CONFIDENTIAL

Protocol

Study Sponsor:	Canadian Immunization Research Network (CIRN)
Funding:	Canadian Institutes of Health Research/Public Health Agency of Canada, GlaxoSmithKline, Sanofi Pasteur Limited, others to be determined
Primary Study Product and numbers	Not Applicable
Other Study Product	Not applicable
Date of protocol	18 May 2021
Date of protocol amendment/administrative change	
Title	A study to evaluate pharmacists as immunizers to improve coverage and provider/recipient satisfaction
Detailed Title	Pharmacists as Immunizers to Improve Coverage and Provider/Recipient Satisfaction: **A** prospective, **C**ontrolled **C**ommunity **E**mbedded **S**tudy with vaccines with low coverage rates (The Improve ACCESS study)
Registration Number	NCT02868970

ORIGINAL PAGE DELETED FOR PRIVACY REASONS

ORIGINAL PAGE DELETED FOR PRIVACY REASONS

SYNOPSIS

Detailed Title	Pharmacists as Immunizers to Improve Coverage and Provider/Recipient Satisfaction: **A** prospective, **C**ontrolled **C**ommunity **E**mbedded **S**tudy with vaccine**S** with low coverage rates (The Improve ACCESS study)
Indication	Implement and compare new community pharmacy-based strategies for improving vaccine coverage.
Rationale for the study and study design	Although there are many safe and effective vaccines for adults, public perception of vaccination is that it is primarily for infants and children. The National Advisory Committee on Immunization (NACI) recommends adults and adolescents receive human papilloma virus (HPV) vaccine, influenza vaccine, zoster vaccine, tetanus-diphtheria-acellular pertussis vaccine (Tdap), meningococcal vaccine, and pneumococcal vaccine. While NACI makes recommendations, provinces and territories (P/Ts) determine if they will fund and implement vaccine programs. Unlike the childhood immunization programs which tend to be funded by P/Ts, many adult vaccines are unfunded, resulting in poor population uptake. In this project we propose to implement and compare new community pharmacy-based strategies for improving vaccine coverage. This study will provide the results to public health, which can then determine future funding strategies.
Objectives	**Primary Objectives:** The proposed study has two primary objectives: 1. To assess the effectiveness of a bundled pharmacist-delivery strategy consisting of communication and funding strategies on vaccine coverage. 2. To determine pre- and post-intervention knowledge, attitudes, beliefs and behaviours (KABB) of target adults, pharmacists, physicians, and vaccine providing nurses. **Secondary Objectives:** 1. To assess the impact of various funding models on vaccination coverage. 2. To evaluate a pharmacy-based strategy for recruiting participants for a patient-reported active adverse event following immunization surveillance system. **Primary Hypothesis:** 1. Vaccine coverage with all studied vaccines will increase significantly after implementation of the bundled pharmacist-delivery strategy. A significant increase will be defined as an increase of ≥10% vaccine coverage from pre-program levels. **Secondary Hypotheses:** 1. The cost of a vaccine is a key factor in an individuals' decision-making

with respect to vaccination. It is expected that vaccinations provided at no or minimal charge will have higher uptake than those that require more financial resources to obtain.

2. We hypothesize knowledge about the vaccines studied, high dose TIV, meningococcal B vaccine, meningococcal ACWY vaccine, and Tdap, is low among the general public, but high among practitioners. We hypothesize we will find a high level of support among both the public and health care providers for pharmacists to provide vaccines measured in our study. Knowledge and support amongst both providers and the public will increase after implementation of the program.

Study design

Methodology

This will be a two-year demonstration program implementation and evaluation project in two Canadian provinces, New Brunswick and Nova Scotia. One community in each province will be allocated to implementation strategies specifically designed for each of the target vaccines. One community in each province will serve as the non-intervention control arm where pharmacist immunization practice will continue unchanged.

Inclusion criteria for the selection of the four communities are a stable population, service by a regional hospital and community pharmacies, and lack of substantial health care spill-over to adjacent communities. Spill over is defined as a pattern of health-care utilization where patients regularly receive care at different regional health centres. Communities will be geographically separated to minimize potential spill over.

Pharmacists in intervention communities will provide vaccines through bundling of different payment mechanisms and communication strategies, depending on the vaccine. Descriptions of the various methodologies used for the study are below.

Different Payment Mechanisms

Intervention communities will provide vaccine through the following payment mechanisms, based on the study vaccine:

1. universal vaccination with “publicly funded” vaccine (vaccine provided to individual without charge (i.e. Tdap vaccine))
2. vaccination using a co-pay model (individuals receive vaccine at no cost after paying a designated co-pay fee comprised of the pharmacy dispensing fee and any administration fee charged by the pharmacist immunizers (i.e. high-dose TIV); and
3. vaccination using the current private market model where vaccine would be purchased either by the recipient or through insurance (standard of care control arm, (i.e. Meningococcal serogroup B, Meningococcal serogroup

ACWY, high-dose TIV influenza, travel health vaccines, and herpes zoster vaccine).

Different Public Communication Strategies

Pharmacists and pharmacy staff in intervention communities will use various public communication strategies, including:

1. targeted mail outs and/or phone calls by pharmacies to individuals in their databases based on risk factors for contracting and/or transmitting vaccine-preventable disease (e.g., immunosuppressant medications, recent birth in family)
2. timed marketing linked to other vaccine clinics (e.g., influenza clinics) and awareness campaigns (e.g., back-to-school advertising)

The non-intervention control arm will be the current model wherein a client specifically requests a vaccination or the pharmacist offers this option while the patient is in the pharmacy.

Outcome measure:

1. Repeated Cross-Sectional KABB

KABB will be determined by public surveys in the four communities and by surveys of health care providers (pharmacists, physicians, and public health practitioners) prior to and after the two-year intervention.

2. Vaccine Coverage

Vaccine coverage (number vaccinated divided by the number eligible for vaccine) will be measured using pharmacy database analysis, public health vaccine reports by physicians, vaccine doses delivered (in all four regions), and by public survey within the study communities (part of the KABB survey). Statistics Canada census data from 2015 will be used to determine the denominator for those eligible for the vaccine by 5-year age groups.

3. Adverse Events Following Immunization Reporting (AEFI)

Using the Canadian National Vaccine Safety Network (CANVAS)'s surveillance system for adverse events following seasonal influenza vaccination, we will compare the proportions of eligible individuals who register for CANVAS and complete the online AEFI survey among pharmacies using active recruitment strategies (e.g., handing out information sheets and registration forms) and those using passive recruitment strategies (e.g., displaying posters and information sheets).

Sample Size

There are four communities involved in the study, Saint John and Moncton, New Brunswick and New Glasgow/Pictou/Antigonish and Kentville/Wolfville/New Minas, Nova Scotia. All participating pharmacies in each community will be allocated either to the bundled pharmacist-delivery intervention or to standard care (control arm). Residents in each community will receive a KABB survey, regardless of whether or not they were vaccinated as part of this study. Information and registration forms

for CANVAS surveillance will be actively distributed to those who received influenza vaccines in the intervention communities and information on CANVAS will be displayed at pharmacies in control communities. A sample size of 400 for the KABB survey will provide a margin of error of less than 5% for estimated proportions. For vaccine coverage, a separate sample size of 596 per group will provide power of at least 80% to detect superiority.

Endpoints **Outcomes/analysis plan/sample size/statistics**

Outcomes

1. Population-specific vaccine coverage before and after program-implementation interventions.
2. Proportion of population in intervention districts whose supplementary health benefit plans cover studied vaccines.
3. Public KABB about vaccine-preventable diseases and related vaccines before and after program-implementation interventions.
4. Public willingness to pay and co-pay for studied vaccines.
5. Healthcare providers KABB regarding pharmacist- delivered vaccine programs.
6. Public and health care provider satisfaction with various models of vaccine program delivery.
7. Proportions of influenza vaccine recipients who register for CANVAS and who complete the online AEFI survey in intervention versus control communities.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

Adult NIS	Adult National Immunization Survey
AEFI	Adverse event following immunization
CANVAS	Canadian National Vaccine Safety Network
CCfV	Canadian Center for Vaccinology
CIRN	Canadian Immunization Research Network
IWK	Izaak Walton Killam Health Centre
KABB	Knowledge, attitudes, beliefs and behaviours
NACI	National Advisory Committee on Immunization
P/T	Provinces and Territories
REB	Research Ethics Board
SAE	Serious adverse event
Tdap	Adult formulation tetanus and diphtheria toxoids and acellular pertussis vaccine
TIV	Trivalent inactivated vaccine, influenza
TpB	Theory of planned behaviour
4CMenB	Meningococcal B vaccine, Bexero (Novartis)
MenACWY	Meningococcal ACWY vaccine, Nimenrix (Pfizer/GSK), Menactra (Sanofi Pasteur), Menveo (GSK).
HZ	Herpes zoster
VZV	Varicella zoster virus
PHN	Postherpetic neuralgia

TRADEMARKS

Adacel®

Avaxim®

Bexsero®

Boostrix®

Engerix®-B

Fluad®

FluLaval Tetra®

FluMist®

Fluviral®

Fluzone High-Dose™

FluZone Quad®

Havrix®

Nimenrix®

Menactra®

Menveo®

Recombivax®

RedCap™

Remark®

Shingrix®

Twinrix®

Typherix®

Typhim Vi®

Vaqta®

ViVaxim®

Vivotif®

Zostavax II®

1 INTRODUCTION

Although there are many safe and effective vaccines for adults, the Public Health Agency of Canada has noted that public perception of vaccination is that it is primarily for infants and children. The National Advisory Committee on Immunization (NACI) recommends that adults and adolescents receive the influenza vaccine, tetanus-diphtheria-acellular pertussis vaccine (Tdap) and meningococcal vaccines (MenACWY, 4CMenB). As well, NACI recommends that people 50 years or older receive the herpes zoster vaccine and that Canadians who travel to high-risk areas should consider getting vaccinated to protect themselves against travel-related illnesses, such as Hepatitis A and Typhoid Fever. While NACI makes recommendations, provinces and territories (P/Ts) determine if they will fund and implement vaccine programs. Unlike most childhood vaccines, which are funded by P/Ts, many adult vaccines are unfunded, resulting in poor population uptake. We propose that lack of publically funding immunization programs for adults including public health driven promotion, is associated with the observed poor population uptake. In this project, we propose to implement and compare new community pharmacy-based strategies with different payment mechanisms and measure the effect on adult vaccine coverage for three vaccines.

1.2 Recommended and Funded Vaccines

Tdap and influenza vaccines are recommended and funded for adults in most provinces; however, uptake of these vaccines remains low according to the Public Health Agency of Canada (PHAC). Increases in influenza vaccination rates amongst adults have stagnated and Tdap coverage amongst adults is estimated to be well under 10% (Public Health Agency of Canada, 2015).

1.3 Recommended but Unfunded Vaccines (RUVs)

With the increasing number of vaccines being brought to market in recent decades and shrinking health care budgets, the list of RUVs has increased (Scheifele et al., 2014). Quadrivalent meningococcal conjugate vaccine (MenACWY) and meningococcal serogroup B vaccine are recommended where regional epidemiology supports their use; however, there are differences in funding between regions. While NACI recommends influenza vaccines for all or some adults, high dose TIV for individuals ≥65 are not routinely funded. Herpes zoster (HZ) is another recommended vaccine for all Canadians who are 50 years of age or older; however, despite this recommendation, Ontario is the only province in Canada that covers the cost of Zostavax II for its residents between 65 and 70 years of age. To prevent travel-related illness, NACI recommends that Canadians get vaccinated against common food and water borne illnesses, such as Hepatitis A and Typhoid fever, as well as blood borne diseases, such as, Hepatitis B, before they travel. Although Canadians visiting certain destinations are recommended to get vaccinated, these vaccines are not publicly funded for Canadian travellers.

1.4 Reasons for Low Vaccine Coverage and Interventions to Improve Coverage

Barriers to achieving high vaccination rates are multifactorial. Some of the most common barriers to vaccination include lack of education about vaccines and vaccine-preventable diseases, lack of infrastructure to deliver vaccines, lack of access to vaccines, financial concerns, and the attitudes of clients and providers toward vaccination (Colgrove, 2007). Briss et al. (2000) found that interventions for improving vaccine coverage can be categorized as those that: a) increase community demand for vaccinations (client education, client reminders, community educational messages through media,

money or discount coupons); b) Enhance access to vaccinations by reducing client-out-of-pocket expenses (providing insurance coverage or reducing co-payment) or expanding access in healthcare settings (reducing the distance from the setting to the population; increasing or changing hours during which vaccination services are provided; delivering vaccinations in clinical settings where they were previously not provided) or reducing administrative barriers to obtaining vaccination services within clinics (developing a "drop-in" clinic or an "express lane" vaccination service); c) improve provider behavior (educating providers about the vaccine, creating standing orders to remind them, implementing electronic systems to remind them or using a feedback system which evaluates the provider's performance). Briss et al.'s systematic review examined promotion of influenza and pneumococcal vaccines and found that interventions that enhanced access to vaccination services were far more effective than those that did not include them. In other words, use of (a) and (b) or (b) and (c) was significantly more effective than (a) and (c).

1.5 Pharmacists as Immunizers

Patients are typically educated about preventative health care during face-to-face visits with physicians in office settings, or in the case of vaccines, by nurses at vaccination appointments. The ability to educate and deliver preventative health care is limited by the available provider time during client visits. Providers note that the time to provide vaccine education is considerable, and clients' acute needs and current disease management generally take priority. New delivery models and a means of extending preventative health care delivery outside of traditional face-to-face office visits are needed (Yarnall, 2003).

Pharmacists are in a unique position of being among the most accessible of health professionals (Canadian Pharmacists Association, 2012). In a study of the attitudes and beliefs of the Canadian public on routine immunization by pharmacists, pharmacists were identified as a trustworthy source of health information, similar to public health officials and exceeded only by family doctors and nurses (MacDougall et al., 2016). Given their extended operating hours, accessibility, and established trust with patients, pharmacists are well-positioned to improve vaccination rates and health system efficacy through injection administration (Houle, 2013) Moreover, people regularly visit community pharmacies for their health care needs, particularly in rural settings, due to extended hours and convenient locations (Kau, 2011). In addition, through their interaction to fill prescriptions and education patients about their use, pharmacists have regular contact with high-risk individuals and are able to proactively and systematically review patients' medical histories and medications, and remind them about the benefits of vaccination. Such interventions have been shown to have a significant impact on a person's decision to be immunized, similar to the impact of a recommendation from a physician or nurse (Grabenstein, 1992).

Several studies from the United States have evaluated immunization rates before and after pharmacists were allowed to administer vaccines and revealed significant increases in coverage rates (Grabenstein, 1999; Steyer, 2004). Grabenstein and colleagues compared vaccination coverage rates in states where pharmacists were allowed to immunize with states where they could not. Between 1995 and 1999, vaccination coverage increased by 10.7% in states where pharmacists could administer the vaccine and 3.5% in states where they could not ($p<0.05$) (Grabenstein, 1999).

As of 2016, legislation has passed in nine Canadian provinces that allow pharmacists to provide immunizations to adults (as well as adolescents and children over the age of 5 in some provinces). There have been limited studies on the impact of this expansion of the professional role of pharmacists on the knowledge, attitudes, beliefs and behaviours (KABB) of the general public and other

immunization providers regarding this change to the immunization landscape in Canada, and no published comparative implementation studies.

1.6 Previous Related Work by Team Members

Team members from the Maritime Provinces, British Columbia and Ontario have undertaken research related to pharmacist-delivered vaccination of various vaccines.

A survey completed across Canada found that pharmacists were willing to incorporate immunization into their practice and that pharmacists thought that adding vaccine administration to their scope of practice would increase public access, improve coverage rates, and be acceptable to the public (Edwards, 2015). A 2010 national survey of physicians, nurses, pharmacists and the general public to assess KABB around the delivery of Tdap and other adult vaccines revealed that greater than 50% of those surveyed would support the expansion of pharmacists' scope of practice to include adult vaccination. Perceived benefits of pharmacists providing immunizations included sharing of the time required to immunize, and enhanced record keeping (MacDougall, 2015).

Pharmacist-based immunization strategies for influenza vaccination were evaluated in small rural communities in interior and northern British Columbia in a 2-year, community cluster-randomized trial. In the intervention communities, pharmacy-based influenza vaccination clinics were held, and were promoted to eligible patients using personalized invitations from the pharmacists; invitations distributed opportunistically by a pharmacist to eligible patients presenting to pharmacies during the flu season, and community-wide promotion using posters and the local media. The mean influenza immunization rate in the control communities (n=15) was 56.9% (SD 28.0) and 80.1% (SD 18.4) in the intervention communities (n=14) (p=0.01) for those ≥65 years of age (Marra, 2014).

In New Brunswick, legislation has enabled pharmacists with proper certification to immunize since 2009. There are limited data about the experiences of Canadian pharmacists as vaccine providers. We are currently analyzing a survey administered to pharmacists in New Brunswick to examine demographics and KABB around immunization. The survey has contributed to the design of the health care provider survey proposed for this project.

OPEN (Ontario Pharmacy Research Collaboration) is conducting a series of studies to examine the impact of the scope of practice change that allowed pharmacists to administer the influenza vaccine for the 2012/13 and 2013/14 influenza seasons. Impact on Ontario immunization rates will be measured using pharmacist and MD billing and public health clinic data. Patient demographic and health data will be used to explore uptake in high-risk populations and demographic and regional differences. Researchers will survey Ontario pharmacists to gauge their attitudes on influenza immunization and determine their readiness stage, facilitators and barriers to implementation and recommendations for system changes. Patient perspectives will be examined broadly via provincial survey. Focus group sessions with physicians and nurses will examine their perceptions of pharmacist-administered flu shots, as well as related issues and challenges.

The first year of that pharmacists participated as immunizers in the universal influenza vaccine program in Nova Scotia, there was an increase in both the number of influenza vaccines administered overall and in influenza coverage rates compared to the previous three influenza seasons. Nova Scotia pharmacists administered 78,102 influenza vaccines in the 2013-2014 season, contributing to an increase of 15.8% in

the total number of influenza vaccines administered compared to the previous flu season, when they were not yet regulated and funded to administer injections (Isenor, 2016)

2 OBJECTIVES

2.1 Primary Objectives

The proposed study has two primary objectives:

1. To assess the effectiveness of a bundled pharmacist-delivery strategy consisting of communication and funding strategies on vaccine coverage.
2. To determine the increase in pre- and post-intervention knowledge, attitudes, beliefs and behaviours (KABB) of target adults, pharmacists, physicians, and public health practitioners.

2.2 Secondary Objectives

1. To assess the impact of various funding models on vaccination coverage.
2. To evaluate a pharmacy-based strategy for recruiting participants for a patient-reported active adverse event following immunization surveillance system.

2.3 Primary Hypothesis:

1. Vaccine coverage with all studied vaccines (high dose TIV, meningococcal B vaccine, meningococcal ACWY vaccine, Tdap, herpes zoster vaccine, and travel health vaccines) will increase significantly after implementation of the bundled pharmacist-delivery strategy. A significant increase will be defined as an increase of ≥10% vaccine coverage from pre-intervention levels.

2.4 Secondary Hypotheses:

1. The cost of a vaccine is a key factor in the individual's decision to be vaccinated. It is expected that vaccinations provided at no or minimal charge will have higher uptake than those that require more financial resources to obtain.
2. Knowledge about the vaccines studied is low among the general public, but higher among practitioners. There is a high level of support among both the public and health care providers for pharmacists as immunizers. Knowledge and support amongst both providers and the public will increase after implementation of the program.

3 STUDY DESIGN

3.1 Vaccine Coverage

There are numerous barriers that impede an individual from becoming vaccinated. A successful intervention should incorporate a multi-faceted approach to improve vaccine uptake. By combining, or bundling different communication strategies, financial incentives and promoting awareness about vaccines and who can administer them, this study seeks study seeks to improve uptake in vaccines with low coverage rates.

To assess the effectiveness of bundled pharmacist-delivery strategy and to assess the impact of various funding models on vaccination coverage, a demonstration program implementation and evaluation project will be conducted in two New Brunswick and two Nova Scotia communities. One community in each province will serve as an intervention community in which implementation strategies specifically designed for each of the target vaccines will be used. One of the communities in each province will serve as the non-intervention control arm where immunization practice will continue unchanged.

It is hypothesized that vaccine coverage will increase significantly, defined as an increase of ≥10% vaccine coverage from pre-program levels, after implementation of the pharmacist-delivery strategy. As public funding of vaccination is a key factor in individuals' decision-making with respect to vaccination, it is also expected that vaccinations provided at no or minimal charge will have higher uptake than those that require more financial resources to obtain.

All pharmacies in the intervention and control communities have been identified using data from Pharmacy Association of Nova Scotia and the New Brunswick Pharmacists' Association. Pharmacies interested in being involved with this research will serve on an advisory board with investigators for logistical and organizational purposes. Pharmacists employed at participating pharmacies will act as non-academic members of the research team who will deliver the targeted vaccines. All pharmacists receive training and certification in vaccine administration through provincial regulatory authorities. Members of the research team will provide additional support to pharmacists involved in the study to reinforce best practice strategies. Pharmacists in intervention communities will provide vaccines through bundling of different communication strategies and payment mechanisms depending on the vaccine.

Pharmacist Intervention Strategies:

1. *Communication Strategies* – Pharmacists and pharmacy staff in intervention communities will use various public communication strategies, including:
    a. targeted mail outs and/or phone calls by pharmacies to individuals in their databases based on risk factors for contracting and/or transmitting vaccine-preventable disease (e.g., immunosuppressant medications, recent birth in family)
    b. timed marketing linked to other vaccine clinics (e.g., influenza clinics) and awareness campaigns (e.g., back-to-school advertising)
2. *Payment mechanisms* – Intervention communities will provide vaccine through the following payment mechanisms, based on the study vaccine:
    a. universal vaccination with "publicly funded" vaccine (vaccine provided to individual without charge (i.e. Tdap vaccine))
    b. vaccination using a co-pay model (individuals receive vaccine at no cost after paying a designated co-pay fee comprised of the pharmacy dispensing fee and any administration fee charged by the pharmacist immunizers (i.e. high-dose TIV); and
    c. vaccination using the current private market model where vaccine would be purchased either by the recipient or through insurance (standard of care control arm, (i.e. Meningococcal serogroup B, Meningococcal serogroup ACWY and high-dose TIV influenza, herpes zoster, and travel health vaccines).

The non-intervention control arm will be the current model wherein a patient specifically requests a vaccination or the pharmacist offers this option while the patient is in the pharmacy. This non-intervention arm will be compared to the intervention arm.

Inclusion criteria

Inclusion criteria for the selection of the four communities include population size (approximately 30,000 adults >18 years of age), stable population, service by a centralized regional hospital and local community hospitals, availability of community pharmacies, interest and availability of community pharmacists (sufficient numbers of pharmacists qualified to provide vaccinations), and lack of substantial health care spill over to adjacent communities. Spill over is defined as a pattern of health-care utilization where patients regularly receive care at different regional health centres. Communities will be geographically separated to minimize potential spill over.

Based on this inclusion criteria, four communities were selected. Intervention communities in which the communication and payment strategies will be implemented are: Saint John, New Brunswick and New Glasgow/Pictou/Antigonish, Nova Scotia area, which include the smaller towns of Stellarton and Westville, Nova Scotia. Control communities where pharmacy delivered immunizations will be offered under their current model are: Moncton, New Brunswick and Kentville/New Minas/Wolfville, Nova Scotia, which include the smaller towns of Canning and Coldbrook, Nova Scotia. Intervention and control communities will be compared to one another to assess the effectiveness of the bundled strategies.

Payment mechanisms will be applied in intervention communities, excluding no client from this strategy. Communication strategies will be targeted based on the type of vaccine a client is eligible to receive. Pharmacists will contact clients over the age of 65 by phone or mail out to recommend high-dose TIV and contact clients who are 50 and older to recommend herpes zoster. Clients who are immunosuppressed may also receive phone calls/mail outs for vaccines against meningococcal disease. Individual eligibility will also be assessed by pharmacists during consultations. Through client's interaction to fill prescriptions, pharmacists have regular contact with high-risk individuals and are able to proactively and systematically review patients' medical histories and medications to remind them of the benefits of specific vaccinations. They can also implement awareness campaigns during travel season and school breaks to target clients who may be travelling to high-risk areas and should consider getting vaccinated to protect themselves against travel-related illnesses, such as Hepatitis A and Typhoid Fever.

Measurement of vaccine coverage

Vaccine coverage rates will be measured using the following:

1. pharmacy database analysis,
2. public health vaccine reports by physicians,
3. number of vaccine doses delivered to pharmacies in all four regions, and
4. public survey within the study communities to determine immunization status.

Pharmacy databases will be used to determine the number of doses administered to individuals relative to the total number of clients in the pharmacy database in the eligible age range. The total number of doses administered by pharmacists (from their database) plus the number administered by family physicians, through study-specific reciprocal notification forms, will also be calculated and compared to

the Statistics Canada population age-specific census data for the community will also be calculated. The study-specific system of reciprocal notification forms for family physicians will be implemented so that it is similar to that used for publicly funded routine pediatric vaccines. Another estimate of vaccine coverage will be vaccine doses distributed to pharmacies in the participating communities (obtained from the manufacturer and Public Health) relative to the eligible population based on Statistics Canada census data from 2016. Specific questions about receipt of target vaccines will be added to the KABB survey that will be administered pre- and post-intervention. These questions will be modeled on a 2014 study performed by the Vaccine Evaluation Center (Schneeberg, 2014). The KABB survey will also include specific questions about willingness to pay to inform decisions about co-payment funding models for recommended adult vaccines.

Outcomes

As a result of this study:

1. Population specific vaccine coverage will be documented before and after program implementation interventions.
2. The proportion of the population in intervention districts whose supplementary health benefit plans cover studied vaccines will be identified.
3. The public willingness to pay and co-pay for studied vaccines will be better known and understood.

For specific outcomes related to each targeted vaccine, see appendices.

3.2 Knowledge, attitudes, beliefs and behaviours

This study will use one survey to assess the KABB of community-dwelling adult members of the public regardless of whether or not they were vaccinated as part of this study and a second survey for physicians, pharmacists, and vaccine providing nurses (e.g. family practice nurses, public health nurses, and nurse practitioners). Surveys will be distributed before and after the intervention regarding knowledge, attitudes, beliefs, and behaviours of targeted study vaccines and their delivery by pharmacists.

Questions included on surveys to assess the KABB of the public will focus on awareness of vaccines availability, attitudes toward vaccines, perceived social pressures to vaccinate, ability to access vaccination, intention to vaccinate, the use of pharmacists as immunizers and willingness to pay for vaccines. Questions included on surveys to assess the KABB of health practitioners will focus on logistics of vaccine delivery and record keeping, attitudes toward vaccines, beliefs about pharmacists as immunizers, support of the current age restriction for pharmacist delivery (children 5 years of age and older in Nova Scotia and New Brunswick) and current immunization practices.

It is hypothesized that knowledge about the vaccines being studied is lower among the general public and higher among practitioners. This study also hypothesizes that there is a high level of support among both the public and health care providers for pharmacists as immunizers. Knowledge and support amongst both providers and the public is expected to increase after the implementation of the

intervention study.

KABB Questionnaire Theoretical Model

Participation in health protective behaviours, such as vaccination, is influenced by psychological factors, many of which are part of greater behavioural change theories (Gerend, 2012). The theory of planned behaviour (TPB) is a theoretical framework that explains the causal chain linking behavioural beliefs, normative beliefs and control beliefs to the formation of intention, presumed to be the immediate antecedent of behaviour (Glanz, 2015; Ajzen, 1986). Intended to explain deliberative actions based on these constructs, the TPB is well positioned to predict immunization, however lacks specificity in healthcare decision making (Corace, 2016).

The health belief model (HBM) was developed in the 1950s by social psychologists in the U.S. Public Health Service in an attempt to understand the common failure of people to accept disease preventives or screening for the early detection of disease (Edberg, 2010). According to the model, engagement in health action rests on the belief that such action can reduce a threat that is both likely and would have severe consequences (Glanz, 2015). The constructs that predict whether and why an individual will take action to prevent, detect or control illness conditions according to the HBM, include perceived susceptibility, severity, benefits and barriers to engaging in health actions, cues to action, and self-efficacy (Glanz, 2015).

There is considerable correlation between the HBM and the theory of planned behaviour (TPB) proposed by Ajzen and Timko (1986). Both theories are based on the same framework, make similar assumptions, have overlapping constructs and adopt an individual level approach to predicting health behaviour. The primary difference between them is that the TPB contains a proximate predictor of behaviour or an intention to act, where the HBM does not (Gerend, 2012). The combination of both of these theories is beneficial to this study because it will allow a broad understanding of the intent to vaccinate in addition to vaccine-specific perceptions of barriers and facilitators that will help focus future intervention. A blended TPB and HBM survey design from a 2014 study led by the Vaccine Evaluation Center along with members at the Canadian Center for Vaccinology (Schneeberg, 2014), will inform the selection of questions for the proposed survey in addition to relevant literature.

Survey Design and Study Population

This study will use repeated cross-sectional online surveys to assess the KABB of community-dwelling adult members of the public regardless of whether or not they were vaccinated as part of this study and a second survey for physicians, pharmacists, and vaccine providing nurses. Surveys will be distributed before and after the intervention regarding knowledge, attitudes, beliefs, and behaviours of targeted vaccines and their delivery by pharmacists.

For the community public surveys, all individuals >18 years of age in the intervention and control communities in Nova Scotia and New Brunswick will be eligible regardless of whether or not they were vaccinated as part of this study. Adult residents in all four participating communities will be informed about the survey and invited to participate by means of local advertisements in community print and online publications, posters, via social media, and through information distributed in the community pharmacies. These advertisements will contain the web address where the online KABB survey can be found.

For the healthcare provider survey, all family physicians, pharmacists and vaccine providing nurses in Nova Scotia and New Brunswick will be eligible. In order to increase national generalizability, we will examine the logistics of partnering with investigators in other provinces to administer the surveys in their jurisdictions. Pharmacists and vaccine providing nurses in all four participating communities will be informed about the survey and invited to participate by means of local advertisements in print and online publications distributed by professional associations (such the Neighborhood Pharmacy Association) via available social media (e.g. Facebook groups and Twitter accounts with permission), posters on internal bulletin boards in local hospitals, and other publicly available means such as targeted outreach via email (e.g., publicly posted email addresses for clinics, pharmacies, etc.). Locally, physicians will be recruited for the KABB survey through the regional hospital medical staff offices. Provincially, physicians will be recruited through Doctors Nova Scotia. These advertisements will contain the web address where the online KABB survey can be found.

Questions to assess the KABB of the public will focus on awareness of vaccines available, attitudes toward vaccines, perceived social pressures to vaccinate, ability to access vaccination, intention to vaccinate, the use of pharmacists as immunizers, willingness to pay for vaccines, and current vaccination status for study vaccines. The health care provider survey will collect information on physicians', nurses' and pharmacists' KABB regarding logistics of vaccine delivery and record keeping, current immunization practices, attitudes toward vaccines, burden of illness associated with vaccine-preventable diseases, pharmacists as immunizers, and the current age restriction (children 5 years of age and older). Educational needs of healthcare providers on the conditions linked to the vaccinations and their prevention will be collected as well.

The public and provider surveys will be distributed accordingly during the 6-month period prior to implementation of the community-wide pharmacy intervention and immediately following the two-year intervention. KABB survey data will be available and collected prior to flu season.

Survey Instruments Development

Validated survey instruments (questionnaires) will be developed using a formative process informed by Ajzen and Timko in the TPB with target constructs from the HBM. Survey instruments will include two different questionnaires and will be distributed twice according to the above timeline:

1. The questionnaire for the public contains approximately 50-60 yes or no, or strength of agreement questions using a Likert scale measuring attitudes toward vaccines, perceived social pressures to vaccinate and perceived/actual behavioural controls. More specifically, data collection will include demographic information, perceived susceptibility and severity of illnesses, perceived benefits and barriers to vaccination, intention to vaccinate, educational needs on prevention and protection, use of pharmacists as immunizers and willingness to pay for vaccines. A draft list of questions has been attached; these questions will be modified, reduced in number, and appropriately ordered prior to finalization. The final survey instrument will be resubmitted to the REB for approval.
2. The questionnaire for health care providers will contain approximately 30-40 yes or no, or strength of agreement questions using a Likert scale measuring knowledge, attitudes and beliefs about the logistics of vaccine delivery and record-keeping, current immunization practices, attitudes toward vaccines, burden of illness associated with vaccine-preventable

diseases, pharmacists as immunizers, and the current age restriction (children 5 years of age and older). A draft list of questions has been attached; these questions will be modified, reduced in number, and appropriately ordered prior to finalization. The final survey instrument will be resubmitted to the REB for approval.

The survey instruments will be constructed following the principles of survey design of Dillman, Smyth, and Christian (2014). Previously validated questions will be employed whenever possible. Statistical analysis will be done with SAS version 9.4 by the Data Management Group at the Canadian Center for Vaccinology (CCfV). Prior to distributing the survey, the content validity of individual questions, as well as the content validity of the entire questionnaire, will be evaluated by a panel of experts comprised of nurses, pharmacists, and infectious diseases physicians and vaccinologists at CCfV. The panel will determine the content relevance of the questions and the questionnaires as a whole using a rating worksheet. Each item will be rated using a standard content validity index with a 4-point ordinal rating scale, where 1 indicated irrelevance and 4 highly relevant. Items that receive a score of 3 or 4 will be judged to have content validity. The content validity index for the entire instrument will be the proportion of items judged to have content validity. Items that do not achieve the required minimum agreement of experts will be eliminated or revised. Test-retest reliability will be assessed by having up to five health care providers and 5 members of the public complete the questionnaires at two different points in time (approximately 14 days apart). A correlation co-efficient will be calculated to compare the two sets of responses; questionnaire responses with a coefficient > 0.70 will be interpreted as consistent.

Remark® software will be used. The database will be accessible through a secure web application with personal passwords for research staff. All participant information will be stored in Remark® and contact information will only be available to authorized staff (e.g., study nurse).

3.3 AEFI Measurement

This study will employ the platform used by the Canadian National Vaccine Safety Network (CANVAS) to conduct active surveillance during the first four weeks of the seasonal influenza vaccine campaign to assess pharmacy-based recruitment of vaccine recipients into an AEFI surveillance program (De Serres, 2012; Bettinger, 2015). Patients receiving an influenza vaccine at a pharmacy in one of the study communities will be eligible to participate in a specific survey of adverse events experienced during the first 7 days following vaccination. In the intervention communities, vaccine recipients will be given an information sheet describing the survey and the CANVAS registration form. Participants will be asked to complete the registration form or to register online by providing their first name, vaccine received and date of vaccination, email address, and telephone number. In the control communities, recruitment will be passive (e.g., posters and information sheets will be displayed) and potential participants will be required to register online. Only individuals ≥18 years of age who received the seasonal influenza vaccine and who are English or French-speaking will be invited to register and complete the survey.

The AEFI survey will be emailed to registered participants on day 8 post-vaccination. An automatic reminder will be sent on day 11 post-vaccination to those who have not completed the survey. The survey will collect information regarding vaccine provider, vaccine product, participant age and gender. Respondents will be asked to indicate if they experienced a health event that prevented their daily activities or led them to seek medical attention. Those who report symptoms severe enough to prevent daily activities or require medical attention will be asked details about the onset, duration, and type of

symptoms experienced within the first 7 days post-vaccination. Participants reporting events severe enough to require medical attention will be contacted by a trained study nurse within 3-5 days. Events will be reported to public health as per local guidelines.

Participants who register for the AEFI survey will be registered in CANVAS as well. As such, they will be invited to complete the "control survey" which aims to determine the underlying rate of illness in the population that occurs irrespective of vaccination, known as the "background event rate". To collect information on the background rate of health events participants will receive a second email survey about two weeks before the start of the next seasonal influenza vaccination campaign (e.g. 2016 participants will receive an email in the fall of 2017 and 2017 participants will receive an email in the fall of 2018). That survey will collect data about the occurrence of clinical problems in the prior 7 days. A reminder email will be sent 7 days before the survey to mark the start of the 7-day monitoring period for participants.

RedCap™ software will be used. The database will be accessible through a secure web application with personal passwords for research staff. All participant information will be stored in RedCap™ and contact information will only be available to authorized staff (e.g., study nurse). The number of influenza vaccine recipients in each community will be ascertained from pharmacy databases.

The proportions of influenza vaccine recipients who registered for and completed the online AEFI survey will be compared among intervention and control communities. Frequencies of severe AEFI, and of AEFI requiring medical attention will be determined. The frequency of severe adverse events will be determined by influenza vaccine type [e.g., quadrivalent inactivated influenza vaccine (QIV), TIV] and by season (i.e., 2016-17 and 2017-18).

4 STUDY PRODUCT AND ADMINISTRATION

Specific product information is provided in each vaccine-specific appendix.

4.1 For a description of Adacel and Boostrix, please see Appendix A.

For a description of Fluzone High-Dose, please see Appendix B.

For a description of Bexsero for Meningococcal serogroup B and Nimenrix, Menactra, and Menveo for Meningococcal serogroups ACWY, please see Appendix C.

For a description of Avaxim, Havrix and Vaqta for Hepatitis A, Engerix-B and Recombivax for Hepatitis B, Twinrix for combination Hepatitis A and B, Typherix, Typhim Vi and Vivotif for Typhoid Fever, and ViVaxim for combination Hepatitis A and Typhoid, please see Appendix D.

For a description of Shingrix and Zostavax II for Herpes Zoster, please see Appendix E.

5 ETHICAL AND REGULATORY CONSIDERATIONS

5.1 Informed Consent Process and Documentation

This study will be conducted in accordance with all Research Ethics Board requirements. The protocol and all related materials will be submitted to the local independent Research Ethics Boards of the Canadian Center for Vaccinology, Halifax (Nova Scotia Health Authority provincial Research Ethics Board, and Horizon Health REB in New Brunswick), and the Child and Family Research Institute (CRFI), Vancouver (they will be responsible for data management for the AEFI survey only) for review and approval. If the survey is administered in other provinces, it will be submitted to the appropriate REBs. All REBs are constituted in conformance with the Canadian Food and Drug Act and Regulations (C05.005, C05.006). A copy of the REBs' letters of approval for the study will be kept.

No changes will be made to the protocol without REB approval. Pharmacists/pharmacies will be able to withdraw their participation from the study at any time without giving a reason.

Participating Pharmacies

For the pharmacy intervention, the participants are the pharmacies that agree to carry out the study intervention rather than members of the public. Pharmacies will be able to withdraw from the study at any time.

General Public and Healthcare Providers' KABB

Survey participants will receive an information sheet providing them with information about the survey prior to completing the online survey. A consent statement will be included as the first question of the survey. An affirmative answer will be required to proceed with the survey. The participants will be notified that they can withdraw from the study at any time until the survey is submitted. Completion of the online survey implies consent. Surveys are anonymous and participants will not be able to withdraw once they have submitted their questionnaire as the survey instrument cannot be traced back to the original participant.

Adverse event following immunization survey

An information sheet will be provided to influenza vaccine recipients and participants will be required to indicate their consent on the introductory page of the online survey in order to proceed to the survey.

6 OUTCOME MEASURES AND STATISTICAL METHODS

6.1 Outcomes/analysis plan/sample size/statistics

6.1.1 Primary Outcomes

1. Population specific vaccine coverage before and after bundled pharmacist-delivery intervention.
2. Proportion of population in intervention districts whose supplementary health benefit plans cover studied vaccines.
3. Public KABB about vaccine preventable diseases and related vaccines before and after program implementation interventions.
4. Public willingness to pay and co-pay for studied vaccines.
5. Health care KABB regarding pharmacist- delivered vaccine programs.
6. Public and health care provider satisfaction with various models of vaccine program delivery.

Proportions of influenza vaccine recipients who register for CANVAS and who complete the online AEFI survey in intervention versus control communities.

6.2 Analysis Plan, Statistics and Sample Size

1. KABB Surveys. Although the response rate is expected to be higher, surveys returned from 400 individuals will provide a 95% confidence interval of ±5% around the point estimate for any survey question. The first level of analysis will comprise a review of descriptive statistics for trends in the data. The second level of analysis will involve tests of association. Continuous variables will be presented as summary statistics (i.e., mean and standard error) and categorical variables by frequency distributions (i.e., frequency counts, percentages and their two-sided 95% exact binomial confidence intervals). Descriptive statistics will be used to estimate the proportion of respondents who answered correctly the knowledge-based questions and who had specific attitudes towards and beliefs about studied vaccines. Differences in survey responses between groups will be assessed using Fisher's exact tests. For continuous predictors, logistic regression will be used. Overall knowledge scores will be compared using t-tests. Associations between attitude questions, behavioral responses and demographics will be estimated using ordinal logistic regression or Fisher's exact tests. P-values < 0.05 will be considered statistically significant. If the data support further analysis, demographic and population characteristic variables will be used to develop predictive models for knowledge and attitude responses. Logistic regression will be used to predict binary knowledge responses, in which the model is used to predict the probability of agreeing or disagreeing with the associated statement. Ordinal logistic regression will be used to predict ordered attitude responses, where the model is used to assess the degree (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree) to which subjects have knowledge regarding particular issues. The particular ordinal logistic regression model to be fit is a cumulative logit model. For each outcome variable, whether binary or ordered, the collection of demographic and population characteristic variables will be used in a backwards elimination stepwise procedure to develop a multiple regression model. Those predictor variables remaining at the termination of the stepwise procedure are summarized, and p-values are indicated. P-values of <0.05 will be considered statistically significant. If the number of survey respondents $N \geq 400$, then the estimated proportion of the "yes" response to any fixed KABB survey item will have margin of error <.05.

2. AEFI Surveys. Point estimates and exact binomial 95% confidence intervals will be calculated for the proportion of influenza vaccine recipients who register for the AEFI survey and the proportion who complete the survey. Descriptive statistics will be used to compare proportions registering and completing the survey among intervention versus control communities. Overall frequency of severe adverse events and the frequency of specific health events (e.g., injection site pain that prevents daily activities) will be calculated. The frequency of severe AEFI will be compared by influenza vaccine type [e.g., QIV, TIV] and by season (i.e., 2016-17 and 2017-18). The frequency of health events after vaccination will be compared to the background event rate estimated by the control survey.

3. Vaccine coverage. Pharmacy databases will be used to determine the number of doses administered to individuals eligible for receipt of vaccine relative to the total number of clients in the pharmacy database in the eligible age range. A second estimate of coverage will be

determined by physician billing data and public health provision of vaccine to physicians relative to the Statistics Canada population age specific census data for that community. A study-specific system of reciprocal notification forms for family doctors will be implemented that is similar to that used for publicly funded routine vaccines. A third estimate of vaccine coverage will be vaccine doses distributed in the participating communities (obtained from the manufacturer) relative to the eligible population based on Statistics Canada census data (2011 and 2016 when available). The fourth estimate of vaccine coverage will be derived from the pre- and post-program public survey. Binomial point estimates and confidence intervals will be made for vaccine coverage rate within site, and coverage will be compared between and among sites using confidence intervals for the difference of binomial proportions, Fisher's exact tests, and logistic regression. Using a margin of superiority of 10%, when comparing two coverage proportions within site or between sites, a sample size of 298 per group gives 80% power to conclude in favor of superiority when the true difference in proportions is at least 20%, and a sample size of 1209 per group provides 80% power when the true difference in proportions is at least 15%, assuming independent responses. However, it is anticipated that there will be dependence within the family unit regarding the decision to be vaccinated, in which case the precision on the binomial point estimate, and thereby, the required sample size, depends on the size of the family unit and the intraclass correlation. Assuming the family unit to consist of two adults, and under the worst-case scenario in which the decision on vaccination is fully concordant for the two family members, the required sample size per group to detect a specified difference is doubled, to 596 (2418) when the true difference is at least 20% (15%). Estimates of the intraclass correlation will be calculated using data from pharmacy databases and from the public survey portion of the study, and these will be used to adjust confidence intervals and test statistics to accommodate within family dependence (Donner, Brikett, & Buck, 1981).

7 STUDY HOLDING RULES AND SAFETY MONITORING

As the study involves vaccines that are authorized for use in Canada a Data Monitoring and Safety Committee will not be constituted and no formal study holding rules will be established. Safety monitoring is described under the description of AEFI surveys and reporting.

Confidentiality of Data and Access to Participant Records

Survey data will be confidential. All records for the KABB survey will be maintained in a safe and secure location at CCfV and/or on a secure server that will be only accessible to trained study staff. The AEFI survey data will be stored on a secure server hosted and supported by the Child and Family Research Institute (CFRI) in Vancouver. The database will be accessible through a secure web application with personal passwords for research staff. Participant contact information (email address, first name, telephone number) will be stored in REDCap. Only research team members at CCfV will have access to participants' contact information (names, email addresses, phone numbers).

Auditing

Audits or inspections may be made by the Research Ethics Board to ensure that the study has been conducted in accordance with the protocol, as applicable.

Stipends for Participation

Participants who complete the KABB Surveys (General Public Survey and Health Care Providers Survey) will be offered the opportunity to be entered in a draw for a chance to win a $100 gift card to a restaurant of their choice. Participation in the draw is completely optional. If they choose to participate in the draw, they will be asked to provide their email address; however, they are informed that their email address will be stored in a separate dataset, which will **not** be linked to their survey responses. No compensation will be provided to the pharmacists who are involved in the Vaccine Coverage Demonstration Program as well as participants who complete the Adverse Events Following Immunization (AEFI) Survey.

Adverse Event Compensation and Insurance

Not applicable.

8 ADMINISTRATIVE MATTERS

8.1 Publication Policy

Study result manuscripts will be initiated and led by the Lead Investigators and reviewed by all other co-investigators who form part of the coverage, KABB and AEFI working groups and submitted to peer-reviewed journals and scientific meetings. All publications and presentations will be subject to the publication policies of the Canadian Immunization Research Network (CIRN).

8.2 Knowledge Translation Plan

As a community-intervention project, the public and immunization providers will be involved in the project during its implementation. Different communication strategies will be tested in this project, and a change in KABB is an outcome measure of the study. Post-program KT will include presentations to stakeholders in the participant communities, engagement of knowledge users and decision makers through feedback sessions, presentations, meetings, and publications. CIRN's Stakeholders Advisory Committee and CIRN's contacts with provincial/territorial and national advisory committees will also be employed.

8.3 Data Management

Data management will be the responsibility of the Data Center at the Canadian Center for Vaccinology. Data management and analysis will be performed on the secure server at CCfV. For the KABB survey, data will be stored in SAS version 9.4 or higher on an Intel Xeon E5-1650 v2 1U rackmount server running the CentOS Linux operating system. Daily differential tape backups are performed in addition to weekly full tape backups.

The cleaned data will then be transferred to the final analysis dataset in the project account. A computer program to perform edit checks will then be run to pick up any data inconsistencies and any invalid values.

The AEFI surveys will be administered using REDCap software on a secure server hosted and supported by the CFRI in Vancouver, the same platform used by CANVAS influenza vaccine surveillance. The database will be accessible through a secure web application with personal passwords for research staff, providing a secure environment (encryption, firewalls, frequent backups and recovery plan). Survey data (without contact information) will be downloaded to the CCfV server for analysis.
Integrity of the KABB and AEFI datasets will be assured by limiting access through passwords and account control. The Computer Centre Manager, upon direction from the Data Manager provides access to computer accounts. Once the dataset has been moved to the project account it is accessible only by the Data Manager or designate. Before the final analysis is run, the datasets will be locked to updates.

8.4 Record retention

Following closure of the study, the investigator will maintain all site study records in a safe and secure location for seven years. The records will be easily accessible, when needed (e.g., audit or inspection). The investigator/institution will notify the REB of any changes in the archival arrangements, including, but not limited to, archiving at an off-site facility or transfer of ownership of the records in the event the investigator leaves the site.

8.5 Quality assurance

REB audits/inspections can occur at any time during or after completion of the study. If an audit or inspection occurs, the investigator and institution agree to allow the auditor/inspector direct access to all relevant documents and to allocate their time and the time of their staff to the auditor/inspector to discuss findings and any relevant issues.

8.6 Provision of study results to investigators

Where required by applicable regulatory requirements, an investigator signatory will be identified for the approval of the study report. The investigator is encouraged to share the summary results with the study participants, as appropriate.

8.7 Timeline

The project is planned for three years and will consist of a pre-program phase, a program phase, and an analysis phase.

Pre-program phase: 6 months

- Administration of pre-program provincial health care provider surveys
- Administration of pre-program community public surveys
- Roll out of program information and training of practitioners

Program phase: 2 years

- Roll out of program to public
- Program delivery
- Ongoing surveillance activities for coverage rates and AEFI

Post program phase: 1 year

- Administration of follow up community public survey
- Administration of follow up community health care provider survey
- Outcome analyses, publication and knowledge translation activities

REFERENCES

Azjen, I. & Timko, C. (1986). Correspondence between health attitudes and behaviour. *Journal of Basic and Applied Pyschology, 7(4)* , 259-276.

Briss, P. A., Rodewald, L.E., Hinman, A.R., Shefer, R.A, Bernier, R.R. et. al. (200). Reviews of evidence regarding interventions to improve vaccination coverage in children, adolescents and adults. *American Journal of Preventive Medicine, 18*(Supplement 1), 97-140.

Canadian Pharmacists Association (January 4, 2012). Pharmacists once again ranked the most trusted profession in Canada. Retrieved from: http://www.healthactionlobby.ca/fr/media-centre/members-in-the-news/93-pharmacists-once-again-ranked-the-most-trusted-profession-in-canada.html (Accessed April 6, 2014)

Canadian Pharmacists Association (2015). Pharmacists' expanded scope of practice. Retrieved from: http://www.pharmacists.ca/index.cfm/pharmacy-in-canada/scope-of-practice-canada/.(Accessed February 13, 2015)

Colgrove, J. (2007). Immunity for the people: The challenge of achieving high vaccine coverage in American history. *Public Health Rep., 122*(2), 248-257.

Corace, K. M., Srigley, Jocelyn A., Hargadon, Daniel P.,Yu, Dorothy, MacDonald, Tara K., Fabrigar, Leandre R. & Garber, Gary E. (2016). Using behavior change frameworks to improve healthcare worker influenza vaccination rates: A systematic review. *Vaccine, 34*(28), 1-8.

De Serres G., G. M. C., Coleman B., Rouleau I., McNeil S., Benoît M., McGeer A., Ambrose A., Needham J., Bergeron C., Grenier C., Sleigh K., Kallos A., Ouakki M., Ouhoummane N., Stiver G., Valiquette L., McCarthy A., Bettinger J.; PHAC-CIHR influenza Research Network (PCIRN). (2012). Short and long-term safety on the 2009 AS03-adjuvanted pandemic vaccine. *PLOS One, 7*(7), e38563. doi:10.1371/journal.pone.0038563

Dillman, D. A., Smyth, J.D., & Melani Christian, L. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored-design method* (4th ed.). Hoboken, NJ: Wiley & Sons.

Donner, A., Smyth, J.D., & Melani Christian, L. . (2014). Randomization by cluster: Sample size requirements and analysis. *American Journal of Epidemiology, 114*(6), 906-914.

Edberg, M. (2010). *Essential readings in health behavior theory and practice*. Sudbury, Massachusetts: Jones and Bartlett Publishers.

Edwards, N., Gorman Corsten, E., Kiberd, M., Bowles, S., Isenor, J., Slayter, K., & McNeil, S. (2015). Pharmacists as immunizers: a survey of community pharmacists' willingness to administer adult immunizations. *International Journal of Clinical Pharmacy, 37*(2), 292-295.

Gerend, M. A. S., Janet E. (2012). Predicting human papillomavirus vaccine uptake in young adult women: comparing the health belief model and theory of planned behavior. *Annals of Behavioral Medicine, 44*(2), 171-180. doi:10.1007/s12160-012-9366-5

Glanz, K., Rimer, B.K.& Viswanath, K. (2015). Health behavior: Theory, research, and practice (4th ed., pp. 483). San Fransico, CA: Jossey-Bass a Wiley Brand.

Grabenstein, J. D. (1999). Pharmacists and immunization: Increasing involvement over a century. *Pharmacy in History, 41*(4), 137-152.

Grabenstein, J. D., Hartzema, A.G., Guess, H.A., Johnston, W.P., & Rittenhouse, B.E. (1992). Community pharmacists as immunization advocates: Cost-effectiveness of a cue to influenza vaccination *Medical Care, 30*, 503-513.

Halperin B.A., M.-C. D., McNeil S., Kalil J., Halperin S.A. (2014). Maintaining the momentum: Key factors influencing acceptance of influenza vaccination among pregnant women following the H1N1 pandemic. *Human Vaccines & Immunotherapeutics, 9*(3), 621-624.

Houle, S. K. D., Grindrod, K.A., Chatterley, T., & Tsuyuki, R.T. (2013). Publicly funded remuneration for the administration of injections by pharmacists: An international review. *Canadian Pharmacists' Journal, 146*(6), 353-364.

Isenor JE, Alia TA, Killen JL, Billard BA, Halperin BA, Slayter KL, McNeil SA, MacDougall D, Bowles SK. Impact of pharmacists as immunizers on influenza vaccination coverage in Nova Scotia, Canada. Hum Vaccin Immunother. 2016: 12(5):1225-8.

MacDougall, D. M., Halperin, B.A., Isenor, J., MacKinnon-Cameron, D., Li, L., McNeil, S.A., Langley, J.M., & Halperin, S.A. (2016). Routine immunization of adults by pharmacists: Attitudes and beliefs of the Canadian public and health care providers. *Human Vaccines & Immunotherapeutics, 12(3)*: 623-31.

MacDougall D, Halperin BA, MacKinnon-Cameron D, Li Li, McNeil SA, Langley JM, Halperin SA. (2015). Universal tetanus, diphtheria, acellular pertussis (Tdap) vaccination of adults: what Canadian health care providers know and need to know. *Human Vaccines and Therapeutics, 11(9):* 2167-79.

Marra F., Kaczorowski J., Gastonguay L., Marra C.A., Lynd L.D., Kendall P. (2014). Pharmacy-based Immunization in Rural Communities Strategy (PhICS): A community cluster-randomized trial. *Canadian Pharmacy Journal (Ott), 147(1)*:33-44.

Public Health Agency of Canada (2014). Vaccine coverage amongst adult Canadians: Results from the 2012 adult National Immunization Coverage (aNIC) survey. Retreived from: http://www.phac-aspc.gc.ca/im/nics-enva/vcac-cvac-eng.php. (Accessed February 13, 2015)

Scheifele, D.W.; Ward, B.J.; Halperin, S.A.; McNeil, S.A.; Crowcroft, N.S.; Bjornson, G. (2014). Approved but non-funded vaccines: Accessing individual protection. *Vaccine, 32(7)*: 766-770.

Schneeberg, A., Bettinger, J.A., McNeil, S., Ward, B.J., Dionne, M., Cooper, C., Coleman, B., Loeb, M., Rubinstein, E., McElhaney, J., Scheifele, D.W., & Halperin, S.A. (2014). Knowledge, attitudes, beliefs and behaviours of older adults about pneumococcal immunization, a Public Health Agency of Canada/Canadian Institutes of Health Research Influenza Research Network (PCIRN) investigation. *BioMed Central Public Health, 14(422)*.

Steyer, TE, Ragucci, KR, Pearson WS, Mainous, AG 3rd. (2004). The Role of Pharmacists in the Delivery of Influenza Vaccinations. *Vaccine, 22 (8)*, 1001-1006.

Yarnall K.S., Pollak K.I., Østbye T., Krause K.M., Michener J.L. (2003). Primary care: is there enough time for prevention? *American Journal of Public Health, 93(4)*: 635-41.

APPENDIX A-E DELETED FOR PRIVACY REASONS