



Original Article

Barriers and facilitators to using pain treatment during newborn screening blood tests at a mother-baby unit

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ABSTRACT

Background: Newborns undergo blood tests for newborn screening (NBS). Breastfeeding, skin-to-skin care (SSC) and sweet solutions effectively reduce pain; however, these strategies are inconsistently used.

Aims: To assess the utilization of, and barriers and facilitators to using pain treatment during NBS.

Methods: Online survey of nurses in a mother-baby unit ascertaining pain management during NBS, and barriers/facilitators to using the three strategies. Participants viewed a video portraying the use of each strategy during NBS.

Results: Thirty-six of 45 nurses participated (response rate = 80%). Thirty-five (97%) reported completing NBS outside the patient's room. Breastfeeding was sometimes supported (44%) and 40% never suggested SSC, while 53% often used sucrose. After viewing the video, nurses preferred sucrose (mean = 82) over breastfeeding (mean = 44) or SSC (mean = 44). Main barriers to using breastfeeding and SSC were ergonomics, contextual factors and time.

Conclusions: Further work is warranted to address barriers to using evidence-based pain treatment for newborns during NBS.

Introduction

Newborn infants undergo blood tests and needles in their first two to three days of life, including a newborn screening (NBS) blood test, which tests for many diseases including newborn errors of metabolism and other diseases (Newborn Screening Ontario, 2017). NBS is most commonly obtained through heel lance or venipuncture. These procedures are painful for newborns and can also cause distress for the parents (Franck et al., 2012a). Undertreated or poorly treated pain in the newborn and early infancy period may result in future non-compliance with immunizations and exaggerated reactions (anxiety, needle-phobia) during future needles and blood tests (von Baeyer et al., 2004), and reduce parental satisfaction with the care received (Franck et al., 2011). Healthcare providers have an ethical responsibility to prevent or minimize pain during blood tests and other painful procedures (American Academy of Pediatrics, 2016).

Breastfeeding (Benoit et al., 2017), skin-to-skin care (SSC) (Johnston et al., 2017), and small volumes of sweet solutions (Harrison

et al., 2017), such as sucrose (Stevens et al., 2016) or glucose (Bueno et al., 2013) effectively reduce pain in newborn infants during short lasting acute painful procedures such as heel lance, venipuncture and immunizations. Systematic reviews and meta-analyses of these strategies compared to no treatment, placebo, or other strategies (such as non-nutritive sucking or swaddling) show a significant reduction in neonatal pain during blood tests and needles (Benoit et al., 2017; Bueno et al., 2013; Harrison et al., 2017; Johnston et al., 2017; Stevens et al., 2016).

National and international guidelines (Lee et al., 2014; American Academy of Pediatrics, 2016) recommend the use of pharmacologic and non-pharmacologic methods of pain reduction for minor painful procedures, including breastfeeding, skin-to-skin care and sucrose. However, such pain-reducing strategies, while simple, low-cost, and strongly recommended, are inconsistently and infrequently used in Canada and across the world (Cruz et al., 2016; Harrison et al., 2017; Johnston et al., 2011). Previous knowledge translation interventions to increase uptake of pain treatment for infants during painful procedures have

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involved educating healthcare providers, but evidence indicates that education alone is insufficient to change practice (Forsetlund et al., 2009; Giguère et al., 2012).

To date, few studies have targeted parents of newborn infants, in spite of the fact that previous studies have shown that parents wish to be more involved in their infant's pain management (Benoit et al., 2016; Cong et al., 2014; Franck et al., 2012a, 2011; Palomaa et al., 2016). Parents have reported they would like to receive more information regarding pain management strategies, they want to have a role in comforting their babies, they hope for more involvement opportunities in caring for their babies in hospital (Axelin et al., 2015; Cong et al., 2013; Franck et al., 2012b), and feel more comfortable accepting procedures involving needles when they are provided with information to help reduce their infant's pain (Nicholls and Southern, 2013).

Given the lack of studies targeting parents of newborn infants to improve use of pain treatment, a pilot randomized controlled trial (RCT) (Lavin Venegas et al., 2019) was conducted at a mother-baby unit in Ontario, Canada, to inform a future full-scale RCT that will evaluate the effectiveness of a brief parent-targeted and parent-mediated (Stacey and Hill, 2013) video (BeSweet2Babies) at increasing uptake of pain treatment during NBS. The BeSweet2Babies video is 5-min long and shows the use, effectiveness as well as ease of use, of breastfeeding, SSC, and sucrose during heel lance and venipuncture. The video explains in user-friendly language how parents can be involved in comforting their infant during these procedures, while showing three infants, each receiving one of the three pain management strategies. The video was initially posted onto YouTube in 2014, with a revised version posted in October 2016 (<https://www.youtube.com/watch?v=L43y0H6XEh4&feature=youtu.be>).

Results of the pilot RCT (Lavin Venegas et al., 2019) which included 100 parents of newborns, half of which were randomized to view the BeSweet2Babies video, showed that parents preferred to use breastfeeding or skin-to-skin care (45/50 and 46/50 respectively) after viewing the video, yet these two methods were rarely used (1/50 and 2/50 respectively). Sucrose was most frequently used (29/50), but fewer parents reported wanting to use it (33/50). To explore potential reasons for the discrepancy between parents' preferred use of evidence-based pain management strategies and nurses' practice, a follow-up survey of nurses (from the same mother-baby unit) was conducted. The objective of the survey was to assess barriers and facilitators to the use of each of the three pain treatment methods by nursing staff.

Materials and methods

Recruitment

The Clinical Manager in the mother-baby unit sent all nursing staff who were currently working in the unit at the time of survey, an invitation email containing a unique online link to Research Electronic Data Capture (REDCap) (Harris et al., 2009) to complete the survey, as well as three additional reminders within a 6-week period. Informed consent was obtained from study participants (implied by completing the survey). All information collected was anonymized.

Survey content

The nursing staff survey was pilot tested by three research nurses. It included 15 questions and took approximately 10–15 min to complete. The first six questions included demographic questions (role in the mother-baby unit, gender, age) and questions to determine their level of experience and employment status. The next 5 questions were closed-ended questions to explore nurses' usual practices regarding NBS, such as identifying the place where the NBS is usually completed, whether parents are usually present during the blood test, and how frequently they suggest breastfeeding or SSC or use sucrose or glucose, assessed as “always”, “often”, “sometimes”, “rarely” or “never” and allowing a

space to comment on facilitators and barriers to using each type of pain management strategy.

Nurses were then invited to watch the BeSweet2Babies video (YouTube link provided) and report their intention to use each of the three different pain treatment methods after viewing the video on a scale from 0 to 100. A final open-ended question allowed nursing staff to provide suggestions to make the use of pain treatment easier during blood tests. The survey was accompanied by an information sheet that explained the risks and benefits of participating, confidentiality and privacy information, as well as a study report with the pilot RCT findings.

Analysis

Data were exported from REDCap into an Excel spreadsheet and imported into SAS 9.4 (SAS Institute Inc., 2011). The follow-up surveys were analyzed using descriptive statistics (frequency and percentage or mean and standard deviation) for quantitative data. Open-ended questions were analyzed using content analysis, categorized into recurring themes and presented with their corresponding frequencies (O' Cathain and Thomas, 2004).

Ethics

Ethical approval was obtained by the two affiliated hospital ethics boards (Reference number: 15/176X and Reference number: 20150906-01H).

Results

The nursing staff survey was emailed to 45 nurses (registered nurses or registered practical nurses), and 36 (80%) completed (or partially completed) the survey. Demographic and descriptive characteristics of nursing staff are presented in Table 1. Of the 36 respondents, 24 were registered nurses and 12 were registered practical nurses, and all but one respondent were female. Respondents were between 20 and 60 years of age, working mainly full or part-time at the mother-baby unit (46% versus 43% respectively), with 11% working on a casual basis.

The survey results are presented in Table 2. The first part of the survey assessed nurses' usual practices in relation to pain management during NBS. All respondents but one (97%) reported completing the NBS test in a room separate from the patient's room, and more than half of the survey respondents (57%) stated that parents were sometimes present in the room when NBS took place. The majority of respondents stated that they sometimes (44%) or rarely (41%) suggested that the

Table 1
Nursing staff demographic and descriptive characteristics (N = 36).

	N (%) / mean (SD)
Role in the mother-baby unit (n = 36)	
Registered Nurse	24 (67%)
Registered Practical Nurse	12 (33%)
Gender (n = 36)	
Male	1 (3%)
Female	35 (97%)
Age (n = 36)	
20–30 years	13 (36%)
31–40 years	9 (25%)
41–50 years	9 (25%)
51–60 years	5 (14%)
Employment status (n = 35)	
Full-time	16 (46%)
Part-time	15 (43%)
Casual	4 (11%)
Length of time working at the mother-baby unit in years (n = 35) (mean, SD)	11 (10.0)

Abbreviations: N, number; SD, standard deviation.

Table 2
Nursing staff follow-up survey results (N = 36).

	N (%)	Q1	Median	Q3
Place where NBS is usually done (n = 35)				
In the patient's room	1 (3%)			
In a room separate to the patient's room	34 (97%)			
Presence of parents in the room during NBS (n = 35)				
Always	0 (0%)			
Often	8 (23%)			
Sometimes	20 (57%)			
Rarely	7 (20%)			
Never	0 (0%)			
Suggest that the mother breastfeeds her baby during NBS (n = 34)				
Always	0 (0%)			
Often	5 (15%)			
Sometimes	15 (44%)			
Rarely	14 (41%)			
Never	0 (0%)			
Suggest skin-to-skin care during NBS (n = 35)				
Always	1 (3%)			
Often	2 (6%)			
Sometimes	8 (23%)			
Rarely	10 (28%)			
Never	14/35 (40%)			
Suggest giving sucrose/glucose during NBS (n = 34)				
Always	9 (26%)			
Often	18 (53%)			
Sometimes	4 (12%)			
Rarely	3 (9%)			
After watching the video, would use/suggest breastfeeding during NBS ^a (n = 33) (mean, SD)	44 (35)	4	50	74
After watching the video, would use/suggest skin-to-skin care during NBS ^a (n = 33) (mean, SD)	44 (34)	2	50	70
After watching the video, would use/suggest sucrose/glucose during NBS ^a (n = 34) (mean, SD)	82 (26)	74	94	100

Abbreviations: N, number; NBS, newborn screening blood test; SD, standard deviation; Q1, first quartile; Q3, third quartile.

^a Measured on a scale from 0 to 100.

mother breastfeed their baby during NBS and 40% responded that they never or rarely (28%) suggested parents hold their newborns skin-to-skin during NBS. Nurses reported always (26%) or often (53%) using sucrose or glucose during NBS.

After watching the video, with respect to how likely nurses would be to suggest or use breastfeeding, SSC, or sucrose/glucose during NBS on a scale from 0 to 100 where 0 represents “not at all likely” and 100 represents “extremely likely”, the mean responses were 44 (SD = 35), 44 (SD = 36), and 82 (SD = 26), respectively.

The qualitative component of the survey allowed staff to comment on the barriers and facilitators to using breastfeeding, SSC and sucrose/glucose. Out of the 36 respondents, 30 (83%) commented on barriers and facilitators to using breastfeeding, 30 (83%) to using SSC, and 22 (61%) to using sucrose or glucose.

Results from the content analysis of nursing staff comments on breastfeeding are presented in Table 3a. Comments from 30 respondents revealed six main themes of perceived barriers to using **breastfeeding** during newborn NBS in order of most frequently identified to least frequently identified: 1) ergonomics (difficulty with positioning); 2) contextual factors (special circumstances, i.e. breastfeeding not established or parents being asleep at the time of bloodwork); 3) time (more time-consuming); 4) perceived side-effects of using breastfeeding as pain treatment (i.e. choking); 5) environmental barriers (space, lighting); and 6) lack of confidence in the effectiveness of breastfeeding in reducing pain during NBS. Only one participant reported a facilitator in addition to barriers: “It sometimes calms the baby during the newborn screen testing”.

Results from the content analysis of nursing staff comments on SSC are presented in Table 3b. Comments from 30 respondents revealed five main themes of perceived barriers to using **skin-to-skin care** during NBS, which were similar to those identified for breastfeeding, listed here in order of most frequently identified to least frequently identified: 1) ergonomics (difficulty with positioning); 2) contextual factors

(special circumstances, i.e. infant's poor health or parents being asleep at the time of bloodwork); 3) time (more time-consuming or lack of time); 4) perceived side-effects of using SSC as pain treatment; and 5) environmental barriers (space, lighting). Only one participant reported a facilitator in addition to barriers: “New parents (are) more interested in being present for tests”.

Results from the content analysis of nursing staff comments on sucrose/glucose are presented in Table 3c. Comments from 22 respondents revealed three main themes of perceived barriers to using **sucrose/glucose** during newborn NBS in order of most frequently identified to least frequently identified: 1) contextual factors (i.e. lack of parental consent); 2) lack of confidence in the effectiveness of sucrose/glucose in reducing pain during NBS; and 3) perceived side-effects (i.e. choking). Two main themes of perceived facilitators were revealed in comments from the 22 respondents: effectiveness of sucrose/glucose in reducing pain during NBS; and availability and ease of use of sucrose/glucose.

The open-ended question regarding suggestions to make the use of the three strategies easier was answered by 5 of the 36 nurses (14%). They suggested having a chair in the procedure room, finding an ergonomic way to do the blood test while the parent holds the baby skin-to-skin or breastfeeds, ideally having private rooms, and being trained on positioning.

Discussion

Principal findings

This survey of nurses showed that nurses prefer to use sucrose over family-led interventions of breastfeeding and SSC during NBS. Even after viewing the video as part of the administered survey, nurses were still less likely to report an intention to use breastfeeding or SSC. More specifically, after viewing the video, nurses reported that they were

Table 3A
Barriers and facilitators to using breastfeeding during newborn screening.^a

Theme	Description of theme	Example quotes
Ergonomics (28/30 respondents)	Nursing staff's difficulty with positioning, maintaining good posture during NBS.	"A barrier would be finding an ergonomic way in doing the blood test without injuries to backs and necks".
Environmental barriers (3/30 respondents)	Lack of suitable space, lighting or infrastructure to complete NBS.	"Space, lighting". "Some rooms are too small, crowded and therefore making it hard to perform the test".
Lack of confidence in the strategy (1/30 respondents)	Lack of confidence in effectiveness of breastfeeding analgesia.	"... due to the fact that mothers milk supply is rarely established by 24 hrs of age when we usually collect the sample I believe it wouldn't be as effective as sucrose".
Time (6/30 respondents)	Time-consuming or lack of time to complete NBS while the mother breastfeeds. Repeat sampling possibly required.	"It would also take longer to collect the sample". "Repeat more than once".
Contextual factors (8/30 respondents)	Circumstances that make using breastfeeding more challenging.	"Breastfeeding often not established". "Testing usually in early morning, parents want to rest". "Mom doesn't want to see".
Perceived Side-effects (5/30 respondents)	Perceived side effects of using breastfeeding during NBS.	"Added stress to parents when baby begins to cry or fuss at breast". "If a lot of blood is required from newborn, venous may need to be used and there would be an increased risk of needle stick injury to nurse, newborn and/or parents if newborn is breastfeeding or skin to skin".

Abbreviations: NBS, newborn screening blood test.

^a 30/36 (83%) nursing staff reported on barriers, and 1/36 (3%) additionally reported on facilitators. Some nurses reported more than one barrier. Content analysis of facilitators could not be conducted due to insufficient data.

Table 3B
Barriers and facilitators to using skin-to-skin during newborn screening.^b

Theme	Description of theme	Example quotes
Ergonomics (28/30 respondents)	Nursing staff's difficulty with positioning, maintaining good posture during NBS.	"Very awkward to do, hard on nurses back".
Environmental barriers (2/30 respondents)	Lack of suitable space, lighting or infrastructure to complete NBS.	"Lack of space in patients' room". "Lighting".
Time (5/30 respondents)	Time-consuming or lack of time to complete NBS while the mother breastfeeds. Repeat sampling possibly required.	"Takes longer to do the test".
Contextual factors (5/30 respondents)	Circumstances that make using skin-to-skin care more challenging.	"Parents usually too tired for AM bloodwork". "Newborn's health status (i.e. ICU/Special Care nursery and not able to engage in skin to skin)".
Perceived Side-effects (4/30 respondents)	Perceived side effects of using SSC during NBS.	"Mothers get upset when the baby cries on the breast". "If a lot of blood is required from newborn, venous may need to be used and there would be an increased risk of needle stick injury to nurse, newborn and/or parents if newborn is breastfeeding or skin to skin".

Abbreviations: NBS, newborn screening blood test; SSC, skin-to-skin care.

^a 30/36 (83%) nursing staff provided comments on barriers, and 1/36 (3%) provided comments on facilitators in addition to barriers. Some nurses reported more than one barrier. Content analysis of facilitators could not be conducted due to insufficient data.

Table 3C
Barriers and facilitators to using sucrose/glucose during newborn screening.^a

Theme	Description of theme	Example quotes
Barriers		
Lack of confidence in the strategy (2/22 respondents)	Lack of confidence in analgesic effectiveness of sucrose/glucose.	"Most of the time sucrose does not work". "50/50 working".
Contextual factors (13/22 respondents)	Circumstances that prevent the use of sucrose/glucose.	"Parents declining use of sucrose during blood tests".
Perceived Side-effects (2/22 respondents)	Possible side effects of using sucrose/glucose during NBS.	"Sometimes sucrose makes babies choke or vomit because it stimulates mucus and babies can choke from their mucus". "Sucrose tends to make the babies sleepy after, may not want to breastfeed".
Facilitators		
Availability and ease of use (3/22 respondents)	Sucrose readily available for administration. Ease of use of sucrose/glucose during NBS.	"Availability and convenience of sucrose". "Easier maneuverability with a flatter surface and space"
Effectiveness (5/22 respondents)	Effectiveness of sucrose/glucose in reducing pain during NBS.	"I do find the sucrose does help the newborn with the pain". "It soothes the baby while the test is being done".

Abbreviations: NBS, newborn screening blood test.

^a 22/36 (61%) nursing staff provided comments on barriers and facilitators. Some nurses reported both barriers and facilitators, while other nurses reported more than one barrier.

much more likely to suggest or use sucrose compared to breastfeeding or SSC. This highlights that what nurses use and prefer to use is at odds with parents' preferences.

Another finding was that almost all NBS tests were completed in a room separate to the patient's room and only sometimes in the presence of parents which make using breastfeeding and SSC especially challenging when the newborns are separated from their mother. This is in contrast with the family-centered care approach which encourages parent's presence and participation in care-giving, such as through parental involvement during painful procedures (Gooding et al., 2011).

Barriers and facilitators to using each pain treatment method were ascertained. Nursing staff reported similar barriers to using breastfeeding and SSC for pain management, the main barrier being difficulty in positioning themselves for the bloodwork, followed by contextual factors (i.e. NBS usually completed early in the morning in this unit when parents are asleep or perceiving that parents did not want to see the painful procedure) and the perceived extra time required to complete the bloodwork using these two strategies. Some nurses were concerned with perceived side-effects of using these strategies during NBS which is consistent with previous studies (Harrison et al., 2015; Taddio et al., 2009), and one nurse reported that breastfeeding might not be as effective as sucrose. One nurse reported that breastfeeding sometimes calms the baby during NBS, and one nurse reported that a facilitator to using SSC was that parents were more interested in being present during blood tests.

The main barriers to using sucrose were contextual factors, more specifically, the lack of parental consent for sucrose. Fewer nurses reported being concerned about perceived side-effects of using sucrose, and lacking confidence about the effectiveness of sucrose in reducing procedural pain. In contrast, more nurses stated the effectiveness of sucrose as a facilitator, as well as its ease of use and availability.

The survey findings were consistent with the pilot RCT findings (Lavin Venegas et al., 2019). More specifically, the self-reported frequency of use of different pain management strategies for newborns undergoing NBS from the nursing staff survey, conducted a year after the pilot RCT, were similar to the objective measures of frequency of use extracted from routinely collected data in the pilot RCT (Lavin Venegas et al., 2019).

The barriers and facilitators found in this survey were also consistent with those found in previous studies, including a provincial survey of Ontario maternal newborn units (Cong et al., 2013; Harrison et al., 2015; Taddio et al., 2009). Additionally, Etchegary et al., in their qualitative interview study regarding parental consent for NBS, found that the process of NBS was highly routinized, where the nurse often goes into the parent's room, confirms the information, and proceeds with the blood test, without requesting parent's permission (Etchegary et al., 2016). This may reduce the opportunity for parents to ask about pain treatment and advocate for it. Many parents in that study reported not being aware of having given consent for NBS, nor did they recall when the blood test took place (Etchegary et al., 2016). This can be expected when newborns are separated from their mother so that NBS can be completed in a separate room or completed when parents are asleep, which was shown to be common practice in this survey study of nurses.

Strengths and limitations

A strength of this study was the high response rate for the nursing staff survey, including their detailed comments about barriers and facilitators to the use of newborn pain treatment. However, results for the nursing staff follow-up surveys should be interpreted with caution, as the study was conducted in a single site and nurses who responded to the survey may not have been the same nurses who cared for the parents who participated in the pilot RCT over a year earlier. However, the mean time for working at that mother-baby unit was 11 years, suggesting that many nurses were likely involved in both parts of the study.

Additionally, since this follow-up study used self-reported surveys, it may be vulnerable to social desirability bias, especially since it was the nursing staff's Clinical Manager who sent the email with the survey invitation. However, the information sheet attached to the survey described in detail the anonymity and confidentiality of the survey. It also stated that their participation was optional and not choosing to participate would not have any consequences for their employment. It is also important to note that nursing staff who chose to respond to the survey, especially the open-ended questions, might be different than those who chose not to complete the survey. Limited information was obtained on facilitators. Further work is needed to understand nursing perceptions of individual and organizational facilitators to using pain treatment during NBS.

Implications for practice

Given the results from this survey, future knowledge translation strategies are warranted to work at addressing modifiable barriers to the use of pain treatment during NBS. Possible interventions may involve showing healthcare providers the BeSweet2Babies video which demonstrates effectiveness and ease of blood collection while infants are breastfeeding and held skin-to-skin. Nurses may be able to better understand how the different methods are used in terms of positioning themselves, the infants and parents. They will also be able to perceive the timing and safety of the procedure by observing how effective and safe the strategies are in soothing the infant, thus, targeting two barriers stated in the follow-up surveys. However, the video on its own does not appear to be sufficiently convincing to nursing staff, and thus, additional written material should be provided, ergonomic interventions should be implemented (i.e. training on positioning, ergonomically designed work space and furniture), as suggested by one of the respondents. A myths and truths section about the three methods could be included in the educational material for both parents and nursing staff, which might help to improve nurses' knowledge and attitudes towards the use of pain treatment and facilitate parental consent for sucrose and engagement in family-led pain-reducing strategies. Healthcare provider educational material should clearly state that parents do wish to be involved in managing their infant's pain, so as to overcome the barrier related to nurses' perception that parents prefer not to participate in pain management.

One barrier frequently mentioned by nursing staff in this unit was that NBS was usually completed early in the morning when parents are thought to be sleeping. It is difficult to conclude whether this is just nurses' perception or if parents have explicitly stated they do not wish to be disturbed. A potential way to overcome this would be to promote the use of pain treatment in written form (i.e. posters in the unit) in addition to the video, reminding parents to ask their nurse for an estimated time of bloodwork and to request their preferred method(s) of pain treatment in advance. This way, parents can be prepared when it is time for the blood test (i.e. initiating breastfeeding or SSC beforehand), so that nurses may avoid having to wait to begin collecting the blood sample. Such posters could also serve as constant reminders for nurses to offer parents the choice of using pain treatment and to ensure that parents' wishes to breastfeed or hold their infant skin-to-skin or use sucrose are met.

Conclusion

Barriers to consistent use of effective pain treatment during NBS remain to be addressed. Future knowledge translation studies could benefit from a thorough assessment of parents' perceived barriers and facilitators to the use of pain treatment. Parents, nursing staff and organizational leaders need to work together as partners in pain management. Further work is warranted to ensure that infants receive evidence-based care.

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Disclosure of interest

The authors report no conflict of interest.

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Appendix A. Supplementary data

Supplementary data related to this chapter can be found at <https://doi.org/10.1016/j.jnn.2018.08.005>

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