Identifying and addressing the impacts of the COVID-19 pandemic on school-based immunisation programmes in the Canadian Maritimes: a mixed methods study protocol

Allyson J Gallant,1 Audrey Steenbeek,2 Scott A Halperin,3 Jeanna Parsons Leigh,4 Janet A Curran2,5

ABSTRACT

Introduction The COVID-19 pandemic highlighted the importance of keeping up to date on routine vaccinations. Throughout the pandemic, many routine vaccine programmes in Canada were paused or cancelled, including school-based immunisation programmes (SBIP). This resulted in decreased coverage for many vaccine-preventable diseases. While the effects of the pandemic on SBIP have been described in other provinces, its effects in the Maritime region (ie, Nova Scotia, New Brunswick and Prince Edward Island) have yet to be understood. We aim to determine how these programmes were affected by COVID-19 and associated public health measures in the Canadian Maritimes by (1) identifying and describing usual and interim catch-up programmes; (2) exploring stakeholders’ perceptions of SBIP through interviews; and (3) designing recommendations with stakeholders to address gaps in SBIP and vaccine coverage.

Methods and analysis A sequential, explanatory mixed methods study design will be used to address the objectives during the study period (September 2022–December 2023). First, an environmental scan will describe changes to SBIP and vaccine coverage over a period of five school years (2018/2019–2022/2023). Findings will inform semistructured interviews (n=65) with key stakeholders (eg, health officials, healthcare providers, school officials and parents and adolescents) to explore perceptions of SBIP and changes in parental vaccine hesitancy during the pandemic. These data will be integrated to design recommendations to support SBIP during two stakeholder engagement meetings. Analysis will be guided by the behaviour change wheel, a series of complementary tools and frameworks to simplify behaviour diagnosis and analysis in public health research.

Ethics and dissemination Ethics approval for this study has been obtained from Dalhousie University’s Health Sciences Research Ethics Board (Ref: 2022-6395). Informed consent will be obtained from participants prior to participating in an interview or stakeholder engagement meeting. Study findings will be disseminated through conference presentations, publications and infographics.

INTRODUCTION

The SARS-CoV-2 virus (COVID-19) was first identified in December 2019 and declared a pandemic by the WHO in March 2020.1 As of January 2023, over 669 million cases of COVID-19 have been confirmed and have resulted in over 6.75 million deaths worldwide.2 In Canada, six waves of COVID-19 cases and five variants of concern have resulted in over 4.5 million confirmed COVID-19 cases since the onset of the pandemic and has resulted in 50,000 deaths.3 High COVID-19 case numbers across the country have resulted in significant strains on provincial health systems.4 While COVID-19 has affected each Canadian province and territory, the burden of the pandemic has varied greatly across the country. The Maritime provinces (ie, Nova Scotia (NS), New Brunswick (NB) and Prince Edward Island (PEI)) have yet to be understood. We aim to determine how these programmes were affected by COVID-19 and associated public health measures in the Canadian Maritimes by (1) identifying and describing usual and interim catch-up programmes; (2) exploring stakeholders’ perceptions of SBIP through interviews; and (3) designing recommendations with stakeholders to address gaps in SBIP and vaccine coverage.
Edward Island (PEI) had a unique experience as they managed to maintain low case numbers through much of the pandemic. As of January 2023, NS had 137,000 confirmed cases, NB had over 86,000 and PEI had over 56,000 cases, thanks in part to strict public health measures (PHM) within and across the provinces.5–8 The Maritime provinces have also had higher completion rates for the primary series of COVID-19 vaccinations (NS: 83.82%; NB: 86.32%; PEI: 87.71%) than the national average (81.86%).9 While PHM and vaccination rates have been successful in controlling transmission of COVID-19, they have also resulted in delays in seeking healthcare services,10 delays or cancelled surgeries,3 and paused or modified public health programmes (eg, school-based immunisation programmes (SBIP));11 these programmes and vaccine uptake.

Schools are natural learning environments for children and many accessible public health initiatives, including SBIP, are implemented in these settings to support equitable health outcomes in students.15 Each province and territory in Canada offers SBIP at no charge, although there are variations in the vaccines offered, grades they are administered in and how provincial public health departments direct these programmes in schools.13 Table 1 highlights the variation in vaccines offered in NS, NB and PEI programmes.

SBIP were paused or modified as schools across Canada switched between in-person and virtual attendance throughout waves of the pandemic,14 resulting in significant decreases in vaccine coverage.15 While decreases may be in part due to structural barriers (eg, accessibility of appointments, healthcare staff shortages),14 increases in vaccine hesitancy and antivaccination views may have also played a role in decreased coverage. Vaccine hesitancy is considered the ‘delay or unwillingness to vaccinate despite accessible vaccination programmes’.17 Vaccine hesitant views have increased in recent years, in tandem with the growth of social media use and the widespread sharing of vaccination misinformation and disinformation online.18–21 The COVID-19 pandemic and focus on the rapid development of safe and effective vaccines against the virus brought vaccines into the global spotlight, with concerns of unintended or long-term side effects, or perceived rushed development of vaccines, resulting in some populations choosing to delay or refuse vaccinations.22 While multiple COVID-19 vaccines (ie, Pfizer-BioNTech (Comirnaty), Moderna (SpikeVax), AstraZeneca (Vaxzevria)) were approved for use in individuals aged 16 years and older in Canada in December 2020,23 vaccines were not approved for adolescents aged 12–15 until May 2021,24 for children aged 5–11 until November 2021,25 Moderna vaccines for infants aged 6 months to children under 5 years of age were approved in July 2022 and Pfizer vaccines for infants and children aged 6 months to 4 years in September 2022.26 With the delays in COVID-19 vaccine approval for children and disruptions to routine SBIP, it is crucial to understand how the pandemic may have affected parents (eg, parents, caregivers and/or legal guardians) and adolescent students’ vaccination views.

While the detrimental effects of the pandemic on SBIP have been described in other Canadian provinces, including Ontario and Alberta,16 25 28 to date, its effects on the Maritime provinces have yet to be established. As there are estimated to be 290,000 children and youth (ages 5–19 years) living in the Maritime region,29 this represents a significant subgroup of the population who may be unvaccinated or undervaccinated against important vaccine-preventable diseases as a result of school closures. Pausing SBIP is a critical public health issue, which may exacerbate health inequities among Maritime children. Examining catch-up programming for school-based immunisations through the application of behaviour change theory may provide a practical approach to designing recommendations to support these programmes and vaccine uptake.

### Behaviour change theory

Using behaviour change theory to inform intervention design can improve intervention effectiveness.30 31 However, these theories can be complex to apply, and subsequently, practical tools have been developed to facilitate their application in intervention design. Among these tools include the behaviour change wheel (BCW), the theoretical domains framework (TDF) and behaviour change techniques (BCTs). The BCW is a three-phase framework developed by synthesising 19 behaviour change theories and supports the systematic identification of intervention and policy content to address target behaviours (figure 1).32 The TDF is comprised of 14 domains to capture the various individual, social and environmental factors, which may support or hinder behaviours,33 34 and can be used independently or mapped into the BCW. The BCTs were developed to

<table>
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<th>Table 1</th>
<th>Summary of vaccines and when they are offered in school-based immunisation programmes in the Maritimes4–79</th>
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<td><strong>Maritime province</strong></td>
<td><strong>NB</strong></td>
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<td><strong>Vaccines and grades offered</strong></td>
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<td>HPV</td>
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<td>Additional catch-up programmes</td>
<td>Varicella offered in grade 9 through 2022–2023 school year</td>
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* Student ages: grade 6 (11/12 years); grade 7 (12/13 years); grade 9 (14/15 years).

HPV, human papillomavirus; NB, New Brunswick; NS, Nova Scotia; PEI, Prince Edward Island; TDaP, tetanus, diphtheria and pertussis.
identify the more granular elements of interventions targeting behaviour change.\textsuperscript{35} The BCW and complementary tools have previously been used in vaccine research to understand and support changes in behaviour, including by the WHO to identify and address vaccine hesitancy,\textsuperscript{36,37} and in the design of vaccine delivery content to optimise uptake.\textsuperscript{38,39}

To date, the majority of COVID-19 research has focused on public health and health system measures to mitigate COVID-19\textsuperscript{40,41} and COVID-19 vaccine development and associated hesitancy.\textsuperscript{32,43} Research investigating COVID-19-related disruptions to routine childhood immunisation programmes has primarily focused on programming administered in healthcare settings for children under 5 years of age,\textsuperscript{44,45} with minimal attention paid to SBIP to date. Therefore, we aim to identify and address the effects of the COVID-19 pandemic on SBIP in the Canadian Maritimes. The Maritime provinces were chosen for the relatively low COVID-19 caseloads, unique COVID-19 PHM and high compliance with PHM compared with the rest of Canada throughout 2020–2021.\textsuperscript{46} The similarities in PHM and compliance across the Maritimes, coupled with the heterogeneity in school-based immunisation programmes in each province, will help juxtapose school-based immunisation service delivery and changes as a result of COVID-19 across the three provinces.

To achieve the study aim, we will address the following key objectives: (1) map available evidence of catch-up programmes for SBIP in the Maritimes due to COVID-19; (2) explore perceptions of SBIP through key stakeholder interviews; (3) integrate study findings and map findings to the BCW; and (4) engage stakeholders in the design of evidence-based, theory-informed recommendations to address gaps in SBIP delivery as a result of COVID-19 and to support uptake of routine adolescent vaccines in the Canadian Maritimes.

**METHODS AND ANALYSIS**

Given the unique circumstances created by the COVID-19 pandemic and the PHMs implemented to mitigate transmission, a mixed methods approach will ensure that comprehensive data are captured to better understand, and ultimately address, the disruptions to SBIP in each of the Maritime provinces. A sequential explanatory design will be used to identify how these immunisation programmes were affected by COVID-19, first through an environmental scan (phase 1) to identify and describe established SBIP and catch-up programmes developed and implemented during COVID-19, followed by phase 2 interviews with key stakeholders (eg, public health officials, school officials, healthcare providers, parents and adolescents) to explore perceptions of SBIP and catch-up programming. Integrating evidence from these two phases will then inform recommendation development (phase 3) to support SBIP delivery and vaccination uptake for routine adolescent vaccines in the Canadian Maritimes (figure 2).

Priority will be placed on the second, qualitative phase of the study which will provide an in-depth understanding of stakeholders’ perceptions of SBIP. Data integration will occur at three points during the study: first, to inform research objectives at each phase; at the intermediate stage as findings from the environmental scan in phase 1 will inform the qualitative interview guides developed in phase 2; and in phase 3 through joint displays and a narrative summary to inform recommendation development.\textsuperscript{47,48} Data collection will take place between

![The behaviour change wheel. Used with permission from Michie et al.\textsuperscript{32}](http://bmjopen.bmj.com/first-published-as-10.1136/bmjopen-2023-073172-on-26-June-2023/downloaded-from-bmjopen.bmj.com.on-June-28-2023-by-guest.Protected-by-copyright.)
Our environmental scan will follow the five-generations in Health: topic identification, refinement, research, outlined by Canadian Agency for Drugs and Technologies in Health (2022–2023). Environmental scans provide valuable context in public health research by identifying healthcare practices, policies and procedures used within, and across, jurisdictions to understand health practices and to identify potential gaps. While the use of environmental scans in health research is well established, their inclusion in mixed methods research is relatively novel. Our environmental scan will follow the five-phase process outlined by Canadian Agency for Drugs and Technologies in Health: topic identification, refinement, research, external review and delivery.

An initial search in March 2022 identified no ongoing or completed environmental scans in this area. The objectives of the environmental scan will be to: (1) describe the provincial-level SBIP in NS, NB and PEI and changes to programming as a result of the COVID-19 pandemic; (2) compare how the changes align and diverge between the three provinces and compare with national guidance from the National Advisory Committee on Immunizations (NACI); and (3) identify any surveillance programmes in place to identify unvaccinated and undervaccinated children as a result of changes to SBIP during the pandemic. We also aim to establish changes in vaccination coverage for vaccines typically offered in school settings since the 2018/2019 school year.

Evidence for the environmental scan will be obtained through passive (ie, grey literature) and active (ie, stakeholder consultation) data collection methods to obtain any and all relevant information. We will seek to identify and describe resources relating to procedures, guidelines, policies and other relevant resources related to school closures, public health programmes and revisions to SBIP and uptake of vaccines (eg, HPV, TDaP) in each province over the span of five school years (from 2018–2019 to 2022–2023). The 5-year time period will allow for a baseline understanding of what SBIP looked like during a typical school year (2018–2019) in each province, identify school closures in each province and catch-up programmes during the COVID-affected school years (2019–2020, 2020–2021 and 2021–2022) school years, and how programmes may have changed in the first school year (2022–2023) without significant school closures and PHM as a result of the pandemic. We will also seek information on provincial vaccination rates for vaccines offered in SBIP over this time to identify any changes in vaccination coverage in each province.

### Data collection

A search strategy and list of relevant keywords informed by a literature review will be developed by the research team to support online document identification. The strategy and keywords will be refined with an expert health sciences information specialist prior to searching to ensure all relevant sites and terms are included.

The search for relevant documents will include targeted website searching and advanced Google searches, two methods for grey literature identification suggested by Godin et al. Targeted website searching will include developing a list of relevant health authority, public health departments, education departments, provincial health and education organisations and government websites that publish information relevant to the research objectives. The search bar in each website will be used to search keywords to identify any relevant documents to the environmental scan. If no search bar exists on the website, advanced Google searching will be used. Advanced Google searching (URL: https://www.google.ca/advanced_search) allows for the search of key terms and can limit search results to the website of interest. All relevant documents from the search will be imported into Covidence (Veritas Health Innovation, Melbourne, Australia), an online review management website, to review. Reference chaining of included resources will be used to identify any final resources to include in the environmental scan. Following this search, connections will be made with public health leaders in each province to seek out any missing data or other internal documents which could support the project.

### Data extraction

A data extraction template will be created in Covidence to extract data relevant to the objectives of the environmental scan. Descriptive data will be extracted (eg, resource type, title, authors, province, publication date) in addition to resource target audience (eg, general public, teachers, parents, students), relevant school details (eg,
school settings, grades affected, dates of school closures) and vaccine programme details (eg, vaccines administered, vaccine programme delivery details, catch up plans developed, vaccination coverage.) The data extraction template will be pilot tested to identify any revisions required or additional items to include prior to extracting data from the included resources.

Data analysis and presentation
Findings will be presented across several formats. First, a descriptive table of included resources and relevant vaccination programme data will be produced. Narrative summaries of changes to each province’s SBIP will be produced, in addition to how these changes compare between provinces and to advice from NACI. Figures will be developed for each province to illustrate a typical school year and when vaccine programmes are typically delivered, and to map the school closures and changes to vaccine programmes throughout the pandemic. Visual and narrative summaries will highlight provincial changes to uptake of vaccines offered in SBIP. Draft findings from the environmental scan will be reviewed by the research team for feedback and approval. The final report will be published and provided to stakeholders in NS, NB and PEI.

Anticipated outcomes
Environmental scan findings will have three purposes within this mixed methods study. First, findings will provide a comprehensive view of baseline SBIP across the Maritimes, changes to programmes as a result of COVID-19, changes in provincial vaccination coverage and potential gaps in SBIP. Second, findings will inform the interview guide used in qualitative interviews (phase 2) to further explore stakeholder perceptions of SBIP and catch-up programmes. Finally, findings will be integrated in phase 3 (recommendations design) and used to inform recommendations designed with stakeholders to support SBIP and vaccine uptake.

Phase 2: stakeholder interviews
An exploratory qualitative study will be used to conduct semistructured interviews with key stakeholders (ie, health officials, healthcare providers, school officials and parents and adolescents) from NS, NB and PEI to gain an in-depth understanding of perceptions of SBIP and changes to programming in the Maritimes. This phase is informed by guidance from Atkins et al for conducting TDF-based qualitative research.33 The objective of this phase will be to explore stakeholders’ perceptions of SBIP and changes to programmes as a result of the COVID-19 pandemic. A secondary objective will be to explore potential changes in parents and adolescents’ vaccination views since the beginning of the pandemic.

Study subjects, recruitment and sampling
Stakeholders will be eligible for inclusion if they are considered a health official (eg, senior health officials, epidemiologists, public health programme coordinators), a healthcare provider who regularly administers routine childhood vaccinations (eg, public health nurses), a school official (eg, principals, teachers), a parent of at least one adolescent (aged 11 or older) affected by the SBIP in the previous 5 years or an adolescent offered routine vaccines in SBIP since 2018. Participants will also need to be a resident of NS, NB or PEI and speak English as a primary or additional language to participate. Parent and adolescent participants will be interviewed as a dyad to ensure parents are aware of, and comfortable with, the questions being asked to their child. Parents may also be able to provide additional context to their child’s responses.

Stratified purposeful sampling65 and convenience sampling66 67 approaches will be used to recruit eligible participants. We aim to recruit at least 13 participants per stakeholder group (minimum 65 total participants), as this aligns with the strategy proposed by Francis et al as cited by Atkins et al. Francis et al suggest interviewing at minimum ten participants to identify key themes, then interviewing three more participants to ensure no new themes arise and data saturation has been achieved. Should new themes emerge during these three additional interviews, interviews will be conducted in increments of three until no further themes arise and saturation has been achieved.68

Participants will be recruited through posts and advertisements on social media (ie, Facebook and Twitter), posters and targeted emailing of health and education stakeholders. Interested participants will be directed to complete a brief screening survey in Research Electronic Data Capture39 to ensure eligibility. Adult participants will be asked to provide informed, written consent to participate in the study prior to completing the survey. Adolescent participants will be asked to provide informed, verbal assent to participate in the study prior to their interview with their parent.

The screening survey will collect demographic details (eg, self-reported gender, age, ethnicity) province of residence (ie, NS, NB or PEI), which stakeholder group they belong to (ie, healthcare provider, health official, school official, parent) as well as contact details, and if they would be interested in participating in future stakeholder meeting associated with the project. Participants who select the parent stakeholder group will also be asked to provide their child’s age to ensure they meet the inclusion criteria, in addition to completing a five-item questionnaire to provide insights into vaccination views. The 5C Scale is a theory-informed measure to assess an individual’s psychological predictors of vaccination.60 The brief version of the 5C scale includes five items, with one item for each of the five constructs: vaccine confidence (eg, I am completely confident that vaccines are safe), complacency (eg, Vaccination is unnecessary because vaccine-preventable diseases are not common anymore), collective responsibility (eg, When everyone else is vaccinated, I don’t need to vaccinate, too), calculation (eg, When I think about getting vaccinated, I weigh the benefits and risks to make the best decision possible) and constraints (eg, Everyday
stress prevents me from getting vaccinated). Responses are measured on a seven-point Likert scale (1=strongly disagree; 7=strongly agree), with higher confidence and calculation scores representing more positive vaccination views, while higher complacency, collective responsibility and constraint scores representing more negative views. The 5C scale has been validated for use among the general public and parent populations and has been recently used to understand influenza vaccine uptake in high-risk adults, COVID-19 vaccine intention among older adults and healthcare providers’ recommendations of vaccines to their patients. Information from the screening survey will be used to stratify participants based on provided sociodemographic details (eg, gender, age, ethnicity), province of residence, stakeholder group and parent 5C scores to capture a diverse range of experiences and perspectives.

Interview guides
Two semistructured interview guides will be developed for this study: one for health officials, school officials and healthcare provider participants and a second guide for parent–adolescent participants. The variations in guides will be used to explore how key education and health stakeholders perceive SBIP, while the parent–adolescent guide will explore their perception of these programmes, barriers and enablers to programming, and how their vaccination views may have evolved since the COVID-19 pandemic. Both interview guides will be informed by results of environmental scan and developed using the capability, opportunity, motivation behaviour (COM-B) and the TDF. The COM-B model is the first step in the BCW framework and allows for the identification of the determinants of behaviour through six interacting elements (eg, psychological capability, physical capability, physical opportunity, social opportunity, reflective motivation and automatic motivation.) Questions and prompts will be developed for each COM-B element and TDF domain to examine views and experiences with SBIP before and during the pandemic. Interview guides will be pilot tested for clarity and revised ahead of data collection.

Data collection
Participants who meet eligibility criteria will be contacted by the lead author to coordinate a time to conduct the interview. Interviews will be conducted via secure Microsoft Teams video conferencing link. The lead author is an experienced qualitative researcher and will be responsible for conducting all interviews. Prior to each interview, the researcher will provide an overview of the study and address any participant questions. Interviews will last 30–45 min, and each participant will receive a CAD $30 honorarium following the interview for their participation. Interviews will be audiorecorded and transcribed in Teams. Generated transcripts will be reviewed by the researcher for accuracy and to anonymise participant details.

Data analysis
Anonymised transcripts will be analysed in NVivo (QSR International, V.12) using deductive directed content and inductive thematic analysis approaches. Participant transcripts will first be reviewed to gain a sense of the interview content. Transcripts will then be reviewed again to identify and code relevant quotes to appropriate elements of COM-B model and TDF domains. Following this directed content analysis, an inductive thematic analysis approach will be used to analyse quotes associated within each of the COM-B elements and TDF domains to identify key themes and subthemes.

Two reviewers will independently code participant transcripts, with one reviewer analysing all transcripts and a second reviewing a 30% random sample of transcripts. Reviewers will meet regularly during data analysis to review coding, discuss and resolve discrepancies and identify any questions with participant quotes. The reviewers will develop a codebook throughout analysis to note content associated with each COM-B element and TDF domain, keep track of comments and conversations, and coding revisions made during each meeting to ensure coding continues to align coding with updated guidelines. Developing coding guidelines has been shown to improve the reliability of coding between reviewers.

Anticipated outcomes
Outcomes from phase 2 will serve three purposes. First, it will provide an in-depth understanding of stakeholders’ perceptions of SBIP and catch-up programming during COVID-19 across the Maritimes. Second, we will gain a sense of parents and adolescents’ vaccination views and potential changes in vaccine hesitancy since the beginning of the COVID-19 pandemic. Finally, findings will be integrated with phase 1 to design evidence-based, theory-informed recommendations to address the gaps in SBIP delivery and additional barriers identified.

Phase 3: data integration and stakeholder engagement meetings
Phase 3 of the study will integrate the findings from phase 1 (environmental scan) and phase 2 (stakeholder interviews) to guide the development of evidence-based, theory-informed recommendations to support SBIP in the Maritimes. Data will be integrated using joint displays and narrative summaries to identify where the data converge and diverge. Findings will then be mapped onto the intervention and policy levels of BCW, and the BCTs to systematically develop recommendations. Two stakeholder meetings will be held to refine, prioritise and finalise recommendations to address identified gaps in SBIP. These procedures are outlined in figure 3.

Data integration
Integrating data in an explanatory sequential study will allow findings from phases 1 and 2 to be connected, providing a comprehensive answer to the study aim and objectives posed from the mixed methods study as...
a whole.67 The joint display figure will depict key findings from the environmental scan and stakeholder interview themes. A narrative summary will complement the figure by juxtaposing key findings and themes from both phases of the study, and additional insights obtained by integrating findings.47 Applying this approach will support a comprehensive understanding of SBIP, gaps in programme delivery and changes in vaccine hesitancy in each Maritime province.

Recommendations design
Findings from data integration will be mapped to the intervention functions and policy category levels of the BCW framework designed by Michie et al.32 The BCW intervention functions provide nine elements (ie, education, persuasion, incentivisation, coercion, training, enablement, modelling, environmental restructuring, restrictions) to consider when designing interventions.32 The intervention functions then map to seven policy categories (ie, guidelines, environmental/social planning, communications/marketing, legislation, service provision, regulation, fiscal measures, guidelines), which could further enable the use of the designed interventions.32 Findings from the mapping exercise will also be mapped to the BCTs, a taxonomy comprising 93 individual BCTs in 16 categories to identify the ‘active ingredients’ which will inform the more granular intervention components.68 For example, the ‘education’ intervention function can map to ‘instruction on how to perform the behaviour’ and ‘information about health consequences’ BCTs.32 68

From these mapping exercises, a list of potential recommendations will be developed to address the identified barriers to vaccine uptake and gaps in SBIP. Developed recommendations will adhere to the Action, Actor, Context, Target, Time framework by identifying who (actor) needs to be engaging in a specific behaviour (action), when (context) and where (time) the behaviour needs to be engaged in, and the audience (target) the outcome of the behaviour is for.69

Stakeholder engagement meetings
Two stakeholder engagement meetings will be held online, one with education and health officials and the second with parents and adolescent stakeholders, to further develop and revise recommendations to address the identified barriers to vaccine uptake and gaps in SBIP in the Maritimes. Dividing the stakeholder meetings across these participant groups will ensure meetings are held at times convenient for each group and to encourage more equal power dynamics within each meeting.70 Each meeting will be led by the lead author and last for a maximum of 2 hours. We will recruit 6–8 stakeholders from across the Maritimes to participate in each meeting (12–16 participants total). Stakeholders will be recruited from the pool of participants from phase 2 who indicated interest in participating in other phases of the research project. Email invitations will be sent to these stakeholders to inform them of the purpose of the meeting and to register their interest in participating. Those interested will be asked to provide informed, written consent and their availability to attend a meeting.

Each meeting will begin with an overview of the research study to date. The list of developed recommendations will then be reviewed with the stakeholders. Each recommendation will be reviewed against the Affordability, Practicability, cost-Effectiveness, Acceptability, Safety and Equity criteria, another complementary tool associated with the BCW, to determine if the recommendation is worth moving forward with, if it needs to be modified to be feasible, or rejected if it is not feasible or does not meet the needs of the stakeholders. Additional discussions will be held to outline other recommendations stakeholders feel could be included, and key recommendations to move forward with for each stakeholder group. Following the meeting, participants will receive a CAD $50 honourarium for their participation.

Anticipated outcome
The outcome from this phase will the list of evidence-based, theory-informed and stakeholder-approved recommendations targeted towards each stakeholder group. An
infographic will be developed to highlight the finalised recommendations from the meeting and distributed to key stakeholders and on social media.

ETHICS AND DISSEMINATION

Ethics approval for this study was obtained from Dalhousie University’s Health Sciences Research Ethics Board (REB # 2022-6395). Findings from this work may promote changes in vaccine hesitancy, health policies and improve the efficiency of vaccine programme delivery within Maritime health systems. Improved adolescent vaccination rates can strengthen the short-term and long-term health outcomes in the Maritimes and help reduce childhood health inequities across provinces. Study findings will be presented in peer-reviewed journals and at conferences. Infographics providing a plain language summary of the study findings and finalised recommendations will be developed and disseminated to researchers, the public and stakeholder organisations.

Limitations

There are many strengths to applying a mixed methods approach to address the study aims and objectives, including providing comprehensive evidence to support the recommendations developed, using multiple approaches to data collection to complement the strengths and weaknesses of the environmental scan and stakeholder interview methods, and using a range of frameworks and tools informed by behaviour change theories to support designing recommendations. However, there are limitations which need to be considered in the context of this research. First, while evidence suggests SBIP experienced substantial challenges as a result of the COVID-19 pandemic,14 issues with these programmes existed prior to the pandemic. A systematic review by Perman et al in 2017 found school-healthcare provider relationships, inadequate infrastructure and staff shortages as barriers to implementing successful SBIP.71 These existing barriers may have been exacerbated during the pandemic. We aim to address this potential limitation by including resources from a prepandemic school year, that is, 2018–2019) in our phase 1 environmental scan and will seek to ask phase 2 key stakeholders about barriers and enablers to successfully SBIP before and during the pandemic.

Potential limitations of the environmental scan include the relevance on publicly available resources to include in our scan and use of primarily grey literature over peer-reviewed literature. Developing connections with provincial public health stakeholders will also be crucial to the success of this work to access unpublished or internal documents. Establishing stakeholder relationships early in the study and using the qualitative study to further understand stakeholders’ perceptions may help address these limitations by gaining more detailed insight into the barriers to vaccination service delivery. Findings from our qualitative sample may not be transferable to the population of interest, especially as we aim to use convenience sampling. Another limitation of this phase is NB is a bilingual province; therefore, only conducting the interviews in English may limit the participation of Francophone community members, potentially further limiting the transferability of our findings. To help combat this, we will stratify participants based on gender, age, ethnicity, province of residence and stakeholder group to gain a variety of views across the Maritimes. Finally, we have experienced challenges with recruiting/retaining adolescent study participants and therefore aim to interview adolescents with their parents as a dyad. While this approach may lead to limitations during data collection in phases 2 and 3 (eg, parents not wanting their child to participate, adolescents not wanting to discuss some topics in fear of their parents or parent influence on responses),5472 it may allow us to capture data on how vaccine decisions and behaviours are shaped within families. We will monitor participants completing our screening survey to determine if there are any under-represented groups (eg, males, younger and/or more vaccine hesitant parents) and develop more targeted recruitment strategies to boost recruitment from these groups as required.

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