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Feasibility of interventions to increase HPV vaccination acceptability and coverage in school-based programs: Findings from a pilot study in Quebec, Canada

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ABSTRACT

Introduction: Human papillomavirus (HPV) vaccines have been offered in Quebec schools to 4th-grade (9–10 years old) girls since 2008 and boys since 2016. HPV vaccine coverage does not reach the 90 % target in many regions. This project evaluated the feasibility and the acceptability of interventions to improve HPV vaccine acceptability and coverage in school-based programs.

Methods: The evaluation was conducted in 32 Quebec schools in 2019–2020. We tested a strategy of three interventions implemented in sequence (face-to-face information session, email reminder with an online decision support tool, and telephone reminder using motivational interviewing (MI) techniques). Parents and school staff completed online surveys. School nurses participated in individual interviews. Key stakeholders participated in a workshop to identify enabling conditions and barriers to implementing interventions across Quebec.

Results: The strategy was generally well-received by school staff, nurses, and parents. Many parents found the 3 interventions helpful to support their vaccination decision. Most parents (92 %) suggested that the face-to-face information session and the decision support tool (82 %) be offered to all parents. Nevertheless, delivering classroom presentations was perceived by nurses as logistically challenging. Parents were generally satisfied with the telephone reminder, but only a limited number of nurses applied motivational interviewing techniques, as half (51 %) of unreturned consent forms were due to forgetfulness.

Conclusion: Our strategy was accepted and deemed feasible by a majority of parents, school staff, and nurses. Collaboration between health authorities and schools is essential for implementing interventions to enhance vaccine acceptance in school-based programs.

1. Introduction

School-based immunization programs ease access to vaccination equity (Siddiqui et al., 2022; Challenges and opportunities of school-based HPV vaccination in Canada, 2023; Cooper Robbins et al., 2011). In Quebec, Canada, vaccination against human papillomavirus (HPV) is offered freely to boys and girls aged 9–10 in Grade 4 by the Ministère de la Santé et des Services sociaux (MSSS). Cervarix (GSK), Bivalent vaccine (HPV-2) and Gardasil 9 (Merck) (HPV-9) are currently distributed in Canada (Ministère de la Santé et des Services sociaux, 2023a). Vaccination should be offered before the onset of sexual activity for maximum efficacy (Ministère de la Santé et des Services sociaux, 2023a; Gouvernement du Québec SC, 2023). Before vaccination days, school nurses visit classrooms to discuss infectious diseases and vaccines offered. Nurses are also responsible for delivering the vaccines and collecting signed consent forms from the parents.

The program was introduced in 2008 for girls and in 2016 for boys. Vaccination coverage varies between regions (66–89 %) and does not always reach the 90 % target for optimal cancer prevention (Canadian Partnership Against Cancer, 2023; Ministère de la Santé et des Services

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Sociaux, 2023b).

Studies conducted in Quebec showed that some groups have consistently lower vaccine acceptance and uptake (children living in areas with a higher proportion of immigrants, non-French speakers, and people from underprivileged backgrounds) (Dionne et al., 2024a). Parent's main concerns were the children's young age, the possible side effects, and the rationale behind boys' vaccination (Dionne et al., 2023; Clément et al., 2017). The information on HPV vaccination provided by the MSSS along with the consent form was not well understood by some parents (Dionne et al., 2023; Clément et al., 2017; Gagnon et al., 2020).

We developed and tested a multicomponent strategy with three interventions to address the key barriers to vaccine acceptance and uptake in Quebec's school-based programs (Clément et al., 2017) (Table 1). The strategy was developed based on evidence from the literature (Siddiqui et al., 2022; Cataldi et al., 2020; Gates et al., 2021; Brewer, 2021; Acampora et al., 2020; Mohamed et al., 2022; Reno et al., 2018), including the findings from two systematic reviews about the effectiveness of educational multi-component interventions (Siddiqui et al., 2022; Bruel et al., 2020). Our strategy was also developed in consultation with interested parties (i.e. The MSSS, regional health authorities, school nurses, immunization experts and decision support tool experts). It was implemented in the fall of 2019, and interventions were offered sequentially. An information session for Grade 4 parents was delivered by school nurses in person at the start of the school year with standardized PowerPoint support (intervention 1), a reminder email including a link to a decision-support tool (intervention 2) was sent by the school to parents who had not returned their signed consent form (mid-fall 2019), and a phone call reminder was done by school nurses trained to use an approach informed by motivational interviewing (MI) techniques to parents who had not returned the consent form after receiving the reminder email. The participating nurses received MI training (online and in-person by a recognized MI trainer) in summer 2019. The intervention development and formative evaluation (focus groups, iterative process) are reported elsewhere (Dionne et al., 2024b). This article presents the results of pilot-testing the strategy and the acceptability of the interventions by parents, school staff, nurses, and immunization managers. Findings showing that schools receiving the strategy had higher HPV vaccine uptake following the strategy compared to control schools are reported elsewhere (Dionne et al., 2024c).

Table 1
Summary of the three interventions.

No	Name	Brief description
Intervention 1	Information session about HPV vaccination for parents of Grade 4 students	In-person group meeting with parents of 4th-grade students to discuss the vaccines offered to students, supported by an evidence-based visual presentation. The information presented in 10 min was about the HPV and Hepatitis A and B virus (prevalence symptoms, consequences), the evolution of HPV infection, the number of HPV-related cancers in Quebec, the vaccine efficacy and safety and the possible adverse events. Basic information on the consent process and vaccination day (how vaccines are administered and what the child should wear and bring) was also provided.
Intervention 2	Reminder email using an interactive information and decision support tool	This email reminder is for parents who have not returned the consent form before vaccination. It includes a web link to an interactive information and decision-support tool. The school nurse provides the names of students who have not returned their consent forms to the school secretary, who then sends the email to these parents. The research team shared the email template with the school secretary.
Intervention 3	Phone call reminders using an approach inspired by motivational interviewing techniques	Parents who had not returned the consent form following the email reminder (intervention 2) received a telephone reminder from the school nurse. All nurses were trained in the summer of 2019 to share information about school immunization and answer parents' questions using motivational interviewing (MI) techniques. The training included a five-hour online course, a one-day face-to-face training session, and an integration workshop. After the workshop, the trainer gave each nurse personalized feedback.

2. Methods

Intervention development and evaluation were based on the mapping intervention planning framework (Bartholomew et al., 1998). This framework comprises four essential principles: (Siddiqui et al., 2022) formulation of problems from a global perspective (individuals, environments, socio-cultural contexts); (Challenges and opportunities of school-based HPV vaccination in Canada, 2023) participation of the parties concerned; (Cooper Robbins et al., 2011) use of recognized theoretical approaches; and (Ministère de la Santé et des Services sociaux, 2023a) use of evidence-based data.

2.1. Settings

Thirty two pilot schools participated across three Quebec regions where the HPV vaccine coverages (adequately vaccinated) were the lowest: Montreal (72.3 %), Laval (76.4 %) and the Laurentides (77.5 %) (Ministère de la Santé et des Services Sociaux, 2023b) (vaccine coverage by school in Suppl. Mat.1). These regions represent Quebec's demographic, socioeconomic and cultural profile diversity, as well as urban and rural heterogeneity. There were also 32 control schools recruited to assess the impact of the project (findings are discussed elsewhere) (Dionne et al., 2024b; Dionne et al., 2024c).

2.2. Recruitment

Using data from the 2017–2018 school year, we selected schools with HPV vaccine coverage below the regional average. Single-sex, religious, specialized, private and schools with fewer than 20 students in Grade 4 were excluded. School principals were invited to participate via email or phone call. The immunization team managers, responsible for organizing vaccinations, recruited school nurses assigned to selected schools ($n = 25$). The strategy was implemented in every school as part of school nurses' vaccination activities. Three nurses from the participating regional public health departments also participated in the project to support activities for the 28 nurses involved.

2.3. Data collection

The parents' survey, developed by the research team based on validated scales, included 36 questions measuring vaccination confidence

(adapted from the Vaccine Confidence Scale (Tatar et al., 2024), decision stage (adapted from the Precaution Adoption Model (Tatar et al., 2024; Shapiro et al., 2018), acceptability (inspired by (Brewer, 2021; Dempsey et al., 2019)) knowledge and hesitancy (inspired by (Dempsey et al., 2019; INSPQ, 2024), and sociodemographic characteristics (Supp. Mat.2). A subsection measured parents' views about the interventions (e.g. appreciation, usefulness, and impact on decision-making). The pre-intervention survey was sent on August 29, 2019, before vaccination, to parents of Grade 4 students by their child's school with a reminder two weeks later. A post-intervention survey was sent after in-school vaccination days on November 21, 2019, with a reminder two weeks later and another on January 6, 2020. The post-intervention survey included 21 questions about interventions for parents in pilot schools.

The survey to school principals and Grade 4 teachers was sent via email by the research team on December 4, 2019, after the interventions' implementation and vaccination, and a reminder was sent on January 9, 2020. Teachers received the survey invitation from their principals. The questionnaire to school staff contained five closed- and open-ended questions developed by the research team to assess information on the school immunization day and the perceptions of interventions. The questionnaires were adapted to be specific to the teachers' and the principals' roles and responsibilities (Supp. Mat.3&4).

Individual interviews were conducted by phone with nurses ($n = 18$) and immunization managers ($n = 4$) in January and February 2020. The interview guide had nine main questions with sub-questions resulting in 35 open-ended questions for nurses and 16 for managers. Questions were about the school vaccination day, the implementation of the interventions, and general opinions about the project. Interviews lasted approximately one hour and were recorded and transcribed. Nurses were contacted by phone after intervention 1 for a short debrief (all 28 nurses were reached). Nurses who needed to call parents ($n = 15$) were asked to collect information using a Microsoft Excel file to standardize quantitative data collection (e.g. number of phone call attempts, whom they talked to, reasons for non-return of the consent form, main concerns regarding HPV vaccine, length of call).

At the end of the project in January 2023 (after the COVID-19 pandemic), a two-hour workshop with key interested parties (i.e., immunization managers, decision-makers, school nurses, and the research team members) was held. It was structured around presenting the key findings and included a general discussion of the enabling conditions and challenges to implementing the strategy across Quebec primary schools.

2.4. Data analysis

Descriptive statistical analysis was performed to present frequencies, percentages and means. Interviews verbatim were analyzed using thematic analysis to identify common themes, topics, ideas, and recurring patterns of meaning. The process includes familiarization with the data, coding, generating themes (e.g., perceptions of the tool), reviewing, defining and naming themes, and reporting. The workshop was recorded, and the research team synthesized the discussions. Quantitative analysis was conducted using SAS software (version 9.4), and qualitative analysis using N'Vivo software (version 1.6.1) (Shapiro et al., 2018).

The project was approved by the CHU de Québec Research Ethics Committee (MP-20-2019-4655, May 16, 2019). Verbatims from focus group recordings were transcribed and de-identified before analysis. Informed consent was obtained from all focus group participants and school nurses recruited for the project, as they had read and signed the form before participating.

3. Results

3.1. Portrait of respondents

A total of 379 parents completed the survey, and their socio-demographic profile is shown in Table 2. Using the number of students in Grade 4 provided by school principals of each school ($n = 1924$), we estimated the response rate at 20 %. The majority were mothers (84 %). Around half of the respondents were aged between 40 and 49 (45 %) and had completed a university degree (50 %). Most (90 %) reported that their child had received all recommended vaccines since birth.

Twenty-eight elementary school principals and 49 teachers completed the post-vaccination surveys. Participation rates were 84 % for principals and 40 % for teachers. Many respondents worked in the Laval region (Table 3). The vast majority (87 % principals, 93 % teachers) completed the survey in French. They had often been in their positions for five years or less, and the vast majority had been at the school recruited for the project for less than five years.

The nurses who participated in the individual interviews came from all three regions (nine Laurentides, five Laval, and four Montreal). All were women. Fifteen described their experience as school nurses; four were new (one year or less), seven had been practising for two to five years, and the remaining four for six to seven years. Six reported previous experience in the healthcare system, having worked in hospitals, home care, routine services, or other nursing positions.

Four managers from the three regions, all women, were interviewed.

A total of 35 people attended the workshop. Participants included collaborators from health centers (Centre intégré de santé et de services sociaux), public health, the Ministry of health and social services (MSSS), school nurses, and project team members.

Table 2
Socio-demographic profile of parents responding to post-intervention surveys in pilot schools, 2019–2020.

		n, % (*N* = 379)
Region	Montreal	70 (18)
	Laval	183 (48)
	Laurentides	126 (33)
Relationship with the child	Father	55 (15)
	Mother	317 (84)
	Tutor or other	6 (2)
Child's gender	Boy	187 (49)
	Girl	188 (50)
	Non-binary	4 (1)
Home language	English	49 (13)
	French	295 (78)
	Other	35 (9)
Age	≤39	178 (47)
	40–49	168 (45)
	≥50	28 (7)
	Missing	5 (1)
Education completed	Highschool or less	88 (23)
	College undergraduate	87 (23)
	University	189 (50)
	Missing	15 (4)
Marital status	Married/common-law	303 (81)
	Single/divorced/ separated	62 (17)
	Missing	14 (2)
Religion or spirituality is important to me.	Yes	177 (47)
	No	168 (45)
	Don't know/Missing	34 (9)
My religious or spiritual practices influence my health choices.	Yes	36 (10)
	No	322 (87)
	Don't know/Missing	21 (4)
My child received the recommended vaccines since birth	Yes, all vaccines	342 (91)
	Yes, some vaccines	30 (8)
	No	3 (1)
	Don't know/Missing	4 (1)

Table 3
Portrait of pilot school staff responding to the survey, 2019–2020.

		n, %	
		Principals ($N = 28$)	Teachers ($N = 49$)
Regions	Montreal	4 (14)	8 (16)
	Laval	13 (46)	28 (57)
	Laurentides	11 (39)	13 (27)
Language	English	5 (18)	4 (8)
	French	23 (82)	45 (92)
Number of years in this position in an elementary school	1–5	18 (64)	18 (37)
	6–10	3 (11)	4 (8)
	11–15	2 (7)	3 (6)
	≥16–20	2 (7)	4 (8)
Number of years at the school recruited for the project.	1–5	22 (79)	20 (41)
	6–10	2 (7)	7 (14)
	≥11	0	18 (37)

3.2. Parental survey: HPV vaccine hesitancy, confidence and stage of decision

At the beginning of the 2019–2020 school year, most parents had never heard of the HPV virus and vaccines (87 % pilot schools, 92 % control schools). Most were not or a little hesitant regarding the HPV vaccine for their children (81 % pilot, 78 % control), and some were quite or very hesitant (19 % pilot, 22 % control).

Parents generally agreed with most statements about their confidence in vaccination in general (eg. Vaccines are safe) (Gilkey et al., 2014). No statistically significant differences existed between pilot and control schools or before and after vaccination.

Regarding the decision stage, around 10 % of parents were unaware that they could vaccinate their children against HPV or hadn't yet thought about it. Approximately 11 % were undecided. Some planned not to vaccinate their children (10 % pilot, 12 % control). Most (55 %) planned to vaccinate their children. Most (80 %) would regret not having their child vaccinated if they get an HPV infection (80 %). There were no differences in responses between pilot and control schools.

3.3. School staff perception and their participation in the SCHOOL-based immunization program

Almost all principals (96 %) supported vaccinating children in schools, as did most Grade 4 teachers (89 %). Similarly, nearly all principals (96 %) felt that communication between school staff and the school nurse was easy, while this proportion was lower among teachers (77 %).

Regarding preparation for school vaccination, 44 % of principals were informed, but 36 % didn't know what would be done. Almost all principals (98 %) felt that the students in their school received the support they needed to ensure that the vaccination process ran smoothly. Teachers (97 %) were actively involved in collecting consent forms. During the fall of 2019, school-based vaccination activities went well, according to school principals (93 %) and teachers (86 %).

3.4. Intervention 1 – Information session on HPV vaccination for parents of grade 4 students

In total, 72 classes were visited by school nurses in the 32 schools at the information evening session at the beginning of the school year. Nurses estimated the attendance to be around 1330 parents. The PowerPoint presentation was used in 62 of the 72 classes. The lack of PowerPoint support was mainly due to technical issues. Nurses' experiences were positive ($n = 22$) and even very positive ($n = 4$). For only one, the meeting "*could have been better.*" School staff were cooperative and welcoming, but a few ($n = 6$) felt less cooperation from the staff, as some teachers were reluctant to share their presentation time with the nurses.

In individual interviews with 18 participating nurses, most ($n = 12$) felt that the presentation's content was adequate for parents. A few mentioned that it was too explicit for aspects related to sexuality ($n = 3$) or could be more simplified (n = 3) or shortened ($n = 2$). Many appreciated the opportunity to connect with parents ($n = 6$): *"They associate the nurse, her face, it creates a bond of trust"* and to have this opportunity to pass on information. A few of them voluntarily said they wanted to repeat the intervention another year ($n = 4$).

To facilitate the intervention's implementation, nurses noted the importance of collaboration with teachers ($n = 9$) and principals ($n = 7$). Some nurses (n = 7) would have preferred that parents be grouped for a single meeting rather than touring several classes on the same evening.

The presence of children and teachers' dissatisfaction with the time taken up during the meeting were obstacles ($n = 4$). Some would have liked more time for parents to participate and ask questions ($n = 4$). The lack of time to prepare for meetings and the ten minutes allotted for presentations were a concern ($n = 3$). Preparing for the presentation, attending meetings in the evening, and taking time to travel to schools were the main impacts on nurses' workload.

The nurses' main suggestions to improve the intervention were providing information in multiple languages (n = 4) and allowing more time to answer parents' questions.

3.4.1. School staff perceptions

Around 40 % of teachers and principals recommended this presentation to parents yearly.

Seven principals and 34 teachers attended the presentation, and most (66–72 %) had a favourable opinion (e.g., clear, useful, easy to understand.) Difficulties were reported by 18 % of principals and 24 % of teachers who assisted, including limited time at the welcome meeting, lack of interest from parents, inadequate content for parents (e.g., choice of images) or lack of facilities.

The brief presentation, collaboration with the school nurse, available room, organized timing, PowerPoint support, and parental interest eased the intervention implementation.

3.4.2. Parents' perceptions

Most respondent parents (71 %, $n = 206$) attended the presentation and were generally satisfied (Table 4). They were almost unanimous (92 %) in recommending this intervention yearly to help parents make vaccination decisions. Around one in five parents indicated that this presentation had influenced their decision to vaccinate their child.

Table 4
Evaluation of the school nurse's classroom presentation by parents in pilot schools, 2019–2020.

	Agree* (n = 206)
The school nurse spent the right amount of time talking about HPV vaccines.	161 (78)
The school nurse did a good job of addressing my concerns about HPV vaccines.	150 (73)
The school nurse used language that was easy to understand	185 (90)
Overall, I was satisfied with how the school nurse discussed HPV vaccines.	171 (83)
My decision to vaccinate my child was influenced by the presentation given by the school nurse.	45 (22)
I recommend that the school nurses offer this presentation every year to all Grade 4 parents to help them make a decision about their child's vaccination	190 (92)

* Combined strongly agree and agree.

3.5. Intervention 2: Email reminder using an interactive decision support tool

There were 203 missing consent forms for a total of 1924 students. The email reminder was, therefore, sent to at least 203 parents in 23 pilot schools. There were 12 schools for which all consent forms were returned, so no reminder was required. Nurses reported that 110 consent forms were returned after the intervention.

Although we had hoped to capture web analytics to assess the decision support tool usage throughout the fall of 2019, technical problems prevented the collection of complete data. Partial data collection showed that across 22 captured website visits, the average time spent on the webpage hosting the decision support tool was 2 min and 11 s.

3.5.1. Nurses' feedback from the individual interviews

Ten of the 18 nurses felt that the email reminder positively impacted the return of consent forms. Two noted that this intervention was useless in an underprivileged environment with uncertain internet access.

3.5.2. School staff perceptions

The majority (82 %) favoured their school sending out this reminder. Four respondents encountered difficulties such as access to families without the Internet and lack of time for personalized mailings. The main facilitating factors reported were having enough time (42 %) and collaborating well with the school nurse (32 %). The research team offered a lump-sum payment to the schools for the time required for administrative tasks related to the project, and this additional funding to carry out this task was identified as a factor contributing to the success by 12 % of principals. Finally, hiring more administrative staff would be helpful (12 %).

3.5.3. Parents' perceptions

Many respondents received this email (Table 5). More than two-thirds (68 %) felt that the decision support tool had addressed their concerns about HPV vaccines. Most (82 %) felt the tool should be available to all parents, and 21 % were influenced by it.

3.6. Intervention 3 - telephone follow-up using an approach inspired by motivational interviewing (mi) techniques

Ninety-one follow-up calls were made, and nurses reached 64 parents during that attempt (Supp. Mat. 5). The nurses managed to speak to the parents on the 1st call (56 %) or left a message (31 %). Mothers talked to the nurses more often than fathers (56 % of mothers vs. 13 % of fathers, missing 30 %). Calls frequently lasted less than 10 min (64 %).

Nurses indicated the main reason mentioned for not returning the consent form. However, data were not collected for 10 calls. In 16 cases, parents had forgotten to complete or return it. For 11 parents, they had signed the consent form, suggesting that it was lost or not handed by the child to the school. Nine parents refused vaccination. Finally, five parents expressed doubts and hesitation about vaccination (e.g., child too young, concerns about vaccine safety and usefulness, lack of information, fear of needles, and preference not to give two injections on the same day).

Table 5
Parents' evaluation of the email reminder, 2019–2020.

	Agree* (n = 219)
This tool helped to address my concerns about HPV vaccination.	142 (68)
The explanations given in this tool were easy to understand.	171 (78)
My decision about my child's vaccination was influenced by this tool	46 (21)
This tool should be available to all parents who have to decide to vaccinate their child against HPV	173 (82)

* Combined strongly agree and agree.

3.6.1. Nurses' feedback

Six of the 18 nurses used MI techniques while talking with parents. A barrier to the intervention was the lack of offices for school nurses in school buildings or the shared office, making it difficult to follow up on calls. Some expressed difficulties communicating with parents (e.g., no return calls, wrong number, language barrier.) Having a lot of phone calls to make and lacking time were cited.

The impact of this task was negligible for three respondents and required more time for two others. Four found the intervention helpful in receiving more signed consent forms.

3.6.2. Parents' perceptions

Of the parents responding to the survey, 9.5 % (n = 26) had received a call from the school nurse. Parents were generally satisfied with their conversation, and the majority said it influenced their decision to vaccinate their children against HPV (n = 22, 85 %) (Table 6).

3.7. Results of the end-of-project workshop with interested parties

Among the main facilitating factors mentioned was good collaboration with schools and teachers. Some suggested sharing information on vaccination coverage with schools to mobilize and raise awareness.

Participants preferred accessing various tools, like a "toolbox available when needed," rather than implementing these interventions in all schools.

However, barriers such as high staff turnover and shortages in healthcare and education complicated consistent parent follow-up.

Participants discussed running a social network campaign to promote the tools to parents as part of a public communication campaign on HPV vaccination. Others feared this campaign might exhaust parents' interest in vaccination in the post-pandemic context. It was mentioned that implementing digital interventions for more disadvantaged parents could be challenging.

4. Discussion

This pilot project gathered feasibility data on a multi-component strategy to enhance HPV vaccine acceptance and uptake in school-based programs. The interventions were generally well-received by school staff, nurses, and parents. Trust in healthcare professionals influences vaccine acceptance (Smith et al., 2017); therefore, school nurses must be equipped to respond to parents' concerns.

All participating nurses perceived the face-to-face information sessions with parents as successfully deployed. Nevertheless, few nurses wanted to repeat the intervention in the future because of the time needed. Some vaccination teams continued to hold these presentations after the project concluded. School nurses suggested creating a short video for parents or organizing large-group meetings as a sustainable alternative.

A personalized email from the school could be an effective strategy to reduce individual phone calls. A systematic review with meta-analysis

Table 6
Parents' evaluation of school nurses' reminder call using MI techniques, 2019–2020 (n, %).

	Agree* (n = 26)
At the beginning of the phone call, the school nurse asked me if I agreed that she communicates information about vaccination to me.	17 (65)
The school nurse listened carefully to me.	22 (85)
The school nurse spent enough time on the topic of vaccination.	22 (85)
The school nurse explained things in a way that was easy to understand.	22 (85)
The school nurse respected my point of view regarding vaccination.	22 (85)
My decision about my child's vaccination was influenced by this phone call with the school nurse	22 (85)

* Combined strongly agree and agree.

concluded that reminder systems could improve HPV vaccination initiation and completion (Siddiqui et al., 2022; Mohamed et al., 2022). This intervention seems feasible on a larger scale without requiring too much organization and resources. It could increase vaccine inequities (e.g., not reaching parents without Internet access or who cannot read), and a letter sent home with the student could be preferred for them.

The MI training helped improve school nurses' skills and confidence (Dionne et al., 2024b). The online MI training is available free of charge to anyone working in Quebec's healthcare network, including school nurses. A study to improve provider communication about HPV vaccines for reluctant parents using MI concluded that the intervention improved communication and that MI played a central role in improving acceptance of HPV vaccines (Reno et al., 2018). Barriers to phone reminders included that the participating school nurses were often on the move and lacked a suitable location. Some workshop participants mentioned that their vaccination teams now had a cell phone or a generic email address so parents could contact the nurses more easily. This solution for improving communication with parents could inspire other vaccination teams.

Collaboration between health authorities and schools is a key enabling condition for implementing any strategy to enhance vaccine acceptance in school-based programs. Our study suggests that such collaboration may be facilitated by offering flexible programs adapted to different schools' needs and capacities, ensuring sufficient school-based nurses to deliver programs and information and integrating feedback from such nurses to ensure the feasibility of plans. A systematic review underlined the importance of involving the various interested parties, including teachers, in the immunization program and process and providing them with appropriate information (Cooper Robbins et al., 2011).

The findings should be interpreted with some limitations. Participation was voluntary in all data collection. The number of survey respondents who received the interventions remained relatively small, and participants who were unavailable or declined to participate may have characteristics and opinions that differ from those recruited. School staff participation rates were high (Dionne et al., 2024b), favouring the generalizability of results for these participants. School nurses and managers may have provided socially desirable answers during the interview. The research team provided a grid for Intervention 3, but some nurses didn't fill it in, leading to missing data.

Since the school was responsible for transmitting the reminder email to the parents, we had no control over the process, which may have led to errors or delays in follow-up. In some schools, the reminder email may have been sent to all parents, not just those who hadn't returned the consent form. Regular contact and follow-up by the research team with schools reduced this risk.

Finally, the particularities of Quebec's HPV immunization program and the acceptability of the vaccines by the majority of parents may limit the transferability of results to different contexts.

5. Conclusion

The interventions implemented to enhance HPV vaccine acceptability and coverage in Quebec schools have shown promising results in positively influencing parents' decision-making regarding vaccination (Dionne et al., 2024c). While logistical challenges were noted, particularly with classroom presentations, the overall positive reception suggests the potential for broader implementation.

CRediT authorship contribution statement

Maude Dionne: Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Chantal Sauvageau:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Doriane Etienne:** Writing – review & editing, Methodology, Investigation, Formal analysis. **Holly O. Witteman:** Writing – review & editing, Supervision, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Ève Dubé:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

Dre Chantal Sauvageau has research grants paid to the organization (Institut national de santé publique du Québec or CRCHU de Québec-Université Laval) for clinical trials and epidemiological studies funded by non-profit organizations: Ministère de la Santé et des Services sociaux du Québec, Bill & Melinda Gates Foundation and Michael Smith Foundation). Dre Sauvageau is an active member of the Comité sur l'immunization du Québec and the Groupe de travail sur la vaccination contre le VPH et le zona of the Comité consultatif national de l'immunization.

Other authors have no conflicts of interest to disclose.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2024.102931.

Data availability

The data that has been used is confidential.

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