Patient perspectives of pain mitigation strategies for adult vaccine injections

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Aims: The aim of this study was to evaluate an educational pamphlet that incorporates evidence-based pain mitigation strategies during adult vaccine injections and determine its effect on the knowledge, attitudes, and behaviors toward use of such strategies among adults in the community receiving immunizations.

Methods: An evidence-based pamphlet about how to reduce pain during vaccination in adults was distributed to a convenience sample of community sites that administer vaccines, including family physician offices, travel clinics, and pharmacies. Providers at the community sites distributed a baseline (pre) questionnaire followed by the pamphlet to study participants. Then participants were vaccinated. Six weeks later, participants were contacted to complete a follow-up (post) questionnaire. Participants’ knowledge, attitudes, and behaviors regarding pain mitigation strategies for vaccine injections were evaluated before and after access to the pamphlet.

Results: Seventy-four people receiving vaccines participated. Participants were predominantly university educated (69%) and female (66%), with a median age of 44.5 years (range, 18–71). Most participants received an injection at a travel or public health clinic (73%). Twenty-seven percent had prior accurate knowledge of pain mitigation strategies. Self-reported pain or fear of needle pain did not change from before access to the pamphlet to six weeks after. Twenty percent of participants used at least one strategy outlined in the pamphlet and found it helpful and 52% were interested in sharing the pamphlet with others.

Conclusions: An educational pamphlet about vaccination pain mitigation resulted in a positive change in knowledge and attitudes around pain mitigation strategies. Further research is needed to explore long-term impact.

RéSUMÉ

Objectifs: L’objectif de cette étude était d’évaluer une brochure éducative qui incorpore des stratégies d’atténuation de la douleur fondées sur des données probantes pendant les injections de vaccins chez les adultes et de déterminer son effet sur les connaissances, les attitudes et les comportements envers l’utilisation de telles stratégies chez les adultes de la communauté qui reçoivent les vaccins.

Méthodes: Une brochure fondée sur des données probantes sur la façon de réduire la douleur pendant la vaccination chez les adultes a été distribuée à un échantillon de commodité de sites communautaires qui administrent des vaccins, y compris des cabinets de médecins de famille, des cliniques de voyage et des pharmacies. Les prestataires dans les sites communautaires ont distribué un (pré)questionnaire de base suivi de la brochure aux participants à l’étude. Les participants ont ensuite été vaccinés. Six semaines plus tard, les participants ont été contactés pour remplir un questionnaire de suivi (post). Les connaissances, attitudes et comportements des participants concernant les stratégies d’atténuation de la douleur concernant les injections de vaccins ont été évalués avant et après l’accès à la brochure.

Résultats: Soixante-quatorze personnes ayant reçu des vaccins ont participé à l’étude. Les participants étaient majoritairement diplômés de l’université (69%) et de sexe féminin (66%), avec un âge médian de 44,5 ans (intervalle 18–71). La plupart des participants ont reçu une injection dans une clinique de santé publique ou de voyage (73 %). Vingt-sept pour cent avaient une connaissance préalable exacte des stratégies d’atténuation de la douleur. La douleur autodéclarée ou la peur de la douleur causée par l’aiguille n’a pas changé d’avant l’accès à la brochure à six semaines après. Vingt
Introduction

Vaccinations are considered to be one of the most successful accomplishments of public health.\(^1\) The Strategic Advisory Committee on Immunization of the World Health Organization has emphasized the importance of immunization across the life course.\(^2\) This is a major tenet of the Immunization Agenda for 2030 endorsed by the World Health Assembly in 2020.\(^3\) Control of the COVID-19 pandemic requires wide vaccine acceptance across all ages, further highlighting the importance of adult immunization. In addition to the COVID-19 vaccine and annual influenza vaccines, adults may require immunization for pertussis, pneumococcal disease, meningococcal disease, herpes zoster, hepatitis A and B, tetanus, and human papillomavirus.\(^4\) However, coverage rates for recommended adult vaccines fall well below national targets in most countries. For example, results from the 2016 adult National Immunization Coverage Survey indicated that only 10% of Canadian adults received a booster dose of pertussis vaccine and only 42% of Canadians 65 years of age and older reported having received the recommended pneumococcal vaccine.\(^5\) Furthermore, only 42% of all Canadian adults and 70% of Canadian seniors reported receiving the influenza vaccine during the 2018–2019 influenza season.\(^6\)

Reasons for vaccine hesitancy are multifactorial; however, it has been established that concerns about pain and needle fears are contributing factors for adults who choose not to receive recommended vaccines.\(^7\) Data from one large cross-sectional study suggest that 24% of adults are afraid of needles and 4% of adults consider themselves to be intensely fearful.\(^8\) That study also reported a prevalence of vaccination nonadherence due to needle fear in 7% of adults.\(^8\) Routine immunizations are the most common painful medical procedure performed globally. To date, little research has been done to address pain mitigation in adults undergoing immunization.\(^9\) Pain during vaccine injections is nevertheless recognized by the World Health Organization as an adverse event following immunization.\(^10\) The first two COVID-19 vaccines available in Canada are known to cause pain on immunization. For example, pain was reported in over 50% who received the BNT162b2 mRNA COVID-19 vaccine produced by Pfizer and two doses are required, further emphasizing the importance of mitigating pain to help encourage acceptance of follow-up doses.\(^1\)

Canadian researchers have led the field with the development of evidence-informed pain management strategies that can be used in adults receiving vaccine injections, but current practice in this population to alleviate immunization pain is not well documented.\(^8\) Developing and communicating methods to manage the pain associated with vaccine injections has the potential to improve the vaccination experience and increase acceptance in those who are fearful of needles. Our study was conducted to address the gap in knowledge that exists in the adult population about effective pain management strategies as described in the 2015 evidence-based Canadian Practice Guidelines to Mitigate Pain at Immunization,\(^12\) which contain recommendations for individuals across the lifespan. The objectives of this study were to evaluate an educational pamphlet that addresses pain mitigation during adult vaccine injections and determine its effect on the knowledge, attitudes, and behavior toward use of such strategies among adults in the community receiving immunizations.

Methods

Educational Pamphlet Development

A multidisciplinary team of experts in their respective fields, including public health, infectious disease physicians, nurses, and pharmacists, employed the use of a modified Delphi method to develop a pamphlet about vaccination pain mitigation based on evidence-based Canadian Practice Guidelines.\(^10,12–15\) Four separate focus groups (with a total of 42 participants) were conducted by the lead investigator to examine the face validity of the draft pamphlet. There were four participant groups (percentage of total participants; total greater than 100% because groups 3 and 4 could overlap): (1) health care professionals, including physicians, nurses, and pharmacists (14%); (2) health care professional students (medicine, nursing, pharmacy; 41%); (3) members of the general public with no health care training (40%); and (4) members of the general public who
were age 65 or older (18%). A multidisciplinary team of experts analyzed the themes and edited images and formatting to respond to feedback and optimize readability, usability, and visual appeal. The final pamphlet included evidence-based pain mitigation strategies related to pain medication, body position, staying calm, and distraction (Appendix A).

**Evaluation of Educational Pamphlet**

**Questionnaire Instrument Development**

Pre and post questionnaires contained 31 questions including demographics (8 items), knowledge (2 items), attitudes and beliefs (10 items, to provide context), and behaviors and intentions (11 items). Knowledge questions covered understanding of pain mitigation strategies currently available. Attitudinal statements evaluated opinions about pain with a 5-point Likert scale (anchors strongly disagree to strongly agree or very unlikely to very likely). In the development of the survey instrument, content validity was assessed using a panel of eight multidisciplinary specialists with expertise in vaccine research. Each question was reviewed and discussed until a consensus was reached. The pre and post questionnaires are available in Appendices B and C.

**Study Setting and Population**

Participants included a convenience sample of adults receiving vaccine injections at a variety of community sites in Nova Scotia, Canada (e.g., family medicine clinics, travel clinics, public health immunization clinics, and pharmacies), between October 2015 and March 2016. Exclusion criteria included those who were less than 18 years of age and those who were unable to read English or provide consent.

**Study Procedures**

Participants were provided information about the study by health care professionals providing the immunizations. Some site health care professionals may have been educated to use pain mitigation strategies during their formal training to perform vaccine injections; however, no formal protocols for pain mitigation strategies during adult vaccine injections existed at any site.

For those interested in participating, written informed consent was obtained and then a sealed package that contained the baseline questionnaire (pre) and pamphlet was provided to participants. The baseline questionnaire was self-administered in the waiting room and collected by the health care providers. Then participants were instructed to read the educational pamphlet. Afterward, participants received their vaccinations.

A follow-up e-mail or phone call was undertaken six weeks after vaccination by the lead investigator and participants were asked to complete the follow-up questionnaire (post). This interval allowed time for individuals to use the learned strategies during any other vaccines received during this time frame, as well as share the pamphlet information with others. Participants had the choice of inputting their responses directly into Opinio (an online survey platform available to researchers at Dalhousie University) or to have the lead investigator record their responses over the phone. For investigator-led interviews, answers were inputted into Opinio by the investigator.

Ethics approval for this study was obtained from Nova Scotia Health Authority (October 28, 2015; REB File No. CDHA-RS/2015-145). All participants provided written informed consent.

**Data Analysis**

Descriptive statistics were used to describe participant demographics and responses to each survey question before and after the intervention. Inferential statistics were used to compare pre and post responses with paired Student’s t-test for continuous variables and McNemar’s test for categorical variables with significance level of $\alpha = 0.05$. IBM SPSS Statistics 25 was used to analyze the data.
### Results

#### Demographics

There were 74 participants. Most participants received an injection at a travel clinic (41%) or public health clinic (32%). The injection was most commonly the intramuscular influenza vaccine (62%). Participants were predominantly female (66%), between the ages of 18 and 64 (65%), and university educated (69%; Table 1).

#### Baseline Knowledge of Pain Mitigation Strategies

Approximately 60% (n = 44) of the participants did not report knowing interventions that could reduce pain. Among those reporting knowledge of pain interventions, 69% (20/29) listed effective interventions (e.g., deep breathing, distraction, topical anesthetics), 24% (7/29) listed ineffective interventions (e.g., ice, ibuprofen, acetaminophen), and 7% (2/29) included both effective and ineffective interventions. Ninety percent (26/29) of those who knew of pain mitigation strategies had used them during previous vaccine injections. Those who did not use the strategies stated that they did not fear the pain of needles and that the pain was not significant enough to warrant any intervention.

#### Fear of Needles and Perceived Pain of Immunizations before and after Pamphlet Review

Participants’ level of needle fear and perceived pain of immunizations before and after introduction to the pamphlet are displayed in Table 2. Most participants (78%) reported absent to mild fear of needles. Nearly all participants (88%) reported needles as being non-painful to minimally painful. There were no statistically significant differences in perception between the pre and post phases of the study (P > 0.05).

#### Attitudes about Pain Mitigation

Forty-two percent of participants (31/74) were interested in learning more ways to decrease pain during vaccination in general. Most were not interested in pain reduction strategies requiring additional time (73%, 54/74) or an additional cost (89%, 66/74). Nearly all participants (92%, 68/74) were not interested in a strategy that required both additional time and cost. However, a higher proportion of participants who reported moderate to severe pain during injection were interested in learning more ways to reduce pain, even if it required additional time (58.3% vs. 13.1%; P = 0.002). There were no statistically significant differences in participants’ interest in pain reduction strategies related to the level of needle fear.

Most participants (69%, 51/74) believed that pain mitigation during vaccine injections is the responsibility of both the patient and health care provider. Only 27% of participants (20/73) recalled a previous discussion with their health care provider about available pain mitigation strategies.

#### Behaviors

At six week follow-up, 19% (14/73) of participants tried at least one of the suggested pain mitigation strategies from the pamphlet. Of those who tried strategies, 4 tried topical anesthetics, 6 tried body position techniques, 9 tried distraction, 8 tried deep breathing, and 4 coughed or held their breath during the injection. Of those who did not try any of the suggested pain mitigating strategies (80%, 59/73), 40 indicated that they do not find immunizations painful and 29 did not have another injection and did not yet have an opportunity to try the strategies (there may be overlap between the 40 and 29, because participants could “select all that apply”).

Fifty percent (36/72) reported that they were somewhat to very likely to use the strategies in the future, 23% (7/27) had shared the pamphlet with family and friends, and 52% (37/71) were somewhat to very likely to recommend the pamphlet to other people in the future.

#### Pamphlet Feedback

Sixteen participants provided feedback to the question requesting comments or suggestions to improving the pamphlet. Of those who had specific comments or suggestions, three indicated that it was “easy to read,” it

Table 2. Number of respondents reporting fear of needles and pain on a scale of 0 to 10 before and after use of the pamphlet (where 0 = no fear and 10 = greatest fear possible).

|                     | No or mild (response of 0–3) | Moderate (response of 4–6) | Severe (response of 7–10) |
|---------------------|------------------------------|----------------------------|---------------------------|
|                     | n (%) Median (IQR)           | n (%) Median (IQR)         | n (%) Median (IQR)        |
| Fear                |                              |                            |                           |
| Before (n = 74)     | 58 (78) 0.79 (1)             | 9 (12) 5 (1)               | 7 (10) 7 (2)              |
| After (n = 73)      | 59 (81) 1 (2)                | 9 (12) 4 (2)               | 5 (7) 7 (3)               |
| Pain                |                              |                            |                           |
| Before (n = 74)     | 59 (80) 1.7 (0.9)            | 10 (13) 4.5 (0.7)          | 5 (7) 7.2 (0.4)           |
| After (n = 72)      | 64 (89) 1.8 (0.8)            | 5 (7) 5 (5)                | 3 (4) 7 (0)               |
included “good, practical tips,” and that it was “very informative,” with one specifically indicating that “breath was the most helpful.” Two indicated locations where the pamphlet could be kept: where blood is drawn, physician waiting rooms, and online. Four participants indicated that although they did not use it, they would recommend it to others who experience pain with immunization. The remaining six respondents indicated they did not use the pamphlet and/or had no suggestions.

Discussion

To our knowledge, this is the first study evaluating a pain mitigation pamphlet in adults undergoing vaccination. This study found that about one quarter of adults had an accurate prior knowledge of pain mitigation strategies for immunization and two out of five reported a desire to further improve their knowledge. One out of five used a pain mitigation strategy during vaccination and one out of two was likely to use an intervention in the future.

There are numerous studies evaluating vaccination pain mitigation education in parents. Across studies, education has been demonstrated to increase knowledge and use of pain interventions during childhood immunization.\(^{12,19}\)

We demonstrated modest use of pain interventions by adults in the present study. The method of evaluation of the pamphlet may have underestimated its value because we did not target individuals specifically with concerns about pain during immunization and fear of needles. It is difficult to recruit participants who fear needles and needle pain, because studies have shown that those who fear a painful stimulus tend to avoid it.\(^{20}\) Despite this, we found that approximately two-thirds of participants were fearful to some degree and one out of five tried interventions recommended in the pamphlet. Also, half of the participants reported intentions to use pain interventions in the future. The majority of participants stated they would share the pamphlet with others. Together, these findings speak to the potential for the information to be used and shared with others, with the potential for it to reach individuals with a higher level concern about fear and pain to facilitate vaccination in that group. The results also serve as a benchmark for future studies to evaluate the prevalence and effect of interventions.

There was limited opportunity for the pamphlet to lead to changes in pain mitigation behaviors because this was only made available on presentation for immunization and there was a lack of integration of the pamphlet recommendations with the health care provider’s actions at the time of immunization. A higher impact may be observed with involvement of health care providers. The CARD program,\(^{21,22}\) a vaccination delivery framework for the delivery of school-based vaccinations, demonstrated that providing education to all individuals involved in the vaccination process increased use of pain interventions as well as decreased vaccination-associated adverse reactions, including fear and dizziness. Adults may also have similar benefit if provided education (such as the evidence-based pamphlet used in this study) and if health care providers are included in the education.\(^{21,22}\) Other educational techniques are also in early phases of being evaluated to help reduce pain and stress-related reactions during vaccination, including a “comfort menu” of options for adolescents in a pediatric clinic-based program.\(^{23,24}\) These examples could be areas for future study in adults as well.

It is important to note that the pamphlet is not expected to be effective for mitigating high levels of needle fear; this requires a more intensive intervention, guided by a health care provider trained in mental health.\(^{19,20}\) Adding information to the pamphlet directing individuals with high levels of needle fear to seek attention from a health care provider, including where to go for more help, might increase utility and can be examined in future versions of the pamphlet.

The small sample size may have resulted in a Type II error. It was not possible to standardize the recruitment and study introduction process due to the varied sites and use of convenience sampling, and this may have contributed to selection bias. In addition, data on the number of people approached who refused to participate were not collected. As such, the results may not be generalizable and may represent selection bias that over- or underestimates the results. Because all participants were seeing a health care provider to receive an immunization, they may have more knowledge and less concerns regarding fear and pain around immunizations. Social desirability bias may have influenced survey responses, both positively and negatively. Participants may have underestimated the impact of pain and fear because they believe they should not fear needles, that needle pain should be minimal, or that they should be able to tolerate the pain without complaint. Conversely, they may have overestimated the impact in an attempt to please health care providers carrying out the study. An additional limitation was the lack of a control group; therefore, there is no direct comparison between those using the pamphlet and those not. We recommend additional evaluation in a larger and more varied population and use of a controlled trial design.

We recommend targeting individuals who have not yet made a decision to be vaccinated in order to determine whether the pamphlet could increase uptake of
vaccination. A previous study reported that 7% to 8% of people cited immunization noncompliance due to needle fear and there was a 10% absolute increase in willingness to be immunized if the vaccine could be administered in a non-painful way. In a separate randomized controlled trial comparing analgesic interventions, 5% of participants reported they would have not been vaccinated in the absence of the pain trial. This suggests that for some individuals, assurance of pain interventions may impact vaccination uptake. Improvement of vaccine uptake by 5% to 10% by incorporating pain mitigation interventions may be an important strategy in addressing the uptake of routine childhood and adult vaccines, as well as annual influenza vaccine and COVID-19 vaccine programs across all age groups.

Future studies may also consider evaluating how individuals prefer to acquire information about effective pain mitigation strategies because it may help with dissemination strategies in the future. There were strategies listed by participants that have no evidence as being effective, including using ice and over-the-counter pain medications prior to injection. This misinformation could affect future uptake of guidelines if individuals attempt ineffective methods and become unwilling to try others.

**Conclusion**

This study provided preliminary evidence of the value of a pamphlet targeted to adults about pain mitigation interventions during immunization. Adults reported intention to share this information within their social networks. This may be a promising strategy, because those who are more concerned about pain and fear during immunization injections may be harder to reach. Further research is required to establish effective methods in disseminating pain mitigation strategies to adults and integrating pain mitigation into routine practice.

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**Authors’ Contributions**

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Kathryn Cull. The first draft of the article was written by Kathryn Cull, Jennifer E. Isenor, and Susan K. Bowles and all authors commented on previous versions of the article. All authors read and approved the final article.

**Disclosure statement**

Kathryn Cull has not declared any conflicts of interest. Susan K. Bowles has not declared any conflicts of interest. Noni MacDonald has not declared any conflicts of interest. Shelly McNeil has not declared any conflicts of interest. Beth Taylor has not declared any conflicts of interest. Kathryn Slayter has not declared any conflicts of interest. Audrey Steenbeek has not declared any conflicts of interest. Anna Taddio has not declared any conflicts of interest. Lucie M. Bucci has not declared any conflicts of interest. Jennifer E. Isenor has not declared any conflicts of interest.

**Ethics Approval**

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Appendix A. Educational pamphlet that addresses effective pain mitigation strategies during adult vaccine injections

Appendix B. Baseline questionnaire for participants

Code: __________

(1) (a) How old are you? ________________
(b) What is your highest level of education?
   - Less than high school
   - Completed high school
   - Some postsecondary
   - Completed postsecondary
   - Advanced degree

(c) What is your gender?
   - Male
   - Female
   - Other

(d) Do you have any chronic medical conditions?
   (Examples: asthma, chronic lung disease, high blood pressure, diabetes, heart disease)
   - Yes
   - No

(2) The immunization(s) you are receiving today is/are (select all that apply):
   - Influenza (flu) vaccine
   - Tetanus, diphtheria, pertussis (Td/Tdap) vaccine
   - Hepatitis A vaccine
   - Hepatitis B vaccine
   - Meningococcal vaccine
   - Twinrix vaccine
   - HPV vaccine
   - Varicella vaccine
   - Zoster (shingles) vaccine
   - Other: __________________________

(3) Specify your level of fear of needles on a scale of 0–10 (where 0 = no fear and 10 = greatest fear possible).

(4) How painful are vaccinations for you on a scale of 0–10 (where 0 = no pain and 10 = worst pain possible).

(5) (a) Do you know of any ways to decrease pain during vaccination?
   - Yes
   - No (If no, please skip to question 6).
   (b) Please list the things you know that are helpful to decrease pain during vaccination.
   (c) Have you used any of these strategies in the past?
   - Yes
   - No
   (d) If you have not used these strategies, please explain why.

(6) (a) Are you interested in learning more about ways to decrease pain during vaccination?
   - Yes
   - No
   - I don’t know
   (b) Would you be interested in using strategies to decrease your pain during vaccination if the strategy added an additional 15–30 minutes to your time?
   - Yes
   - No
   - I don’t know
(c) Would you be interested in using strategies to decrease your pain during vaccination if they cost an additional $17.00?
□ Yes
□ No
□ I don’t know

(d) Would you be interested in using strategies to decrease your pain during vaccination if they cost an additional $17.00 and added an additional 15–30 minutes to your time?
□ Yes
□ No
□ I don’t know

(7) Whose responsibility is it to address pain during vaccination in an adult?
□ The patient
□ The health care provider
□ Both the patient and the health care provider

(8) Has your health care provider ever discussed ways to minimize pain during vaccination?
□ Yes
□ No
□ I don’t know/remember

We will have a follow-up questionnaire to send to you in 6 weeks. It will be similar to the one completed today. Please provide your e-mail address below so we can send you the link to the questionnaire. If you do not have an e-mail address, please include your phone number and we will contact you by phone to complete the follow-up questionnaire.

E-mail address or phone number:

Please note that you will only be contacted via e-mail or phone for this particular study and then your e-mail address and/or phone number will be removed from our files and will not be reused or forwarded to any other individuals.

Thank you for completing the questionnaire. You may now remove the pamphlet (next page). When you have finished, please return the questionnaire to the person who provided this to you. You may keep the pamphlet.

Appendix C. Follow-up questionnaire for participants

You recently completed a questionnaire about pain during vaccination and were provided with a pain pamphlet to read. This is the follow-up questionnaire.

Are you interested in helping us by answering a short (5- to 10-minute questionnaire)?
If yes (continue); if no (thank you)

(1) Did you read the pain pamphlet?
□ Yes
□ No
□ I don’t remember/don’t know

(2) Specify your level of fear of needles on a scale of 0–10 (where 0 = no fear and 10 = greatest fear possible).

(3) How painful are vaccinations for you on a scale of 0–10 (where 0 = no pain and 10 = worst possible pain).

(4) Since reading the pamphlet, have you tried any of the suggested strategies? (Select all that apply)
□ Yes
□ No

   Why not? (select all that apply)
□ I do not find immunizations painful
□ Cost of topical anesthetic
□ Time/Convenience
□ Forgot to do it
□ They were not helpful
□ Other ______________________

(5) How likely is it that you will use one or more of the strategies from the pain pamphlet in the future?
□ Very likely
□ Likely
□ Somewhat likely
□ Unlikely
□ Very Unlikely

(6) Have you shared the information in the pamphlet with someone else?
□ Yes
□ No

   If yes, with whom?
□ Family member
□ Friend
□ Other

(7) How likely are you to recommend the pain pamphlet to other people?
□ Very likely
□ Likely
□ Somewhat likely
□ Unlikely
□ Very Unlikely

(8) Please include any comments or suggestions you have to help us improve the pamphlet.