Journal of Neonatal Nursing 29 (2023) 781–785

Contents lists available at ScienceDirect

Journal of Neonatal Nursing

journal homepage: www.elsevier.com/locate/jnn

A descriptive evaluation of time savings and work experience among neonatal clinicians when using a responsive bassinet

Patricia Gellasch [a,*], Tracy A. Walsh [b], Sebastian Geiger [c]

[a] The College of New Jersey, United States
[b] Happiest Baby, Inc, United States
[c] Clarkson University, United States

ARTICLE INFO

Keywords:
Responsive bassinet
Neonatal intensive care
Innovative technology
Nurse engagement
Time savings

ABSTRACT

Purpose: To describe the experiences of neonatal clinicians using a responsive bassinet (SNOO) in inpatient care settings and to explore time savings and the mechanisms by which SNOO impacts clinician experience.
Methods: A prospective quantitative descriptive study using an online survey was conducted using a convenience sample of neonatal clinicians in the United States.
Results: A total of 146 respondents met the eligibility criteria; 91% were neonatal nurses. Respondents reported SNOO generated an average time savings of 1.9 h per shift. Most clinicians agreed SNOO provided them with support in their daily work (98%) and decreased stress (97%). SNOO decreased interruptions (79%) and gave staff extra time to care for higher acuity patients (70%). Respondents reported infants in SNOO stayed asleep longer (80%) and cried less frequently (76%).
Conclusions: SNOO may serve as a valuable tool in neonatal settings to support clinical staff and enhance nurse experience.

1. Introduction

Practicing in the neonatal intensive care unit (NICU) requires the ability to prioritize competing demands (Rogowski et al., 2015). Embracing innovative technologies designed to help nurses deliver quality patient care may present an opportunity for a more efficient workflow with fewer interruptions, thereby allowing nurses to focus their efforts on patients and tasks that most require their expertise. Most NICU studies have targeted the use of electronic healthcare records (EHR) to improve efficiency and care quality (Adams, 2022a; Huennekens et al., 2020; Vinks et al., 2020), while few have described the direct experiences of NICU clinicians when using new technologies (Holmes and Wright, 2019; Holsti et al., 2019; Joyce, 2019; Lewis et al., 2021).

The SNOO Smart Sleeper (SNOO), a responsive bassinet for infants ages 0–6 months, provides infants with calming, womb like sensations including gentle rocking, white noise, and secure swaddling (Fig. 1). The SNOO has sensors to detect infant fussing (movement, crying), and in response it gradually increases motion and sound, modeling the actions of an experienced caregiver. Once the infant calms, SNOO incrementally returns to its baseline level. If the infant does not calm within several minutes, the bassinet automatically turns off. SNOO has been found to be equally effective at eliciting a calming response in infants when compared to parent soothing (Möller et al., 2019). An analysis of aggregated consumer sleep log data of SNOO users (n = 7157) found the responsive bassinet was associated with on average 1 h of additional infant sleep each night from birth through the first 6 months of life when compared to normative infant sleep (Okun et al., 2020). SNOO is supportive of the Eat, Sleep, Console care model for infants with neonatal abstinence syndrome (NAS) (Ponder et al., 2021). Research describing clinician experience when using innovative devices in NICU settings is limited. This study aimed to describe the experiences of NICU clinicians when using SNOO in hospital settings, and it explored time savings and the mechanisms by which SNOO impacts clinician experience.

Abbreviations: EHR, Electronic health record; NICU, Neonatal intensive care unit; NAS, Neonatal Abstinence Syndrome; SNOO, SNOO Smart Sleeper; NPS, Net Promoter Score.

* Corresponding author. 2791 Nottingham Way, Mercerville, NJ, 08619, United States.
E-mail address: gellascp@tcnj.edu (P. Gellasch).

https://doi.org/10.1016/j.jnn.2023.03.001
Received 17 March 2023; Accepted 18 March 2023
Available online 23 March 2023

Fig. 1. SNOO bassinet.

2. Methods

2.1. Design and sample

A prospective descriptive study using an online survey was conducted with a convenience sample of NICU clinicians in the United States. Institutional Review Board (IRB) approval was obtained from The College of New Jersey. An electronic survey link was distributed to the clinical champion at each hospital who served as the main point of contact for the COVID-19 SNOO Donation program through Happiest Baby, Inc. Participating hospitals received a SNOO donation between March 15, 2020 and August 31, 2022. Each clinical champion was emailed and asked to circulate a link and QR code to all colleagues routinely using SNOO. The link and QR code were distributed electronically to the sample via an email invitation and a link to an anonymous and confidential survey. Each email invitation had a unique hyperlink and QR code for the institution. Responses were capped at 30 per institution to avoid oversampling from any single hospital.

A 20-question survey was developed by the researcher and administered using SurveyMonkey, an online, digital survey platform. Subjects who clicked on the email link were directed to an initial eligibility screening question. To meet the inclusion criteria, subjects had to report using the SNOO in their clinical setting. Those who answered they had not used the SNOO were ineligible to participate. Individuals who did not meet the eligibility criteria were asked a subsequent question to determine why they had not used SNOO in their setting. Informed consent was collected among eligible subjects prior to entering the survey. Four questions focused on respondent demographics, five on clinician experience when using SNOO, and four on perceived patient impact. Three open-ended questions were included to allow respondents to provide information about what they liked about SNOO, any challenges encountered when using SNOO, and anything else they wanted to share about using the SNOO. Subjects who completed the survey had the option to receive a $5 Amazon digital gift card to acknowledge them for their time and participation. On average, the survey took 6 min to complete. Subjects who were ineligible, those who did not complete the survey, or those who did not provide an email address did not receive a gift card. The survey remained open for a period of 30 days, with clinical champions receiving weekly reminders.

2.2. Data analysis

Descriptive statistics were used to quantify and summarize responses to each survey question by the PI using Microsoft Excel. Frequency and response distributions were calculated. The analysis was confirmed by a data analyst research assistant. Data pertaining to clinician experiences with SNOO for specific patient populations (e.g., NAS, preterm infants), perceived effectiveness of SNOO relative to other soothing techniques used in NICU settings, and open-ended responses were not included in this analysis and will be reported in a separate manuscript.

3. Results

3.1. Sample demographics

A total of 150 NICU clinicians representing 26 hospitals responded to the survey, of which 146 met the inclusion criteria. The survey completion rate was 92%. The organizational response rate was 27%. On average, approximately 5.8 clinicians participated from each hospital. The respondents represented 26 hospitals across 17 states within the United States, with relatively balanced geographical representation (31% Midwest, 31% South, 23% West, 15% Northeast). In terms of respondent roles, the majority reported they were nurses (91%). Demographic characteristics are reported in Table 1.

3.2. Characteristics of infants and SNOO utilization

Respondents primarily reported using SNOO in NICU environments: Level IV (n = 49; 34%), Level III (n = 61; 43%), Level II (n = 32; 22%), and Level 1 Nurseries (n = 27; 19%). SNOO was also used in infant/mother rooms (n = 19; 13%), other pediatric-focused hospital units (n = 6; 4%) (i.e., general pediatric units, pediatric intensive care units), and for other situations (n = 4; 3%), which included private duty and other pediatric intensive units. On average, respondents reported using SNOO for 2.3 patients each week (SD = 1.48) and most (n = 125; 83%)

Table 1
Demographic characteristics of sample (N = 143).

Characteristics	Frequency (n)	%
Clinical Role		
Nurse (bedside, nurse educator, etc.)	114	79
Nurse Manager	17	12
Advanced Practice Provider (APRN, NP, PA, etc.)	4	3
Physician	1	1
Social Worker	0	0
Other (child life specialists, patient care assistants, unit director, case manager)	8	6
Care Setting		
Level IV – Highest level of neonatal care	49	34
Level III – Subspecialty newborn care	61	43
Level II – Advanced newborn care	32	22
Level I – Nursery	27	19
Baby/mother rooms	19	13
Pediatric unit	6	4
Other	4	3
Professional Tenure		
10+ years	65	45
1–3 years	23	16
3–5 years	15	10
5–10 years	35	24
Less than 1 year	5	3
Average Tenure at Current Hospital		
10+ years	56	39
1–3 years	22	15
3–5 years	18	13
5–10 years	38	26
Less than 1 year	9	6
SNOO Duration		
More than 2 years	69	46
1–2 years	56	37
<1 year	21	14
Not eligible (to participate)	4	3

reported using the SNOO for at least 1 year. Respondents indicated using SNOO for infants experiencing NAS (n = 138; 97%), fussy infants (n = 128; 90%), late-term preemies (n = 64; 45%), routine newborns (n = 63; 44%), and post-op infants (n = 10; 7%).

3.3. Clinician perceptions of time and SNOO utilization

Survey respondents were asked, "How much time does SNOO save you each shift by soothing fussy infants?" Respondents could choose, "The SNOO does not save me time" or they could select a range of times from "fewer than 15 min" to "more than 5 h" (Table 2). Most of the respondents (n = 99; 73%) reported saving greater than 1 h of time during their shift because of using SNOO (Fig. 2). To calculate the average time savings, the midpoint between each time interval was identified (i.e., 1–2 h = 1.5 h). The data were grouped into these intervals and the midpoints were multiplied by the frequencies of the corresponding intervals. The sum of the products was divided by the total number of values to calculate mean time savings per shift. On average, clinicians reported saving 1.9 h of time per shift. No respondents selected that the SNOO did not save them time during their shift. The means between acuity care settings were compared. Although there was not a statistically significant difference between acuity care settings, a slightly higher self-reported time savings was noted among clinicians using SNOO in higher acuity care settings.

3.4. Mechanisms of action of time savings

Respondents were asked to identify the main reasons SNOO saved them time (Table 3). Most respondents reported that infants in SNOO stayed asleep longer (n = 109; 80%) and cried less frequently (n = 103; 76%). Respondents reported that SNOO utilization resulted in reduced infant crying time (n = 97; 71%), infants falling asleep faster (n = 97; 71%), and that infants in SNOO required less medical intervention (n = 48; 35%). Only 2% (n = 3) found that none of the listed mechanisms of time savings applied.

Respondents were asked to identify how SNOO impacted their time during their shift. Most respondents reported they experienced reduced interruptions during their shift (n = 107; 79%) and that the SNOO gave them more time to tend to higher acuity patients (n = 95; 70%). Respondents reported that using a SNOO during their shift gave them more time to spend educating families (n = 76; 56%), helped them to stay focused during the shift (n = 73; 54%), and made it easier to work at the top of their license (n = 43; 32%). One respondent (1%) selected 'other' and specified that SNOO improved sleep console scores for substance-exposed infants.

3.5. Clinicians' perceptions of SNOO as a resource

A 4-point Likert agreement scale was used to determine clinicians' perceptions of SNOO utilization across a variety of domains (Table 4). Responses were subsequently grouped into binary categories: agree ("Strongly Agree" and "Somewhat Agree") and disagree ("Somewhat Disagree" and "Strongly Disagree"). Nearly all clinicians (89%–99%) agreed that SNOO had a positive impact. The strongest agreement was concentrated in the statements, "shows the hospital is committed to trialing innovative technologies" (99% agreement), "gives staff extra time to focus on other tasks" (98% agreement), and "helps reduce staff stress" (97% agreement). Nearly all clinicians (91%–100%) agreed that SNOO positively impacted infants across several domains. A strong level of agreement was concentrated in the statements reflecting that SNOO "reduces infant fussing" (100% agreement), "improves infant sleep" (99% agreement), "enhances the quality of infant care" (96% agreement), and "keeps infants safely positioned on their back" (96% agreement).

An 11-point Likert scale (0 = not at all likely, 10 = extremely likely) was included in the survey to determine the Net Promoter Score (NPS). Using the standard NPS methodology of asking, "How likely would you be to recommend SNOO to a colleague to use in their hospital?" the reported data was categorized into three groups: detractors (those rating the bassinet 0 to 6), neutrals (those rating it 7 or 8), and promoters (those rating the bassinet 9 or 10). Detractors represent individuals not happy with SNOO, neutrals represent those who are satisfied with the SNOO, but not enthusiastic, and promoters are those who are enthusiastically supportive of the SNOO. In this study, 9% of respondents were detractors (n = 12), 32% were neutral (n = 44), and 59% were promoters (n = 80). The NPS score, calculated by subtracting the percentage of detractors from the percentage of promoters, was 50%.

Table 2
Time savings per shift per respondent (N = 136).

Reported Time Savings Per Shift	Interval Midpoint (Hours)	Frequency (n)	%
More than 5 h	5	5	4
4–5 h	4.5	4	3
3–4 h	3.5	11	8
2–3 h	2.5	36	26
1–2 h	1.5	43	32
30 min to 1 h	0.75	30	22
15–30 min	0.375	4	3
<15 min	0.125	3	2
No time savings	0	0	0

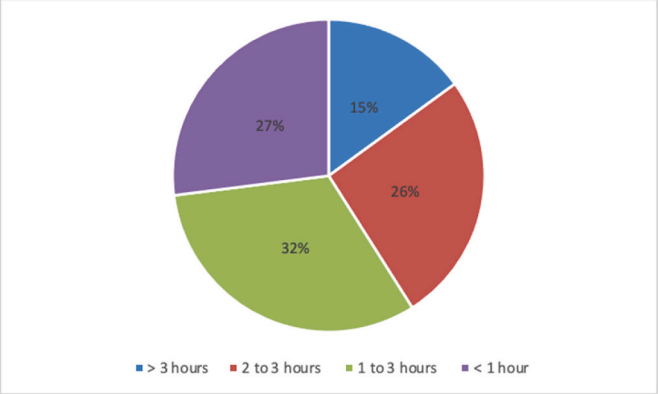

Fig. 2. Clinician time savings per shift (N = 136).

Table 3
Mechanisms of time savings (N = 136).

In your experience, what are the main reasons SNOO saves you time? (Please check all that apply)	Frequency (n)	%
Babies in SNOO stay asleep longer	109	80
Babies in SNOO cry less frequently	103	76
Babies in SNOO cry for less time	97	71
Babies in SNOO fall asleep faster	97	71
Babies in SNOO require less medical intervention	48	35
None of the above	3	2
Other (please specify)	2	1
How does SNOO affect how you spend your time during your shift? (Please check all that apply)	Frequency (n)	%
Reduces interruptions during my shift	107	79
Gives me more time to tend to higher acuity patients	95	70
Give me more time to educate patients and families	76	56
Helps me stay focused during my shift	73	54
Makes it easier for me to work at the top of my license	43	32
Other (please specify)	1	1

Table 4
Clinician responses impact of SNOO (N = 136).

Dimensions and items	Responses n (%)					
	Strongly agree	Agree	Total agreement	Disagree	Strongly disagree	Total disagreement
Shows hospital is committed to innovation	78 (57)	56 (41)	**134 (99)**	2 (1)	0 (0)	**2 (1)**
Gives staff extra time to focus on other tasks	68 (50)	65 (48)	**133 (98)**	3 (2)	0 (0)	**3 (2)**
Helps reduce staff stress	64 (47)	68 (50)	**132 (97)**	4 (3)	0 (0)	**4 (3)**
Offers staff support in lieu of hospital volunteers	57 (42)	64 (74)	**121 (96)**	15 (11)	0 (0)	**15 (11)**
Helps staff model safe sleep practices for parents	52 (38)	70 (51)	**122 (89)**	13 (10)	1 (1)	**14 (11)**
Reduces infant fussing	79 (58)	57 (42)	**136 (100)**	0 (0)	0 (0)	**0 (0)**
Improves infant sleep	69 (51)	66 (49)	**135 (99)**	1 (1)	0 (0)	**1 (1)**
Enhances the quality of infant care	61 (45)	72 (53)	**133 (98)**	3 (2)	0 (0)	**3 (2)**
Keeps infants safely on the back	79 (58)	51 (38)	**130 (96)**	6 (4)	0 (0)	**6 (4)**
Improves the hospital experience for parents	47 (35)	76 (56)	**123 (91)**	11 (8)	1 (1)	**12 (9)**

4. Discussion

Research is limited on the experiences of NICU clinicians when using innovative technologies in their care settings. Some data show that the implementation of certain technologies provides an opportunity to save nurses time during their shift. A recent study found NICU nurses saved 3.5 h per week when an EHR was updated to include an automated calculation to track growth in very low birth weight infants (Adams, 2022a). In this study, NICU clinicians perceived SNOO as generating time savings during their shift. On average, respondents reported 1.9 h of time saved per shift, with a slightly higher time saving having been reported among clinicians using SNOO in higher acuity settings. NICU nurses spend 60% of their time during a shift providing care to ventilated patients, while only 34% of their time is spent with patients receiving noninvasive ventilation modalities, and 13% with special care infants (Langhammer et al., 2018). Most respondents (98%) in this study perceived they had more time to focus on other tasks when using the SNOO and as many as 70% of respondents in this study reported SNOO provided them with more time to tend to higher acuity patients.

Although less time is typically spent with lower acuity patients in the NICU, there are scenarios that require more hand-on nursing care, such as when caring for a fussy infant, or an infant with NAS (Adrian et al., 2020). Most respondents in this study reported using SNOO with substance-exposed infants (97%) and fussy infants (90%), situations associated with greater hands-on care, such as consoling, rocking, or holding. NICU nurses experience higher levels of stress and increased workload when they are assigned to infants with NAS during their shift. They attribute their higher levels of stress and increased workload to excessive infant crying and difficulties consoling infants with NAS (Shannon et al., 2021). The respondents in this study perceived SNOO as helping infants sleep longer (80%), cry less frequently (70%), and cry for less time (71%), domains that not only reduce interruptions for NICU staff, but are also associated with healthy growth and development for infants in NICU settings (Bazregari et al., 2019; Hendy et al., 2022).

NICU nurses are charged with completing more than 100 tasks per shift (Rogowski et al., 2015). Research shows that nurses spend a significant amount of time completing tasks that could be delegated to others (Michel et al., 2021; Yen et al., 2018). Interruptions, higher workload, and staff stress are factors that contribute to missed care in the NICU (Aiken et al., 2018; Culbreth and Spratling, 2023; Genna et al., 2023; Tubbs-Cooley et al., 2019; Ogboenyiya et al., 2020). Poorer outcomes for neonates have been associated with inadequate staffing and suboptimal work conditions (Genna et al., 2023; Lake et al., 2018), situations often associated with interruptions that lead to missed nursing care. Missed care is considered a medical error, the third leading cause of death overall in the United States (Makary and Daniel, 2016). A recent study showed that of 198 reported safety incidents in a Level III NICU in Germany, 184 (93%) were considered 'preventable' or 'likely preventable' (Brado et al., 2021). The respondents in this study reported that SNOO reduced interruptions (79%) and helped them to stay focused during their shift (54%).

Staffing, missed care, increased workload, and making an error are among the top professional concerns of NICU nurses (Walden et al., 2020). When nurses are supported in their work environments, they are less likely to experience burnout, resign from their role, or miss nursing care (Tubbs-Cooley et al., 2019). While nurses remain focused on providing high quality care to their NICU patients, they are amid navigating several professional issues, such as staffing shortages and professional burnout, both of which are at an all-time high. As many as 66% of NICU clinicians report burnout (Haidari et al., 2021), and many institutions are experiencing low levels of staffing (Boston-Fleischhauer, 2022). Most respondents (89%) in this study perceived the SNOO as offering staff support and helping to reduce staff stress (97%). Additionally, 99% of respondents agreed that having a SNOO showed their hospital was committed to trialing innovative technologies and 32% of respondents reported that SNOO made it easier to provide top-of-license care. Top-of-license practice is associated with individual clinician satisfaction and patient benefits, as well as system-wide value, which includes the delivery of higher quality care, as well as economically efficient care (Medical Economics, 2017).

Industries across multiple sectors (e.g., banking, insurance, technology, healthcare) use NPS to determine how enthusiastic consumers are about a product or service, and to measure industry growth. According to the developers of NPS, a score that falls between 50 and 100 is considered excellent (Reichheld and Markey, 2011). Within healthcare, NPS is used internationally to evaluate consumer satisfaction and healthcare quality performance (Adams et al., 2022b). The NPS threshold for the healthcare industry, defined as companies that provide a medical service, manufacture equipment, or connect patients to local healthcare units, was reported to be 40% (Survicate, 2021). The respondents in this study reported a NPS of 50% demonstrating positive clinician experience with SNOO and that they would recommend the SNOO to their colleagues.

5. Limitations

There were several limitations associated with this study. The survey offers the self-reported experiences and perceptions of NICU clinicians. The study was a descriptive study, and therefore a relationship between variables or cause and effect cannot be established. Future research should consider an objective measurement of time savings when using the SNOO and assess potential impact of time savings in NICU settings through an experimental research design.

The data were collected using an unvalidated, self-reported survey instrument. Although the survey was developed by a PhD-prepared researcher and reviewed by an expert for face validity, it was not pilot tested or analyzed for content validity. Future research aimed at exploring the impact of SNOO on clinicians should consider incorporating validated testing measures.

The use of a convenience sample may introduce bias and reduce generalizability. The responses in this study represent only the participants who chose to participate in the study. The survey relied on self-

reported clinician responses and assumes respondents will be truthful. It is possible that respondents were more likely to give socially desirable answers, although the researchers attempted to mitigate this potential for bias by collecting data anonymously and maintaining confidentiality.

6. Conclusions

Support is not always available to NICU clinicians, due to staffing issues, limited volunteers, and high acuity patients requiring time sensitive interventions. The findings of this study showed that NICU clinicians perceived SNOO as a resource that saved them time per shift and offered them meaningful workplace support. SNOO utilization helped to improve clinician experience and self-reported workflow, and NICU clinicians perceived this as allowing them more time to focus on higher priority tasks with fewer interruptions. At a time when nurses do not feel supported in their clinical settings, and the intent to leave the profession is being reported at record high rates, the adoption of innovative technologies, such as the SNOO, offer a cost-effective opportunity for organizations to support their staff and improve clinician experience.

Ethical approval

The study design and procedures were approved by The College of New Jersey IRB (Approval number: IRB-2022-0482).

Funding

Patricia Gellasch, PhD, APN-C received funding to conduct this study from Happiest Baby, Inc. (HBI), manufacturer of the SNOO Smart Sleeper bassinet.

Declaration of competing interest

Although Patricia Gellasch, PhD, APN-C received funding to conduct this study from Happiest Baby, Inc. (HBI), manufacturer of the SNOO Smart Sleeper bassinet, she was free to publish the findings of the analysis whether they were in favor of HBI. The findings of the study will have no impact on future collaborations between both parties. Tracy Walsh has been compensated as an employee of HBI. Sebastian Geiger has nothing to disclose.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jnn.2023.03.001.

References

Adams, K., 2022. Cedars-Sinai's EHR Tool Saves Nurses Hours Per Week. Becker's Hospital Review. https://www.beckershospitalreview.com/ehrs/cedars-sinai-s-ehr-tool-saves-nurses-hours-per-week.html. (Accessed 26 February 2023).

Adams, C., Walpola, R., Schembri, A.M., Harrison, R., 2022. The ultimate question? Evaluating the use of Net Promoter Score in healthcare: a systematic review. Health Expect. 25 (5), 2328–2339. https://doi.org/10.1111/hex.13577.

Adrian, A., Newman, S., Mueller, M., Phillips, S., 2020. A mixed-methods study to investigate barriers and enablers to nurses' implementation of nonpharmacological interventions for infants with neonatal abstinence syndrome. Adv. Neonatal Care 20 (6), 450–463. https://doi.org/10.1097/ANC.0000000000000794.

Aiken, L.K., Sloane, D.M., Barnes, H., Cimiotti, J.P., Jarrín, O.F., McHugh, M.D., 2018. Nurses' and patients' appraisals show patient safety in hospitals remains a concern. Health Aff. 37 (11), 1744–1751. https://doi.org/10.1377/hlthaff.2018.0711.

Bazregari, M., Mirlashari, J., ranjbar, H., Pouraboli, B., 2019. Effect of clustered nursing care on sleep behaviors of the preterm neonates admitted to the neonatal intensive care unit. Iranian Journal of Neonatology 10 (3), 14–20.

Boston-Fleischhauer, C., 2022. Reversing the great resignation in nursing: more things to consider. J. Nurs. Adm. 52 (6), 324–326. https://doi.org/10.1097/NNA.0000000000001155.

Brado, L., Tippmann, S., Schreiner, D., et al., 2021. Patterns of safety Incidents in a neonatal intensive care unit. Frontiers in Pediatrics 9, 664524. https://doi.org/10.3389/fped.2021.664524.

Culbreth, R., Spratling, R., 2023. Drivers of medical errors in the neonatal intensive care unit (NICU): a qualitative analysis. Journal of Neonatal Care 29 (1), 179–182. https://doi.org/10.1016/j.jnn.2022.05.004.

Genna, C., Thekkan, K.R., Raymakers-Janssen, P.A.M.A., Gawronski, O., 2023. Is nurse staffing associated with critical deterioration events on acute and critical care pediatric wards? A literature review [published online ahead of print, 2023 Feb 10] Eur. J. Pediatr.. https://doi.org/10.1007/s00431-022-04803-2, 10.1007/s00431-022-04803-2.

Haidari, E., Main, E.K., Cui, X., et al., 2021. Maternal and neonatal health care worker well-being and patient safety climate amid the COVID-19 pandemic. J. Perinatol. 41 (5), 961–969. https://doi.org/10.1038/s41372-021-01014-9.

Hendy, A., Alsharkawy, S.S., El-Nagger, N.S., 2022. The outcomes of a healing environment and clustering nursing care on premature infants' vital signs, pain, and sleeping. J Med Life 15 (11), 1347–1351. https://doi.org/10.25122/jml-2022-0253, 2022.

Holmes, M., Wright, M.E., 2019. Survey of neonatal intensive care unit nurses' use of a motion/sound infant seat. Adv. Neonatal Care 19 (2), 151–159. https://doi.org/10.1097/ANC.0000000000000579.

Holsti, L., MacLean, K., Oberlander, T., Synnes, A., Brant, R., 2019. Calmer: a robot for managing acute pain effectively in preterm infants in the neonatal intensive care unit. Pain Reports 4 (2), e727. https://doi.org/10.1097/PR9.0000000000000727.

Huennekens, K., Oot, A., Lantos, E., Yee, L.M., Feinglass, J., 2020. Using electronic health record and administrative data to analyze maternal and neonatal delivery complications. Joint Comm. J. Qual. Patient Saf. 46 (11), 623–630. https://doi.org/10.1016/j.jcjq.2020.08.007.

Joyce, K., 2019. Smart textiles: transforming the practice of medicalisation and health care. Sociol. Health Illness 41 (1), 147–161. https://doi.org/10.1111/1467-9566.12871.

Lake, E.T., Staiger, D., Edwards, E.M., Smith, J.G., Rogowski, J.A., 2018. Nursing care disparities in neonatal intensive care units. Health Serv. Res. 53 (S1), 3007–3026. https://doi.org/10.1111/1475-6773.12762.

Langhammer, K., Roth, B., Kribs, A., Göpel, W., Kuntz, L., Miedaner, F., 2018. Treatment and outcome data of very low birth weight infants treated with less invasive surfactant administration in comparison to intubation and mechanical ventilation in the clinical setting of a cross-sectional observational multicenter study. Eur. J. Pediatr. 177 (8), 1207–1217. https://doi.org/10.1007/s00431-018-3179-x.

Lewis, T.T., Kim, H., Darcy-Mahoney, A., Waldron, M., Lee, W.H., Park, C.H., 2021. Robotic uses in pediatric care: a comprehensive review. J. Pediatr. Nurs. 58, 65–75. https://doi.org/10.1016/j.pedn.2020.10.016.

Makary, M.A., Daniel, M., 2016. Medical error-the third leading cause of death in the US. Br. Med. J. 353, i2139. https://doi.org/10.1136/bmj.i2139.

Medical Economics, 2017. Practicing at the Top of Your License. https://www.medicaleconomics.com/view/practicing-at-the-top-of-your-license. (Accessed 28 February 2023).

Michel, O., Garcia Manjon, A.J., Pasquier, J., Ortoleva Bucher, C., 2021. How do nurses spend their time? A time and motion analysis of nursing activities in an internal medicine unit. J. Adv. Nurs. 77 (11), 4459–4470. https://doi.org/10.1111/jan.14935.

Möller, E.L., de Vente, W., Rodenburg, R., 2019. Infant crying and the calming response: parental versus mechanical soothing using swaddling, sound, and movement. PLoS One 14 (4), e0214548. https://doi.org/10.1371/journal.pone.0214548.

Ogboenyiya, A.A., Tubbs-Cooley, H.L., Miller, E., Johnson, K., Bakas, T., 2020. Missed nursing care in pediatric and neonatal care settings: an integrative review. MCN Am. J. Matern./Child Nurs. 45 (5), 254–264. https://doi.org/10.1097/NMC.0000000000000642.

Okun, M., Karp, H., Balasubramanian, S., 2020. SNOO: a wellness device to improve infant sleep. SLEEP 43 (S1), A371–A372.

Ponder, K.L., Egesdal, C., Kuller, J., Joe, P., 2021. Project Console: a quality improvement initiative for neonatal abstinence syndrome in a children's hospital level IV neonatal intensive care unit. BMJ Open Qual 10 (2), e001079. https://doi.org/10.1136/bmjoq-2020-001079.

Reichheld, F., Markey, R., 2011. The Ultimate Question 2.0.: How Net Promoter Companies Thrive in a Customer-Driven World. Harvard Business Review Press, Boston, MA, USA.

Rogowski, J.A., Staiger, D.O., Patrick, T.E., Horbar, J.D., Kenny, M.J., Lake, E.T., 2015. Nurse staffing in neonatal intensive care units in the United States. Res. Nurs. Health 38, 333–341. https://doi.org/10.1002/nur.21674.

Shannon, J., Blythe, S., Peters, K., 2021. The complexities associated with caring for hospitalised infants with neonatal abstinence syndrome: the perspectives of nurses and midwives. Children 8 (2), 152. https://doi.org/10.3390/children8020152.

Survicate, 2021. NPS Benchmarks for 2021: Good Net Promoter Scores by Industry. https://survicate.com/nps-benchmarks/. (Accessed 26 February 2023).

Tubbs-Cooley, H.L., Mara, C.A., Carle, A.C., Mark, B.A., Pickler, R.H., 2019. Association of nurse workload with missed nursing care in the neonatal intensive care unit. JAMA Pediatr. 173 (1), 44–51. https://doi.org/10.1001/jamapediatrics.2018.3619.

Vinks, A.A., Punt, N.C., Menke, F., et al., 2020. Electronic health record-embedded decision support platform for morphine precision dosing in neonates. Clin. Pharmacol. Therapeut. 107 (1), 186–194. https://doi.org/10.1002/cpt.1684.

Walden, M., Janssen, D.W., Lovenstein, A., 2020. What keeps neonatal nurses up at night and what gets them up in the morning? Adv. Neonatal Care 20 (6), E102–E110. https://doi.org/10.1097/ANC.0000000000000723.

Yen, P.Y., Kellye, M., Lopetegui, M., et al., 2018. Nurses' time allocation and multitasking of nursing activities: a time motion study. AMIA Annu Symp Proc 1137–1146 eCollection 2018.