

PROJECTED OUTCOMES OF AN EXPANDED ROLE FOR PHARMACY PROFESSIONALS IN THE PROVISION OF PUBLICLY FUNDED IMMUNIZATION SERVICES IN NEW BRUNSWICK



Chris Folkins
Clark Brewster
Rebecca Foster

Madeleine Gorman-Asal
Adrienne Gulliver
Pablo Miah
Ted McDonald

Sandra Magalhaes
Paramdeep Singh
Emily Thomson

PROJECT TITLE

Projected outcomes of an expanded role for pharmacy professionals in the provision of publicly funded immunization services in New Brunswick

PRINCIPAL INVESTIGATOR

Chris Folkins, Registered Pharmacist, Research Assistant, NB-IRDT

RESEARCH TEAM

Clark Brewster, UNB Student Researcher, NB-IRDT
Rebecca Foster, UNB Student Researcher, NB-IRDT
Adrienne Gulliver, UNB Student Researcher, NB-IRDT
Emily Thomson, UNB Student Researcher, NB-IRDT
Madeleine Gorman-Asal, Research Assistant, NB-IRDT
Paramdeep Singh, Data Analyst, NB-IRDT
Pablo Miah, Data Analyst, NB-IRDT
Sandra Magalhaes, Research Associate, NB-IRDT
Ted McDonald, Director, NB-IRDT

PUBLICATION DATE

Published October 2021

Updated January 2022

ACKNOWLEDGEMENT

This study was supported by the New Brunswick Innovation Foundation (NBIF) New Brunswick Priority Occupation Student Support (NBPOSS) Fund, as well as the Maritime SPOR Support Unit (MSSU), which receives financial support from the Canadian Institutes of Health Research (CIHR), the Nova Scotia Department of Health and Wellness, the New Brunswick Department of Health, the Nova Scotia Health Research Foundation (NSHRF), and the New Brunswick Health Research Foundation (NBHRF). The opinions, results and conclusions reported in this paper are those of the authors and are independent from the funding sources. No endorsement by the named funding partners is intended or should be inferred.

HOW TO CITE THIS PRODUCT

Folkins, C., Brewster, C., Foster, R., Gulliver, A., Thomson, E., Gorman-Asal, M., Singh, P., Miah, P., Magalhaes, S., & McDonald, T. (2021). Projected outcomes of an expanded role for pharmacy professionals in the provision of publicly funded immunization services in New Brunswick. Fredericton, NB: New Brunswick Institute for Research, Data and Training.

Table of Contents

Background.....	1
Research Objective.....	1
Summary of Key Findings	2
Cost Outcomes.....	2
Health and Access to Care Outcomes	3
Detailed Report and Methodologies	4
1. Projected Percentage of Publicly Funded Vaccines Administered by Pharmacy Professionals in 2023	4
2. Projected Pneu23 and Td/Tdap Vaccine Counts in 2023	5
3. Estimated Pneu23 and Td/Tdap Vaccine Acquisition and Administration Service Costs in 2023 in Physician-Only and Blended Models	7
Vaccine Acquisition Costs	7
Physician Vaccine Administration Service Costs Per Dose	7
Pharmacy Professional Vaccine Administration Service Cost Per Dose	8
Total Vaccine Administration Service Costs Under the Physician-Only Model	8
Total Vaccine Administration Service Costs Under the Blended Model	8
4. Estimated Physician Time Saved Under Blended Model	11
5. Estimated Number of Additional Patients That Could Be Rostered with a Family Physician Under the Blended Model.....	13
6. Estimated Health System Cost Savings Associated with Rostering of New Patients Under the Blended Model	15
7. Estimated Cost Savings Due to Decreased Pneumonia Hospitalizations Under the Blended Model	16
8. Productivity Losses Avoided Under the Blended Model Due to Avoidance of Time Off Work to be Vaccinated.....	17
9. Productivity Losses Avoided Under the Blended Model Due to Avoidance of Time Off Work Due to Illness	19
References.....	21
Appendix I	23

Annual Pneu23 and Td/Tdap Vaccination Rates in New Brunswick by Age, Sex, and Health Zone 2006-2018	23
---	----

List of Tables

Table 1: Cost Outcomes for the Province of New Brunswick in Blended Model Compared to Physician-Only Model.....	2
Table 2: Health and Access to Care Outcomes for Province of New Brunswick in Blended Model Compared to Physician-Only Model	3
Table 3: Impact of Varying Anticipated Increase in Vaccination Coverage Under Blended Model on Provincial Health Costs and Number of Vaccinations Administered in 2023 (Pneu23 and Td/Tdap Combined)	10
Table 4: Impact of Varying Proportion of Vaccinations Administered by Pharmacy Professionals in Blended Model on Total Provincial Health Costs (Acquisition and Administration Service) (Pneu23 and Td/Tdap Combined)	10

List of Figures

Figure 1: Annual Vaccination Rate for Pneu23 in New Brunswick by Age, 2006-2018.....	24
Figure 2: Annual Vaccination Rate for Td/Tdap in New Brunswick by Age, 2006-2018	25
Figure 3: Annual Vaccination Rate for Pneu23 in New Brunswick by Sex (Age 2+), 2006-2018.....	26
Figure 4: Annual Vaccination Rate for Td/Tdap in New Brunswick by Sex (Age 2+), 2006-2018	27
Figure 5: Annual Vaccination Rate for Pneu23 in New Brunswick by Health Zone (Age 2+), 2006-2018	28
Figure 6: Annual Vaccination Rate for Td/Tdap in New Brunswick by Health Zone (Age 2+), 2006-2018	29

Background

New Brunswick (NB) legislation permits pharmacy professionals (pharmacists, and as of 2021, registered pharmacy technicians) to administer a wide range of immunizations to their patients. Many vaccines in New Brunswick are publicly funded and available at no charge to patients when administered by a physician or nurse practitioner; however, the majority of these vaccines are not publicly funded when administered by pharmacy professionals, even though legislation permits their administration.

Currently, only vaccines against influenza and COVID-19 are publicly funded when administered by pharmacy professionals in NB. This creates a scenario in which patients wishing to take advantage of the convenience and accessibility offered by pharmacy-based vaccination services must pay for most vaccinations (including drug costs and service administration fees) out of pocket – even when, in the case of publicly funded vaccines, these same vaccinations are available through a physician at no cost to the patient.

This situation represents a barrier to accessible health services, particularly for NB residents who do not have access to a primary care provider, and a missed opportunity to take advantage of the full scope of practice of NB's pharmacy professionals. By expanding the repertoire of publicly funded vaccinations that can be administered by pharmacy professionals, it is hypothesized that cost savings, improved health outcomes, and improved access to care could be realized in New Brunswick.

Research Objective

The main objective of this study is to understand how expanding the number of publicly funded vaccines pharmacy professionals can administer would impact provincial spending, access to care, and health outcomes in New Brunswick.

The pneumococcal polysaccharide (Pneu23) vaccine and tetanus-diphtheria/tetanus-diphtheria-acellular pertussis (Td/Tdap) boosters were selected as candidates for our analysis owing to the ease of assessment for vaccine eligibility in a community pharmacy setting, as well as the large size of the eligible populations. Using a combination of NB Physician Billing data accessed through the New Brunswick Institute for Research, Data and Training (NB-IRDT), as well as various sources from the literature, we modelled two scenarios set in the year 2023:

- 1) **Physician-Only model** – Publicly funded Pneu23 vaccine and Td/Tdap boosters continue to be available through physicians/nurse practitioners but not through pharmacy professionals (this is the current situation in NB).
- 2) **Blended model** – Publicly funded Pneu23 vaccine and Td/Tdap boosters are available through physicians/nurse practitioners as well as pharmacy professionals.

To analyze the impact of adding Pneu23 and Td/Tdap to the repertoire of publicly funded vaccines available through pharmacy professionals, we examined outcomes under both the Physician-Only model and the Blended model. Key findings are summarized below, followed by a detailed report describing our complete methodology and results. Appendix I presents annual vaccination rates for Pneu23 and Td/Tdap in NB by age, sex, and Health Zone.

Summary of Key Findings

Cost Outcomes

Below is a summary of cost outcomes for the province of New Brunswick in the Blended model compared to the Physician-Only model.

Cost savings under the Blended model are given a **positive** value.

Increased costs under the Blended model are given a **negative** value.

The presented values represent estimated cost differentials in the year 2023. Similar values for all cost differentials would be expected annually in each year following 2023. Therefore, the sum of these values represents the estimated total annual cost savings under the Blended model.

Table 1: Cost Outcomes for the Province of New Brunswick in Blended Model Compared to Physician-Only Model

Cost description	Cost differential under Blended model (compared to Physician-Only model) (\$)
Vaccine acquisition costs	-\$49,995.75
Vaccine administration service costs	-\$19,085.07
Health system cost savings due to increased patient rostering with family physicians	\$1,463,838.38
Health system costs savings due to pneumonia hospitalizations avoided	\$12,201.70
Productivity losses avoided due to time off work to be vaccinated	\$284,880.54
Productivity losses avoided due to time off work due to illness	\$65.01
Estimated total annual cost savings for province of NB under Blended model	\$1,691,904.81

Health and Access to Care Outcomes

Below is a summary of health and access to care outcomes for the province of New Brunswick under the Blended model compared to the Physician-Only model.

The presented values represent estimated outcomes in the year 2023. With the exception of 'New patients rostered with NB family physicians' (which is a one-time occurrence based on the estimated number of physician hours saved annually), similar health and access to care outcomes would be expected on an annual basis moving forward.

Table 2: Health and Access to Care Outcomes for Province of New Brunswick in Blended Model Compared to Physician-Only Model

Description of outcome	Magnitude of outcome under Blended model (compared to Physician-Only model)
Additional Pneu23 vaccinations administered (annual)	1,118
Additional Td/Tdap vaccinations administered (annual)	1,477
Hours of physician time saved (annual)	2,074
New patients rostered with NB family physicians (one-time)	3,005
Additional pneumonia hospitalizations avoided among 65+ age group (annual)	1.17
Invasive pneumococcal disease cases avoided among employed individuals (annual)	0.023
Pertussis cases avoided among employed individuals (annual)	0.038

Conclusion: The addition of Pneu23 and Td/Tdap to the repertoire of publicly funded vaccines that can be administered by New Brunswick's pharmacy professionals is estimated to

- produce an annual cost savings of **\$1,691,904.81** for the province
- increase the number of individuals vaccinated against pneumonia and tetanus/diphtheria/pertussis by **1,118 and 1,477** (respectively) annually
- save **2,074 hours of physician time** annually
- permit the rostering of **3,005 new patients** with NB family physicians
- avoid **1.17 hospitalizations** due to pneumonia annually among individuals aged 65+

Detailed Report and Methodologies

1. Projected Percentage of Publicly Funded Vaccines Administered by Pharmacy Professionals in 2023

In many Canadian provinces, including New Brunswick, publicly funded influenza vaccines are available through pharmacy professionals. For this study, we used influenza vaccination data from previous influenza seasons in NB to determine the proportion of individuals vaccinated by pharmacy professionals vs. physicians (or nurse practitioners) when both options are available (note that here and throughout this report, service totals for nurse practitioners are included in physician totals).

For our analysis, we assumed that the relative proportion of pharmacy professional to physician service usage will be the same regardless of vaccine type. In other words, the relative proportion of flu vaccinations administered by pharmacy professionals as compared to physicians was used as an estimate of the anticipated relative proportion of Pneu23 and Td/Tdap vaccinations administered by pharmacy professionals compared to physicians.

Influenza vaccination service counts based on service claims by NB pharmacy professionals for the years 2014 to 2019 were obtained from a 2020 Canadian Foundation for Pharmacy report.¹ Influenza vaccination service counts based on service claims by NB physicians for the years 2014 to 2017 were obtained from the NB Physician Billing data set via NB-IRDT. Only physician vaccination service claims for individuals aged 5 or older were considered, as pharmacy professionals were only permitted to administer vaccinations to individuals aged 5+ prior to 2021.

Pharmacy professional and physician service counts were projected for the year 2023 using linear regression, and these counts were used to determine the anticipated relative proportion of total vaccinations performed by pharmacy professionals in 2023.

Key Findings:

- Pharmacy professionals are projected to administer 61.1% of influenza vaccinations in NB in the year 2023.
- We assume that pharmacy professionals would also administer 61.1% of Pneu23 and Td/Tdap vaccines in NB if these were added to the repertoire of publicly funded vaccines available through pharmacy professionals in 2023.

2. Projected Pneu23 and Td/Tdap Vaccine Counts in 2023

Anticipated vaccination service usage in NB for Pneu23 and Td/Tdap in the year 2023 was estimated using linear regression based on service claims data from past years obtained from the NB Physician Billing data set. This estimate only considered claims for individuals aged 2 or older, as pharmacy professionals are currently only permitted to administer vaccinations to individuals aged 2+, and it is assumed this will remain unchanged in 2023.

Physician claims data is available for the 2005-2018 fiscal years. Vaccination service claim counts were observed to follow a generally linear increasing trend over this period, with one notable exception: Starting in 2011, NB experienced a number of pertussis outbreaks, which led to substantial changes in clinical practice surrounding pertussis vaccination and, consequently, significant deviations from the normally observed linear rate of change in Tdap vaccine service counts.

Considering this information, anticipated vaccine counts in 2023 were estimated as follows:

- ➔ For Pneu23, vaccine counts in 2023 were projected using linear regression based on physician service claims data for the years 2005-2018.
- ➔ For Td/Tdap, physician service claims data for the years 2005-2010 were used to estimate the usual annual rate of change in Td/Tdap vaccine totals (as this period was unaffected by outbreaks and is thus assumed to better represent the rate of change under normal circumstances). This rate of change was applied annually to 2018 vaccine counts to obtain an estimate of vaccine counts in 2023.

The estimated vaccine counts resulting from this approach represent anticipated vaccine counts in 2023 by physicians, assuming the service model for these vaccines remains as it is now. Therefore, these are taken as the vaccine counts in 2023 under our Physician-Only model.

Data from the literature shows that when pharmacists began administering influenza vaccines, an increase in overall vaccination coverage (i.e., the proportion of the population vaccinated) was observed. The reported increase in coverage ranged from 7.8 to 16.8%.^{2,3} For our analysis, we assume a similar increase in vaccine coverage will occur if pharmacy professionals are made available to administer publicly funded Pneu23 and Td/Tdap vaccines.

Therefore, to estimate Pneu23 and Td/Tdap vaccine counts in 2023 under our Blended model, we applied a 12.3% (mean of 7.8 and 16.8%) increase to the estimated vaccine counts under the Physician-Only model.

Key Findings:

- Under the Physician-Only model, we estimate that a total of 9,090 Pneu23 and 12,004 Td/Tdap vaccinations will be administered by physicians/nurse practitioners in NB in 2023.
- Under the Blended model, we estimate that a total of 10,208 Pneu23 and 13,481 Td/Tdap vaccinations will be administered by physicians/nurse practitioners/pharmacy professionals in NB in 2023.
 - 61.1% of these (6,236 Pneu23 and 8,235 Td/Tdap) will be administered by pharmacy professionals.
 - The remainder (3,972 Pneu23 and 5,246 Td/Tdap) will be administered by physicians/nurse practitioners.
- Notably, the Blended model is anticipated to result in the vaccination of 1,118 additional individuals with Pneu23 and 1,477 additional individuals with Td/Tdap in 2023 compared to the Physician-Only model.

Sensitivity Analyses

Sensitivity analyses were performed varying the proportional increase in vaccination coverage anticipated under the Blended model, using 7.8% growth as a minimum case and 16.8% growth as a maximum case. This resulted in an estimated min-max range of 9,799 – 10,617 Pneu23 immunizations and 12,941 – 14,021 Td/Tdap immunizations administered in total in NB in 2023 under the Blended model (with 61.1% being administered by pharmacy professionals and the remainder by physicians/nurse practitioners in each case).

3. Estimated Pneu23 and Td/Tdap Vaccine Acquisition and Administration Service Costs in 2023 in Physician-Only and Blended Models

Vaccine Acquisition Costs

The total costs paid by the province of NB to purchase publicly funded Pneu23 and Td/Tdap vaccines utilized in 2023 under the Physician-Only and Blended models were estimated based on current distributor prices for these vaccines, obtained from the McKesson Canada PharmaClik online order management system, accessed through a community pharmacy in July 2021.

As Td and Tdap are separate products with different costs, the cost per dose for the Td/Tdap vaccine was estimated using a weighted average of Td and Tdap vaccine prices, weighting by the relative proportion of Td and Tdap vaccine doses administered by NB physicians in 2018 (from NB Physician Billing claims data). To account for the typical discounts on market price received by Canadian provinces when purchasing vaccines, a 42.5% reduction was applied to the cost per dose of each vaccine (based on the median discount in market price received by the Ontario Ministry of Health and Long-Term Care on the purchase of influenza vaccines, as reported in a previous study).⁴

The discounted cost per dose was multiplied by projected vaccine counts in 2023 to yield an estimate of the total acquisition costs to the province for Pneu23 and Td/Tdap vaccines in 2023 under the Physician-Only and Blended models (note that the same cost per dose is used under each model).

In addition to vaccine acquisition costs, provision of publicly funded immunizations incurs an additional cost to the province in the form of payments to health care providers for the service of administering the vaccines. We estimated administration service costs in 2023 under the Physician-Only and Blended models as follows:

Physician Vaccine Administration Service Costs Per Dose

Physician vaccine administration service costs differ depending on the vaccine product administered, as well as whether the vaccine is administered in the context of a visit in which the physician provides another billable service (i.e., 'with visit,' in which case the administration fee is lower), or whether the sole purpose of the physician visit is the administration of the vaccine (i.e., 'without visit,' in which case the administration fee is higher).

Additionally, physician administration service costs increase slightly each year. Administration costs per dose in 2023 were estimated using linear regression based on service fees reported in NB Physician Billing data for the years 2005-2018. Separate determinations were made for Pneu23 and Td/Tdap vaccines in both 'with visit' and 'without visit' scenarios.

Since Td and Tdap are separate vaccine products, the weighted average service fee for both vaccines (weighted by vaccine counts for each vaccine in a given year) was taken as the service cost of the Td/Tdap vaccine. Using this approach, the projected physician vaccine

administration service fees in 2023 are: \$12.93 for Pneu23 'with visit,' \$13.09 for Td/Tdap 'with visit,' \$21.00 for Pneu23 'without visit,' and \$21.23 for Td/Tdap 'without visit.'

Pharmacy Professional Vaccine Administration Service Cost Per Dose

NB pharmacists are paid a service fee of \$13 by the province for administration of influenza vaccines under all circumstances as of the 2020-2021 influenza season. Historically, pharmacist vaccine administration service fees have not changed as frequently as physician service fees and were only recently increased to \$13. For this reason, it is assumed that standard administration service fees for pharmacy professionals will remain at \$13 in 2023. Moreover, it is assumed that pharmacy professionals would be paid the same \$13 service fee for administration of Pneu23 and Td/Tdap as they are paid for administration of the influenza vaccine.

Total Vaccine Administration Service Costs Under the Physician-Only Model

The total administration service cost for Pneu23 and Td/Tdap (combined) under the Physician-Only model was estimated by multiplying each cost per dose (for Pneu23 'with visit' and 'without visit' and Td/Tdap 'with visit' and 'without visit') by the corresponding estimated vaccine count in 2023 and adding the resulting values together.

Total Vaccine Administration Service Costs Under the Blended Model

Overall physician administration service costs under the Blended model were estimated by multiplying each physician service cost per dose by the corresponding estimated count of vaccines administered by physicians under the Blended model and adding the resulting values together.

Pharmacy professional administration service costs under the Blended model were estimated by multiplying \$13 by the total count of all vaccines administered by pharmacy professionals under the Blended model. Estimated service costs for vaccine administration by physicians and pharmacy professionals were added together to give the total estimated administration service costs under the Blended model.

Key Findings:

- Combining vaccine acquisition costs and administration service costs, the Physician-Only model is estimated to cost the province \$706,709.51 while the Blended model is estimated to cost the province \$775,790.33 for Pneu23 and Td/Tdap vaccines in 2023, reflecting an increased cost of \$69,080.82 for the Blended model. A similar cost differential would be expected on an annual basis moving forward.
- The increased cost of the Blended model is a result of the anticipated increase in vaccination coverage achieved under this model. The cost required to purchase the additional vaccine doses administered under this model (1,118 Pneu23 and 1,477 Td/Tdap) is offset somewhat but not entirely by the lower average administration service fee per dose paid to pharmacy professionals (\$13) compared to physicians (\$14.23) under the Blended model.

Sensitivity Analyses

Sensitivity analyses were performed varying the proportional increase in vaccination coverage anticipated under the Blended model, using a 7.8% increase as a minimum case and a 16.8% increase as a maximum case. With a 7.8% increase in vaccination coverage, the Blended model is estimated to cost an additional \$37,993.94; and with a 16.8% increase, the Blended model is estimated to cost an additional \$100,167.70. A similar cost differential would be expected on an annual basis moving forward.

Sensitivity analyses were also performed varying the proportion of total vaccinations estimated to be administered by pharmacy professionals under the Blended model from the base estimate of 61.1% to values of 25%, 50%, 75%, and 100%. Note that the total cost to the province for vaccine acquisition and service decreases as the proportion of vaccinations administered by pharmacy professionals increases. This is due to the lower average per-dose administration service fee for vaccinations administered by pharmacy professionals compared to physicians.

Results of the sensitivity analyses are summarized below:

Table 3: Impact of Varying Anticipated Increase in Vaccination Coverage Under Blended Model on Provincial Health Costs and Number of Vaccinations Administered in 2023 (Pneu23 and Td/Tdap Combined)

% Increase in vaccination coverage →		Cost to Province of NB (\$)		
		Base (12.3%)	Min (7.8%)	Max (16.8%)
Physician -Only model	Vaccine acquisition costs	406,469.51	406,469.51	406,469.51
	Administration service costs	300,240.00	300,240.00	300,240.00
	Total	706,709.51	706,709.51	706,709.51
Blended model	Vaccine acquisition costs	456,465.26	438,174.13	474,756.39
	Administration service costs	319,325.07	306,529.32	332,120.82
	Total	775,790.33	744,703.45	806,877.21
Extra Cost in Blended model		69,080.82	37,993.94	100,167.70
Additional vaccinations in Blended model		2,595	1,646	3,544

Table 4: Impact of Varying Proportion of Vaccinations Administered by Pharmacy Professionals in Blended Model on Total Provincial Health Costs (Acquisition and Administration Service) (Pneu23 and Td/Tdap Combined)

Proportion of vaccinations administered by pharmacy professionals in Blended model	Total cost (acquisition and administration service) to Province of NB
25%	\$786,331.67
50%	\$779,028.56
75%	\$771,725.45
100%	\$764,422.34

4. Estimated Physician Time Saved Under Blended Model

Under the Blended model, a significant proportion of the vaccinations performed by physicians under the Physician-Only model are instead performed by pharmacy professionals, resulting in time savings for physicians.

Physician time saved under the Blended model was estimated as follows, considering the combined total of Pneu23 and Td/Tdap vaccinations:

- ➔ The total number of vaccinations performed by pharmacy professionals under the Blended model in 2023 was determined to be 6,236 Pneu23 and 8,235 Td/Tdap (see Section 2).
- ➔ The number of additional vaccinations administered under the Blended model compared to the Physician model was determined to be 1,118 Pneu23 and 1,477 Td/Tdap (see Section 2). These vaccinations were assumed to be administered entirely by pharmacy professionals and were not counted among those 'taken over' from physicians, as they were assumed to result from individuals taking advantage of newly available pharmacy services who did not previously make use of physician vaccination services. As such, these vaccinations were not considered to contribute to physician time savings.
- ➔ The number of vaccinations contributing to physician time savings was taken as the number of vaccinations performed by pharmacy professionals under the Blended model, less the number of additional vaccinations administered under the Blended model (i.e., $6,236 - 1,118 = 5,118$ Pneu23, and $8,235 - 1,477 = 6,758$ Td/Tdap).
- ➔ Based on values in the literature,⁵ the average physician time spent on administration of a vaccine was assumed to be 10.41 minutes for Pneu23 and 10.52 minutes for Td/Tdap (these are weighted averages of the mean vaccination appointment times for adults and children reported in the literature, weighted by projected Pneu23 and Td/Tdap vaccine counts in 2023 in NB in the 2-18 and 19+ age groups). Accordingly, we estimate that $(5,118 * 10.41) / 60 = 888$ hours of Pneu23 vaccination appointments and $(6,758 * 10.52) / 60 = 1,186$ hours of Td/Tdap booster appointments transferred to pharmacy professionals will save a combined 2,074 hours of physician time under the Blended model in 2023.

* It is noted that physician service claims data in NB shows that the majority of Pneu23 (88.3%) and Td/Tdap (82.7%) vaccinations by physicians occur in the context of an existing appointment in which the patient is seeing the physician for another reason (i.e., 'with visit' vaccinations). We acknowledge that 'with visit' vaccinations may in some cases be more time efficient than those 'without visit,' since time spent on activities such as general assessment and chart review may already be accounted for as part of the existing appointment. Nevertheless, vaccination still requires activities such as vaccine-specific assessment, consultation, and documentation in addition to dose preparation and administration, regardless of whether it occurs 'with visit' or 'without visit.'

The values for vaccine administration time used in our calculations are taken from a study of appointment times in vaccine clinics⁵ and reflect only 'in-clinic' time (i.e., pre-clinic time such as clinic preparation and booking, and post-clinic time such as post-vaccine monitoring and claim submission, are excluded). The time spent on specific activities during the 'in-clinic' time is not reported in greater detail, however. Therefore, given the data available, we are unable to determine to what degree time spent on "with visit" vaccinations may differ from time spent on those "without visit". Considering this limitation, we acknowledge that our estimate of physician time saved may represent an upper bound owing to the possibility of shorter appointment times for "with visit" vaccinations.

** It is noted that some physicians may delegate vaccine administration responsibilities to other practitioners such as nurses or physician assistants employed in their clinics. In these cases, time saved under the Blended model could be considered as "practitioner time" saved within the clinic rather than strictly physician time saved.

Key Findings:

- An estimated 2,074 hours of physician time is saved in 2023 as a result of pharmacy professionals sharing vaccine administration responsibilities for Pneu23 and Td/Tdap under the Blended model. Similar time savings would be expected on an annual basis moving forward.

Sensitivity Analyses

Sensitivity analyses were performed varying the proportion of total vaccinations estimated to be administered by pharmacy professionals under the Blended model from the base estimate of 61.1% to values of 25%, 50%, 75%, and 100%. Estimated physician time savings increased as the proportion of vaccinations administered by pharmacy professionals increased, as follows (time savings reported for 2023, with similar time savings expected on an annual basis moving forward):

- 25% of vaccinations administered by pharmacy professionals resulted in an estimated 581 hours of physician time saved.
- 50% of vaccinations administered by pharmacy professionals resulted in an estimated 1,615 hours of physician time saved.
- 75% of vaccinations administered by pharmacy professionals resulted in an estimated 2,649 hours of physician time saved.
- 100% of vaccinations administered by pharmacy professionals resulted in an estimated 3,683 hours of physician time saved.

5. Estimated Number of Additional Patients That Could Be Rostered with a Family Physician Under the Blended Model

The physician time saved under the Blended model, as determined above, could potentially allow family physicians to roster additional patients under their care owing to the additional practice hours made available as a result of offloading a portion of vaccine administration responsibilities to pharmacy professionals. We estimated the number of additional patients that could be rostered under the Blended model. This estimate assumes that all time saved under the Blended model is saved by family physicians, that time saved translates directly to increased capacity to take on new patients on an hour-for-hour basis, and that practitioners would choose to devote 100% of the time saved to taking on new patients.

Based on values in the literature, the average physician time spent during a general primary care visit with a patient was assumed to be 13.8 minutes,⁶ and the average number of times a rostered patient visits their primary care physician in a year was assumed to be 3,⁷ giving an average of 41.4 minutes of physician time devoted to each rostered patient per year. Considering that the Blended model is estimated to yield a savings of 2,074 physician hours in 2023, and assuming this same number of hours or greater continues to be saved on an annual basis, we estimate that family physicians could make use of this time to roster an additional $(2,074 * 60) / 41.4 = 3,005$ patients.

* As noted above, some physicians may delegate vaccine administration responsibilities to other practitioners such as nurses or physician assistants employed in their clinics. In these cases, the degree to which hours of 'practitioner time' saved under the Blended model could translate to capacity to roster new patients may vary according to differences in personnel and patient management among individual clinics.

For example, while physician time is no doubt a limiting factor in a clinic's capacity to take on new patients, some clinics employing nurses to administer vaccines may be able to repurpose nurse time saved under the Blended model to free up physician time spent on other activities and thus still generate capacity for increased patient load. Conversely, clinics which have already optimized delegation of tasks to other practitioners may find limited opportunity for increased patient rostering under the Blended model. Another possibility is that, regardless of the practitioner involved, decreased appointment burden in clinics under the Blended model may improve logistic/administrative efficiency in a manner that may yield some capacity for increased patient rostering. With these considerations in mind, we acknowledge that the estimated number of new patients that could be rostered under the Blended model may represent an upper bound.

Key Findings:

- We estimate that 3,005 new patients could be rostered with NB family physicians as a result of physician time saved under the Blended model due to the offloading of a proportion of vaccine administration responsibilities to pharmacy professionals.

Sensitivity Analyses:

Sensitivity analyses were performed varying the proportion of total vaccinations estimated to be administered by pharmacy professionals under the Blended model from the base estimate of 61.1% to values of 25%, 50%, 75%, and 100%. The estimated number of new patients that could be rostered under the Blended model increased as the proportion of vaccinations administered by pharmacy professionals increased, as follows:

- 25% of vaccinations administered by pharmacy professionals is estimated to permit the rostering of 842 new patients with NB family physicians.
- 50% of vaccinations administered by pharmacy professionals is estimated to permit the rostering of 2,341 new patients with NB family physicians.
- 75% of vaccinations administered by pharmacy professionals is estimated to permit the rostering of 3,839 new patients with NB family physicians.
- 100% of vaccinations administered by pharmacy professionals is estimated to permit the rostering of 5,338 new patients with NB family physicians.

Sensitivity analyses were also performed varying the average annual number (range 1 – 12 visits per year) and duration (range 5 – 20 minutes) of primary care visits by rostered patients to family physicians, giving an estimated min-max range of 751 to 9,015 new patients that could be rostered with NB family physicians under the Blended model.

6. Estimated Health System Cost Savings Associated with Rostering of New Patients Under the Blended Model

The literature suggests that individuals rostered with a family physician are less costly to the health care system than non-rostered patients. Based on this information, we estimated health system cost savings that could be realized by the rostering of new patients under the Blended model.

A 2017 study (using data from the 2012 fiscal year)⁸ of the costs associated with various primary care models in Ontario estimated mean total health system costs of \$2,608 per patient per annum for patients not rostered with a primary care provider, and costs of \$2,227 per patient per annum for rostered patients, for a savings of \$381 to the health system per rostered patient in Ontario in 2012.

CIHI data on national health expenditure trends⁹ were used to determine the average annual rate of change in annual health care spending in Ontario (2.39% increase per year), and this was applied iteratively to the savings per rostered patient in 2012 (\$381) to estimate the savings per rostered patient in Ontario in 2023 (\$494.04).

Next, CIHI data⁹ were used to project the average annual health care expenditure per capita in NB and Ontario to 2023, and the estimated ratio of NB to Ontario expenditure in 2023 (0.986) was used to estimate health system savings per rostered patient in NB in 2023 (i.e., $\$494.04 \times 0.986 = \487.12). Multiplying this value by the estimated number of new patients rostered under the Blended model, we estimated health system cost savings of $\$487.12 \times 3,005 = \$1,463,838.38$ in 2023, owing to the increased rostering of patients with NB family physicians under the Blended model.

Key Findings:

- We estimate a health system cost savings of \$1,463,838.38 in 2023 owing to the rostering of 3,005 new patients with NB family physicians under the Blended model. Similar savings would be expected on an annual basis moving forward.

Sensitivity Analyses:

Sensitivity analyses were performed varying the proportion of total vaccinations estimated to be administered by pharmacy professionals under the Blended model from the base estimate of 61.1% to values of 25%, 50%, 75%, and 100%. The estimated cost savings associated with rostering of new patients under the Blended model increased as the proportion of vaccinations administered by pharmacy professionals increased, as follows (with cost savings estimated for 2023, and similar savings expected on an annual basis moving forward):

- 25% of vaccinations administered by pharmacy professionals is estimated to result in health system cost savings of \$410,171.10.

- 50% of vaccinations administered by pharmacy professionals is estimated to result in health system cost savings of \$1,140,158.64.
- 75% of vaccinations administered by pharmacy professionals is estimated to result in health system cost savings of \$1,870,146.19.
- 100% of vaccinations administered by pharmacy professionals is estimated to result in health system cost savings of \$2,600,133.73.

Sensitivity analyses were also performed varying the average annual number (range 1 – 12 visits per year) and duration (range 5 – 20 minutes) of primary care visits by rostered patients to family physicians, giving an estimated min-max range of 751 to 9,015 new patients that could be rostered with NB family physicians under the Blended model, translating to a min-max range of health system cost savings of \$365,959.60 to \$4,391,515.14 in 2023 (with similar savings expected on an annual basis moving forward).

7. Estimated Cost Savings Due to Decreased Pneumonia Hospitalizations Under the Blended Model

Hospitalizations due to pneumonia are expensive, costing the province an estimated \$9,311 per case in 2015. This number is predicted to increase to \$10,718 per case by 2025.¹⁰ Owing to the increased vaccination coverage anticipated under the Blended model, we anticipate a decreased incidence of hospitalizations due to pneumonia under this model. We estimated the decrease in prevalence of pneumonia hospitalizations and associated cost savings in the 65+ age group under the Blended model, as shown below.

Using published projections in the literature¹⁰ in conjunction with Census population projections, the base risk of hospitalization due to pneumonia in the 65+ age group in NB in 2023 was estimated to be 974 cases per 100,000 population. This value was multiplied by the additional 790 individuals aged 65+ estimated to be vaccinated with Pneu23 under the Blended model, and the estimated vaccine effectiveness of Pneu23 (0.152 according to the literature),¹¹ to yield the annual number of pneumonia hospitalizations in the 65+ age group avoided under the Blended model (1.17).

Based on previously reported cost per case projections for pneumonia hospitalization in 2015 and 2025¹⁰ and assuming a linear cost increase per year, the cost per pneumonia hospitalization in NB in 2023 is estimated to be \$10,436.60. Therefore, the annual cost savings due to pneumonia hospitalizations avoided in the 65+ age group under the Blended model is estimated to be $1.17 * \$10,436.60 = \$12,201.70$.

Key Findings:

- We estimate that 1.17 hospitalizations due to pneumonia in the 65+ age group will be avoided in 2023 under the Blended model, with an associated cost savings of \$12,201.70. Similar hospitalization outcomes and savings would be expected on an annual basis moving forward.

Sensitivity Analyses:

Sensitivity analyses were performed varying the proportional increase in vaccination coverage anticipated under the Blended model, using a 7.8% increase as a minimum case and a 16.8% increase as a maximum case.

With a 7.8% increase in vaccination coverage, an estimated 0.74 hospitalizations due to pneumonia in the 65+ age group are avoided in 2023 under the Blended model with an associated cost savings of \$7,737.66.

With a 16.8% increase in vaccination coverage, an estimated 1.60 hospitalizations due to pneumonia in the 65+ age group are avoided in 2023 under the Blended model with an associated cost savings of \$16,665.74. Similar hospitalization outcomes and cost savings would be anticipated on an annual basis moving forward.

8. Productivity Losses Avoided Under the Blended Model Due to Avoidance of Time Off Work to be Vaccinated

Productivity losses are incurred when individuals are required to take time off work to seek vaccination from their healthcare provider. While most family physicians are only available during typical working hours to administer vaccines, requiring that patients take time off work to access these services, pharmacies are open during evenings and on weekends, providing the opportunity to access vaccination services without taking time off work.

We estimated the productivity losses that are anticipated to be avoided under the Blended model owing to the avoidance of the need to take time off work when making use of pharmacy-based vaccination services.

For this estimation, it is assumed that under the Blended model all individuals seeking vaccination from a physician will do so during working hours and will therefore require time off work to be vaccinated, and that individuals seeking vaccination from a pharmacy professional will do so outside of working hours and will not take time off work. It was assumed that the average time taken off work to be vaccinated would be 2 hours (an estimate that has been used previously in a study similar to this one).⁴

The number of vaccinations contributing to avoided productivity losses was taken as the number of vaccinations performed by pharmacy professionals under the Blended model, less the number of additional vaccinations administered under the Blended model (i.e., $6,236 - 1,118 = 5,118$ Pneu23, and $8,235 - 1,477 = 6,758$ Td/Tdap). This represents the number of vaccinations that would have been performed by physicians under the Physician-Only model which would be taken over by pharmacy professionals under the Blended model.

It was assumed that individuals aged 19-64 were likely to participate in the labour force. Projection of vaccine counts to 2023 for the 19-64 age group was divided by the projection of vaccine counts for all ages (2+), showing that 29.1% of individuals expected to be vaccinated with Pneu23 and 75.2% of individuals expected to be vaccinated with Td/Tdap would be in the 19-64 age group in 2023. Therefore, we estimate that $5,118 * 0.291 = 1,491$ Pneu23 vaccinations and $6,758 * 0.752 = 5,080$ Td/Tdap vaccinations taken over by pharmacy professionals under the Blended model would be administered to individuals in the labour force in 2023.

To approximate the impact of unemployment on these numbers, we multiplied them by the complement of the NB unemployment rate as of June 2021 (i.e. $[1 - 0.093]$, from Statistics Canada, with the understanding that Statistics Canada's unemployment rate is based on a labour force aged 15+), yielding estimates of 1,353 Pneu23 and 4,607 Td/Tdap vaccinations being taken over by pharmacy professionals under the Blended model and administered to employed individuals in 2023.

Adding these values together and multiplying by 2 hours per vaccine appointment, we estimate that 11,920 hours of productivity losses would be avoided under the Blended model in 2023. Multiplying this value by the average hourly wage in NB (\$23.90, estimated by projecting Statistics Canada-derived average annual income in NB to 2023 using linear regression and dividing by 1,950 working hours per year), we estimate \$284,880.54 in productivity losses would be avoided under the Blended model in 2023. Similar loss avoidance would be expected on an annual basis moving forward.

Key Findings:

- We estimate productivity losses of 11,920 working hours, equating \$284,880.54, would be avoided under the Blended model in 2023 owing to the avoidance of the need for individuals to take time off work when seeking vaccination from pharmacy professionals. Similar loss avoidance would be expected on an annual basis moving forward.

Sensitivity Analyses:

Sensitivity analyses were performed varying the proportional increase in vaccination coverage anticipated under the Blended model, using a 7.8% increase as a minimum case and a 16.8% increase as a maximum case. With a 7.8% increase in vaccination coverage, we estimate productivity losses of 12,290 working hours, equating \$293,741.76, would be avoided under the Blended model in 2023. With a 16.8% increase in vaccination coverage, we estimate

productivity losses of 11,553 working hours, equating \$276,019.31, would be avoided under the Blended model in 2023. Similar loss avoidance would be expected on an annual basis moving forward.

Additional sensitivity analyses were performed varying the proportion of total vaccinations estimated to be administered by pharmacy professionals under the Blended model from the base estimate of 61.1% to values of 25%, 50%, 75%, and 100%. The estimated productivity losses avoided under the Blended model increased as the proportion of vaccinations administered by pharmacy professionals increased, as follows (with loss avoidance estimated for 2023, and similar loss avoidance expected on an annual basis moving forward):

- 25% of vaccinations administered by pharmacy professionals is estimated to result in the avoidance of 3,340 hours / \$79,824.22 of productivity losses.
- 50% of vaccinations administered by pharmacy professionals is estimated to result in the avoidance of 9,284 hours / \$221,888.57 of productivity losses.
- 75% of vaccinations administered by pharmacy professionals is estimated to result in the avoidance of 15,228 hours / \$363,952.92 of productivity losses.
- 100% of vaccinations administered by pharmacy professionals is estimated to result in the avoidance of 21,172 hours / \$506,017.26 of productivity losses.

9. Productivity Losses Avoided Under the Blended Model Due to Avoidance of Time Off Work Due to Illness

It is anticipated that fewer individuals will become ill and require time off work to recover under the Blended model owing to the anticipated increase in vaccination coverage under this model.

We estimated productivity losses avoided under the Blended model due to avoidance of time off work due to illness. This estimation does not account for time off work to care for non-working family members who become ill, nor does it account for decreased productivity among individuals who present to work while ill. This estimation focused on illness due to pertussis and invasive pneumococcal disease (IPD).

As in our previous calculations, individuals aged 19-64 were assumed to participate in the labour force. The numbers of additional individuals vaccinated under the Blended model (1,118 Pneu23, 1,477 Td/Tdap) were adjusted to reflect the previously calculated proportion of individuals aged 19-64 receiving each vaccine ($1,118 \times 0.291 = 326$ for Pneu23, $1,477 \times 0.752 = 1,110$ for Td/Tdap). These were further adjusted to reflect NB's unemployment rate as described above ($326 \times 0.907 = 295$ for Pneu23, $1,110 \times 0.907 = 1,007$ for Td/Tdap). Furthermore, the value for Td/Tdap was adjusted to reflect only those individuals receiving Tdap and thus protected against pertussis (based on relative proportion of Tdap to total Td/Tdap vaccinations in 2018 NB physician service claims, i.e., $1,007 \times 0.99 = 997$).

Based on this approach, an additional 295 employed individuals are estimated to be vaccinated with Pneu23, and an additional 997 employed individuals are estimated to be vaccinated with Tdap under the Blended model. The additional number of vaccinated individuals was multiplied by the base risk of illness (9.7/100,000 population for IPD – Canadian average 2007-2011¹²; 5/100,000 population for pertussis – Canadian average 2005-2011)¹³ and estimated vaccine effectiveness (0.8 for Pneu23 for IPD prevention¹⁴, 0.753 for Tdap for pertussis prevention¹⁵) to yield the estimated number of illness cases avoided (0.023 for IPD, 0.038 for pertussis).

These values were multiplied by the average time off work due to illness (6 days *7.5 hrs = 45 hours for both community-acquired pneumonia¹⁶ and pertussis¹⁷) and summed to yield the hours of lost productivity avoided under the Blended model (2.7 hours). Multiplying by the average hourly wage in NB as determined above (\$23.90) yields \$65.01 of productivity losses due to time off work due to illness avoided as a result of the anticipated increase in vaccination coverage under the Blended model in 2023. Similar loss avoidance would be expected on an annual basis moving forward.

Key Findings:

- We estimate that productivity losses of 2.7 working hours, equating \$65.01, due to time off work due to illness would be avoided as a result of the anticipated increase in vaccination coverage under the Blended model in 2023. Similar loss avoidance would be expected on an annual basis moving forward.

Sensitivity Analyses

Sensitivity analyses were performed varying the proportional increase in vaccination coverage anticipated under the Blended model, using a 7.8% increase as a minimum case and a 16.8% increase as a maximum case. With a 7.8% increase in vaccination coverage, we estimated productivity losses of 1.7 working hours, equating \$41.23, would be avoided under the Blended model in 2023. With a 16.8% increase in vaccination coverage, we estimated productivity losses of 3.7 working hours, equating \$88.80, would be avoided under the Blended model in 2023. Similar loss avoidance would be expected on an annual basis moving forward.

References

1. Canadian Foundation for Pharmacy. Claims for services going up, up, up. 2020. <https://www.cfpnet.ca/en/news/details/id/340>
2. Buchan SA, Rosella LC, Finkelstein M, Juurlink D, Isenor J, Marra F, et al. Impact of pharmacist administration of influenza vaccines on uptake in Canada. *CMAJ*. 2017 Jan;189(4):E146-52.
3. Isenor JE, O'Reilly BA, Bowles SK. Evaluation of the impact of immunization policies, including the addition of pharmacists as immunizers, on influenza vaccination coverage in Nova Scotia, Canada: 2006 to 2016. *BMC Public Health*. 2018;18(787).
4. O'Reilly DJ, Blackhouse G, Burns S, Bowen JM, Burke N, Mehlretter J, et al. Economic analysis of pharmacist-administered influenza vaccines in Ontario, Canada. *Dove Press*. 2018(10):655-63.
5. Crocker-Buque T, Edelstein M, Mounier-Jack S. A process evaluation of how the routine vaccination programme is implemented at GP practices in England. *Implementation Science*. 2018;13(1).
6. Irving G, Neves AL, Dambha-Miller H, Oishi A, Tagashira H, Verho A, et al. International variations in primary care physician consultation time: a systematic review of 67 countries. *BMJ Open*. 2017;(7).
7. McLeod L, Buckley G, Sweetman, A. Ontario primary care models: a descriptive study. *CMAJ Open*. 2016;4(4).
8. Laberge M, Wodchis WP, Barnsley J, Laporte A. Cost of health care across primary care models in Ontario. *BMC Health Serv Res*. 2017;17(511).
9. Canadian Institute for Health Research. *National Health Expenditure Trends, 2020 – List of Data Tables*. 2020. Accessed July 2021 from <https://www.cihi.ca/en/national-health-expenditure-trends>
10. The Conference Board of Canada. *The Economic Burden of Pneumonia in Canada*. Status Quo Forecast. 2017. https://www.conferenceboard.ca/temp/dd1ae658-b4c6-4ed9-a0b3-e71eb65d88d6/8723_The-Economic-Burden-of-Pneumonia-in-Canada_BR.pdf
11. Dominguez À, Soldevila N, Toledo D, Torner N, Force L, Pérez MJ, et al. Effectiveness of 23-valent pneumococcal polysaccharide vaccination in preventing community-acquired pneumonia hospitalization and severe outcomes in the elderly in Spain. *Plos One*. 2017;12(2).
12. Government of Canada. *Invasive Pneumococcal Disease*. Accessed July 2021. <https://www.canada.ca/en/public-health/services/immunization/vaccine-preventable-diseases/invasive-pneumococcal-disease/health-professionals.html>
13. Government of Canada. *Pertussis (whooping cough): for health professionals*. Accessed July 2021. <https://www.canada.ca/en/public-health/services/immunization/vaccine-preventable-diseases/pertussis-whooping-cough/health-professionals.html>
14. Government of Canada. *Pneumococcal vaccine: Canadian Immunization Guide*. Accessed July 2021. <https://www.canada.ca/en/public-health/services/publications/healthy->

[living/canadian-immunization-guide-part-4-active-vaccines/page-16-pneumococcal-vaccine.html#a5](#)

15. Koepke R, Eickhoff JC, Ayele RA, Petit AB, Schauer SL, Hopfensperger DJ, et al. Estimating the effectiveness of tetanus-diphtheria-acellular pertussis vaccine (Tdap) for preventing pertussis: evidence of rapidly waning immunity and difference in effectiveness by Tdap brand. *J Infect Dis.* 2014;210(6):942-53.
16. Marrie TJ, Beecroft MD, Herman-Gnjidic Z. Resolution of symptoms in patients with community-acquired pneumonia treated on an ambulatory basis. *J Infect.* 2004;49(4):302-9.
17. Lee LH, Pichichero ME. Costs of illness due to *Bordetella pertussis* in families. *Arch Fam Med.* 2000;9:989-96.

Appendix I

Annual Pneu23 and Td/Tdap Vaccination Rates in New Brunswick by Age, Sex, and Health Zone 2006-2018

Physician service claims data from the NB Physician Billing data set were used to evaluate annual incidence of Pneu23 and Td/Tdap vaccination in New Brunswick by age, sex, and Health Zone for the years 2006 to 2018.

The annual vaccination rate for a given demographic (i.e., the percentage of a given population demographic vaccinated in a given year), was computed by dividing total physician vaccination service claims by Canadian Census population estimates for NB for the demographic and year of interest. Results are presented in figures below, and key findings are summarized.

Key Findings:

The following trends were noted in the data (statistical significance was not evaluated):

- In each year observed, Pneu23 and Td/Tdap vaccination rates were higher among older individuals than younger individuals.
- In each year observed, Pneu23 and Td/Tdap vaccination rates were higher among females than males.
- Observed Pneu23 and Td/Tdap vaccination rates tended to be higher in Health Zones containing larger population centers.

Figure 1: Annual Vaccination Rate for Pneu23 in New Brunswick by Age, 2006-2018

Annual vaccination rate presented as percentage of population of interest receiving vaccination in year of interest.

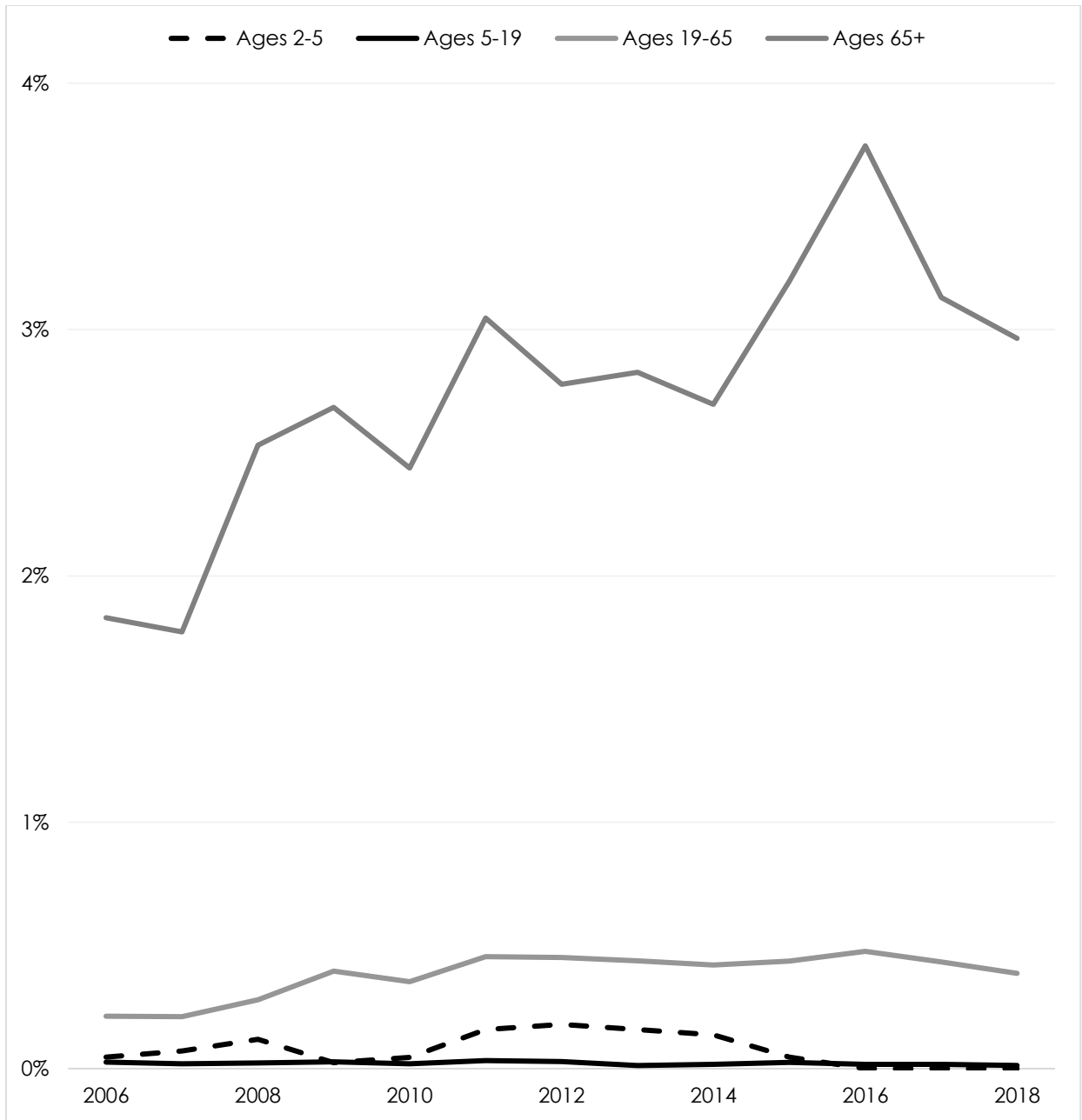


Figure 2: Annual Vaccination Rate for Td/Tdap in New Brunswick by Age, 2006-2018

Annual vaccination rate presented as percentage of population of interest receiving vaccination in year of interest. Increased vaccination rates starting in 2011 and a spike in 2012 are believed to reflect changes in clinical practice associated with pertussis outbreaks.

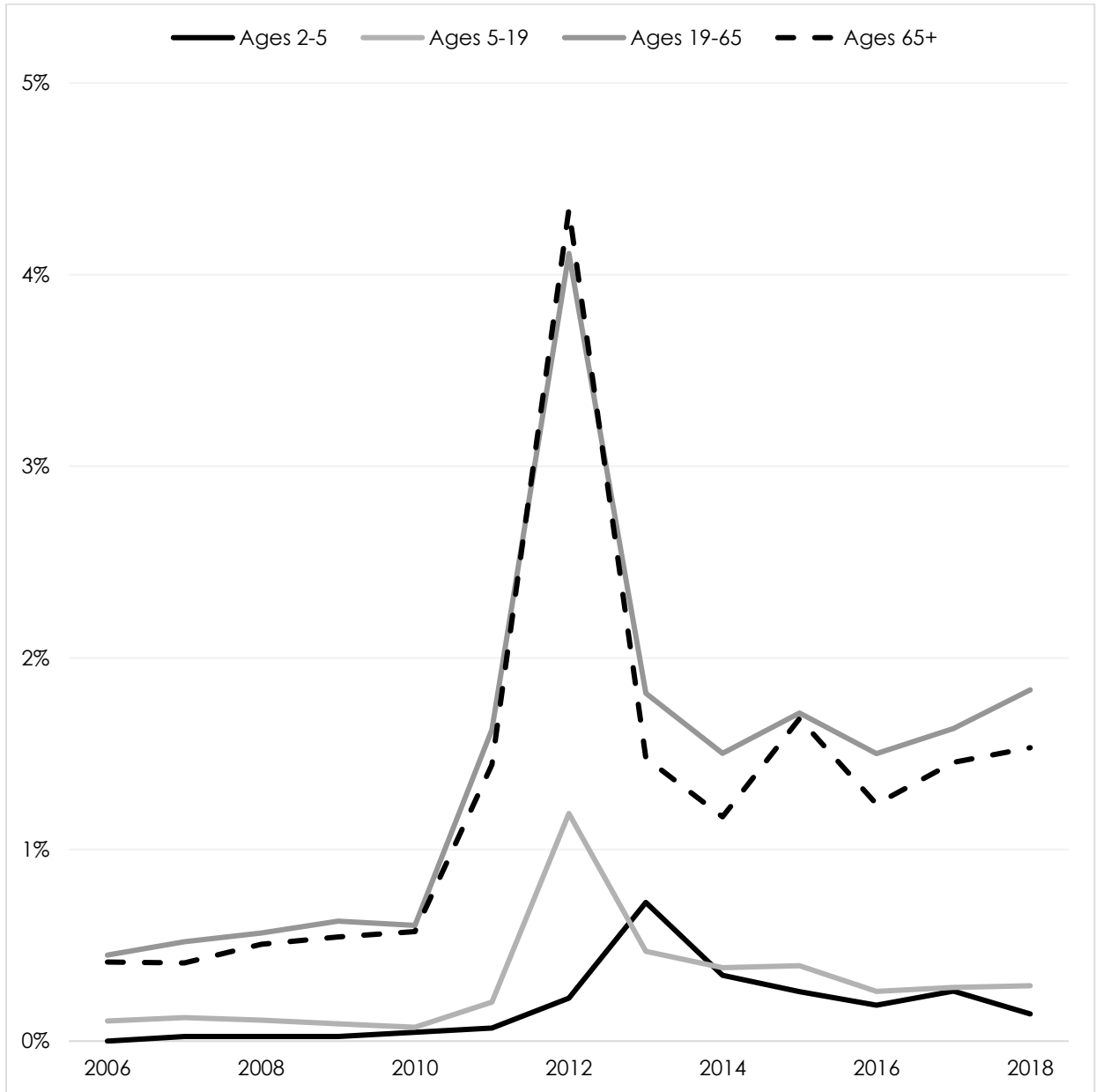


Figure 3: Annual Vaccination Rate for Pneu23 in New Brunswick by Sex (Age 2+), 2006-2018

Annual vaccination rate presented as percentage of population of interest receiving vaccination in year of interest.

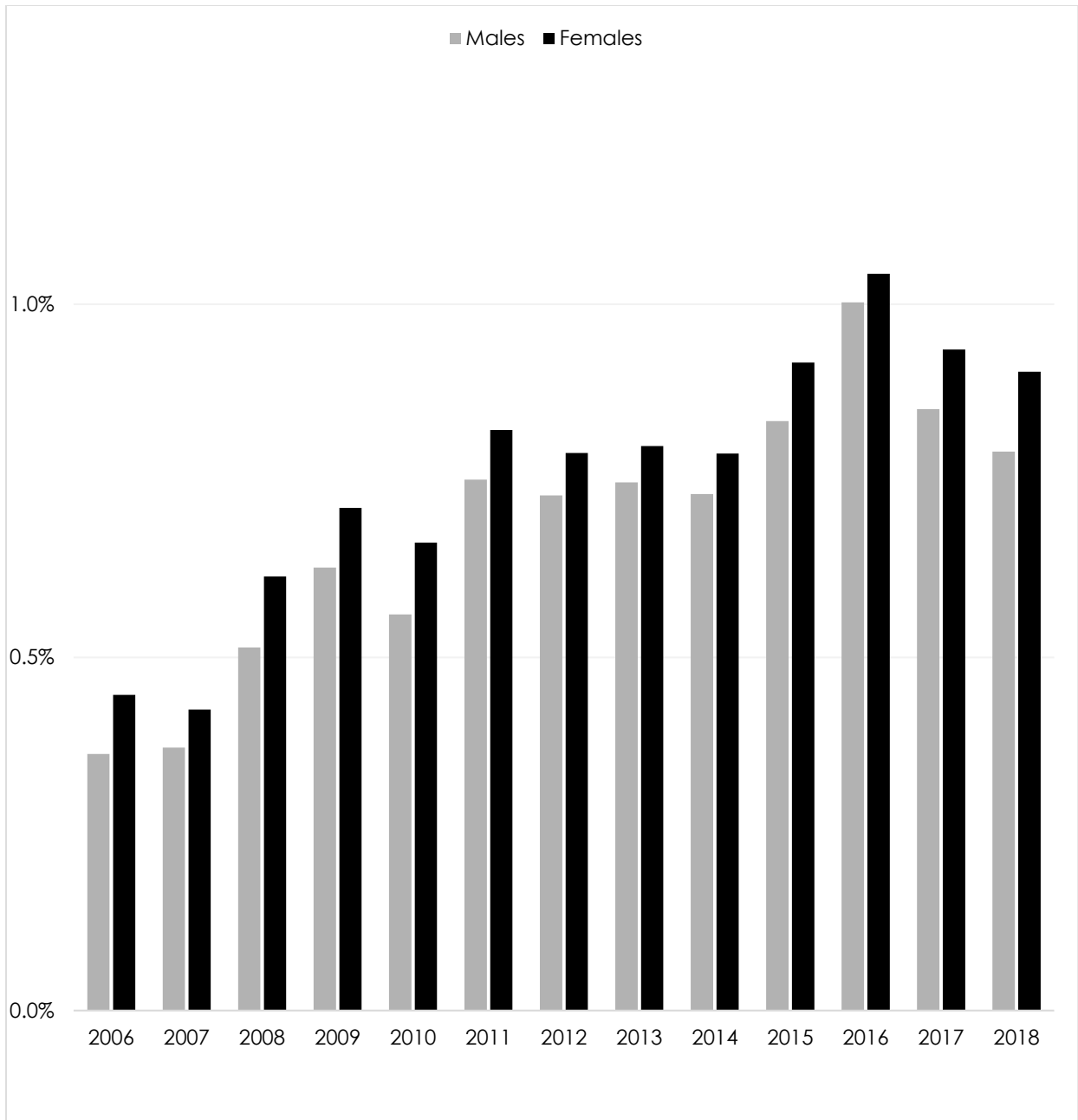


Figure 4: Annual Vaccination Rate for Td/Tdap in New Brunswick by Sex (Age 2+), 2006-2018

Annual vaccination rate presented as percentage of population of interest receiving vaccination in year of interest. Increased vaccination rates starting in 2011 and spike in 2012 are believed to reflect changes in clinical practice associated with pertussis outbreaks.

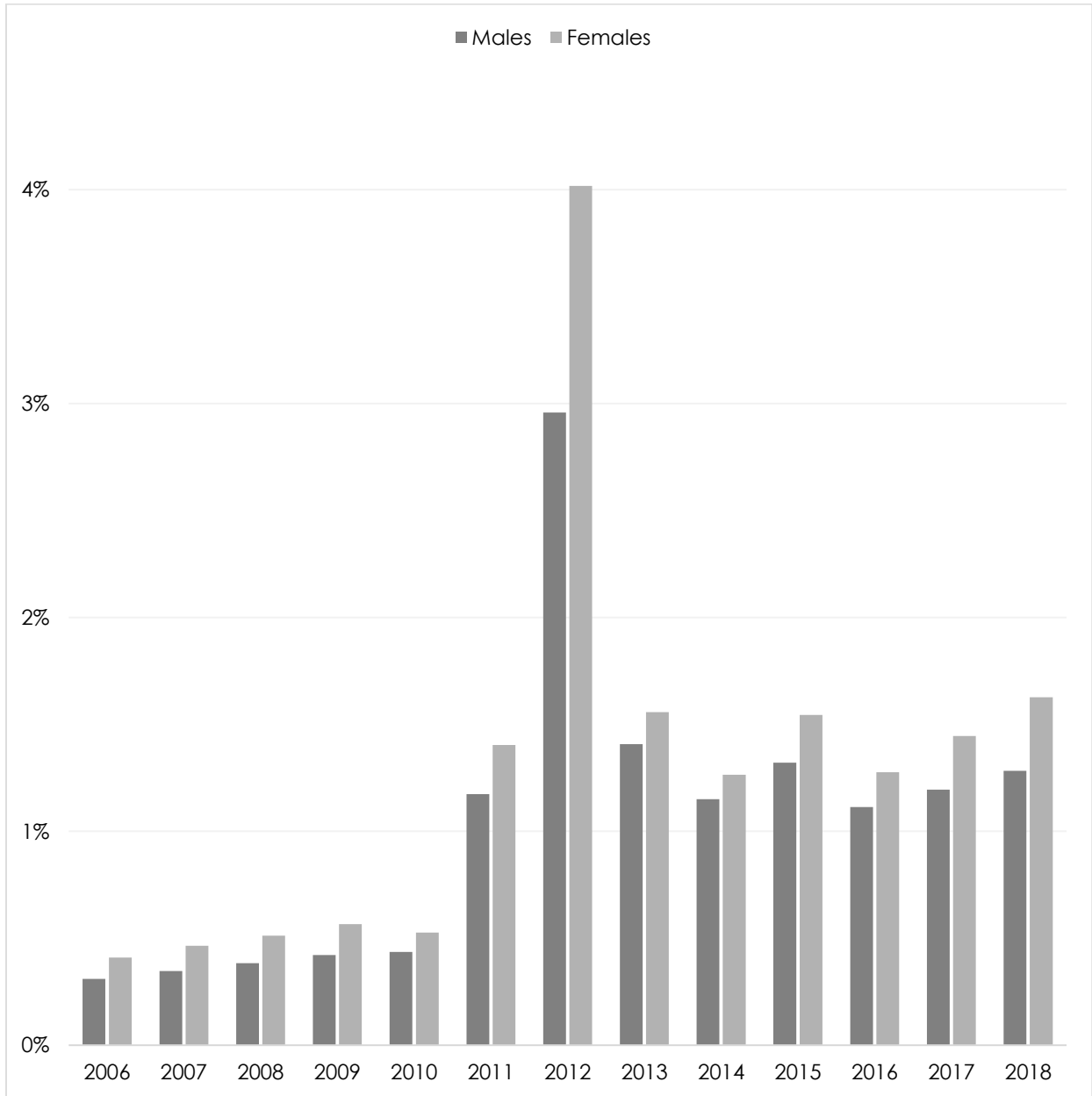


Figure 5: Annual Vaccination Rate for Pneu23 in New Brunswick by Health Zone (Age 2+), 2006-2018

Annual vaccination rate presented as percentage of population of interest receiving vaccination in year of interest.

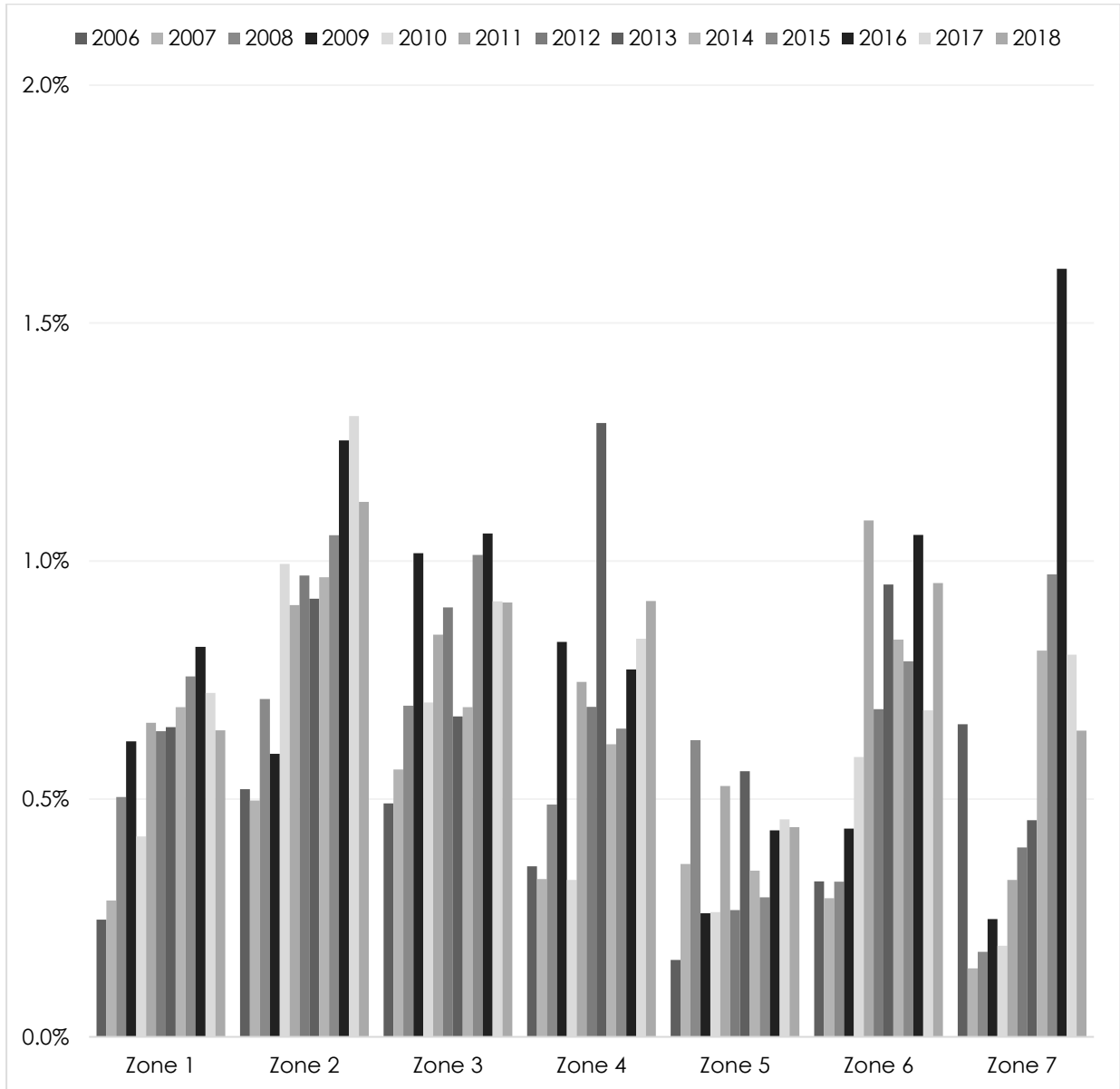


Figure 6: Annual Vaccination Rate for Td/Tdap in New Brunswick by Health Zone (Age 2+), 2006-2018

Annual vaccination rate presented as percentage of population of interest receiving vaccination in year of interest. Increased vaccination rates starting in 2011 and a spike in 2012 are believed to reflect changes in clinical practice associated with pertussis outbreaks.

