figure 4.15). From 2007 to 2016, the reported incidence of HIV in males and females showed similar increasing trends. In 2016, HIV rates among males and females were comparable.

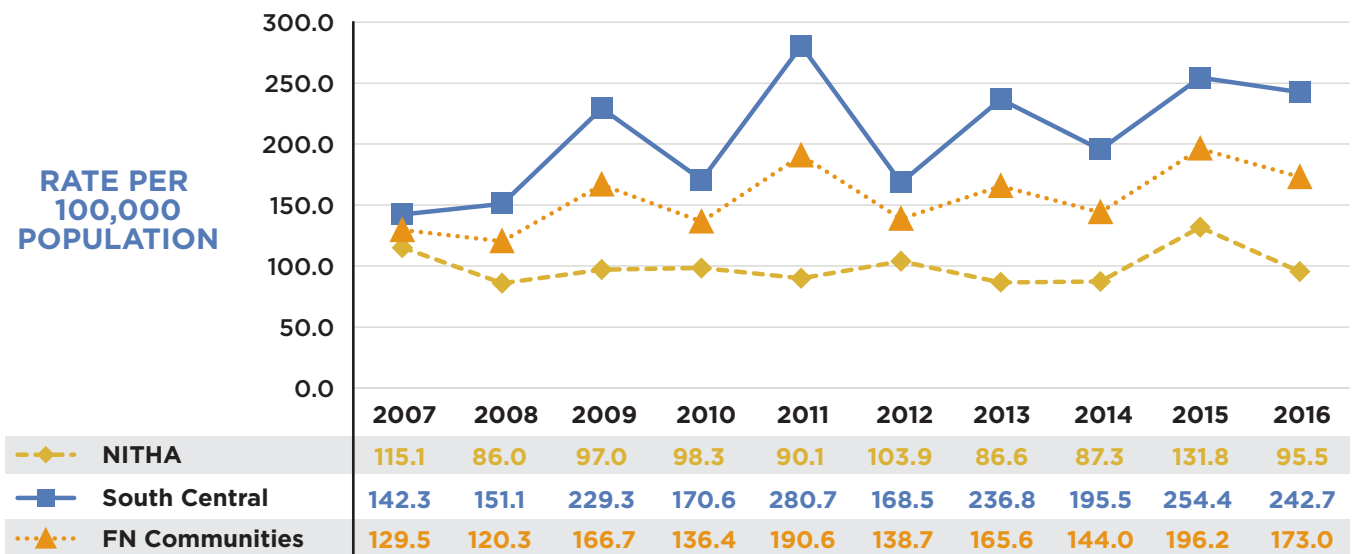
When stratified by age groups, the incidence of HIV in males and females in 2016 differed, with females in the 15 to 29, and 50 years and older age groups experiencing higher rates of diagnoses than males (Figure 4.16). Males aged 30 years and older represented about a 41% proportion of all reported HIV cases in Saskatchewan First Nations communities in 2016.

Figure 4.17: Hepatitis C rates for Saskatchewan First Nations communities, overall Saskatchewan population and Canada, 2007-2016



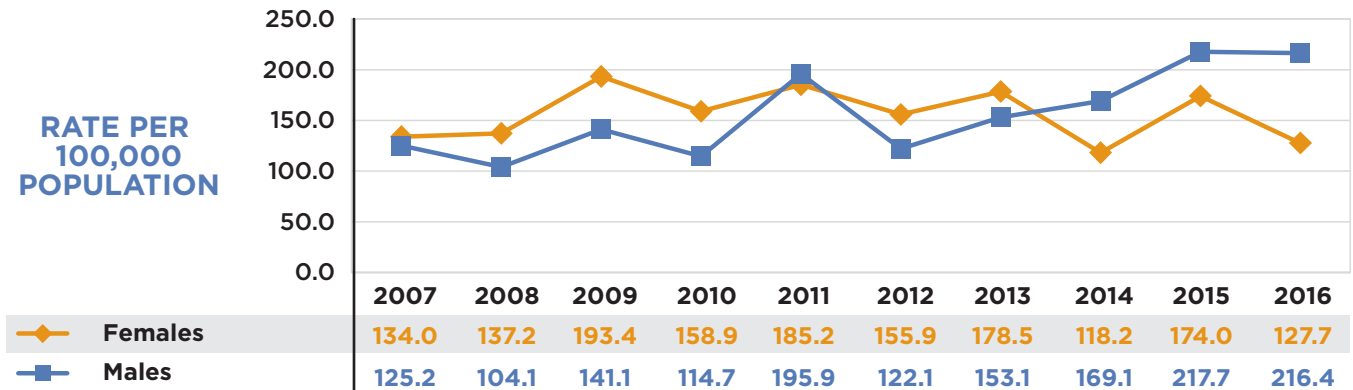
Source: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016), PHAC Canadian Notifiable Disease On-line (2007-2016)

Figure 4.18: Hepatitis C rates by jurisdiction, Saskatchewan First Nations communities, 2007-2016



Source: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

Figure 4.19: Hepatitis C rates by gender, Saskatchewan First Nations communities, 2007-2016



Source: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2007-2016)

KNOW YOUR STATUS PROGRAM

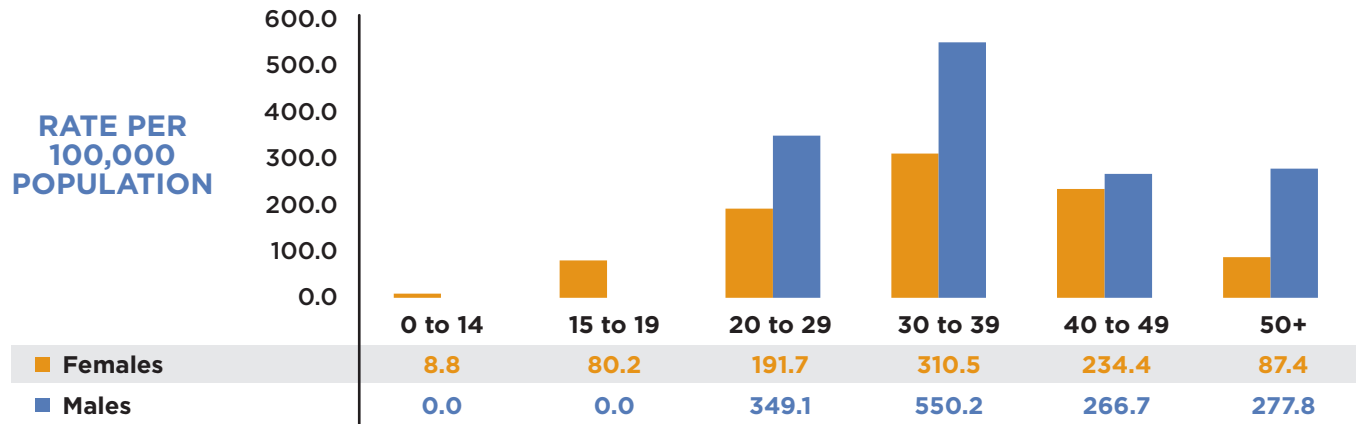
In 2011, Big River First Nation (BRFN) implemented a HIV screening program called *Know Your Status* in response to growing concerns about the lack of access to HIV and STBBI testing and care for Saskatchewan First Nations communities. (29)

The KYS program was developed through the collaborative efforts of Big River Chief and Council, community members, health care staff, administration, and provincial stakeholders in partnership with ISC, SK policy makers. (30). Know Your Status is a community-driven and led approach that is flexible to mobilize services to locations that are best for the client. The KYS model is culturally grounded, multi-disciplinary, and multi-jurisdictional. (31) The core KYS program consists of comprehensive 1) STBBI testing; 2) specialized nursing and outreach services; and 3) harm reduction and prevention services. (31, 32)

Other service components include education, mental health and addiction services, access to primary care, infectious disease specialists and lab services. (31) Individuals diagnosed with HIV are seen by community health nurses, then rapidly linked to the care of an Infectious disease doctor either in-person or through the use of the Internet-based videoconferencing technology, such as Telehealth. (29)

The KYS model has since been adapted and adopted by other First Nations communities. As of April 2018, the KYS program has led to the creation of 30 HIV testing sites in Saskatchewan First Nations communities, 19 harm reduction programs, 13 specialized community health nurses and outreach professionals. There are 15 communities that have access the full KYS program that includes all three core components, while 52 communities have access to the partial program, consisting of one or two components.

Figure 4.20: Hepatitis C rates by age group and gender, Saskatchewan First Nations communities, 2016



Source: ISC, FNIHB, SK and NITHA, SK Ministry of Health iPHIS (2016)

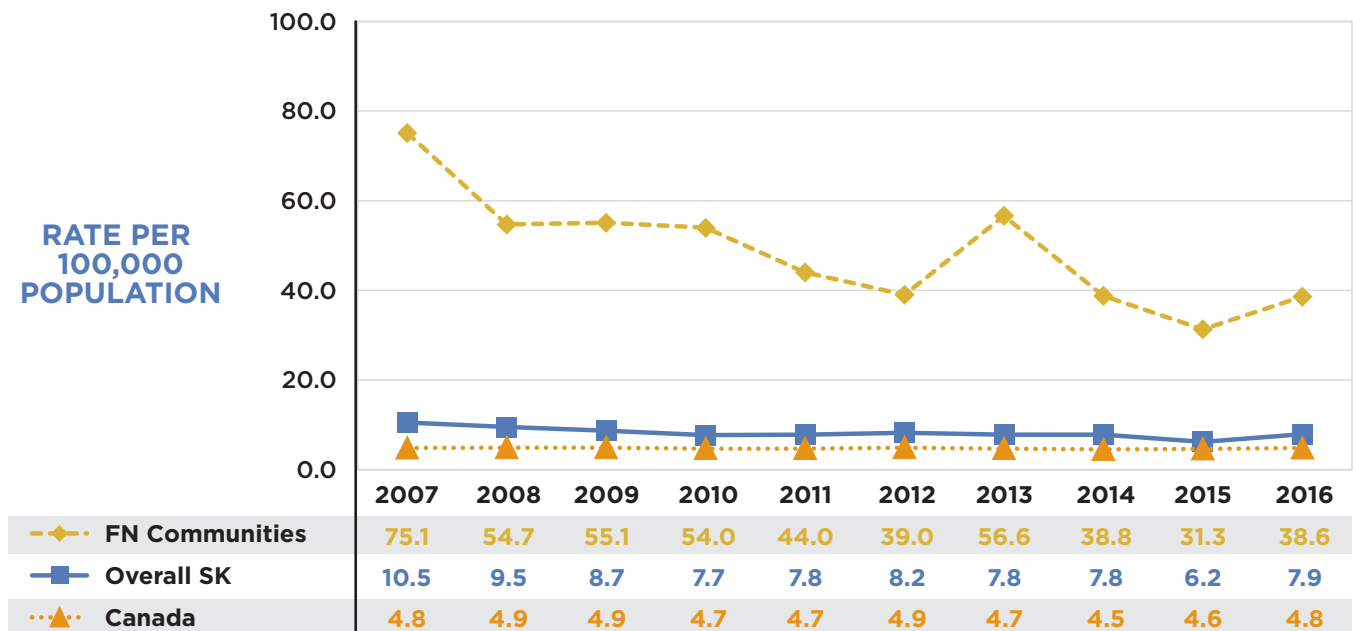
HEPATITIS C VIRUS, 2007-2016

The hepatitis C (HCV) virus is a sexually transmitted and blood-borne infection that can cause liver disease. The virus is transmitted through use of needles and drug equipment, sexual contact, blood transfusion, and any other means that involves contact with infected blood, vaginal, or seminal fluids. (33) Some people that become infected with HCV do not have symptoms and are able to clear the virus from their body, while others who are infected develop chronic liver conditions which can lead to scarring of the liver, liver failure or liver cancer later in life. (34) While there are no vaccines to prevent HCV infection, treatment does exist, and are known to be over 90% effective. (34)

In Saskatchewan First Nations communities, rates of HCV increased by 34% from a rate of 129.5 cases per 100,000 population in 2007 to 173.0 cases per 100,000 population in 2016, with peaks rates in alternating years from 2007 onward (Figure 4.17). The observed fluctuations in rates are likely due to small changes in numbers of cases reported each year in Saskatchewan First Nations communities. There was a marginal increase in rates of HCV for the overall Saskatchewan and Canadian population from 2007 to 2016. In 2016, rates of HCV among Saskatchewan First Nations communities were about three and over four times higher than rates for the overall Saskatchewan and Canada populations, respectively.

Rates of HCV in South Central were on average two times higher than rates in NITHA communities. Rates in South Central increased by 71% from 2007 to 2016, while rates in NITHA communities decreased by 17% from 2007 to 2016 (Figure 4.18). In 2016, the HCV rate in South Central was over two times higher than rates in NITHA communities.

Figure 4.21: Active tuberculosis rates for Saskatchewan First Nations communities, overall Saskatchewan population and Canada, 2007-2016



Source: Tuberculosis Prevention and Control Saskatchewan (TBPC-SK) Tuberculosis Information System (TBIS) (2007-2016), PHAC TB in Canada—Supplementary tables (2016)

There was also a peak rate of 280.7 cases per 100,000 observed for South Central in 2011, which was likely a result of increased HIV and HCV testing connected to the Know Your Status program, but the actual reason for the increase is not known.

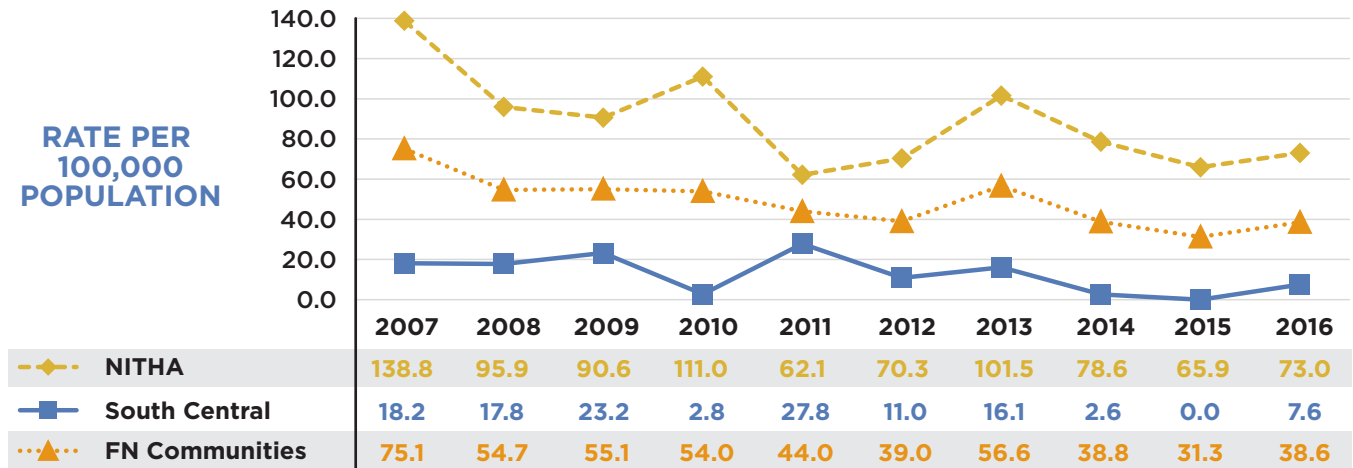
From 2007 to 2016, hepatitis C rates among males increased by 73%, while rates among females decreased by about 5% (Figure 4.19). In 2016, males were almost two times more likely than females to test positive for HCV. The higher numbers of HCV infection among males may be linked to injection drug use. The Ministry of Saskatchewan reported that in 2016, 91% of HIV cases co-infected with HCV, reported injection drug use. (28)

For age group breakdown, males and females in the 30 to 39 age group had the highest reported rates of HCV at 550.2 cases per 100,000 population and 310.5 cases per 100,000 population, respectively (Figure 4.20). But in general, males 20 years and over age groups had higher rates of HCV than females.

TUBERCULOSIS

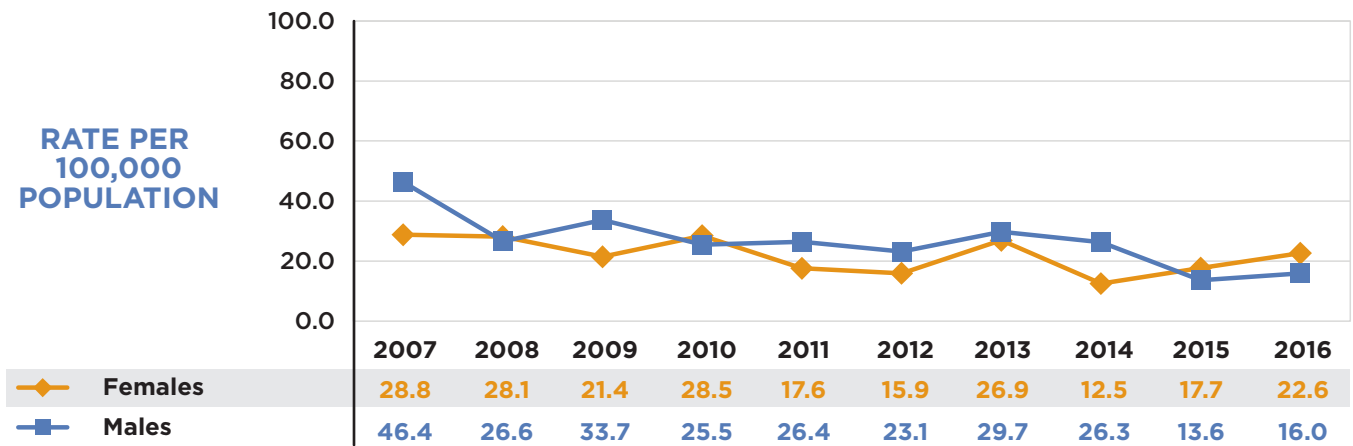
Tuberculosis is an infection caused by the bacterium *mycobacterium tuberculosis*. These bacteria are spread through the air by droplets from an infected person. (35) Most peoples' immune systems are able to kill off the bacteria and rid it from the body. However, for some people the bacteria remain inactive in the body. The inactive form of TB is called latent TB infection (LTBI). This form of TB does not make people feel sick and cannot be spread to others. (36) However, LTBI can become active TB at any time, especially in infants, young children and in individuals with health conditions that weaken their immune system, such as cancer, HIV/AIDS, and other immunosuppressive conditions. (26,35) A person with TB can be cured by taking the full course of recommended medications.

Figure 4.22: Active tuberculosis rates by jurisdiction, Saskatchewan First Nations communities, 2007-2016



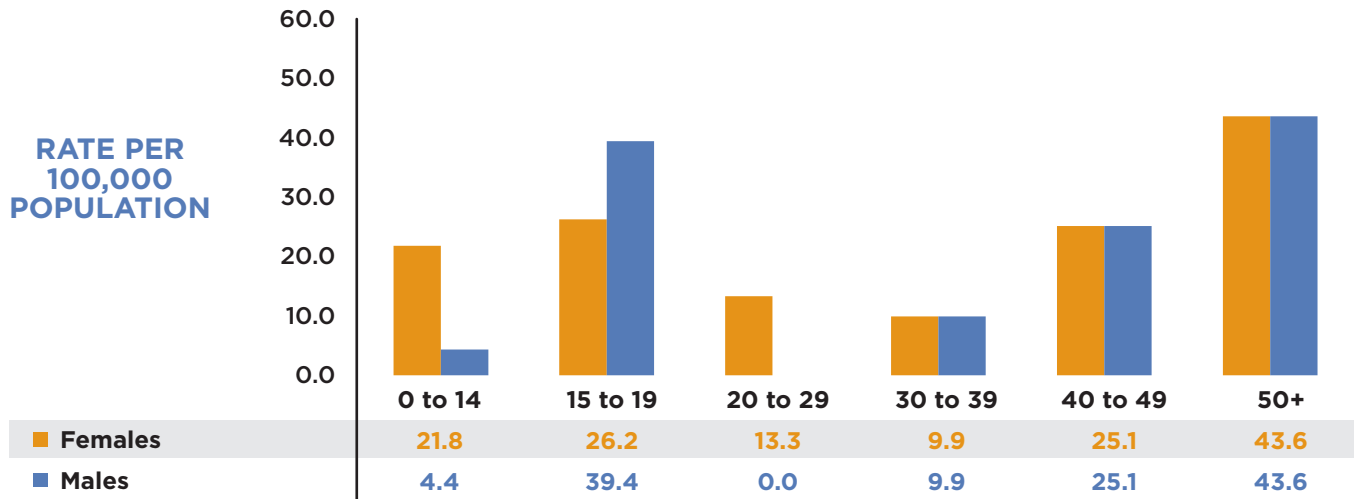
Source: TBPC-SK, TBIS (2007-2016)

Figure 4.23: Active tuberculosis rates by gender, Saskatchewan First Nations communities, 2007-2016



Source: TBPC-SK, TBIS (2007-2016)

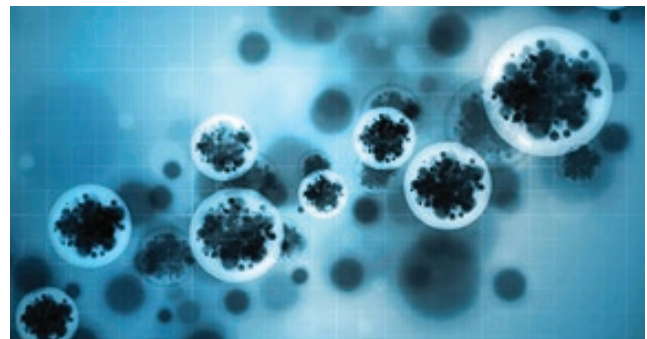
Figure 4.24: Active tuberculosis rates by age group and gender, Saskatchewan First Nations communities, 2016



Source: TBPC-SK, TBIS (2007-2016)

The active TB rates in Saskatchewan First Nations communities were very high when compared to rates for the overall Saskatchewan and Canadian populations. However, a declining trend in active TB rates was observed in Saskatchewan First Nations communities from 2007 to 2016, with a 49% decline in rates of reported TB disease (Figure 4.21). The overall Saskatchewan population also experienced a 25% decline in rates of disease, while rates in Canada remained relatively constant. In 2016, active TB rates in Saskatchewan First Nations communities were about five times and eight times higher than for the overall Saskatchewan and Canadian population, respectively.

In comparison to South Central, active TB rates in NITHA communities were considerably higher. From 2007 to 2016, the rate of active TB in NITHA communities declined by 47%, while rates for South Central declined by 58% (Figure 4.22). However, the rate of active TB in NITHA communities in 2016 was almost 10 times higher than the rate of disease in South Central. These high rates of active TB in NITHA communities were likely due to a number of TB outbreaks that occurred in the area.



The active TB rates among females in 2016 were over 1.4 times higher than rates in males (Figure 4.23). These differences in rates between females and males were comparable to that of 2015. Prior to 2015, males were generally more likely than females to test positive for active TB.

Figure 4.24 shows that in 2016, the infection rates between males and females varied by age groups. There were more males than females in the 15 to 19 age group that tested positive for active TB, while more females than males in the 0 to 14 and 20 to 29 age groups tested positive for active TB.

Use of Technology for Quicker and Timely Access to Tuberculosis Diagnosis in Remote Communities

In recent years, there has been an increased use of technology in Saskatchewan's First Nations communities to improve access to health care TB case management. Some of these technologies include: (37)

- 1 Telehealth—an Internet-based videoconferencing technology used for health care services including education and training, and by health care providers to assess patients;
- 2 Remote Presence Robotic Technology—consisting of a maneuverable robot and a portable device called “Doc-in-the-box” that enables face-to-face communication between a patient and health care provider; and
- 3 GeneXpert-MTBC/RIF (M. tuberculosis complex/resistance to rifampin)—a diagnostic technology currently being piloted in northern First Nations communities with high rates of active TB. (36)

GeneXpert is being used in addition to routine TB screening to reduce diagnostic delays, especially within remote northern settings, and to detect drug resistance in remote and isolated areas earlier. (38) Suspected TB patients' specimens are tested by GeneXpert, and if negative, TB is quickly ruled out. But, if positive, treatment can be initiated for the patient while the specimen is sent for further diagnostic testing. (36) One of the goals of using rapid diagnostic technology is to reduce the spread of TB within the community.

OTHER NOTIFIABLE DISEASES

This section provides brief information on other notifiable diseases in which five or more cases have been reported in Saskatchewan First Nations communities from 2017 to 2016. These diseases include enteric and vaccine preventable diseases, and diseases that are transmitted primarily by respiratory routes.

ENTERIC DISEASES

Enteric diseases are illnesses that affect the gastrointestinal tract. These diseases are caused by bacteria, chemicals, biological toxins, parasites or viruses that enter the body after a person eats food or drinks water that is contaminated. (39) Another route of exposure is vomit or feces of an infected person or by contact with animals. Some symptoms of enteric diseases include nausea, vomiting, diarrhea, fever and stomach cramps. (40)

Food/water-borne illnesses, which are caused by enteric pathogens, affect an estimated 11 to 13 million Canadians each year. (40) There are approximately 30 specific pathogens known to cause foodborne illness. (41) Most cases of food-borne illnesses are mild, but can be severe in certain at risk populations such as people with weakened immune systems, children, the elderly and pregnant women. (42) Although most cases of food/water-borne diseases are mild, the impact of this illness can create a significant burden on the population in terms of costs associated with hospitalization, loss of productivity, and other related costs. (42)

Saskatchewan First Nations communities experienced a number of cases of food/water-borne illness from 2007 to 2016. The most reported of these were shigellosis, salmonellosis and campylobacteriosis (Table 4.1). There was a decrease in the reporting of aeromonas and giardiasis when compared to the previous nine years (2004–2012), but a large increase in reports of vancomycin-resistant enterococci, cryptosporidiosis, and salmonellosis and diseases among Saskatchewan First Nations communities.

VACCINE PREVENTABLE DISEASES

Vaccine-preventable diseases are those communicable diseases that can be prevented from causing serious complications such as meningitis, pneumonia, swelling of the brain, amputations and death through routine vaccinations of the population. (43)

The most reported vaccine-preventable disease among Saskatchewan First Nations communities between 2004–2012 and 2007–2016 was pertussis, with the largest proportion of cases being reported in 2010 (Table 4.1). Efforts to increase immunity and control the spread of vaccine-preventable diseases among Saskatchewan First Nations communities are covered in Chapter 3: Immunization of the First Nations Health Status Report 2018.

DISEASES TRANSMITTED BY RESPIRATORY ROUTES

There are a number of diseases whose primary route of infections is through the respiratory system. The diseases reported here, which are also vaccine-preventable diseases, are invasive meningococcal, invasive pneumococcal and invasive streptococcal diseases and influenza.

The most reported diseases transmitted by respiratory routes from 2007–2016 were influenza, streptococcal A-invasive and pneumococcal-invasive (Table 4.1). These were also the most reported diseases transmitted by respiratory routes from 2004–2012.

The spread of Invasive Group A streptococcal (iGAS) infections has become a growing concern across in Canada. These forms of streptococcal infections are severe and can cause pneumonia, meningitis, sepsis, streptococcal toxic shock syndrome, and necrotizing fasciitis, also known as ‘flesh eating disease’. (44)

The incidence rate of iGAS has increased and circulating subtypes have been identified. In Canada, an extremely rare type emm 74 strain, has increased in many Canadian provinces since 2015, (45) while the dominant strain observed in Saskatchewan and Saskatchewan First Nations communities was type emm 81 strain.

The most commonly reported risk factors for iGAS infection among Saskatchewan First Nations communities were lifestyle risk factors related to homelessness, and suppressed immunity related to HCV and HIV infections. Some of the reported medical risk factors were diabetes, chronic renal and chronic heart diseases. Currently, the Public Health Agency of Canada and ISC, SK have set up a sub-working group to discuss potential collaboration to examine the drivers for upsurge and outbreaks of iGAS.

PUBLIC HEALTH IMPLICATIONS

The changes in the epidemiology of HIV infections observed among First Nations over the last decade indicate that some progress has been made in addressing the burden of communicable diseases among this population. Although, trend analysis of surveillance data shows some progress in preventing and reducing the spread of communicable diseases, more work is needed to further close gaps in health inequities among Saskatchewan First Nations communities. For example, there have been efforts by the research community to map out epidemiological trends and to promote evidence-based HIV prevention interventions, by showing genotyping and phylogenetic relationships, tailored to the local Saskatchewan epidemiological context and targeted at those most at risk. (46)

However, programs and initiatives implemented to reduce the burden of communicable diseases in Saskatchewan First Nations communities must first acknowledge and consider the contextual nature of burden of diseases among First Nations communities and factors such as the intergenerational legacy of colonialism, residential schools, and social determinant of health issues that exist for Indigenous peoples in Canada, including Saskatchewan First Nations communities. (47)

Table 4.1: Number of notifiable diseases (excluding STBBIs and TB) by year and jurisdiction, 2007-2016

	2007		2008		2009		2010	
	South Central	NITHA	South Central	NITHA	South Central	NITHA	South Central	NITHA
Enteric, Food and Waterborne Diseases								
Aeromonas	6	5	8	<5	<5	5	5	<5
Amoebiasis	0	<5	0	0	0	<5	0	0
Campylobacteriosis	13	<5	6	<5	<5	5	<5	<5
Cryptosporidiosis	<5	0	9	14	<5	<5	0	0
Giardiasis	5	6	5	6	0	6	<5	<5
Hepatitis A	0	0	0	0	0	0	0	0
Listeriosis	0	0	0	<5	0	0	0	0
Salmonellosis	8	<5	<5	9	6	8	5	7
Shigellosis	0	0	0	0	0	0	0	0
Vancomycin-resistant enterococci	<5	<5	<5	<5	<5	<5	<5	0
Verotoxigenic E. coli	0	0	0	0	0	<5	0	0
Yersinia enterocolitica	0	0	<5	0	0	0	0	0
Vaccine-Preventable Diseases								
Varicella (chicken pox)	5	0	0	0	<5	0	5	0
Diphtheria	0	0	0	<5	0	<5	0	0
Hepatitis B (Acute, Carrier)	0	0	0	<5	0	0	0	0
H. influenza-invasive	0	0	<5	<5	<5	<5	0	<5
Mumps	0	0	0	0	<5	0	0	0
Pertussis	<5	0	<5	6	5	<5	28	63
Diseases Transmitted by Respiratory Routes								
Meningococcal-invasive	<5	<5	0	<5	<5	<5	0	0
Pneumococcal-invasive	0	23	<5	8	0	<5	6	7
Streptococcal A-invasive	6	8	18	9	17	6	9	7
Influenza	6	<5	15	10	93	148	0	<5

Continued: Table 4.1: Number of notifiable diseases (excluding STBBIs and TB) by year and jurisdiction, 2007-2016

2011		2012		2013		2014		2015		2016		Total (2007 to 2016)	
South Central	NITHA	South Central	NITHA	South Central	NITHA	South Central	NITHA	South Central	NITHA	South Central	NITHA	South Central	NITHA
<5	<5	<5	6	0	<5	0	<5	0	0	0	0	26	32
0	0	0	<5	0	<5	0	0	0	0	0	0	0	7
<5	<5	6	<5	<5	<5	6	0	6	<5	6	<5	55	32
0	0	<5	0	6	10	<5	<5	<5	0	0	<5	23	27
0	<5	<5	<5	<5	<5	0	<5	<5	<5	<5	0	22	37
<5	0	0	0	0	0	0	0	0	0	0	0	<5	0
0	0	0	0	0	0	0	0	0	0	0	0	0	<5
7	<5	6	0	<5	<5	<5	<5	16	5	<5	17	58	61
48	25	39	41	<5	<5	0	0	0	0	0	0	88	68
<5	<5	<5	<5	<5	<5	0	0	0	9	0	22	16	41
0	0	<5	0	<5	0	<5	0	<5	<5	<5	<5	7	5
0	0	0	<5	0	0	0	<5	0	0	0	<5	<5	<5
0	0	<5	0	0	<5	0	0	0	<5	<5	<5	15	5
0	0	0	0	0	0	0	0	0	<5	0	0	0	<5
0	0	<5	<5	0	0	<5	0	<5	0	<5	0	0	5
5	<5	<5	<5	<5	<5	<5	0	<5	<5	0	0	14	12
0	0	0	0	0	0	0	0	0	<5	0	0	<5	<5
7	6	<5	<5	0	<5	14	10	5	7	<5	14	65	110
<5	<5	0	0	0	0	0	<5	0	0	0	0	5	6
10	<5	13	7	6	<5	6	12	5	17	7	10	54	96
13	6	9	<5	<5	8	7	5	8	6	9	9	97	68
24	23	20	18	29	13	7	62	8	43	7	131	209	455

Appendix

Communicable Disease Methodology

Data Sources

- 1 Overall Canadian Population
 - » Total Canadian population, including First Nations on and off reserve
 - Canadian Notifiable Disease Surveillance System, Public Health Agency of Canada (PHAC)
 - Chlamydia, gonorrhoea, syphilis, hepatitis C (HCV), tuberculosis (TB)
 - Saskatchewan Ministry of Health's HIV/AIDS Annual Report, 2007 and 2016
 - Human immunodeficiency virus (HIV)
- 2 Overall Saskatchewan population
 - » Total Saskatchewan population, including First Nations on and off reserve populations
 - Centre for Communicable Diseases and Infection Control, PHAC
 - Chlamydia, gonorrhoea, syphilis, HCV
 - Saskatchewan Ministry of Health's HIV/AIDS Annual Report, 2007 and 2016
 - HIV
 - PHAC Tuberculosis in Canada Report, 2016
 - TB
- 3 Saskatchewan First Nations communities
 - » Registered to a Saskatchewan First Nations band and residing on reserve
 - » Does not include non-registered First Nations or non-First Nations that may be living on reserve
 - Integrated Public Health Information System (iPHIS) maintained by Saskatchewan Ministry of Health, 2007–2016
 - STI, BBP and other notifiable diseases
 - » NITHA and ISC, FNIHB, SK iPHIS data includes confirmed cases of infection/disease for Saskatchewan First Nations communities
 - Tuberculosis Information System (TBIS), 2007–2016
 - TB

Approach to Data Analysis

The surveillance of reportable diseases in Saskatchewan is conducted mainly through the Integrated Public Health Information System (iPHIS), while tuberculosis surveillance data is collected under the Tuberculosis Prevention and Control Program. These reporting systems were implemented in 2004 and 1986, respectively.

The crude incidence rates of all reported communicable diseases were calculated by dividing the total number of new cases of the disease per year by the total population within the specific year, expressed as the number of cases/events per year by 100,000 population.

$$\frac{\text{Number of new cases of disease (per year)}}{\text{Total number of people (within that specific year)}} \times 100,000 \text{ population}$$

Data Limitations

- Communicable diseases data for Saskatchewan First Nations communities will not include those who were diagnosed while living off reserve or diagnosed outside of Saskatchewan.
- Communicable diseases data only reflects reported cases, most commonly the proportion of individuals that tested positive for a given disease. As such, there may be an underestimation of the true incidence of the disease.
- Given the differences in age distribution between Saskatchewan First Nations population and the overall Saskatchewan and Canadian populations; the higher proportion of young people in First Nations communities may be one factor that explains the higher incidence of some diseases among Saskatchewan First Nations communities. Due to lack of available and accessible provincial data, age standardized rates cannot be calculated.
- Increasing incidence of communicable diseases may not necessarily reflect a true increase in infection rates. These increases may be a result of changes in screening/testing methods and the frequency of testing in a given population.

References

- 1 Doom H. Emerging infectious diseases. *Medicine* [Internet]. 2014 Jan;42(1):60–63. Available from: doi.org/10.1016/j.mpmed.2013.10.014
- 2 Lindahl J, Grace D. The consequences of human actions on risks for infectious diseases: a review. *Infection Ecology & Epidemiology* [Internet]. 2015 Nov 27;5:30048. Available from: dx.doi.org/10.3402/iee.v5.30048
- 3 Song R, Hall H, Harrison K, Sharpe T, Lin L, Dean H. Identifying the impact of social determinants of health on disease rates using correlation analysis of area-based summary information: research articles. *Public Health Reports* [Internet]. 2011;126(3):70–80. journals.sagepub.com/doi/10.1177/003335491112605312
- 4 National Collaborating Centre for Aboriginal Health. An overview of Aboriginal health in Canada: setting the context [Internet]. Prince George (BC): NCCAH; 2013 [cited 2018 Oct 18]. Available from: www.ccnsa-nccah.ca/docs/context/FS-OverviewAboriginalHealth-EN.pdf
- 5 Statistic Canada. Aboriginal peoples in Canada: Key results from the 2016 Census [Internet]. Ottawa (ON): Government of Canada; 2017 [cited 2018 Jul 25]. Available from: www150.statcan.gc.ca/n1/daily-quotidien/171025/dq171025a-eng.htm
- 6 Public Health Agency of Canada. The Chief Public Health Officer's report on the state of public health in Canada 2013: Infectious Disease—The never-ending threat [Internet]. Ottawa (ON): Government of Canada; 2013 Sep [cited 2018 Jul 25]. Available from: www.phac-aspc.gc.ca/cphorsphc-respcacsp/2013/assets/pdf/2013-eng.pdf
- 7 Canadian Public Health Association. Sexually transmitted and blood-borne infections (STBBIS) and related stigma [Internet]. Ottawa (ON): Canadian Public Health Association; 2017 [cited 2018 Jul 25]. Available from: www.cpha.ca/sexually-transmitted-and-blood-borne-infections-and-related-stigma
- 8 Canadian AIDS Treatment Information Exchange (CATIE). HIV in Canada: A primer for service providers [Internet]. Toronto (ON): CATIE; 2018 [cited 2018 Jul 25]. Available from: www.catie.ca/en/hiv-canada/3/3-2
- 9 Public Health Agency of Canada. Reports on sexually transmitted infections in Canada: 2013–2014 [Internet]. Ottawa (ON): Government of Canada; 2017 [cited 2018 Jul 25]. Available from: www.canada.ca/content/dam/phac-aspc/documents/services/publications/diseases-conditions/report-sexually-transmitted-infections-canada-2013-14/report-sexually-transmitted-infections-canada-2013-14-eng.pdf
- 10 Statistics Canada. Census Profile, 2016 Census [Internet]. Ottawa (ON): Government of Canada; 2016 [cited 2018 Jul 25]. Available from: www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=PR&Code1=47&Geo2=PR&Code2=01&Data=Count&SearchText=Saskatchewan&SearchType=Begins&SearchPR=01&B1=Population&TABID=1
- 11 Choudhri Y, Miller J, Sandhu J, Leon A, Aho J. Chlamydia in Canada, 2010–2015. *Can Commun Dis Rep*. 2018;44(2):49–54. Available from: doi.org/10.14745/ccdr.v44i02a03
- 12 Public Health Agency of Canada. Notifiable diseases online [Internet]. Ottawa (ON): Government of Canada; 2018 [cited 2018 Aug 2]. Available from: dsol-smed.phac-aspc.gc.ca/dsol-smed/ndis/diseases/chlm-eng.php
- 13 Dielissen P, Teunissen D, Lagro-Janssen A. Chlamydia prevalence in the general population: is there a sex difference? a systematic review. *BMC Infectious Diseases*. 2013;13:534. Available from: www.biomedcentral.com/1471-2334/13/534
- 14 Public Health Agency of Canada. Report on sexually transmitted infections in Canada: 2012 [Internet]. Ottawa (ON): Government of Canada; 2015 [cited 2018 Aug 2]. Available from: www.catie.ca/sites/default/files/Report-on-STIs-in-Canada-2012.pdf
- 15 Choudhri Y, Miller J, Sandhu J, Leon A, Aho J. Gonorrhoea in Canada, 2010–2015. *Can Commun Dis Rep*. 2018;44(2):37–42. Available from: doi.org/10.14745/ccdr.v44i02a01
- 16 Totten S, MacLean R, Payne E. Gonorrhoea in Canada: 2003–2012. *Can Commun Dis Rep*. 2015;41(2):26–29. Available from: www.canada.ca/content/dam/phac-aspc/migration/phac-aspc/publicat/ccdr-rmtc/15vol41/dr-rm41-02/assets/pdf/ccdrv41i02a02-eng.pdf
- 17 Government of Canada. Gonorrhoea [Internet]. Ottawa (ON): Government of Canada; 2017 Jul [cited 2018 Aug 2]. Available from: www.canada.ca/en/public-health/services/diseases/gonorrhoea.html
- 18 Public Health Agency of Canada. Canadian guidelines on sexually transmitted infections [Internet]. Ottawa (ON): Government of Canada; 2016 Dec [cited 2018 Aug 2]. Available from: www.canada.ca/en/public-health/services/infectious-diseases/sexual-health-sexually-transmitted-infections/canadian-guidelines.html
- 19 Government of Canada. Syphilis [Internet]. Ottawa (ON): Government of Canada; 2015 Jul [cited 2018 Aug 2]. Available from: www.canada.ca/en/public-health/services/diseases/syphilis.html

- 20 Canadian AIDS Treatment Information Exchange (CATIE). Syphilis: It's serious. And it's here [Internet]. Toronto (ON): CATIE; 2018 [cited 2018 Aug 2]. Available from: www.catie.ca/fact-sheets/infections/syphilis
- 21 Government of Canada. Section 5-10: Canadian guidelines on sexually transmitted Infections—management and treatment of specific infections—Syphilis [Internet]. Ottawa (ON): Government of Canada; 2018 Jan [cited 2019 Jan 11]. Available from www.canada.ca/en/public-health/services/infectious-diseases/sexual-health-sexually-transmitted-infections/canadian-guidelines/sexually-transmitted-infections/canadian-guidelines-sexually-transmitted-infections-27.html
- 22 Choudhri Y, Miller J, Sandhu J, Leon A, Aho J. Infectious and congenital syphilis in Canada, 2010–2015. *Can Commun Dis Rep.* 2018;44(2):43–8. Available from: doi.org/10.14745/ccdr.v44i02a02
- 23 Government of Canada. Reported cases from 1924 to 2016 in Canada—Notifiable diseases on-line [Internet]. Ottawa (ON): Government of Canada; 2018 Jun [cited Aug 3]. Available from: diseases.canada.ca/notifiable/charts?c=pl
- 24 Government of Canada. Causes of HIV and AIDS [Internet]. Ottawa (ON): Government of Canada; 2015 Nov [cited 2018 Aug 3]. Available from: www.canada.ca/en/public-health/services/diseases/hiv-aids/causes-hiv-aids.html
- 25 Public Health Agency of Canada. HIV and AIDS in Canada: Surveillance report to December 31, 2014 [Internet]. Ottawa (ON): Government of Canada; 2015 Nov [cited 2018 Aug 3]. Available from: <http://healthy Canadians.gc.ca/publications/diseases-conditions-maladies-affections/hiv-aids-surveillance-2014-vih-sida/alt/hiv-aids-surveillance-2014-vih-sida-eng.pdf>
- 26 Bourgeois AC, Edmunds M, Awan A, Jonah L, Varsaneux O, Siu W. HIV in Canada—Surveillance report, 2016. *Can Commun Dis Rep.* 2017;43(12):248–56. Available from: doi.org/10.14745/ccdr.v43i12a01
- 27 Government of Saskatchewan. HIV / AIDS in Saskatchewan [Internet]. Regina (SK): Government of Saskatchewan; 2008 Nov [cited 2018 Sep 12]. Available from: publications.gov.sk.ca/documents/13/81384-hiv-aids-annual-rep-2007.pdf
- 28 Government of Saskatchewan. HIV Prevention and control report for 2016 [Internet]. Regina (SK): Government of Saskatchewan; 2016 Nov [cited 2018 Sep 12]. Available from: publications.gov.sk.ca/documents/13/104861-2016-Saskatchewan-HIV-Prevention-and-Control-Report.pdf
- 29 Health Canada. Project evaluation: Know your status: A comprehensive review of HIV testing, case management, and treatment in Big River, a Saskatchewan First Nation. Regina (SK): First Nations Inuit Health Branch, Saskatchewan Region; 2012 [cited 2018 Oct 3].
- 30 Canadian AIDS Treatment Information Exchange (CATIE). Know your status [Internet]. Toronto (ON): CATIE; 2016 [cited 2018 Sep 12]. Available from: www.catie.ca/index.php?q=en/pc/elements/know-your-status
- 31 First Nations Inuit Health Branch Saskatchewan Region. HIV/STBBI Update. Presented at: First Nations Partners Meeting, 2018 Oct 17–18; Regina
- 32 Sinclair J, Faber D, Bridges L, Pederson P, Dillman C. Know your status HIV/AIDS project 2013 community review, March 2013: BRFN courage to change recommendation report. Big River First Nation; 2013 [cited 2018 Oct 3].
- 33 Canadian AIDS Treatment Information Exchange (CATIE). The epidemiology of hepatitis C in Canada [Internet]. Toronto (ON): CATIE; 2017 [cited 2018 Sep 13]. Available from: www.catie.ca/en/fact-sheets/epidemiology/epidemiology-hepatitis-c-canada
- 34 Canadian Liver Foundation. Hepatitis C [Internet]. Ottawa (ON): Canadian Liver Foundation; 2017 [cited 2018 Sep 13]. Available from: www.liver.ca/patients-caregivers/liver-diseases/hepatitis-c/
- 35 Government of Canada. Causes of tuberculosis (TB) [Internet]. Ottawa (ON): Government of Canada; 2016 Mar [cited 2018 Sep 13]. Available from: www.canada.ca/en/public-health/services/diseases/tuberculosis-tb/causes-tuberculosis-tb.html
- 36 Government of Canada. Tuberculosis [Internet]. Ottawa (ON): Government of Canada; 2013 Nov [cited 2018 Sep 13]. Available from: www.canada.ca/en/health-canada/services/health-concerns/diseases-conditions/tuberculosis.html
- 37 Khan I, Ndubuka N, Stewart K, McKinney V and Mendez I. The use of technology to improve health care to Saskatchewan's First Nations communities. *Can Commun Dis Rep.* 2017;43(6):120–4. Available from: doi.org/10.14745/ccdr.v43i06a01
- 38 Public Health Agency of Canada. Canadian Tuberculosis Standards 7th Edition - Chapter 3: Diagnosis of active tuberculosis and drug resistance [Internet]. 2014 [cited 2018 Sep 13]. Available from: www.phac-aspc.gc.ca/tbpc-latb/pubs/tb-canada-7/assets/pdf/tb-standards-tb-normes-ch3-eng.pdf

- 39 Public Health Agency of Canada. Evaluation of the Public Health Agency of Canada's food-borne and water-borne enteric illness activities 2012-17. Ottawa (ON): Government of Canada; 2018 Mar [cited 2018 Sep 13]. Available from: www.canada.ca/en/public-health/corporate/transparency/corporate-management-reporting/evaluation/report-evaluation-food-borne-water-borne-enteric-illness-activities-2012-2017.html
- 40 Canadian Public Health Association. Foodborne illnesses—what causes food poisoning [Internet]. Ottawa (ON): CPHA; 2018 [cited 2018 Sep 13]. Available from: www.cpha.ca/foodborne-illnesses-what-causes-food-poisoning
- 41 Lukacsovics A, Hatcher M, Papdopoulos A. Risk factors and surveillance systems for foodborne illness outbreaks in Canada [Internet]. Vancouver (BC): National Collaborating Centre for Environmental Health; 2014 Jun [cited 2018 Sep 13]. Available from: www.ncceh.ca/sites/default/files/Risk_Surveillance_FBI_Outbreaks_June_2014.pdf
- 42 Ottawa Public Health. Enteric disease in Ottawa, 2011: Knowledge to action report [Internet]. Ottawa (ON): City of Ottawa; 2011 [cited 2018 Sep 13]. Available from: www.ottawapublichealth.ca/en/reports-research-and-statistics/resources/Documents/enteric_knowledge_report_2011_en.pdf
- 43 Public Health Agency of Canada. Vaccine preventable disease: Surveillance report to December 31, 2015 [Internet]. Ottawa (ON): Government of Canada; 2015 [cited 2018 Sep 13]. Available from: www.canada.ca/content/dam/phac-aspc/documents/services/publications/healthy-living/vaccine-preventable-disease-surveillance-report-december-31-2015/vaccine-preventable-disease-eng.pdf
- 44 Dickson C, Pham MT, Nguyen V, Broacher C, Silverman MS, Khaled K, Hovhannisyan G. Community outbreak of invasive group A streptococcus infection in Ontario, Canada. *Can Commun Dis Rep* 2018;44(7/8):182-8. doi.org/10.14745/ccdr.v44i78a06
- 45 Teatero S, McGeer A, Tyrrell G, Hoang L, Smadi H, Domingo MC et al. Canada-wide epidemic of emm 74 group A streptococcus invasive disease. *Open Forum Infectious Diseases* 2018; 5(5): [dx.doi.org/10.1093/ofid/ofy085](https://doi.org/10.1093/ofid/ofy085)
- 46 Canadian AIDS Treatment Information Exchange (CATIE). Why has HIV in Saskatchewan become more harmful for some people? [Internet]. Toronto (ON): CATIE; 2018 [cited 2018 Oct 2]. Available from: www.catie.ca/en/catieneews/2018-08-14/why-has-hiv-saskatchewan-become-more-harmful-some-people
- 47 Wilk P, Maltby A, Cooke M. Residential schools and the effects on Indigenous health and well-being in Canada—a scoping review. *Public Health Reviews* 2017;38(8):1-23. publichealthreviews.biomedcentral.com/articles/10.1186/s40985-017-0055-6



Chapter 5: Social Determinants of Health

HIGHLIGHTS

- This chapter provides current trends on the social determinants of health in Saskatchewan First Nations communities, including Indigenous peoples' language, food, security, education, income and employment.
- Saskatchewan First Nations communities saw an increase in the proportion of people aged 25 to 54 completing high school between 2006 and 2016 (17.1% to 26.4%).
- The median income in Saskatchewan First Nations communities increased 40.2% among individuals aged 25 to 54 between 2006 and 2016.
- In 2015, more than a third (37%) of the households in Saskatchewan First Nations communities faced food insecurity.

Social determinants of health (SDOH) are the economic and social factors (including income, education, employment opportunities, food security and housing) that influence the health of individuals and communities. (1,2) The World Health Organization's Commission on SDOH identified three principles of action to improve population health including: (i) improving daily living conditions; (ii) addressing inequity of power, money and resources; and (iii) measuring and understanding the problem, and evaluating public health actions. (3) In the Canadian context, the SDOH could also include health care services, geography and Indigenous ancestry (see Table 5.1). (2) The Government of Canada has recognized the role of public policies to address health inequalities by working towards (i) strengthening the evidence base to inform decision-making; (ii) engaging beyond the health sector; and (iii) sharing knowledge of action across Canada. (4) Public policies play a key role in positively affecting the SDOH in a population. (2) This chapter provides data on SDOH indicators for Indigenous peoples living in Saskatchewan over time (using available data—see appendix for details).

These indicators are limited to available data and include information on Indigenous peoples' language, state of food security, housing conditions, education opportunities, and income and employment opportunities.

Specific SDOH for Indigenous peoples¹ in Canada, include colonization, racism and self-determination. (2) The role of government policies and regulations, including residential schools, has been identified as contributors to the health inequities among Indigenous peoples in Canada. (2) Some of the health disparities faced by Indigenous peoples in Saskatchewan are highlighted in other chapters of this report.

Table 5.1. Key SDOH factors identified from the Canadian societal context. (2)

Indigenous ancestry	Health care services
Disability	Housing
Early life	Geography
Education	Income
Employment	Race
Food security	Social safety net
Gender	Social exclusion

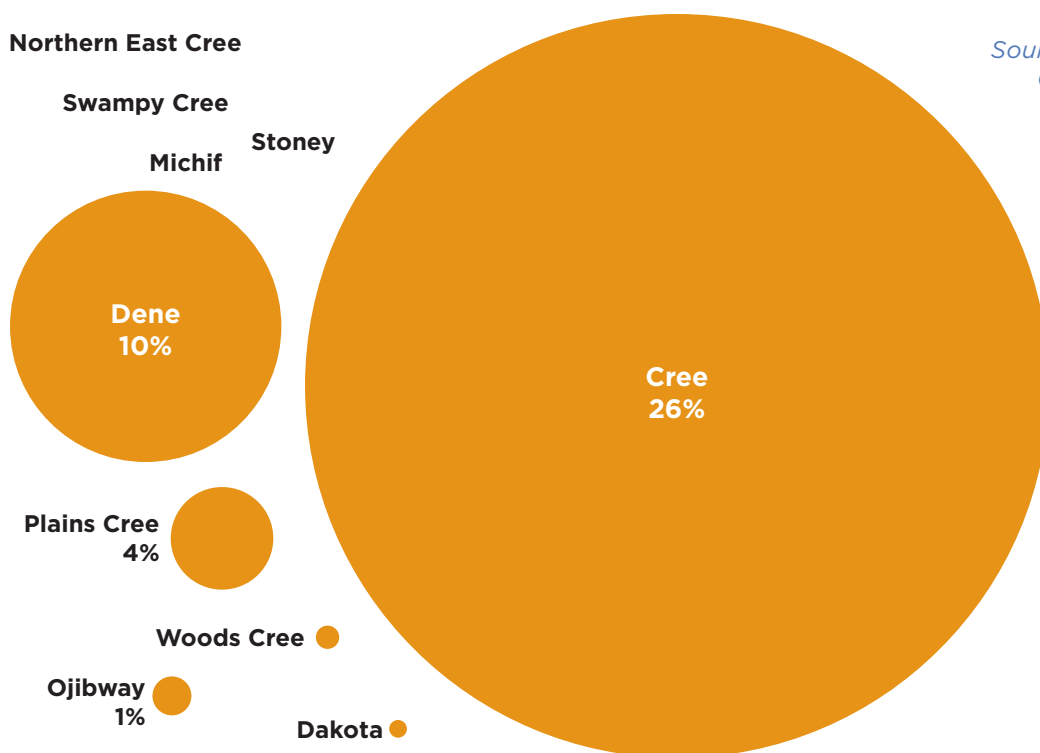
LANGUAGE

Culture and language are identified as strong social determinants of health for Indigenous peoples in Canada. (5) Consequently, revitalization of Indigenous peoples' culture and language is considered significant to improve their health status. (5) For further information on how culture and language play a strong role in Indigenous peoples' SDOH, refer to the factsheet produced by the National Collaborating Centre for Aboriginal Health. (5)

According to the 2016 Census of Population, at least 10 different Indigenous languages were reported to be spoken at home by people living in Saskatchewan First Nations communities. Approximately 41% of the people living in Saskatchewan First Nations community speak one of the Indigenous languages. In 2016, Cree and Dene were reported as the most commonly used Indigenous languages spoken at home by people living in Saskatchewan First Nations communities (Figure 5.1).

¹ The term "Indigenous peoples" is used to present Statistics Canada data for "aboriginal identity", which is defined as someone who is "First Nations (North American Indian), Métis or Inuk (Inuit)".

Figure 5.1: Indigenous peoples' languages spoken at home in First Nations communities in Saskatchewan, 2016 (n=55,940).



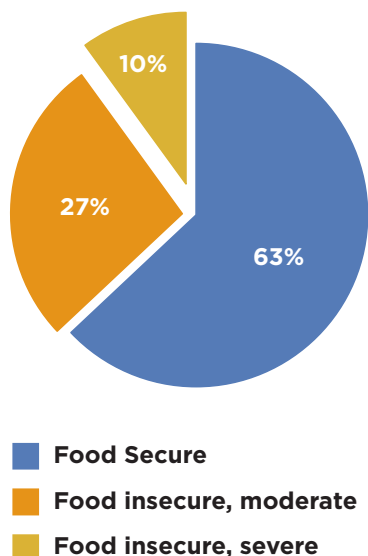
Source: Statistics Canada, 2016
Census of Population

FOOD SECURITY

As defined by the World Food Summit (1996), “food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. (6) Food insecurity has been associated with poor health status among children and adults in Canada, with increased risk for chronic conditions, such as hypertension, hypocholesteremia and diabetes. (2) Food insecurity also compromises an individual’s ability to manage their health needs and has been associated with adverse consequences for diseases including HIV/AIDS and diabetes. (2)

In 2015, 37% of the First Nations households in Saskatchewan First Nations communities were classified as food insecure: 27% of the households were classified as moderately insecure² and 10% as severely insecure³. (7) The contributing factor to high rates of food insecurity is the high cost of food in First Nations communities—average weekly cost of groceries in communities was \$258, compared to \$177 in Saskatoon (largest city in Saskatchewan). (7)

Figure 5.2: Income-related food insecurity among First Nations households in Saskatchewan First Nations communities, 2015 (n=1,008). (7)



Source: Published information from the First Nations Food, Nutrition and Environment Study (FNFNES): Results from Saskatchewan (2015). (7)

² Families rely on lower quality/priced foods
³ Families regularly experience food shortages

There are many community-led success stories in Saskatchewan First Nations communities that are addressing the SDOH including initiatives to reduce food insecurity. The next section highlights one such success story shared by Prince Albert Grand Council. Culturally respectful community-led initiatives are necessary for improving the health and wellbeing of individuals and communities.

PRINCE ALBERT GRAND COUNCIL SUCCESS STORY

One of the objectives of the Prince Albert Grand Council (PAGC) Aboriginal Diabetes Initiative (ADI) Team is to increase food security by facilitating community-driven food security initiatives. In the spring of 2018, the team purchased raised garden beds for their seven communities. The garden beds were placed at community health centres and daycares, and were used for a variety of activities throughout the spring and summer, including gardening workshops and providing fresh produce for cooking classes.

In Wahpeton Dakota Nation, potatoes were planted in the garden beds. In August, health centre staff harvested the garden beds, and delivered bags of potatoes to Elders in the community. The potatoes were also used at a cooking class for high school students, where participants learned about the health benefits of fresh versus processed food, while practicing their cooking skills. Community members in Wahpeton are already talking about what should be planted in the garden beds next year, and the PAGC ADI Team plans to build on this year’s gardening initiative by offering canning and preservation workshops using the produce from the garden beds!



Left: raised garden beds at Wahpeton Health Centre. Right: potato harvest from Wahpeton Health Centre.

HOUSING

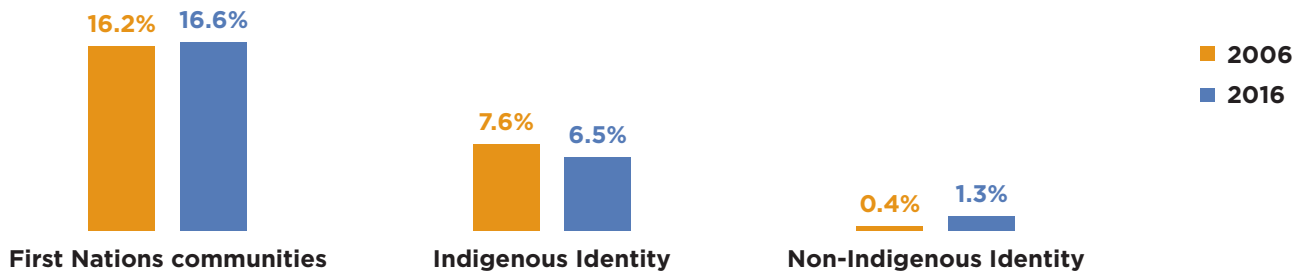
Proper housing and living conditions are also necessary for the health and wellbeing of individuals and their families. (2) Overcrowded housing⁴ has been associated with increased risk of contracting infectious diseases and having poor health. (2) In 2016, Census data show that Saskatchewan Indigenous peoples were five times more likely to be living in severely overcrowded housing⁵ compared to non-Indigenous peoples (6.5% and 1.3%, respectively) (Figure 5.3). (8)

The proportion of severely overcrowded households reported in Saskatchewan First Nations communities remained relatively unchanged between 2006 and 2016 (16.2% and 16.6%, respectively). Further resources

in housing are needed particularly in First Nations communities where crowded housing conditions have not improved in the past decade.

In terms of housing repairs, in 2016, households in Saskatchewan First Nations communities were 7.6 times more likely to need major repairs compared to households in non-First Nations communities (51.1 versus 6.7%, respectively) (Figure 5.4). However, there was a slight decrease in the proportion of households requiring major repairs in First Nations communities between 2006 and 2016 (53.7% to 51.1%). These trends further highlight the need for more resources to improve housing conditions to improve the health and wellbeing of individuals and communities.

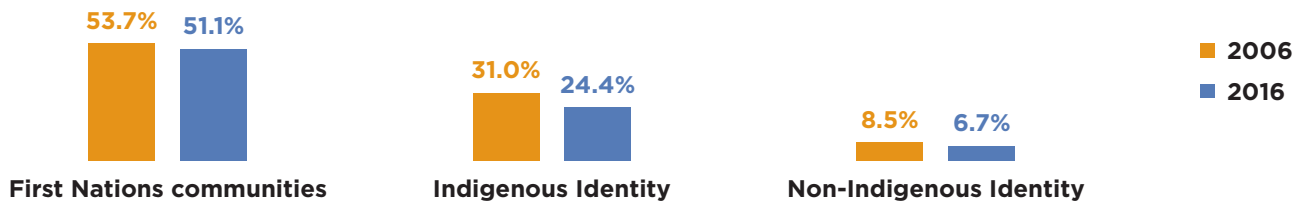
Figure 5.3: Proportion of households in Saskatchewan First Nations communities, Indigenous households in Saskatchewan and non-Indigenous households in Saskatchewan classified as severely overcrowded (average of ≥ 1.5 persons per room), Saskatchewan, 2006 and 2016.



Source: Statistics Canada, 2016 Census of Population

* Rooms refer to all rooms within a dwelling excluding bathrooms, halls, vestibules and rooms used solely for business purposes.

Figure 5.4: Proportion of households in Saskatchewan First Nations communities, Indigenous households in Saskatchewan and non-Indigenous households in Saskatchewan needing major repair, 2006 and 2016.



Source: Statistics Canada, 2006 and 2016 Census of Population

⁴ Persons Per Room (PPR) definition is used due to data availability. Limitations of PPR definition are available in Canadian Mortgage and Housing Corporation website (8).

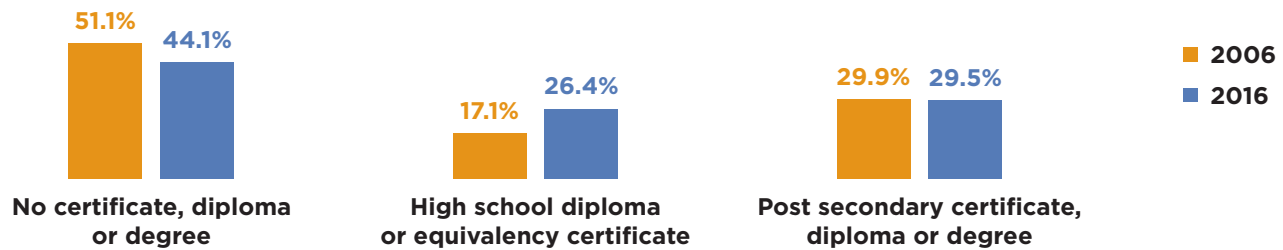
⁵ Based on Persons Per Room (PPR) definitions: overcrowded as more than 1.0 persons per room severely overcrowded as more than 1.5 persons per room.

EDUCATION

Improvement in education status is known to be associated with positive physical and mental health outcomes, and equally, people with excellent health status are also able to benefit more from their education. (2) Based on Census data, Saskatchewan First Nations communities attained higher levels of education in 2016 compared to 2006.

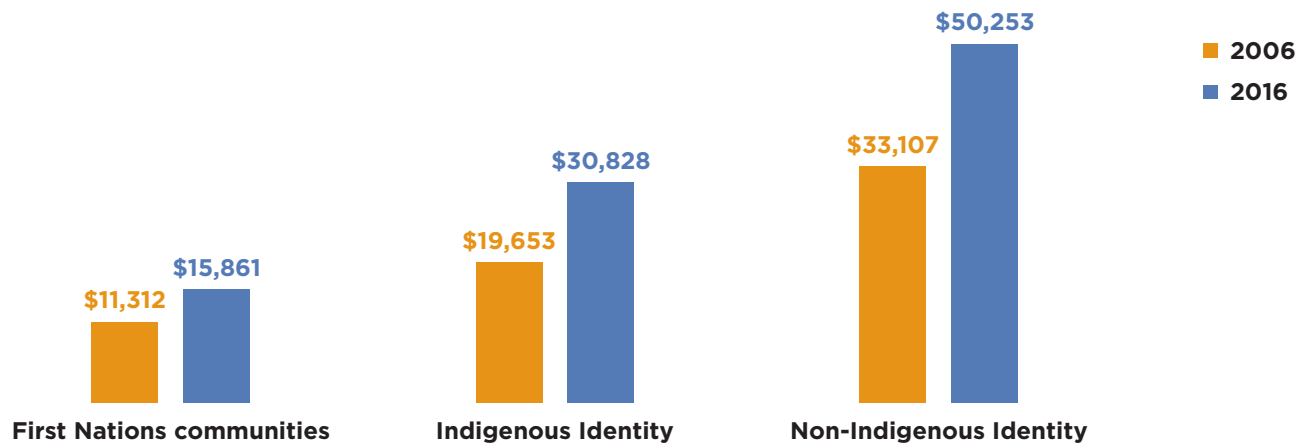
There was an increase in the proportion of 25 to 54 year olds attaining high school diplomas in 2016 compared to 2006 (17% in 2006 to 26% in 2016). Overall, there was also a decrease in the proportion of 25 to 54 year olds with no certificate, diploma or degree in 2016 compared to 2006 (51% in 2006 to 44% in 2016) (Figure 5.5).

Figure 5.5: Highest certificate, diploma or degree attained by First Nations people aged 25 to 54 years in Saskatchewan First Nations communities, 2006 and 2016.



Source: Statistics Canada, 2006 and 2016 Census of Population

Figure 5.6: Median income among First Nations people in Saskatchewan First Nations communities, Indigenous people in Saskatchewan and non-Indigenous people in Saskatchewan for 25 to 54 year olds, 2006 and 2016.



Source: Statistics Canada, 2006 and 2016 Census of Population

INCOME

Income is strongly associated with several health outcomes in Canada including birthweight, injury, early childhood development, mental wellness, health service utilization, chronic diseases, infectious diseases, mortality and life expectancy. (2) There are many reasons for the strong relationship between income and health outcomes (for details, see Raphael). (2) Between 2006 and 2016, the median income for 25 to 54 year old First Nations people in Saskatchewan First Nations communities increased by \$4,549 (or a 40.2% increase).

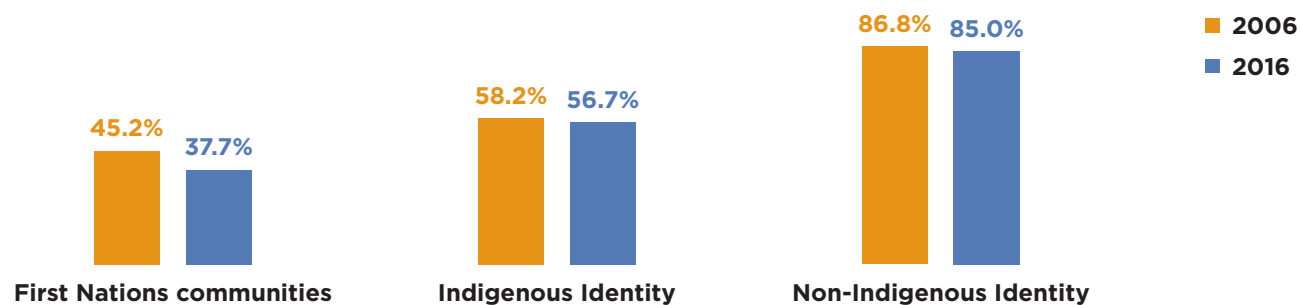
In comparison, the median income for this age group among non-Indigenous peoples in Saskatchewan increased by \$17,146 (or a 51.8% increase) (Figure 5.6). There is an income gap between Indigenous and non-Indigenous populations in Saskatchewan, and improving income opportunities would also address the health disparities faced by Indigenous peoples.

EMPLOYMENT

Employment status has an impact on the financial status of an individual and unemployment as well as underemployment has been associated with various health outcomes. (2) Research shows that women, ethnic minorities, individuals with disability and lower level of educations are more likely to work in low income jobs. (2) A recent report from Statistics Canada's 2016 Census of Population shows that fewer Canadians aged 25 to 54 were working full-time in 2015 compared to 2005. (9) The financial crisis in 2008–2009 and automation technology were identified as possible reasons for the decrease in the workforce. (9)

Similar to the overall Canadian trends, Saskatchewan in general saw a slight decrease in employment rates among those aged 25 to 54 (86.8% to 85.0%). In Saskatchewan First Nations communities, the employment rates among First Nations people decreased from 45.2% to 37.7% in the same age group (Figure 5.7). The participation rates⁶ for employment also decreased in Saskatchewan First Nation communities from 60.6% to 53.8% (Figure 5.8).

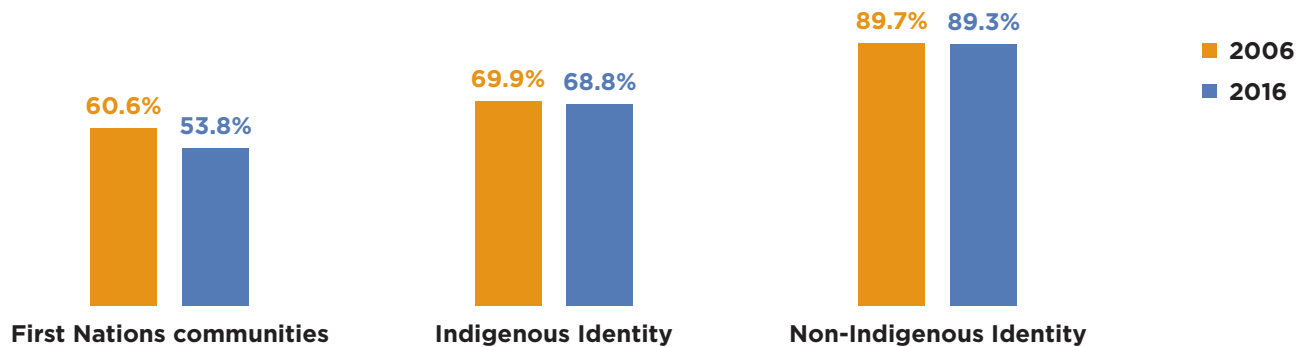
Figure 5.7: Employment rates among First Nations people living in Saskatchewan First Nations communities, Indigenous people in Saskatchewan and non-Indigenous people in Saskatchewan for 25 to 54 year olds, 2006 and 2016.



Source: Statistics Canada, 2006 and 2016 Census of Population

⁶ Participation rate is defined as total labour force expressed as a percentage of the population aged 25 to 54. Not in labour force is defined as “those who, during the reference week, were unwilling or unable to offer or supply labour services under conditions existing in their labour markets, that is, they are neither employed nor unemployed” (10).existing in their labour markets, that is, they are neither employed nor unemployed” (10).

Figure 5.8: Participation rates among First Nations people living in Saskatchewan First Nations communities, Indigenous people in Saskatchewan and non-Indigenous people in Saskatchewan for 25 to 54 year olds, 2006 and 2016.



Source: Statistics Canada, 2006 and 2016 Census of Population

PUBLIC HEALTH IMPLICATIONS

Indigenous peoples in Saskatchewan face disparities in many health outcomes (as described in previous chapters on opioid overdose and communicable diseases). The factors contributing to the disparities are many of the Indigenous-specific SDOH including colonization, racism, residential school attendance and experience, disparities in housing, education, income, and food security. As summarized in this chapter, there are areas where positive trends have been observed (example, increase in education attainment), but there are many other areas that require further public health action and community-led and culturally safe initiatives to reduce the health disparities faced by Indigenous peoples.

Appendix

Data Sources

- 1 Census of population, Statistics Canada
 - » Language, housing, education, income and employment: This source provides a statistical portrait of Canada every five years. Data from 2016 and 2006 were used. For more information on these data and its quality, please refer to the “Aboriginal Peoples Survey, 2006: Concepts and Methods Guide” and “Aboriginal Peoples Reference Guide, Census of Population, 2016”. (11,12)
- 2 Chan et al (2018) - First Nations Food, Nutrition and Environment Study (FNFNES):
 - » Food security: This source was used to obtain information on the status of food insecurity in Saskatchewan First Nations communities. For more information about this please, please refer to the “First Nations Food, Nutrition and Environment Study (FNFNES): Results from Saskatchewan (2015)”. (7)

Data Limitations

- Data are not available for all social determinants of health including racism, colonization and residential school attendance and experience.
- Detailed limitations of the data sources (Census and FNFNES) are outlined on their website. (7,11,12)

References

- 1 World Health Organization. (2018). World Health Organization. Retrieved Aug 8, 2018, from WHO.INT: www.who.int/social_determinants/sdh_definition/en/
- 2 Raphael, D. (2016). *Social Determinants of Health: Canadian Perspective*, Third Edition. Toronto: Canadian Scholars' Press Inc.
- 3 CSDH. (2008). *Closing the gap in a generation: health equity through action on the social determinants of health: Final report of the commission on social determinants of health*. Geneva: World Health Organization.
- 4 Government of Canada. (2018, Jun 13). Government of Canada. Retrieved Aug 20, 2018, from CANADA.CA: www.canada.ca/en/public-health/services/health-promotion/population-health/what-determines-health.html
- 5 National Collaborating Centre for Aboriginal Health. (2016). Culture and language as social determinants of First Nations, Inuit and Metis Health. National Collaborating Centre for Aboriginal Health (NCCAHA).
- 6 Food and Agriculture Association. (2006). Food Security. Retrieved Feb 18, 2019, from FAO.ORG: www.fao.org/fileadmin/templates/faoitally/documents/pdf/pdf_Food_Security_Cocept_Note.pdf
- 7 Chan, L., Receveur, O., Batal, M., Sadik, T., Schwartz, H., Ing, A., et al. (2018). First Nations Food, Nutrition and Environment Study: Results from Saskatchewan 2015. Ottawa: University of Ottawa.
- 8 Canada Mortgage and Housing Corporation. (2016, May 31). Canada Mortgage and Housing Corporation. Retrieved Aug 21, 2018, from CMHC-SCHL.GC.CA: www.cmhc-schl.gc.ca/en/Housing-Observer-Online/2016-Housing-Observer/Measuring-Overcrowding-USA-and-Canada.
- 9 Statistics Canada. (2017). Labour in Canada: Key results from the 2016 census. Ottawa: Statistics Canada.
- 10 Statistics Canada. (2015). Section 2: Determining labour force status. Retrieved Feb 18, 2019, from STATCAN.GC.CA: www150.statcan.gc.ca/n1/pub/71-543-g/2012001/part-partie2-eng.htm.
- 11 Statistics Canada. (2013). Aboriginal Peoples Survey, 2006: Concepts and Methods Guide. Retrieved Feb 18, 2019, from STATCAN.GC.CA: www150.statcan.gc.ca/n1/pub/89-637-x/89-637-x2008003-eng.htm.
- 12 Statistics Canada. (2017). Aboriginal Peoples Reference Guide, Census of Population, 2016. Retrieved Sept 4, 2018, from STATCAN.GC.CA: www12.statcan.gc.ca/census-recensement/2016/ref/guides/009/98-500-x2016009-eng.cfm



Chapter 6: Diabetes

The chronic condition known as diabetes mellitus (diabetes) was described by notable historians and researchers throughout centuries before the biomedical mechanisms of the disease were better understood. (1) During those historical periods, efforts were put into identifying the disease in order to develop appropriate treatment. Now with the availability of effective treatment options, prognosis for individuals with diabetes has improved. As individuals with diabetes, in particular type-2 diabetes, continue to live longer, the focus has been on the management and care of individuals living with diabetes to prevent further complications from the disease. (2-6)

Indigenous peoples living with diabetes experience higher rates of complications, hospitalization, and death in comparison to non-Indigenous peoples. (2) Although there are three different types of diabetes, type-2 diabetes is the most prevalent form affecting Indigenous peoples of Canada. (7-12) The focus of this chapter will be on the burden of type-2 diabetes among Saskatchewan's First Nations population.

To estimate the incidence, prevalence and burden of diabetes in Saskatchewan First Nations populations, three Saskatchewan research studies using health administrative data and one using data from Saskatchewan's Chronic Kidney Disease Program and clinical hemodialysis databases will be highlighted.

Further estimates of diabetes in Saskatchewan First Nations populations will be made using anti-hyperglycemic drug claims through Non-Insured Health Benefit (NIHB) Program.

DIABETES MELLITUS

Diabetes is considered an epidemic of the 21st century because of the burden of the disease and its complications. (8) Diabetes is caused by the body's inability to produce or properly use the hormone, insulin, to control sugar levels in the blood. (2, 13) Complications of diabetes include nerve damage, stroke, kidney and cardiovascular diseases, and blindness. (15) There are three main types of diabetes: type-1, type-2, and gestational diabetes. Type-1 diabetes is an autoimmune disease that results in the body's inability to produce insulin. (14) This form of diabetes generally develops in children and youth. Type-2 diabetes is a metabolic disorder that occurs when the pancreas is unable to produce enough insulin or the body is unable to use the insulin it produces. (14) This type of diabetes generally develops in adults, but children and youth can be affected. Although type-2 diabetes is a serious health condition, it is manageable. Unlike type-1 and type-2 diabetes, gestational diabetes is usually a temporary condition that develops during pregnancy; (16) however, gestational diabetes increases a woman's risk of developing type-2 diabetes later in life. (12)

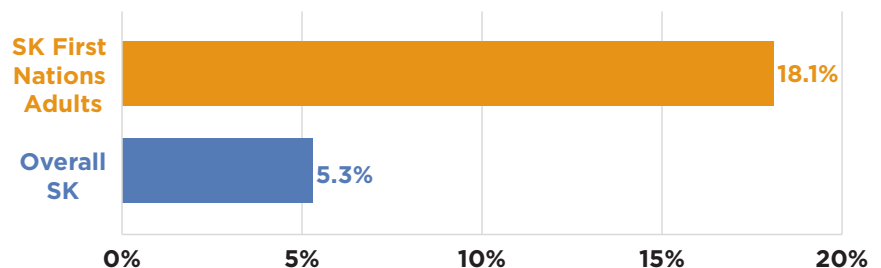
HIGHLIGHTS

- Estimation of the incidence and prevalence of diabetes among Saskatchewan First Nations population is challenging due to limited availability of First Nations-specific data on diabetes. In 2015, the Saskatchewan First Nations Food, Nutrition and Environment Study (FNFNES) reported that the age-standardized prevalence of diabetes for the overall Saskatchewan population and First Nations adult population surveyed were 5.3% and 18.1%, respectively.
- The highlighted research studies found that:
 - First Nations adults experience onset of type-2 diabetes at a younger age.
 - Type-2 diabetes was the leading cause of chronic kidney disease (CKD) in Saskatchewan First Nations people and women experienced a higher proportion of CKD burden.
 - Offspring of First Nations youth diagnosed with diabetes were at a higher risk for developing type-2 diabetes.
 - First Nations females with high birth weight (HBW) were more likely than males with HBW to develop type-2 diabetes.
- The percentage of anti-hyperglycemic drug claims made by First Nations in Saskatchewan through the Non-Insured Health Benefit (NIHB) Program has steadily increased. From 2007 to 2016, there was a 28% and 34% increase in anti-hyperglycemic drug usage among females and males, respectively.

The risk factors for diabetes include: low physical activity, heavy tobacco use, (9) cardiovascular disease, obesity, older age, family history of type 2 diabetes, ethnicity, prediabetes, and history of gestational diabetes. (17) Several risk factors such as physical inactivity, smoking and unhealthy diet are modifiable through lifestyle changes. (9). Many individuals with diabetes live with other chronic health conditions, including high blood pressure and depression. (9,18)

In 2016, an estimated 7.0% of Canadians aged 12 years and older reported being diagnosed with diabetes. (19) Ninety percent of Canadians diagnosed with diabetes had type-2 diabetes, while the majority of children and youth with diabetes had type-1 diabetes. (14) The prevalence of type-2 diabetes among First Nations peoples in Canada was estimated to range from three to five times higher than in non-Indigenous peoples of Canada. (3,5) There was also a high prevalence of undiagnosed diabetes and prediabetes cases in Canada. (8) In Saskatchewan, an estimated 8.8% of the population were living with diabetes in 2016; which represented a 58% increase from 2006. (9) However, the Canadian Diabetes Association estimated that 29% of the Saskatchewan population were actually living with undiagnosed diabetes and prediabetes in 2016. (9) It is estimated that by 2026, 12% of the Saskatchewan population will be living with diabetes. (9)

Figure 6.1: Age-standardized diabetes prevalence in overall Saskatchewan and Saskatchewan First Nations populations, 2015

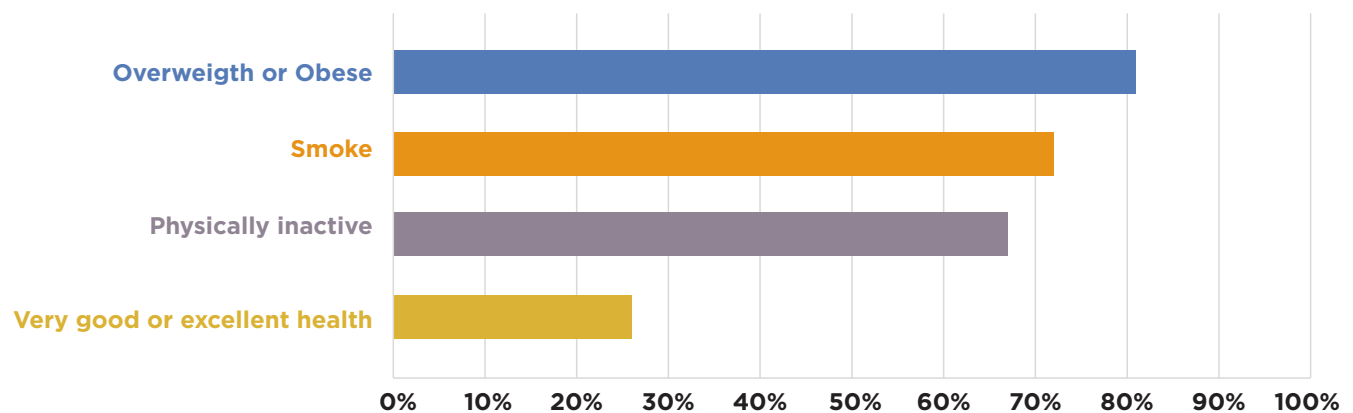


Source: First Nations Food, Nutrition and Environment Study, Results from Saskatchewan (2015)

TYPE-2 DIABETES IN SASKATCHEWAN FIRST NATIONS POPULATION

Type-2 diabetes is a rapidly emerging disease that heavily impacts the health and wellbeing of Indigenous peoples. (2) In 1937, a population-based study did not detect type-2 diabetes among Saskatchewan First Nations population. (9) Since then, incidence of diabetes has steadily increased in Canada, with the highest burden of disease affecting First Nations populations. (2) Estimation of the incidence and prevalence of diabetes among Saskatchewan First Nations population has been challenging due to limited availability of First Nations-specific data on chronic diseases, in particular diabetes. However, the Saskatchewan First Nations Food, Nutrition and Environment Study (FNFNES) reported that the age-standardized prevalence of diabetes for the overall Saskatchewan population and First Nations adult population surveyed in 2015 were 5.3% and 18.1%, respectively. (20) (Figure 6.1) The FNFNES was conducted in Saskatchewan to fill gaps in knowledge about the health of First Nations peoples living in First Nations communities south of the

Figure 6.2: Self-perceived health among First Nations adults in Saskatchewan



Source: *First Nations Food Nutrition and Environment Study (2015)*

60th parallel. (20) One section of the report focused on diabetes and its prevalence among Saskatchewan First Nations adults. Twenty seven percent of FNFNES participants also reported being food insecure, while 10% reported severe food insecurity. (20)

CHALLENGES AND BARRIERS TO CARE

Saskatchewan First Nations population face many challenges and barriers that affect their ability to seek care and to manage their diabetes. Many communities experience a high prevalence of food insecurity, limited access to programs and services and a wide range of social determinants of health issues such as low income, low levels of education and employment, and inadequate housing (refer to the Social Determinants of Health chapter). Other challenges faced by Saskatchewan First Nations population include low retention of healthcare professionals, delayed diabetes diagnosis, and factors associated with colonization such as residential school and intergenerational trauma. (9)

The FNFNES reported that 19% of participants had diabetes; an age-standardized prevalence rate of 18.1%. (20) Of the total participants surveyed (Figure 6.2): 72% smoked, 67% were physically inactive, 81% were overweight or obese, and 26% reported that they were in very good or excellent health. (20)

INCREASING BURDEN OF DIABETES AMONG FIRST NATIONS POPULATION

Although, a number of studies make reference to the increasing burden of diabetes in First Nations

population, only a small body of research is primarily focused on the incidence, prevalence and burden of diabetes in Saskatchewan First Nations population. This section presents key findings from four research studies on the burden of diabetes in: adults, youth and women with gestational diabetes.

ADULTS (20 years and older)

A research study by Jiang, Osgood, Lim, Stang and Dyck, published in 2014, examined the risk of end-stage renal disease (ESRD) among First Nations and non-First Nations adults (20 years and older) with diabetes. (10) This retrospective study used health administrative data to examine the competing risks of ESRD and death without ESRD among Saskatchewan adults with diabetes from 1980 to 2005. Women with gestational diabetes were not included in the study. A limitation identified by these researchers was their inability to distinguish between type-1 and type-2 diabetes among the study populations. (10)

The study found that most non-First Nations adults diagnosed with diabetes were older than 60 years of age, while First Nations adults were much younger at time of diagnosis. Since First Nations individuals were younger than non-First Nations individuals at time of diabetes diagnosis, they were more likely to survive long enough for ESRD to occur. This age-related survival advantage, after a diagnosis of diabetes, also contributed to an elevated risk for ESRD among First Nations individuals with diabetes. The risk of ESRD was 2.66 times higher among First Nations participants than among non-First Nations participants and the risk of ESRD and death without ESRD is higher among males than females.

Some implications from these findings are that First Nations adults are increasingly experiencing onset of type-2 diabetes at a younger age. Among First Nations children, the prevalence of diabetes tripled between 1980 and 2005, which has resulted in offspring of these individuals with diabetes experiencing an even higher risk of developing type-2 diabetes.

Some key recommendations from the researchers include the need to:

- Reinforce prevention and management initiatives for First Nations children and young adults; paying particular attention to diabetes in pregnancy;
- Delay the occurrence of type-2 diabetes, which may in turn reduce the risk of chronic complications and premature death; and
- Address accessibility and quality of diabetes care, which is necessary in order to achieve therapeutic targets for blood glucose level, blood pressure and lipid control.

Adults (18 years and older)

A retrospective study by Thomas et al aimed to identify the severity of chronic kidney disease (CKD) among registered Saskatchewan First Nations adults (18 years and older) and to estimate distance traveled for kidney care. (21) This retrospective cross-sectional study, used data from Saskatchewan's Chronic Kidney Disease Program and the provincial clinical hemodialysis databases. Some limitations of the study, as mentioned by the researchers, were that these databases do not capture data from patients not followed by the chronic kidney health program. Also, there was significant limitation due to missing data, particularly as it related to stages of CKD.

The study found that type-2 diabetes was the leading cause of CKD in Saskatchewan First Nations people and women experienced a higher proportion of CKD burden. First Nations people were also on average 14 years younger and had more severe stages of CKD than non-First Nations people. There were a higher proportion of First Nations people on dialysis and they were more likely than non-First Nations people to travel 200 km or greater to access kidney health services and dialysis. The study showed that First Nations people under-utilized home dialysis treatment; however, the reason for the underutilization of home therapies, such as dialysis is unclear. The researchers did acknowledge the need for further research to identify barriers to providing equitable home services within First Nations communities as those provided to non-First Nations people.

Due to missing data on the stages of CKD, a large number of cases had to be excluded from the analysis. As such, more research is needed to determine contributing factors to the high burden of CKD among Saskatchewan First Nations people, which would in turn help identify opportunities for improved service delivery to these communities.

Some key recommendations from the researchers include the need for:

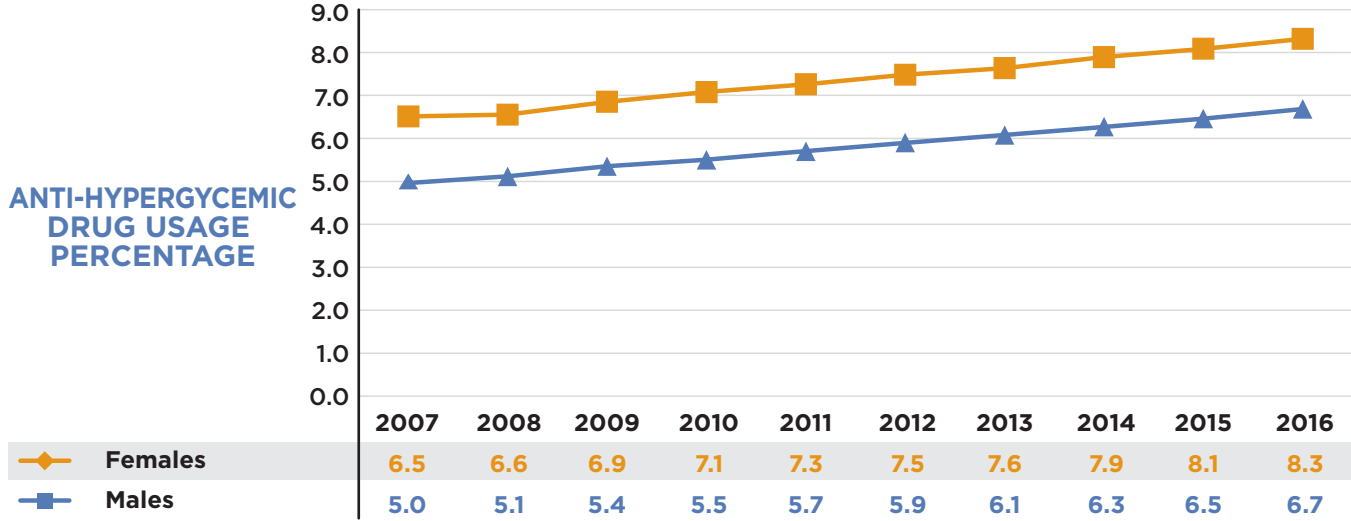
- A pan-Canadian approach to identify potential variations in epidemiological and demographic contributors to CKD between provinces and to identify and address barriers to treatment to ensure that regional differences are considered and addressed;
- Identification of geographical areas in Saskatchewan with the highest need for kidney health services; and
- Improved delivery of kidney health programs, as well as, effective implementation of primary prevention initiatives to delay the onset of type-2 diabetes in First Nations people.

Youth (20 years and under)

Another research study by Dyck, Jiang, and Osgood examined the risk of ESRD and death among First Nations and non-First Nations individuals with youth-onset diabetes. (11) The retrospective cohort study used health administrative data from 1980 to 2005 to examine ESRD and death among youth diagnosed with diabetes before the age of 20. A limitation identified by these researchers was their inability to distinguish between type-1 and type-2 diabetes among the study population. (11)

The key findings from this study were that First Nations youth experienced a tripling in prevalence of diabetes between 1980 and 2005. First Nations individuals with youth-onset diabetes experienced significantly higher rates of ESRD and increased mortality compared to non-First Nations individuals with youth-onset diabetes. Twenty-five years after being diagnosed with diabetes, the cumulative incidence of ESRD was 12.3% for First Nations individuals versus 4.3% for non-First Nations individuals. The risk of ESRD was 2.6 times higher among First Nations individuals compared to non-First Nations individuals with youth-onset diabetes. These adverse outcomes were likely due to increasing age with diabetes diagnosis. Also, First Nations individuals with youth-onset diabetes tended to develop ESRD at slightly younger age than non-First Nations individuals with youth-onset diabetes, but were older at age of death, which might be attributable to differences between the effects of type-1 and type-2 diabetes. Offspring of First Nations youth diagnosed with diabetes were at a higher risk for developing type-2 diabetes.

Figure 6.3: Percentage of anti-hyperglycemic drug usage among First Nations in Saskatchewan by gender, 2007–2016



Source: Non-insured health benefit (NIHB), Indigenous Services Canada

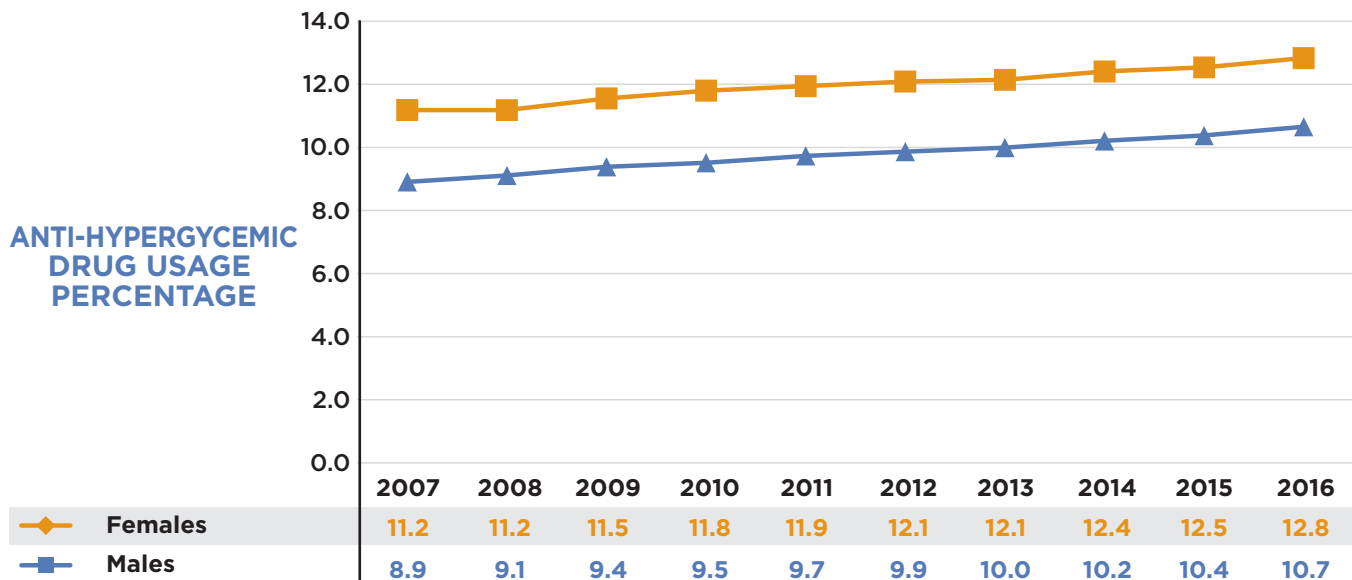
Some of the key recommendations from the researchers, with regards to this study, include the need to:

- Establish effective prevention of diabetes in pregnancy and systematic screening and optimal management of pre-gestational and gestational diabetes to reduce intergenerational risk for type-2 diabetes;
- Identify youth with type-2 diabetes as early as possible through screening programs based on known risk factors and exposure to diabetes in-utero;
- Prevent or slow the progression of diabetic renal disease through smoking prevention and cessation programs and by meeting Diabetes Canada clinical practice guidelines;
- Address accessibility and quality of diabetes care in order to achieve therapeutic targets for blood glucose level, blood pressure and lipid control; and
- Develop a comprehensive strategy to reduce diabetes complication including delaying the onset of type-2 diabetes.

Pregnant Women

The research study by Dyck, Karunanayake, Pahwa, and Osgood examined the relationship between low birth weight (LBW (<2500g)) and high birth weight (HBW (>4000g)), and both type-2 and gestational diabetes. (12) This study was a survival analysis using health administrative data of women from their 2001 study (22) and a small group of women from a 2003 birth weight and ESRD study. (23) These women were then re-identified within a larger maternal cohort, which included all mothers eligible for Saskatchewan Health Benefits between January 1, 1980 to December 31, 2009 and linked with all live births and still born babies delivered during the same period. These mothers and their offspring were followed-up until March 31, 2013 to investigate the relationship between birth weight and time to occurrence of the first episode of gestational diabetes (in female offspring) and time to diagnosis of type-2 diabetes.

Figure 6.4: Percentage of anti-hyperglycemic drug usage among First Nations adults (aged 20 years and older) in Saskatchewan by gender, 2007–2016



Source: Non-Insured Health Benefit (NIHB), Indigenous Services Canada

The key findings from this study were that Saskatchewan First Nations women who were born with HBW were significantly more likely to develop type-2 diabetes than those with normal birth weight (NBW) or LBW when followed for up to 60 years. First Nations mothers born with HBW were also at increased risk of developing gestational diabetes when followed for 40 years or more. Elevated gestational diabetes rates preceded the significant appearance of type-2 diabetes in remote Saskatchewan First Nations communities in the 1990s and increasing HBW rates paralleled rising gestational diabetes and type-2 diabetes incidences over a number of decades. First Nations females with HBW were also more likely than males with HBW to develop type-2 diabetes. The researchers suggested that the inter-generational increase in type-2 diabetes risk mediated through prenatal exposure is a contributing factor to the epidemic of type-2 diabetes among First Nations people. (12)

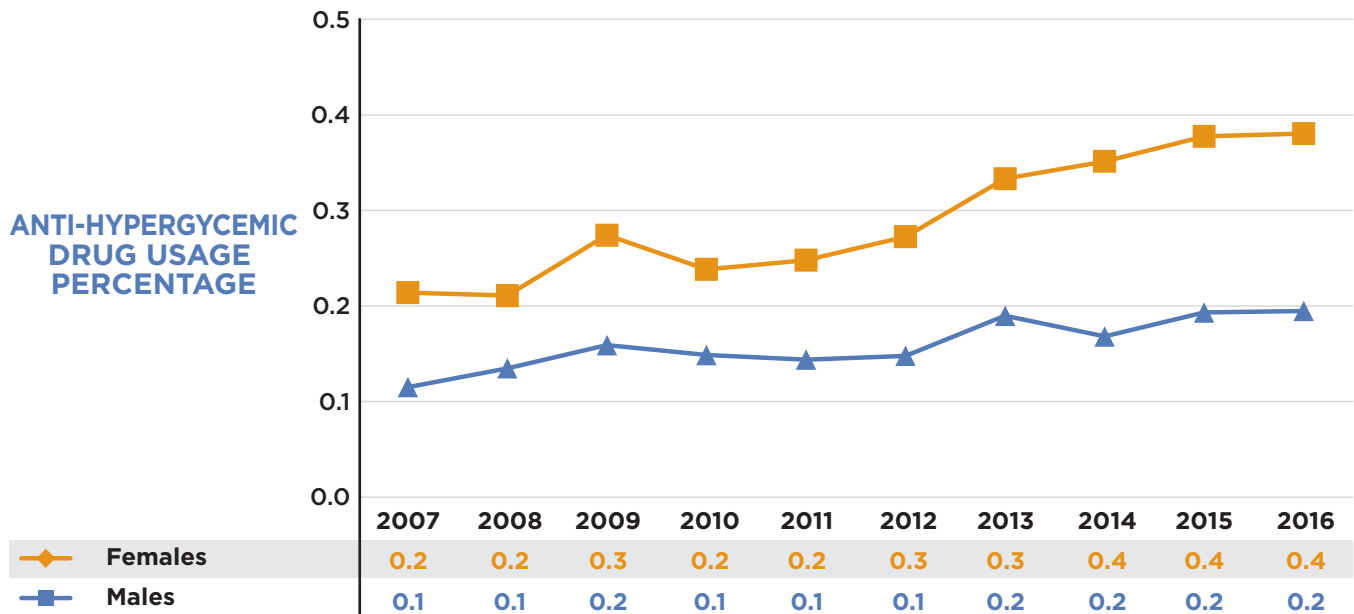
ANTI-HYPERGLYCEMIC DRUGS

Anti-hyperglycemic drugs are used to treat diabetes and are usually provided in addition to lifestyle interventions (diet and exercise) to control blood glucose levels. (6,24) In this section, anti-hyperglycemic drug claims made through the Non-Insured Health Benefit (NIHB) Program is used to calculate the percentage of the registered Saskatchewan First Nations population on anti-hyperglycemic drugs out of the eligible registered Saskatchewan First Nations population. First Nations people registered to bands outside of Saskatchewan were not included in this estimate. Although First Nations people in Saskatchewan are primarily affected by type-2 diabetes, (13) it was difficult to differentiate the type of diabetes a given anti-hyperglycemic drug was prescribed to treat. Therefore, the following estimates do not distinguish between types of usage and conditions being treated.

Anti-hyperglycemic Drug Usage, 2007–2016

Anti-hyperglycemic drug usage among First Nations in Saskatchewan has been steadily increasing since 2007 (Figure 6.3). There was a 28% and 34% increase in anti-hyperglycemic drug usage among females and males, from 2007 to 2016, respectively. The higher percent usage observed among females may in part be attributed to claims made by women with gestational diabetes.

Figure 6.5: Percentage of anti-hyperglycemic drug usage among First Nations youth (aged 19 years and under) in Saskatchewan by gender, 2007–2016



Source: Non-Insured Health Benefit (NIHB), Indigenous Services Canada

Anti-hyperglycemic Drug Usage (≥ 20), 2007–2016

Anti-hyperglycemic drug usage was highest among First Nations adults aged 20 years and older (Figure 6.4). As adults are the population most affected by type-2 diabetes, (18) the majority of these anti-hyperglycemic drug claims were likely prescribed to treat type-2 diabetes.

Anti-hyperglycemic Drug Usage (≤ 19), 2007–2016

Among children and youth aged 19 years and under, the anti-hyperglycemic drug usage among females was generally higher than among males (Figure 6.5). However, this trend of increasing anti-hyperglycemic drug usage was less pronounced among this age group than in the 20 years and over age group as there were less children and youth receiving anti-hyperglycemic drugs through the NIHB program during this period. The trend shows the anti-hyperglycemic drug use ratio for females and males was generally 2:1. This is consistent with the literature, which addresses the disproportionate burden of diabetes experienced by First Nations women. (13,17)

PUBLIC HEALTH IMPLICATIONS

The increasing prevalence of type-2 diabetes among Saskatchewan First Nations population is concerning because of the disproportionate burden of disease within the population. As a number of studies have shown, not only do First Nations individuals living with diabetes need increased contact with health care professionals to manage their condition, they also deal with challenges of limited access to health care professionals, poor housing conditions, food insecurity and other factors related to the social determinants of health. The FNFNES showed that a number of Saskatchewan First Nations communities are dealing with food insecurity. High rates of food insecurity are reported to be an effect of the ongoing shift in dietary consumption that exists today for First Nations people. (17) However, further research is required to better understand the effects of these changes on the care and management of diabetes in Saskatchewan First Nations population.

BATTLE RIVER TREATY 6 HEALTH CENTRE, NORTH BATTLEFORD, A SASKATCHEWAN SUCCESS STORY

The Battle River Treaty 6 Health Centre (BRT6HC) on community Diabetes in Pregnancy (DIP) Program has not always been what it is today; rather it developed over many years. The first in community diabetes in pregnancy care for a BRT6HC community was provided in 1997. The recognition of the need for such a program was identified at this time due to the barriers mothers faced in receiving care outside of community which left many mothers undiagnosed or untreated for gestational diabetes mellitus. The program has grown in the past two decades but continues to have the same goals of empowering mothers to have healthy pregnancies and babies, collaborating with health professionals within the agency and health authority, using best practice evidence from clinical practice guidelines and providing culturally appropriate care. The once modest program has grown to include Community Health Nurses, Diabetes Nurse Educator, Registered Dietitians, Exercise Therapist, and Family Health Workers. All staff provide individual diabetes awareness sessions to address clients unique needs. It is a credit to the BRT6HC agency for recognizing the value of team of different professionals that contribute to managing diabetes in pregnancy.

All visiting health professionals are allowed great flexibility to see clients in situations that best suit their needs that include meeting in community clinics, places of work and home. This reduces some of the potential barriers to receiving individualized care. Internal referrals are addressed to Diabetes Team members. There is an understanding that DIP clients are prioritized due to the short duration of pregnancy as well as the serious complications for mom and baby. The Saskatchewan Health Authority, DIP Program in Saskatoon and local obstetricians are all aware of BRT6HC services and frequent communication through referrals and progress reports have become efficient.

While there are many supports in place for women and their families in the member communities, some women may still not get screened for GDM due to barriers. In an attempt to further improve client care BRT6HC has been working towards offering 50 GM Oral Glucose Tolerance Tests on community to remove barriers. This is only possible by partnering with a physician that shares the same vision for diagnosis and care of DIP.



Image provided courtesy of James Smith Cree Nation

Appendix

Diabetes Methodology

1 Saskatchewan registered First Nations population

- » Registered to a Saskatchewan First Nations living on or off reserve
- » Data Sources:
 - NIHB data cubes (de-identified data)-
 - Anti-hyperglycemic medication
 - Research Studies—uses Saskatchewan Ministry administrative health data:
 - ‘Differential mortality and the excess burden of end-stage renal disease among First Nations people with diabetes mellitus: a competing-risks analysis’, 2014
 - » Incidence and prevalence of diabetes in First Nation adults
 - ‘The long-term risks of end-stage renal disease and mortality among First Nations and non-First Nations people with youth-onset diabetes’, 2014
 - » Incidence and prevalence of diabetes in First Nation children and youth
 - ‘The hefty fetal phenotype hypothesis revisited: high birth weight, type-2 diabetes and gestational diabetes in a Saskatchewan cohort of First Nations and non-First Nations women’, 2017
 - » Survival analysis to determine risk of developing gestational and type-2 diabetes
 - Research Study—uses Saskatchewan’s Chronic Kidney Disease Program and the provincial clinical hemodialysis databases:
 - ‘A retrospective study of chronic kidney disease burden in Saskatchewan’s First Nations people’, 2018
 - » Burden of CKD in First Nations adults

2 Non-First Nations Saskatchewan population

- » Non-First Nations population are non-registered First Nations people who are not included in the Indian Registry
- » Data Sources:
 - Research Studies—uses Saskatchewan Ministry administrative health data:
 - ‘Differential mortality and the excess burden of end-stage renal disease among First Nations people with diabetes mellitus: a competing-risks analysis’, 2014

- » Incidence and prevalence of diabetes in First Nation adults
- ‘The long-term risks of end-stage renal disease and mortality among First Nations and non-First Nations people with youth-onset diabetes’, 2014
 - » Incidence and prevalence of diabetes in First Nation children and youth
- ‘The hefty fetal phenotype hypothesis revisited: high birth weight, type-2 diabetes and gestational diabetes in a Saskatchewan cohort of First Nations and non-First Nations women’, 2017
 - » Survival analysis to determine risk of developing gestational and type-2 diabetes
- » Research Study—uses Saskatchewan’s Chronic Kidney Disease Program and the provincial clinical hemodialysis databases:
 - ‘A retrospective study of chronic kidney disease burden in Saskatchewan’s First Nations people’, 2018
 - Burden of CKD in First Nations adults

Approach to Data Analysis

The percent anti-hyperglycemic drug usage prevalence using NIHB data was calculated as follows:

$$\frac{\text{Number of Saskatchewan region band members who had at least one anti diabetic medication claim in a specific calendar year}}{\text{Total band population in the specified calendar year}} \times 100\%$$

Data Limitations

- Type-1 and -2 diabetes cannot be distinguished for both adults and children.
- NIHB data provided does not distinguish First Nations individuals residing in communities from those residing outside these communities.
- The lack of available recent data and literature on estimates of diabetes incidence in the First Nations population in Saskatchewan is a major gap.
- Drug usage data may be affected by an increase in compliance of patients filling drug prescription, changes in physician prescribing practice, improved access to primary care and many other reasons. Therefore, the interpretation of drug usage numbers should be done with caution.

References

- 1 Diabetes Canada. History of diabetes [Internet]. Ottawa (ON): Diabetes Canada; 2018 [cited 2018 Dec 6]. Available from: www.diabetes.ca/about-diabetes/history-of-diabetes
- 2 Institute of Health Economics. Diabetes care and management in Indigenous populations in Canada: A pan-Canadian policy roundtable [Internet]. Edmonton (AB): IHE; 2017 [cite 6 Dec 2018].
- 3 Harris S, Tompkins J, TeHiwi B. Call to action: A new path for improving diabetes care for Indigenous peoples, a global review. 2017 *Diabetes Res and Clin Pract* 123: 120–133. Available from: doi.org/10.1016/j.diabres.2016.11.022
- 4 Best Practices for the Prevention and Management of Diabetes and Obesity-Related Chronic Disease among Indigenous Peoples in Canada: A Review. Available from: doi.org/10.1016/j.jcid.2015.10.007
- 5 Harris S, Bhattacharyya O, Dyck R, Hayward M, Toth E. Clinical practice guidelines: Type 2 diabetes in Aboriginal peoples. 2013 *Can J Diabetes* 37: S191–S196. DOI: doi.org/10.1016/j.jcid.2013.01.046
- 6 Harper W, Clement M, Goldenberg R, Hanna A, Main A, Retnakaran R et al. Canadian Diabetes Association Clinical Practice Guidelines Expert Committee Clinical practice guidelines: Pharmacologic management of type 2 diabetes. 2013 *Can J Diabetes* 3: S61–S68. Available from: doi.org/10.1016/j.jcid.2013.01.021
- 7 Dyck R, Osgood N, Lin TH, Gao A, Stang MR. Epidemiology of diabetes mellitus among First Nations and non-First Nations adults. *CMAJ*. 2010;182(3):249–256. Available from: doi.org/10.1503/cmaj.090846
- 8 Canadian Diabetes Association. 2015 report on diabetes—driving change [Internet]. Toronto (ON): CDA; 2015 [cited 6 Dec 2018]. Available from: www.diabetes.ca/getmedia/5a7070f0-77ad-41ad-9e95-ec1bc56ebf85/2015-report-on-diabetes-driving-change-english.pdf.aspx
- 9 Canadian Diabetes Association. 2016 Report on diabetes in Saskatchewan [Internet]. Toronto (ON): CDA; 2016 [cited 12 Dec 2018]. Available from: www.diabetes.ca/getmedia/6444750c-931b-4d8d-916f-29b5db73f580/Diabetes-in-SK_FINAL.pdf.aspx
- 10 Jiang Y, Osgood N, Lim HJ, Stang MR, Dyck R. Differential mortality and the excess burden of end-stage renal disease among First Nations people with diabetes mellitus: a competing-risks analysis. 2014 *CMAJ* 186(2):103–109. doi: doi.org/10.1503/cmaj.130721
- 11 Dyck R, Jiang Y, Osgood N. The long-term risks of end-stage renal disease and mortality among First Nations and non-First Nations people with youth-onset diabetes. 2014 *Can J Diabetes* 38(4):237–43. doi: doi.org/10.1016/j.jcid.2014.03.005
- 12 Dyck R, Karunanayake C, Pahwa P, Osgood N. The hefty fetal phenotype hypothesis revisited: high birth weight, type 2 diabetes and gestational diabetes in a Saskatchewan cohort of First Nations and non-First Nations women. 2017 *J Dev Orig Hlth Dis*. doi: doi.org/10.1017/S2040174417000988
- 13 Crowshoe L, Dannenbaum D, Green M, Henderson R, Hayward MN, Toth E. 2018 Clinical practice guidelines: Type 2 diabetes and Indigenous peoples. 2018 *Canadian J Diabetes* 42:S296–S306. Available from: guidelines.diabetes.ca/docs/cpg/Ch38-Type-2-Diabetes-and-Indigenous-Peoples.pdf
- 14 Diabetes Canada. History of diabetes [Internet]. Ottawa (ON): Diabetes Canada; 2018 [cited 2018 Dec 6]. Available from: www.diabetes.ca/about-diabetes/types-of-diabetes
- 15 Government of Canada. Type 2 diabetes [Internet]. Ottawa (ON): Government of Canada; 2018 [cited 2019 Jan 14]. Available from: www.canada.ca/en/public-health/services/diseases/type-2-diabetes.html
- 16 Diabetes Canada. History of diabetes [Internet]. Ottawa (ON): Diabetes Canada; 2018 [cited 2018 Dec 6]. Available from: www.diabetes.ca/diabetes-and-you/living-with-gestational-diabetes
- 17 Diabetes Canada. 2018 Clinical practice guidelines for the prevention and management of diabetes in Canada. 2018 *Can J Diabetes* 42(1):A6–A16.
- 18 First Nations Information Governance Centre. National report of the First Nations regional health survey phase 3: volume 1 [Internet]. Ottawa (ON): FNIGC; 2018 [cited 6 Dec 2018]. Available from: fnigc.ca/sites/default/files/docs/fnigc_rhs_phase_3_national_report_vol_1_en_final_web.pdf
- 19 Statistics Canada. Health Fact Sheets: Diabetes, 2016 [Internet]. Ottawa (ON): Government of Canada; 2017 [cited 2018 Dec 6]. Available from: www150.statcan.gc.ca/n1/pub/82-625-x/2017001/article/54859-eng.htm
- 20 First Nations Food, Nutrition and Environment Study, Results from Saskatchewan 2015 [Internet]. Ottawa (ON): FNFNES; 2018 [cited 6 Dec 2018]. Available from: www.fnfnes.ca/docs/Saskatchewan_Report_Aug_8_2018.pdf

- 21 Thomas D, Huang A, McCarron M, Kappel J, Holden R, Yeates K et al. A retrospective study of chronic kidney disease burden in Saskatchewan's First Nations people. 2018 *Can J Kidney Health Dis* 5:1-13. Available from: doi.org/10.1177/2054358118799689
- 22 Dyck R, Klomp H, Tan L. From 'thrifty genotype' to 'hefty fetal phenotype': the relationship between high birthweight and diabetes in Saskatchewan registered Indians. 2001 *Can J Public Health* 92:340-344.
- 23 Dyck, RF, Klomp, H, Tan, L, Stang, MR. An association of maternal age and birth weight with end stage renal disease in Saskatchewan: sub-analysis of Registered Indians and those with diabetes. 2003 *Am J Neph* 23:395-402.
- 24 Chaudhury A, Duvoor C, Dendi VSR, Kraleti S, Chada A, Ravilla R et al. Clinical review of antidiabetic drugs: Implications for type 2 diabetes mellitus management. 2017 *Frontiers in Endocrinol* 8(6):1-12. doi: doi.org/10.3389/fendo.2017.00006



Indigenous Services
Canada

Services aux
Autochtones Canada

Canada