Effectiveness of Educational Materials about Reducing Pain in Infants Receiving Immunizations in a Paediatric Outpatient Setting: A Cluster Randomized Trial

by

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A thesis submitted in conformity with the requirements for the degree of Master of Science

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Abstract

**Background:** Immunizations are common painful medical procedures for infants and educating parents at their paediatrician’s office on pain management (PM) can help improve utilization of strategies.

**Objective:** To determine the effectiveness of educating parents at the paediatric clinic on increasing the number of PM strategies utilized during their infant’s immunization appointments.

**Methods:** This was a partially blinded cluster randomized controlled trial at a paediatric clinic at St. Michael’s Hospital where parents were randomized by groups according to their paediatrician. Parents in the intervention group received written and video information on immunization PM and parents in the control group did not.

**Results:** 160 parent-infant dyads from 4 physician clinics were observed during their immunization procedure. A statistically significant increase (p<0.01) in the use of ≥1 analgesic strategies was found in the intervention group compared to the control group.

**Conclusions:** Paediatric clinics are an effective setting to educate parents about immunization PM.
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List of Abbreviations

BF – Breastfeeding
CI – Confidence Interval
FLACC – Face Legs Activity Cry Consolability
GEE – Generalized Estimating Equation
GTA – Greater Toronto Area
HELPinKids – Help Eliminate Pain in Kids™
ICC – Intraclass Correlation Coefficient
MAISD - Measure of Adult and Infant Soothing and Distress
MBPS – Modified Behavioral Pain Scale
MD – Mean Difference
NICU – Neonatal Intensive Care Unit
NIPS – Neonatal Infant Pain Scale
NRS – Numerical Rating Scale
RA – Research Assistant
RC – Research Coordinator
RR – Risk Ratio
SBS – Shaken Baby Syndrome
SD – Standard Deviation
SIDS – Sudden Infant Death Syndrome
VAS – Visual Analog Scale
WBC – Well-Baby Checks
Chapter 1

1 Background

1.1 Statement of Problem

1.1.1 Inadequate pain management in infants

Immunizations are the most common painful medical procedures for healthy infants in their first year of life.\(^1-^4\) In Ontario, infants undergo as many as eight separate immunizations in their first year of life.\(^5\) Therefore, routine immunizations can result in a significant burden of pain and distress for healthy infants and their caregivers. Fortunately, there are numerous analgesic options available to parents of infants from oral sucrose administration before injections, breastfeeding during injections, to distracting infants with toys during the injections. Despite these numerous options available to reduce immunization pain, the use of pain relieving strategies in clinical practice remains scarce.\(^1,^6-^9\) During immunization procedures as many as 90% of infants and young children exhibit serious distress.\(^4\) Treating pain during childhood immunization can reduce the distress during the procedure and improve satisfaction of the immunization experience for children and families.\(^1\) Promoting more positive immunization experiences can lead to increased adherence with the immunization schedule, better maintenance of immune health, and increased trust in health care providers.\(^1,^4\)

1.1.2 Under-utilization of pain management strategies

Despite the plethora of interventions available to parents and clinicians,\(^6\) the rate of utilization of these methods remains surprisingly low.\(^1,^2,^10\) Parents have indicated a willingness to learn/know more about methods in which they can better comfort their children during injection procedures.\(^2,^9,^11\) The biggest barrier to utilization is the access of information about these strategies to parents and immunizers. Increasing the dissemination of pain relieving strategies to these stakeholders is the key to increasing the utilization of these strategies.
1.2 Study Objectives and Research Design

1.2.1 Primary objective
To determine the clinical effectiveness of educational materials (written and video information on pain management strategies) provided to parents in the management of their infants’ pain during immunization.

1.2.2 Primary research question
Does providing educational material on infant immunization pain management strategies vs. general information about immunizations (control) to parents prior to their infant’s routine 2- and 4-month well-baby check-up lead to an increased utilization of pain-relieving strategies (specifically: topical anaesthetics, sweet-tasting solutions, breastfeeding, holding upright) for their current and upcoming immunization injections?

1.2.3 Secondary questions
Does providing educational material on infant immunization pain management strategies vs. control (general information about immunization) to parents prior to their infant’s routine 2- or 4-month well-baby appointments:

1. Reduce pain in infants as measured by a validated pain tool, Modified Behavioral Pain Scale (MBPS), by a blinded assessor?
2. Improve self-reported parent satisfaction (i.e. 5-point Likert scale) with their infant’s pain management during their immunization procedure?
3. Increase in parent soothing behaviours as measured by a validated behavioural tool by a blinded assessor?
4. Decrease in parent and observer reported pain with the infant’s immunization procedure?
5. Decrease cry duration in infants as measured by a blinded assessor?
1.3 Research Hypothesis and Rationale

1.3.1 Hypotheses

It was hypothesized that providing parents with the educational materials on immunization pain management (PM) for their infants at the paediatric clinic prior to their infant’s routine 2-month or 4-month immunization appointment would lead to:

1. An increase in the utilization of pain management strategies by parents in the intervention group; specifically the utilization of the following strategies: topical anaesthetics, sweet-tasting solutions, breastfeeding, and holding upright at the first immunization visit day when the education was provided and second immunization visit day.

2. A decrease in the infant’s pain response from immunization in the intervention group as a result of increased PM strategy utilization, measured by a validated pain tool, Modified Behavioral Pain Scale (MBPS), from videotapes by a blinded assessor.

3. Greater parental satisfaction with their infant’s comfort level during the immunization injections as a result of their increased knowledge and utilization of analgesic strategies.

4. An increase of parental soothing behaviours in the intervention group as a result of their increased knowledge and utilization of PM strategies.

5. A decrease in parent and observer reported pain for infants in the intervention group as a result of increased PM strategy utilizations.

1.3.2 Hypotheses rationale

Educating parents on pain-relieving interventions with the use of written and video information has the potential to increase utilization of analgesic strategies during immunization, and empower parents to take an active role in the management of their child’s health. Previous studies by our research group have shown knowledge uptake from the educational video and factsheet in parents of newborn children. However, the increase in knowledge uptake did not necessarily translate into increases in utilization of these strategies, as in one trial a small percentage of parents read the
material from discharge packages. In the other study parents were provided the educational information at their infant’s birth during post-partum stay at the hospital, 2 months before their infant received any injections. Additionally during the post-partum stay parents receive a pile of information from their discharge packages, guidance from the healthcare staff, breastfeeding classes etc. and information that is not of immediate use to them (injections in 2 months) could’ve been given a lower priority by parents at the time. When we surveyed parents of 2 month infants a significant percentage of parents (81%) they expressed interest in receiving this information at their doctor’s office before their infant’s first set of injections. The convenience and the time available to parents at paediatric clinics makes it an ideal place to provide our educational materials. Based on this evidence, it was hypothesized that providing educational material in a setting where parents have expressed interest in receiving the information will result in increased utilization of pain relieving strategies.

The methods tested in this study are relatively cost-effective. Cost of printing written material and distributing multiple DVD copies of the video to clinics is minimal compared to alternative teaching methods such as classes by an educator. Additionally, it can easily be implemented into clinical practice in the form of providing a simple handout at the front desk (reception) and/or running the video on the waiting room TV.

The research methodology employed in this study may help to bridge the gap between clinical practice and evidence-based research strategies for enhanced pain management in infants for routine medical procedures such as immunizations.

1.4 Literature Review

1.4.1 Pain management during infant immunizations

Vaccines are regarded as one of the most significant medical achievements of mankind. During the 20th century, the average human life span has increased by approximately 30 years and, a significant portion of it can be attributed directly to the reduction in the number of infectious diseases due to vaccination. Infectious diseases associated with high morbidity and mortality, such as smallpox have been eradicated by
vaccination, and another, polio, is expected to be eradicated in the near term.\textsuperscript{16} Vaccine administration, however, requires needle puncture or ‘shot’ and the discomfort associated with injection procedures and has been a barrier for vaccination uptake.\textsuperscript{18} Currently, the national vaccine schedule in Canada recommends immunizations against 17 specific infectious diseases for children and adolescents. According to the Ontario immunization schedule, infants may receive as many as eight injections in their first year of life.\textsuperscript{5} These multiple and frequent administrations of injections at doctor’s visits become not only distressing for infants but a concern for parents and health care providers as well.\textsuperscript{3,4,10,19} Parents and health care providers sometimes withhold and/or delay vaccination in children to avert child suffering. Studies reveal that these negative experiences with vaccination pain lead to development of life-long needle fears and possibly immunization non-compliance.\textsuperscript{1,18}

Parents report that they lack information regarding managing immunization pain in children.\textsuperscript{6,10} A recent cross-sectional survey conducted with parents visiting a children’s museum in Toronto, found that 70\% of surveyed parents never received any education on how to reduce pain.\textsuperscript{2} Furthermore, 98\% of mothers of newborn infants having recently visited their doctor’s office for their infants immunizations, report that they would like information on the topic of pain management during vaccinations.\textsuperscript{9} Increasing the use of evidence-based analgesic strategies available for managing pain can help make immunization injections for infants less painful and can also increase immunization compliance. Parents, health care providers, and infants can all benefit from having a more pleasant experience with the injections if administered in a way that causes the least amount of pain possible to infants.

\subsection*{1.4.2 Strategies to reduce infant pain during immunizations}

There are a multitude of pain management strategies that research has shown to be effective in managing infant pain during immunizations.\textsuperscript{3,4,20,21} Pharmacological,\textsuperscript{22} physical,\textsuperscript{23} and psychological\textsuperscript{24} options have been shown to reduce pain in infants during immunizations. Sweet tasting solutions,\textsuperscript{20,25-30} topical anaesthetics,\textsuperscript{31-36} breastfeeding,\textsuperscript{20,37-}
holding upright,\textsuperscript{23,41-45} and distractions\textsuperscript{24,46-48} have all been proven to be pain relieving strategies.

1.4.2.1 Pharmacological interventions

1.4.2.1.1 Sweet-tasting solutions (sugar water)

Sweet-tasting solutions in the form of oral sucrose or glucose have demonstrated analgesic effects in infants less than 1 year of age, with or without non-nutritive sucking.\textsuperscript{20,25-30,49} The proposed analgesic effect is poorly understood but thought to involve the release of endogenous opioids that serve to provide pain relief that lasts for several minutes.\textsuperscript{50} The most effective dose is not well defined but the most commonly observed dose is 2 mL of ~25% (weight/volume) of sucrose.\textsuperscript{6,22} 24% sucrose in 2mL packets is available commercially as TootSweet\textsuperscript{TM} (Natus Medical Incorporated) and is widely available in many institutions. Adverse events from sweet-tasting solutions such as coughing and gagging are very rare (reported in only 1 trial) and are not considered to be clinically significant.\textsuperscript{22} For non-breastfeeding mothers, sweet-tasting solutions should be administered during vaccination.\textsuperscript{6}

A meta-analysis from six randomized controlled trials\textsuperscript{6} comparing sucrose solutions to placebo (sterile water) showed a reduction in pain using validated pain tools (SMD -0.56, 95% CI [-0.72, -0.40], \(p < 0.001\)). Sweet-tasting solutions have also demonstrated analgesic effectiveness in other procedural painful events such as heel lance, venipuncture, circumcisions, etc.\textsuperscript{49}

1.4.2.1.2 Topical anaesthetics

Topical anaesthetics work to reduce the pain from injection by numbing the skin around the area of injection. Several formulations of these anaesthetics are available in Canada: lidocaine-prilocaine 5% cream or patch (EMLA\textsuperscript{TM}, AstraZeneca Canada), amethocaine 4% gel (Ametop\textsuperscript{TM}, Smith and Nephew) and liposomal lidocaine 4% cream (Maxilene, RGR Pharma).\textsuperscript{22,51,52} The mechanism of action of these agents is by reversibly inhibiting
neural pulses by blocking the transmission of action potentials across nerve endings in the dermis. Topical anaesthetics are applied to the site of injection (upper thigh for infants <1 year of age and upper arm for children >1 years of age) 30-60 minutes before the injection, depending on the formulation used. They are available for purchase over the counter (without prescription) at local pharmacies. Local skin reactions such as pallor (whiteness of skin), itchiness, and erythema (redness of skin) have been reported but these effects are usually mild and transient.

The clinical practice guidelines on reducing vaccination pain in children published in 2010 in the Canadian Medical Association Journal lists the use of topical anaesthetics to mitigate vaccination pain as a Grade A Level I recommendation based on “good evidence” from randomized controlled trials as shown in meta-analysis from 4 trials. Topical anaesthetics significantly reduced the pain of injection when compared to placebo cream as assessed by validated pain measures in infants (SMD -0.43, 95% CI [-0.60, -0.26], p =0.001). Topical anaesthetics have also been recommended for pain management use in other painful procedures heel lances and venipuncture. With the availability of newer agents with short application time the use of topical anaesthetics can be incorporated into clinical practice to reduce the pain of injections.

1.4.2.2 Physical interventions

1.4.2.2.1 Breastfeeding

Breastfeeding during painful procedures has been a proven method of mitigating pain in infants. Holding the infant close, providing skin-to-skin contact, the act of suckling, the comfort of the mother, and the sweet breast milk all serve to provide analgesia for infants. Breastfeeding should begin before the injection and continue during and after throughout the procedure ensuring that a good latch is maintained. No reports of choking, gagging, and coughing from breastfeeding during immunizations have been observed/reported.

The recommendation to use breastfeeding during immunization procedures is based on “good evidence” from randomized controlled trials (Grade A Level I recommendation)
as shown in meta-analysis of four trials illustrating a significant decrease in pain in breastfed infants compared to non-breastfed, as measured using validated pain tools (SMD -2.03, 95% CI [-2.26, -1.80], p<0.001). Breastfeeding serves as an effective pain management strategy for a variety of painful procedures as shown in the Cochrane review by Shah et al.  

1.4.2.2 Holding upright

Holding infants in a bear hug, or in a parent’s lap has been shown to reduce pain during immunization injections when compared to infants who are in supine position (lying down) on the exam table. Evidence suggests that infants should not be placed in a supine position during immunizations. The recommendation to hold infants in lap or in upright position instead of supine position on the exam table during infant immunizations is based on “good evidence” from randomized controlled trials (Grade E Level I recommendation). Three of the four studies included in the meta-analysis reported higher pain scores for children immunized in the supine position. A Cochrane review by Pillai Riddell et al suggests that in infants 1-36 months of age who are being held during painful procedures experience the same acute pain vs. the supine position.

1.4.2.3 Psychological interventions

1.4.2.3.1 Distraction

Distraction techniques have been shown to reduce pain from injections in children of all ages. Distraction methods include rocking, cuddling, singing, talking or distracting with age-appropriate objects or toys. The recommendation to use distraction for pain relief during injections is based on “fair evidence” from randomized controlled trials (Grade B Level I recommendation). The recent Cochrane review by Pillai Riddell et al updates on the effectiveness of distraction techniques specific to toy and video distractions. The review found that toy distraction in
older infants did not decrease pain and there was some evidence that suggested video
distraction was effective in decreasing pain. Although there is insufficient evidence for or
against the use of distraction, given it’s none to minimal risk of harm, distraction can be
used as a way to reduce pain at the time of injections.

1.4.3 Current pain management practices for infant immunizations in
clinics

Current pain management practices for children <1 year of age receiving immunizations
reveal sparse use of effective pain relieving strategies despite extensive evidence of their
efficacy. In an audit for analgesic practices by paediatricians in the Greater Toronto Area
(GTA) during routine immunizations it was found that effective analgesic strategies were
sparsely used in clinical practice. Only 12% of paediatricians reported that they at least
sometimes applied local anaesthetics to reduce vaccination injection pain, while only 6%
of mothers surveyed in the audit reported the use local anaesthetics.

Similarly, a 2011 survey of nurses in the “Immunisation Nurses Special Interest Group”
in the state of Victoria, Australia revealed little use of pain management strategies such
as sugar water, breastfeeding, and topical anaesthetics for vaccine injection. The
Victorian nurses surveyed revealed that 69% of the 125 responders had no pain
management policy in their main place of employment where they delivered
immunizations. Eighty-eight percent of nurses reported they never used sugar water or
did not have it available for immunizations of infants <12 months of age. Breastfeeding
during the immunization was used only 54% of the time and topical anaesthetics were
used only 8% of the time. The most utilized strategy was distraction as defined by the use
of toys, talking, and physical comfort used ‘often’ and ‘always’ 75% of the time.

To catalogue what parents of healthy infants were naturalistically doing to manage their
infant’s pain during immunization appointments Lisi et al analyzed videotapes of infants
in their first year of life whom were receiving immunizations. A total of 760 parent-infant
dyads from three paediatric clinics in Toronto, Ontario revealed that parents primarily
used non-pharmacological techniques to comfort their infants in distress and sparsely
used proven pharmacological techniques for pain management. Use of topical anaesthetics in this study was <1%, while physical comfort and rocking was 40-45%, and distraction at 5-10%.  

These studies reveal that there remains a substantial lack of pain management strategies used by parents in comforting their infants during immunizations. The need for providing parents with this information regarding proven pain management strategies may help increase the utilization of these strategies. Creating a knowledge translation framework to establish proven strategies for pain management for infant immunizations, disseminating them through clinical practice guidelines and educational materials to the relevant stakeholders would be the next steps to addressing this knowledge gap.

1.4.4 Knowledge translation framework

Despite evidence-based and feasible interventions available to mitigate childhood vaccination pain;22-24 there exists a knowledge gap in parents.1,10 This knowledge-to-care gap can be addressed by using theoretical frameworks of knowledge translation.56,57 Graham et al56 outlines the relationship between knowledge creation from primary research and knowledge transfer to the end users. This framework theorizes using the “knowledge creation funnel” (i.e. primary research studies) from which a “knowledge-to-action cycle” (i.e. knowledge translation) allows for the implementation of the research findings in the relevant community to the relevant stakeholders.56

The knowledge funnel represents knowledge creation, where primary research studies produce results in the field. Efforts to refine and review the results of these studies in the form of systematic reviews and meta-analyses can be termed as the knowledge synthesis phase. This is further distilled into a third-generation of knowledge in the form of knowledge tools or products such as practice guidelines, and decision aids. Implementation of these tools now requires entering the action cycle of knowledge translation. The primary goal here is the dissemination of the knowledge by tailoring information to the needs of the intended stakeholders. Adapting the knowledge to the local context, assessing the barriers to knowledge use, implementation of the
interventions and monitoring the knowledge use are the next sequentially dynamic steps in the knowledge-to-action cycle.\textsuperscript{56}

We can apply this “knowledge translation framework” to address the topic of managing child pain during vaccination. Some initial steps in this process have already been undertaken. Knowledge synthesis in the form of systematic reviews have been produced\textsuperscript{3,22-24} along with knowledge tools in the form of a clinical practice guideline on the topic.\textsuperscript{6} These tools have been tailored towards appropriate stakeholders (parents of newborn infants), and have illustrated high levels of knowledge acquisition.\textsuperscript{13} In addition, feedback on these tools have been obtained and modification of them to parent preferences have taken place.\textsuperscript{13} Trials that disseminate this information have also been undertaken, such as Schechter et al\textsuperscript{58} who used “academic detailing” in training immunizers about some of the pain management strategies. The study illustrated a slight increase in parent self-reported use of these strategies after the implementation of the training session in comparison to before.\textsuperscript{58} In the following paragraph, the process leading to the development of the clinical practice guideline on pain management strategies for infant immunizations and the subsequent educational materials that came about from the guideline is outlined.

\subsection*{1.4.5 Clinical practice guideline on reducing the pain on childhood vaccination}

From a previous knowledge synthesis grant, Taddio\textsuperscript{6} led a committee of experts in the field of infant pain management, the Help Eliminate Pain in Kids (HELPinKids) committee who developed the first ever clinical practice guideline on effective pain management strategies for mitigating acute pain during child immunization injections.\textsuperscript{6} Pain management is usually based on a “3-P” approach, involving pharmacologic, physical and psychological strategies. Selected panel members performed a series of systematic reviews and meta-analyses for each of these domains. Evidence was limited to randomized controlled trials and studies with quasi-experimental designs. The Cochrane Risk of Bias Tool was used to determine the quality of included studies.\textsuperscript{6} The expert panel then critically appraised the evidence and generated recommendations using the
evidence-based methods outlined by the Canadian Task Force on Preventive Health Care. Recommendations for each clinical question were made according to the strength of the scientific evidence. From this clinical practice guideline, user-friendly educational tools in the form of an informational pamphlet/factsheet and an informational video were produced.

The next step was to modify these educational materials to meet the preferences of stakeholders, determine whether appropriate knowledge acquisition occurred from these materials, and finally to test the effectiveness of these educational materials to influence behaviour change and increase the use of pain-relieving methods during infant immunizations.

1.4.6 Educational materials

The educational materials from the clinical practice guideline on managing infant pain during vaccinations, consisted of a two-sided factsheet and an ~8 minute video about pain-relieving methods that can be used to mitigate pain and distress in infants and children undergoing immunizations. The factsheet and video were produced by the AboutKidsHealth™ team from the Hospital for Sick Children, Toronto. A clinician-directed factsheet and video and a parent-directed factsheet and video were produced. The designed factsheet was organized into pharmaceutical, physical and psychological strategies of pain management and was chronologically organized into when the strategy should be applied (before, during, and/or after the injection). The video consisted of vignettes of these strategies in action as well as explanations on how to use them (i.e. how to and where to apply topical anaesthetics). Information handouts and videotapes have both been shown to be effective educational methods of patient education for parents in primary care settings.

These materials were subsequently pilot-tested with parents of healthy newborn infants at Mount Sinai Hospital, Toronto. Parents were asked to complete pre- and post-intervention questionnaires and to provide feedback from interviews after reading and viewing each of the educational tools. They also provided their comments and
suggestions for improvement on the tools through 20-minute interviews. Multiple iterations of the educational tools were tested until parents expressed satisfaction with information and visual aesthetics of the materials. Parents illustrated high levels of knowledge acquisition and agreeability with the presented materials.\textsuperscript{13}

Parents illustrated high levels of knowledge transfer from viewing the informational factsheet in a four group randomized trial design with 120 newborn mothers in the maternity ward at Mount Sinai Hospital, Toronto.\textsuperscript{11} The study found that the factsheet led to acute gains in knowledge and that knowledge gains persisted after 2 months when mothers were followed-up by telephone surveys. Thus, the capacity for these materials to effectively educate parents’ knowledge of pain-relieving methods is evident. In contrast, a randomized trial by our study group where the information factsheet was passively included in discharge packages given to parents of newborn infants, only 21\% of the intervention mothers reported that they had read the pamphlet upon follow-up telephone calls.\textsuperscript{9} Mothers who did read the pamphlet demonstrated higher levels of knowledge despite the low level of uptake in this passive dissemination method.

As passive dissemination of materials has been consistently proven ineffective, studies indicate that a more tailored-education approach provides a higher likelihood of influencing uptake of pain relieving strategies.\textsuperscript{56,61-63} Providing parents with a video complementing the written information provides a relatively cost-effective, and a more focused intervention. Written information can be made readily available at clinics and videos can be easily shown in waiting room TVs while the families are waiting for their appointment.

Thus, the idea for this thesis project was to deliver the educational materials regarding pain-relieving strategies to parents in a paediatric office setting to determine whether this resulted in increased utilization of pain-relieving strategies by parents. Outlined below is a systematic review conducted on determining whether providing educational materials to parents of newborn infants on infant health topics in office or hospital settings lead to measurable changes in parent behaviours.
1.4.7 Systematic review of literature on educating parents of young infants

To examine whether educating parents of young infants (less than 12 months of age) in clinical settings was an effective means of influencing their behaviour to improve infant care, a systematic review of the literature on patient education of infant baby topics in parents of young infants was conducted.

1.4.7.1 Study selection

Studies selected for review in this search had the following characteristics:
(1) Randomized or quasi-randomized trial designs with parents as subjects.
(2) Community or hospital settings in developed countries (all countries in North America and Europe, Japan, Australia and New Zealand).
(3) Intervention occurred with parents of healthy infants <12 months of age.
(4) Educational topics were regarding infant-health topics only.
(5) Outcome assessment consisted of assessing an actual behavioural change measure from the intervention, not just knowledge increase.

Unpublished studies, letters, studies with only abstracts published, and studies not in the English language were not considered.

1.4.7.2 Literature search strategy

The following databases were searched MEDLINE (1946 – August 2013), EMBASE (1947 – August 2013), Cochrane Central Register of Controlled Trials (August 2013), PsycINFO (1806 – August 2013), ERIC (1965 – August 2013), and CINAHL (1983 – August 2013). Key words used in the search: patient education, consumer health information, health literacy, health education, health promotion, patient discharge education, parents, fathers, mothers, neonates, newborn, and infants as appropriate to each database (see Appendix A for search strategy). References from the studies obtained
were hand-searched for additional articles. Two individuals, CP and SS, reviewed titles and abstracts obtained from the search independently.
1.4.7.2.1 Literature search flow diagram

Figure 1: Literature Search flow diagram

- MEDLINE: 3389
- EMBASE: 6541
- CCRT: 545
- PsycINFO: 792
- ERIC: 372
- CINAHL: 1756
- Total: 13395

Duplicates removed: 2468

Abstracts reviewed: 10927

Excluded by title or abstract/did not meet inclusion criteria: 10898

Full papers reviewed: 29

Excluded: 12
- N=1 intervention method undefined
- N=4 knowledge outcome only, no behavioural outcome measured
- N=3 not a randomized trial
- N=2 parents of infants >12 months
- N=2 trials in progress

Articles found by hand search: 5

Included in systematic review: 22
Included in meta-analysis: 12

CCRT = Cochrane Central Register of Controlled Trials
CINAHL = Cumulative Index to Nursing and Allied Health Literature
ERIC = Educational Resources Information Center
1.4.7.3 Data extraction
Data was extracted from identified research studies by two individuals (CP and SS) using a structured data extraction form. Content included: author and citation, population and setting, study design, nature of control and intervention, comparison group(s), outcomes assessed, sample size of treatment and control, and outcome data. In situations where the measures of effect were not provided numerically in published papers, data available in graphic form were used to estimate values.

1.4.7.4 Data outcomes
This analysis extracted data outcomes only related to behavioural changes in subjects as a result of the intervention provided to them. Data outcomes collected were double-checked between two individuals (CP and SS). Outcomes assessed depended upon the nature of the educational topic of the intervention parents received. Outcomes collected were: observance of injury prevention recommendations from the educational materials, prevalence of injury-risk behaviour from a standardized scale, breastfeeding prevalence at 2, 4, or 6-months of age, breastfeeding self-efficacy, infant care skills self-efficacy, adherence to guidance recommendations on diet and vitamins, and proportion of immunized infants at 7 months of age.

1.4.7.5 Data synthesis
The data was combined using a random effects model (Review Manager 5.1.7 Cochrane Collaboration, http://www.ccims.net/RevMan) for the studies regarding the topic of breastfeeding. Breastfeeding prevalence measures were divided into short-term (<4 months) and long-term (4-6 months) outcomes. This was defined in a previous meta-analysis of primary-care interventions to improve breastfeeding status conducted by the US Preventive Services Task Forces.\textsuperscript{64} We reported risk ratios (RR) and 95\% confidence intervals (CI) for measures of effect size. When zeros were present in the 2x2 table for any study, 0.5 was added to each cell before meta-analysis in order for calculation to occur.
$I^2$ values were used to assess heterogeneity between studies, a measure of variability amongst studies included in meta-analysis. This test determines whether the variation in findings are genuine or due to chance alone. The $I^2$ values were classified as follows: 25% and below as low heterogeneity, 50-75% as moderate heterogeneity and 75% and higher heterogeneity to be considered as high heterogeneity. When $I^2$ values were more than 40%, the size and corresponding P value from the $\chi^2$ test were taken into consideration in assessing the heterogeneity of the studies.

1.4.7.6 Studies on educating parents on infant-related health topics

Twenty-two studies were identified that educated parents on infant-related health topics. These studies are outlined in detail in Table 1. The educational topics covered that were covered were: 1) anticipatory guidance on general baby care topics (N=4), 2) Shaken Baby Syndrome (SBS) (N=2), 3) Sudden Infant Death Syndrome (SIDS) (N=1), breastfeeding (N=12), and 4) injury prevention (N=3). The method of educational interventions used in the studies were as follows: written handouts of information (N=4), educational videos (N=2), one-on-one bedside counselling (N=6), written and video information (N=2), written and verbal information (N=4), written information and one-on-one counselling (N=1), video information and one-on-one counselling (N=1), and group education and written information (N=2).

1.4.7.6.1 Studies educating parents on anticipatory guidance

Four trials that educated parents on the topic of anticipatory guidance were identified for inclusion in this review (See Table 1 below). In the study by Adam et al., mothers of newborn infants were recruited to receive either the intervention (N=49) consisting of a handout and a group discussion on the topic of introducing solids only after the 4-month mark by group leaders or standard of care (N=54) – no handout, and no group discussion on the selected topic (N=54). Mothers were randomized to control and intervention alternating every two weeks. At follow-up interviews of mothers during their infant’s well-baby checks 52% of intervention mothers were found to have introduced solids at
the 2-3 month mark vs. 77% of the control mothers (p<0.05).\textsuperscript{66} The provision of a handout along with group discussion was effective in influencing mothers to follow the recommended suggestions. The authors postulated that the engaging group discussions spurred on during the educational session were possibly a contributing factor to the success of the intervention. However, the major limitation of this study is the significant loss to follow-up (45% in the intervention group and 37% in the control group) with no intent to treat analysis performed by the researchers.

In the quasi-randomized study by Paradis et al\textsuperscript{67} parents of 1-month old infants were randomized by the week in which they visited the paediatric office on whether to receive a 15-minute DVD video on anticipatory guidance topics (intervention; N=70) or just the written handouts on anticipatory guidance already available at the clinic (control; N=67). Follow-up telephone interviews of mothers by blinded research assistants two weeks after intervention delivery measured 3 primary outcomes: 1) knowledge of infant development, 2) infant care skills self-efficacy and 3) problem-solving competency of parents, using validated scales. Results showed no differences in the mean score of competence in problem solving and self-efficacy of parents with infant care skills (e.g. bathing your baby, soothing your crying baby, etc.) between the intervention and control groups, 82.6(7.7) vs. 84.6(5.7) p=0.92 and 4.6(0.4) vs. 4.6(0.4) p =0.51, respectively.\textsuperscript{67} When the researchers took a more detailed look at the items on their self-efficacy scale they found an increase in the intervention group for 2 out of the 6 specific skills (“bathing your baby” and “recognizing congestion”). When the researchers assessed their secondary outcomes of health care utilization via chart reviews they found a significant decrease in the number of additional clinic visits in the intervention group vs. the control group. The authors of the paper postulated that the reason for their lack of difference in the primary outcome may have been due to their already high baseline scores of parent self-efficacy and problem-solving competency. Despite the lack of success with their intervention in the primary outcome, the authors of the study concluded that the DVD intervention was a useful and beneficial intervention pointing to the positive impacts seen in their secondary outcomes and the feasibility and low-cost benefits of the DVD intervention.
Stille et al\textsuperscript{68} randomized parents of newborn infants visiting 3 inner-city paediatric primary care sites for their baby’s first well-child visit to receive either an interactive graphic card, verbal reinforcement about immunization compliance, and stickers added to the card when immunizations completed (N=156) or routine information given to control (N=159). Parents were followed-up when their infants was 7 months of age as by then they would should have completed three sets of routine immunizations. Data on whether their infants were up to date in their immunizations was collected from medical chart review. The proportion of infants who received age-appropriate immunizations were 58.3\% in the intervention group vs. 57.9\% in the control group (p=0.7).\textsuperscript{68} The lack of effectiveness of the intervention may have been due to the short duration of the intervention since providers administered the interactive graphic card as part of their routine anticipatory guidance that typically took 2 to 3 minutes to administer. The authors suggested that a more elaborate intervention could have been more successful and concluded that the need to keep interventions brief may compromise its potential effectiveness.

Similarly, in the study by Zahr et al\textsuperscript{69} 150 mothers visiting the paediatric clinic during their infant’s well-baby check appointments were recruited into three groups: E1 – group teaching session by a trained nurse on diet, vitamins, and immunization importance (N=48); E2 – printed information from the clerk on immunization importance (N=47); or control – routine care (N=55) where no information regarding these topics was given. At follow-up 6-8 weeks post intervention delivery the researchers found that there was no difference between the three groups in immunization appointment compliance (59.5\% vs. 59.6\% vs. 63.6\%), diet compliance (72.5\% vs. 84.8\% vs. 78.3\%), or vitamin compliance (44.4\% vs. 50\%) compliance respectively.\textsuperscript{69} The authors concluded that the study was not successful in increasing compliance even if there was evidence of knowledge acquisition (a common result seen in knowledge translation studies). They speculated that a more stringent reinforcement session, nurse relationship with the patients, and a more tailored intervention may have led to better the results seen in this study.

The four studies reviewed in this section on the topic of anticipatory guidance each measure different outcomes and use varying educational tools. The positive result shown
by Adam et al\textsuperscript{66} with the use of group teaching was in contrast with the results seen in Zahr et al\textsuperscript{69} despite both studies using similar educational intervention methods and outcome measures of compliance. Paradis et al\textsuperscript{67} showed some evidence for their educational methods to be effective to affect parent behaviour in regards to baby care self-efficacy but was ultimately not an effective intervention. Stille et al\textsuperscript{68} used a written educational method and they too were unsuccessful in their attempt to increase the rate of up to date immunizations. These studies show mixed results in effectiveness of a variety of educational methods, may it be group counselling, video information, or written information in regards to influencing parent behaviour change.
Table 1: Studies educating parents on anticipatory guidance

<table>
<thead>
<tr>
<th>Study</th>
<th>Population and setting</th>
<th>Design</th>
<th>Educational method</th>
<th>Intervention</th>
<th>Comparison</th>
<th>Outcome assessment and results</th>
</tr>
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<tbody>
<tr>
<td>Adam et al. (1985)</td>
<td>Mothers of newborn infants recruited in a municipal hospital during their post-partum stay</td>
<td>Quasi-randomized. Control or intervention groups by alternating weeks.</td>
<td>Group education and written information</td>
<td>8-14 mothers/group attending group meetings where group leaders discussed and provided handouts on the topic of diet and solid foods (N=49)</td>
<td>Control – standard care (N=54)</td>
<td>Mothers were interviewed at each visit to the clinic using standard questionnaire asking about feeding, and infant health for 4 months. Loss to follow-up at 2-3 months (Intervention: n=27 mothers interviewed; Control: n=34 mothers interviewed). At 3-4 months (Intervention: n=25 mothers interviewed; Control: n=32 mothers interviewed) Outcome: Percentage of non-recommended food use through the first 4 months of life 2-3 months: Intervention – 52% vs. Control – 77%  P&lt;0.05 3-4 months: Intervention – 96% vs. Control – 64%  P&lt;0.02</td>
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<tr>
<td>Paradis et al. (2011)</td>
<td>137 parents of 1-month old infants recruited in the waiting room of the paediatric office</td>
<td>Quasi-randomized by alternating week</td>
<td>Video information</td>
<td>15-minute DVD video on what to expect for parents with a newborn baby (N=70)</td>
<td>Written handouts on anticipatory guidance on well-baby topics – Control (N=67)</td>
<td>Baseline scores of self-care efficacy and competency. Follow-up telephone interview 2-weeks after on measures of self-efficacy and problem solving through validated scales. Loss to follow-up – Intervention group: N=67 completed follow-up; Control group: N=64 completed follow-up Infant self-care efficacy: Intervention: 4.6(0.4) vs. Control: 4.6(0.4)  p=0.5 Problem-solving competency:</td>
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<tr>
<td>Study</td>
<td>Design</td>
<td>Intervention Group</td>
<td>Control Group</td>
<td>Measure of Compliance</td>
<td>Results</td>
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<td>Stille et al. (2001)</td>
<td>Randomized, parallel</td>
<td>Intervention group received an interactive graphic card with immunization schedule, verbal reinforcement, and stickers added to the card when immunizations completed (N=156)</td>
<td>Routine information given to control (N=159)</td>
<td>Measure of whether infant at 7 months are “age appropriate” in their immunizations</td>
<td>Intervention: 82.6(7.7) vs. Control: 84.6(5.7) p=0.5</td>
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</table>
| Zahr et al. (1989)           | Randomized, unspecified method   | Experimental 1 (E1) – teaching session by trained nurse explaining diet, vitamin regimen and follow-up vaccination importance (N=48) | Control (C) – routine care provided at clinic (N=55) | Data collected from follow-up at 6-8 weeks and medical records on compliance of: | Attendance of 2 subsequent immunization appointment visits: E1 – 59.5%  E2 – 59.6%  C – 63.6%; p=0.4  
Diet compliance: E1 – 72.5%  E2 – 84.8%  C – 78.3%; p=0.4  
Vitamin compliance: E1 – 44.4%  E2 – 50%; p=0.13 |

E1 = Experimental 1; E2 = Experimental 2; C = Control
1.4.7.6.2 Studies educating parents on Shaken Baby Syndrome

Two studies on the topic of Shaken Baby Syndrome (SBS) were identified (Table 2). In the study by Barr et al.,\textsuperscript{70} research assistants recruited, randomized, and educated mothers into two groups. The intervention group received information on SBS prevention in the form of an 11-page booklet and a 12-minute DVD video (N=1347). These interventions highlighted recommendations to help parents stay calm and decrease frustration levels and to avoid unnecessary pick-up events that could lead to SBS. Mothers in the control group received unrelated information in the form of two brochures and videos on infant safety (N=1364). At follow-up, “frustration level per day” and “pick-up events per day from infant crying” of mothers were collected from daily diaries. Mothers kept track of these events in a diary for 2 months post-recruitment rating their frustration using a Likert scale (from 1 to 5) and counting their daily pick-up events. No significant differences were found for the outcomes of frustration level and pick-up events, $1.20(1.19) \text{ vs. } 1.20(1.05)$, $3.08(3.39) \text{ vs. } 3.03(3.21)$, respectively.\textsuperscript{70} The intervention was not effective in altering maternal behavioural responses to infant crying as intended by the authors. The authors proposed that if these materials were provided by clinicians, nurses, or instructors and reinforced by multiple exposures it could have had a greater chance in influencing maternal behaviours.

McRury et al\textsuperscript{71} randomized 51 mothers to view either an intervention VHS tape on methods to soothe the infant to prevent SBS (N=27) or to the control group (N=24) receiving general newborn parenting care (N=24). Mothers were trained by the research assistant to keep track of their infant’s crying in a diary/time sheet. The primary outcome assessed in the study was the mean total daily hours of crying up to 12 weeks post-intervention. No significant differences in the mean daily hours of crying was noted in the two groups [1.2(0.8) vs. 1.8(2.0), $p=0.8$].\textsuperscript{71} The authors concluded that the educational intervention was unable to influence mother’s behaviour in tempering mean infant crying proposing that perhaps the instinctual actions promoted in the video may have been common to mothers in the control group as well.

The two studies on the topic of SBS showed limited effectiveness in altering parent behaviour in regards to suggestions about SBS prevention. The limitation on both of
these studies were their reliance on self-report as the outcome measure through recorded behaviour in a diary by the participating parents which may have been inaccurate as mothers are not necessarily blinded to the treatment groups and outcome measures (parents can over/under exaggerate measures such as daily crying hours, frustration levels, etc.).
Table 2: Studies educating parents on shaken baby syndrome

<table>
<thead>
<tr>
<th>Study</th>
<th>Population and setting</th>
<th>Design</th>
<th>Educational method</th>
<th>Intervention</th>
<th>Comparison</th>
<th>Outcome assessment and results</th>
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<tbody>
<tr>
<td>Barr et al. (2009)</td>
<td>Mothers recruited in 10 prenatal class sites, 3 maternity wards, and 11 paediatric hospitals.</td>
<td>Randomized, parallel</td>
<td>Written and video information</td>
<td>SBS prevention recommendations 11-page booklet and 12-minute DVD (N=1347)</td>
<td>2 brochures and video on infant safety (N=1364)</td>
<td>Validated diary of infant states (self-report of infant behaviours) and parent frustration level kept track by parents (length of assessment unspecified). Loss to follow-up – Pick-up events in the Intervention group: N=940 assessed, in the Control group: N=892 assessed. Frustration level in the Intervention group: N=917 assessed, in the Control group: N=892 assessed. <strong>Pick-up events:</strong> Intervention: 3.08(3.39) vs. Control: 3.03(3.21) <strong>Frustration level:</strong> (Likert 1 to 5 scale) Intervention: 1.20(1.19) vs. Control: 1.20(1.05)</td>
</tr>
<tr>
<td>McRury et al. (2010)</td>
<td>51 mothers in the newborn nursery of a community hospital who had access to view a VHS tape at home. Mothers recruited by fliers instructing them to call the research assistant before discharge if willing to participate.</td>
<td>Randomized, parallel</td>
<td>Video information</td>
<td>30-minute VHS tape instructing on the “THB – The Happiest Baby” method of infant soothing. Theory: Actions mimicking the conditions in the womb will trigger a calming reflex. Swaddling instructions etc. (N=27)</td>
<td>30-minute control VHS tape on general newborn parenting care recommendations. (N=24)</td>
<td>Mothers asked to complete a diary recording their infants crying patterns 3 days a week for 12 weeks. Loss to follow-up – At 4 weeks (Intervention N=16 assessed, Control N=17 assessed). At 6 weeks (Intervention N=16 assessed, Control N=17 assessed). At 8 weeks (Intervention N=17 assessed, Control N=17 assessed). At 12 weeks (Intervention N=14 assessed, Control N=12 assessed). <strong>Mean total daily hours of crying</strong> of intervention vs. control: 4 weeks – Intervention: 2.1(1.2) vs. Control: 2.4(0.9) 6 weeks – Intervention: 1.9(1.1) vs. Control: 2.2(1.2) 8 weeks – Intervention: 1.5(1.2) vs. Control:</td>
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<td>2.2(1.2)</td>
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<tr>
<td>12 weeks</td>
<td>Intervention</td>
<td>Control</td>
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<td></td>
<td>1.2(0.8)</td>
<td>1.8(2.0)</td>
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</tbody>
</table>

SBS = Shaken Baby Syndrome  
DVD = Digital Video Disk  
VHS = Video Home System; THB = The Happiest Baby
1.4.7.6.3 Studies educating parents on Sudden Infant Death Syndrome

In the single study found on the topic of Sudden Infant Death Syndrome (SIDS) by D’Halluin et al.,72 320 mothers in the post-partum ward were randomized to the intervention group that first received an educative questionnaire, followed by a pamphlet, and verbal information from the paediatrician on preventing SIDS (N=148), or the control group that received only the pamphlet and verbal information from the paediatrician on preventing SIDS (N=144). Follow-up telephone interviews with the mothers when the infant was 3-months old revealed that there was a significant difference in the number of recommendations utilized of the 10 recommendations provided in the intervention group vs. the control group: 8.28(1.51) vs. 7.62(1.72); p<0.001.72 The authors attributed the success of their intervention to their educational method of “formative evaluation”, a pedagogic method that the educative questionnaire sensitized mothers to prevention of SIDS and thus improved their knowledge and observance of the recommendations. This form of intervention primed parents to the upcoming educational material via the questionnaire allowing for greater knowledge gain and improved utilization of recommendations.
Table 3: Studies educating parents on sudden infant death syndrome

<table>
<thead>
<tr>
<th>Study</th>
<th>Population and setting</th>
<th>Design</th>
<th>Educational method</th>
<th>Intervention</th>
<th>Comparison</th>
<th>Outcome assessment and results</th>
</tr>
</thead>
<tbody>
<tr>
<td>D’Halluin et al. (2011)\textsuperscript{72}</td>
<td>320 mothers in the post-partum ward</td>
<td>Randomized, parallel</td>
<td>Written and verbal information</td>
<td>Baseline knowledge/educational questionnaire with recommendations to prevent SIDS, a pamphlet, and paediatrician verbal information (n=148)</td>
<td>Verbal information from paediatrician only (n=144)</td>
<td>Phone survey of mothers when baby was 3-months old (day 90). Asked an \textbf{observance} questionnaire of the recommendations to prevent SIDS and then a knowledge questionnaire testing what they actually knew about the recommendation. Max score of 10 observed recommendations utilized assessed. \textbf{Observance of SIDS prevention recommendations:} Intervention 8.28(1.51) vs. Control 7.62 (1.72), p&lt;0.001</td>
</tr>
</tbody>
</table>

SIDS = Sudden Infant Death Syndrome
1.4.7.6.4 Studies educating parents on breastfeeding

Twelve studies were found in the literature search that examined the effect of education to parents on the topic of breastfeeding (Table 4). In the study by Curro et al\textsuperscript{73} 200 primipara women were recruited during their visit to the paediatric clinic for their infant’s two-week well-baby visit were recruited. Mothers were strata-randomized by their geographic location and their occupation (factors that researchers believed to be predictors of breastfeeding duration) after recruitment and collection of demographic information. The intervention group received a booklet on breastfeeding management containing information about advantages of prolonging breastfeeding for the first six months of life in addition to the standard of care 10-minute breastfeeding counselling session (N=103) and mothers in the control group received just the standard of care 10-minute breastfeeding counselling session (N=97). Telephone interviews 7-months post-recruitment found no significant difference in the prevalence of “exclusive or complementary breastfeeding” at 6-months of age: 48.5\% in the intervention group vs. 43.7\% in the control group.\textsuperscript{73} The authors postulated that the verbal counselling received by both groups in the study could be creating a plateau effect on breastfeeding duration that could not be increased with the addition of a booklet. The authors powered the study to attempt to see an increase from 50\% prevalence of breastfeeding to 70\% in the intervention group but were unable to observe such a difference.

Frank et al\textsuperscript{74} performed a study with 343 low-income mothers in the post-partum ward using a 2x2 factorial design testing the effect of providing research-based discharge packages and counselling about breastfeeding to mothers instead of the standard of care, commercial discharge package and routine counselling. The groups were as follows: 1) routine counselling and routine discharge package (N=83), 2) routine counselling and research discharge package (N=77), 3) research counselling and commercial discharge package (N=84), and 4) research counselling and research discharge package (N=79). The research counselling consisted of a 20-40 minute counselling session and 8 follow-up phone calls from the counsellor throughout the follow-up period. The research discharge package consisted of providing mothers with breast pads and pamphlets on breastfeeding. Routine counselling consisted of the 5-10 minute counselling provided by nurses as per
standard care and the commercial discharge package given to all mothers at the hospitals that contained bottles, nipples, and pamphlets from formula companies containing product promotion. The study examined “percent breastfeeding” at 4-month telephone surveys was measured. Women who received the research discharge pack (N=156 combined), compared with those who received the commercial pack (N=167 combined), were more likely to prolong exclusive breast-feeding: 60 days vs. 42 days (p=0.004). There was also a significant increase in the prevalence of breastfeeding at the 4-month follow-up mark in the “research counselling and research discharge package” group as compared to the other 3 groups p=0.038. The authors concluded that the research discharge packages combined with the research counselling were successful tools in improving duration of breast-feeding in low-income mothers. Providing both education tools resulted in an additive effect in the success of the intervention.

In a cluster randomized trial by Gross et al75 273 African American women were recruited and randomized to receive a combination of a breastfeeding promoting video and peer counselling in a 2x2 factorial design depending on which of the 4 clinics the women were visiting. The four study groups for which data was collected on were: video and peer counselling (N=35), peer-counselling alone (N=32), the video alone (N=33), or no intervention (control; N=15). The study measured breastfeeding prevalence at follow-up at 1-,8-, and 16-week(s) post-partum in the four study groups. Results showed a significantly higher proportion of mothers breastfeeding in the three treatment groups than the no intervention group at the 8-week and 16-week follow-up but not at the 1-week follow-up. Comparing the treatment group of video and peer counselling vs. the control, at the 8-week follow-up 70% of the mothers were breastfeeding in the treatment group vs. 23% in the control group (p<0.05) and at the 16-week follow-up the breastfeeding prevalence was 40% vs. 0%. The authors concluded that the intervention in the form of a video and the peer counselling were effective in educating mothers enough to increasing the prevalence of breastfeeding. However, the high rate of loss to follow-up in the study from recruitment to initial follow-up (61% dropout rate from the 273 women recruited) and the resulting small sample size compromises the internal validity of the study.
In a study of 160 primiparous mothers, Henderson et al\textsuperscript{76} randomized half of the mothers to the intervention group consisting of a one-to-one 30 minute breastfeeding session and the other half to regular counselling by the hospital midwives as per standard care at the hospital. The control group received just the regular counselling by the hospital midwives as per standard care. Follow-up at 1.5, 3 and, 6 months revealed no difference between the groups in breastfeeding duration.\textsuperscript{76} The study concluded that their intervention failed to show a difference in the breastfeeding rates of mothers between groups. The authors proposed that lack of blinding of the educator and participants as well as the possibility of the “Hawthorne effect” from the hospital midwives in the unit contributed to the negative findings. The fact that the same midwives provided the intervention in both groups may have resulted in contamination in the standard care group resulting in the observer diminished intervention effect.

Johnson et al\textsuperscript{77} randomized 60 post-partum mothers testing their educational materials into one of three groups: Group A received a referral card for a lactation consultant; Group B received a referral card and a pamphlet on breastfeeding; and Group C received a referral, pamphlet on breastfeeding, and a bedside teaching session from the lactation consultant. The primary outcome was the prevalence of breastfeeding at one month post-partum determined from telephone surveys. The study found that those receiving all three educational tools (Group C) had significantly higher prevalence of breastfeeding than the other two groups.\textsuperscript{77} However, the rate of follow-up contact was only 46\% and 24\% in Groups A and B respectively as compared to 80\% follow-up rate in Group C. The authors proposed that the social relationship established from the teaching session encouraged higher follow-up rate for Group C. Thus the high rate of dropouts in Groups A and B pose a real threat to the conclusion of the study.

In the study by Kaplowitz and Olson\textsuperscript{78} the effect of a breastfeeding education program where mothers received 5 pamphlets on breastfeeding was compared to the standard of care (no information). The authors also recorded the “predisposition” of mothers on their feeding choices for their infant on whether they wished to breastfeed, bottle-feed or were undecided. Mothers in each of these “predisposition groups” were randomized to either the intervention or control group. Although the study found an increase in knowledge
regarding breastfeeding, the actual prevalence of breastfeeding between the intervention group (N=18) and the control group (N=22) was non-significant, (5/18 vs. 5/22; p>0.05). The results of the knowledge test indicated that mothers predisposed to breastfeeding reinforced their knowledge on breastfeeding and mothers in other groups gained in their knowledge of breastfeeding, however, this did not result in increased prevalence of breastfeeding. A major limitation of this study worth noting is the very small sample size of the study, which may not have been sufficiently powered to show a difference between groups.

Labarere et al\textsuperscript{79} evaluated whether the rates of breastfeeding increased when mothers were provided with a 30-minute one-to-one structured breastfeeding educational session during their stay in the post-partum ward. The study randomized 210 mothers in post-partum ward to receive either the 30-minute educational session designed to provide information and discussion on breastfeeding topics followed by an information leaflet or the control group where mothers received the usual encouragement on breastfeeding as per standard care. They found that 34.4\% of intervention mothers (N=93) receiving the educational session were breastfeeding at 17 weeks vs. a rate of 40.2\% in control mothers (N=97) who received usual care (p>0.05).\textsuperscript{79} The authors proposed that the lack of positive findings could be due to lack of multiple educational sessions and reinforcement.

In a study with mothers in the maternity ward receiving 3-individualized sessions (two in the ward after delivery and one by telephone 1 week post discharge) to increase breastfeeding self-efficacy, McQueen et al\textsuperscript{80} found no difference between the intervention (N=69) and control groups (N=81) in regards to the breastfeeding prevalence at 4-weeks (85.9\% vs. 74.4\%; p=0.08) and 8-weeks post-partum (70.5\% vs. 65.6\% p=0.56).\textsuperscript{80} There was an increasing trend however in the intervention group for breastfeeding prevalence at both 4-weeks and 8-weeks. The authors noted that this study was designed as a pilot study and that the increasing trend seen in the study as a result of the intervention warrants a larger, adequately powered trial.

Morrow et al\textsuperscript{81} tested the effectiveness of a home based peer counselling on breastfeeding in newborn parents to assess the effect of whether six home visits (n=45) or three home
visits (n=55) made a difference in the rate of exclusive breastfeeding mothers at follow-up vs. a control group (n=35) receiving no home visits. There was a statistically significant difference in the proportion of women who were exclusively breastfeeding between the 3 groups at 3 months post-partum: 67% vs. 50% vs. 12% for six visits vs. three visits vs. the control group respectively (p<0.001). Additionally the there was also a difference seen between the six-visit and three-visit group at the 3 month mark, p=0.02.\textsuperscript{81} This study found that early and repeated counselling contact with mothers was successful. This finding reiterates the effectiveness of enhanced, personalized educational interventions rather than untailored, passive ones.

Perez-Escamilla et al\textsuperscript{82} designed a trial testing the effectiveness of an individual breastfeeding guidance module (consisting of a pamphlet, poster, nurse guidance) to low-income mothers rooming-in at the post-partum ward. In this study mothers enrolled at one hospital were randomized to receive either the intervention (breastfeeding guidance; N=53) or standard care (no guidance; N=54) while a third group of mothers from a second hospital with a nursery were enrolled to serve as another control group (N=58) where mothers and infants were not in the same room during post-partum. Mothers in all groups were interviewed and assessed on their prevalence of full breastfeeding or any breastfeeding at 8, 70, and 135 days post-partum. The authors reported analyses by subsets of primiparous and multiparous mothers and found no differences between breastfeeding rates between the rooming-in breastfeeding guidance group vs. rooming-in group. A difference between the two rooming-in groups vs. the nursery group was seen in primiparous full breastfeeding rates in the short term (day 8 only).\textsuperscript{82} It should be noted however that this subgroup analyses severely reduced the subject size reported on as only 37% of mothers among the 165 study mothers were primiparous. As there were no difference seen between the rooming-in education group and rooming-in control group it is difficult to conclude that the education was effective.

Pollard\textsuperscript{83} conducted a randomized trial with 86 primiparous mothers where all mothers were shown a 35-minute educational session on breastfeeding. They were stratified by mode of delivery and “return to school/work status” and then were randomized to the intervention or control group. After viewing the video, mothers in the intervention group
(N=43) received a daily breastfeeding log with weekly reminder calls to keep the logs up to date for 6 weeks; whereas mothers in the control group (N=43) received usual care after viewing the videotape and did not receive the breastfeeding log. Follow-up at 6-months revealed a similar prevalence of breastfeeding between the intervention group and the control group, 37% and 34% (P>0.05). The intervention group did not breastfeed significantly longer than the control group. This was not particularly surprising however, as both the intervention and control groups received the exposure in the form of the educational video on breastfeeding. The breastfeeding log did not prove to cause mothers to increase their rate of breastfeeding at follow-up.

Finally, Porteous et al recruited 51 women in the post-partum unit and randomized half to receive individualized professional support group on breastfeeding and a home-visit (intervention group) while the other half received conventional nursing care (control group). Presence of breastfeeding at 4 weeks, measured by telephone surveys, found that there was a statistically significantly higher rate of breastfeeding in the intervention group, 26/26 (100%) than in the control group, 17/25 (68%) p=0.005. Although this study proved to be successful in adequately educating parents on breastfeeding leading to higher breastfeeding prevalence it should be noted that this was an intensive and costly intervention undertaken. As these home visits by the midwives were 60-90 minutes long and phone calls between mothers and midwives were 10-15 minutes in length, the resources allocated for implementing this intervention should be considered in the evaluation of feasibility of the intervention.

On the topic of educating mothers on breastfeeding the 12 studies identified in this review tested several different types of educational methods to examine whether mothers breastfeed their infants for longer duration as compared to their control counterparts. Five of the twelve studies presented were effective in showing an increase in breastfeeding rates in the intervention groups vs. control while seven of the twelve studies failed to show any difference in breastfeeding rates as a result of the intervention provided. We found that effective studies such as Frank et al, Gross et al, Johnson et al utilized education methods that provided lengthy one-to-one counselling from midwives or lactation consultants at the post-partum ward. Other effective studies
such as Morrow et al\textsuperscript{81} provided similar one-to-one education from home visits, or in the case of Porteous et al\textsuperscript{84} provided one-to-one counselling at the post-partum ward and from repeated home visits. These more intensive methods of education could have contributed to the success seen in these studies. It should be noted however that three of these successful studies, Gross et al,\textsuperscript{75} Johnson et al\textsuperscript{77} and Porteous et al\textsuperscript{84} had sample sizes of less than 30 in each group while Johnson et al\textsuperscript{77} was also limited by severe loss to follow-up.

Unsuccessful studies such as Curro et al\textsuperscript{73}, Kaplowitz et al\textsuperscript{78}, and Pollard\textsuperscript{83} examined less intensive methods of education such as pamphlets, however, some unsuccessful studies, Henderson et al,\textsuperscript{76} Labarere et al,\textsuperscript{79} McQueen et al,\textsuperscript{80} and Perez-Escamilla et al\textsuperscript{82} utilized one-to-one counselling methods similar to the successful studies. The unsuccessful nature of some of these studies could be attributed to study design as Curro et al\textsuperscript{73} compared written information and counselling vs. counselling only. Pollard\textsuperscript{83} similarly compared video information and breastfeeding log vs. video information. These two studies could have perhaps seen different results if a less active control group were used. To determine the overall effectiveness of these intervention methods in regards to breastfeeding prevalence we performed a meta analysis below (see section 1.4.7.8).
<table>
<thead>
<tr>
<th>Study</th>
<th>Population and Setting</th>
<th>Design</th>
<th>Educational method</th>
<th>Intervention</th>
<th>Comparison</th>
<th>Outcome Assessment and Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curro et al. (1997)</td>
<td>200 primipara women at a paediatric clinic in Rome recruited during their visit at 10-20 days after birth</td>
<td>Stratified randomized, by location and occupation, parallel</td>
<td>Written and verbal information</td>
<td>Booklet on breastfeeding management and 10-minute individual counselling (N=103)</td>
<td>10-minute counselling only (N=97)</td>
<td>Telephone interview 7-months post recruitment blinded to allocation. <strong>prevalence of breastfeeding 6-months of age:</strong> Intervention: 48.5% vs. Control: 43.5%</td>
</tr>
<tr>
<td>Frank et al. (1987)</td>
<td>343 primipara mothers at the post-partum ward randomized to 4 groups</td>
<td>Cluster randomized by site, parallel</td>
<td>Written information and one-to-one education</td>
<td>1) Research Counselling (RC) [20-40 minute counselling], 8 phone calls by counsellor, and Research discharge Package (RP) that contained breast pads and pamphlets (N=79)</td>
<td>2) Standard Counselling (SC) and Commercial discharge Package (CP) (N=83) vs. 3) Standard Counselling (SC) and Research Package (RP) (N=77) vs. 4) Research Counselling (RC) and Commercial Package (CP) (N=84)</td>
<td>% Breastfeeding at 4-months from telephone surveys Research pack vs. Commercial pack 60 days vs. 42 days (p=0.004) There was a 5% loss to follow-up in this study at the 4-month telephone survey mark from the initially N=343 recruited mothers, for a final sample of N=323 mothers. <strong>Follow-up report of breastfeeding at 4-months:</strong> RC and RP = 71%; SC and CP = 54%; RC and CP = 56%; SC and RP = 54%; p=0.038 for research package controlling for research counselling <strong>At 7-10 days:</strong> Loss to follow-up: Control group (N=15 assessed); Video (N=33 assessed); Counselling (N=32); Video and Counselling (N=35)</td>
</tr>
<tr>
<td>Gross et al. (1998)</td>
<td>273 African American pregnant women from 4 clinics recruited.</td>
<td>Cluster Randomized by clinic, parallel</td>
<td>Video and one-to-one information</td>
<td>Promoting breastfeeding from a motivational video and One-on-one counselling or group counselling (N=35)</td>
<td>Peer-counselling only (N=32); motivational video only (N=33); control (N=15)</td>
<td>Follow-up on breastfeeding prevalence by telephone surveys</td>
</tr>
<tr>
<td>Henderson et al. (2001)(^7^6)</td>
<td>160 primiparous mothers from the post-partum ward</td>
<td>Randomized, parallel</td>
<td>One-to-one education</td>
<td>One-to-one education for 30 minutes. Self-positioning and self-attachment. The LATCH tool was used for evaluation of positioning and attachment. (N=80)</td>
<td>Regular counselling as per standard of care (N=80)</td>
<td>Follow-up telephone calls for breastfeeding duration</td>
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<td><strong>At 8 weeks:</strong></td>
<td>Loss to follow-up: Control (N=13 assessed); Video (N=28 assessed); Counselling (N=24 assessed); Video and Counselling (N=30) Control 23%; Video 75%; Counselling 75%; Video and Counselling 70% p&lt;0.05</td>
<td>Control: 53%; Video 67%; Counselling 72%; Video and Counselling 80% p&lt;0.05</td>
<td>At 6 weeks: Loss to follow-up: Intervention (N=79 assessed); Control (N=79 assessed) Intervention 76% vs. Control 82%; p=0.3</td>
<td>At 3 months: Loss to follow-up: Intervention (N=78 assessed); Control (N=76 assessed) Intervention 72% vs. Control 75%; p=0.7</td>
<td>At 6 months: Loss to follow-up: Intervention (N=75 assessed); Control (N=75 assessed) Intervention 56% vs. Control 64%; p=0.3</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Johnson et al. (1984)(^7^7)</th>
<th>60 post-partum mothers randomly assigned to one of three groups where</th>
<th>Randomized, parallel</th>
<th>Written information and one-to-one</th>
<th>Group C: referral card and pamphlet manual and bedside teaching</th>
<th>Group A: referral card (N=24) Group B: referral</th>
<th>Mothers contacted 30 days after study and asked about breastfeeding prevalence</th>
</tr>
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<tbody>
<tr>
<td><strong>At 6 weeks:</strong> Loss to follow-up: Intervention (N=78 assessed); Control (N=76 assessed) Intervention 72% vs. Control 75%; p=0.7</td>
<td>Significant loss to follow-up at 30 days: Group</td>
<td>At 6 months: Loss to follow-up: Intervention (N=75 assessed); Control (N=75 assessed) Intervention 56% vs. Control 64%; p=0.3</td>
<td>At 6 months: Loss to follow-up: Intervention (N=75 assessed); Control (N=75 assessed) Intervention 56% vs. Control 64%; p=0.3</td>
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<td>Significant loss to follow-up at 30 days: Group</td>
<td></td>
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</tbody>
</table>

Henderson et al. (2001)\(^7^6\) 160 primiparous mothers from the post-partum ward Randomized, parallel One-to-one education One-to-one education for 30 minutes. Self-positioning and self-attachment. The LATCH tool was used for evaluation of positioning and attachment. (N=80) Regular counselling as per standard of care (N=80) Follow-up telephone calls for breastfeeding duration At 6 weeks: Loss to follow-up: Intervention (N=79 assessed); Control (N=79 assessed) Intervention 76% vs. Control 82%; p=0.3 At 3 months: Loss to follow-up: Intervention (N=78 assessed); Control (N=76 assessed) Intervention 72% vs. Control 75%; p=0.7 At 6 months: Loss to follow-up: Intervention (N=75 assessed); Control (N=75 assessed) Intervention 56% vs. Control 64%; p=0.3

Johnson et al. (1984)\(^7^7\) 60 post-partum mothers randomly assigned to one of three groups where Randomized, parallel Written information and one-to-one Group C: referral card and pamphlet manual and bedside teaching Group A: referral card (N=24) Group B: referral Mothers contacted 30 days after study and asked about breastfeeding prevalence

Significant loss to follow-up at 30 days: Group
<table>
<thead>
<tr>
<th>Study</th>
<th>Sample Description</th>
<th>Education Method</th>
<th>Intervention Details</th>
<th>Follow-up Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaplowitz et al. (1983)</td>
<td>44 mothers from obstetric clinics in their 4th to 6th month of pregnancy.</td>
<td>Randomized, parallel</td>
<td>Written information Breastfeeding education program – 5 pamphlets on breastfeeding (N=22)</td>
<td>A 54% loss to follow-up (N=13 assessed), Group B 76% (N=16 assessed), Group C 20% loss to follow-up (N=12 assessed)</td>
</tr>
<tr>
<td>Labarere et al. (2003)</td>
<td>210 mothers in the post-partum ward in a hospital in France hospital that were planning on breastfeeding</td>
<td>Randomized, parallel</td>
<td>One-to-one education One-to-one structured hospital education session on breastfeeding (n=106)</td>
<td>Duration of breastfeeding at 2-months of age by telephone survey. Loss to follow-up: 4 mothers in the intervention group unable to be contacted.</td>
</tr>
<tr>
<td>McQueen et al. (2011)</td>
<td>150 primiparous mothers recruited in-hospital maternity ward receiving a self-efficacy intervention</td>
<td>Randomized, parallel</td>
<td>One-to-one education Three individualized sessions designed to increase breastfeeding self-efficacy in mothers (n=69)</td>
<td>Rate of breastfeeding at 17 weeks from surveys by mail. Loss to follow-up: 13 mothers lost in intervention group (N=93 assessed); 7 mothers lost in control group (N=97 assessed)</td>
</tr>
</tbody>
</table>

**Breastfeeding at 30d:**
Group A – 16% vs. Group B – 25% vs. Group C – 67%; p<0.05

**Breastfeeding at 2 months:**
Intervention: 5/18 (28%) vs. Control: 5/22 (23%); p>0.05

**Breastfeeding at 17 weeks:**
Intervention – 32/93 (34.4%) vs. Control – 39/97 (40.2%); p>0.05

**Breastfeeding at 4 weeks follow-up:** In the control group 3 mothers lost to follow-up (N=76) and 5 additional mothers lost to follow-up at 8 week follow-up (N=73).
<table>
<thead>
<tr>
<th>Study</th>
<th>Methodology</th>
<th>Interventions</th>
<th>Outcome</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morrow et al. (1999)(^1)</td>
<td>130 parents recruited based on census data found, approached and enrolled by study team. Home-based peer counselling.</td>
<td>Cluster randomized, parallel One-to-one education Six counselling home visits (N=45) Three counselling home visits (N=55)</td>
<td>Control – no visits; (N=35)</td>
<td>Breast feeding at 4 weeks: Intervention: 85.9% vs. Control: 74.4% p=0.08 Breastfeeding at 8 weeks: Intervention: 70.5% vs. Control 65.6% p=0.56</td>
</tr>
<tr>
<td>Perez-Escamilla et al. (1992)(^2)</td>
<td>165 healthy mothers in the nursery after delivery who were planning to breastfeed their children. Hospital A assigned to Control 1. Hospital</td>
<td>Quasi – randomized, parallel One-to-one education</td>
<td>Intervention: Rooming-in with individual breastfeeding guidance (RIBFG) at Hospital B (N=53) Control 1: Nursery mothers (NUR) that were not rooming-in at Hospital A (N=58) Control 2: Rooming-in (RI)</td>
<td>Exclusive breastfeeding at 2 weeks: 6-visit: 80% vs. 3-visit: 62% vs. control: 24% p&lt;0.001 Exclusive breastfeeding at 3 months: 6-visit 67% vs. 3-visit 50% vs. control 12% p&lt;0.001 Non-significant at 4-weeks, 6-weeks and 2 months.</td>
</tr>
</tbody>
</table>

Small loss to follow-up at 2 weeks: 6-visit group (N=44 assessed); 3-visit group (N=52 assessed); control (N=34 assessed). Small loss to follow-up at 3 months: 6-visit group (N=42 assessed); 3-visit (N=50) assessed; control (N=33 assessed). Outcome assessment of Full breastfeeding and any breastfeeding, stratified by primiparous and multipara mothers. We report here the results of primiparous.
<table>
<thead>
<tr>
<th>Study</th>
<th>Sample Size and Recruitment</th>
<th>Randomization Method</th>
<th>Intervention Details</th>
<th>Outcomes</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollard (2011) (^83)</td>
<td>86 primiparous mothers recruited from the obstetrical department of a community hospital. Randomization to groups after videotaped educational session.</td>
<td>Quasi-randomized by delivery and return to work status, parallel</td>
<td>All mothers watched an introductory video on breastfeeding before randomized. Intervention mothers received a breastfeeding log. Also received weekly calls for 6 weeks for reminders to keep the log up-to-date (N=43)</td>
<td>Breastfeeding at 6 months: Experimental: 15(37%) vs. Control 14 (33%), p&gt;0.05</td>
<td>Loss to follow-up, N=2 in the experimental group. (N=41 assessed). No loss to follow-up in the control group (N=43 assessed)</td>
</tr>
<tr>
<td>Porteous et al. (2000) (^84)</td>
<td>51 women recruited in the postpartum unit in Hamilton, Canada.</td>
<td>Randomized, parallel</td>
<td>Individualized professional support group on breastfeeding. Home visits by investigator (N=26)</td>
<td>Presence of breastfeeding at 4 weeks postpartum. Assessed by telephone survey.</td>
<td>Intervention – 26(100%) vs. Control – 17(68%), p=0.005</td>
</tr>
</tbody>
</table>

RC = Research Counselling; RP = Research discharge Package; SC = Standard Counselling; CP = Commercial discharge Package
RIBFG = Rooming-In with individual Breastfeeding Guidance; NUR = Nursery; RI = Rooming-In; BF = Breastfeeding
1.4.7.6.5 Studies educating parents on injury prevention

Three studies that educated parents on injury prevention for their infant were identified. Kendrick et al\(^8^5\) designed a cluster randomized trial where mothers of infants in their first year of life visiting 36 general practices were randomized (18 in each group) to receive either a package on injury prevention (N=1110; intervention) or no package (N=1019; control). Mothers in the intervention group received age-appropriate safety advice at child health surveillance consultations, home safety equipment, and first aid training from health visitors and practice nurses at three visits. The investigators reviewed the health records of the recruited participants to measure the number of “medically attended unintended injuries” within 25 months of study commencement. No significant differences in the outcomes were noted between the intervention and control groups (31.8% vs. 32.4%; \(p=0.77\)).\(^8^5\) The authors of this study proposed that perhaps providing parents with information on a specific injury type as their education rather than multiple injury types could have yielded more positive results.

Nansel et al\(^8^6\) tested the power of individually tailored pamphlets with parents of young infants visiting their paediatric office for their well-baby checks. In this study the intervention group was asked to complete a baseline questionnaire regarding their safety practices from which a tailored handout was printed out and given to parents addressing the top two topics of safety needs (from a possible 5) specific for their child’s tendencies (N=70). This group was compared to the control group who received general written handouts (N=67). Participants were then followed up by telephone 3-weeks after intervention delivery and assessed their injury risk behaviour scores defined by the authors and compared to their baseline scores. The authors selected the injury risk and preventive behaviours for inclusion in their assessment based on the current recommendations of the American Academy of Pediatrics at the time of the study. Parents in the intervention group showed a decrease in injury risk behaviour by 4.68(6.44) points vs. 1.54(5.58) points in the control group, \(p<0.01\). This study showed that the effectiveness of tailored education interventions in influencing behavioural change in parents. It should be noted however that the outcome was assessed only 3 weeks after intervention administration. This follow-up may have been too brief and did
not assess whether the change in parents’ behaviour was sustainable or whether it led to a reduction in unintentional injuries in their infants.

In the last study by Reich et al\textsuperscript{87} on educating parents about injury prevention, 198 primiparous mothers visiting the obstetric clinic were recruited and randomized to receive either an intervention educational baby book on safety practices (N=53), an active control non-educational book group (same baby book without the educational text) (N=56), or a no book control group (N=58). Mothers were assessed for their baseline safety practices during their third trimester of pregnancy and where followed-up on their safety practices when their child was 2, 4, 6, 9, 12, and 18 months of age. Between-group comparisons showed a reduction in risks in the educational book vs. no book group for the number of safety risks in the environment. Logistic regression analysis of between-group comparison showed a statistically significant difference between the educational book and control groups for 8 out of 14 “low-effort practice changes” such as no small objects, no sharp objects, not smoking in the house etc. The authors attribute the success of the intervention to the low reading level of the written material provided (written at the first grade level) in the form of a baby book.\textsuperscript{87}

Each of the three studies identified in this search on the topic of injury prevention in infants provided parents with written materials as their educational intervention. Two of the studies, Nansel et al\textsuperscript{86} and Reich et al\textsuperscript{87} measured the change in safety practices of parents after the educational intervention and were able to find a positive effect for this outcome. The study by Kendrick et al\textsuperscript{85} measured a slightly different outcome in the form of injury visits after educational interventions and the study yielded a negative result. The two positive studies showed merit for using tailored and easy to read written information to maximize learning from educational written materials.
Table 5: Studies educating parents on injury prevention

<table>
<thead>
<tr>
<th>Study</th>
<th>Population and Setting</th>
<th>Design</th>
<th>Educational method</th>
<th>Intervention</th>
<th>Comparison</th>
<th>Outcome assessment and results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kendrick et al. (1999)</td>
<td>Mothers of 3-12 month old infants from 36 general practices in Nottingham</td>
<td>Cluster randomized, parallel</td>
<td>Written information</td>
<td>A package of safety advice given at 6-9, 12-15, and 18-24 months. Safety checks, equipment and first aid training at child’s well-baby check (N=1100)</td>
<td>Control – standard care (N=1019)</td>
<td>Any medically attended unintentional injuries. Frequency (mean percentage, SD) Intervention: 346 (31.8; 8.18); Control: 220 (32.4; 10.4); p=0.77</td>
</tr>
<tr>
<td>Nansel et al. (2002)</td>
<td>213 parents of infants 6-20 months of age visiting a paediatric clinic for their infant’s well-baby check</td>
<td>Randomized, parallel</td>
<td>Written information</td>
<td>Individually-tailored pamphlet printout from computer on injury prevention for young infants based on parental responses to questionnaire</td>
<td>Generalized information (control)</td>
<td>Baseline vs. follow-up injury risk behaviours by telephone interviews 3-weeks later. Follow-up assessed for N=174 (81.7% follow-up). Intervention: N=85 assessed, Control: N=89 assessed. Mean decrease in injury risk difference behaviour: Intervention: 4.68(6.44) vs. Control: 1.54(5.58); P&lt;0.01</td>
</tr>
<tr>
<td>Reich et al. (2010)</td>
<td>198 primiparous mothers recruited in their third trimester from waiting rooms of obstetric clinics in an urban area</td>
<td>Randomized, parallel</td>
<td>Written information</td>
<td>Baby Books Program (N=62)</td>
<td>Non-educational book (active control) (N=66) No book (control) (N=70)</td>
<td>Total number of risks in environment (pooled count) from 6 follow-up time points: 2, 4, 6, 9, 12 and 18 months. Values reported in mean (SD). 84.3% loss to follow-up rate, overall N=167 assessed for follow-up. Intervention: N=53; Active Control N=56; Control N=58 Number of risks in environment: Intervention: 2.41(1.69) vs. Active Control – 2.70(1.89) vs. Control – 2.83(1.86)</td>
</tr>
</tbody>
</table>

SD = Standard Deviation
1.4.7.7 Quality assessment of the studies included using the risk of bias tool

The risk of bias for each study was assessed using the Cochrane risk of bias tool. Table 6 shows the judgements of the found studies by two reviewers (CP and SS) for the following domains: sequence generation, allocation concealment, blinding of participants, study personnel and outcome assessors, incomplete reporting of outcome data, selective outcome reporting, and other sources of bias. A rating of high, low or unclear risk of bias was assigned according to the recommended criteria from the Cochrane Handbook. Only 1 of the 22 reviewed studies received all low risk of bias in all domains. Of the 22 reviewed studies, 18 studies received at least one high risk of bias rating; 8 studies received high risk of bias ratings in 2 categories and 2 studies received high risk of bias ratings in 3 categories or higher. The most commonly rated high risk domain was blinding of personnel, this is common as the study personnel would have to provide education to the treatment group and thus would have to ascertain knowledge on group allocation. Hence, it should be noted that 4 studies received primarily low ratings in all categories but the domain of blinding of personnel.
Table 6: Risk of bias assessment table

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Random sequence generation</th>
<th>Allocation concealment</th>
<th>Blinding of participants and personnel</th>
<th>Blinding of outcome assessment</th>
<th>Incomplete outcome data</th>
<th>Selective outcome reporting</th>
<th>Other sources of bias</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anticipatory Guidance (N=4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adam et al. (1985)</td>
<td>66</td>
<td>High</td>
<td>High</td>
<td>Participant: Unclear</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Personnel: High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paradis et al. (2011)</td>
<td>67</td>
<td>Low</td>
<td>High</td>
<td>Participant: Unclear</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td>Personnel: High</td>
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</tr>
<tr>
<td>Stille et al. (2001)</td>
<td>68</td>
<td>High</td>
<td>High</td>
<td>Participant: Unclear</td>
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<td>Low</td>
<td>Low</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td>Personnel: High</td>
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</tr>
<tr>
<td>Zahr et al. (1989)</td>
<td>69</td>
<td>Unclear</td>
<td>Unclear</td>
<td>Participant: Unclear</td>
<td>Unclear/Low</td>
<td>Low</td>
<td>Low</td>
<td>None</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Personnel: High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Shaken Baby Syndrome (N=2)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barr et al. (2009)</td>
<td>70</td>
<td>Low</td>
<td>Low</td>
<td>Participants: Unclear</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Personnel: Unclear/High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McRury et al. (2010)</td>
<td>71</td>
<td>Low</td>
<td>Low</td>
<td>Participants: Low, Personnel: Low</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>None</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td><strong>Sudden Infant Death Syndrome (N=1)</strong></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>D’Halluin et al. (2011)</td>
<td>72</td>
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<td>Low</td>
<td>Participants: Low</td>
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<td>Low</td>
<td>Low</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Personnel: Low</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Breastfeeding (N=12)</strong></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Curro et al. (1997)</td>
<td>73</td>
<td>Low</td>
<td>Unclear</td>
<td>Participants: Unclear</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Personnel: High</td>
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<td></td>
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</tr>
<tr>
<td>Frank et al. (1987)</td>
<td>74</td>
<td>Low</td>
<td>Low</td>
<td>Participants: Unclear</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td>Personnel: High</td>
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<td></td>
</tr>
<tr>
<td>Gross et al. (1998)</td>
<td>75</td>
<td>Low</td>
<td>High</td>
<td>Participant: Unclear/High</td>
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<td>High</td>
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<td>None</td>
</tr>
<tr>
<td>Study Authors</td>
<td>Low</td>
<td>Unclear</td>
<td>Low</td>
<td>Participant: Unclear/ Low</td>
<td>Personnel: High</td>
<td>Low</td>
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<td>Low</td>
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<td>-----------------------------------</td>
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</tr>
<tr>
<td>Henderson et al. (2001)</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Participant: Low</td>
<td>Personnel: High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Johnson et al. (1984)</td>
<td>Unclear</td>
<td>Unclear</td>
<td>Low</td>
<td>Participant: Unclear/ Low</td>
<td>Personnel: High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Kaplowitz et al. (1983)</td>
<td>Unclear</td>
<td>Unclear</td>
<td>Low</td>
<td>Participant: Unclear/ Low</td>
<td>Personnel: High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Labarere et al. (2003)</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Participant: Unclear/ Low</td>
<td>Personnel: High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>McQueen et al. (2011)</td>
<td>Low / Unclear</td>
<td>Low</td>
<td>Low</td>
<td>Participant: Low/ Unclear</td>
<td>Personnel: High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Morrow et al. (1999)</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Participant: Low</td>
<td>Personnel: High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Perez-Escamilla et al. (1992)</td>
<td>High</td>
<td>Unclear</td>
<td>Low</td>
<td>Participant: Low</td>
<td>Personnel: High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Pollard (2011)</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Participant: Low</td>
<td>Personnel: High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Porteous et al. (2000)</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Participant: Unclear/ Low</td>
<td>Personnel: High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Kendrick et al. (1999)</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Participant: Unclear/ Low</td>
<td>Personnel: High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Injury Prevention (N=3)**
<table>
<thead>
<tr>
<th>Study</th>
<th>Level</th>
<th>Type</th>
<th>Participant</th>
<th>Personnel</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nansel et al. (2002)</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Unclear</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Participant: Low</td>
<td>Personnel: Low</td>
<td>Low</td>
</tr>
<tr>
<td>Reich et al. (2010)</td>
<td>Unclear</td>
<td>Low</td>
<td>Participant: Low</td>
<td>Personnel: Unclear</td>
<td>Low</td>
</tr>
</tbody>
</table>
1.4.7.8 Meta-analysis of studies on educating parents of young infants

Among the studies on educating parents previously described, we were able to meta-analyze trials pertaining to the topic of breastfeeding as all 12 of these trials measured the outcome of prevalence of breastfeeding at follow-up in the intervention vs. control group. Each study utilized different follow-up time points and different educational methods depending on the study design. The follow-up time point at which breastfeeding prevalence was measured ranged from 1-month to 6-months post intervention delivery. When multiple follow-up time points were present, the most long-term outcome was selected. And when multiple groups existed in the study the most intensive educational treatment arm was compared with the least intensive treatment arm (control or standard of care). In the study by Perez-Escamilla et al, the results were only reported separately for primiparous and multiparous women, both of these groups were included separately in the meta-analysis. If studies reported both outcomes on “full-breastfeeding” and “partial breastfeeding” the outcome of choice selected was “full-breastfeeding” as this delineates the outcome of the majority of other studies in the analysis.

Overall, educational materials regarding breastfeeding were found to be effective in promoting breastfeeding prevalence, RR [95% CI] of 1.25 [1.01, 1.53] as illustrated in Figure 2, below. There was a moderate level of heterogeneity found in the analysis I²=59% which was significant by $\chi^2=29.53$, p=0.003. The total number of participants for the outcome was 629 in the intervention arm and 615 in the control arm. Qualitatively, 10 of the 12 studies had point estimates favouring the intervention and 4 of the 10 studies were statistically significant. Three out of the four of these positive studies used a one-to-one personal education method as their intervention, a more intensive method of educating parents which perhaps explains their higher degree of success.
Table 1: Randomised and controlled trials investigating breastfeeding interventions.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Intervention Events</th>
<th>Control Events</th>
<th>Weight</th>
<th>Risk Ratio IV, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curro 1997</td>
<td>50</td>
<td>103</td>
<td>42</td>
<td>97</td>
</tr>
<tr>
<td>Frank 1987</td>
<td>58</td>
<td>79</td>
<td>45</td>
<td>83</td>
</tr>
<tr>
<td>Cross 1998</td>
<td>12</td>
<td>30</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Henderson 2001</td>
<td>42</td>
<td>75</td>
<td>48</td>
<td>75</td>
</tr>
<tr>
<td>Johnson 1984</td>
<td>8</td>
<td>12</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Kaplowitz 1983</td>
<td>5</td>
<td>18</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>Labaree 2003</td>
<td>32</td>
<td>93</td>
<td>39</td>
<td>97</td>
</tr>
<tr>
<td>McQueen 2011</td>
<td>43</td>
<td>61</td>
<td>48</td>
<td>73</td>
</tr>
<tr>
<td>Morrow 1999</td>
<td>28</td>
<td>42</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td>Perez-Escamilla 1992 A</td>
<td>6</td>
<td>22</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Perez-Escamilla 1992 B</td>
<td>3</td>
<td>27</td>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>Pollard 2011</td>
<td>15</td>
<td>41</td>
<td>14</td>
<td>43</td>
</tr>
<tr>
<td>Pouteau 2000</td>
<td>26</td>
<td>26</td>
<td>17</td>
<td>25</td>
</tr>
</tbody>
</table>

Total (95% CI) 629 615 100.0% 1.25 [1.01, 1.53]

Heterogeneity: Tau² = 0.06; Chi² = 29.53, df = 12 (p = 0.003); I² = 59%

Test for overall effect: Z = 2.30 (p = 0.04)

![Figure 2: Breastfeeding prevalence in participants receiving breastfeeding education vs. standard care](image)

1.4.7.8.1 Long-term vs. short-term breastfeeding prevalence

The heterogeneity observed in the analysis can be explained by the variability in the time of outcome measurement. Naturally, mothers are less likely to still be breastfeeding the older their infant is (mothers begin introducing solids into their infant’s diet) and thus distant outcome measures are more likely to favour the control group. We performed a subgroup analysis where we divided the outcomes by short-term follow-up (1 to 4 months) and long-term follow-up (4 to 6 months), See Figure 3. In the subset of the 5 studies77,78,80,81,84 that measured short-term outcomes in the range of there was a substantially higher intervention effect RR [95% CI] of 1.72 [1.08, 2.73] and higher heterogeneity (χ² = 15.45, p = 0.004; I² = 74%). Thus the effectiveness of the educational intervention was more substantial for short-term breastfeeding prevalence and these results weren’t due to chance but rather a true measured effect.

Seven studies73-76,79,82,83 that measured long-term outcomes in the range of 4 to 6 months found that the effect of the intervention was less significant and the population was more homogenous (RR 1.08 CI 0.88 to 1.32; χ² = 11.7 df, p = 0.14; I² = 36%). This indicates that the educational interventions were not effective in causing an increase in breastfeeding
prevalence in the long-term and the differences seen in the study were likely due to chance.

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Intervention Events</th>
<th>Total Events</th>
<th>Control Events</th>
<th>Total Events</th>
<th>Weight</th>
<th>Risk Ratio IV, Random, 95% CI</th>
<th>Risk Ratio IV, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johnson 1984</td>
<td>8</td>
<td>12</td>
<td>2</td>
<td>13</td>
<td>2.1%</td>
<td>4.33 [1.14, 16.49]</td>
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</tr>
<tr>
<td>Kaplowitz 1983</td>
<td>5</td>
<td>18</td>
<td>5</td>
<td>22</td>
<td>3.1%</td>
<td>1.22 [0.42, 3.57]</td>
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</tr>
<tr>
<td>McQueen 2011</td>
<td>43</td>
<td>61</td>
<td>48</td>
<td>73</td>
<td>14.6%</td>
<td>1.07 [0.85, 1.35]</td>
<td></td>
</tr>
<tr>
<td>Morrow 1999</td>
<td>28</td>
<td>42</td>
<td>4</td>
<td>33</td>
<td>3.8%</td>
<td>5.50 [2.14, 14.13]</td>
<td></td>
</tr>
<tr>
<td>Porteous 2000</td>
<td>26</td>
<td>26</td>
<td>17</td>
<td>25</td>
<td>13.7%</td>
<td>1.46 [1.11, 1.92]</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>159</td>
<td>166</td>
<td>37.2%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>110</td>
<td>76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.15; Chi² = 15.45, df = 4 (P = 0.004); I² = 74%
Test for overall effect: Z = 2.31 (P = 0.02)

1.3.2 Long-term outcomes (follow-up 4 to 6 months)

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Intervention Events</th>
<th>Total Events</th>
<th>Control Events</th>
<th>Total Events</th>
<th>Weight</th>
<th>Risk Ratio IV, Random, 95% CI</th>
<th>Risk Ratio IV, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curr 1997</td>
<td>50</td>
<td>103</td>
<td>42</td>
<td>97</td>
<td>13.0%</td>
<td>1.12 [0.83, 1.52]</td>
<td></td>
</tr>
<tr>
<td>Frank 1987</td>
<td>56</td>
<td>79</td>
<td>45</td>
<td>83</td>
<td>14.4%</td>
<td>1.31 [1.03, 1.67]</td>
<td></td>
</tr>
<tr>
<td>Cross 1998</td>
<td>12</td>
<td>30</td>
<td>0</td>
<td>13</td>
<td>0.5%</td>
<td>11.29 [0.72, 177.56]</td>
<td></td>
</tr>
<tr>
<td>Henderson 2001</td>
<td>42</td>
<td>75</td>
<td>48</td>
<td>75</td>
<td>13.9%</td>
<td>0.88 [0.67, 1.14]</td>
<td></td>
</tr>
<tr>
<td>Labarere 2003</td>
<td>32</td>
<td>95</td>
<td>39</td>
<td>97</td>
<td>11.4%</td>
<td>0.86 [0.59, 1.24]</td>
<td></td>
</tr>
<tr>
<td>Perez-Escamilla 1992 A</td>
<td>6</td>
<td>22</td>
<td>1</td>
<td>15</td>
<td>1.0%</td>
<td>4.09 [0.55, 30.61]</td>
<td></td>
</tr>
<tr>
<td>Perez-Escamilla 1992 B</td>
<td>3</td>
<td>27</td>
<td>2</td>
<td>26</td>
<td>1.4%</td>
<td>1.44 [0.26, 7.96]</td>
<td></td>
</tr>
<tr>
<td>Pollard 2011</td>
<td>15</td>
<td>41</td>
<td>14</td>
<td>43</td>
<td>7.3%</td>
<td>1.12 [0.62, 2.03]</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>470</td>
<td>449</td>
<td>62.8%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>215</td>
<td>191</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.03; Chi² = 11.00, df = 7 (P = 0.14); I² = 36%
Test for overall effect: Z = 0.74 (P = 0.46)

| Total (95% CI)         | 629                 | 615          | 100.0%         | 1.25 [1.01, 1.53] |        |                               |                               |
| Total events           | 326                 | 267          |                |                |        |                               |                               |

Heterogeneity: Tau² = 0.06; Chi² = 29.53, df = 12 (P = 0.003); I² = 59%
Test for overall effect: Z = 2.10 (P = 0.04)
Test for subgroup differences: Chi² = 3.30, df = 1 (P = 0.07); I² = 69.7%

Figure 3: Short-term and long-term breastfeeding prevalence for participants receiving breastfeeding education vs. standard care

1.4.7.8.2 Effectiveness of one-to-one educational intervention and written/verbal educational intervention

To examine the relative success of the different educational intervention methods employed in the studies the twelve breastfeeding studies were divided into two groups. Studies that provided any form of individual counselling as the tested educational method (one-to-one education) or studies that provided written and/or verbal information about breastfeeding. These divisions were chosen as one-to-one education is more intensive and has a longer educational component than the written and verbal educational component. Additionally, all five of the successful studies from the twelve reviewed studies provided one-to-one education to mothers on breastfeeding. Figure 4 shows the results below of the analysis which found the effect of the one-to-one education to be slightly higher than the overall observed effect, RR [95% CI] of 1.33 [1.01, 1.74], and relatively the same
heterogeneity ($\chi^2=29.45$, $p=0.04$; $I^2=69\%$). Studies that employed the written and/or verbal educational technique were found to be unsuccessful, RR [95% CI] of 1.13 [0.87, 1.46].

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Intervention Events</th>
<th>Control Events</th>
<th>Total</th>
<th>Weight</th>
<th>Risk Ratio IV, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frank 1987</td>
<td>56</td>
<td>79</td>
<td>45</td>
<td>83</td>
<td>14.4% 1.31 [1.03, 1.67]</td>
</tr>
<tr>
<td>Gross 1998</td>
<td>12</td>
<td>30</td>
<td>0</td>
<td>13</td>
<td>0.5% 11.29 [0.72, 177.56]</td>
</tr>
<tr>
<td>Henderson 2001</td>
<td>42</td>
<td>75</td>
<td>48</td>
<td>75</td>
<td>13.9% 0.88 [0.67, 1.14]</td>
</tr>
<tr>
<td>Johnson 1984</td>
<td>8</td>
<td>12</td>
<td>2</td>
<td>13</td>
<td>2.1% 4.33 [1.14, 16.49]</td>
</tr>
<tr>
<td>Labaree 2003</td>
<td>32</td>
<td>93</td>
<td>39</td>
<td>97</td>
<td>11.4% 0.86 [0.59, 1.24]</td>
</tr>
<tr>
<td>McQueen 2011</td>
<td>43</td>
<td>61</td>
<td>48</td>
<td>73</td>
<td>14.6% 1.07 [0.85, 1.35]</td>
</tr>
<tr>
<td>Morrow 1999</td>
<td>28</td>
<td>42</td>
<td>4</td>
<td>33</td>
<td>3.8% 5.50 [2.14, 14.13]</td>
</tr>
<tr>
<td>Perez-Escamilla 1992 A</td>
<td>6</td>
<td>22</td>
<td>1</td>
<td>13</td>
<td>1.0% 4.09 [0.81, 20.61]</td>
</tr>
<tr>
<td>Perez-Escamilla 1992 B</td>
<td>3</td>
<td>27</td>
<td>2</td>
<td>26</td>
<td>1.4% 1.44 [0.26, 7.96]</td>
</tr>
<tr>
<td>Porzous 2000</td>
<td>26</td>
<td>26</td>
<td>17</td>
<td>25</td>
<td>13.7% 1.46 [1.11, 1.92]</td>
</tr>
</tbody>
</table>

Subtotal (95% CI): 467 / 453 / 76.7% / 1.33 [1.01, 1.74]

Total events: 256 / 206

Heterogeneity: $Tau^2 = 0.09$; $Chi^2 = 29.45$, df = 9 ($p = 0.0005$); $I^2 = 69\%$

Test for overall effect: $Z = 2.06$ ($p = 0.04$)

2.1.2 Written and/or verbal education

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Intervention Events</th>
<th>Control Events</th>
<th>Total</th>
<th>Weight</th>
<th>Risk Ratio IV, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curo 1997</td>
<td>50</td>
<td>103</td>
<td>42</td>
<td>97</td>
<td>13.0% 1.12 [0.83, 1.52]</td>
</tr>
<tr>
<td>Kaplowitz 1983</td>
<td>5</td>
<td>18</td>
<td>5</td>
<td>22</td>
<td>3.1% 1.22 [0.42, 3.57]</td>
</tr>
<tr>
<td>Pollard 2011</td>
<td>15</td>
<td>41</td>
<td>14</td>
<td>43</td>
<td>7.3% 1.12 [0.62, 2.03]</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>162</td>
<td>162</td>
<td>162</td>
<td>162</td>
<td>23.3% 1.13 [0.87, 1.46]</td>
</tr>
</tbody>
</table>

Total events: 70 / 61

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.02$, df = 2 ($p = 0.99$); $I^2 = 0\%$

Test for overall effect: $Z = 0.90$ ($p = 0.37$)

Total (95% CI): 629 / 615 / 100.0% / 1.25 [1.01, 1.53]

Total events: 325 / 267

Heterogeneity: $Tau^2 = 0.06$; $Chi^2 = 29.53$, df = 12 ($p = 0.003$); $I^2 = 59\%$

Test for overall effect: $Z = 2.10$ ($p = 0.04$)

Test for subvariance differences: $Chi^2 = 0.73$, df = 1 ($p = 0.39$), $I^2 = 0\%$

Figure 4: One-to-one education and written/verbal education on breastfeeding effects on breastfeeding prevalence for participants

1.4.7.9 Summary of findings

In the 22 studies found in this search 17 of the studies showed positive point estimates of educational interventions being effective in influencing behavioural change in parents. Eight out of the seventeen studies showed statistically significant results. These eight studies used group education, one-on-one education, and written and verbal information. These educational methods were more intensive than the ones in studies that were not efficacious, in terms of longer exposure time to the education and a more interactive educational method. Thus lending some merit to providing educational interventions that are active and multi-dimensional rather than simple passive methods.

The meta-analysis of the educational materials on the topic of breastfeeding showed that mothers in the intervention groups were 1.25 times more likely to prolong breastfeeding compared to their control counterparts during the first 4 months after birth.
The systematic review presented here provides the evidence for educational materials to be effective in teaching parents about infant topics and influencing their behaviour. Although there are mixed results in their effectiveness as many studies found did not show improvement, overall it can be concluded that these educational methods have the ability to be effective especially if they are active and multi-dimensional. This search justifies the study presented in this thesis on determining whether the educational materials provided on pain-relieving strategies to parents has the power to influence parents on utilizing more of these methods. Choosing the appropriate outcome to measure the effect of the education that the materials provided is important for examining whether the education truly made a difference. The studies in this review all used unique outcomes that were either directly related to the behaviour the education was trying to increase (i.e. breastfeeding and breastfeeding prevalence) or were using near proxies of behaviour such as self-efficacy.

1.4.8 Measuring the impact of education

Choosing the appropriate outcome for studies on patient education is crucial for determining the effectiveness of the teaching provided. Determining the outcome measure is dependent on the topic of the education, and the method of delivery of the educational material. Currently, the majority of tools measured are: beliefs/attitudes/behaviours (29%), knowledge (26%), and self-efficacy (19%).

Traditionally, patient education studies focused on measuring knowledge outcomes; whereas, current studies use wider ranges of outcomes and place a greater focus on including clinically relevant outcomes. Research has shown that self-efficacy is a potent predictor of behaviour. It is suggested that using multiple outcome measurement types such as knowledge and behaviour helps in giving a better indication for the effectiveness of the education. We outline below our choice of primary outcome measure in the form of a checklist of behaviour and our secondary outcome measures of pain that are clinically relevant.
1.4.9 Choice of outcome scales utilized for the proposed study

1.4.9.1 Strategy utilization checklist

To obtain which pain management strategies parents utilized during their infant’s immunizations we used a checklist tool during observation of the injection procedure. The tool captured whether parents used various analgesic strategies, i.e. sugar water or breastfeeding and the timing of use of these strategies in relation to the injection, i.e. starting breastfeeding before the injection, and continuing throughout the procedure. The tool included a notes section to capture any delineation in regards to how the strategy was used. This tool was a modified version from previous studies by our research group developed during conducting telephone interviews with mothers of 2-month infants.\textsuperscript{2,9,11} In this study the checklist was completed by a blinded research assistant (AI) who reviewed the study video tapes and noted the information on interventions parents used during the vaccine injection procedure. A recently completed study by our research group used this checklist to validate maternal self-report from observed.\textsuperscript{14}

1.4.9.2 Modified Behavioral Pain Scale (MBPS)

Pain is a subjective experience and is best measured by self-report. With infants in their first year of life however a verbal self-report assessment is not possible. While there are some merits to using physiological measures in assessing pain such as heart rate, oxygen saturation etc. these measures have not been proven to be sensitive to changes in pain.\textsuperscript{91} The Modified Behavioral Pain Scale (MBPS) is a behavioural scale that determines infant pain by assigning a score to the following 3 categories: facial expression, cry and body movement. The total score ranges from 0 to 10 (Appendix B). For this study, MBPS was used to measure infant pain and distress experienced during the observed immunization procedure. A blinded research assistant (HS) assessed videotapes and scored the pain before (baseline) and after (post) each of the injections that the infant received. This was a secondary outcome to the study to observe whether increased pain management utilization indeed translated into infants experiencing less pain in the intervention group.
The MBPS scale is a validated pain measure\textsuperscript{92} that has been used in several previous trials infants in this age group.\textsuperscript{29,93-95} The Modified behavioral pain scale has demonstrated good validity with the observer visual analog scale (VAS; [0.68, p<0.001]) and the paediatrician VAS (0.74, p<0.001). Construct validity of the scale was demonstrated by significantly lower pre-injection than post-injection scores (1.9 vs. 7.3, p<0.01) and by significantly lower scores in infants treated with lidocaine-prilocaine compared to placebo (6.8 vs. 8, p<0.01). Inter-rater agreement among five raters was 0.95, p<0.01 using intraclass correlation coefficients (ICC) and test-retest reliability was also high (0.95, p<0.001).\textsuperscript{92} MBPS has demonstrated clinical utility,\textsuperscript{96} and is considered to be more feasible than two other scales for measuring infant acute pain (Neonatal Infant Pain Scale [NIPS] and Face Legs Activity Cry [FLACC]) as it was the more preferred scale by pain raters.\textsuperscript{97}

1.4.9.3 Measure of Adult and Infant Soothing and Distress (MAISD) tool

The Measure of Adult and Infant Soothing and Distress (MAISD) tool was used to quantify parent and nurse behaviours during the procedure. MAISD was a tool developed for infants 6 weeks to 22 months old to assess behaviours of parents, infant, and clinicians during immunizations.\textsuperscript{98} For the purposes of this study parents accompanying the infant during the immunizations and the clinician giving the injections behaviour were coded for the designated time segments before and after the injection. The behaviours coded for were physical comforts (e.g. rocking, patting, etc.), distraction (e.g. singing, talking, etc.), and verbal reassurance (e.g. reassuring comments). See Appendix C for a sample scoring sheet. The purpose of examining these behaviours was to use a validated tool to capture the frequency that these behaviours occurred in parents and clinicians in both the education and control group. Particularly, MAISD was used to help determine clinician treatment of the different study groups to ascertain if there was any performance bias. The MAISD is key to capturing the tendencies of parents and clinicians during the immunization procedure. A blinded research assistant (EH) coded parent and clinician behaviour by the MAISD tool during infant’s immunization using videotapes.
1.5 Study Rationale

Based on the literature review there is merit in providing education to parents of infants regarding topics of infant care and management. Infants are subjected to many skin-breaking procedures during their first year of life including routine immunizations that are noted to be painful. Therefore providing parents information on immunization pain management strategies is important to facilitate its utilization and mitigate pain from injections. Experts in the field of patient education suggest that parents absorb information regarding topics the best when there is a heightened awareness and interest in the particular topic. Additionally, a greater effectiveness seems to be observed when multiple educational methods are combined, such as supplementing written information with oral instruction. Thus, we decided to provide our two educational tools in the form of a written pamphlet and video together.

In order to identify an appropriate environment in which to educate parents about immunization pain management, we carried out a telephone-survey with 174 new mothers from Mount Sinai Hospital and IWK Health Center. Almost all (98%) of the respondents indicated that they were interested in learning about ways to minimize the pain and distress their infant experienced during immunizations and 87% suggested that the best place to receive this information would be from their doctor’s office. Further, 17% specified that this information would be most effectively used if received before the baby’s initial immunizations. As parents have shown to respond best to information that focuses on their specific area of concern, presenting information to parents at the relevant vaccination appointment itself may yield beneficial results.

The target population for this study were parents of infants being immunized rather than clinicians providing the immunizations. Directing these strategies towards parents instead of clinicians (the immunizers) was a decision that the research team decided to take due to a variety of reasons: (1) Despite clinician’s knowledge of child vaccination and availability of utilizing these pain mitigating strategies (e.g. sugar water and topical anaesthetics are available in clinics and pharmacies), clinicians rarely suggest their use in
clinical practice,\textsuperscript{8,10} (2) parents are responsible for their children’s care and want to obtain the skills to optimally care for their children,\textsuperscript{99} and (3) parents have reported that lack of information on these strategies is the major reason for under-utilization of pain-relieving strategies for their children.\textsuperscript{100}

In summary, this cluster randomized trial will seek to determine if dissemination of the educational materials to new parents in an outpatient paediatric clinic setting leads to improved utilization of pain-relieving strategies and reduced subsequent pain responses in infants during their routine 2, 4, and/or 6 month immunizations compared to standard of care.

1.6 Summary and Strategy

1.6.1 Summary

A multitude of strategies are available for parents to mitigate their infant’s pain during immunization injections. Parents report a penchant for information regarding comforting their infants during immunizations and directing educational materials towards them can empower them to utilize these methods for increased pain relief. Evidence for a positive effect in providing educational interventions to parents in written and video formats on infant topics exists. This research study would like to determine if providing parents with information on pain-relieving strategies at the time of their infant’s immunization appointment at their paediatric clinic leads to an increase in their use.

1.6.2 Strategy

The proposed study was a cluster randomized in which parents were randomized to receive an infant immunization pain-relieving educational package (intervention group) or general information about immunizations package (control group). Parents were assessed on their use of pain-relieving strategies and whether this led to decreased pain experienced by their infants.
Developing the culture of utilizing more of these strategies perhaps begins with initiative from the parents and their push to advocate greater use of proven pain relieving strategies during immunizations for their infants. The research methodology employed in this study can help bridge the gap between clinical practice and evidence-based research strategies for enhanced pain management in infants for routine medical procedures such as immunizations.

### 1.6.3 Immunization schedule

In Ontario at the time of the study, infants received DTaP-IPV-Hib, PCV, and rotavirus oral vaccine at 2, 4 and 6 months of age. As an outcome investigated in this study was immunization pain, we had to ensure that the same vaccines were administered to minimize the variability in pain response due to the injected liquids. Thus, only infants at 2, 4, and 6 months were targeted for study so as to ensure as much uniformity as possible between all of the immunized infants.
Chapter 2

2 Methods

2.1 Study Design and Setting

This was a partially-blinded longitudinal cluster randomized trial conducted at an outpatient paediatric clinic affiliated with St. Michael’s Hospital in Toronto, Canada.

A cluster randomized design was chosen in this study to decrease the risk of experimental contamination (sharing of information between study groups). The unit of randomization in cluster randomized trials is the “cluster” (a group) and in this trial this was at the level of the physician that parents and their accompanying infants were visiting.

2.2 Ethics

The Research Ethics board (REB) at St. Michael’s Hospital in Toronto, Canada (REB# 12-195C) as well as the University of Toronto (Approval ID: 28316) approved this study. The study was registered on www.clinicaltrials.gov and the registration number is NCT01713322.

2.2.1 Ethical considerations

The candidate obtained written, informed consent from all eligible parents on the first study visit day during the recruitment phase of the study. Informed consent for participation from parents was obtained in accordance with the International Conference on Harmonization-Good Clinical Practice\textsuperscript{101} and Tri-Council Policy Statement-2\textsuperscript{nd} Edition guidelines.\textsuperscript{102} Participants received information about the study and their freedom to withdraw at any time without any impact on the care received at St. Michael’s Hospital. Participants were also assured that all identifying personal information would be kept confidential.

When parents were approached for participation, subjects were not told of the true nature of the differences between the two study groups in the study or the study hypothesis.
Parents were told that the study would like to test the dissemination of one of two educational material regarding infant immunizations to many clinics in the city. Parents were told that the study would like to observe and videotape how their infant’s immunization procedures typically undergo as a part of the study. Videotaping minimized bias during follow-up appointments as outcome measurements from the videotapes would allow for blinded assessments of outcomes. This intentional lack of disclosure was because awareness of the outcome measurement of pain by parents could have biased their use of pain-relieving methods and assessment of their infant’s pain. At the conclusion of the study, parents were debriefed regarding the true hypothesis of the study. This use of deception was to allow for an unbiased conduct of this trial was the key to our ability to answer the defined research questions.

2.3 Population and Setting
The study population consisted of parents of infants either 2- or 4-months old undergoing immunization injections at an outpatient paediatric clinic affiliated with St. Michael’s Hospital, Toronto.

2.4 Inclusion/Exclusion Criteria

2.4.1 Inclusion criteria:
- Parents of infants >30 weeks gestational age (GA)
- Parents of 2 or 4-month old healthy infants during their routine check-up.
- Parent accompanying infant at all immunization appointments

2.4.2 Exclusion criteria:
- Parents that are delaying their infant’s immunization schedule for an extended time (more than 2-3 months)
- Parents who are unable to read and understand English
- Infants with congenital anomalies, neurological conditions, and maternal psychiatric conditions
2.5 Intervention
There were two study groups in this study. Parents in the intervention group received information on how they can comfort their infants during immunizations in the form of written and video information (Appendix D). Parents in the control group received general information on the diseases infant immunizations protect against adopted from the Toronto Public Health website (Appendix E).

2.6 Randomization
Using a computer random number generator, a research assistant (RA) uninvolved with the study retrieved a randomization code for the 4 participating physician practices from the study statistician—½ in control and ½ in intervention group. The attending physicians each see patients over 4-hour morning and afternoon periods, and all potential patients during this period were assigned to either the control or intervention group. As attending physicians adhere by a weekly set schedule during the clinic, all future appointments with parents were made under the same physician.

An advantage to this cluster design was that each clinic could simulate the atmosphere of the current standard of care at this clinic or the atmosphere of an intervention clinic that promotes the use of the pain-relieving strategies. During the intervention clinic hours the intervention video was playing in the waiting room TV, posters of the enlarged pamphlet were posted around the clinic and copies of the pain management pamphlets were also available for parents. At the conclusion of each of the clinic hours the clinic was remodelled to represent standard care as needed.

2.7 Procedures
This study was a longitudinal cluster randomized trial with parent-infant dyads visiting their paediatric clinic for a routine appointment. The research coordinator (the candidate)
identified potential parents for recruitment ahead of time by examining the appointment schedule of each physician shift one week in advance. The candidate identified potential parent-infant dyads that could be recruited for the study based on infant’s date of birth from the appointment lists. Infants who were 2-months or 4-months of age and met study inclusion criteria (assessed from patient charts) were targeted as potential subjects. When eligible parents arrived at the clinic for their infant’s scheduled appointment a member of the clinic staff (receptionist or nurse) first approached parents of eligible infants in the waiting room and provided them with some study information while introducing the candidate. The candidate then explained the study using a structured recruitment script and obtained informed consent from participating parents.

Parents who agreed to participate in the study signed consent forms for participation where one copy was obtained for research records and the other for the parent’s record. See Appendix F for consent forms. After obtaining consent parents (still in the waiting room) were given their allocated educational material as per their randomized clinic cluster; parents in the intervention group received a factsheet and were then shown a video regarding infant pain management methods (Appendix D) in addition to receiving a generalized infant immunization information pamphlet (Appendix E). Parents assigned to the control group received just the generalized infant immunization information pamphlet (Appendix E). Parents were observed to ensure that they completely went through their assigned educational package to ensure treatment fidelity.

After parents had completed the assigned education the candidate completed the basic demographic data form with the parent, collecting maternal and infant characteristics. At the conclusion of the demographic data collection phase parents were asked to continue with their doctor’s visit as per usual as the candidate informed them that he will return to their exam room once it’s time for the immunization injections. As per usual practice at this clinic location, after parents were called into the exam room from the waiting room they first met with their paediatrician for their infant’s check-up. Once the paediatrician had completed the check-up and physical examination of the infant he/she informed the study nurse and the candidate that the infant was ready for their scheduled immunizations (2-month shots or 4-month shots) at the conclusion of their appointment. Paediatricians
and the candidate then completed a quick checklist that kept track of which pain management methods parents inquired about during their interaction, before the injection procedure.

At the time of the immunization injection procedure, the nurse administering the immunization and the candidate entered the examination room. Nurses recited a prepared script preparing parents for the immunizations, asking intervention parents if there was any particular strategy they would like to utilize. Parents were given time to position their baby as they pleased, if parents demanded the use of sugar water, it was provided to them as it was in stock at the clinic. The candidate videotaped the procedure and completed a checklist of the pain-relieving methods used by the parents during the immunizations. The candidate began filming when infants were being administered the oral rotavirus vaccination and continued filming throughout both of the injections received by the infant up to a maximum of 2 minutes after the infant had received his/her last injection. After the injections were completed and the nurse that administered the injections had left the room, parents were asked to rate their infant’s overall pain from the two immunization injections using an 11-point numerical rating score range (0-10). The candidate who filmed and observed the immunizations similarly rated pain with the same rating system. At the conclusion of the appointment, the candidate noted the time of the follow-up appointment scheduled by parents for the infant’s upcoming scheduled routine check-up and immunizations (usually, 2-months from the current appointment).

During the parents return for visit day 2, parents were re-approached by the candidate and reminded of their continued participation in the study where they would be observed and videotaped during their infant’s immunization appointment. Parents were not given any educational material during this follow-up appointment on visit day 2 and were videotaped during their infant’s immunizations exactly in the same manner as the initial appointment on visit day 1. At the conclusion of the follow-up appointment on visit day 2 parents were debriefed about the true hypothesis of the study. Parents in the control group were provided with the intervention factsheet and an online link to the intervention video.
Collected videotapes were organized and stored in a secure location at our University of Toronto research office where blinded RA1 (AI) assessed analgesic strategy utilization, blinded RA2 (HS) assessed infant pain from the validated Modified Behavioural Pain Scale (MBPS) pain measurement tool, and RA3 (EH) assessed parent and nurse behaviour from the Measure of Adult Infant Soothing and Distress (MAISD) tool as well as infant cry duration, coded as vocalizations in the presence of facial grimacing.

2.7.1 Intervention education package–managing infant pain from immunizations

User-friendly educational materials in the form of a structured written one-page factsheet of pain-relieving methods, and a video with vignettes of pain management methods were created for parents. The strategies shown in the materials were created from the evidence-based recommendations of the aforementioned clinical practice guideline. The visually aesthetic factsheet is organized in chronological order of use and each section is separated according to the theme title, the “3 P’s of pain management”. Thus parents were directed towards what type of pain management methods (pharmacological, physical, or psychological) available to them along with the timing (before, during, or after injection) in relation to the injection these could be best utilized.

In the video, healthcare professionals highlight the same strategies that parents can use to reduce their infant’s pain during immunizations while showcasing the proper technique of use of these methods using vignettes. Both the factsheet and video that encompass this study’s educational material address evidence-based pain management methods applicable for infants <12 months of age.

We decided to include a written and video component in the educational material as parents that participated in our pilot-testing reported a preference for both tools to be presented together serving a complimentary purpose.¹³
2.7.1.1 Administration of the pain education package
Parents recruited into the intervention group were given a pamphlet outlining various pain management strategies that can be utilized to comfort their infants during immunizations. They were asked to read the pamphlet and then subsequently shown a video (~5 minutes) illustrating the effectiveness of the strategies with real life examples. The video was played on the waiting room TV where parents were able to listen and watch the video. In the rare event (<10 times through the course of the study) that the video could not be shown on the TV the DVD video was shown on a laptop. This education phase of the study took ~10 minutes to complete. Parents were provided with a pamphlet about general information about immunizations, identical to the one given to the control group. They were allowed to take both of the pamphlets (the intervention pain-management strategies pamphlet and the control general immunization info pamphlet) home with them. During the follow-up appointments parents received reminders of the strategies, via posters and copies of the pamphlet they received earlier displayed around the clinic.

2.7.2 Control education group – general information infant immunizations
Parents recruited into the control group were shown and asked to thoroughly read a pamphlet regarding general information about childhood immunizations (Appendix E). This pamphlet, developed by Toronto Public Health, titled, “Keep your children healthy! Protect them! Immunize them!” outlined all of the diseases that infant immunizations protect against. The pamphlet included information regarding the yellow immunization card, and included a chart of the standard immunization schedule. The pamphlet did not contain any information regarding strategies to comfort infants during their injection procedures.

2.7.2.1 Administration of the control education package
Parents recruited to the control group whom were administered the generalized information pamphlet were given 2-3 minutes to go through the pamphlet. This study
phase took a maximum of 5 minutes. Parents were allowed to take this pamphlet home with them.

2.7.3 Additional details on procedures

All immunizations were administered using the current Ontario Immunization Schedule recommendations. At present, Diphtheria and Tetanus toxoids, acellular Pertussis adsorbed, Inactivated Poliovirus and Hemophilus b conjugate vaccine (DTaP-IPV/Hib) and pneumococcal conjugate vaccine (PCV) are administered at 2 and 4 months by injection and the Rotavirus vaccine is administered orally. At the 6-month immunization appointments the DTaP-IPV/Hib vaccine and the pneumococcal conjugate vaccine (PCV) is administered.

The oral vaccine was administered first followed by the DTaP-IPV/Hib injection, and then lastly the PCV injection, as per usual practices. Immunizations were injected as per the current practice with DTaP-IPV/Hib injection preceding the more painful PCV injection. The immunizations were performed by trained nurses in a standardized manner, with a 25-gauge, 1 inch needle. As all of the injections are intramuscular injections, a rapid injection technique without prior aspiration was used and immunizations were administered to the upper outer aspect of the thigh in all infants.

A digital videotape recorder was used to capture the immunization procedure. Video camera was positioned so as to capture the infant’s facial expression and body movements as best as possible. Research assistant was trained to ensure proper operation of the video camera. The videotaped procedure recorded 3 phases: 1) baseline: before injection (~30 seconds) 2) immunization injection, and 3) up to 3 minutes after the immunization injection.
2.8 Outcome Measures

2.8.1 Primary outcome
The number of pain management strategies utilized by parents during immunization injections on visit day 1 (2-month or 4-month), and immunization injections on study visit 2 (4-month or 6-month). Specifically the increase of one of these 4 strategies: topical anaesthetics, sugar water, breastfeeding, and holding. The four selected strategies that the study focused on had high level of effectiveness in pain relief\(^6,22,23\) and little seen utilization.\(^1,7,8,10\) A blinded research assistant coded this outcome from recorded videotapes of the immunization procedure.

2.8.2 Secondary outcomes

i. Observer-rated infant pain during immunization injections, as measured from video footage of the procedure by a validated measure of pain in infants, the Modified Behavioural Pain Scale (MBPS) (0-10), for study visit day 1 and visit day 2.

ii. Observer-rated parent behaviour during immunization injections, as measured by a validated tool, the Measure of Adult and Infant Soothing and Distress (MAISD), for study visit day 1 and visit day 2.

iii. Parent-rated infant pain during immunization injections, as measured by a validated tool, the Numerical Rating Scale (NRS) (0-10), in real-time, for study visit day 1 and visit day 2.

iv. Observer-rated infant pain during immunization injections, as measured by a validated tool, the Numerical Rating Scale (NRS) (0-10), in real-time, for study visit day 1 and visit day 2.

v. Parent-reported satisfaction with their immunization experience, as measured by a 5-point Likert scale, for study visit day 1 and visit day 2.

vi. Duration of infant crying during immunization injections, as measured in seconds from video footage of the procedure, for study visit day 1 and visit day 2.
2.9 Outcome Assessments

2.9.1 Primary outcome – pain management utilization

The primary outcome of this study was the measurement of the utilization pain-relieving strategies by parents during their two immunization appointments as measured by a blinded RA (AI) from videotapes of the procedure.

Specifically, the correct use of 4 strategies that were emphasized in the intervention educational material was examined. These strategies include: 1) topical anaesthetic creams, 2) sugar water before the injection, 3) breastfeeding and 4) holding/cuddling the infant throughout the procedure. The correct use of these four strategies were coded as follows for each strategy: 1) application of topical anaesthetics before the injection, 2) sugar water administration before or during the injection only, 3) breastfeeding: appropriate latch of infant before the injections continuing during and after the injection, and 4) infants being held in the parents’ lap starting before the injection and continuing during and after the injections. The use of these strategies was tracked using a checklist of pain management strategies by a research assistant in real-time as well, as a backup measurement.

2.9.2 Secondary outcomes

2.9.2.1 Modified Behavioral Pain Scale

One of the secondary outcomes assessed in this study was the quantity of pain experienced by the infant. Pain was assessed from video recordings of the immunization procedure using the Modified Behavioral Pain Scale (MBPS). MBPS is a validated observational measure of acute pain in infants undergoing immunization injections. The score incorporates 3 behavioral domains (facial grimacing, crying, and body movements) individually scored and summed for an overall pain score ranging from 0 (no pain) to 10 (maximum pain). See Appendix B for the sample-scoring sheet. The scale has been used in previous trials of pain and distress assessment in infants and has been validated in infants 4-6 months old undergoing immunizations.
Pain was coded during each of the 2-month and 4-month appointments in the following manner: before the first immunization injection [baseline]; during the next 15 seconds immediately after the first immunization injection [injection]; before the second immunization injection [baseline-2]; during the next 15 seconds immediately after the second immunization injection [injection-2] and lastly 1 minute after the last injection [injection-2-recovery phase].

The primary outcome measure of infant pain used in the analysis was the mean of the 2 immunization injections administered at the first study day visit and second study day visit.

2.9.2.2 Measure of Adult and Infant Soothing and Distress

The Measure of Adult and Infant Soothing and Distress (MAISD) tool was used to quantify parent behaviour during the procedure assisting in determining the utilization of specific pain-management strategies. The scale was developed in infants of 6 weeks to 22 months to assess behaviours of parent, child and nurses during immunization procedures (Appendix C for the sample-scoring sheet). Behaviours coded for the purposes of this study were: verbal distraction, physical comfort, rocking, and verbal reassurance. As the prevalence of other behaviours was too scarce, only the prevalence of these four chosen behaviours were selected for coding. The MAISD tool was used to code during the following segments of the immunization procedure: 15-0 seconds baseline before the first injection and a maximum of 0-60 seconds after the second injection. Coding segments were broken down into epochs of 5 seconds where the presence of any of the behaviours in one segment was coded as 1 for used and the lack of the behaviour in the segment was coded as 0. Thus, 3 five second epochs were coded for at baseline and 12 five second epochs were coded for post injection.

The primary outcome measure for MAISD used in the analysis was chosen to be the behaviour of physical comfort.
2.9.2.3 Numerical Rating Scale (NRS)

Parent rating of overall infant pain after both injections at study visit 1 and study visit 2 was assessed using an 11-point (0-10) numeric rating scale (NRS). The use of the NRS to obtain assessments from parents provided a valid, relatively inexpensive, and feasible method. Additionally the parent assessment of their infant’s pain was a blinded and a clinically relevant outcome measurement.

The primary outcome measure used in this study was observer mean NRS score from injection 1 and injection 2 and parent NRS score for both injections.

2.9.2.4 Parent satisfaction with immunizations

Parent satisfaction with their infant’s comfort level during their immunization procedure using a 5-point Likert scale; whereby 1 = very dissatisfied, 2 = somewhat dissatisfied, 3 = neutral, 4 = somewhat satisfied, 5 = very satisfied.

2.9.2.5 Duration of crying

Duration of infant crying (in seconds) after the immunization injections was assessed from video recordings. Crying was defined as vocalization after the needle poke in the presence of facial grimacing. Crying was coded in the following segments: 15-0 seconds before the first injection [baseline]; 0-15 seconds after the first injection [post-injection1]; 15-0 seconds before the second immunization injection [baseline-2]; from 0-120 seconds after the second injection [post-injection2].

The primary outcome measure used in the analysis was 0-120 seconds following the second injection at study visit 1 and 2.

2.9.3 Demographic data collected

Demographic data on mothers were obtained from interview questionnaires after consent
was obtained from recruited parents. The maternal demographics captured were: maternal age, marital status, education level, ethnicity, obstetric history, and number of previous children. The infant characteristics that were captured in the questionnaire were: infant age at vaccination, gestational age at birth, delivery method, birth weight, current age, and current weight. These characteristics were obtained as reported by mothers and/or obtained from the medical chart. Minimal information (age, sex, reason for refusal, previous children) was also collected (with consent) from parents who declined to participate. This was done to ensure that there were no differences in parent characteristics who agreed to participate compared to those who refused.

2.10 Sample Size Calculation

The sample size calculation was based on the primary outcome of use of four pain management strategies that has been shown to the most effective strategies in comforting babies but the least utilized.\textsuperscript{1,2,7-9,11} These four measures were: breastfeeding, sugar water, topical anaesthetics, and holding. In sample data collected from 174 postpartum mothers as part of another study, the mean number of these strategies that were correctly used was 0.7 (scored from 0 to 4) with a standard deviation of 0.5.\textsuperscript{11}

We hypothesized that providing the educational material will result in an increase the mean number of these four pain-management strategies used by 0.4. As the study design is a cluster randomized control trial information on Intraclass Correlation Coefficient (ICC) was needed, however no such information was available in the literature. Therefore for the purposes of this study, an ICC of 0.05 was chosen because patients within a clinic were assumed to be nearly independent. In addition, studies show that ICCs calculated from outcomes of cluster randomized studies in primary settings have been 0.05 or lower.\textsuperscript{103} Sample size calculation with the assumption of 5% significant level ($\alpha=0.05$), 80% power ($\beta=0.8$), and estimates ($\text{delta} = 0.4$, standard deviation = 0.5), yielded a total of 144 parents are required in this study (36 in each of the 4 clusters). Accounting for 10% loss to follow-up, the sample was increased to 160 parents.
2.11 Training of Physicians and Nurses

Physicians and nurses in the intervention group were trained about the interventions prior to the commencement of the study during a one-hour in-service where the educational materials to be shown to parents were reviewed. A group discussion was held afterwards where any questions/queries regarding the educational material and the conduct of the trial was sorted out. At this paediatric center, nurses provided all of the injections for the infants. All the 3 staff nurses administered vaccine injections using a standardized technique in their clinic at 2-month, 4-month and 6-month immunizations. As per standard practice nurses typically do not provide additional information to parents regarding pain management from vaccine injection, however, nurses were asked to provide full support with parent-led pain-relief methods when parents asked to utilize a strategy that was shown to them. Nurses were to be as accommodating to parents as possible (e.g. if parents wish to cuddle/breastfeed the baby during the injections, or if parents wanted to use sugar water before the injection for comfort; nurses complied with this request prior to administering the injection.)

2.12 Blinding

2.12.1 Study personnel

The members of the clinical staff and the candidate involved with recruitment, education, and follow-up could not be blinded to treatment allocation due to the nature of the intervention. As randomization occurred by physician clinic times all recruited patients during the specified time were assigned to one group. In addition, the clinic displayed posters of the intervention pamphlet (Appendix D) and played the video in the waiting room TV.

2.12.2 Nurses (immunizers)

The three nurses that work at this clinic provided all of the injections for infants. The nurses were required to read a script prior to delivering immunizations that was specific to whether the recruited parents were in the intervention or control group. Script used for intervention patients at the time of injections: You were given some information about
**making your baby more comfortable during the injection, is there anything specific you want us to do? How would you like to position your baby?** Script used for control patients at the time of immunizations: *Is everyone ready for the vaccination? How would you like to position your baby?*

### 2.12.3 Parents

Parents were blinded to their group allocation. Since all parents under one physician’s care are assigned to the same treatment arm, they will be unaware of the alternate treatment condition. As parents were not be told of the real hypothesis of the study, there was a minimal risk of bias in outcome reporting, including utilization of pain management strategies, and perceptions of pain, knowledge of strategies, and satisfaction with the immunization procedure.

### 2.12.4 Outcome Assessor(s)

The trained RAs that scored strategy utilization, pain, and interactions were blinded to the purpose of the study and the treatment allocation. Study personnel collecting data and clinicians were instructed to ensure that any indication of group allocation is not captured during the video recording so as to maintain concealment of treatment allocation.

### 2.13 Additional Measures Undertaken to Minimize Bias

A cluster randomized trial was selected as the study design. Randomization minimizes the issue of imbalance between balance known and unknown confounders such as education level, previous experience with infant immunizations, and socioeconomic status between control and intervention groups, minimizing their influence on the outcome. The study used a cluster randomized controlled trial design rather than a traditional randomized controlled trial design because it could otherwise have been susceptible to contamination. There is potential for parents that were randomly assigned to the control group to be present at the same clinic time as another group of parents who
were randomly assigned to the intervention group. As the interventions were offered in the waiting area, it would not be possible to show the video on the TV in the waiting area, and parents in the control group may overhear the conversation the research coordinator (the candidate) would have with the parents in the intervention group. This would result in contamination as parents in the control group may ask questions about the intervention to the research coordinator or the paediatrician and thus defeat the purpose of the study. In this case, differences between groups in outcome measures would be diluted, as the control group would have received unintended information regarding pain-relieving strategies. Assigning the physicians to either the control or intervention group ensured that parents could remain blinded and contamination between groups can be circumvented throughout the entire duration of the study.

Another challenge posed by the longitudinal aspect of the study design was attrition bias. Since parents were being followed for ~2 months after recruitment, and being asked to participate with study procedures for two doctor’s appointments, the possibility of loss to follow-up existed from cancelled appointments, impromptu appointments, or moving to a different physician clinic location. Demographic information was collected at the initial appointment thus information on dropouts can be compared. Data on dropouts between the first appointment (2-month or 4-month immunizations) and the follow-up appointment (4-month or 6-month immunizations) was kept and used for comparisons.

Lastly, since the candidate and the study staff was not blinded to treatment allocation outcome measurements collected in real-time were subjected to bias. Nurses may have been inclined to assist parents additionally in the intervention or control group. Similarly, research assistants and nurses may have perceived the pain to be more severe in the control group than the intervention group. By using videotapes, blinded research assistants measured the strategy utilization. Videotapes were also used for measures of pain (i.e. MBPS and cry time), and behaviour (i.e. MAISD). This minimized susceptibility to measurement biases in our study and increased the internal validity. Training and standardization of procedures helped in minimizing performance and measurement biases associated with the conduct of the trial. Nurses used identical injection techniques for procedures to parents in both treatment arms. Other associated
biases were minimized by standardization of procedures such as training in obtaining consent and recruiting patients, and proper videotaping techniques during the injection procedure.

2.14 Compliance and Missing data

Analysis for this study was done by intent-to-treat principles. No missing data was included in the analysis. The candidate and RAs entered all data into Microsoft Excel™ spread sheets. The candidate and an RA working together checked collected data for accuracy on a later date.

2.15 Statistical Analysis

A p-value of <0.05 was considered significant for the primary outcome at visit 1 and 2. A Bonferonni correction of 6 was used for secondary outcomes: 1) mean MBPS of first and second injections, 2) cry time 0-120 seconds after both injections, 3) MAISD score for physical comfort, 4) mean observer NRS score of first and second injections, 5) parent NRS score for both injections, and 6) parent satisfaction with comfort level. Hence, the p-value was reduced to <0.008. Other analyses that may have been performed (post-hoc) were considered exploratory with no correction in p-value and the results are shown separately from the primary and secondary outcome results.

2.15.1 Baseline characteristics

Demographic data were compared between groups by Student’s t-test, $\chi^2$ test, or Fisher’s exact test as appropriate.
2.15.2 Primary objective

The number of correctly utilized pain management interventions by parents at the time of injections was used for analysis. In particular the use of four of these pain-relieving strategies, topical anaesthetics, sugar water, breastfeeding, and holding/cuddling were used for analysis. As the data on the number of interventions used was not normally distributed, utilization data were dichotomized into either a ‘0’ (no interventions) or ‘1’ (at least 1 intervention). Outcomes were compared between groups using regression models fitted with a General Estimating Equation (GEE) to account for correlation within clusters. The investigators examined variables as covariates only if they differed significantly between groups.

2.15.3 Secondary objectives

The mean of the MBPS scores for both injections immediately after the needle procedures were compared between groups using simple linear regression models fitted with a GEE to account for within cluster correlations. The means of MAISD scores for each behaviour, the means of cry time, and the means of parent and observer NRS pain ratings during the immunization procedures were assessed between groups using regression models fitted with a GEE to account for within cluster correlations. Parent satisfaction was dichotomized into either “Very satisfied” or “Somewhat satisfied and lower” and were compared between groups using regression models fitted with a GEE.

2.15.4 Assessing reliability

Reliability for outcome measures for MBPS, MAISD, and infant cry were tested through intraclass correlation coefficients (ICC) between two sets of ratings on each measured variable. Both intra-rater and inter-rater reliability was reported for most outcomes. We determined an ICC measure of more than 0.6 to be deemed as reliable.
2.15.5 Interim analysis

No interim analyses were performed.
Chapter 3

3 Results

This chapter presents the findings of the study. Sample characteristics and participant flow through the trial is first described. The results associated with the outlined primary and secondary outcomes are then reported.

3.1 Participant Flow

One hundred and ninety-one parents were approached for participation in this study during their infant’s visit to the paediatric clinic between November 3rd 2012 and December 8th, 2013. Altogether 160 parent-infant dyads (84%) consented to participate from the N=4 study clinics. Eighty parents from the N=2 study clinics were randomized to educational intervention and 80 parents from the N=2 study clinics were randomized to the control group. All parents completed the subsequent 1st observation appointment on the first visit day. Overall 126 (79%) parents completed follow-up on the second visit day. Sixty (75%) parents from N=2 intervention study clinics completed observation at of the follow-up immunizations on study visit 2 and 66 (82.5%) from the N=2 control study clinics parents completed the 2nd follow-up observation on study visit 2. See Figure 3 for the CONSORT flow diagram of study participants.
Figure 5: Flow diagram of study participants

Eligible infants and parents approached for participation (N=4 clinics; N=191 subjects)

Declined to participate (N=31 subjects)
Reasons:
• Uncomfortable with videotaping (N=20)
• Not interested (N=5)
• Inconvenient (N=3)
• Did not want breastfeeding to appear in video (N=3)

Obtained consent and randomized (N=4 clinics, N=160 subjects)

Allocated to pain management education intervention (N=2 clinics, N=80 subjects)
Received allocated intervention (N=2 clinics, N=80 subjects)

Completed 1st follow-up (N=2 clinics, N=80 subjects)
Analyzed at 1st follow-up (N=2 clinics, N=80 subjects)

Lost to follow-up: N=20 (25%) subjects
Completed 2nd follow-up (N=2 clinics, N=60 subjects)
Analyzed at 2nd follow-up (N=2 clinics, N=60 subjects)

Allocated to control education (N=2 clinics, N=80 subjects)
Received allocated intervention (N=80 subjects)

Completed 1st follow-up (N=2 clinics, N=80 subjects)
Analyzed at 1st follow-up (N=2 clinics, N=80 subjects)

Lost to follow-up: N=14 (17%) subjects
Completed 2nd follow-up (N=2 clinics, N=66 subjects)
Analyzed at 2nd follow-up (N=2 clinics, N=66 subjects)
3.1.1 Characteristics of consenting parents vs. non-consenting parents

Baseline characteristics (sex of their children, number of children, and infant age) of non-participants (N=31) were compared to those who participated in the study (N=160). No differences were found in these characteristics between these two groups (p>0.05) (Table 7) Reasons cited by parents for choosing not to participate are listed in Figure 5.

Table 7: Characteristics of consenting parents vs. non-consenting parents

<table>
<thead>
<tr>
<th></th>
<th>Consented parents (N=160)</th>
<th>Non-consented parents (N=31)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant sex (males)</td>
<td>88 (55%)</td>
<td>14 (45%)</td>
<td>0.31</td>
</tr>
<tr>
<td>Number of children</td>
<td>1[1,2]</td>
<td>1[1,2]</td>
<td>0.31</td>
</tr>
<tr>
<td>First time parents</td>
<td>93 (58%)</td>
<td>16 (52%)</td>
<td>0.50</td>
</tr>
<tr>
<td>Infant age (days)</td>
<td>77.9 (28.8)</td>
<td>81.9 (32.0)</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Values are in N (%) or median [inter-quartile range]

† Chi-square or Student’s t-test used for test of significance where appropriate

3.2 Characteristics of Groups

3.2.1 Baseline characteristics of participating parents

The total samples size was 160 parent-infant dyads; 80 mothers were from 2 physician clinics in the pain education intervention group and 80 mothers were from 2 physician clinics in the control group. Demographic characteristics of participating mothers and infants are shown in Table 8. Maternal characteristics between the two groups did not defer in any of the demographic categories collected included age, education, and number of children. Infant characteristics of weight and age between the two groups were similar on the follow-up visit day 2 as well.
Table 8: Demographics of all participating mothers and infants

<table>
<thead>
<tr>
<th></th>
<th>Intervention (N=80)</th>
<th>Control (N=80)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maternal characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal age (years)</td>
<td>33.2 (6.2)</td>
<td>32.8 (5.3)</td>
<td>0.68</td>
</tr>
<tr>
<td>Mode of delivery (vaginal)</td>
<td>57 (71%)</td>
<td>51 (64%)</td>
<td>0.31</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>58 (73%)</td>
<td>57 (71%)</td>
<td>0.74</td>
</tr>
<tr>
<td>Single</td>
<td>9 (11%)</td>
<td>12 (15%)</td>
<td></td>
</tr>
<tr>
<td>Common-in-law</td>
<td>13 (16%)</td>
<td>11 (14%)</td>
<td></td>
</tr>
<tr>
<td>Education completed</td>
<td></td>
<td></td>
<td>0.21</td>
</tr>
<tr>
<td>University/College</td>
<td>69 (86%)</td>
<td>63 (79%)</td>
<td></td>
</tr>
<tr>
<td>High school/Grade school</td>
<td>11 (14%)</td>
<td>17 (21%)</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td>0.79</td>
</tr>
<tr>
<td>Caucasian</td>
<td>36 (45%)</td>
<td>33 (41%)</td>
<td></td>
</tr>
<tr>
<td>Afro-American</td>
<td>16 (20%)</td>
<td>14 (18%)</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>23 (29%)</td>
<td>25 (31%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>5 (6%)</td>
<td>8 (10%)</td>
<td></td>
</tr>
<tr>
<td>Twin delivery (yes)§</td>
<td>2 (3%)</td>
<td>6 (8%)</td>
<td>0.28</td>
</tr>
<tr>
<td><strong>Number of children in the family:</strong></td>
<td></td>
<td></td>
<td>0.47</td>
</tr>
<tr>
<td>1</td>
<td>49 (61%)</td>
<td>44 (55%)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>21 (26%)</td>
<td>28 (35%)</td>
<td></td>
</tr>
<tr>
<td>3 or more</td>
<td>10 (13%)</td>
<td>8 (10%)</td>
<td></td>
</tr>
<tr>
<td><strong>Infant characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant sex (males)</td>
<td>40 (50%)</td>
<td>48 (60%)</td>
<td>0.20</td>
</tr>
<tr>
<td>Birth weight (Kg)</td>
<td>2.98 (0.79)</td>
<td>2.87 (0.87)</td>
<td>0.37</td>
</tr>
<tr>
<td>Gestational age at birth (weeks)</td>
<td>37.9 (2.71)</td>
<td>37.3 (2.87)</td>
<td>0.15</td>
</tr>
<tr>
<td>Preterm infants (&lt;37 weeks)</td>
<td>19 (23%)</td>
<td>27 (34%)</td>
<td>0.16</td>
</tr>
<tr>
<td>Infant weight at study visit 1 (Kg)</td>
<td>5.08 (1.27)</td>
<td>5.19 (1.25)</td>
<td>0.55</td>
</tr>
</tbody>
</table>
Infant age at study visit 1 (days) 75 (28) 81 (29) 0.18
Infant weight at study visit 2 (Kg)** 6.86 (1.22) 6.60 (1.15) 0.22
Infant age at study visit 2 (days)** 145 (33) 149 (33) 0.55

Values are in N (%) or mean (SD)
† Chi-square or student’s t-test used for test of significance
§ Fisher’s exact test for significance
* N=8 twins in study, data on first twin reported in table
** N=60 assessed on study visit 2 in the intervention group, N=66 assessed on study visit 2 in the control group

3.2.2 Characteristics of dropout parents

Altogether, 126 parents completed follow-up for both study visits (study visit 1 and 2) while 34 parents were lost to follow-up on study visit 2. Characteristics of dropout parents and non dropout parents are listed below in Table 9. No differences were found between both groups for maternal education, number of children, and infant weight. Interestingly, there were less male infants in the dropout group 35% (N=12) than in the non dropout group 60% (N=75), p<0.01.

Table 9: Characteristics of dropout parents vs. non-dropout parents

<table>
<thead>
<tr>
<th></th>
<th>Dropout group (N=34)</th>
<th>Non-dropout group (N=126)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education completed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University/College</td>
<td>25 (74%)</td>
<td>107 (85%)</td>
<td>0.12</td>
</tr>
<tr>
<td>High school/Grade school</td>
<td>9 (26%)</td>
<td>19 (15%)</td>
<td></td>
</tr>
<tr>
<td>Number of children in the family:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>19 (56%)</td>
<td>74 (59%)</td>
<td>0.13</td>
</tr>
<tr>
<td>2</td>
<td>8 (24%)</td>
<td>41 (32%)</td>
<td></td>
</tr>
<tr>
<td>3 or more</td>
<td>7 (20%)</td>
<td>11 (9%)</td>
<td></td>
</tr>
<tr>
<td>Infant weight at study visit 1 (Kg)*</td>
<td>4.99 (1.01)</td>
<td>5.18 (1.32)</td>
<td>0.38</td>
</tr>
<tr>
<td>Infant sex (males)*</td>
<td>12 (35%)</td>
<td>76 (60%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Infant age (days)*</td>
<td>67 (17)</td>
<td>81 (31)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Values are in N (%) or mean (SD)

† Chi-square or Student’s t-test used for test of significance

* N=8 twins in study, data on first twin reported in table

3.3 Primary Outcome of Study: Utilization of Pain Management Methods

3.3.1 Utilization on study visit 1

For both injections on study visit 1 there was a higher frequency of analgesic strategy utilization in the intervention group vs. the control group when examining the use of one or more of the four analgesic strategies (holding, breastfeeding, topical anaesthetics, and sugar water) in N=64 (80%) vs. N=21 (26%), p<0.01, respectively (Table 10). The rate of utilization of pain relieving strategies was the same for both the injections during study visit 1. One parent transitioned from breastfeeding during the first injection to holding during the second injection in the control group. Nine (11%) and 10 (13%) of parents in the intervention group used two analgesic strategies in combination for the first injection and second injections, respectively. No participants in the control group were found to utilize more than 1 of the main four analgesic strategies for both injections on the first study visit.

Examining specific strategy use for the first injection amongst intervention and control groups, results indicated increased use of holding [N=41 (51%) in the intervention group vs. N=15 (19%) in the control group, p<0.01], breastfeeding [N=20 (25%) in the intervention group vs. N=6 (8%) in the control group, p<0.01], and sugar water [N=12 (15%) in the intervention group vs. N=0 (0%) in the control group, p<0.01]. Strategies used for the second injections were similar: holding [N=41 (51%) in the intervention group vs. N=16 (20%) in the control group, p<0.01], breastfeeding [N=20 (25%) in the intervention group vs. N=5 (6%) in the control group, p<0.01], and sugar water [N=13 (16%) in the in the intervention group vs. N=0 (0%) in the control group, p<0.01].
Table 10: Pain management interventions utilized during both injections on the first study visit

<table>
<thead>
<tr>
<th>Intervention (N=80)</th>
<th>Control (N=80)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First injection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Utilization of pain relieving strategies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holding</td>
<td>41 (51%)</td>
<td>15 (19%)</td>
</tr>
<tr>
<td>Breastfeeding</td>
<td>20 (25%)</td>
<td>6 (8%)</td>
</tr>
<tr>
<td>Topical Anaesthetics</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sugar Water</td>
<td>12 (15%)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of pain relieving strategies used altogether</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>16 (20%)</td>
<td>59 (74%)</td>
</tr>
<tr>
<td>1 or more</td>
<td>64 (80%)</td>
<td>21 (26%)</td>
</tr>
<tr>
<td><strong>Other pain relieving strategies used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacifier</td>
<td>11 (14%)</td>
<td>8 (10%)</td>
</tr>
<tr>
<td>Bottle feeding</td>
<td>3 (4%)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Second Injection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Utilization of pain relieving strategies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holding</td>
<td>41 (51%)</td>
<td>16 (20%)</td>
</tr>
<tr>
<td>Breastfeeding</td>
<td>20 (25%)</td>
<td>5 (6%)</td>
</tr>
<tr>
<td>Topical Anaesthetics</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sugar Water</td>
<td>13 (16%)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of pain relieving strategies used altogether</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>16 (20%)</td>
<td>59 (74%)</td>
</tr>
<tr>
<td>1 or more</td>
<td>64 (80%)</td>
<td>21 (26%)</td>
</tr>
<tr>
<td><strong>Other pain relieving strategies used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacifier</td>
<td>11 (14%)</td>
<td>7 (9%)</td>
</tr>
<tr>
<td>Bottle feeding</td>
<td>3 (4%)</td>
<td>0</td>
</tr>
</tbody>
</table>

Values are in N (%)

† Modeled using regression fitted with GEE
3.3.2 Utilization on study visit 2

On study visit 2 (~2 months from study visit 1) we saw a similar trend in that there was higher strategy utilization in the intervention group vs. the control group in examining the use of one or more of the targeted four analgesic strategies, \(N=41\) (68%) vs. \(N=21\) (32%), \(p<0.01\), respectively. Compared to study visit 1 however there was a decrease in analgesic strategy utilization from 80% on study visit 1 to 68% on study visit 2. Table 11 below shows analgesic utilizations for both injections on study visit 2. Results for injection 2 analgesic strategy utilization in one or more of the targeted strategies were similar to that of injection 1 between the intervention and control groups: \(N=41\) (68%) vs. \(N=20\) (30%), \(p<0.01\), respectively. Two (3%) and 3 (5%) of parents in the intervention group used two analgesic strategies in combination for the first and second injections, respectively. No participants in the control group were found to utilize more than 1 of the four main analgesic strategies for both injections on study visit 2.

Examining specific strategy use on the follow-up study visit 2 for the first injection amongst intervention and control groups, results indicated increased use of holding \(\text{[N}=28\text{ (47%)}\text{ in the intervention group vs. N}=17\text{ (26%)}\text{ in the control group, }p<0.01\text{]}\), and breastfeeding \(\text{[N}=11\text{ (18%)}\text{ in the intervention group vs. N}=4\text{ (6%)}\text{ in the control group, }p<0.01\text{]}\). Use of topical anaesthetics was: \(\text{[N}=2\text{ (3%)}\text{ vs. N}=0\text{ (0%)}\text{]}\) and use of sugar water was \(\text{[N}=2\text{ (3%)}\text{ vs. N}=0\text{ (0%)}\text{]}\) in the intervention and control groups, respectively. Strategy utilization for the strategies during the second injections was similar for holding \(\text{[N}=27\text{ (45%)}\text{ in the intervention group vs. N}=16\text{ (24%)}\text{ in the control group, }p<0.01\text{]}\), and breastfeeding \(\text{[N}=12\text{ (20%)}\text{ in the intervention group vs. N}=4\text{ (6%)}\text{ in the control group, }p<0.01\text{]}\). Use of topical anaesthetics during the second injections was \(\text{[N}=2\text{ (3%)}\text{ vs. N}=0\text{ (0%)}\text{]}\) and use of sugar water was \(\text{[N}=3\text{ (5%)}\text{ vs. N}=0\text{ (0%)}\text{]}\), in the intervention and control groups, respectively. As shown, strategy use by parents was consistent between both injections on the same study visit appointment.
Table 11: Pain management interventions utilized during both injections on the second study visit

<table>
<thead>
<tr>
<th>Intervention (n=60)</th>
<th>Control (n=66)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Utilization of pain relieving strategies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holding</td>
<td>28 (47%)</td>
<td>17 (26%)</td>
</tr>
<tr>
<td>Breastfeeding</td>
<td>11 (18%)</td>
<td>4 (6%)</td>
</tr>
<tr>
<td>Topical Anaesthetics</td>
<td>2 (3%)</td>
<td>0</td>
</tr>
<tr>
<td>Sugar Water</td>
<td>2 (3%)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of pain relieving strategies used altogether</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>19 (32%)</td>
<td>45 (68%)</td>
</tr>
<tr>
<td>1 or more</td>
<td>41 (68%)</td>
<td>21 (32%)</td>
</tr>
<tr>
<td><strong>Other pain relieving strategies used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacifier</td>
<td>7 (12%)</td>
<td>9 (14%)</td>
</tr>
<tr>
<td>Bottle feeding</td>
<td>2 (3%)</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intervention (n=60)</th>
<th>Control (n=66)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Utilization of pain relieving strategies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holding</td>
<td>27 (45%)</td>
<td>16 (24%)</td>
</tr>
<tr>
<td>Breastfeeding</td>
<td>12 (20%)</td>
<td>4 (6%)</td>
</tr>
<tr>
<td>Topical Anaesthetics</td>
<td>2 (3%)</td>
<td>0</td>
</tr>
<tr>
<td>Sugar Water</td>
<td>3 (5%)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of pain relieving strategies used altogether</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>19 (32%)</td>
<td>46 (70%)</td>
</tr>
<tr>
<td>1 or more</td>
<td>41 (68%)</td>
<td>20 (30%)</td>
</tr>
<tr>
<td><strong>Other pain relieving strategies used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacifier</td>
<td>7 (12%)</td>
<td>9 (14%)</td>
</tr>
<tr>
<td>Bottle feeding</td>
<td>2 (3%)</td>
<td>0</td>
</tr>
</tbody>
</table>

Values are in N (%)  
† Modeled using regression fitted with GEE
3.3.3 Post-hoc analyses

3.3.3.1 Utilization rates of preterm infants

As shown in the demographics table (Table 8) the proportion of preterm infants in both study groups were >20% and a post-hoc analysis was performed to determine whether parents of this subset of infants had different pain management utilization tendencies than the rest of the group.

Results for study visit 1 showed 14 out of 19 (74%) parents of preterm infants vs. 50 out of 61 (82%) parents of term infants (p=0.43), utilized 1 or more of the 4 measured strategies in the intervention group. For control infants on study visit 1, 4 out of 27 (15%) parents of preterm vs. 17 out of 53 (32%) parents of term infants (p=0.10), utilized 1 or more of the measured strategies. Similarly for study visit 2, 9 out of 13 (69%) parents of preterm infants vs. 32 out of 47 (68%) parents of term infants (p=0.94), utilized 1 or more of the measured strategies in the intervention group. Lastly, for study visit 2, 9 out of 26 (35%) of parents of preterm infants vs. 12 out of 40 (30%) parents of term infants utilized 1 or more of the measured strategies in the control group.

3.3.3.2 Utilization patterns among paediatricians

A post-hoc analysis on the effect of the 7 paediatricians that practiced at this clinic was performed to determine if differences in utilization rates existed. At study visit 1, 4 paediatricians in the intervention group who administered vaccines had utilization rates that ranged between 76% and 83% (p=0.91). Similarly, 3 paediatricians in the control group who administered vaccines had utilization rates that ranged between 20%-29% (p=0.76). At study visit 2, the utilization rates ranged between 65% and 71% (p=0.99) for the paediatricians in the intervention group and for the control group the rates ranged between 0% and 37% (p=0.99).
3.3.3.3 Utilization rates between first and second visits

Forty-eight of the 60 (80%) parents that completed study visit 2 utilized 1 or more of the pain relieving strategies at study visit 1 in the intervention group. The rate of utilization of pain relieving strategies at study visit 1 was identical among participants [16 of the 20 (80%)] in the intervention group. For control group parents, 17 out of the 66 (26%) parents that completed study visit 2 utilized 1 or more strategies at study visit 1. This was similar to the utilization of drop out control parents who did not attend study visit 2 where 4 of the 14 (29%) parents utilized 1 or more strategies at study visit 1.
3.4 Secondary Outcomes of Study

3.4.1 Multiple testing of secondary outcome variables

Due to the multiplicity of testing, the significance level of secondary outcomes of the study was adjusted using the Bonferroni correction. The Bonferroni correction sets a more conservative estimate of significance level by dividing the critical p value ($\alpha$) by the number of comparisons (k) being performed. The six outcomes examined were: 1) MBPS post score (mean of first 15 seconds post each injection), 2) cry time 0-120 seconds (post both injections), 3) parent NRS score (post both injections), 4) observer NRS score post-injection 2, 5) MAISD score for physical comfort, and 6) parent satisfaction with comfort level. Given the new significance level calculated to be 0.008, whereby $\alpha=0.05$ and k=6. Table 12 below shows results for the secondary outcomes listed above.

Examining the results with this new significance level for study visit 1 outcomes, MAISD physical comfort (33.1 vs. 42.1, p<0.0001), mean observer NRS post injections (5.0 vs. 5.7, p<0.0001), and parent satisfaction (71% vs. 51%, p<0.0001) were found to be significantly different between the intervention and control groups, respectively. At study visit 2, mean MBPS scores of both injections (7.8 vs. 8.2, p=0.0019) and mean observer NRS post injection (4.7 vs. 5.5, p=0.0023) were found to be significantly different between the intervention and control groups, respectively.

Table 12: Secondary outcomes of the study±

<table>
<thead>
<tr>
<th>Study visit 1</th>
<th>Intervention (n=80)</th>
<th>Control (n=80)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean MBPS post injection 1 and 2 (0-15 seconds), mean (SD)</td>
<td>8.3 (1.2)</td>
<td>8.5 (1.0)</td>
<td>0.1067</td>
</tr>
<tr>
<td>Cry time post injection 2 (0-120 sec), mean (SD)</td>
<td>44.1 (28.9)</td>
<td>41.1 (26.5)</td>
<td>0.0192</td>
</tr>
<tr>
<td>MAISD physical comfort, %mean (%SD)</td>
<td>33.1 (26.5)</td>
<td>42.1 (31.8)</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Parent NRS post-injection study visit 1, mean (SD)</td>
<td>6.5 (1.9)</td>
<td>6.9 (2.0)</td>
<td>0.1208</td>
</tr>
<tr>
<td>Study visit 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcomes</td>
<td>Intervention (n=60)</td>
<td>Control (n=66)</td>
<td>P-value†</td>
</tr>
<tr>
<td>Mean MBPS score post injection 1 and 2 (0-15 seconds), mean (SD)</td>
<td>7.8 (1.3)</td>
<td>8.2 (1.4)</td>
<td>0.0019*</td>
</tr>
<tr>
<td>Cry time post injection 2 (0-120 sec), mean (SD)</td>
<td>47.2 (27.8)</td>
<td>48.3 (30.4)</td>
<td>0.6187</td>
</tr>
<tr>
<td>MAISD physical comfort, %mean (%SD)</td>
<td>42.8 (32.0)</td>
<td>44.8 (34.3)</td>
<td>0.8213</td>
</tr>
<tr>
<td>Parent NRS post-injection study visit 2, mean (SD)</td>
<td>6.4 (2.0)</td>
<td>6.9 (2.1)</td>
<td>0.0598</td>
</tr>
<tr>
<td>Average observer NRS post injection 1 and 2, mean (SD)</td>
<td>4.7 (2.0)</td>
<td>5.5 (2.0)</td>
<td>0.0023*</td>
</tr>
<tr>
<td>Parent satisfaction at study visit 2 – Comfort level for your baby for procedure, N (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very satisfied</td>
<td>39 (65%)</td>
<td>42 (64%)</td>
<td>0.7167</td>
</tr>
<tr>
<td>Else (collapsed)</td>
<td>21 (35%)</td>
<td>24 (36%)</td>
<td></td>
</tr>
</tbody>
</table>

† Modeled using regression fitted with GEE

± P-value significance assessed as per Bonferroni correction (p<0.008).

* Denotes a statistically significant value, p<0.008
3.4.2 Infant pain from modified behavioural pain score (MBPS)

Outcome data for pain scores as assessed by the 10-point MBPS scale on study visit 1 and study visit 2 are shown in Table 13. Differences in pain scores were found between groups at baseline for both injections but no differences were seen in the pain scores post injections 1 and 2. Acute pain scores post first injection [7.7(1.8) vs. 7.9(1.6); p=0.44] and second injection [9.1(0.7) vs. 9.2(0.7); p=0.31] were not statistically significantly different between the intervention vs. control groups respectively. Pain scores on recovery (60-75 seconds after the second injection) were also not statistically significantly different [4.0(1.8) vs. 4.3(2.1); p=0.42] between the two groups.

The primary pain outcome measure of average pain scores on study visit 1 of both injection 1 and 2 post-injection were non-significant between the intervention vs. control group: [8.3(1.2) vs. 8.5(1.0), p=0.11].

On study visit 2 differences in pain scores were found between groups post-injections. Acute pain post first injection [6.7(2.1) vs. 7.3(2.2); p=0.02] and second injection [8.6(1.0) vs. 9.2(0.9); p<0.01] were significantly lower in the intervention vs. control groups, respectively. Pain scores on recovery (60-75 seconds after the second injection) were not statistically significantly different [4.2(1.9) vs. 4.5(2.2); p=0.07] in the intervention vs. control groups, respectively.

For the primary pain outcome measure of average pain scores post injection on study visit 2, pain scores were significantly lower in the intervention group than the control, [7.8(1.3) vs. 8.2(1.4), p=0.002].

Table 13: Pain scores of infants on the first and second study visits

<table>
<thead>
<tr>
<th>Study visit 1</th>
<th>Intervention (n=80)</th>
<th>Control (n=80)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phases of the procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Injection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline at 15-0 seconds before</td>
<td>2.9 (1.7)</td>
<td>3.4 (2.0)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td></td>
<td>Intervention (n=60)</td>
<td>Control (n=66)</td>
<td>P-value†</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------</td>
<td>----------------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>First Injection</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline at 15-0 seconds before</td>
<td>3.0 (1.7)</td>
<td>3.2 (1.8)</td>
<td>0.5151</td>
</tr>
<tr>
<td>Post at 0-15 seconds after</td>
<td>6.7 (2.1)</td>
<td>7.3 (2.2)</td>
<td>0.0170</td>
</tr>
<tr>
<td><strong>Second Injection</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline at 15-0 seconds before</td>
<td>4.2 (2.3)</td>
<td>4.9 (2.8)</td>
<td>0.0895</td>
</tr>
<tr>
<td>Post at 0-15 seconds after</td>
<td>8.6 (1.0)</td>
<td>9.2 (0.9)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Recovery phase at 60-75 seconds after</td>
<td>4.2 (1.9)</td>
<td>4.5 (2.2)</td>
<td>0.0675</td>
</tr>
<tr>
<td>Average baseline score from injection 1 and injection 2</td>
<td>3.6 (1.8)</td>
<td>4.1 (1.9)</td>
<td>0.1969</td>
</tr>
<tr>
<td>Average post score from injection 1 and injection 2±</td>
<td>7.8 (1.3)</td>
<td>8.2 (1.4)</td>
<td>0.0019*</td>
</tr>
</tbody>
</table>

Values are in mean (SD)

† Modeled using regression fitted with GEE

± Main outcome assessed as per Bonferroni correction

* Denotes a statistically significant value, p<0.008
3.4.2.1 Effect of utilization on MBPS scores

*Post-hoc* analyses determining the effect of utilization of 1 or more strategies on the MBPS scores revealed no lowering of pain scores from utilization on study visit 1 but a lowering of pain scores on study visit 2. The average post-injection 1 and 2 pain score on study visit 1 proved to have no significant effect on the coefficient for utilization, \(-0.13 \ [95\% \ CI; -0.30,0.04], \ p=0.14\). On study visit 2 the average post-injection 1 and 2 pain score was found to be lower in infants with 1 or more utilizations, illustrating an effect on the coefficient for utilization, \(-0.36 \ [95\% \ CI; -0.64,-0.08], \ p=0.01\). Thus a -0.36 point lower MBPS score was observed in infants whose parents utilized 1 or more strategies than those who utilized none.

3.4.2.2 Reliability of MBPS scores

Intra-rater reliability was tested on N=32 (~25%) of infants. Sixteen infant-parent dyads came from the intervention group, and 16 came from the control group. The intraclass correlation (ICC) was found to be in the range of 0.87-1.00. Inter-rater reliability was tested with a second rater on N=8 (5%) of the pain scores and the ICC found was in the range of 0.87-0.97.

3.4.3 Maternal and infant soothing distress (MAISD) of parents

Parent behaviour during the immunization appointments were captured using the MAISD tool. Only selected components of the MAISD were sought as most were not observed in the majority of parents and clinicians. Table 14 below shows the mean percentage of behaviour occurrences before the first injection and after the second injection for the following behaviours: verbal distraction, physical comfort, rocking, and verbal reassurance. The main outcome assessed for this measure was physical comfort.

Results on study visit 1 showed no differences in behaviours of parents at baseline between the intervention and control groups. For our primary behaviour outcome of MAISD, physical comfort there was a statistically significant difference seen at the
Bonferroni correction significance level for the post injection phase between the intervention vs. control groups [33.1\% vs. 42.1\%; \( p<0.008 \)]. During the second study visit, no significant differences were observed for physical comfort, rocking, and verbal reassurance.

Table 14: Soothing behaviours of parents during the first and second study visits

<table>
<thead>
<tr>
<th>Study visit 1</th>
<th>0-60 seconds AFTER Injection</th>
<th>Intervention ( (n=80) )</th>
<th>Control ( (n=80) )</th>
<th>P-value(^\dagger)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distraction (verbal by parent)</td>
<td>3.7 (8.6)</td>
<td>3.3 (13.1)</td>
<td>0.2312</td>
<td></td>
</tr>
<tr>
<td>Physical comfort (by parent)</td>
<td>33.1 (26.5)</td>
<td>42.1 (31.8)</td>
<td>&lt;0.0001*</td>
<td></td>
</tr>
<tr>
<td>Rocking (by parent)</td>
<td>29.9 (29.6)</td>
<td>25.2 (29.9)</td>
<td>0.0002</td>
<td></td>
</tr>
<tr>
<td>Verbal reassurance (by parent)</td>
<td>16.8 (18.2)</td>
<td>15.3 (20.9)</td>
<td>0.4774</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study visit 2</th>
<th>0-60 seconds AFTER Injection</th>
<th>Intervention ( (n=80) )</th>
<th>Control ( (n=80) )</th>
<th>P-value(^\dagger)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distraction (verbal by parent)</td>
<td>1.9 (9.1)</td>
<td>2.1 (9.7)</td>
<td>0.8722</td>
<td></td>
</tr>
<tr>
<td>Physical comfort (by parent)</td>
<td>42.8 (32.0)</td>
<td>44.8 (34.3)</td>
<td>0.8213</td>
<td></td>
</tr>
<tr>
<td>Rocking (by parent)</td>
<td>33.6 (30.8)</td>
<td>32.7 (34.2)</td>
<td>0.8338</td>
<td></td>
</tr>
<tr>
<td>Verbal reassurance (by parent)</td>
<td>16.4 (15.7)</td>
<td>17.9 (18.4)</td>
<td>0.4055</td>
<td></td>
</tr>
</tbody>
</table>

Values are in \%mean (\%SD)

\(^\dagger\) Modeled using regression fitted with GEE

\(\pm\) Main outcome assessed as per Bonferroni correction

* Denotes a statistically significant value, \( p<0.008 \)
3.4.3.1 Reliability of parent MAISD scores

Intra-rater reliability was tested on N=32 (~25%) of infants. Sixteen infant-parent dyads came from the intervention group, and 16 came from the control group. The intraclass correlation (ICC) was found to be in the range of 0.87-0.97 with the exception of ICC for coding distraction, which was found to be 0.49 (95% CI 0.25-0.73).

3.4.4 Parent satisfaction with infant immunizations

Parent report on their satisfaction with the comfort level of their infant during the immunizations, and the degree to which parents felt they comforted their infant, are displayed in Table 15 below. On study visit 1 parents in the intervention group reported to be “very satisfied” significantly more than parents in the control group, N=57 (71%) vs. N=41 (51%), p<0.0001 respectively. During the second study visit however, N=39 (65%) of parents reported that they were “very satisfied” with the comfort of their baby in the intervention group, and a similar proportion, N=42 (64%) reported the same in the control group (p=0.72).

Table 15: Parent opinions on procedural satisfaction and educational materials provided from the first and second study visits±

<table>
<thead>
<tr>
<th>Item</th>
<th>Intervention (N=80)</th>
<th>Control (N=80)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study visit 1 – Comfort level of your baby for the procedure\textsuperscript{a}</td>
<td>Very satisfied</td>
<td>57 (71%)</td>
<td>41 (51%)</td>
</tr>
<tr>
<td></td>
<td>Else (collapsed)</td>
<td>23 (29%)</td>
<td>39 (49%)</td>
</tr>
<tr>
<td>Study visit 2 – Comfort level of your baby for the procedure\textsuperscript{b}</td>
<td>Very satisfied</td>
<td>39 (65%)</td>
<td>42 (64%)</td>
</tr>
<tr>
<td></td>
<td>Else (collapsed)</td>
<td>21 (35%)</td>
<td>24 (36%)</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Study visit 1: N=80 in the intervention and control group

\textsuperscript{b} Study visit 2: N=60 in the intervention group and N=66 in the control group

Values are in N (%)

† Modeled using logistic regression fitted with GEE
± Main outcome assessed as per Bonferroni correction (p<0.008)

* Denotes a statistically significant value, p<0.008

3.4.5 Parent and observer pain scores

3.4.5.1 Parent reported pain scores from numerical rating scale

Parent-reported infant pain scores of the immunization injections at study visit 1 and 2 are shown in Table 16. Results from study visit 1 show that parents in the intervention group rated their infant’s pain 0.4 units lower than the control group, however this difference was not statistically significant [6.5(1.9) vs. 6.9(2.0); p=0.12]. NRS scores on study visit 2 showed a similar trend in that parents in the intervention group rated their infant’s pain 0.5 units lower than the control group however this difference was also not significant [6.4(2.0) vs. 6.9(2.1) p=0.06].

Table 16: Parent-rated infant pain using 0-10 Numerical Rating Scale (NRS) ±

<table>
<thead>
<tr>
<th></th>
<th>Intervention (N=80)</th>
<th>Control (N=80)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study visit 1, Mean (SD)a</td>
<td>6.5 (1.9)</td>
<td>6.9 (2.0)</td>
<td>0.1208</td>
</tr>
<tr>
<td>Study visit 2, Mean (SD)b</td>
<td>6.4 (2.0)</td>
<td>6.9 (2.1)</td>
<td>0.0598</td>
</tr>
</tbody>
</table>

a Study visit 1: N=80 in the intervention and control group
b Study visit 2: N=60 in the intervention group and N=66 in the control group

Values are in mean (SD)
‡ Modeled using logistic regression fitted with GEE
± Main outcome assessed as per Bonferroni correction

* Denotes a statistically significant value, p<0.008
### 3.4.5.2 Observer reported pain scores from numerical rating scale

Observer-rated infant pain scores from both immunization injections at study visit 1 and 2 are shown in Table 17. Results for study visit 1 show that infants in the intervention group experienced less pain than infants in the control group infants post-injection 1, 3.5(1.8) vs. 4.1(2.1), p<0.01, respectively. Similarly observer reported pain score was statistically significantly lower post-injection 2 in the intervention group vs. the control group, 6.7(1.8) vs. 7.4(1.9), p<0.01. On study visit 2 observer-rated infant pain was non significant for post-injection 1 between the intervention and control groups 3.0(2.2) vs. 3.7(2.3), p=0.09, respectively; but was significant for post-injection 2, 6.4(2.1) vs. 7.2(2.0), p<0.01 for intervention and control groups, respectively.

The primary method of assessment of the outcome was the observer rated average post-injection 1 and 2 NRS scores. Results showed that at study visit 1 intervention group infant pain was significantly lower than control group infant pain at the corrected p-value, [5.0 vs. 5.7, p<0.0001]. At study visit 2, infant pain scores were again significantly lower in the intervention group vs. the control group, [4.7 vs. 5.5, p=0.002].

### Table 17: Observer-rated infant pain using 0-10 Numerical Rating Scale (NRS)

<table>
<thead>
<tr>
<th>Phases of the procedure</th>
<th>Intervention (N=80)</th>
<th>Control (N=80)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Injection</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline before injection, mean (SD)</td>
<td>0.2 (0.7)</td>
<td>0.3 (1.0)</td>
<td>0.2082</td>
</tr>
<tr>
<td>Post after injection, mean (SD)</td>
<td>3.5 (1.8)</td>
<td>4.1 (2.1)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Second Injection</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline before injection, mean (SD)</td>
<td>0.9 (1.5)</td>
<td>1.5 (1.7)</td>
<td>0.0002</td>
</tr>
<tr>
<td>Post after injection, mean (SD)</td>
<td>6.7 (1.8)</td>
<td>7.4 (1.9)</td>
<td>0.0006</td>
</tr>
<tr>
<td>Average post NRS for injection 1 and injection 2, mean (SD)±</td>
<td>5.0 (1.7)</td>
<td>5.7 (1.8)</td>
<td>&lt;0.0001*</td>
</tr>
</tbody>
</table>

*Study visit 2 (follow-up)*
## 3.4.6 Infant pain assessed by cry duration

Observer-rated infant cry duration after both immunization injections on study visit 1 and 2 are shown in Table 18. The primary method of assessment for cry duration was cry duration of infant for 0-120 second after the second injection. There was no difference found in the 0-120 seconds post-injection 2 score at the corrected p-value significance between the intervention and control groups: 44.1(28.9) vs. 41.1(26.5), p=0.02. On study visit 2, no differences were again found in the 0-120 post second injection score between the groups: 47.2 vs. 48.3, p=0.62.

<table>
<thead>
<tr>
<th>Phases of the procedure</th>
<th>Intervention (n=80)</th>
<th>Control (n=80)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline at injection 1 (15-0 sec before)</td>
<td>1.8 (3.8)</td>
<td>1.7 (4.1)</td>
<td>0.6955</td>
</tr>
</tbody>
</table>
### Study visit 2 (follow-up)

<table>
<thead>
<tr>
<th></th>
<th>Intervention (n=60)</th>
<th>Control (n=66)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline at injection 1 (15-0 sec before injection)</td>
<td>1.1 (3.1)</td>
<td>2.2 (4.8)</td>
<td>0.0201</td>
</tr>
<tr>
<td>Post injection 2 (0-120 sec after second injection)±</td>
<td>47.2 (27.8)</td>
<td>48.3 (30.4)</td>
<td>0.6187</td>
</tr>
</tbody>
</table>

Values are in mean (SD)

† Modeled using logistic regression fitted with GEE

± Main outcome assessed. P-value significance assessed as per Bonferroni correction (p<0.008).

### 3.4.6.1 Reliability of cry duration

Intra-rater reliability was tested on N=32 (~25%) of infants. Sixteen infant-parent dyads came from the intervention group, and 16 came from the control group. The intraclass correlation (ICC) was found to be in the range of 0.91-1.00. Inter-rater reliability was tested with a second-rater on N=8 (5%) of the pain scores and the ICC found was in the range of 0.95-1.00.

### 3.4.7 Failed attempts of strategy utilization

A post-hoc analysis was performed on failed attempts of strategy utilization of breastfeeding, holding. See Table 18 for results. Two mothers (2.5%) in the intervention group and one mother (1.25%) in the control group on study visit 1 were unable to latch their infant during the first and second injections. On the second study visit day, two mothers (2.5%) in the intervention group and one mother (1.25%) in the control group were unable to latch their infant during the first and second injections.
Some parents also failed to utilize the proper technique for holding their infant during immunizations. Videotape analysis of study day 1 revealed two instances of failed holding techniques (2.5%) in the intervention group and one instance of failed holding techniques (1.25%) for both the first and second injections. On the second study visit day, four mothers (5%) in the intervention group and six mothers (7.5%) in the control group used the holding strategy incorrectly during the first injection. During the second injection four mothers (5%) in the intervention group did not use the holding strategy correctly and eight mothers (10%) in the control group did not use the holding strategy correctly.

Table 19: Failed holding and breastfeeding utilization attempts of parents during the first and second study visits

<table>
<thead>
<tr>
<th>Study visit 1</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Phases of the procedure</td>
<td>Intervention (N=80)</td>
<td>Control (N=80)</td>
</tr>
<tr>
<td>First Injection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failed breastfeeding attempts</td>
<td>2 (2.5%)</td>
<td>1 (1.25%)</td>
</tr>
<tr>
<td>Failed holding attempts</td>
<td>2 (2.5%)</td>
<td>1 (1.25%)</td>
</tr>
<tr>
<td>Second Injection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failed breastfeeding attempts</td>
<td>2 (2.5%)</td>
<td>1 (1.25%)</td>
</tr>
<tr>
<td>Failed holding attempts</td>
<td>2 (2.5%)</td>
<td>1 (1.25%)</td>
</tr>
<tr>
<td>Study visit 2 (follow-up)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intervention (N=60)</td>
<td>Control (N=66)</td>
</tr>
<tr>
<td>First Injection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failed breastfeeding attempts</td>
<td>2 (2.5%)</td>
<td>1 (1.25%)</td>
</tr>
<tr>
<td>Failed holding attempts</td>
<td>4 (5%)</td>
<td>6 (7.5%)</td>
</tr>
<tr>
<td>Second Injection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failed breastfeeding attempts</td>
<td>2 (2.5%)</td>
<td>1 (1.25%)</td>
</tr>
<tr>
<td>Failed holding attempts</td>
<td>4 (5%)</td>
<td>8 (10%)</td>
</tr>
</tbody>
</table>

Values are in N (%)
4 Discussion

4.1 Summary of results

To our knowledge this is the first study that evaluates the impact of infant immunization pain management education in an outpatient setting. The educational intervention was successful in increasing the utilization of one or more selected analgesic pain management strategies during the first and second (2-month follow-up appointment) immunization appointments (study visit 1 and study visit 2). Particularly, significant increases in the strategy use during the first visit for breastfeeding, holding, and sugar water were seen in the intervention group compared to the control group (p<0.05). This difference sustained for study visit 2 in the strategies for breastfeeding and holding but tapered for sugar water. Validated tools used to blindly assess pain scores (MBPS) revealed that parents that utilized one or more strategies had significantly lower acute pain scores for injections than parents that did not utilize any of the strategies, but this difference was only shown on the second visit day and not first. Parents in the control group exhibited greater physical soothing behaviour post injection at their first visit than their intervention comparators (p<0.001); this difference disappeared at the second visit. Intervention parents reported greater satisfaction with their infant’s immunization procedure in the first visit, during the second visit however, parents in the intervention group reported similar satisfaction with their immunization procedure as compared to the control parents. Mean NRS observer report of infant pain from both injections revealed significant differences between intervention and control groups at study visit 1 and study visit 2. Cry duration for the first 2 minutes after both injections did not differ between groups for infants on the first and second study visits.

4.2 Study flow and participant characteristics

The study assessed 160 parents from 4 study clinics, where all parents completed the 1st follow-up appointment on study visit 1 and 126 (79%) parents completed their 2nd
follow-up appointment on study visit 2. Characteristics between dropout parents and infants were similar in maternal characteristics of education level and family size and infant weight but different for infant sex. It is likely that this difference was due to chance and no effect was seen on the outcomes of the study similar to other studies that have seen a difference in infant sex.9

The majority of loss to follow-up was due to parents changing health care provider (paediatrician/family physician) to provide primary care for their infant between study visit 1 and 2 (two month later follow-up). Six parents (3 participants in each group) that arrived for study visit 2 refused follow-up citing an unspecified “inconvenience” incurred from study participation during the first visit prompting them to decline follow-up. Additionally, paediatricians in the study clinic do not usually provide prolonged primary care services. The paediatricians at the clinic typically only accept patients for primary care when the parents either do not have an identified caregiver for their infant or are not able to secure an appointment in a timely manner. Therefore paediatricians in this clinic will see families during this transitional period and parents have to commute from their place of residence to this clinic, which is a major inconvenience especially in the winter season.

Demographic characteristics of mothers and infants collected in the study were similar for both intervention and control groups. Maternal demographics related to education level, and ethnicity were found to be typical of what is seen in the area of Toronto where the clinic location served as the majority of the population were college/university graduates and of Caucasian decent.105

4.3 Increased utilization of pain management strategies

The primary outcome assessed in this study was determining the increased use of effective analgesic strategies secondary to the education provided to parents. The four strategies chosen to determine this outcome were based on findings from pain audits illustrating their rare use in the primary care settings,7,8,10 despite their proven
effectiveness in providing pain relief. Results showed that providing parents with a written handout and showing them a short video on the effectiveness of these strategies increased their use of at least 1 or more of these strategies (p<0.01) during their infant’s immunizations during their current and follow-up appointments. Four out of every five parent (80%) in the intervention group used 1 or more analgesic strategies while only 1 out of every 4 parent (26%) in the control group used 1 or more analgesic strategies.

The particular increase in the use of these strategies in the education group vs. the control group was seen in holding (51% vs. 19%), breastfeeding (25% vs. 8%), and sugar water (15% vs. 0%). Nevertheless these results are consistent with a recent study published by our study team. In this study parents were provided education on pain management strategies for immunization in prenatal class and a similar increase in utilization of these strategies were noted. Similar to the outcomes measured in this study, the prenatal education study measured utilization of 3 strategies (topical anaesthetics, sugar water, and breastfeeding) and found that parents in the education reported significantly more use than parents in the control group (34% vs. 17%, p<0.01). In addition, the results of our studies also found a marked an increase in the use of analgesic strategies compared to our previous studies.

These results demonstrate that our education method was efficacious in increasing utilization of holding, and breastfeeding during the initial and the follow-up (two months after) appointment. Strategy utilization was likely high for these two strategies as these two comforting methods are the most readily available to utilize for parents. Strategies such as topical anaesthetics require purchase and planning ahead of time as their administration must be at least 30 minutes before injections. Similarly sugar water requires preparation from home or can be asked for by the parent if the clinic supplies it.

Although, overall use of strategies remained high in the intervention group at the follow-up appointment between the educational and control group there was a decrease in the utilization strategies overall 80% vs. 68% in the use of 1 or more strategies. Particularly there was a marked decrease in the use of sugar water between the first appointment (13%) and the follow-up appointment (5%). This trend could have been due to three
reasons: 1) during the follow-up appointment no reinforcement regarding the educational material was provided, 2) as all sugar water use occurred from the convenience of the clinic providing this strategy upon request, parents during the second visit did not ask for its use nor did they prepare sugar water from home ahead of time, and 3) educational methods have been shown to be less effective long-term as shown in the meta-analysis discussed earlier on the topic of breastfeeding education, which showed a higher effect size in short-term breastfeeding prevalence behaviour and a diminished, non-significant effect was seen for long-term breastfeeding prevalence. The lack of effectiveness seen for long-term outcomes could be due to reduced emphasis on the topic of infant immunization pain management by parents. As the infant got older a new set of challenges may have been the focus for parents learning perhaps putting infant immunization pain management on the backburner.

4.3.1 Strategy utilization in preterm infants

To determine whether parents of preterm infants had different rates of strategy utilization a subgroup analysis was performed comparing their utilization rates. Results showed that the subset of preterm infants in the intervention group during study visit 1 and study visit 2 had similar rates of utilization of strategies compared to term infants for utilization of the 4 measured strategies. As preterm infants may have been exposed to previous painful procedures (during their stay in the Neonatal Intensive Care Unit [NICU]) parents in these groups may have gained knowledge regarding pain-relieving methods for skin breaking procedures. However, our results demonstrate these parents had similar utilization rate of pain management strategies compared to parents of term infants.

4.3.2 Utilization patterns among paediatricians

The utilization pattern was similar in both the intervention and control groups regardless of the paediatricians they visited. During study visit 1, the utilization rates for paediatricians in the intervention group were in range of 76% to 83% and 20% to 29% in
the control group. At study visit 2, utilization rates paediatricians were in the range 65% to 71% and 0% to 37%, respectively, for intervention and control groups. As there were no differences between paediatricians in utilization patterns, it was concluded that paediatricians did not influence the utilization patterns of parents.

4.3.3 Strategy utilization differences between study visit 1 and study visit 2

Examination of utilization rates of only parents that attended both study visits 1 and 2 demonstrated no difference in the rate of utilization of 1 or more strategies between groups at both time points. Parents who did not attend study visit 2 had identical utilization rates at the first study visit as parents who did attend study visit 2. Thus, drop out parents did not drive the changes in utilization that were observed at the second study visit.

4.4 Barriers to analgesic strategy utilization

Even though there were increases in the uses of analgesic interventions by parents during their infant’s immunization appointments, barriers continue to exist in terms of utilization. Firstly, we observed multiple instances where mothers who wished to breastfeed their infant during the immunization were not given enough time to be successful in latching their baby during the injection failing to use the strategy correctly. Similarly, many parents also did not hold their infant correctly during the injections. As many as 10% of parents in the control group attempted to hold and comfort their infant while the baby was laying down in supine position instead of the correct technique of holding the baby upright. If these parents received information on how to correctly hold their infant from the educational group they could have utilized this technique.

Secondly, parental attitude towards the topic of infant pain management for immunizations influenced the use of analgesic strategies. Although not explicitly captured, the candidate observed anecdotally that certain parents were more enthusiastic
regarding the topic of infant pain management during immunizations for infants and others were more dismissive on the topic. Some parents felt that it was “not necessary” to utilize some of the interventions that they were educated on for such a “short” routine procedure such as immunizations for their infants, namely these were pharmacological strategies such as topical anaesthetics and sugar water.

Additionally, the lack of availability of selected interventions and/or the more intensive level of effort needed to utilize some of the analgesic methods likely affected the utilization of such strategies as topical anaesthetics. Parents also likely underutilized strategies depending on information given to them on unscientific evidence acquired from other sources or concerns. Despite the educational intervention dispelling myths regarding such fallacies of select strategies, specifically, choking from breastfeeding, association between breastfeeding and needle prick, and side effects of topical anaesthetics and sugar water, parents could still have held back their use of these strategies. These myths are perpetuated by misinformation given by previous healthcare providers, information from the Internet, anecdotal stories from friends and families, etc. There were eight instances throughout the study in which the candidate noted that parents found themselves correcting their knowledge on the analgesic strategies covered in the educational materials. These topics were: choking from breastfeeding during the needle, association of breastfeeding and needle pricks, and side effects of sugar water.

Although, the clinical staff at the clinic were asked to accommodate any parent request of analgesic strategy outlined in the education the opinions and beliefs of clinicians on the use of these strategies were not controlled and this did deter some parents in utilizing these strategies. The candidate, who observed all of the immunization procedures noted (anecdotal) that immunizers sometimes showed “attitude” towards parents attempting to utilize select strategies such as breastfeeding or expressed scepticism regarding the efficacy of certain strategies, such as topical anaesthetics. Consequently, as the opinions of healthcare providers are highly regarded by parents this may have served as a barrier to utilization. In our previous studies we have found parent report of clinician blocking of the use of strategies.9,11,14
In summary, synchronicity between the message in the educational package and the information provided by healthcare providers is needed to minimize the barriers to utilization for parents. Greater emphasis on healthcare personnel in providing pain management options to parents during immunizations can occur from institutionally mandated continuing professional education programs regarding this topic.

4.5 Comparison of results with previous studies of office setting interventions

Comparing this study to others aimed to promote behaviour change in parents of young infants in clinical settings that were discussed earlier in a systematic review; our intervention method (use of a factsheet and video) was similarly to most of the studies. Most of the reviewed studies featured providing written information in combination with verbal or video components, but comparison groups that often still received information on the educating topic in the form of counselling or written information. Our study featured written and video information compared to a control group receiving no information related to the educational topic from any study personnel, perhaps increasing the observed difference in utilization seen in comparison to the reviewed studies.

From the seven efficacious studies in the review, there were 3 studies that demonstrated an effectiveness of their written educational materials in parents. Two of these studies provided information to parents in the post-partum ward, while one provided information in an office setting similar to that used in this study. This study, Nansel et al, was a randomized trial that had a comparable sample size to our study (near 160 subjects) and provided the education during the parents stay in the waiting room. Additionally, the study measured the direct of effect on behaviour change from their education in assessing injury risk and preventative behaviour occurrences. Although the education topic and outcome assessments were different, our results were in line with their study in regards to the impact on the primary outcome of utilization.
For the purposes of this study we did not evaluate knowledge increases resulting from the educational materials as this has been shown in our previous studies both long-term and short-term in different settings.\textsuperscript{11,13,14} Providing education on infant pain management in the office setting resulted in the intended behaviour change sought in this study. The clinical setting and the applicable educational method employed in this study proved to be effective in influencing parents to utilize more pain management strategies during their infant’s first observed immunization visit and the second visit. However, there was a decline in pain management utilization during the follow-up study visit 2 suggesting a need for reinforcement of the educational material provided during the initial visit. Additionally, support from health care providers in advocating for the use of the interventions can keep levels of utilization high long-term. The timing and the setting in which the education was provided to parents, in the waiting room right before their infant was to receive immunizations, created a “teachable moment” in which parent awareness and interest of this particular topic was high perhaps increasing the effectiveness of the educational material.\textsuperscript{60} Additional strengths of the study design include: 1) cluster randomization so that the effect of the intervention did not affect the control group (no contamination of the intervention to the control group), 2) appointments were observed to assess parent and infant behaviour instead of reliance on self-report, and 3) outcome assessments were blinded increasing the validity in our findings.

4.6 Infant pain scores and cry duration

The pain scores measured in this study showed infants in the intervention group to experience less pain than those in the control group for study visit 2 (p<0.0001). The MBPS pain scores found in this study were comparable to those found in other studies examining the same injections in young infants (<6 months of age), in the 8.5 to 9 range for acute pain.\textsuperscript{106,107}

Although we expected to see a greater difference in pain scores between groups in this study, it should be noted that this was a secondary outcome of the study and thus the study was not powered to see the ~15\% clinically significant decrease\textsuperscript{96} in pain between
groups used in our other studies. Our study observed a decrease of 5-7% in MBPS scores between the intervention and control groups. Based on these results a sample size three times higher than what was used would be needed to power the study to observe this difference.

In regards to cry duration again no difference was seen between study groups for both first and second study visits. Perhaps there may not have been enough of an effect from the greater utilization of pain management strategies to make a difference in selected pain measures such as cry duration. It should be noted however that infants may cry for a variety of reasons and given the long waiting times at the clinic on particular days whether crying was associated with pain or hunger could not be delineated. Additionally, when we examined parents that utilized 1 or more of the analgesic strategies and compared them to those that used none of them, there was a significant decrease in the pain experienced by infants. Thus it is evident that parents who utilized more analgesic strategies were able to better comfort their infant.

Analyses comparing the effect of utilization on the MBPS pain scores revealed no correlation during study visit 1 but a negative effect during study visit 2 indicating evidence of effective pain relief from strategy utilization. It could be possible that on study visit 2 parents were able to better comfort their infants during the injections than they were able to on the first study visit. This could potentially be due to more experience with utilizing the pain management strategy and thus being able to provide a greater analgesic effect and lower pain score.

4.6.1 Proximal soothing and infant pain

Physical comfort methods used by parents (according to the MAISD) were examined qualitatively as a potential factor related to observed pain scores from the MBPS between intervention and control groups. There were no statistical differences in pain scores at study visit 1 between the two groups; however, lower pain scores were observed in the intervention group at visit 2. There was a significant difference in proximal soothing by parents at study visit 1 between intervention and control parents (increased proximal
soothing after the second injection in the control group). Interestingly, in a separate study on the effect of caregiver proximal soothing of infants receiving injections in their first year of life, found that proximal soothing played a minimal role in pain comfort.\textsuperscript{108} Thus there is supporting data that the observed increased use of proximal soothing by parents in the control group on study visit 1 after the injections did not contribute to pain relief. At study visit 2, where even rates of proximal soothing between the intervention and control groups were seen, there was a greater difference observed between pain scores. Additionally, the pain scores at study visit 2 were collectively lower. This may be attributed to developmental changes in how infants express pain over time. Older infants may express fewer changes in body movements and settle more easily than younger infants allowing for more variability in scores on the pain measurement tools used.

4.6.2 Multiple testing to reduce the risk of type 1 errors

As the study contained multiple comparison outcomes between groups the problem associated with multiple testing may arise. The chance of rejecting the null hypothesis increases with the number of tests performed. To account for this type I error in study results the Bonferroni Correction,\textsuperscript{109} was used for exploratory analysis. At the new significance level of 0.008 as per the Bonferroni Correction at study visit 1, measure of observer NRS, MAISD physical comfort, and parent satisfaction were the only identified significant differences between groups. Similarly at study visit 2, mean MBPS scores and observer NRS scores were found to be significant. Assessing the results of the study in light of the Bonferroni corrections, only one pain measure is significant at study visit 1, the observer NRS and two pain measures were significant at study visit 2 (observer NRS and MBPS). Despite the 4 measures of pain assessed in the study the lack of differences found between groups for most of the measures at the corrected significance level reveals that perhaps observed differences were due to chance rather than true effect
4.7 Parent report of infant pain

Parent report of infant pain from the 11-point Numerical Rating Scale (NRS) ratings found no significant difference between groups at both the first and second study visits. The lack of difference seen for this measure could be due to a few reasons. Parents who received the pain management education may have overestimated their infant’s pain as they were primed with the information that vaccine injection is painful. Further, twenty percent of parents did not use any pain relieving interventions and may have reported much higher pain scores. These parents may have limited experience in quantifying their infant’s pain resulting in overestimating the score.

Interestingly, during first study visit parents who utilized 1 or more strategies were found to have a correlation for reporting roughly a half a point higher NRS score than no utilization parents. For those parents who chose to use interventions for their infant’s injection pain may have felt that they did not do enough for their infant’s pain seeing their infant in distress during the procedure and thus rating a higher pain score.

The pain scores reported by parents were similar to those reported by parents in a previous study of mothers of 2-month old infants who were educated about pain management strategies at prenatal classes.\textsuperscript{14} Parent reports of their infant’s pain on the NRS in the previous study and the present study were in the range of 6 to 7 (out of 10). There were no differences between groups in the present study despite the use of more pain management interventions. Parents in the intervention group may have over reported their infant’s pain scores because they were conscious about pain and pain management options.

4.8 Observer report of infant pain

Observer report of infant pain from the 11-point NRS ratings was found to be significantly lower in the intervention group vs. the control group at both study visits. It should be noted however that this rating by the observer (the candidate) is the most biased pain measure utilized in this study. This measure is from a non-blinded assessor in
real time and is thus prone to be influenced by the observer’s perception on the effectiveness of interventions.

4.9 Parent behaviour during immunizations

As assessed by the MAISD tool capturing adult behaviour during infant immunizations parents from the control group expressed higher levels of physical comforting on study visit 1. As unintuitive as this may seem, a recent naturalistic cohort study observing parent soothing behaviour during infant immunizations revealed that higher pain scores after the second injections were seen to be associated with higher frequencies of physical comfort behaviour. The study postulated that the level of pain-related distress exhibited by the infant influences parent behaviours, where greater distress prompts greater parental soothing. This is in line with what one would expect from parents, as they instinctively start comforting their child if they see them in distress and as parents utilized less comforting strategies in the control group, infant distress would have been greater in this group eliciting greater soothing behaviour from parents.

4.10 Nurse behaviour during immunizations

In regards to the immunizers (nurses), factors such as videotaping, comfort level in accommodating analgesic strategies and their personal opinions on the efficacy of the strategies are key factors to consider when interpreting the results of this study.

Nurse behaviour towards the baby and the parents could’ve been altered as result of being videotaped for the study. Nurses could have been providing more comfort to babies in both groups participating in the study. This may have resulted in diluting the overall effect from the intervention in the study than the true effect. Even though the nurses were trained and instructed to accommodate any analgesic intervention parents wanted to utilize, we were unable to control their personal opinions regarding the efficacy of techniques and their attitude towards accommodating for interventions. For the purposes
of the study, nurses adjusted their injection technique to accommodate mothers who held
or were breastfeeding their infants during the procedure. However, this was a deviation
from their usual practice and may have influenced the way they administered the
injections. Lastly, whether it was due to the workflow of the clinic or disrespect of the
analgesic intervention use from the parent, nurses on rare occasions hurried their
injection procedures without allowing for mothers to settle their baby into their holding
position or ensuring that a latch had been established prior to the injection.

4.11 Parent satisfaction with immunization

Intervention group parents reported higher satisfaction levels with their infant’s comfort
level during immunizations on study visit 1 than their control counterparts. These
differences were not seen however during study visit 2 between the groups. For parents,
seeing their child cry during the first experience could have influenced their willingness
to use strategies during the second visit as they may perceive them to be not effective,
despite the evidence from the literature presented to them. Utilizing interventions such as
breastfeeding may increase the duration of their visit and if they are in a rush to complete
the procedure they may choose not to breastfeed or give topical anaesthetics which have
higher effectiveness than other interventions recommended. The overall reduction in
utilization of strategies during the second visit, could have influenced parent report of
their infant’s satisfaction of the appointment not having utilized as many effective pain-
relieving strategies as observed in the first study visit.

4.12 Impact of observer presence during immunizations

There are a few key points that must be noted on what is the impact of observation of the
immunizations on this study. Firstly, the candidate who observed all the appointments
was a male and thus may have impacted the recruitment rate and the analgesic
interventions employed by mothers (e.g. the mother may feel less comfortable
breastfeeding while bring observed). Three mothers declined participation in the study as
they wished to breastfeed during the immunization and did not want a male stranger in the room during that time. This impact of the observer’s gender may have altered the analgesic intervention of some mothers, specifically in regards to breastfeeding resulting in underutilization of this strategy.

Secondly, participation in the study by parents and the influence of observer who also provided the education to them to be present during their infants’ immunization appointment may result in over-utilization of analgesic methods. In order “to impress” the observer/educator and/or the clinical staff present during the immunizations parents may choose more analgesic interventions then they might have otherwise selected.

Thirdly, although the observer followed strict standard operating procedure in his interactions with participants the fact that he was not blinded may have influenced his attitude and behaviour towards participants. It is possible that there may have been undue influence on encouraging parents in the education group to utilize more analgesic strategies than in the control group.

In summary, the impact of merely observing the immunization event may have altered the behaviour of participating parents in the study. Tendencies in utilization of analgesic strategies alter, as participants are conscious that they are being observed and noted on their actions. Parents as a result may overall increase their utilization strategy use yet may also decrease the utilization of specific strategies as well. The impact of the observation and the observer himself is an important consideration to keep in mind when interpreting the results of this study.

4.13 Study strengths

Strengths of this study include randomizing of participants by way of cluster design, blinding of participants to study objectives and group assignments, real-world setting and implementation approach, combination of a pamphlet and video, consistency in intervention delivery and immunization observations, and blinding of the primary and secondary outcome measures via videotape analyses.
Employing a cluster randomized trial design at the level of doctors rather than on an individual level reduced the possibility of contamination bias between participants. As the education package was delivered to participants in the waiting room by video and information pamphlets individual randomization of the subjects would be difficult to achieve. As participants visited their respective paediatricians at fixed time schedules in morning or afternoon blocks during the weekdays it was possible to prepare either a “pain management-friendly” educational clinic or standard of care control clinic whereby all participants visiting one doctor would be randomized to one group. This also assisted in concealing treatment allocation from participants.

The recruiter (the candidate) utilized a consistent script for recruitment which did not disclose the research hypothesis or which behaviours were being studied. This assisted in keeping parents blinded to study objectives and minimize influence of study participation on their behaviour. Intervention delivery was standardized and documented so that it was consistently delivered to all participants and all participants were observed during their first immunization appointment resulting in complete data collection. This consistency in the clinic set up, recruitment method, and educational delivery increased treatment fidelity. There were three nurses that provided all of the immunization injections for the infants in the study using the same injection technique between them to limit performance bias.

The study presented was a real-world scenario in which parents were provided with educational information during their time in the waiting room, a commonplace and time where parents have ample time\textsuperscript{15} and often occupy themselves with reading materials. The cost of printing and providing written materials and running the DVD video on the waiting room TV monitor is very minimal and one that can easily be incorporated onto many outpatient clinics.

The pamphlet and video educational materials provided to parents were focus group tested and had undergone multiple iterations.\textsuperscript{13} The synchronization of information, familiar graphics, and chronological presentation between the two materials enhanced the
effectiveness of the materials. Where the pamphlet was able to neatly organize information for parents, the video served to provide vignettes of the strategies in action.

With the use of videotapes primary and secondary outcomes for the study were assessed by trained research assistants blinded to group allocation and study hypotheses so as to allow for an unbiased outcome measurement.

4.14 Study limitations

Some limitations to the study design employed that should be considered when interpreting the results of this study include lack of blinding of recruiter and clinician, “enhanced standard care”, and increased variability in clinic setup.

Firstly, due to the cluster randomized nature of this trial whereby randomization occurred at the level of physicians rather than at the individual level thus the recruiter, the clinicians and the nurses were all aware of the group allocation. This may have led to performance bias from the recruiter/observer and the nurse administering the injections. However, standardization of the recruitment script and consistency in nurse behaviour and injection technique minimized this effect. A training session with the physicians and nurses and study investigators prior to the commencement of the study ensured that nurses would facilitate any analgesic intervention that parents proposed and that they would not provide any undue influence on the use of analgesic strategies parents wish to utilize.

Secondly, participants in the control group received a pamphlet that outlined general information regarding immunization injections for the infant. This information may or may not be given consistently to parents visiting this clinic. Thus, the study did not have a true “standard of care” group but rather an “enhanced standard of care” group. Providing information to parents about immunization injections could have made parents more conscious regarding their infant’s immunizations than they perhaps would have been without this information.
Lastly, it should be noted that the generalizability of this study is influenced by factors relating to differences in clinic set up between different office settings. Every clinic has its own workflow, waiting room set-up, and set of clinicians which are not identical to the study presented here. Clinicians in other clinics may not be as likely to incorporate pain management strategies into their practice. Office settings also may not have a waiting room TV or receptionists that can provide hand out material for parents.

4.15 Internal validity

The randomized nature of the study, the standardization of procedures during the conduct of the study, and blinded outcome assessments strengthen the internal validity of the findings of this study. Randomization minimizes selection bias and the effect of known and unknown confounders strengthening the associations found in the study. Standardizing the script that nurses delivered to parents during the injection procedures, as well as their injection technique along with the procedures for video capturing strengthened the internal validity of this study. Increasing the rigor of the trial by standardization minimizes effects from extraneous variables that could affect the relationship between the exposure and outcome. Holding as many variables as constant as possible minimizes biases that could affect the outcome of the study. Injection technique of nurses and nurse behaviour were standardized as much as possible to minimize performance bias and with the use of videotape, there was no reliance on parent self-report and blinded research assistants were able to assess the primary and secondary outcomes thereby reducing measurement bias.

However, aspects of the study such as lack of blinding of the clinical staff and the observer threaten the internal validity of the study. The role of performance bias could have exaggerated the differences seen in the study if the nurses were providing extra care and comfort for those infants in the intervention group and were more willing to accommodate pain relieving strategies. Alternatively, nurses could have also been diminishing the differences between groups if they were providing “enhanced standard care” for those infants in the control group. Nurses in trying to “look good on camera”
could be providing extra comfort for infants in the standard of care group then what they would normally. It is difficult to standardize the behaviour of nurses to this degree where complete control of their interaction with the infants and parents can be achieved.

4.16 External validity

The cluster randomized trial design employed in this study along with easily implementable as well as self-directed educational materials, and broad exclusion criteria strengthen the external validity of the study. Randomizing at the cluster level allowed for the setup of a ‘pain education friendly’ clinic. Whereby the educational video was playing in the waiting room TV and copies of the information sheet were on coffee tables and posters were displayed on the walls in the waiting room. This is a realistic setup of how educational materials can be implemented in a wide variety of clinics and the positive results in increasing utilization shown for the study adds to the success that can be expected from wide implementation of these materials. Lastly, the study had broad inclusion criteria where preterm as well as term infants could be recruited for participation, which adds to the applicability of our findings to many more infants.

There are also threats to the external validity of this study that are worth mentioning. This study was conducted at a teaching and research friendly hospital. The clinical staff at the clinic may have been more accommodating in implementing changes to their clinic (allowing for the education materials to be presented as well as supporting parents in using the pain management strategies they learned about). Nurses at the clinic were asked to accommodate all strategies parents wished to utilize for the purposes of the study. As observed in previous studies of telephone surveys of mothers of children in their first year of life, clinician blocking of the use of these pain management strategies regularly occurs at clinics.\textsuperscript{9,11,14} Lastly, the educational materials were produced and tested in English only. Thus only parents who could understand and read English were able to participate. Whether these materials would be effective in other languages remains untested.
4.17 Implications of findings for paediatric clinics

Implications for practices willing to use these educational methods should consider the positive effect of the study as a strong motivator for implementation. The success of the educational materials hinged on the timing and setting of providing the factsheet and showing the video and ensuring that parents could successfully attempt the pain relieving methods should they choose to try them. Office settings who wish to use these materials should ensure that they are willing to accommodate the use of all of these strategies and take the appropriate steps to ensure that the clinical staff is trained to assist parents. If clinics can provide sugar water and/or topical anaesthetics for parents that request it the utilization of pain management strategies can be enhanced even further.

Institutional buy-in and wide scale education of healthcare providers on improving the use of these practices would provide the best results from implementing this education. If the healthcare providers bring this topic of pain relief for immunizations to the forefront, and there is synchronization between the attitude of providing this pain relief from the clinicians as well as the parent dramatically higher increases in the use of the strategies will be observed.

4.18 Summary and future considerations

In summary, providing parents with educational materials on infant immunization pain management in the form of a written factsheet and short video proved to be efficacious in increasing the use of one or more selected pain management interventions (topical anaesthetics, sugar water, breastfeeding, or holding) by parents of young infants (<6 months of age) relative to the control group who received only generalized information regarding immunizations. The success of this study provides support for widespread implementation of these educational materials in paediatric or office settings where parents of young infants are receiving their primary care to raise awareness and promote increase use infant immunization pain management strategies. It is important to keep in mind however that more wide scale studies testing these materials across multiple regions
and multiple practices may be needed to support the goal of a large-scale implementation of the materials across all communities.

The office setting is an important location for providing education to parents and therefore a key location for conducting studies like this one. Surveys of primary care physicians have shown that they would like to incorporate more effective methods of providing anticipatory guidance to their patients in the 5-10 minutes they provide for education and teaching to parents.\textsuperscript{110}

Although targeting parents of young infants to advocate for an increased use of pain relieving methods is the best way to increase utilization, support from healthcare providers and opinions of health care providers is the key to really making a difference. Parents look towards their healthcare provider as the primary source of information for the care of their child\textsuperscript{100} and therefore emphasis on providing continuing professional education, research studies on educating primary health care providers and dissemination of guidelines can all help in breaking the barriers to increased utilization of strategies and ensure as much reduction of pain for infants as possible.
Chapter 5

5 Conclusions

The low cost and easy to implement educational methods employed in this study on infant pain management interventions (topical anaesthetics, sugar water, breastfeeding, and holding) proved to be efficacious in increasing the utilization of these strategies. This was the first study to examine the effect of providing educational materials on this topic in a paediatric office setting. Future research projects attempting to increase the use of pain management strategies for immunizations should continue to target barriers to implementation seen in this study. Educating and supporting clinicians as much as possible in incorporate these evidence-based strategies, as a part of their practice would serve well to provide better pain management during immunizations for all infants.

Research into combining multiple avenues of providing education on this topic, may it be in prenatal classes, or maternity wards could serve to enhance the effect of these materials even further. Providing this information electronically through smartphone apps and targeting the audience of young parents through social media via twitter and facebook could be new and exciting avenues to research on educating parents on these topics. Higher accessibility to this material for parents can improve the quality of pain care received in infants.
References


53. Denson D, Mazolt J. *Physiology and pharmacology of local anesthetics. In: Sinatra*


98. Lindsey LC, Rebecca SB, Catherine BM, Jill EM. Assessing Medical Room Behavior During Infants' Painful Procedures: The Measure of Adult and Infant Soothing and Distress (MAISD). *Child Health Care*. 2005;34.


Appendix A

The following tables record the search strategies and terms used in each of the databases. Search results were limited to English Language articles and age group (children 0-23 months) as available.

**MEDLINE:**

The search strategy for OvidSP MEDLINE (1946 to February 6, 2013) retrieved 3389 references of which 3320 were unique and not duplicated in our other searches. A combination of MeSH and free text terms were used.

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**EMBASE**

The search strategy for OvidSP Emebase Classic+Embase <1947 to 2013 Week 05> retrieved 6541 references of which 5061 were unique and not duplicated in our other searches. A combination of EMBASE and free text terms were used.

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EBM Reviews - Cochrane Central Register of Controlled Trials

The search strategy for OvidSP EBM Reviews - Cochrane Central Register of Controlled Trials < January 2013> retrieved 545 references of which 276 were unique and not duplicated in our other searches. English language articles were removed manually as there is no language limit available in this database. A combination of primarily MeSH, EMBASE and free text terms were used.

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<td>Limit Age Groups: Infant, Newborn: birth-1 month</td>
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<td>Age group ,limit</td>
</tr>
<tr>
<td>S8</td>
<td>S4 or S7</td>
<td>1899</td>
<td>Combined Group</td>
</tr>
<tr>
<td>S9</td>
<td>Limiters - Language: English</td>
<td>1756</td>
<td>FINAL results</td>
</tr>
<tr>
<td>----</td>
<td>----------------------------</td>
<td>------</td>
<td>--------------</td>
</tr>
</tbody>
</table>
## Appendix B

### Modified Behavior Pain Scale Coding Manual

<table>
<thead>
<tr>
<th>Observed behaviour</th>
<th>Score (0-10)</th>
<th>Operational definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Facial expression</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Definite positive expression</td>
<td>0</td>
<td>Smiling.</td>
</tr>
<tr>
<td>• Neutral expression</td>
<td>1</td>
<td>Brow bulge, naso-labial furrow.</td>
</tr>
<tr>
<td>• Slightly negative expression: ex. grimace</td>
<td>2</td>
<td>Brow bulge, naso-labial furrow, eyes closed tight, open lips with or without reddened face.</td>
</tr>
<tr>
<td>• Definite negative expression: i.e. furrowed brows, eyes closed tightly</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Cry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Laughing or giggling</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>• Not crying</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>• Moaning, quiet vocalizing, gentle or whimpering cry</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>• Full lunged cry or sobbing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>• Full lunged cry, more than baseline cry</td>
<td>4</td>
<td>To be scored only if infant is crying during baseline</td>
</tr>
<tr>
<td><strong>Movement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Usual movements/activity, or resting/relaxed</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>• Partial movement or attempt to avoid pain by withdrawing the limb where the puncture is done</td>
<td>2</td>
<td>Squirming, arching, limb tensing/clenching</td>
</tr>
<tr>
<td>• Agitation with complex movements involving the head, torso or the other limbs, or rigidity</td>
<td>3</td>
<td>Generalized limb and/or body movements, or rigidity.</td>
</tr>
</tbody>
</table>

As adapted from:
Appendix C
Measure of Adult and Infant Soothing and Distress (MAISD) Coding Manual

If the observed activity fits within the description of a category this category is coded to have a value of “1”, indicating “Yes” otherwise the category is defaulted to “0” or “No”.

<table>
<thead>
<tr>
<th>Adult Category</th>
<th>Definition and Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distraction</td>
<td>Behaviors intended to distract the infant. This may include the use of props (e.g., holding up toys, pointing to posters on the wall) or not (e.g., making funny faces, clapping). This is still coded even if the child does not appear to be distracted by the behaviour.</td>
</tr>
<tr>
<td>Offer Toy</td>
<td>If the adult simply hand the child a toy-like object in an effort to comfort or distract him/her. If the parent uses the toy to interact with the child, code Distraction and not Offer Toy. Often an adult may hand the child a toy so that the child will soothe him/herself.</td>
</tr>
<tr>
<td>Offer Pacifier</td>
<td>If the parent either hands the infant the pacifier or put the pacifier in the infant’s mouth. This is still coded if the infant does not accept the pacifier.</td>
</tr>
<tr>
<td>Offer Food</td>
<td>Feeding can include handing the child a bottle, cracker, or other food. Code even if the child rejects the food. Do not code this if the mother attempts to or is nursing the child.</td>
</tr>
<tr>
<td>Attempt to Nurse</td>
<td>Attempts to nurse or actually engaging in nursing.</td>
</tr>
<tr>
<td>Tickle</td>
<td>Purposeful tickling of the child in order to produce laughter. The child does not have to laugh or squirm.</td>
</tr>
<tr>
<td>Rub/ Massage/ Pat</td>
<td>Rubbing, massaging, or patting the child. This may be on the head, back, or other body part. This is often intended to distract and/or comfort the child.</td>
</tr>
<tr>
<td>Kiss</td>
<td>Kissing the child.</td>
</tr>
<tr>
<td>Hug</td>
<td>A comforting hug. If the adult is simply holding the child so that the procedure may be performed, do not code hug. This has to be an obvious and blatant squeeze.</td>
</tr>
<tr>
<td>Sitting Rock</td>
<td>If the parent remains in the chair and begins to sway, rock, or bounce the child. Code Standing Rock if the parent stands up and/or walks.</td>
</tr>
<tr>
<td>Standing Rock</td>
<td>When the adult stands up and rocks, sways, or bounces, or when the adult moves around the room while holding the child.</td>
</tr>
<tr>
<td>Verbal Reassurance</td>
<td>You may still be able to code things that you can hear (e.g., Verbal Reassurance) and if you have a good guess at a behaviour. For example, if the adult is frowning, then turns his/her back to the camera, and then turns around again and is still frowning, you can guess that he/she continued to frown when not visible.</td>
</tr>
<tr>
<td>Not Visible</td>
<td>Code if the adult is not visible.</td>
</tr>
</tbody>
</table>
## Measure of Adult and Infant Soothing and Distress (MAISD) Coding Manual

<table>
<thead>
<tr>
<th>Infant Category</th>
<th>Definitions and Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage in Distraction</td>
<td>Watches distraction (e.g., toys, posters on the wall, television, funny faces, clapping) or interacts with parent on non-procedural event (e.g., playing with toy, playing peek-a-boo).</td>
</tr>
<tr>
<td>Play with Object Alone</td>
<td>Manipulating, moving, or playing with a toy or object of interest (e.g., stuffed animal, sock, keys, bottle, piece of plastic). However, he/she must play by his/herself otherwise code as Engage in Distraction. This may be interpreted as self-soothing rather than relying on adult-soothing, even if adult gives child the object.</td>
</tr>
<tr>
<td>Suck on Pacifier</td>
<td>If the pacifier is in the infant’s mouth at all, even if you can not see sucking action, code this.</td>
</tr>
<tr>
<td>Consume Food</td>
<td>Drinking from a bottle or eating solids (e.g., crackers, baby food).</td>
</tr>
<tr>
<td>Nursing</td>
<td>Attempts to breast-feed (e.g., pulling on mom’s blouse, says “nurse”) or actually engaged in nursing.</td>
</tr>
<tr>
<td>Happy Behavior</td>
<td>Smiling, cooing</td>
</tr>
<tr>
<td>Laugh</td>
<td>Laughing</td>
</tr>
<tr>
<td>Negative Behavior</td>
<td>Furrowed brow, eyes closed tightly, open lips. Negative whining/complaining sounds. If the baby is just making typical baby squeaks and other noises, only code if the noise appears to be a distress/negative sound.</td>
</tr>
<tr>
<td>Cry</td>
<td>Sobbing or full-lunged cry.</td>
</tr>
<tr>
<td>Scream</td>
<td>High-pitched yell.</td>
</tr>
<tr>
<td>Flail</td>
<td>Complex, agitated body movements. If child is being restrained, look for body tension and squirming. If the child is simply wiggling around, do not code this as flail. Flail is a distress behavior.</td>
</tr>
</tbody>
</table>
## Appendix D

Figure 1: Written fact sheet presented to parents in the intervention group.

### The 3 P’s of Helping your Baby during Vaccinations

**A Parent’s Guide: Babies up to 1 year old**

#### Step 1: Pharmacological (Pain Medicine)

<table>
<thead>
<tr>
<th>Medicine Type</th>
<th>Product Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topical Anaesthetics</td>
<td>Lidocaine (Maxilone®), tetracaine (Ametop®), lidocaine-prilocaine (EMLA®).</td>
</tr>
<tr>
<td>SUGAR WATER</td>
<td>Give sugar water</td>
</tr>
</tbody>
</table>

- **Before Injection**
  - May cause temporary reddening or whitening of skin – this is normal. If there is a rash, talk to your doctor – it could be an allergic reaction.
  - Avoid acetaminophen (Tylenol®), ibuprofen (Advil®), ice and cold sprays before injection – they have not been proven to reduce injection pain. After injection, acetaminophen or ibuprofen may be used to relieve fever or discomfort.

#### Step 2: Physical (Body Position and Activity)

<table>
<thead>
<tr>
<th>Position</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hold upright</td>
<td>Hold your baby close during injection – in a hug or on your lap. This feels good and helps your baby stay still. Avoid holding your baby too tightly – this can increase pain and distress.</td>
</tr>
<tr>
<td>HOLD</td>
<td>Start breastfeeding your baby before injection and continue during and after injection. If 1 injection is planned, position your baby to expose 1 leg: expose both legs for 2 or more injections. If the baby cannot be breastfed, offer a bottle or pacifier starting before injection and continue during and after injection.</td>
</tr>
<tr>
<td>Breastfeed</td>
<td></td>
</tr>
</tbody>
</table>

#### Step 3: Psychological (Thoughts and Behaviours)

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep breaths</td>
<td>Stay calm and use your normal speaking voice. This helps your baby stay calm – babies look to their parents for how to act and feel. If you are nervous, take a few slow, deep breaths to calm yourself before and during injection – breathe so your stomach expands, not your chest. You can do this while holding your baby.</td>
</tr>
<tr>
<td>BREATHE DEEPLY</td>
<td>Help keep your baby’s attention away from the injection. Distractions you can use: rocking, cuddling, singing, talking, sucking (breastfeeding or pacifier). Distract with objects or toys (bubbles, pop-up books, rattles) when your baby is calm enough to do so; otherwise, distress can be increased.</td>
</tr>
<tr>
<td>DISTRACT</td>
<td></td>
</tr>
<tr>
<td>Distract</td>
<td></td>
</tr>
</tbody>
</table>

These are scientifically proven ways of reducing pain in babies during vaccine injections. Think about what worked and plan ahead to make the next vaccination less painful.

Figure 2: Screen shots of video shown to parents in the intervention group

Additional Info regarding the educational material

1) The Help Eliminate Pain in Kids 3P’s of Infant Pain Management Factsheet. The factsheet is organized in suggested chronological order of use of the strategies, from top to bottom as suggestions for before, during, then after the injections. The information is also structured to be presented by the 3P’s of pain management (pharmacological, physical, psychological) and instructions on how and when to use these various strategies are for their infant is presented in a clear and succinct fashion.

2) Infant Pain Management Video. The video contains vignettes of the strategies, as well as testimonials from experts in the field of infant pain management. The video illustrates the use of possible pain-relieving strategies in all three domains of pain management (pharmacological, physical, and psychological).

Reference: http://www.youtube.com/watch?v=jxnDc2PxGUC
Figure 1: Control education package: general information regarding infant immunizations

DISEASES THAT CAN BE PREVENTED WITH IMMUNIZATION

Diphtheria is a very serious bacterial infection that can cause breathing problems, heart failure, paralysis (loss of control over muscles in the body) and death. Whooping cough (Pertussis) causes severe coughing spells for weeks or months. It can also cause pneumonia (lung infection), middle ear infection, convulsions (seizures), swelling of the brain and death. Tetanus (lockjaw) causes painful muscle spasms, breathing failure and death. It is caused by bacterial spores in the soil which can infect deep wounds. Polio can cause paralysis, swelling of the brain and death. People get polio from drinking water or eating food containing the polio virus. Cases are uncommon in Canada but do occur worldwide. Haemophilus B (Hib) is a bacterium that can cause middle ear infection, damage to joints, pneumonia, swelling of the brain and spinal cord, and death. Pneumococcal disease is a bacterial infection which causes middle ear infection, pneumonia, brain infection (meningitis), and an infection of the lining of the brain and spinal cord. Rotavirus is a common virus that causes severe diarrhea, vomiting and diarhoea that can lead to dehydration (loss of bodily fluids). Babies and young children are at greatest risk. Meningooccal Meningitis is a bacterial infection of the spinal cord and lining of the brain. It can also cause a serious infection in the blood that can lead to sudden severe illness and death. Measles (Red Measles) causes rash, high fever, cough, runny nose and watery eyes. It can cause middle ear infection, pneumonia and swelling of the brain. Mumps causes fever, headache, facial and painful swelling of the glands in the mouth and neck. It can cause swelling of the brain. It may also cause swelling of the ovaries and testes and, in rare cases, sterility. Rubella (German Measles) causes fever, rash, swelling of the neck glands and pain, in the joints, bruising and bleeding. Getting rubella during pregnancy can lead to birth defects. Chickenpox (Varicella) can cause scarring of the skin, skin infections, pneumonia, swelling of the brain and death. Shingles, a painful rash, can occur in later life.

Appendix E

Figure 1: Control education package: general information regarding infant immunizations

Every time your school-aged child receives a vaccine, report it to Toronto Public Health.

Immunization protects us all

WHAT is Immunization?
Immunization and vaccination both mean receiving a vaccine. Immunization makes people immune to a disease meaning they are protected from it.

HOW does it work?
Immunization helps prepare the body to fight disease. If an immunized child is exposed to one of these diseases, their body is ready to act quickly and stop the disease from happening. Therefore, they are best protected when they receive all of their vaccines according to the immunization schedule.

It is safe.
Immunization is very safe. All vaccines are thoroughly tested before public use and continuously monitored for safety.

ARE there any side effects?
Serious side effects are rare. Some people experience pain after receiving an injection and the area may swell or get red. For more information on reducing the pain of immunization or preventing mild reactions, talk to your doctor or visit toronto.ca/health.

Ontario’s Publicly Funded Immunization Schedule

Appendix F

Consent to Participate in a Research Study

Principal Investigators:
Dr. Michael Sgro MD, Department of Paediatrics, St. Michael’s Hospital, Tel #: 416-864-6060 ext. 6560
Dr. Anna Taddio PhD, Child Health Evaluative Sciences, Sick Kids, Tel #: 416-813-6235

Co-Investigators:
Dr. Vibhuti Shah, MD, Staff Neonatologist, Mount Sinai Hospital, Tel #: 416-586-4816
Chaitya Parikh, BSc, Graduate Department, University of Toronto, Tel #: 905-599-9121

Title of Research Study:
Testing Educational Material about Immunizations in a Paediatric Clinic

Sponsors:
The study is supported by miscellaneous funds held by investigators.

Before agreeing to take part in this research study, it is important that you read the information in this research consent form. It includes details we think you need to know in order to decide if you wish to take part in the study. If you have any questions, ask a study doctor or study staff. You should not sign this form until you are sure you understand the information. All research is voluntary. You may also wish to discuss the study with your family doctor, a family member or close friend. This will help prevent unnecessary harm to you.

Purpose of the Research:
Infants undergo immunization injections, or ‘shots’ as part of routine medical care. The aim of this study is to obtain parent opinions about the use of educational material about immunizations in young infants. Based on the results of the study we may begin to provide this material to all parents of young infants coming to this clinic.

Description of the Research:
You are being asked to participate in this research study because you have an infant who will be undergoing his/her routine 2-month or 4-month checkup and immunization.

If you choose to participate the following will be done:
1. You will receive one of two educational packages containing information on infant immunizations. The educational package you receive will be determined by chance, like flipping a coin.
2. We will observe your infant’s current set of immunizations at this appointment as well as the next set of immunizations at your upcoming appointment.
3. The immunization procedure will be videotaped to allow the study staff to make more accurate observations about your child’s immunization. If you do not consent to the videotaping you will not be able to participate in the study.

4. We will also ask you some questions about the immunizations regarding your experience with them and the educational material we presented. We will then provide you with any outstanding information regarding our study to conclude.

Participation in the study may add up to 15 minutes to your immunization appointment, although we will ask you to participate in the waiting room so as to minimize any additional time incurred.

We will ensure that the videotaping will not interfere with your baby’s immunization procedure.

The entire study will take place at your pediatrician’s office. A total of 160 infants will be included and the entire study will take about one year to complete.

There will be no changes made to any therapies your infant is having. Infant health record charts will be reviewed as part of this study to gather information about the birth characteristics of your child (such as weight, gestational age at birth, sex, clinical conditions, and medications used).

**Potential Discomforts**
Some extra time may be required to answer questions and videotape the immunization procedure. Approximately 15 minutes may be added to the appointment from reviewing the educational material, videotaping of the immunization procedure, and answering a few brief questions after the appointment. At the follow-up appointment 5 minutes of additional time may be incurred from answering questions and videotaping of the immunization procedure. Overall up to 20 minutes of total time commitment is expected from parents for the entire study duration.

**Potential Benefits:**
*Your participation in this study will help us gain important information regarding early infant immunizations and educational materials to parents about infant immunizations.*

**Voluntary Participation:**
Participation in research is voluntary. You can choose not to participate or you may withdraw at any time without affecting your infant’s medical care.

**Alternatives to Participation:**
If you do not participate in this study, you will not receive the educational information as it is not routinely provided. In addition your infant will not be videotaped.

**Confidentiality:**

*Personal Health Information*
If you agree to participate in the study, the study doctor and his/her study team will ask you to provide some basic information about you and your child. This will include personal health information and information that can identify you including your age, sex and level of education and your child’s sex.

The data collected from this study including the videotapes of your child’s immunization procedures will be stored in a secure, locked location. Only members of the research team will have access to the data. This could include external research team members. Following completion of the research study, the data will be kept for 10 years and then destroyed. Published study results will not reveal your identity.

The supervisors of this project are located at St. Michael’s Hospital, SickKids, Mount SinaiHospital, and the University of Toronto.

**Reimbursement:**
You will not be paid to participate in this study.

**Compensation for Injury:**
We do not anticipate any harm to you by participating in the study. In no way does signing this consent form waive your legal rights nor does it relieve the investigators, sponsors or involved institutions from their legal and professional responsibilities. You do not give up any of your legal rights by signing this consent form.

**Participation:**
Participation in any research study is voluntary. If you choose not to participate, you and your family will continue to have access to customary care at the doctor’s office and at St. Michael’s Hospital. If you decide to participate in this study, you can change your mind without giving a reason, and you may withdraw from the study at anytime without any effect on the care you and your family will receive at the doctor’s office and St. Michael’s Hospital. It is your choice to take part in this study. You can stop at any time. The care you get at the doctor’s office and St. Michael’s Hospital will not be affected in any way by whether you take part in this study.

If you become ill or are harmed because of study participation, we will treat you for free. Your signing of this consent form does not interfere with your legal rights in any way. The study staff, any people who gave money for the study, or the hospital are still responsible, legally and professionally, for what they do.
Consent To Participate in a Research Study

Study Title: Testing Educational Material about Immunizations in a Paediatric Clinic

By signing this form, I agree that:
1) You have explained this study to me. You have answered all my questions.
2) You have explained the possible harms and benefits (if any) of this study.
3) I know what I could do instead of taking part in this study. I understand that I have the right not to take part in the study and the right to stop at any time. My decision about taking part in the study will not affect my health care at St. Michael’s Hospital.
4) I am free now, and in the future, to ask questions about the study.
5) I have been told that my medical records will be kept private except as described to me.
6) I understand that no information about who I am will be given to anyone or be published without first asking my permission.
7) I have read and understood pages 1 to 4 of this consent form. I agree, or consent, to take part in this study.

__________________________
Printed Name of Subject & Age

__________________________
Printed Name of Parent/Legal Guardian Parent/Legal Guardian’s signature & date

__________________________
Printed Name of person who explained consent Signature, date and time

If you have any questions about this study, please call Chaitya (Jay) Parikh, at 905-599-9121.

If you have any questions regarding your rights as a research participant, you may contact Dr. Robert Hyland, Chair, Research Ethics Board at 416-864-6060 ext. 2557 during business hours.

Version Date: October 24, 2012
Videotaping Consent Form – Parents

Principal Investigators:
Dr. Michael Sgro, Department of Paediatrics, St. Michael’s Hospital, Tel #: 416-864-6060 ext. 6560
Dr. Anna Taddio, Child Health Evaluative Sciences, SickKids, Tel #: 416-813-6235

Co-Investigators:
Dr. Vibhuti Shah, Staff Neonatologist, Mount Sinai Hospital, Tel #: 416-586-4816
Chaitya Parikh, BSc, Graduate Department, University of Toronto, Tel #: 905-599-9121

Title of Research Study:
Testing Educational Material about Immunizations in a Paediatric Clinic

Confidentiality:
The pictures or tapes produced from this study will be stored in a secure, locked location. Only members of the research team will have access to them. The videotapes will only be used for the purpose of this study. Following completion of the study, the tapes/pictures will then be destroyed in a secure manner.

Consent:
By signing this form, I agree that:
1) I also agree to have my infant videotaped during this study. These videotapes will be used to track the immunization procedure of my infant.
2) I understand that I have the right to refuse to let my infant take part in this study. I also have the right to take my child out of this part of the study at any time. I can change my mind and refuse to participate right before or even after the tapes are made. My decision will not affect my family’s health care at St. Michael’s Hospital.
3) I am free now, and in the future, to ask questions about the taping/picture taking.
4) I understand that no information (including these videotapes) about my child will be given to anyone or be published without first asking my permission.
5) I have read and understood the contents of this consent form. I agree, or consent, to have my child ______________________________ videotaped during this study.

If you have any questions about this study, please call Chaitya (Jay) Parikh, at 905-599-9121.

If you have any questions regarding your rights as a research participant, you may contact Dr. Robert Hyland, Chair, Research Ethics Board at 416-864-6060 ext. 2557 during business hours.

______________________________   _____________________________
Printed Name of Parent/Legal Guardian  Signature & date

______________________________   _____________________________
Printed Name of person who explained consent  Signature & date

Version Date: October 24, 2012
Videotaping Consent Form – Clinic Staff

Principal Investigators:
Dr. Michael Sgro MD, Department of Paediatrics, St. Michael’s Hospital, Tel#: 416-864-6060 ext. 6560
Dr. Anna Taddio PhD, Child Health Evaluative Sciences, SickKids, Tel#: 416-813-6235

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Title of Research Study:
Testing Educational Material about Immunizations in a Paediatric Clinic

Confidentiality:
The pictures or videotapes produced from this study will be stored in a secure, locked location. Only members of the research team will have access to them. All tapes will be destroyed following completion of the study.

Consent:
By signing this form; I agree that:
1) I agree to participate as the immunizer in this study and have the procedure videotaped during this study. Participation in being videotaped will not affect my current or future employment or staff evaluation.
2) I understand that patient consent has been obtained for videotaping of the procedure.
3) I understand that I have the right to refuse to take part in this study and not have my procedure videotaped at any time. My decision will not affect my employment at St. Michael's Hospital.
4) I am free now, and in the future, to ask questions about the taping/picture taking.
5) I understand that no information (including these videotapes) will be given to anyone or be published without first asking my permission.
6) I have read and understood pages 1 to 2 of this consent form.

If you have any questions about this study, please call Chaitya (Jay) Parikh, at 905-599-9121.

If you have any questions regarding your rights as a research participant, you may contact Dr. Robert Hyland, Chair, Research Ethics Board at 416-864-6060 ext. 2557 during business hours.

______________________________    __________________________
Printed Name of Clinician               Signature & date

______________________________    __________________________
Printed Name of person who explained consent   Signature & date