

Encouraging Vaccination Confidence (EVC) Project Report

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Note: This report describes an outreach initiative. It is not a research report. All project deliverables mentioned in this report are available on our website:

<https://www.dal.ca/faculty/science/imhotep/programs/vaccine-confidence.html>

Table of Contents

Project Overview.....	3
Project Objectives.....	4
Revised Project Timeline.....	4
Introduction.....	6
The Science behind the Pandemic.....	6
Focus Group Findings.....	7
Activity Development Process.....	9
Baseline Knowledge.....	9
Creation and Testing of Activities.....	9
Activity Selection.....	9
Training of Mentors.....	10
Implementation at School Sites.....	12
EVC School Sites.....	12
Student Turn-Out.....	14
Follow-up Survey with School Sites.....	15
Confidence Rating Measures.....	15
EVC Sessions' Composition.....	15
Follow-up Survey Questions.....	16
Challenges with Project Outreach.....	17
Testimonials.....	17
Project Products and Media Coverage.....	18
Project Deliverables.....	18
Media Coverage.....	20
Discussion.....	21
Addressing Misinformation.....	21
Addressing How to Improve Vaccination Rates.....	22

Confidence Ratings for Vaccinations.....	22
Conclusion.....	23
Summary and Suggestions	23
EVC Project Team.....	24
EVC Steering Committee.....	26
References and Acknowledgements.....	27

Project Overview

The Encouraging Vaccination Confidence (EVC) project was a science outreach to educate youth of African heritage (and especially African Nova Scotians (ANS)) about coronavirus and COVID-19. Imhotep's Legacy Academy (ILA), the lead organization, received funding from the Natural Sciences and Engineering Research Council of Canada (NSERC) and collaborated with other organizations to make this initiative possible. Our Steering Committee was composed of representatives from Imhotep's Legacy Academy, the Canadian Center for Vaccinology (CCfV), Health Association of African Canadians (HAAC), Promoting Leadership in health for African Nova Scotians (PLANS), and Université Sainte Anne.

An array of hands-on educational activities was developed in-house to explain the mechanisms of vaccines, how viruses spread and how public health guidelines like wearing a mask and social distancing work. These activities were developed with knowledge gained from conducting focus groups with ANS students aged 6–19. We gauged our activity delivery on the students' baseline understanding of vaccinology and microbiology at the outset of this project.

The initial goal was to reach 750 English and 50 French African heritage students. We expanded the project scope to be all-inclusive after receiving tremendous positive feedback in October 2021 from sessions in the Annapolis Valley and Antigonish regions. By February 2022, we exceeded our target and reached 900 total students in Annapolis Valley, Halifax Regional Municipality, Truro, Antigonish, Beechville, Dartmouth, Cape Breton, and other regions across Nova Scotia.

A follow-up survey was conducted to collect data and gain insights into the effectiveness of science sessions on pandemic preparedness. In general, EVC session participants reported that our sessions made them more likely to get a COVID-19 vaccine, that their understanding of the science of the vaccines improved, and that they are starting to believe the benefits outweigh the risks of vaccination. The results align with the suggestion that the EVC project could potentially lead to improved pandemic preparedness and compliance with public health protocol and/or guidelines. Ultimately, it is noted that participants reported the influence of relatives' biases on vaccinations as one of the determining factors

leading to vaccination confidence. From our anecdotal observations, psychological factors such as group polarization and conformity may sway African Heritage students to self-report in favor of vaccines when participating in EVC sessions with multiracial group composition. Therefore, we recommend that there should be future research done to evaluate how outreach initiatives in different participant group compositions alters vaccination rates. Lastly, the development of a spin-off program targeted toward family members may improve overall health outcomes in ANS communities by addressing the influence of relatives' biases.

Project Objectives

1. Provide information to students and their families to make informed decisions related to vaccinations.
2. Dispel vaccine misinformation online and through social media.
3. Identify credible sources of information and develop critical analytical skills for making decisions.
4. Create a network for students to reach out to regarding any medically related questions.
5. Achieve an understanding of how vaccines work on a biological level.
6. Achieve an understanding of how wearing a face mask protects from contracting COVID-19 and reduces transmission rates.
7. Gain confidence in the science behind vaccines and their benefits in protecting against various viruses such as Influenza (the Flu), Hepatitis B, etc.

Revised Project Timeline

Initially, the project was scheduled for July to December 2021. However, it was adjusted from July 2021 to March 2022 to reach more schools after the December holidays. In addition, we experienced staff hiring issues which delayed the project initiation. There were some setbacks with EVC staff dropping out of the project after training. This created a delay as we needed to allot more time to hire and train more staff. Some of the staffing issues were exacerbated by the pandemic. Our project ended in March 2022, but we will continue to offer sessions upon request until the end of

June 2022. After that, the EVC science activities will be integrated into ILA's After-School Program (ASP) and our deliverables will be available on the ILA website for any groups who wish to use them.

Introduction

In 2020, the COVID-19 pandemic uprooted our lives. There was a complete shift in our everyday routines as we learned to cope with social isolation, changes to our work and school environments, and enhanced sanitary practices. Especially, our youth struggled with being separated from friends and the challenges introduced by online learning.

A year later, there was hope on the horizon when COVID-19 vaccines were developed. With vaccines now available, the possibility of returning to our everyday lives seemed significantly more attainable. The conversations around vaccinations are typically among adults and professionals; any concerns are usually addressed on this level, and children are secondary beneficiaries of these conversations. With the spread of misinformation in online media, ILA saw a need for developing a STEM outreach program tailored specifically to address the concerns and needs of children in the ANS communities.

The Science behind the Pandemic

Many people are unaware that COVID-19 is caused by the virus SARS-CoV-2 which belongs to a family of viruses known as Coronaviruses. Coronaviruses have been studied for years, and there are a few infamous ones, such as SARS-CoV-1 and MERS-CoV. These viruses cause infection of the respiratory tract ranging in severity from flu-like symptoms to fatalities. Notably, an African American woman, Kizzmekia Corbett, was among the few scientists conducting research on coronaviruses prior to the pandemic. She led the COVID-19 vaccine research at Moderna, and she has been praised for her role in leading the effort to stop the COVID-19 pandemic.

Researchers applied prior research on other strains of Coronaviruses (e.g., MERS, SARS-COV-1) to the research on SARS-CoV-2. In addition, vaccine research, including mRNA vaccine technology, was underway for several years. It was quickly adapted in the efforts to find a vaccine against COVID-19.

With existing research on their side and an abundance of interest and financial backing by world governments and organizations, researchers could develop a safe and effective vaccine quickly.

This does not mean these vaccines were released without testing. Clinical trials are the standard manner for testing the safety and efficacy of mRNA vaccines and other pharmaceutical products. The COVID-19 mRNA vaccines (from Pfizer and Moderna) are currently approved in Nova Scotia, Canada. These vaccines work in the same way by triggering our bodies to develop antibodies for recognizing and identifying viral proteins to develop a defense mechanism against them. For the vaccinated, when the virus attempts to enter, their body will quickly recognize it and act on the threat to protect against severe outcomes such as hospitalization or fatality.

For more information on vaccines, there is an excellent YouTube video that illustrates the different types of vaccines: <https://www.youtube.com/watch?v=4SKmAlQtAj8> . This is an invaluable resource to explain what happens when we get vaccinated.

Focus Group Findings

We conducted focus groups to collect data for developing our activities (refer to Appendix: Focus Group Questions). Focus groups were conducted with a total of 60 ANS students in summer 2021, with the majority being participants in Science Summer Camps, ages 6 - 18. The regions engaged were Digby, Halifax, and Cape Breton. Approximately 90% of the participants were under 16, and 10% were vaccinated. Fifty students were English-speaking and 10 spoke French.

In Figures 1 and 2, the results of assessment of baseline knowledge are shown, for English and French ANS students respectively. Overall, the students lacked a rudimentary understanding of vaccinology and epidemiology. The most alarming finding was that their local clinics lacked resources for the students, such as booklets with information about viruses and how vaccines work. Ultimately, this left an information gap, and social media filled that void, resulting in several vaccination misconceptions.

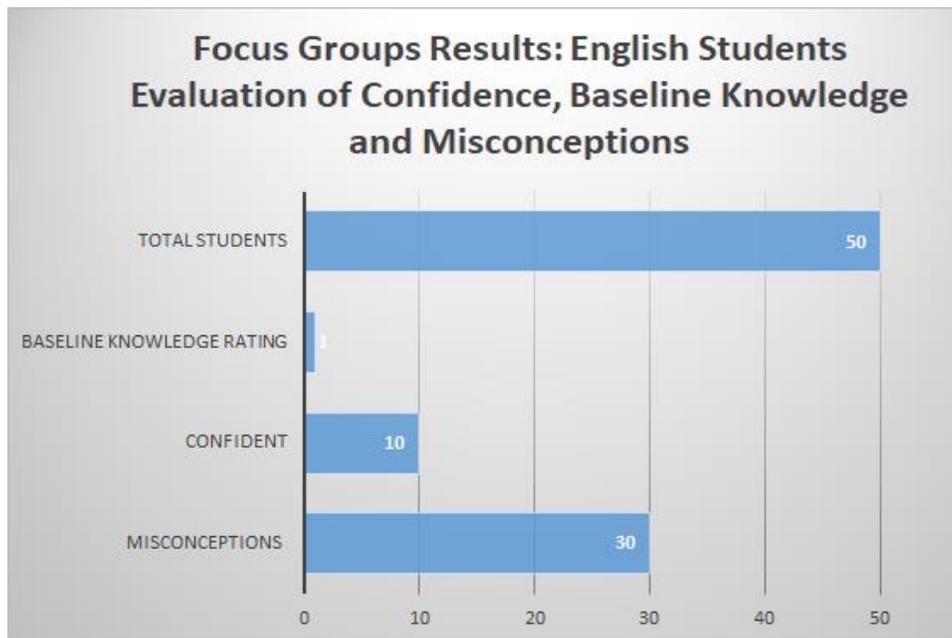


Figure 1. Data collected from Focus Groups (in English) with 50 ANS students across the province. Approximately 2% of ANS students showed basic knowledge related to vaccinology and epidemiology, 20% of ANS students rated themselves as being confident in vaccine effectiveness and resources, and 60% were predisposed to misinformation via social media channels (e.g., Facebook, Instagram, Twitter, etc.) and believed the information they received. Baseline Knowledge Rating was calculated based on how many bullets points out of 10 were correctly identified from the fact sheet.

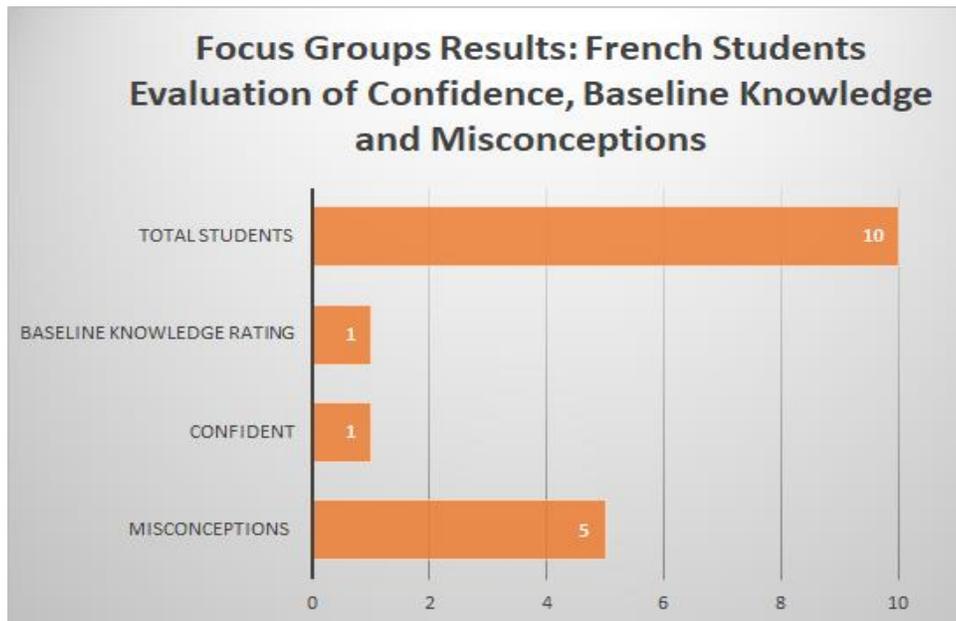


Figure 2. Data collected from Focus Groups (in French) with 10 ANS students across the province. Approximately, 10% of ANS students showed basic knowledge related to vaccinology and epidemiology, 10% of ANS students rated themselves as being confident in vaccine effectiveness and resources, and 50% were predisposed to misinformation via social media channels (e.g., Facebook, Instagram, Twitter, etc.) and believed the information they received. Baseline Knowledge Rating was calculated based on how many bullets points out of 10 were correctly identified from the fact sheet.

Activity Development Process

Baseline Knowledge

Focus group participants were asked a series of questions pertaining to their knowledge of vaccinology and epidemiology, such as "Do you know how viruses spread? Can you explain how a vaccine works? What is the difference between viral infection versus bacterial infection?" Our activities were developed to address limited working knowledge in those areas based on responses. It was apparent that misconceptions were prevalent in students who reported lower confidence ratings.

Creation and Testing of Activities

The EVC activities were broken into Grades 4 - 6, Grades 7 - 12, and All Grade Levels. One primary developer created 6 activities, and the additional two developers worked on creating the other 2 activities. In total, the EVC team developed 8 activities: 3 explaining vaccine mechanisms, 2 explaining herd immunity, 1 explaining mutations in viruses, and 2 explaining mask/social distancing functionality (refer to Appendix: Activity Booklet [English Version] for specific details of activities). These activities were tested 3 times and after the first two times, we made modifications where necessary (e.g., changing the concentration and formulation of chemical compounds).

Activity Selection

Three activities were selected to be presented to students (Activities #2, #7, and #8 as shown in Appendix: EVC Activity Booklet [English Version]). These 3 activities are centered around explaining the fundamental principles of how vaccines work, how wearing a mask and social distancing reduces the spread of viruses, and explaining what herd immunity means. These activities were selected because they are tailored to a general audience (all grade levels). In contrast, the other activities were categorized by the caliber of grade-level material needed to comprehend the activities (e.g., high school vs. elementary activities).

EVC sessions were composed of the selected science activities followed by a post-test and watching videos from credible sources. This is necessary to reiterate the material covered in the session (refer to Appendix: EVC Project PowerPoint [English Version]). The entire session lasted about 1.5 hours or less. This varied depending on the questions asked, and the extent of discussions with, EVC session participants.

Training of Mentors

The EVC team was composed of both English- and French-speaking mentors. Mentors were trained on three activities (Activity #2, #7 & #8 as shown in Figures 3, 4 and 5) for 1.5-hour sessions offered publicly. We studied extensively the information collected from clinical trials related to the COVID-19 vaccines, which were featured in our deliverables (refer to Appendices: Brochure, Parent Pamphlet, and Rack Card [English Versions]).

After consultation with the steering committee, a presentation consisting of these 3 activities, a post-test, and 4 videos was determined as the best way to deliver information to students through repetition and testing students on the spot. We employed the theory of the testing effect, which was first documented by Edwina E. Abbott in 1909, to help reinforce the information covered. The Project Manager/Lead Developer trained mentors in a scenario where the mentors role-played as the students. Mentors received immediate feedback, and subsequently, they were tested on a series of common questions that may arise when interacting with students.

Thereafter, mentors accompanied the Project Manager/Lead Developer or Fully-Trained Mentor to a live session to observe first-hand how to engage students. In the subsequent session, the trainee mentor led the session, and the Project Manager/Lead Developer or Fully-Trained Mentor played the role of the observer to provide feedback. Once concluded, if the trainee's performance was satisfactory, they would be cleared to go on their own to perform sessions without supervision. If not, they were retrained in-person. The mentors' performance was determined based on how many questions the mentor could answer correctly, their teacher's affect (i.e., a measure of teacher's enthusiasm for the content of learning

as a source of student motivation [Dynneson, 2009]) when engaging students, and their ability to acknowledge gaps in comprehension while directing students to resources.



Figure 3. Activity #2: Our Immune Systems Deserve Some Credit Pt. 1.
This activity explains how vaccines work to dissolve viral cells (killing them).



Figure 4. Activity #7: What you can't see?

This activity illustrates herd immunity and emphasizes the mathematical model of transmission rate reductions post-vaccination.



Figure 5. Activity #8: Mask'd Up

This activity focuses on demonstrating the effectiveness of wearing a mask and socially distancing combined to reduce the spread of viruses.

Implementation at School Sites

EVC School Sites

Our goal of 800 students was exceeded as of March 5th, 2022. We aimed to get 1-2 schools in every district and engage students not already involved in ILA.

Below is a list of all the schools and institutions which hosted us for our EVC sessions:

- Annapolis West Education Centre (AWEC)
- Auburn High School (AHS)
- Bridgetown Regional Community School (BRCS)
- Brookside Elementary School (BES)
- Citadel High School (CHS)
- Cobequid Education Centre (CEC)
- Dr. John Hugh Gillis High (JHGH)

- Eric Graves Jr. High School (EGJHS)
- Evangeline Middle School (EMS)
- Fairview Jr. High
- Horton High School (HHS)
- Kings County Academy (KCA)
- Middleton Regional High School (MRHS)
- Nelson Whynder Elementary School (NWES)
- Ridgecliff Middle School
- Truro Elementary School (TES)
- Truro Jr. High School (TJHS)
- West Hants Middle School (WHMS)
- Windsor Elementary School (WES)

The following is a list of community centers where EVC sessions were held:

- Sexton Campus
- The North Grove
- YMCA
- Virtual Sessions – Open to the Public

ILA programs students engaged with the EVC project:

- ASP (after-school) Program
- VSP (virtual school tutoring) Program

Student Turn-Out

Originally, the project scope was to include ANS students only. However, we expanded the project scope to be all-inclusive because of much positive feedback. We collected student responses to the EVC project outreach activities. Most students attending the EVC sessions were of African Heritage, and ANS Student Support Workers were the primary contacts and facilitators at schools holding sessions. The demographics are shown in Figure 6.

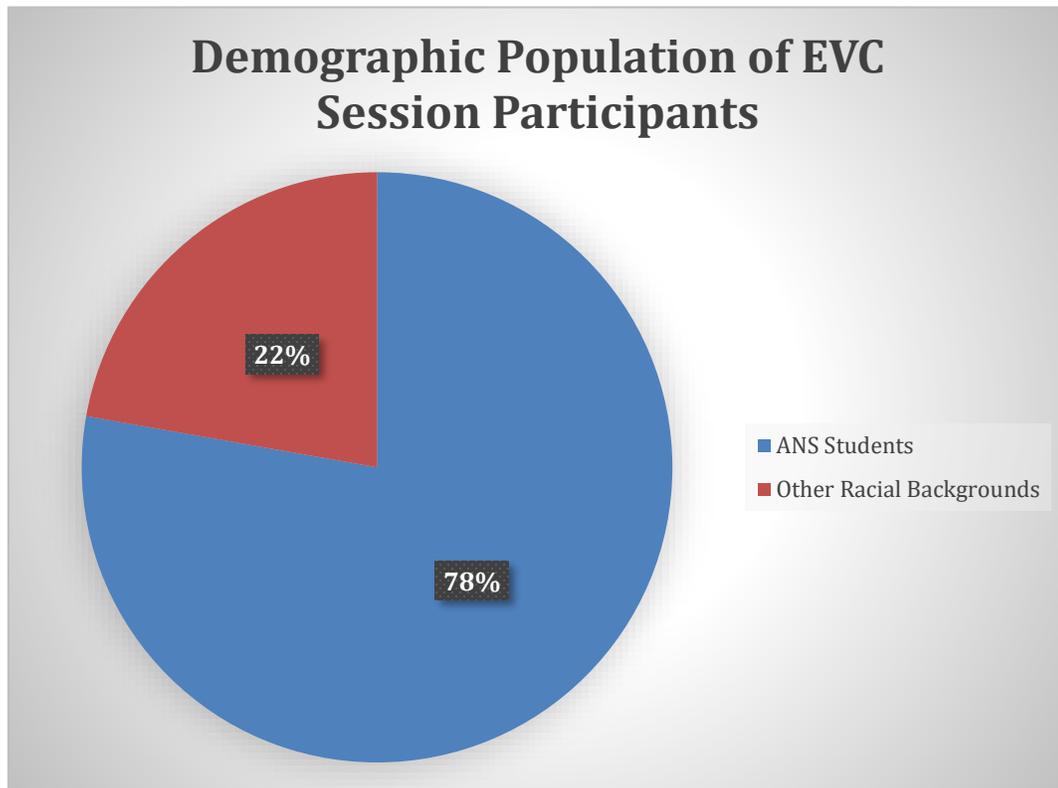


Figure 6. Demographics of EVC Session Participants

The number of students who identified as of African Heritage (ANS) or other racial backgrounds was determined by asking the students by a show of hands how they would identify. In total, there were **900** students, with 700 ANS students and 200 of other racial backgrounds.

Follow-up Survey with School Sites

Confidence Rating Measures

Students were in grades 6-12, and the age range was 11-19 for the respondents. This survey was not setup as a research study, and it was focused on the evaluation of the performance of this STEM outreach project in improving pandemic preparedness.

Hence, the data collected from the surveys only looked at the improvements in student comprehension of the subject matter to make informed decisions related to getting vaccinated, and their ability to distinguish between misinformation and credible scientific findings.

EVC Sessions' Composition

While conducting sessions, mentors observed that African Heritage students tended to be less engaged in sessions and more likely to conform to the group consensus due to group polarization in multiracial groups. In other words, African heritage students are more likely to agree verbally in the group to avoid conflict and, behind closed doors, express their true feelings about vaccinations. Hypothetically, this could be due to African Heritage students feeling more comfortable asking questions and/or disagreeing if they are in a group with race concordant peers and mentors. To decrease this occurrence, mentors asked students of African heritage about what potential barriers are within their communities that could create vaccine hesitancy.

In response, African Heritage students highlighted the importance of family influence and the perceived lack of trustworthiness of the scientific process behind the creation of the vaccines. From this finding, a new arm of the project was created centered on parental engagement and holding virtual sessions with parents to answer any questions posed. In addition, a parent pamphlet was created to explain the scientific history behind mRNA vaccine technology and how the vaccines were developed so rapidly.

Follow-up Survey Questions

An optional follow-up survey was conducted with the students who participated between November 2021 to February 2022. The questions in Table 1 below were asked of students in a follow-up survey distributed by educators, support workers, and administration at schools.

Questions (in English)	Les Questions (en Française)
<p>Question #1: Has this session made you more likely to get a COVID-19 vaccination? (Please circle) Yes or No</p>	<p>Question #1 : Cette séance vous a-t-elle rendu plus susceptible d'être vacciné par COVID-19 ? (Encerclez) Qui ou Non</p>
<p>Question #2: Has your understanding of the science behind viruses and vaccines improved because of this session? (Please Circle) Yes or No</p>	<p>Question #2 : Votre compréhension de la science derrière les virus et les vaccins s'est-elle améliorée grâce à cette séance ? (Encerclez) Qui ou Non</p>
<p>Question #3: Which vaccines are available in Nova Scotia as of October 2021? (Please Circle) Pfizer, Moderna, AstraZeneca, J&J</p>	<p>Question #3 : Quels sont les vaccins disponibles en Nouvelle-Écosse en octobre 2021 ? (Encerclez) Pfizer, Moderna, AstraZeneca, J&J</p>
<p>Question #4: Do you think the benefits outweigh the risks of getting vaccinated? (Please Circle) Yes or No</p>	<p>Question 4 : Pensez-vous que les avantages l'emportent sur les risques de se faire vacciner ? (Encerclez) Qui ou Non</p>

Table 1. Follow-up survey Questions Administered to EVC Session Participants

We received 60 follow-up survey responses. The results show a dramatic increase in understanding and confidence ratings of vaccination effectiveness for questions 1, 2 and 3, after our presentations, as shown in Figure 7 below. However, the responses to question #4 do not show as dramatic a result in confidence that the benefits outweigh the risks of vaccination. This points to the need for activities that focus on that aspect of epidemiology.

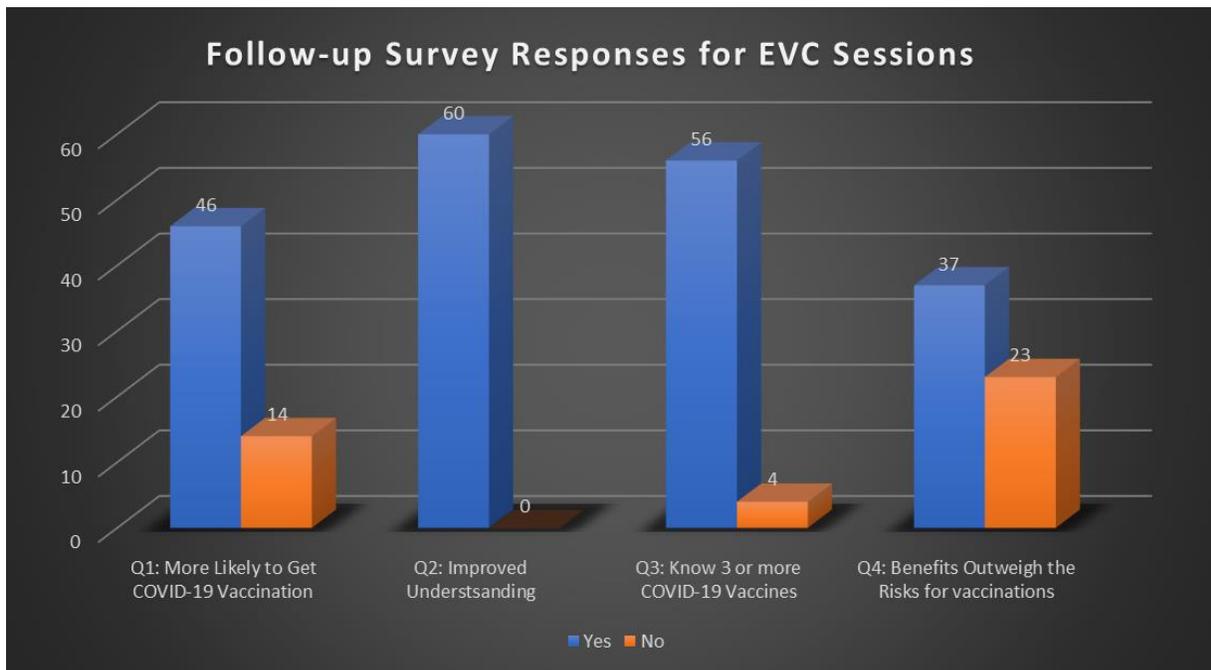


Figure 7. Follow-up Survey Results for Q1: more likely to get a COVID-19 vaccination, Q2: understanding of the science behind viruses and vaccines improved, Q3: know 3 or more vaccines available in Nova Scotia as of October 2021 and Q4: the benefits outweigh the risks of getting vaccinated

Challenges with Project Outreach

Initially, we faced a small turnout for EVC sessions due to the parental viewpoint on vaccines as being controversial. The Project Manager/Lead Developer received multiple threats from parents who were against COVID-19 vaccines, attempting to discourage us from engaging children in vaccine knowledge. However, these incidents died down as we received more media coverage (refer to Media Coverage Section), and schools started to reach out to us to do more sessions after COVID-19 variants arose, such as Delta and Omicron. We relied on teachers and the school administration to spread the word about the project for the parents to provide consent for their children to attend. Our sessions were successful in generating word-of-mouth advertising.

Testimonials

As noted, we received positive testimonials from participants. For example, “when are you coming back?”, “if I need to talk to anyone about getting the vaccine, could I reach out to you?” and “we would like to learn more about viruses!”. EVC staff enjoyed a heartfelt interaction with students and

believe they had a long-lasting impact on students' decision-making process for health determinant actions.

Project Products and Media Coverage

Project Deliverables

In this section, we want to highlight all the deliverables created for the EVC project, which include this final report (in English and French).

- A. Rack Cards (in English and French) about what EVC sessions offer to students.
 - EN: <https://cdn.dal.ca/content/dam/dalhousie/pdf/faculty/science/imhotep/Imhotep-EVC-Rack-Card-e.pdf>
 - FR: <https://cdn.dal.ca/content/dam/dalhousie/pdf/faculty/science/imhotep/Imhotep-EVC-Rack-Card-f.pdf>
- B. Registration Form (in English and French) for EVC session participants to get consent from parents to participate in sessions.
 - EN: <https://cdn.dal.ca/content/dam/dalhousie/pdf/faculty/science/imhotep/Imhotep-EVC-Registration-Consent-Form-e.pdf>
 - FR: <https://cdn.dal.ca/content/dam/dalhousie/pdf/faculty/science/imhotep/Imhotep-Formulaire%20de%20consentement-fr.pdf>
- C. Promotional Video (only in English) featuring an EVC Mentor to advertise EVC Sessions.
 - EN: <https://youtu.be/evUCMkr5A-Q>
 - FR: Translation in Video Description
- D. Brochures (in English and French) with information on COVID-19, its impacts in ANS communities, and answers to Frequently Asked Questions [FAQs] around COVID-19.
 - EN: https://cdn.dal.ca/content/dam/dalhousie/pdf/faculty/science/imhotep/Imhotep-EVC-Brochure_e.pdf
 - FR: <https://cdn.dal.ca/content/dam/dalhousie/pdf/faculty/science/imhotep/Imhotep-EVC-Brochure-f.pdf>
- E. Parent Pamphlets (in English and French) with information on COVID-19, mRNA technology, and answers to Frequently Asked Questions [FAQs] around Children getting COVID-19 Vaccines

- EN: <https://cdn.dal.ca/content/dam/dalhousie/pdf/faculty/science/imhotep/Imhotep-EVC-Parent-Pamphlet-E.pdf>
- FR: <https://cdn.dal.ca/content/dam/dalhousie/pdf/faculty/science/imhotep/Imhotep-EVC-Parent-Pamphlet-F.pdf>

F. Activity Booklet (in English and French) featuring all 8 activities developed for the EVC project

- EN: <https://cdn.dal.ca/content/dam/dalhousie/pdf/faculty/science/imhotep/Imhotep-EVC-Activity-Booklet-e.pdf>
- FR: Available upon request via email to ilaevc@dal.ca

Activity #1 – Everyone Can Play

Activity #2 – Our Immune Systems Deserves Some Credit Pt. 1

Activity #3 – The Unknown Enemy

Activity #4 – Our Immune Systems Deserves Some Credit Pt. 2

Activity #5 – Tell Me A Bedtime Story

Activity #6 – Become A Membrane Advocate

Activity #7 – What You Can't See!

Activity #8 – Mask'd Up

G. EVC YouTube Videos (in English and French) which feature the 3 selected activities for in-person/virtual EVC sessions

Video #1: Our Immune Systems Deserves Some Credit Pt. 1

- EN: <https://youtu.be/m2jxIZTib7k>
- FR: <https://youtu.be/Nz-rRd4u2UQ>

Video #2: What You Can't See!

- EN: <https://youtu.be/xlh7G32hHTY>
- FR: <https://youtu.be/rWckinFCc6w>

Video #3: Mask'd Up

- EN: <https://youtu.be/mWOqYCcDkdg>
- FR: <https://youtu.be/B4Qqh6HGtIQ>

H. Testimonial Video (only in English) featuring an EVC session participant

- EN: <https://youtu.be/xagxGKfeb7c>
- FR: Translation in Video Description

I. EVC Final Report (in English) is this document in its entirety

EN: available on our website <https://www.dal.ca/faculty/science/imhotep/programs/vaccine-confidence.html>

Media Coverage

J. Global Morning Interview – Halifax News

Date: November 2nd, 2021

EN: <https://globalnews.ca/video/8342806/imhoteps-legacy-academy-ila-launches-vaccination-project-for-students-across-the-province/>

Google FR: https://globalnews-ca.translate.google.com/video/8342806/imhoteps-legacy-academy-ila-launches-vaccination-project-for-students-across-the-province/?x_tr_sl=en&x_tr_tl=fr&x_tr_hl=en&x_tr_pto=wapp

K. Dal News – Article

By: S. Abbott

Date: November 5th, 2021

Title: Dal Outreach Group Builds Vaccine Confidence in Youth Through Community Engagement

EN: <https://www.dal.ca/news/2021/11/05/vaccine-hesistancy-youth.html>

Google FR: https://www-dal-ca.translate.google.com/news/2021/11/05/vaccine-hesistancy-youth.html?x_tr_sl=en&x_tr_tl=fr&x_tr_hl=en&x_tr_pto=wapp

L. CityNews – Article

By: S. Gow

Date: November 9th, 2021

Title: Vaccine project expanded to help inform all students in the province

EN: <https://halifax.citynews.ca/rooted/vaccine-project-expanded-to-help-inform-all-students-in-the-province-4734109>

Google FR: https://halifax-citynews-ca.translate.google.com/rooted/vaccine-project-expanded-to-help-inform-all-students-in-the-province-4734109?x_tr_sl=en&x_tr_tl=fr&x_tr_hl=en&x_tr_pto=wapp

M. CBC News – Article

By: R. Woodbury

Date: November 27th, 2021

Title: Dalhousie University project tackling vaccine hesitancy among youth

EN: <https://www.cbc.ca/news/canada/nova-scotia/dalhousie-university-imhotep-s-legacy-academy-covid-19-vaccines-1.6257417>

Google FR: https://www-cbc-ca.translate.google.com/news/canada/nova-scotia/dalhousie-university-imhotep-s-legacy-academy-covid-19-vaccines-1.6257417?x_tr_sl=en&x_tr_tl=fr&x_tr_hl=en&x_tr_pto=wapp

Discussion

Addressing Misinformation

Misconceptions were demonstrated when students talked about the vaccine changing their DNA and how all vaccines cause blood clots. These misconceptions arise from misinformation through social media outlets. Mentors quickly denied these facts and provided accurate information to students from credible sources such as Health Canada, CDC, and FDA. From observations, when engaging ANS students, their ability to differentiate and tell us where they received misinformation about COVID-19 was accompanied by hesitancy around disclosing this information.

Our interactive presentations enabled students to ask whether two masks were better than one or if the vaccine changed the recipient's DNA. Many students believed that two masks were better than one. However, public advisories have not suggested wearing two masks as more robust protection against contracting the virus. Some students believed that receiving the vaccine changed the recipient's DNA, allowing them to be immune to the virus but jeopardizing their fertility later in life. However, we informed them that although the vaccine trains their immune response, it does not change their DNA. There is a possibility that the public may have to receive booster shots or COVID-19 immunizations similar to the way they receive an annual flu shot or hepatitis immunizations received in schools because the longevity of COVID-19 vaccine effectiveness is not yet known.

Our main goal was to diminish misinformation that could deter community members from getting vaccinated. When holding sessions, students were asked questions to test their knowledge of the measures taken by health authorities to protect us during this pandemic. Some students knew that these measures were essential but not how and why they should comply with public health protocols.

By engaging students in active learning of vaccinology (experiential or discovery learning), we hoped to address public health misinformation by encouraging students to be analytical thinkers and questioning the credibility of information sources. Primarily, students should take away from the sessions

the skills to question the credibility of what they read online and synthesize important health information to make informed health decisions.

Addressing How to Improve Vaccination Rates

Pandemic Preparedness is often thought of as institutional readiness to deal with potential outbreaks. It has not been fully investigated if using STEM outreach activities as an administrative tool could improve vaccination rates in youth. From our follow-up survey data, we have determined the effectiveness of hands-on science activities in improving vaccinology comprehension. In order to obtain a statistically robust result, we suggest research be done on the effectiveness of the delivery of STEM outreach programs for pandemic preparedness under controlled conditions.

Hypothetically, with continuous engagement in ANS communities, we may be able to gradually improve vaccination rates through STEM outreach education as a vector for preventative medicine.

Confidence Ratings for Vaccinations

The EVC project provides insights into what drives ANS community members to get (or not get) vaccinated. There is a question of whether confidence in vaccination rates and credible information sources are the determining factors for vaccination rates. EVC session participants expressed a variety of factors that influence their decision-making process for getting COVID-19 vaccines. Summarizing these factors produced 5 viable questions ANS students consider before deciding on vaccination. We refer to these 5 questions, as the 5 Ds in Decision-making around vaccine hesitancy.

Below are the formulated questions based on our interactions:

1. Do I have confidence in the information provided?
2. Do my family members have confidence in vaccines?
3. Do I have confidence in healthcare providers throughout this process?
4. Do I have confidence in the science behind making the vaccine?
5. Do I feel confident with my understanding of the benefits and risks of getting vaccinated?

Conclusion

Summary and Suggestions

The main objective of the EVC project was to reduce/eliminate misconceptions concerning COVID-19 vaccines, as these concerns and anxieties limit willingness to get vaccinated. The sources of misinformation were discovered during the focus groups and participation in the EVC sessions. The ANS students' opposition to the COVID-19 vaccine can be attributed primarily to family influence and the lack of trust in the scientific process after many years of healthcare systemic racism.

To combat the dissemination of misinformation, we recommend that future research studies be conducted to evaluate how effective STEM outreach activities could be to improve vaccination rates under controlled conditions. In addition, there should be a development of a spin-off program targeted toward adult family members. A separate project should be pursued to get the EVC deliverables into the hands of ANS community clinics and hubs. As a final remark, we believe that if there was initially cross-provincial and educational pandemic preparedness integrated into the K-12 curriculum before the COVID-19 pandemic (for example addressing measles or smallpox), it would have drastically decreased the misinformation circulation and vaccine hesitancy around COVID-19. Hopefully, our project will serve as a framework for addressing misinformation prior to future global health emergencies.

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