A complementary approach to the vaccination promotion continuum: An immunization-specific motivational-interview training for nurses

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ABSTRACT

Aim: To develop and validate immunization-specific motivational-interview (MI) training for immunization nurses.
Background: We previously demonstrated that a MI-based intervention on immunisation, performed during postpartum by MI-trained healthcare workers at the hospital maternity ward, reduced parental vaccine hesitancy (VH) and increased vaccine coverage of their children. In this study, we propose immunization-specific MI training for immunization nurses. Together, MI-based training and interventions provide complementary approaches to existing strategies along the vaccination promotion continuum.
Design: Multiple pretest/posttest design with questionnaires self-administered before and after each training days (4 time points).
Methods: We developed an in-person immunization-specific MI-training workshop for immunization nurses, held on two days three months apart, with 7 h of MI-training dispensed on day 1, and 4 h on day 2. The self-administered Motivational Interviewing Skills in Immunization (MISI) questionnaire was used at four time points (before and after each of the 2 training days) to evaluate three core aspects of participant MI training: (1) MI-knowledge acquisition; (2) MI-skills application and (3) self-rated self-confidence in applying MI knowledge and skills in vaccination clinical practice. Between November 2016 to December 2017, 34 immunization nurses enrolled in our MI-training workshops.
Results: The immunization-specific MI-training improved the three core areas evaluated in participants i.e. MI-knowledge acquisition, MI-skills application, and self-rated self-confidence in applying these in vaccination clinical practice.
Conclusions: Our immunization-specific MI-training enabled immunization nurses to significantly improve MI knowledge, skills and self-confidence in applying MI in the clinic. These results, taken together with those on the MI-based intervention for parents that we previously reported, support the notion of proposing validated immunization-specific MI training for immunization nurses in order to curb parental VH.
Impact: Immunization-specific MI-training would be easily amenable for the training of other health professionals in the field of immunization to help promote vaccination and curb parental VH.

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1. Introduction

The World Health Organisation (WHO) recently ranked vaccine hesitancy (VH) among the 10 most pressing global health threats [1]. The increasing number of vaccine-hesitant individuals worldwide currently ranges from 15 to 30% of the population, depending on the country [2–4]; MacDonald and SAGE Working Group on [5–7]. Immunization-specific MI-based interventions

are considered potentially helpful approaches and communication tools to address vaccination promotion, parental VH and immunization decision-making [8–15]. We previously showed that an MI-based intervention, conducted postpartum at the maternity ward, enhanced parental intention to vaccinate (VI) and vaccine coverage of their child [8–12]. MI-style counseling is a patient-centric approach based on patient responsibility and capacity for change. VH is often related to fear and misinformation. Immunization-specific MI-training may help healthcare workers better address parental VH. Complementary immunization-specific MI-based strategies, such as MI training for health professionals and MI-based interventions for parents, could help alleviate parental ambivalence and VH by raising internal motivation to have themselves and their children vaccinated.

Despite the promising implementation of MI-based interventions in a variety of health-related contexts, developing MI competencies is complex. MI training is often provided in the form of one- to three-day workshops, dispensing a median nine hours of training [16]. However, the literature points out that MI competencies tend to diminish quickly over time when not applied [17]. One way of mitigating this effect could be to provide systematic post-training feedback, support or supervision [17]. Most studies that have evaluated MI training report measuring improvement of trainees in three core aspects of participant MI learning: (1) MI-knowledge acquisition, (2) MI-skills application, and (3) self-confidence to use MI knowledge and skills in clinical practice. Several reports suggest these three core aspects as key to both MI learning and training [18–23]. A fourth core aspect of MI training is concerned by patient-health outcomes.

We posited that, by the end of our immunization-specific MI-training workshop, participant immunization nurses would have acquired sufficient basic MI knowledge and MI-skills for them to feel confident enough to apply these to their daily vaccination work routine in clinical practice, especially among vaccine-hesitant parents.

2. Methods

2.1. Participants

In collaboration with the Eastern Townships Department of Public Health, a free-of-cost immunization-specific MI-training workshop was offered to all immunization nurses administering vaccines in the Eastern Townships region of the Province of Quebec (CANADA). Participation was on a strictly voluntary basis. Each MI-training workshop was dispensed over 2 days, three months apart. Immunization nurses working in public health clinics perform the vast majority of vaccinations in the Province of Quebec. Participant immunization nurses were specifically released from work by their supervisors in order to attend the MI-training workshop. The 11-hour training was accredited for continuing education and paid for by the Eastern Townships Department of Public Health. Between November 2016 and December 2017, the immunization-specific MI-training workshop was offered every four months, to a maximum of 15 participants each time. We enrolled a total of 34 immunization nurses from 9 health care facilities located across 8 of the 9 administrative territories of the Eastern Townships.

### 2.2. MI-training protocol and curriculum

The MI curriculum was designed to be immunization-specific, as mentioned above. The training protocol was carefully co-developed by two MI experts, in collaboration with members of the Motivational Interviewing Network of Trainers (MINT) and

the immunization experts who pioneered the PromoVac strategy [8–12]. In addition, the MI-training curriculum and protocol were revised by independent MI experts. The MI-training workshop consisted of a total of 11 h of in-person training spread over 2 days three months apart: 7 h on day 1, followed three months later by 4 h on day 2. MI training workshops were dispensed by an MI expert, member of the MINT. As described in Fig. 1 (Text box 1), day 1 was devoted to discovering the MI philosophy and acquiring certain of the basic MI skills e.g., asking open-ended questions, making reflective listening statements, summarizing as needed, and providing information exclusively when prior permission to do so was granted by the patient. Learning processes included MI theory, observation and active participation of trainees in immunization-specific situational exercises. The three-month interval between the two workshop days provided participants with a window of opportunity to apply and practise their newly acquired MI knowledge and skills in their daily vaccination work routine and clinical practice. The second day of training was devoted to revisiting the MI skills learned during the initial day of training, with a supervised group feedback discussion during which participants were invited to share any of the practical challenges or difficulties encountered as well as to offer up potential solutions or ways to overcome these.

2.3. Training evaluation protocol using the motivational interviewing skills in immunization (MISI) questionnaire

To assess the effectiveness of our immunization-specific MI-training protocol, we used our previously developed written survey called the Motivational Interviewing Skills in Immunization (MISI) questionnaire [24]. Here, we used a pre-test/post-test design to evaluate our immunization-specific MI-training protocol. We asked immunization nurse participants to complete the MISI pre-questionnaire before each day of training. Pre-questionnaires were sent out to participant nurses by email two weeks prior to each of the training days. Participants were invited to return their completed questionnaire, at their own convenience by email, fax or in-person on the morning of the training day. Post-questionnaires were sent by email two days after each training day and participants were invited to return them completed within the next two weeks either by email or fax.

The MISI is short written questionnaire designed to evaluate the three core aspects of participant MI learning and requires approximately 15 min to fill out [24]. The first core aspect of participant MI learning, MI-knowledge acquisition, is assessed using nine multiple-choice questions on MI theory, principles and related skills. The next core aspect of participant learning, MI-skills application, is evaluated using two different types of questions. First, an open-response situational question which the participant is instructed to answer by writing an MI-consistent dialogue. This question was adapted from the Helpful Responsiveness Questionnaire (HRQ) developed by W. R. Miller et al. [22] for vaccination-specific contexts. Second, participants self-rate their own use of fifteen proposed MI skills and MI-consistent or -inconsistent behaviors. The final 6 items of the MISI questionnaire evaluate the third core aspect of participant MI learning: self-confidence in applying MI knowledge and skills in their daily vaccination work routine and clinical practice. The open-response situational question, based on the HRQ, is analyzed according to a coding manual that we developed previously [24]. Briefly, the coder identifies and scores each MI skill as follows: open-ended question (1 point), reflective listening statement (between 1 and 2 points depending on the complexity level), affirmative reflective statements (1 point) and "elicit - provide - elicit" skill (between 1 and 3 points depending on the completion status). The MI-adherence score was adapted from
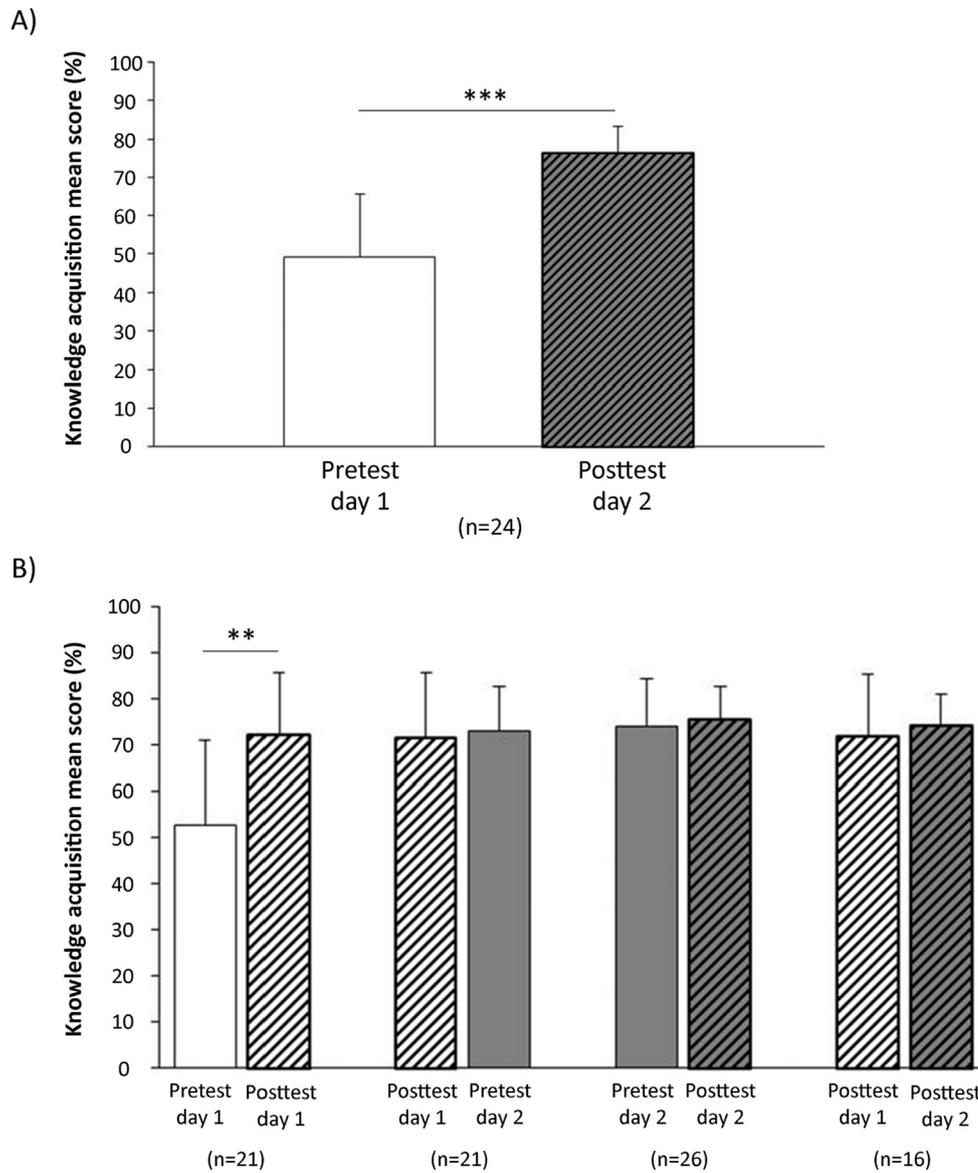
Fig. 1. Knowledge acquisition of participants during and after specific MI training on vaccination. (A) Knowledge acquisition improvement of participants during entire MI training. (**B**) Most of this learning appears during the first day of training. Knowledge acquisition is maintained between two days of training 3 months apart. No significant knowledge acquisition happened during the second day of training. The bars indicate the mean+SD. **p < 0.01, ***p < 0.001 by Wilcoxon signed-rank test.

the Motivational Interviewing Treatment Integrity [25], a validated MI assessment tool. The MI-adherence score evaluates (on a scale from 1 to 5) the level of MI consistency (closer to 5) or inconsistency (closer to 1) of the participant's written dialogue.

2.4. MISI scoring

Scoring of the MISI questionnaire responses was performed as previously described [24]. Briefly, multiple-choice questions were dichotomously coded: 1 point for each correct answer and 0 for any wrong answers. The 6-point Likert-scale items on MI skills were also dichotomously coded. For MI-adherent items, only the two highest category responses (i.e. "Frequently" and "Extremely") were attributed 1 point. For MI non-adherent items, only the lowest category response ("Not at all") was attributed 1 point. Continuous variables for the core aspect "self-confidence in using MI in clinical practice" were coded according to the number of points scored in the 10-point Likert-scale items. The total for each core aspect was calculated by summing up each item contained in the

respective aspects. Raw totals were converted over to 0–100 scales using simple linear transformation accounting for items with missing values. For the open-response situational question, the total score was calculated by summing up the total points attributed for counts of each of the 4 MI skills and those for MI-adherent items.

2.5. Data analysis

Participant characteristics were described. Categorical variables were presented by numbers and percentages, whereas continuous variables were presented by mean and standard deviation (SD). Each core aspect of participant MI training was analyzed separately from the others. Core aspects with greater than 20% missing data were excluded from analyses. The Friedman test was used to determine at least one significant difference (p < 0.05) between scores measured pre- and post-training on days 1 and 2. Each pair of pre- and post- scores were also compared by running a Wilcoxon signed-rank test. The numbers of participants varied from one

Box 1 Overview of the specific MI applied to vaccination training developed for nurse care practitioners.

Training day 1 (7 h)

Main objective: Discovery and familiarization to MI.

Presentation of training (30 min)

What is taught	Way of learning
a. Awareness to the importance of listening in MI (30 min)	"Ice-breaker" activities
b. Stages of change, readiness to change (50 min)	Small groups working with clinical vignette
c. Defining "righting reflex", MI style, principles and processes (50 min)	Role play, Demonstration of directive style of counseling *vs* MI style and group feedback
d. Core MI skills (open ended questions, affirmations reflective listening, summaries, elicit-provide-elicit) (1.5 h)	Video presentation, theory, participants recognition and identification of core MI-skills, plenary discussion
e. MI-related skills application and experimentation of MI style counseling (2.5 h)	Pair working exercise on open questions and reflections, half-group cooperative exercise and group feedback, real plays (experiencing patient, counselor and observer role)
Conclusion (20 min)	

Training day 2 (4 h)

Main objective: Consolidate knowledge and skills learned on first day of training.

The second day of training starts with an « ice-breaker activity ». Reviewing of MI related knowledge and skills is done according to participants needs (exercises, theory, discussion, etc.) Participants are also invited to share how they apply MI skills to their practice and discuss about difficulties and ways to overcome it.

analysis to another due to the fact the questionnaires were not completed by every participant at each of the four time points. All statistical analyses were conducted using SPSS version 24.

3. Results

3.1. Participant characteristics

A total of 34 immunization nurses working in the Eastern Townships public health clinics enrolled for one of the three immunization-specific MI-training workshops held between November 2016 and December 2017. Ten enrolled for the first workshop, 9 for the second, and 15 for the last. Among the 34 participants, 2 were men and 32 were women (Table 1), 3 (8.8%) had been working in the field of vaccination for less than a year, 6 (17.6%) for one to four years, 5 (14.7%) for five to nine years and 20 (58.8%) for a decade or more.

3.2. Evaluation of training participation

Of the 34 immunization nurse participants who attended the 2-day MI-training workshops, 32 (94.1%) completed both pretests, 22

Table 1
Characteristics of participants.

Age (years), *mean ± sd* (min – max)*	43.2 ± 11.4 (25 – 63)
Sex, *n (%)*	
Female	32 (94.1)
Male	2 (5.9)
Years of experience in vaccination, *n (%)*	
<1 year	3 (8.8)
Between 1 and 4 years	6 (17.6)
Between 5 and 9 years	5 (14.7)
More than 10 years	20 (58.8)

* 1 missing value for age.

(64.7%) completed the day-1 posttest, and 26 (76.5%) completed the day-2 posttest. Of the 34 participants, 15 completed all four questionnaires.

3.3. Dependant variables

3.3.1. Overview of the three MI core areas evaluated and of MI improvement

Fifteen participants responded to all four questionnaires. As reported in Table 2, MI-knowledge acquisition, MI-skills application as evaluated by a written dialogue, and self-confidence in applying MI knowledge and skills in clinical practice were all significantly improved by training. Although participants reported improvement of self-confidence in applying MI skills in their daily vaccination work routine and clinical practice, the observed difference was not significant according to our statistical analysis (p = 0.057).

3.3.2. MI-knowledge acquisition

Following MI training, as shown in Fig. 1A, we noted a significant improvement in MI-knowledge acquisition as evidences by the difference between scores of the day-1 pretest and of the day-2 posttest (49.31 ± 16.33 *vs* 76.39 ± 6.80; p < 0.001). As shown in Fig. 1B, the greatest improvement in MI-knowledge occurred over the first day of training, as evidenced by the difference between MI-knowledge scores of the day-1 pretest and posttest (52.65 ± 18.56 *vs* 72.29 ± 13.55; p = 0.003). MI-knowledge acquisition persisted over the three-month interval between training days, as MI-knowledge scores of the day-2 pretest were similar to those of the day-1 posttest (73.02 ± 9.67 *vs* 71.76 ± 13.99; p = 0.565) as shown in Fig. 1B. However, no significant improvement in MI knowledge occurred between the day-2 pretest and posttest (73.93 ± 10.40 *vs* 75.64 ± 7.04) as also shown in Fig. 1B.

Table 2
Global statistical analysis of key aspects scores of motivational interviewing (MI) training prior to and after day 1 and day 2 of training by Friedman test.

	n	Score on	Score (mean ± SD)				p
			Pretest day 1	Posttest day 1	Pretest day 2	Posttest day 2	
Knowledge acquisition	15	100	47.04 ± 18.41	73.06 ± 13.34	72.59 ± 8.26	74.81 ± 6.60	**<0.001**
MI-skills application - Written dialogue	9	–	4.78 ± 3.60	10.22 ± 2.73	7.00 ± 3.35	10.78 ± 5.65	**0.002**
MI-skills application - Participants perceptions	14	100	44.29 ± 17.66	47.35 ± 22.66	60.31 ± 20.19	61.90 ± 23.88	0.057
Self-confidence to apply MI related skills	13	100	73.46 ± 13.77	79.10 ± 11.40	79.31 ± 9.08	81.62 ± 8.83	**0.028**

Values in bold: p<0.05
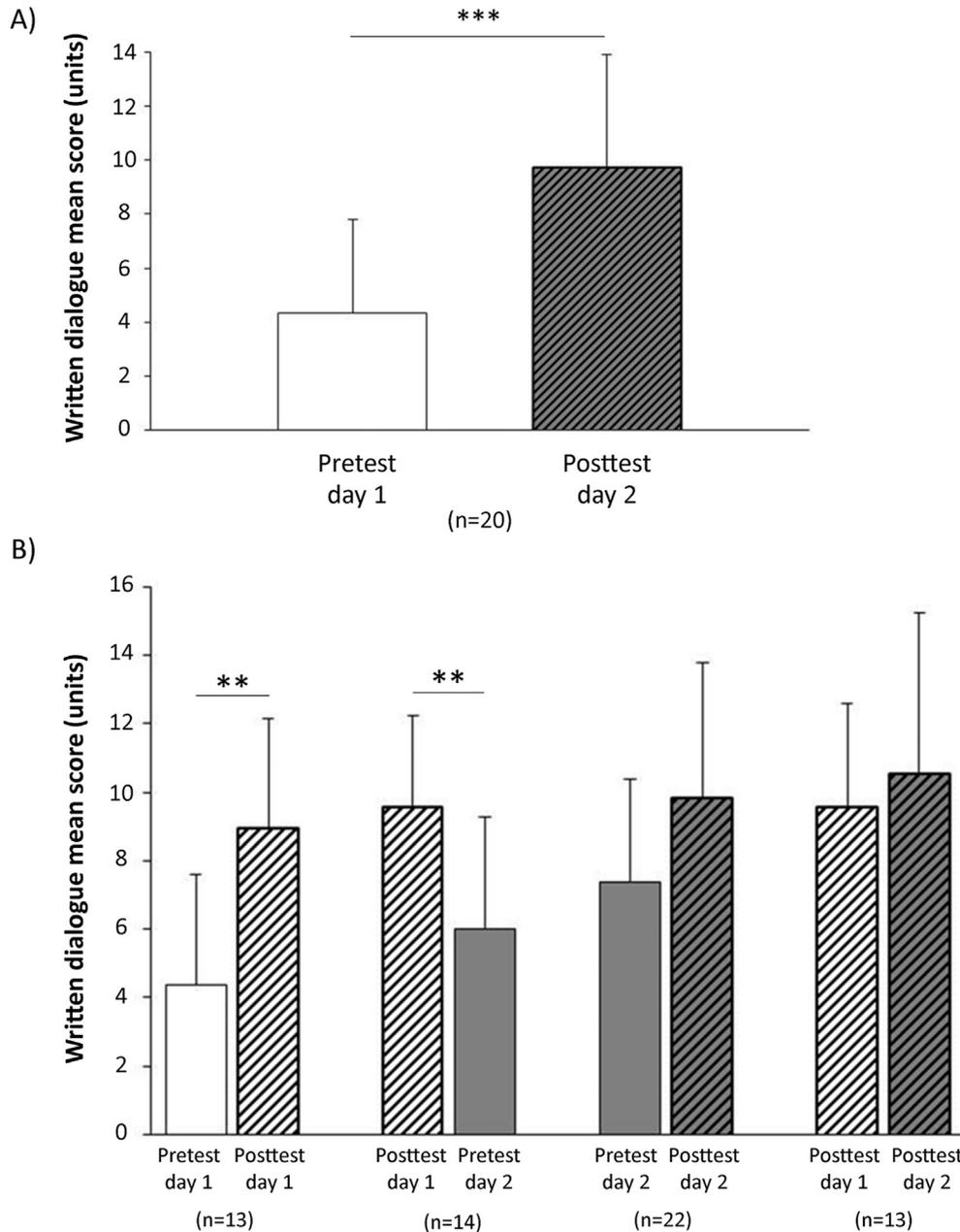
Fig. 2. MI-related skills application to situational exercise (HRQ-type question). Improvement of HRQ-type question mean score of participants during entire MI training. (**B**) Improvement of participants mean score regarding application of MI-skills to a situational exercise after one day of training. Significant diminution of MI-related skills application to HRQ-type question from participants between posttest of day 1 and pretest of day 2 of training. After day 2 of training, mean score of participants returned to similar or higher level as day 1 posttest regarding application of MI-related skills to situational exercise. The bars indicate the mean + SD. **p < 0.01, ***p ≤ 0.001 by Wilcoxon signed-rank test.

3.3.3. MI-skills application

Compared to the day-1 pretest score, participants' mean score on the written dialogue in response to the open-ended HRQ-type situational question significantly increased (4.35 ± 3.44 *vs* 9.70 ± 4.19; p < 0.001) after MI training (Fig. 2A). The newly acquired capacity to apply the MI skills learned on day 1 is evidenced by the increase in mean scores for that open-ended question (4.38 ± 3.23 *vs* 8.92 ± 3.25; p = 0.005) between that day's

pretest to posttest respectively (Fig. 2B). Our immunization-specific MI-training protocol provided participants with a built-in three-month window of opportunity to practice the knowledge and skills learned during the first day of training in their vaccination work routine and clinical practice. Somewhat paradoxically, as shown in Fig. 2B, capacity to apply MI skills in the form of a written dialogue diminished over the three-month interval. Indeed, the mean score on the open-ended HRQ-type situational question was significantly weaker on the day-2 pretest than on the day-1 posttest (6.00 ± 3.26 *vs* 9.57 ± 2.65; p = 0.002). However, as shown in Fig. 2B, the day-2 posttest mean score on the open-ended question was similar or greater to that measured on the day-1 posttest (10.54 ± 4.70 *vs* 9.54 ± 3.04; p = 0.687).

Participants also rated their use of MI skills by responding to a set of multiple-choice questions. After training was completed, the

mean score of participant's self-rated use of their MI skills significantly rose (58.23 ± 23.16 *vs* 36.88 ± 18.64; p = 0.001) compared to that measured on the day-1 pretest (Fig. 3A). Participants' self-rated use of their MI skills also increased between the day-1 and day-2 posttests, as shown by the upward shift in mean score on the multiple-choice questions (48.63 ± 22.40 *vs* 64.00 ± 24.40; p = 0.023) (Fig. 3B).

3.3.4. Self-confidence in applying MI in daily vaccination clinic practise

As showed in Fig. 4A, participants rated their self-confidence in applying MI techniques in clinical practice. Self-confidence rose sharply after training, as shown by the upward shift in mean scores (69.33 ± 15.09 *vs* 80.80 ± 7.90; p = 0.001) measured on the day-1 pretest and the day-2 posttest respectively. As shown in Fig. 4B, self-rated self-confidence in applying MI in daily vaccination
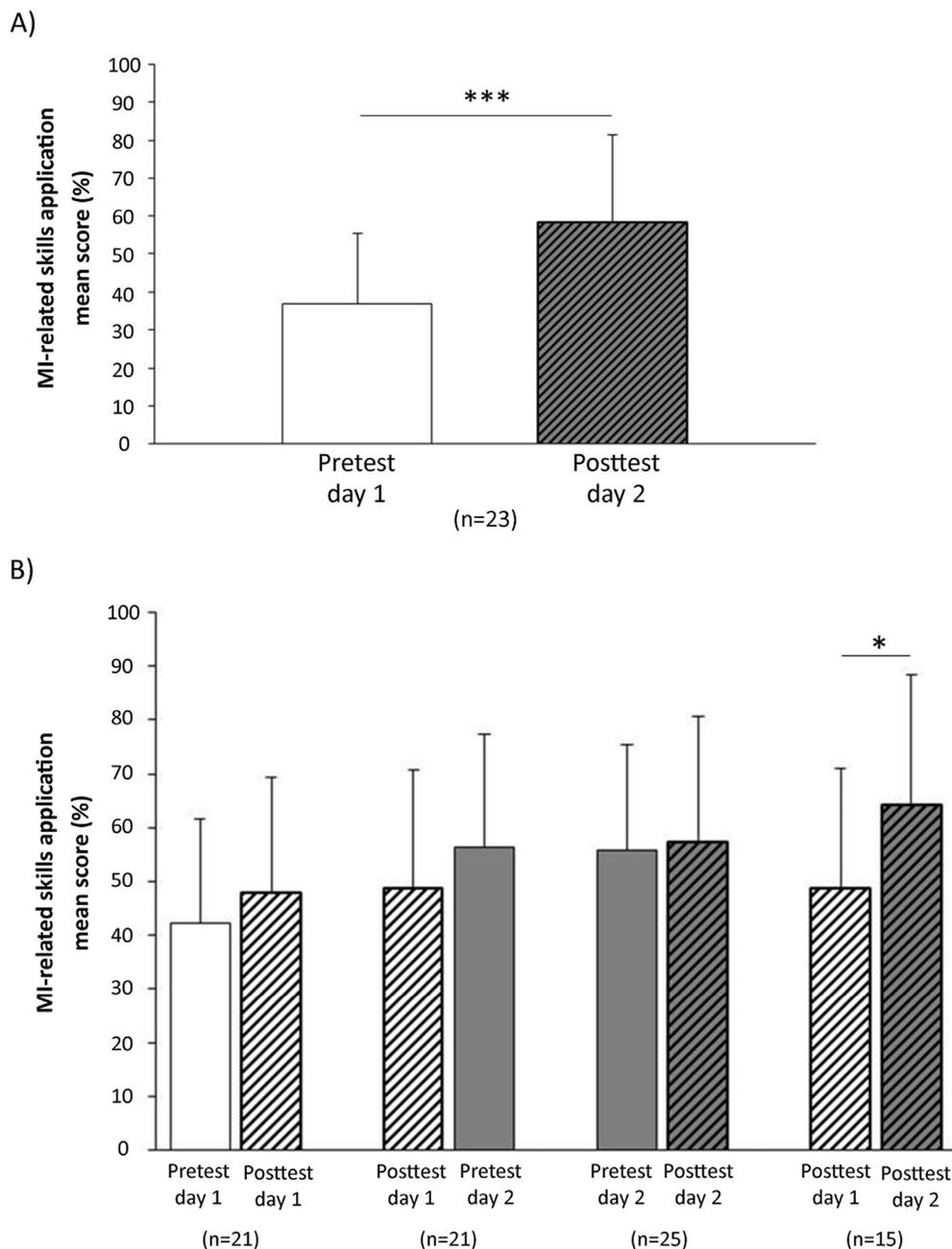
Fig. 3. Perception of participants to apply MI-related skills in their clinical practice. (**A**) According to participant's perception, they significantly improved their application of MI-related skills in their clinical practice at the end of training. (**B**) They improve their application of MI-related skills between end of training day 1 and end of training day 2. The bars indicate the mean + SD. *p < 0.05, ***p ≤ 0.001 by Wilcoxon signed-rank test.

A)

B)
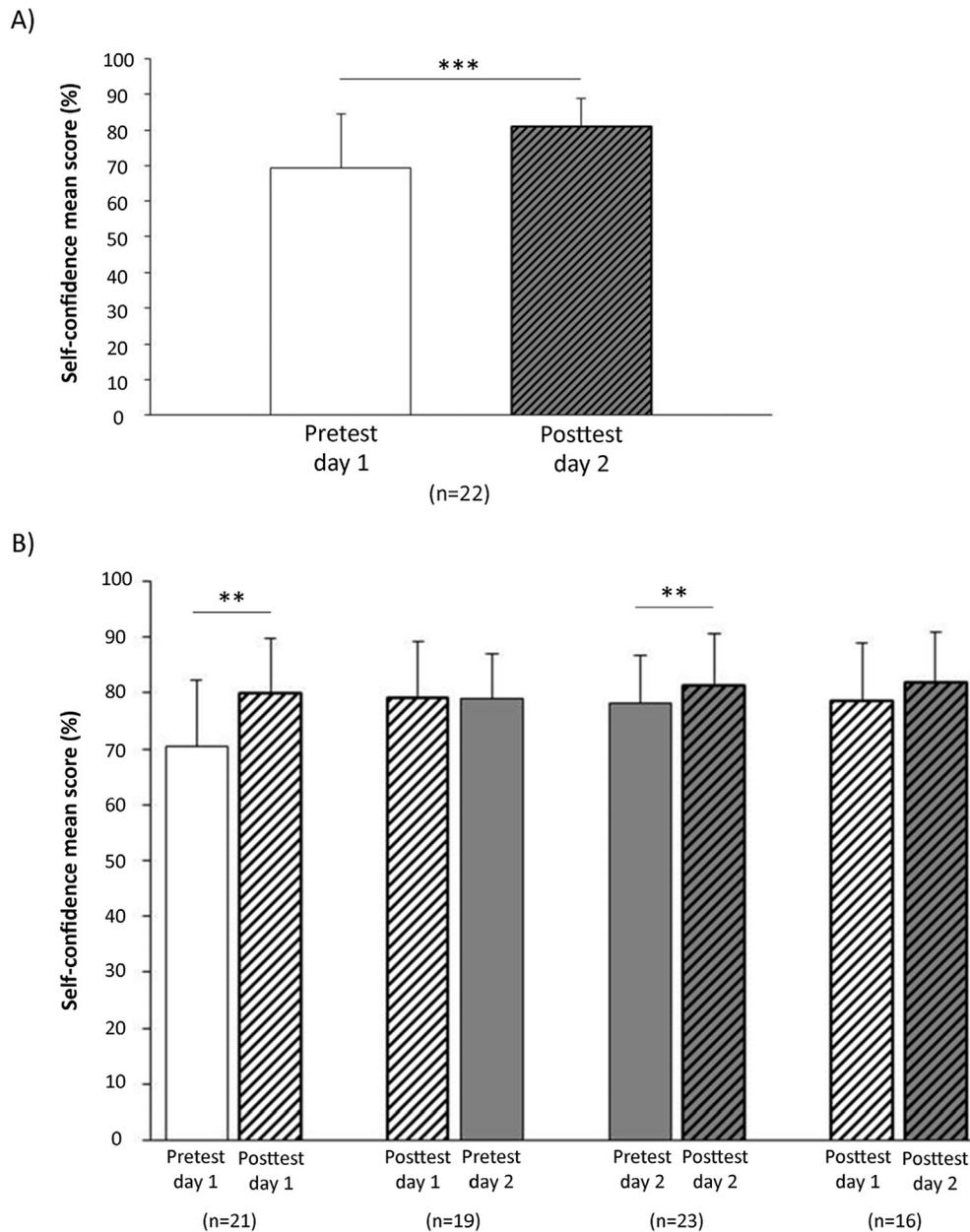
Fig. 4. **Self-confidence of participants to apply MI-related skills in their clinical practice after and during training.** (**A**) Training led to improvement of self-confidence mean score of participant between pretest of day one and posttest of day 2 of training. (**B**) Participant's level of self-confidence remained stable between end of day 1 and prior to day 2 of training. Each day of training contributed to elevate self-confidence level of participants. The bars indicate the mean + SD. **p < 0.01, ***p ≤ 0.001 by Wilcoxon signed-rank test.

clinical practise remained unchanged after the three-month interval. Indeed, similar scores were measured on the day-1 posttest and day-2 pretest (79.13 ± 10.16 *vs* 78.93 ± 8.18; p = 0.943). However, each day of training contributed to incrementally raise the self-rated self-confidence of participants, as shown by the two successive and significant increases in self-confidence scores measured on the day-1 pretest and posttest (70.40 ± 11.84 *vs* 79.76 ± 9.88; p = 0.004) and on the day-2 pretest and posttest (78.23 ± 8.54 *vs* 81.13 ± 9.49; p = 0.002) (Fig. 4B).

4. Discussion

As expected, results showed that our immunization-specific MI-training protocol seems to allow immunization nurse participants to acquire MI knowledge and basic MI skills, while raising their self-confidence in applying these to their daily vaccination work routine and clinical practice. Our MI-training protocol recapitulates the stepwise learning described previously by Madson et al. [26] and covers the four core areas of MI learning which are: (1) becoming familiar with the MI philosophy; (2) acquiring basic MI skills (asking open-ended questions, affirming the patient's response, applying accurate reflections, summarizing as necessary); (3) recognizing and reinforcing the patient's own articulation of change and (4) rolling with resistance i.e. avoiding confrontation and argumentation with the patient. The 11 h of MI training provided by our workshop protocol were split 7:4 over 2 days of training held three months apart. This timeline seemed particularly appropriate to meet the MI-training objectives. Indeed, results showed improvement in each of the four core areas of MI learning addressed by the MI training dispensed during our workshop. Our protocol is also consistent with recommendations found in the literature [16].

Based on Kirkpatrick's training evaluation method [21], our questionnaires evaluated three key MI-training outcomes known as (1) participant's reactions to the different aspects of training, (2) MI skills and (3) clinical use of MI. Among the strengths of our study are the use of four separate time points to measure participant MI knowledge and skills, and that of the MISI questionnaire, a previously validated tool for immunization-specific MI training [24]. Thus we were able to validate that MI-learning objectives for day 1 and day 2 were attained in a timely manner by participant trainees. In fact, as planned and expected by the expert MI trainer, our results reveal that most MI-knowledge and MI-skill concepts were learned by the end of training day 1. The three-month interval between training days 1 and 2 was greater than the 10-day to 2-month intervals reported previously for other MI-training protocols [27,28]. However, our longer interval did not seem to negatively impact MI-knowledge acquisition by participants, as MI-knowledge levels remained unchanged between days 1 and 2. As anticipated and previously described in the literature [17], participants' capacity to apply MI skills (as measured here by a written MI-consistent dialogue) diminished somewhat between days 1 and 2. Fortunately, training on day 2 reactivated and further consolidated participants' MI skills by reviewing MI concepts using theory, exercises and a feedback discussion of the strengths and challenges experienced by participants. This result supports the notion, reported in literature, of the importance of feedback, support and supervision to sustain MI learners following initial training. Overall, participants expressed a high level of satisfaction with the immunization-specific MI-training curriculum (data not shown).

According to Kirkpatrick's training evaluation model, the fourth MI-training aspect to assess is concerned by patient-health outcomes. We have previously evaluated health outcomes among the children of parents who received an MI-based immunization intervention (the PromoVac strategy) conducted postpartum at the hospital maternity ward. Briefly, we showed that our MI-based intervention conducted with parents of newborns during postpartum increased parental intention to vaccinate their infant and improved vaccination coverage of their child up to 2 years of age [8–12].

5. Limitations

One of the limitations of our study is the relatively lower number of participants than originally expected for certain results, due to the fact that every participant did not complete their questionnaires at each of the four study time points. This limitation affects the generalisability of our results. Also, for feasibility considerations, we were unable to follow-up with every participant once her participation ended. For this reason, the three-month interval between evaluations did not allow us to determine whether, or for how long, MI knowledge and MI skills persisted beyond the last day of training. Evaluation of MI-skills application was limited to a written response in the form of an MI-consistent dialogue. Even though this method may seem relatively inconvenient at first glance, we found it rather user-friendly and inexpensive. Importantly, it also provided a technology-bungle-free method for evaluation, compared to other methods using audio and video recordings. However, participant scores for MI-skills application, as measured by the written situational dialogue, are not necessarily representative of how immunization nurses would perform MI in a real-life clinical counseling setting.

Because training was offered on a strictly voluntary basis, as opposed to a mandatory basis, it is possible that our results carry a bias due to participants being relatively more motivated to learn MI than the average trainee. Participants' knowledge and professional background could possibly have differed from one another. However, even though the level of MI knowledge prior to training was different between participants, all of them experienced an increase in MI knowledge after training. Moreover, according to our results, their relative levels of experience in the field of vaccination did not seem to influence their MI-learning scores (data not shown). Finally, given that the MISI questionnaire is self-administered, bias of completion between participants is possible. Indeed, in order to answer our questions some participants may have sought information from other sources in addition to the MI training we dispensed.

6. Conclusion

Our training protocol successfully improved MI knowledge, MI skills and the self-rated self-confidence of participants in applying MI in their daily vaccination work routine and clinical practice. This study's results further support the rationale for providing validated immunization-specific MI training to nurses in the field of vaccination. This type of MI training could easily be adapted for other care practitioners and professionals in field of immunization. It could also be offered to health professionals as part of accredited continuing education. A continuum of well-integrated and complementary approaches should help promote vaccination. We propose that immunization-specific MI-training for immunization nurses and MI-based interventions for parents provide advantageous strategies to add to the existing continuum. Together, they can help health professionals address and curb parental VH by providing urgently-needed decision-making support.

7. Conflict of interest statement

Nothing to declare.

8. Authors' contributions

Arnaud Gagneur designed the study and the training protocol, performed data interpretation; he also wrote, reviewed and edited the manuscript.

Julie Bergeron performed data interpretation; she also wrote, reviewed and edited the manuscript.

Virginie Gosselin performed data entry, data analysis and data interpretation; she also wrote and reviewed the manuscript.

Anne Farrands designed the training protocol, collected data and performed data interpretation. She also reviewed the manuscript.

Geneviève Baron participated in the conception and design of the study, performed data interpretation and reviewed the manuscript.

All authors read, edited and approved the final manuscript.

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