DOI: 10.1097/JPN.0000000000000254

*J Perinat Neonat Nurs* • Volume 31 Number 2, 160–165 • Copyright © 2017 Wolters Kluwer Health, Inc. All rights reserved.

# Blood Sampling in Newborns

## *A Systematic Review of YouTube Videos*

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**ABSTRACT**

Objective of this study was to conduct a systematic review of YouTube videos showing neonatal blood sampling, and to evaluate pain management and comforting interventions used. Selected videos were consumer- or professional-produced videos showing human newborns undergoing heel lancing or venipuncture for blood sampling, videos showing the entire blood sampling procedure (from the first attempt or puncture to the time of application of a cotton ball or bandage), publication date prior to October 2014, Portuguese titles, available audio. Search terms included "neonate," "newborn," "neonatal screening," and "blood collection." Two reviewers independently screened the videos and extracted the following data. A total of 13 140 videos were retrieved, of which 1354 were further evaluated, and 68 were included. Videos were mostly consumer produced (97%). Heel lancing was performed in 62 (91%). Forty-nine infants (72%) were held by an adult during the procedure. Median pain score immediately after puncture was 4 (interquartile range [IQR] = 0-5), and median length of cry throughout the procedure was 61 seconds (IQR = 88). Breastfeeding (3%) and swaddling (1.5%) were rarely implemented. Posted YouTube videos in Portuguese of newborns undergoing blood collection demonstrate minimal use of pain treatment, and maximal distress during procedures. Knowledge translation strategies are needed to implement effective measures for neonatal pain relief and comfort.

**Key Words:** infant, neonatal nursing, newborn, pain

All newborn infants undergo blood sampling for newborn screening, and sick hospitalized infants require repeated blood sampling and other painful procedures over the course of their hospitalization.[1–6] High-quality synthesized evidence is available on effective, simple-to-use, and low-cost interventions for neonatal procedural pain treatment. Effective interventions include breastfeeding before and during painful procedures such as heel lancing and venipuncture,[7] skin-to-skin contact, or kangaroo care before and throughout the procedure[8] and small amounts of sweet solutions such as glucose and sucrose.[9,10]

These interventions are recommended in internationally published guidelines[11–13]; however, studies conducted over many years across different continents continue to demonstrate that newborn infants undergo numerous painful procedures in which analgesic strategies are not consistently and effectively implemented.[1–6] Results of a recently published systematic review indicate a strong association between pain-related stress in preterm infants to poor developmental outcomes such as limited growth and weight gain, changes on the development of subcortical structures, and gray matter, and cognitive and motor developmental changes.[14]

Therefore, developing, evaluating, and implementing knowledge translation strategies on neonatal pain relief are essential to improve outcomes for infants

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**Disclosure:** The authors have disclosed that they have no significant relationships with, or financial interest in, any commercial companies pertaining to this article.

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*Submitted for publication: September 26, 2016; accepted for publication: February 11, 2017.*

in neonatal units. Knowledge translation is defined as a dynamic and interactive process, including synthesis, dissemination, exchange, and application of knowledge to improve health of individuals, to improve effectiveness of health services and products, and finally to strengthen the healthcare system.[15] In the last few years, the Internet has provided additional means by which health information can be disseminated.

The Internet provides unprecedented opportunities for patients and general public to retrieve health information at a global level.[16] Specifically, YouTube is a popular tool that has over a billion users and allows people to watch and share originally created videos,[17] and potentially provides a new way to communicate evidence-based health information to a large number of people.[18] Harrison et al[18] conducted a systematic review of YouTube videos showing infant immunizations, and reported minimal use of recommended pain treatment strategies. Since then, they posted their own YouTube video showing infants receiving effective pain treatment (breastfeeding and sucrose) during immunization (https://www.youtube.com/watch?v=8Wzjxvrl91U) for widespread dissemination of knowledge to parents and healthcare providers.[19]

The purpose of this study was to conduct a similar systematic review of YouTube videos showing neonatal blood sampling, to assess infants' pain during the procedures, and to ascertain the use of effective procedural pain management strategies.

## METHODS

### Type of study

A systematic review of YouTube videos of newborn infants undergoing blood sampling.

### Search methods

Videos were considered as eligible if they met the following criteria: consumer- or professional-produced videos showing human newborns undergoing heel lancing or venipuncture for blood sampling, videos showing the entire blood sampling procedure (from the first attempt or puncture to the time of application of a cotton ball or bandage), publication date before October 2014, Portuguese titles, available audio.

Search terms included "neonate," "newborn," "neonatal screening," and "blood collection." Terms were selected according to the highest proportion of web searches on Google Trends.[20] Therefore, 4 different search strategies were organized combining 2 terms per search.

Search methods were based in a prior systematic review of YouTube videos.[18] A new YouTube account was created to eliminate the chance of search history influencing search rankings. The end point was determined through a discontinuation rule of 70 videos. It means that when 70 consecutive videos did not meet the eligibility criteria and were excluded, no future videos were screened. After viewing a video that met the inclusion criteria, the first 5 related suggested videos that appeared were screened.[18]

### Data extraction

Two reviewers performed the screening independently and assessed videos for eligibility (EN and LF). In case of conflicts not solved through a consensus between the 2 reviewers, a third reviewer (MB) was consulted.

Data were independently extracted by 2 authors (EN and TC) and included video name and URL, date of upload, length of the videos, number of views, number of likes, number of dislikes, number of comments, type of the video, type of painful procedure, number of punctures, total length of the procedure (from the first attempt or puncture to the time of application of a cotton ball or bandage), positioning of the infant during the procedure, use of observable analgesic strategy(ies) before, during, and or after puncture(s), and type of observable analgesic strategy(ies) implemented. Infants' pain was assessed using a commonly used subset of the Neonatal Facial Coding System (NFCS)[21] (brow bulge, eye squeeze, nasolabial furrow, stretch open mouth) at 15 seconds after the first and last puncture, as well as prevalence of crying before, during, and after the procedure, and total length of crying (from the first attempt or puncture to the time of application of a cotton ball or bandage).

### Data analysis

Data were stored in a pretested Microsoft Excel for Windows spreadsheet and logistic checks were performed by a third reviewer (MB). Data were analyzed using the software SPSS version 20. Descriptive data are presented as mean and standard deviation in case of normal distribution, and are presented as median and interquartile ranges (IQR) if data did not follow normal distribution. Pain scores were calculated only if all 4 facial actions were able to be observed by both coders (EN and TC), and agreement between 2 coders was assessing by using $\kappa$ statistics. All data were analyzed for $\kappa$ statistics, including videos in which grimacing was not considered observable by the coders. Agreement between the coders in regard to length of crying was evaluated by the intraclass correlation coefficient.

## RESULTS

Searches were conducted during March 2015. Of the 13 140 videos retrieved, 1354 were evaluated; 68 videos of neonates undergoing blood sampling were included (see Figure 1).

The oldest included video was posted in October 2006. Median length of the videos was 214.5 seconds (IQR = 204.25, range 33-638 seconds) and median number of views was 416 (IQR = 4527.49, range 45-28 285). Number of likes per video varied between 1 and 18, and number of dislikes ranged from 1 to 15. There were comments in 21 videos (range 1-19).

Included videos were mostly produced by families (66 videos, 97%). One video showed twins receiving one procedure each; therefore, data of 69 infants who underwent blood sampling were evaluated.

Heel lancing was performed in 62 (91%) infants and venipuncture in 7 infants. Number of attempts for blood sampling ranged from 1 (53 infants, 77%) to 6 (1 infant) punctures (median 1, IQR = 0). Length of the procedure (from the first attempt or puncture to the time of application of a cotton ball or bandage) ranged from 9.5 to 348 seconds, median of 96 seconds (IQR = 92).

The majority of the newborns were held by an adult before and during the procedure (49 infants, 72%). Comforting/analgesic strategies included breastfeeding (2 infants) and swaddling (1 infant).

It was possible to score the NFCS at 15 seconds immediately after the first puncture or attempt in 23 (33%) infants. Median pain score was 4 (IQR = 0.5, range 0-4), and the majority (74%) of the assessed infants presented the highest pain score possible as displayed at Figure 2. Five infants who received more than one puncture were assessed after the last puncture for the same facial actions. Results were median pain score 4 (IQR = 0, range 0-4): 4 infants scored 4, and 1 infant scored 0.

Crying before the procedure was observed in 29 (46%) infants, and crying during and after blood sampling was observed in 62 (91%). Median time spent crying during the entire procedure (from the first puncture or attempt until the application of a cotton ball or bandage) was 61 seconds (IQR = 88, range from 0 to 300 seconds).

Interrater agreement of the NFCS and total time spent crying of all included videos was established by 2 trained observers (EN and TC). Data extracted from videos were included on the analyses (see Table 1).

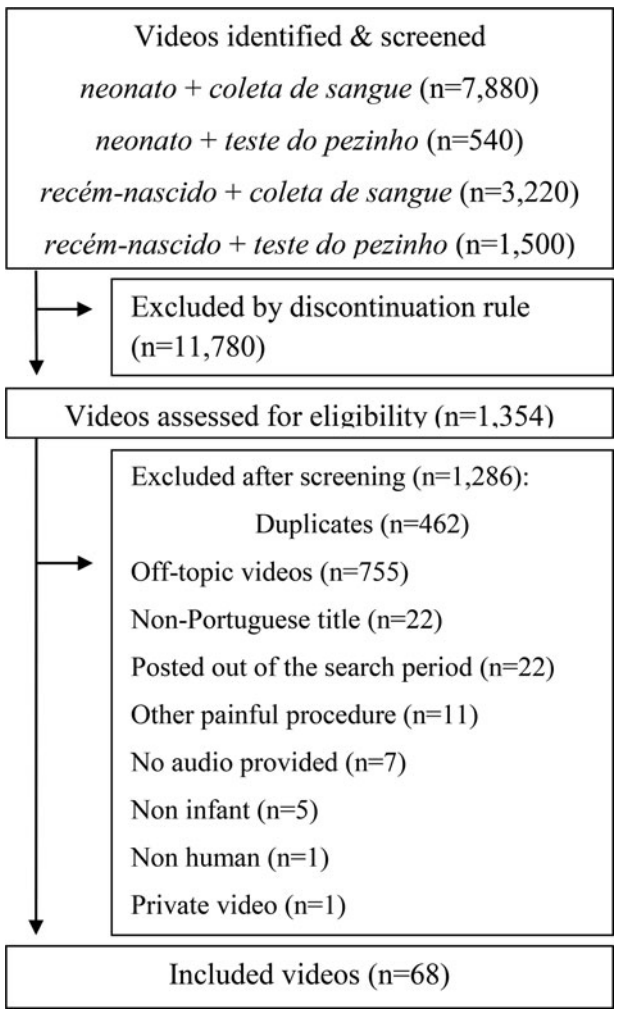


**Figure 1.** Study selection process for systematic review (PRISMA diagram).

## DISCUSSION

Systematic review of YouTube videos is an innovative method for measuring knowledge translation. Although search and screening processes are not standardized yet for this type of research, systematic review methods are evolving. Our method was based on a prior systematic review of YouTube videos showing infant immunization.[18] This new area of research includes a limited number of studies of pediatric pain-related videos published on the Internet to date.[18,22]

A large variability on the characteristics of the included videos, such as length, number of views, number of likes and dislikes, was observed. This might be explained by the nature of the videos, which were mainly produced by families. The reasons for which parents post such videos of their infants undergoing blood sampling are not known, and similarly to what was performed in a prior review, we did not seek to uncover reasons for these posts.[18]

This systematic review of 68 YouTube videos with Portuguese titles showing newborn infants undergoing blood sampling clearly showed that most infants were highly distressed during the procedures.

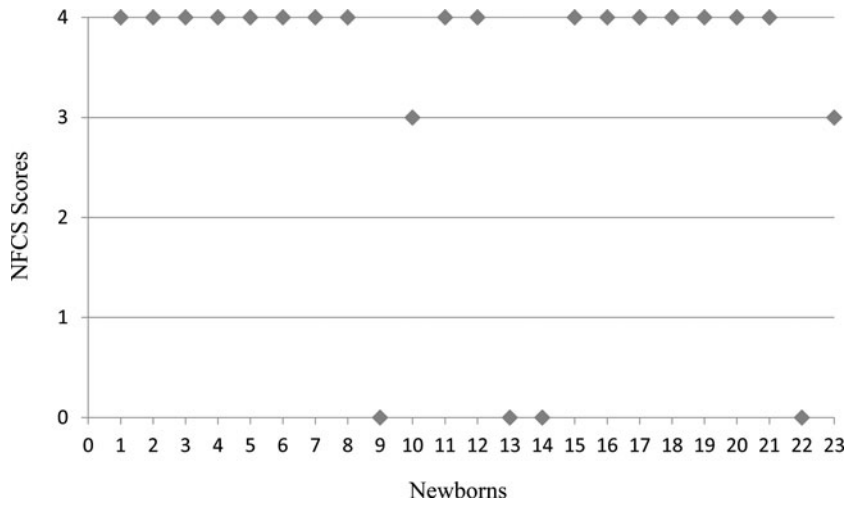


**Figure 2.** Pain scores at 15 seconds immediately after the first puncture or attempt. São Paulo, 2015.

Recommended pain treatment strategies such as breastfeeding, skin-to-skin care, or sucrose were almost never used despite internationally published consensus and guidelines recommending the pain prevention and treatment for newborns during blood sampling and other painful procedures.[11–13,23,24] Placing the infants on their parents' lap was observed in 72% of the videos although this is insufficient to effectively reduce pain.[25] Effective analgesic strategies for single neonatal procedures such as breastfeeding, skin-to-skin contact, and sweet solutions were rarely implemented as highlighted by the included videos.

The heterogeneity of the included videos precludes an assessment of reasons for the lack of implementing analgesic strategies during neonatal blood sampling. Barriers for using breastfeeding and/or skin-to-skin contact described in the literature may include professional's preference to perform blood sampling without the parents, parents' preference not to be involved during painful procedures, units' cultures and/or policies, out-of-date policies, insufficient time, knowledge, and education of the healthcare professionals, staff being uncomfortable performing blood sampling, with infants being breastfed or positioned on skin to skin.[26,27] Sweet solutions may not be readily available for administration in clinical settings.[28] Parental refusal has also been identified as a barrier for administration of sweet solutions.[28,29] Further exploring these barriers is necessary as an attempt to contribute on the development and implementation of knowledge translation strategies tailored to contribute to better neonatal pain outcomes.

Table 1. **Interrater reliability for grimacing and total time spent crying**

| **Grimacing** | **κ (CI 95%)** |
|---|---|
| Brow bulge | 0.77 (0.69-0.84) |
| Eye squeeze | 0.84 (0.77-0.9) |
| Nasolabial furrow | 0.87 (0.81-0.92) |
| Open mouth | 0.88 (0.82-0.93) |
| **Crying** | **ICC (CI 95%)** |
| Time spent crying | 0.983 (0.972-0.989) |

Abbreviations: CI, confidence interval; ICC, intraclass correlation coefficient.

Improving neonatal pain treatment by consistently using effective internationally recommended pain treatment strategies is important. Traditionally, education has targeted healthcare providers; however, supporting parents to advocate for effective pain treatment for their infants may contribute to improved neonatal pain management practices. Knowledge translation interventions targeted at parents are rarely described in the literature. In a randomized controlled trial, parents received (i) a pain information booklet and information on how to provide comfort to their infants, in addition to a generic booklet on neonatal care, or (ii) a generic booklet on neonatal care alone.[30] Parents who received specific information on neonatal pain management and comfort were more satisfied with the information and more involved with their infants during painful procedures.[30]

Regardless the presence of one or more family members, the included videos did not highlight parental involvement on infants' comforting and pain management. However, studies indicate that parents consider their participation on neonatal pain control as vital and they want to be involved on their infant's care during painful procedures although barriers such as emotional

difficulties in being present or participating and staff attitudes and behaviors are described.[30–32] Some nurses consider parents' presence for observing and comforting their infants important; however, some nurses feel this is inappropriate and not in the best interests of the infant or family.[33] In addition to this, our results conflict with findings of a Canadian prospective observational study that indicates parental presence as a consistent predictor on the use of analgesic interventions during tissue-damaging procedures in hospitalized neonates (ie, infants received analgesia more frequently if their parents were present).[4]

Informing parents on the risks of untreated neonatal pain and on effective and safe strategies available for pain prevention and management may empower them on advocating for better pain care for their infants. Several strategies can be implemented, as per the booklet investigated in a recently published study.[30] Following current trends, consumers wish to search for and create content online and interact with like-minded others.[34] Therefore, the Internet and social media are powerful ways of dissemination of information and interaction. Video-based demonstrations have been increasingly used to teach consumers about health topics and also to promote wellness.[22] The YouTube, particularly, can be utilized as a platform to communicate important health information.[35] However, the effects of the Internet, and social media on health outcomes such as satisfaction, feasibility, clinical utility, clinical practices, are still poorly investigated to date.

Therefore, this review will serve as a baseline to evaluate the impact of the "Seja doce com os bebês" video on neonatal pain relief practices captured by videos prospectively posted on YouTube. This is a publicly accessible video that was produced and originally published on YouTube on July 2014, in English and French, and is named "Be Sweet to Babies" with an updated version on January 2016 (https://www.youtube.com/watch?v=HmJGQJ8ayL8).[36] The Portuguese version, the "Seja doce com os bebês" video, was published on YouTube on October 2014, with an updated version on January 2016 (https://www.youtube.com/watch?v=ZGLSNdYtppo).[37] It has reached more than 7500 views and 50 likes after being available for 24 months. The video clearly shows the effectiveness of 3 interventions on neonatal pain relief in which parents can be involved: breastfeeding, skin-to-skin contact, and sweet solution.

Interestingly, coders reported extremely poor blood sampling technique in a large number of included videos. Analyzing the procedures' technique was beyond the scope of the present study although this might have influenced neonatal pain responses during blood collection. Further analyses of the included videos focusing on the procedures' technique may indicate the need of educational strategies for healthcare professionals focusing on blood sampling procedures in neonate infants.

Limitations to the study include that most videos were produced by families, which resulted in a large variability on these videos' characteristics and quality, precluding data extraction and analyses for some of the videos, especially for grimacing.

## CONCLUSION

This systematic review included 68 videos publicly posted on YouTube showing newborn infants undergoing blood sampling. Procedures caused pain and distress on infants and analgesic and comforting interventions were rarely implemented. Knowledge translation strategies targeted at healthcare professionals and parents are needed as an attempt of implementing evidence-based, effective, and safe strategies for neonatal pain relief in clinical settings. Finally, this review will serve as a baseline to evaluate the impact of a knowledge translation tool using YouTube.

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