

SCHOOL-BASED IMMUNIZATION COVERAGE IN NOVA SCOTIA: 2015-2016

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Acknowledgements

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Introduction

Delivery of vaccines via school-based immunization programs is an effective delivery model to reach the adolescent target population. A school-based delivery model provides equal access to immunization for the adolescent population (attending schools) and can reduce disparities in vaccine coverage.

In Nova Scotia, the school based immunization program is the primary method of delivery for the following four publicly funded vaccines:

- Tetanus, Diphtheria, and Acellular Pertussis (Tdap)
- Meningococcal Quadrivalent (Men-C-ACYW)
- Hepatitis B
- Human Papillomavirus (HPV)

The school based immunization program is delivered by Public Health Services to grade seven students within public and private schools as well as students who are home schooled (if known). The program is delivered by community health nurses within First Nations schools on-reserve. The vaccines are administered to both males and females.

Monitoring immunization coverage rates provides important information for Public Health planning and decision making. Immunization coverage rates are a useful indicator of vaccine uptake within populations and of a population's susceptibility to vaccine-preventable diseases. In 2010-2011, based on national targets for vaccine coverage, the Department of Health & Wellness set the following provincial targets for school-based immunization coverage rates:

- Tdap, Men-C-ACYW, Hepatitis B: $\geq 90\%$ coverage
- HPV: $\geq 80\%$ coverage

This report focuses on immunization coverage rates for the school-based program in Nova Scotia for the 2015-2016 school year. Immunization coverage rates found in this report are presented at the provincial level and the management zone level. Coverage rates are presented by vaccine and by dose.

Methodology

The coverage rates calculated for this report reflect the ***proportion of the 2015-2016 grade seven cohort who were immunized in the 2015-2016 school year.***

Immunization coverage rates are calculated as follows:

$$\text{Coverage rate (\%)} = \frac{\text{\# immunized (numerator)}}{\text{\# of students in grade seven (denominator)}} \times 100$$

Numerator:

The number of students in grade seven who received the vaccine between September 1, 2015 and August 31, 2016. Grade level was not available for all immunization records therefore grade seven was estimated based on age at the time of immunization, using a four year age range (11-14). School year was defined as September 1 to August 31 to allow for immunizations administered during the summer months. The numerator data used in this report was extracted from the Application for Notifiable Disease Surveillance (ANDS) and the Application for Notifiable Disease and Immunization (ANDI). All school-based immunizations delivered by Public Health are entered into ANDS or ANDI. Any notifications (e.g. reciprocal forms) that are received for immunizations delivered by other health care providers are also entered into ANDS or ANDI by Public Health.

For multi-dose vaccines, if dose 1 occurred prior to the year of interest the records for that individual were excluded so that dose 2 is not erroneously counted as dose 1. Any records identified as home schooled were excluded because they are not reflected in the denominator.

Denominator:

The number of students enrolled in grade seven as of September 30, 2015 (excluding home-schooled children). This includes all students enrolled, and may include individuals who did not require the immunization at the time of the program delivery (if they had already received the dose previously from a physician or outside of the province, etc.). The data on grade seven enrolment for the school-based program come from the Nova Scotia Department of Education and Early Childhood Development and from the First Nations communities.

For vaccines with multi-dose schedules (HPV and Hepatitis B), coverage is calculated for each valid dose and for the full series. Descriptions for valid doses are presented below (Table 1).

Table 1: Description of valid doses for HPV and Hepatitis B vaccines

HPV & Hepatitis B Valid Dose Criteria	
Dose 1	# of students who received a dose of the vaccine in the specified school year.
Dose 2	# of students who received a second dose of the vaccine ≥168 days after the first dose, in the specified school year.

Adverse Events Following Immunization (AEFI):

The number of adverse events following immunization (AEFI) related to school-based immunizations are presented in the report. The AEFI data were extracted from ANDS and ANDI.

Limitations

Coverage rates presented in this report reflect the *proportion of the grade seven cohort immunized during the 2015-2016 school year, not the proportion of the grade seven cohort who have up to date coverage of the four school-based vaccines.*

- A National standard for coverage reporting is to report on up-to-date coverage at 17 years. Given that ANDS was launched in 2008, there is currently insufficient data on childhood immunizations in ANDS to achieve this. For birth cohorts born after 2008 the goal would be to follow the National standard.
- For grade seven students who miss a dose during the given school year the timing of administration of the missing dose varies across the province. In Western, Northern, and Eastern Zones missed doses are often able to be administered prior to the subsequent school year (by August 31st). However, in Central zone missed doses are typically administered in the following school year (during grade 8). The potential impacts on the coverage rates are:
 - For single dose vaccines: By using the age range (11-14) to estimate grade 7, single dose vaccines administered in grade 8 are potentially counted in the numerator contributing to overestimated coverage rates. This has the greatest potential impact for Central zone.
 - For multi-dose vaccines: If a student starts the series in the year of interest, but receives the second dose in the subsequent school year, only the first dose is counted. This results in lower coverage rates for complete series during the current school year. This has the greatest potential impact for Central Zone.

The numbers of students immunized within the school based program are extracted from ANDS and ANDI for this report. Immunizations by providers other than Public Health are included if notifications have been received by Public Health and entered into ANDS or ANDI. Notifications that are not received by Public Health and/or not entered into ANDS or ANDI, will result in lower coverage rates. However, given that the school-based vaccines are delivered primarily by Public Health the potential impact of this is thought to be minimal.

Denominator data (the number of students) was based on September enrolment. By using September enrolment, the movement of students between zones could potentially result in a student immunization being counted in a particular zone, but that student being reflected in the denominator of another zone. This will impact zone-level coverage rates however, provincial coverage rates are not impacted by this potential limitation.

Use of the September enrolment data also assumes that all students who are enrolled in grade seven in the current school year are eligible for immunization. Students who were immunized in a previous school year (e.g. Hepatitis B for travel) have not been removed from the denominator potentially contributing to lower reported coverage rates.

By estimating grade level based on a four year age group the potential exists to capture immunizations for students who may not be captured in the denominator (e.g. grade 8 students – described above). This could potentially inflate the coverage rates.

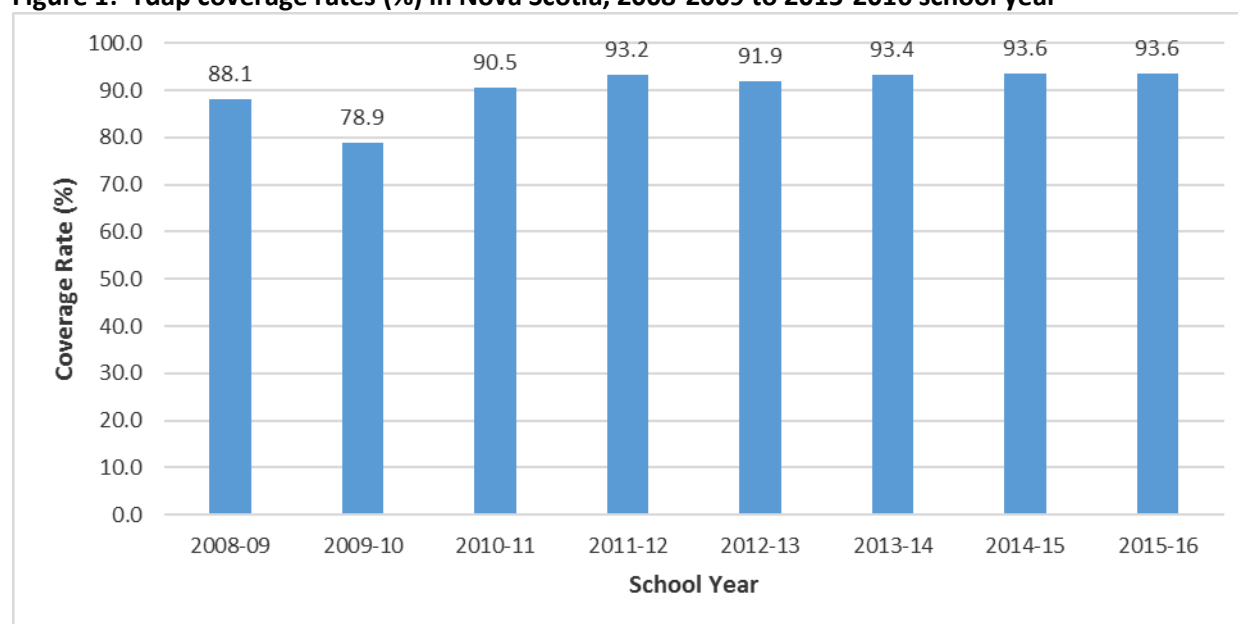
Records identified as home schooled were excluded from the numerator because they are not reflected in the denominator due to a lack of accurate data on the total number of home-schooled children in Nova Scotia. However, records that are missing school information are included resulting in the potential for some home-schooled records to be included and coverage rate estimates to be higher.

Tetanus, Diphtheria, and Acellular Pertussis (Tdap)

The Tdap vaccine is administered as a single dose and protects against Tetanus, Diphtheria, and Pertussis (Whooping Cough). There have been no cases of Diphtheria in Nova Scotia in over a decade and only one case of Tetanus in the past five years. The province continues to see pertussis cases each year. Over the past 2 years (2015 and 2016) there was a total of 175 cases (rate of 11.7 per 100,000) which is high in comparison to the previous four years (2011-2014: n=40, rate of 1.3 per 100,000).

Coverage rates for Tdap vaccine are presented below (Figure 1 and Table 2). For the 2015-2016 school year the provincial coverage rate was **93.6 %**. This is similar to previous years and is above the provincial target of 90 percent. Over the past 8 school years (2008-2009 to 2015-2016) Tdap coverage has ranged between 78.9 % and 93.6 %.

Figure 1: Tdap coverage rates (%) in Nova Scotia, 2008-2009 to 2015-2016 school year*



*Between the 2008-2009 and 2012-2013 school years the immunization schedule varied as follows: 2008-2009: grade 7 and 14-16 year olds, 2009-2010: grade 10, 2010-2011: grades 7&8, 2011-2012 and beyond: grade 7. The 2008-2009 NS coverage rate does not include data from Eastern zone because the 14-16 year old cohort were immunized in the 2007-2008 school year and therefore not captured in this analysis.

During the reporting period Tdap coverage rates ranged from 88.8 % (Eastern Zone) to 95.5 % (Northern Zone) across the health authority (Table 2).

Table 2: Tdap coverage rates (%) by Zone, 2015-2016

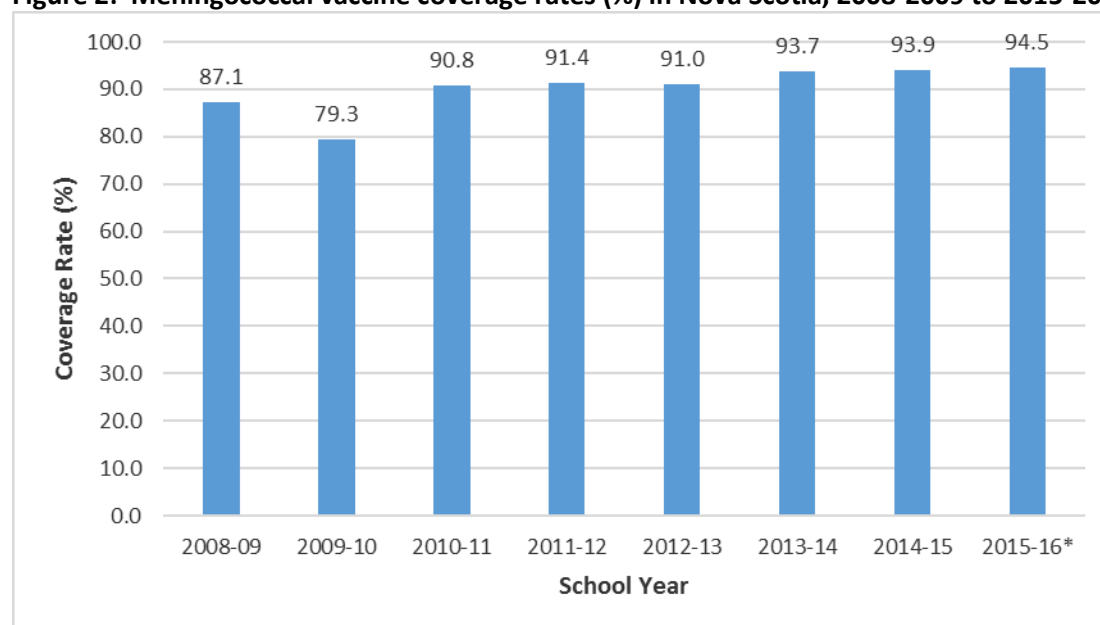
ZONE	Coverage Rate (%)
1-Western	92.0
2-Northern	95.5
3-Eastern	88.8
4-Central	95.4
NS	93.6

Meningococcal Quadrivalent (Men-C-ACYW)

The 2015-2016 school year was the first year for the Meningococcal quadrivalent vaccine. It is administered as a single dose and protects against illness caused by serogroups A, C, Y, and W-135 of the bacteria, *Neisseria meningitides*. The previous vaccine only provided protection against serogroup C. In 2015 and 2016 there were 11 cases of Invasive Meningococcal Disease. Five of these cases were serogroup B, five were serogroup Y, and one was serogroup W-135.

Coverage rates for Meningococcal vaccine are presented in Figure 2 and Table 3. For the 2015-2016 school year the provincial coverage rate was 94.5 %. This is similar to previous years and is above the provincial target of 90 %. Over the past 8 school years (2008-2009 to 2015-2016) Meningococcal vaccine coverage ranged between 79.3 % and 94.5 %.

Figure 2: Meningococcal vaccine coverage rates (%) in Nova Scotia, 2008-2009 to 2015-2016*



*Between the 2008-2009 and 2012-2013 school years the immunization schedule varied as follows: 2008-2009: 14-16 year olds, 2009-2010: grade 10, 2010-2011 and beyond: grade 7. The 2008-2009 NS coverage rate does not include data from Eastern zone because the 14-16 year old cohort were immunized in the 2007-2008 school year and therefore not captured in this analysis. In the 2015-2016 school year the vaccine changed from Men-C-C to Men-C-ACYW.

Across the health authority coverage rates ranged from 90.7 % (Eastern Zone) to 97.0 % (Northern Zone) during the reporting period (Table 3). The ninety percent target was achieved in all zones.

Table 3: Men-C-ACYW coverage rates by Zone, 2015-2016

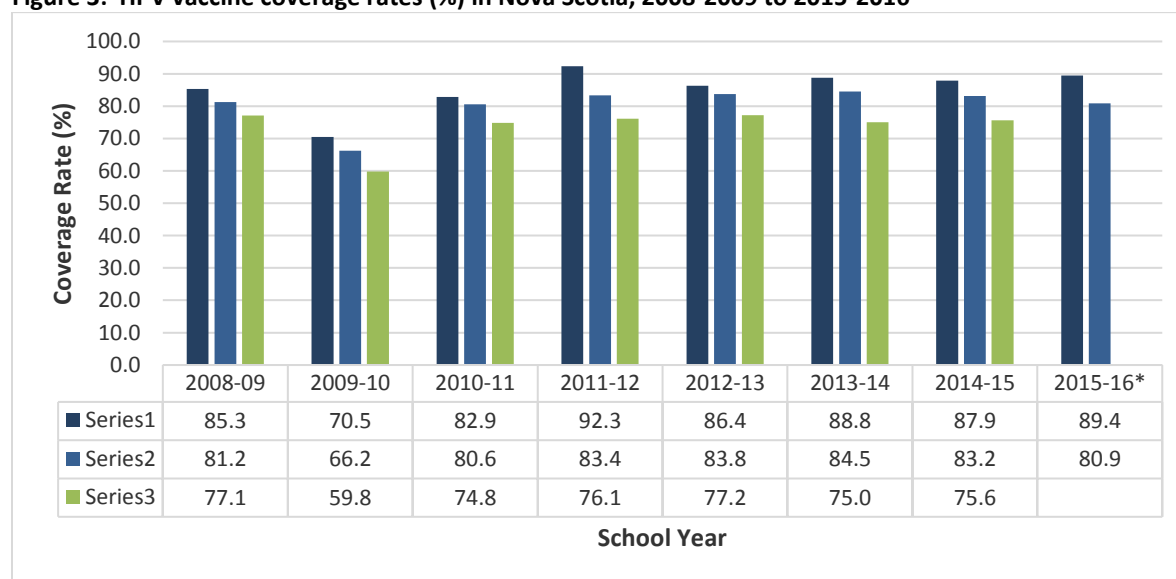
ZONE	Coverage Rate (%)
1-Western	92.8
2-Northern	97.0
3-Eastern	90.7
4-Central	95.6
NS	94.5

Human Papillomavirus (HPV)

Human Papillomavirus (HPV) vaccine protects against HPV, a common sexually transmitted infection. The vaccine protects against the most common types of HPV that infect the genital area, including the 2 types of HPV that cause 70 % of cervical cancer. HPV infection is not a notifiable disease in Nova Scotia (or Canada), however greater than 70 % of sexually active Canadians are estimated to have a sexually transmitted HPV infection at some point in their lives¹. The HPV vaccine was introduced into the school-based immunization program in the 2007-2008 school year for females as a series of three doses for female students. The 2015-2016 school year was the first year the vaccine was provided to both male and female students. It was also the first year the vaccine was provided as a two dose series.

Coverage rates per dose for HPV vaccine are presented in Figure 3 and Table 4. Coverage rates decreased for each dose. For the 2015-2016 school year the provincial coverage rate for the complete series (2 doses) was **80.9 %**. This is higher than previous years coverage with 3 doses and meets the provincial target of 80 percent. Over the past 8 school years (2008-2009 to 2015-2016) full HPV coverage (completed the series) ranged between 59.8 % and 80.9%.

Figure 3: HPV vaccine coverage rates (%) in Nova Scotia, 2008-2009 to 2015-2016*



*Between the 2008-2009 and 2015-2016 school years the immunization schedule varied as follows: 2008-2009: grade 7 (females, 3 doses) ; 2009-2010: grade 10 (females, 3 doses) ; 2010-2011: grades 7&8 (females, 3 doses); 2011-2012 to 2014-2015: grade 7 (females, 3 doses); 2015-2016: (females and males, 2 doses)

Across the health authority, coverage rates (for the full series) ranged from 77.3 % (Western Zone) to 85.7 % (Northern Zone) during the reporting period (Table 4). Two zones (Northern & Central) achieved the 80% target.

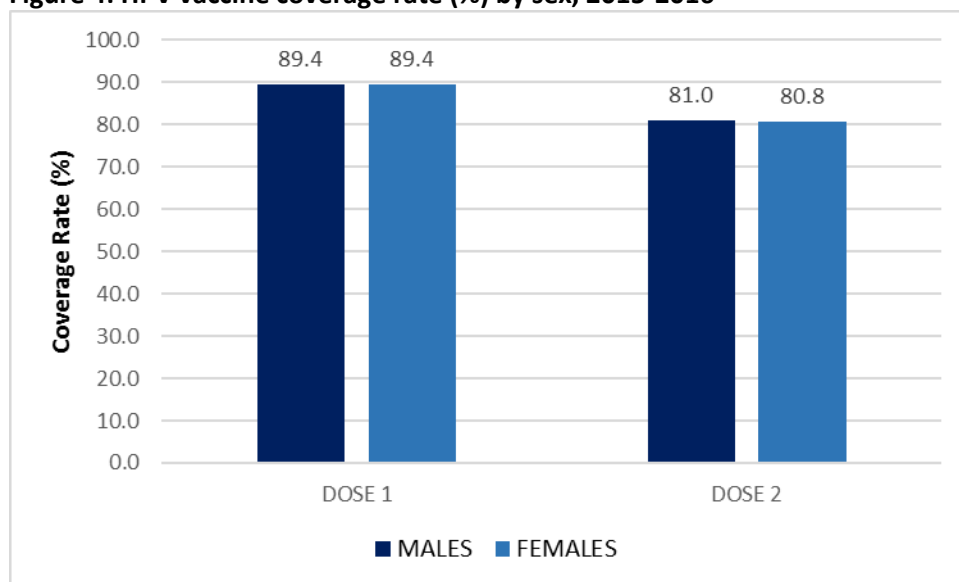
Table 4: HPV coverage rates (%) by Zone, 2015-2016

ZONE	Coverage Rate (%)
1-Western	77.3
2-Northern	85.7
3-Eastern	79.4
4-Central	81.3
NS	80.9

¹<http://www.phac-aspc.gc.ca/std-mts/hpv-vph/fact-faits-eng.php#sm>

As described above, the 2015-2016 school year was the first year the vaccine was provided to both male and female students. There were no differences in coverage rates for males and females (Figure 4).

Figure 4: HPV vaccine coverage rate (%) by sex, 2015-2016

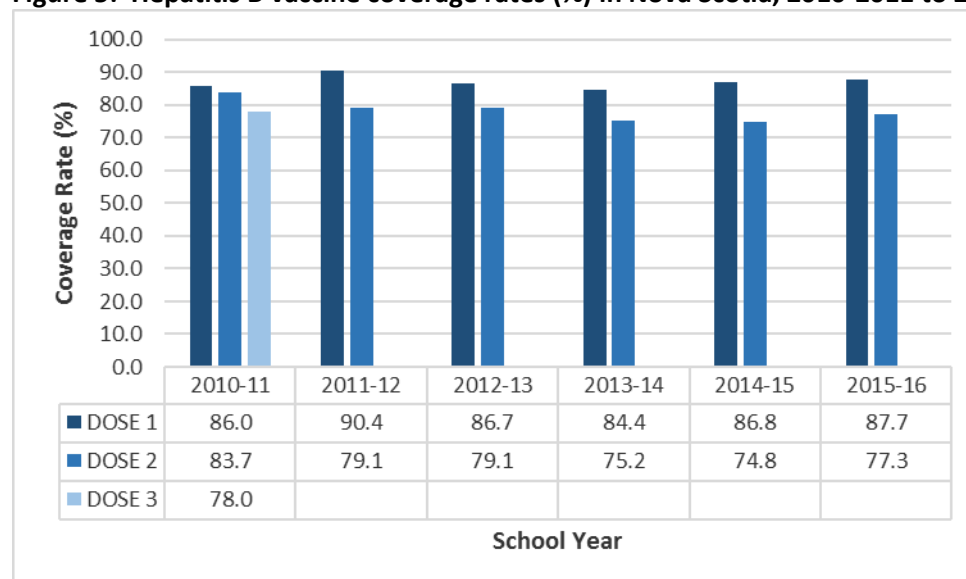


Hepatitis B

Hepatitis B vaccine is administered in the school program as a series of two doses and protects against the Hepatitis B virus. Hepatitis B is caused by contact with the blood or body fluids of someone who is infected. The annual rate of acute Hepatitis B infection in Nova Scotia is low. Over the past 5 years there has been an average of approximately 5 cases per year.

Coverage rates per dose for Hepatitis B vaccine are presented in Figure 5 and Table 5. Coverage rates for the complete series are lower than the rates for the first dose. For the 2015-2016 school year the provincial coverage rate for the complete series was 77.3 %. This is similar to previous years and is below the provincial target of 90 percent. Over the past 5 school years (2012-2013 to 2015-2016) the coverage rate for the complete series of Hepatitis B vaccine ranged between 74.8 % and 79.1 %.

Figure 5: Hepatitis B vaccine coverage rates (%) in Nova Scotia, 2010-2011 to 2015-2016*



*In the 2010-2011 school year Hepatitis B vaccine was administered as 3 doses of pediatric formulation (due to a global shortage of adult formulate). In the subsequent years it was administered as 2 doses of adult formulation.

Hepatitis B vaccine coverage rates by Zone are presented in Table 5. Full coverage (complete doses) rates ranged from 75.2 % (Western) to 84.3 % (Northern) across the health authority. None of the zones achieved the 90% target rate.

Table 5: Hepatitis B coverage rates (%) by Zone, 2015-2016

ZONE	Coverage Rate (%)
1-Western	75.2
2-Northern	84.3
3-Eastern	78.2
4-Central	75.5
NS	77.3

Adverse Events Following Immunization

An adverse event following immunization (AEFI) is any untoward medical occurrence which follows immunization and which does not necessarily have a causal relationship with the vaccine. The Public Health Agency of Canada (PHAC) collects and monitors data on Adverse Events Following Immunization (AEFI) to identify potential concerns regarding vaccine safety.

During the 2015-2016 school year, there were 3 AEFIs that met the criteria for reporting to PHAC. Based on the classifications described in the Nova Scotia Immunization Manual (<http://novascotia.ca/dhw/cdpc/documents/immunization-manual.pdf>), the 3 AEFIs were classified as follows:

Classification	Total # Reported	Sub-classification
Local Reaction	1	Cellulitis
Systemic Reaction	1	Rash
Unknown	1	

There were no hospitalizations or deaths associated with the AEFIs.

Discussion

Coverage rates presented in this report are based on immunizations administered within a given school year. As such they reflect the *proportion of the grade seven cohort immunized in that given school year*, rather than the proportion of the grade seven cohort who have up-to-date coverage of the four school-based vaccines. Methods to estimate up-to-date coverage by age will continue to be explored for future reporting.

Immunization targets were achieved for Tdap, Men-C-ACYW, and HPV in the 2015-2016 school year, but the target was not achieved for Hepatitis B.

Factors that potentially could have had an impact on the immunization coverage rates presented in the report, are described below:

- Hepatitis B vaccine is administered as part of non-publicly funded travel-related immunizations by providers other than Public Health. If Public Health was not notified of these immunizations or if these immunizations did not occur in the 2015-2016 school year they would not have been captured in these analyses. Also, students who have been immunized outside of the current school year cannot be removed from the denominator because the denominator data (grade seven enrolment) is in aggregate form. As a result, Hepatitis B coverage in the current school year likely underestimates the proportion of grade seven students protected against Hepatitis B.
- For single dose vaccines, coverage estimates may overestimate the proportion of grade seven students immunized in the current school year because missed doses given to grade eight students are potentially captured due to the age range used to estimate grade.
- For multi-dose vaccines if a student misses the last dose they may not complete the series until the following school year (e.g. when they are in grade 8) and not be captured in the data for the report, resulting in lower coverage rates for completing the full HPV or Hepatitis B series.

Currently, the existing provincial applications, ANDS and ANDI, are being replaced by Panorama. Panorama will enhance the quality of the data available for reporting immunization coverage and will help to address the denominator data issue described above.

Between 2010-2011 and 2015-2016 coverage rates for the school-based program were consistent. Rates were lowest in the 2009-2010 school year. In 2009-2010 the school-based program was delivered to grade ten students due to the Public Health response to H1N1. Lower coverage rates for 2009-2010 could be due to lower uptake among older students and/or lower uptake due to the focus on H1N1 immunization.

Appendix – Number of Immunizations & Students Enrolled (2015-2016)

ZONE		TDAP	MEN-C-ACYW-135	Vaccine		DOSE 1	DOSE 2
				HBV			
WESTERN	# Immunized	1938	1956	1796	1584	1799	1629
	# Eligible	2107	2107	2107	2107	2107	2107
	% Coverage	92.0	92.8	85.2	75.2	85.4	77.3
	95 % CI	90.8-93.1	91.7-93.9	93.7-86.7	73.3-77.0	83.8-86.8	75.5-79.1
NORTHERN	# Immunized	1621	1647	1553	1432	1543	1456
	# Eligible	1698	1698	1698	1698	1698	1698
	% Coverage	95.5	97.0	91.5	84.3	90.9	85.7
	95 % CI	94.4-96.4	96.1-97.7	90.1-92.7	92.0-94.4	89.4-92.2	84.0-87.3
EASTERN	# Immunized	1551	1584	1513	1365	1517	1387
	# Eligible	1746	1746	1746	1746	1746	1746
	% Coverage	88.8	90.7	86.7	78.2	86.9	79.4
	95 % CI	87.3-90.2	89.3-92.0	85.0-88.2	76.2-80.1	85.2-88.4	77.5-81.3
CENTRAL	# Immunized	4487	4497	4123	3548	4311	3822
	# Eligible	4702	4702	4702	4702	4702	4702
	% Coverage	95.4	95.6	87.7	75.5	91.7	81.3
	95 % CI	94.8-96.0	95.0-96.2	86.7-88.6	74.2-76.7	90.9-92.4	80.1-82.4
NS	# Immunized	9597	9685	8987	7929	9170	8294
	# Eligible	10253	10253	10253	10253	10253	10253
	% Coverage	93.6	94.5	87.7	77.3	89.4	80.9
	95 % CI	93.1-94.1	94.0-94.9	87.0-88.3	76.5-78.1	88.8-90.0	80.1-81.6