Highlights

- In 2024, 830,611 doses of publicly funded vaccine were reported as administered in Nova Scotia. About two thirds of these were influenza vaccines (35.0%) or COVID-19 vaccines (31.7%).
- Sixty-one adverse events following immunization (AEFI) were reported in 2024 – a rate of 7.3 per 100,000 doses administered. The majority of these were classified as non-serious (52 AEFIs, 85%).
- Individuals aged 2–17 years old had the highest age-specific AEFI reporting rate, all of which were non-serious (14 reports; 13.2 per 100,000 doses).
- AEFIs were reported by a variety of sources, including physicians and nurse practitioners (39%), pharmacists (18.0%), public health (13.1%), hospitals (9.8%) and other sources (19.7%).
- Of nine serious AEFI reports in 2024, all 9 reported neurologic and 'other' reactions and 3 also reported allergic reactions (33.3%).

Background

Vaccines, including all publicly funded vaccines[1] (PFVs) used in Nova Scotia, are rigorously tested and monitored to ensure they are safe and effective. However, as with all medical products, side effects may occur. Most are mild and self-limiting, and serious reactions are rare. Monitoring these events helps ensure that the benefits of immunization continue to outweigh the risks.

An adverse event following immunization (AEFI) is any unexpected medical occurrence that happens after a vaccine is administered. The clinical characteristics of the reaction and its timing relative to vaccination(s) are considered when classifying an event as an AEFI. Not all reported AEFIs are necessarily caused by the vaccine but may be classified as an AEFI solely based on their timing in relation to the vaccine, rather than a confirmed causal link.

Surveillance of AEFIs is important to maintain vaccine safety and uphold public confidence. To enable the early detection of safety concerns, Canadian and international standards require adverse events to be reported. The World Health Organization (WHO) categorizes AEFI by frequency, ranging from *very rare* (occurring in fewer than 1 per 100, 000 doses) to *very common* (more than 1 per 10 doses).[2] An effective surveillance system should be capable of detecting both common and rare events, including those that are serious.

[1] See Appendix A for Nova Scotia's list of publicly funded vaccines (PFVs) from 2019-2024 and their abbreviations

[2] World Health Organization. (2014). *Global manual on surveillance of adverse events following immunization* (Revised March 2016). Table 3: Frequency of occurrence of reported adverse reactions. Geneva: WHO. ISBN: 978-92-4-150776-9.

In Nova Scotia, AEFI surveillance is governed by the *Health Protection Act*.[3] The surveillance system is designed to monitor the safety of vaccines administered in the province, detect concerns requiring rapid investigation or intervention, and identify risk factors for adverse events. Immunization providers are required to report AEFI to local public health. Reports may also come from patients or the public. After a local public health investigation into each report, the Regional Medical Officer of Health determines whether they meet the criteria for AEFI that is reportable to the Department of Health and Wellness. Eligible AEFIs are reported by DHW to the Public Health Agency of Canada (PHAC), supporting national monitoring. DHW also analyzes AEFI reports and summarises them in this annual report. Figure 1 illustrates the AEFI reporting and review process.

The purpose of this annual report is to describe AEFI trends in Nova Scotia from 2019 to 2024, with a focus on 2024, in order to provide insight into the safety profile of PFVs, support accountability, and strengthen engagement with the surveillance system among reporting partners.

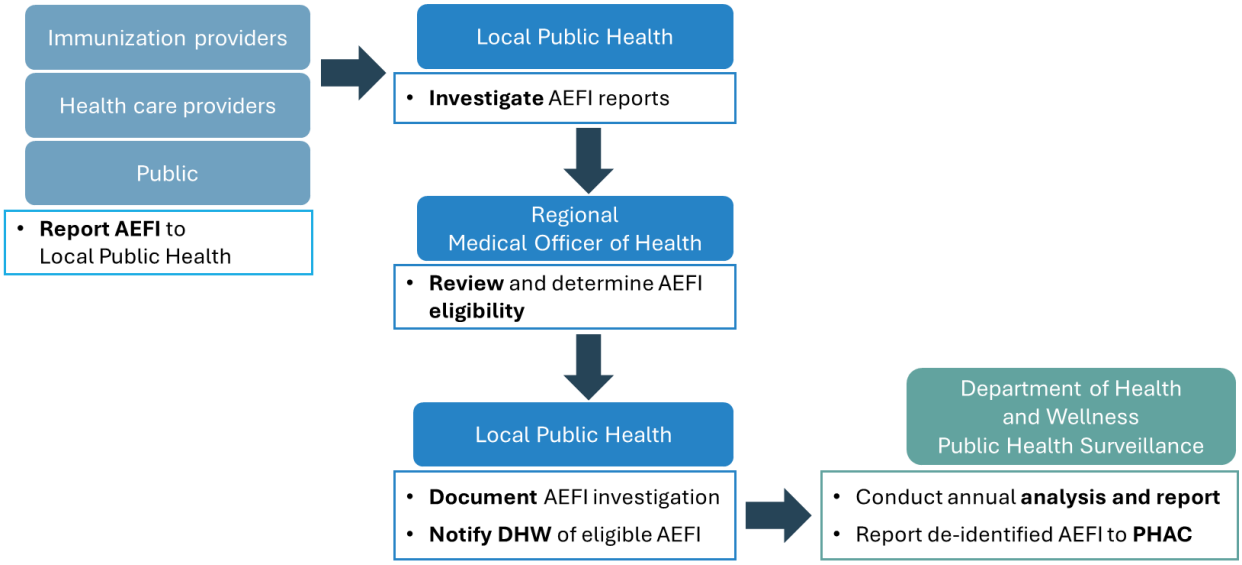


Figure 1: Overview of AEFI surveillance process in Nova Scotia

Note on changing immunization schedules

In 2024, there were 27 PFVs in NS. As the provincial PFV program evolves, changes to the immunization schedule during the report period should be considered when interpreting AEFI data. Between 2019 and 2024, new vaccines were introduced (COVID-19, mpox); existing programs were expanded (meningococcal B, enhanced influenza, measles); and eligibility for some vaccines was reduced (*Haemophilus influenza* type b).[4] As vaccine offerings and eligibility criteria change over time, AEFI reporting rates and patterns may shift. These changes may not reflect changes in the underlying risk of AEFI and should be considered when interpreting trends across years.

[3] Nova Scoria Health Protection Act. Amended 2024. Available from the Nova Scotia Department of Health and Wellness: https://novascotia.ca/dhw/cdpc/acts-and-legislation.asp
[4] See Appendix B for a detailed list of PFV changes between 2019 and 2024.

Methodology

Data sources and inclusion criteria

Data for this report were obtained from Panorama, Nova Scotia's provincial public health information system, which contains reported immunization records and AEFIs. Immunization data in Panorama are integrated from multiple settings:

- Public Health: vaccinations are entered directly into Panorama.
- Pharmacies: PFVs administered in pharmacies are recorded in CANImmunize or the Drug Information System (DIS) and uploaded to Panorama in near real time.
- Primary Healthcare Providers: records from primary care electronic medical record (EMR) systems are transferred to Panorama monthly. Some primary healthcare providers continue to report immunizations on a paper reciprocal form which is sent to Public Health for manual entry into Panorama.
- Long-term care: Vaccinations are documented in CANImmunize
- Hospitals: Some units document vaccinations in CANImmunize; others use paper reciprocals that are submitted to public health for manual entry into Panorama

The analysis includes all AEFIs reported following the administration of a vaccine on the list of PFVs between January 1, 2019, to and December 31, 2024. Vaccines not publicly funded during this period were excluded; those with changing funding status were included only for the years in which they were publicly funded. AEFIs were included if they met provincial reporting criteria and followed a vaccine that was administered in Nova Scotia and is on the PFV list, regardless of the recipient's residency or whether the dose was publicly or privately purchased.

AEFI reports were linked to immunization records within Panorama. Serious AEFI were validated through manual review of report forms, with discrepancies resolved in consultation with Nova Scotia Health, which leads AEFI investigations.

AEFI classification

AEFIs were classified as **serious** if they were life-threatening, resulted in death, required hospitalization or prolonged an existing hospitalization, caused residual disability, or were associated with congenital malformation. **Non-serious AEFI** met reporting criteria but did not meet the threshold for serious.

Analysis

AEFI reporting **rates** were calculated per 100,000 doses administered. The **numerator** was the number of AEFI reports in Panorama. Because some AEFIs occur after the administration of multiple vaccines at or near the same time, each AEFI was attributed to all relevant vaccines for vaccine-specific analysis. For overall analyses, each AEFI was counted only once. The **denominator** was the number of PFV doses administered, as recorded in Panorama. Each dose was counted

separately, even if administered to the same individual on the same date. Stratified analyses used the number of doses administered within each relevant subgroup.

AEFI counts and rates were summarized by:

- Seriousness - serious vs. non-serious
- Age group - <2 years, 2–17 years, 18–64 years, ≥65 years
- Vaccine agent - including standard-dose, high-dose, and enhanced dose for influenza
- Nova Scotia Health Administration Zone - inferred from service delivery location if missing; unknowns reported separately
- Reporting source - e.g., public health, pharmacy, primary care
- AEFI category – allergic, local, neurologic, other, per national AEFI reporting guideline
- AEFI reaction type - for serious AEFI only

Panorama is a real-time surveillance system; historical data reported here are expected to vary slightly from previous reports.

Categorization of AEFIs following COVID-19 vaccination

Due to the widespread uptake and heightened public attention surrounding COVID-19 vaccines, many AEFIs were reported following these vaccinations. To support year-over-year comparability, AEFIs following COVID-19 vaccination (December 1, 2020, to December 31, 2024) were described separately in this report. All other AEFIs (January 1, 2018, to December 31, 2024) were aggregated as non-COVID-19 vaccine AEFIs. AEFIs where COVID-19 vaccines and non-COVID-19 PFVs were administered in close succession were included in both categories.

Limitations

In Nova Scotia, immunization reporting by providers is not mandatory, although it is strongly encouraged. In the absence of a comprehensive immunization registry, Panorama records likely underestimate the number of doses administered. This underestimated denominator may result in inflated AEFI rates.

In addition, only AEFIs recorded in Panorama are included in this report. Passive surveillance systems are subject to reporting biases — including underreporting of non-serious AEFIs and variability in reporting that reflects factors such as provider practices, levels of public awareness, and heightened vigilance and robust safety monitoring amongst children under 2 years old. These limitations may affect the completeness and consistency of the data and should be considered when interpreting AEFI rates and trends.

Summary of AEFI in Nova Scotia, 2019-2024

Overview

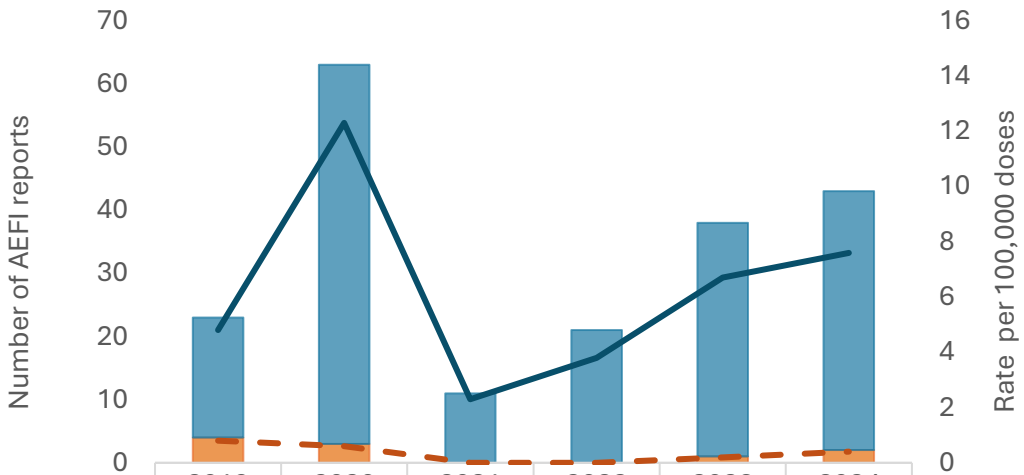
A total of 830,611 doses of publicly funded vaccines (PFVs) were administered in Nova Scotia in 2024, covering 27 different vaccine agents. During this period, 61 AEFI were reported – a rate of 7.3 per 100,000 doses administered, following 84 vaccine administrations involving 18 different vaccine agents. Of these, 18 occurred following COVID-19 vaccine only, 38 followed non-COVID-19 vaccine(s) only, and 5 followed instances in which COVID-19 and non-COVID-19 vaccines were given at or around the same time. Because these 5 AEFI were counted in both the non-COVID-19 and COVID-19 categories, the sum of AEFI reports in these two categories exceeds the total number of AEFI reports.

Of the 61 reported AEFI, 9 were serious (14.8%, 1.1 per 100,000 doses).

AEFI reports following non-COVID-19 vaccines

In 2024, 43 AEFI were reported following immunization from a non-COVID-19 vaccine (7.6 per 100,000 doses) (Figure 1). Reports of serious AEFI were very rare, with <1 report per 100,000 doses (n=2, 0.4 per 100,000 doses).

Analysis of the trend over the last 5 years showed the AEFI reporting rate more than doubled from 2019 to 2020 (4.8 to 12.3 per 100,000 doses). While there is no clear explanation for this single-year increase, the majority of these AEFIs were reported following influenza quadrivalent vaccine (n=50, 83.3%) and serious AEFIs remained very rare (n=2, 0.4 per 100,000 doses). After a sharp decrease from 2020 to 2021, the annual rate of AEFI reports increased between 2021 and 2024. Given the small number of AEFI reports each year, even minor fluctuations can substantially impact the calculated AEFI reporting rate. Ongoing monitoring will be important to interpret this trend. Reports of serious AEFI have remained very rare during this period.



	2019	2020	2021	2022	2023	2024
Total AEFI	23	63	11	21	38	43
Non-serious AEFI	19	60	11	21	37	41
Serious AEFI	4	3	0	0	1	2
AEFI rate	4.8	12.3	2.3	3.8	6.7	7.6
Serious AEFI rate	0.8	0.6	0	0	0.2	0.4

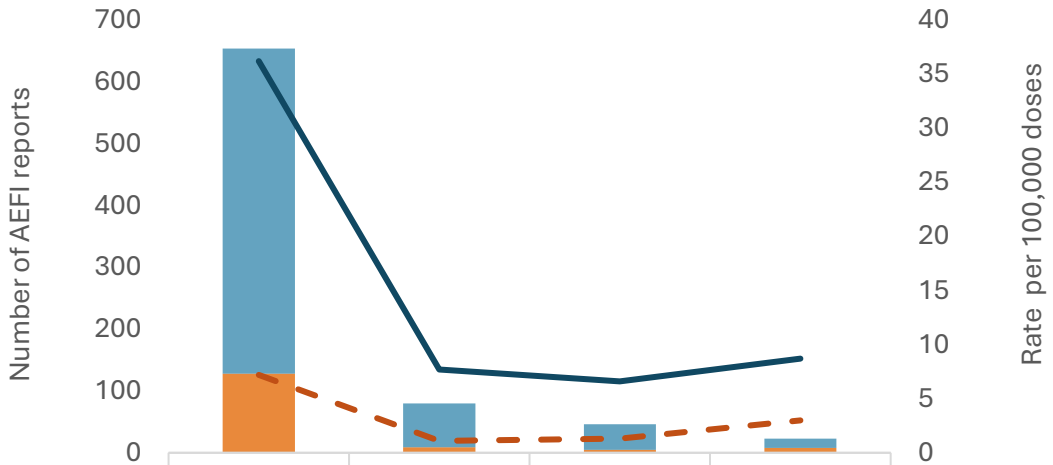
Figure 2: Number and rate of AEFI following non-COVID-19 vaccinations in Nova Scotia, 2019 - 2024.

AEFI reports following COVID-19 vaccines

Almost a third (31.7%) of all vaccine doses administered in 2024 were COVID-19 vaccines (263,696 doses). During this time, 23 AEFIs were reported following COVID-19 vaccination (8.7 per 100,000 doses) (Figure 2). This was a similar rate to 2023. Serious AEFI reports were rare, (n=8, 3.0 per 100,000 doses).

The COVID-19 vaccine program began in December 2020. During the first month, 2,753 doses were administered with 4 AEFIs reported, including one classified as serious. These data are not included in Figure 3 as they represent only a single month of activity. Heightened awareness and vigilance related to COVID-19 vaccines may have contributed to increased reporting of AEFIs in 2021. After a sharp decline in the rate of total and serious AEFI reporting rates following COVID-19 vaccination from 2021 to 2022, these rates have remained within a stable range between 2022 and 2024.

The number of doses of COVID-19 vaccine administered in 2024 was lower than in either 2023 or 2022. The risk profile of vaccine recipients may account for some of the variation in the rate of serious AEFI reported.



	2021	2022	2023	2024
Total AEFI	654	80	46	23
Non-serious AEFI	526	71	41	15
Serious AEFI	128	9	5	8
Serious AEFI Rate	7.2	1.1	1.3	3.0
AEFI Rate	36.2	7.7	6.6	8.7

** In December 2020, 2,753 COVID-19 vaccines were administered with 4 AEFIs reported (one serious).*

Figure 3: Number and rate of AEFI following COVID-19 vaccination in Nova Scotia, 2021 – 2024[*].

AEFI reports by age group

The median age of individuals with AEFI reports in 2024 was 33.5 years (range <1 year to 87 years). Children aged 2-17 years had the highest age-specific reporting rate in 2024 (13.2 per 100,000 doses). This age group, as well as children <2 years old, had no reports of serious AEFI.

The highest age-specific rate of serious AEFI reports was for adults aged 65 years and older (2.0 per 100,000 doses) (Table 1).

Table 1: Number and rate per 100,000 doses of AEFI in Nova Scotia by age group, 2024 (n=61 reports)

Age (years)	Number of AEFI reports	Number of Serious AEFI Reports	Number of Doses	AEFI Report Rate	Serious AEFI Report Rate
Under 2	6	0	96,068	6.2	0.0
2-17	14	0	105,706	13.2	0.0
18-64	21	2	278,822	7.5	0.7
65 and above	20	7	350,016	5.7	2.0

AEFI reports by NSH Administration Zone

The rate of AEFI reporting varied by zone, with the largest number of AEFI reports received from Central Zone – 37 AEFI reports (Figure 3). This rate of 9.0 per 100,000 doses was also the highest AEFI report rate among the four zones. Northern Zone had the fewest AEFI reports and the lowest AEFI reporting rate (n=5, 4.0 per 100,000 doses).

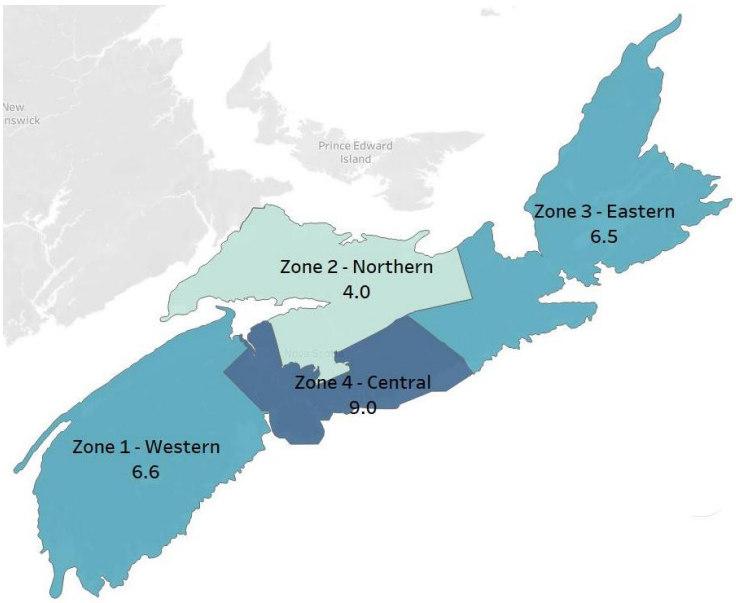


Figure 4: AEFI reporting rate per 100,000 doses by Nova Scotia health administration zone[5], 2024 (n=61 reports)

AEFI reports by vaccine agent

Influenza (35.0%) and COVID-19 vaccines (31.7%) together accounted for almost two-thirds of vaccines administered in 2024. Reflecting this high volume, these vaccines had the greatest number of AEFI reports. AEFI reporting rates for these vaccines were among the lowest in 2024: 8.7 per 100,000 doses for COVID-19, 5.0 per 100,000 doses for influenza standard dose, and 3.9 per 100,000 doses for influenza enhanced dose (Table 1).

The vaccine agents with the highest AEFI reporting rate were Tdap-IPV and Men-C-ACYW, which were each associated with 4 reported AEFI (51.7 per 100,000 doses and 38.6 per 100,000 doses, respectively).

Nine vaccine agents[6] had no associated AEFI reports over a combined 23,952 doses administered: Hepatitis A, *Haemophilus influenza* type b (Hib), inactivated polio (IPV), Influenza high-dose, Influenza unspecified formulation, Meningococcal conjugate C (Men-C-C), Rabies, Smallpox/mpox (SMV) and Diphtheria and tetanus vaccine (Td).

[5] Vaccine doses where zone was unspecified were excluded from zone-specific rate calculations
[6] See Appendix A for list of vaccine agents and abbreviations.

The 9 serious AEFIs were reported following COVID-19 vaccination (n = 7), influenza standard dose (n = 1), and both COVID-19 vaccine and influenza standard dose administered within a short interval (n=1).

Table 2: Number and rate of AEFI reports in Nova Scotia by vaccine, 2024 (n=61 reports)

Vaccine Agent Abbreviation[Error! Bookmark not defined.]	**Number of AEFI reports**	**Number of Doses**	**AEFI Reporting Rate per 100,000 doses**
COVID	23	263,696	8.7
DTaP-IPV-Hib	5	28,565	17.5
HAHB	2	12,322	16.2
HB	6	21,923	27.4
HPV	6	21,157	28.4
Influenza Enhanced	5	129,530	3.9
Influenza Standard Dose	8	161,019	5.0
Men-B	1	4,853	20.6
Men-C-ACYW	4	10,350	38.6
MMR	3	8,260	36.3
MMRV	2	15,731	12.7
Pneu-C	3	34,614	8.7
Pneu-P	1	8,719	11.5
Rot	2	20,108	9.9
RSV	2	8,118	24.6
Tdap	6	45,813	13.1
Tdap-IPV	4	7,737	51.7
Var	1	4,144	24.1
			Vaccines with no AEFI reports
HA	0	2,308	0.0
Hib	0	264	0.0
IPV	0	265	0.0
Inf (High)	0	3,484	0.0
Inf (Unspecified)	0	1,986	0.0
Men-C-C	0	7,386	0.0
Rab	0	991	0.0
SMV	0	290	0.0
Td	0	6,978	0.0

** Pneu-C includes vaccine agents Pneu-C-10, Pneu-C-13, Pneu-C-15, Pneu-C-20, and Pneu-C-unspecified*

AEFI reporting source

AEFI reports were submitted from a range of sources (Figure 4), with physicians and nurse practitioners contributing the largest share (39.3%), followed by pharmacists (18%), public health (13.1%), hospitals (9.8%), and other sources (19.7%). The other sources included long-term care facilities and clinics in community settings.

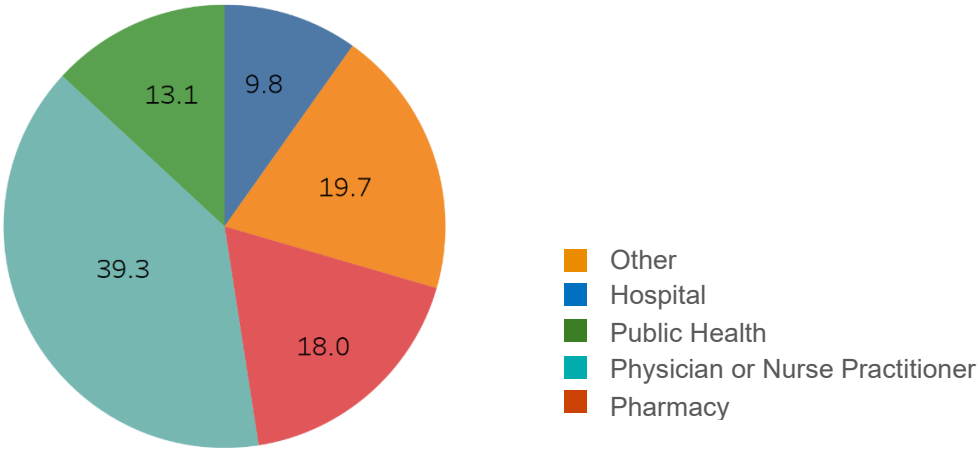


Figure 5: Proportion of AEFI reports by reporting source, 2024 (n=61 reports).

AEFI category and symptom type

AEFIs are categorized based on their associated symptoms and/or diagnoses – allergic, neurologic, local, or other (Figure 5). Since a single AEFI can involve symptoms in multiple categories, the sum across categories exceeds the total number of AEFI reported.

The most common categories were allergic (n=28, 45.9%) and 'other' (n=29, 47.5%). The 'other' category includes symptoms not categorized as allergic, local, or neurologic. Neurologic symptoms were the least frequent (n=10, 16.4%).

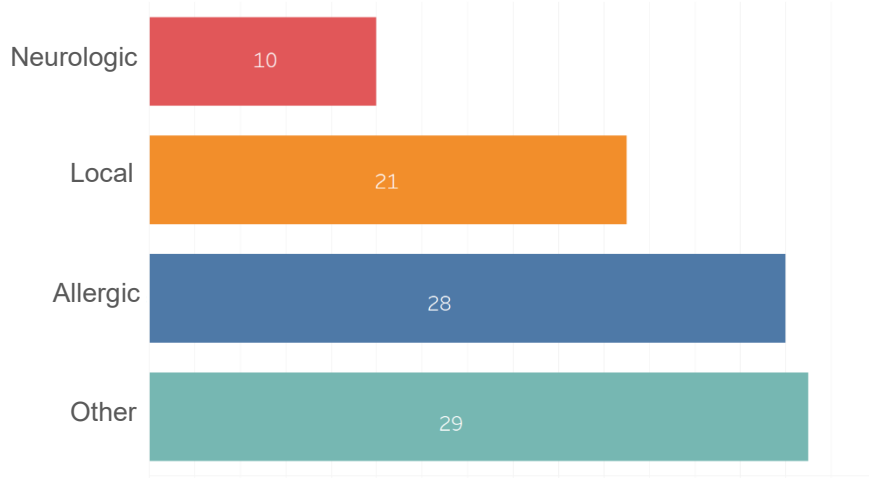


Figure 6: Distribution of AEFI reports by AEFI category in Nova Scotia, 2024 (n=61 reports).

The nine AEFI classified as serious were further categorized by reaction type (Table 3). All nine reported both neurologic and 'other' reaction types – including two with Bell's palsy, one with Guillain-Barré syndrome, and one with other paralysis. Three reports (33.3%) included allergic reactions, including cardio-vascular and respiratory reactions. No serious AEFI reports included local reactions.

Table 3: Category and reaction type of serious AEFI reports in Nova Scotia, 2024 (n=9 reports)

AEFI Category	Reaction Type	Number of Reports
Allergic	Cardio-vascular	1
	Respiratory	2
Neurologic	Bell's Palsy	2
	Guillain-Barré Syndrome (GBS)	1
	Other Paralysis	2
	Other neurologic diagnosis	1
	Depressed/altered level of consciousness, lethargy or personality change lasting >= 24hrs	1
	Fever (>=38.0 C)	2
Other	Thrombocytopenia	1
	Adverse Events of Special Interest	2
	Fever >= 38.0 C	1
	Severe diarrhea	1
	Other serious or unexpected event(s) not listed above	4

Appendix A: Publicly funded vaccines (PFVs) in Nova Scotia, 2019-2024

Vaccine Agent Abbreviation	Vaccine Generic Name	Vaccine Trade Name
COVID-19	Non-replicating vector COVID-19 vaccine	COVID-19 ASTRAZENECA
		COVID-19 AstraZeneca Vaxzevria
		COVID-19 COVISHIELD
		COVID-19 JANSSEN
	Recombinant spike protein COVID-19 vaccine	COVID-19 Novavax Nuvaxovid
		COVID-19 Novavax Nuvaxovid XBB.1.5
	mRNA COVID-19 vaccine	COVID-19 12+ Pfizer Comirnaty KP.2
		COVID-19 12+ Pfizer Comirnaty XBB.1.5
		COVID-19 Moderna Spikevax
		COVID-19 Moderna Spikevax BIVALENT (Orig/BA.1)
		COVID-19 Moderna Spikevax BIVALENT (Orig/BA.4/5)
		COVID-19 Moderna Spikevax KP.2
		COVID-19 Moderna Spikevax Omicron XBB.1.5
		COVID-19 Pfizer Comirnaty BIVALENT (Orig/BA.4/5)
		COVID-19 Pfizer-BioNTech Comirnaty
		COVID-19 INFANT 6m-4y Pfizer Comirnaty XBB.1.5
		COVID-19 PED 5-11y Pfizer Comirnaty XBB.1.5
		COVID-19 Ped 5-11yrs Pfizer BIVALENT (Orig/BA.4/5)
		COVID-19 infant 6m-4yrs Pfizer Comirnaty
		COVID-19 pediatric 5-11yrs Pfizer Comirnaty
DTaP-IPV-Hib	Diphtheria, tetanus, acellular pertussis, inactivated poliomyelitis and *Haemophilus influenzae* type b pediatric vaccine	Pediacel
		Pentacel
HA	Hepatitis A pediatric vaccine	Havrix 720 Jr
		Vaqta Ped
		Havrix 1440 Adult

	Hepatitis A regular strength vaccine	Vaqta Adult
HAHB	Hepatitis A and B pediatric vaccine	Twinrix Jr
	Hepatitis A and B regular strength vaccine	Twinrix Adult
HB	Hepatitis B dialysis strength vaccine	Recombivax Dialysis
	Hepatitis B pediatric strength vaccine	Engerix-B Jr
		Recombivax Ped
	Hepatitis B regular strength vaccine	Engerix-B Adult
		Recombivax Adult
IPV	Poliomyelitis inactivated vaccine	Imovax Polio
Inf	Influenza quadrivalent high-dose vaccine	FluLaval Tetra
		Fluzone
		Fluzone Quad
	Influenza quadrivalent vaccine	Fluzone High-Dose Quad
	Influenza trivalent vaccine	Flucelvax
		Fluad
		Fluviral
		Fluzone
MMR-Var	Measles, mumps, rubella and varicella vaccine	Priorix-Tetra
		ProQuad
MMR	Measles, mumps and rubella vaccine	MMR II
Men-B	Meningococcal B vaccine	Bexsero
Men-C-ACYW	Meningococcal conjugate A + C + Y + W vaccine	Menactra
		Menveo
		Nimenrix
Men-C-C	Meningococcal conjugate C vaccine	Menjugate
		NeisVac-C
Pneu-C-10	Pneumococcal conjugate 10-valent vaccine	Synflorix
Pneu-C-13	Pneumococcal conjugate 13-valent vaccine	Prevnar13
Pneu-C-15	Pneumococcal conjugate 15-valent vaccine	Vaxneuvance
Pneu-C-20	Pneumococcal conjugate 20-valent vaccine	Prevnar20

APPENDIX A

Pneu-P-23	Pneumococcal polysaccharide 23-valent vaccine	Pneumovax23
RSV	RSV (respiratory syncytial virus) vaccine	Abrysvo
		Arexvy
Rab	Rabies vaccine	Imovax Rabies
		RabAvert
Rota-5	Rotavirus pentavalent vaccine	RotaTeq
SMV	Smallpox and monkeypox vaccine	Imvamune
Tdap-IPV	Tetanus, diphteria, acellular pertussis and inactivated poliomyelitis vaccine	Adacel-Polio
		Boostrix-Polio
Tdap	Diphtheria, pertussis and tetanus vaccine	Adacel
		Boostrix
Td	Diphteria and tetanus vaccine	Td Adsorbed
Var	Varicella (chicken pox) vaccine	Varivax III

Appendix B: Changes to publicly funded vaccine (PFV) program in Nova Scotia, 2019-2024

Year	Vaccine	Program Change
2019	HPV	Available to individuals with HIV and for men who have sex with men, ≤ 45 years of age
2019	Hib	No longer publicly funded for individuals with HIV (IDEG recommendation)
2019	Rotavirus	Available to children born on or after November 1, 2019, up to 8 months of age
2020	COVID – 19	Introduced for ≥ 16 years
2021	COVID-19	Expanded to individuals aged 5 to 15 years; first boosters introduced
2022	COVID-19	Expanded to individuals ≥ 6 months to 4 years; second boosters introduced
2022	COVID-19	Universal fall program introduced
2022	Mpox	Introduced for post-exposure immunization, outbreak control and pre-exposure prophylaxis for eligible high-risk individuals
2023	COVID-19	Spring program introduced for high-risk individuals
2023	Meningococcal B	Expanded to high-risk youth < 26 years of age living in congregate living settings for the first time
2023	Influenza - Enhanced	Introduced for all individuals ≥ 65 years of age (2023 – 2024 Influenza Season)
2024	Measles-containing vaccines	Expanded to: adults born before 1970 without measles immunity at increased risk due to travel or outbreaks; children 6 to < 12 months travelling to high-risk areas; post-secondary students; health care workers.
2024	PCV-20	Replaced Pneumococcal-23 for adults
2024	PCV-15	Replaced Prevnar-13 for immunocompetent children
2024	Mpox	Expanded to health care professionals working in or persons visiting an Mpox outbreak zone within impacted African countries