

Improving Safe Infant Sleep Compliance Through Implementation of a Safe Sleep Bundle

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ABSTRACT

Background: Sleep-related infant deaths continue to be a significant public health issue that nondiscriminately impacts family units with increased risk notably in premature infants discharged home from the neonatal intensive care unit (NICU). The American Academy of Pediatrics endorses the use of safe sleep practices with specific recognition of the unique challenges faced in the NICU setting.

Purpose: The purpose of this quality improvement (QI) project was to implement a safe sleep bundle and evaluate its effectiveness in improving caregiver compliance to safe sleep practices in a level III NICU at a large joint military medical facility.

Methods: A QI initiative with a pre- and postanalysis was performed using a convenience method of sampling. Infants 32 weeks or more post-menstrual age in a level III NICU were analyzed pre- and post-interventions. The intervention included a safe sleep bundle that encompassed: (1) policy update, (2) standardized sleep sacks, (3) crib cards and certificates, and (4) creation of a provider order set in the electronic health record (EHR). A standardized crib audit tool evaluated sleep and bed position, items in the crib, order set in the EHR with consideration of special medical circumstances.

Results: Postintervention assessment after the implementation resulted in a significant improvement of overall safe sleep compliance modeled by NICU staff, increasing to 100% from a baseline of 18% pre-intervention ($P = .029$).

Implications for Practice and Research: Role-modeling behaviors of clinical staff may reduce the risk of sleep-related infant deaths upon discharge. A multifactorial approach can leverage successful strategies for improving safe sleep compliance in a NICU setting.

Key Words: neonatal intensive care unit, premature infant, quality improvement, safe sleep, sudden infant death syndrome, sudden unexpected infant death

According to the American Academy of Pediatrics (AAP),¹ approximately 3500 infants die in the United States every year from sleep-related infant deaths, including sudden infant death

syndrome (SIDS). SIDS is the term used to describe any sudden and unexpected death, whether explained or unexplained, occurring during infancy.¹ The Centers for Disease Control and Prevention² further reiterates the issue stating that, in 2017, there were approximately 1400 infant deaths due to SIDS, 1300 infant deaths due to unknown causes, and 900 infant deaths due to accidental suffocation/strangulation in bed. Additionally, in the state of Maryland, SIDS was one of the leading causes of death in 2017, with 55 cases accounting for 12% of all infant mortalities in the entire state.³ Sleep-related infant deaths continue to be a national threat and public health issue that can have long-lasting impacts on family units.

Prematurity is a strong risk factor for sudden unexpected infant death (SUID). SUID encompasses all sudden and unexpected causes of death in an infant younger than 1 year; this includes SIDS, accidental suffocation or strangulation, and entrapment.¹ The increased risk of SUID for the preterm population is secondary to increased biological vulnerabilities noted at earlier gestational ages.⁴ Compliance with safe sleep is critical in helping to establish positive long-term outcomes with regard to the prevention of SUID events in the neonatal

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Ethical approval was provided by the Institutional Review Board (IRB) of Walter Reed National Military Medical Center and the University of Maryland School of Nursing in advance of implementation. Both IRBs did not require consent from the parents and/or guardians of the patients involved.

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population. An informal interview was performed at a large joint military medical facility by the project's clinical site representative in the fall of 2019. The findings highlighted clinical staff concerns with non-compliance to safe sleep practices and how that may translate to home life once an infant was discharged from the hospital.

The purpose of this quality improvement project was to implement a safe sleep bundle and evaluate its effectiveness in improving compliance with safe sleep practices of clinical staff providing care to eligible infants 32 weeks or more post-menstrual age in a level III neonatal intensive care unit (NICU) at a large joint military medical facility. It was anticipated that this practice change would improve compliance with safe sleep practices, thus reducing the risk of SUID events with the intention to prevent infant morbidity and mortality once discharged home.

LITERATURE REVIEW

This literature review provided synthesis of the evidence supporting the implementation of a safe sleep bundle. The review encompassed multifactorial interventions to include visual displays; environmental management strategies (ie, acquisition of sleep sacks to replace loose blankets); policy creation or revisions; and the development of an order set with specific criteria for eligibility for supine sleep positioning. The quality of the evidence was determined using Melnyk and Fineout-Overholt's level of evidence rating system (see Supplemental Table 1, available at: <http://links.lww.com/ANC/A139>).⁵ Every article was categorized as a level IV with each record obtained using the PubMed database. Nine articles were retained for further screening with 5 articles included in this review. The 5 articles included human subjects, encompassed a neonatal population with publication after 2016, and were peer-reviewed. Most of the articles were conducted in the United States, with 1 observational study performed in Saudi Arabia. Exclusion criteria included studies with unrelated outcomes and articles with focus on parental education versus education of clinical staff.

Safe sleep bundles that included visual displays (ie, "back to sleep" crib cards, safe sleep certificates) have been found to be one of the successful strategies in increasing adherence to safe sleep practices among clinicians, caregivers, and parents.^{6,7} There was also a significant decrease in the presence of loose items in cribs post-intervention to include clothing, diapers, stuffed toys, burp cloths, extra blankets, suction bulbs, wipes, and medical equipment not in use ($P < .01$).⁶

Environmental management strategies with the acquisition of sleep sacks were used to replace loose blankets. Zachritz et al⁸ utilized a sleep sack to promote standardization of safe sleep practices resulting in a drastic improvement with consistency in

modeling behaviors observed in NICU nurses. The study by Hwang et al⁷ did not include sleep sacks as a project intervention, but they specifically discussed struggling with keeping excessive blankets out of the cribs. This proved to be a significant barrier to not achieving their goal of 90% compliance overall.⁸ Sobaihi et al⁹ emphasized the importance of role modeling when attempting to propagate right practices within the community; this especially holds true for the demonstration of a supine sleep position in a hospital environment.

Heitmann et al¹⁰ conducted a policy-driven effort with the aim at increasing knowledge and compliance of staff members to safe sleep practices. Comparison of pre- and postaudit findings showed a 45.6% ($P \leq .001$) decrease in observance of infants who were found with any risk factors for an unsafe sleep environment. Zachritz et al⁸ also developed a clinical practice guideline to promote safe sleep practices among NICU nurses. The intervention resulted in improved safe sleep modeling behaviors from 20% to 90% of the time.

The development of a specific criteria order set encourages documentation of infant sleep position and environment by NICU physicians and nurses.⁸ In one study, documentation served as a reminder to all clinicians to maintain safe sleep environments with significant improvement from 47.7% to 81% ($P < .001$), including an increase in supine and flat crib position, no use of positioning devices, and no soft objects in the crib with noted consideration of the infant's medical and developmental needs.⁷

Collectively, all studies implemented a multifactorial bundle encompassing a multicomponent interventional strategy to improve safe sleep compliance, thus encouraging a safe environment through role-modeling behaviors. Kellams et al¹¹ also supported using multiple interventions to improve compliance with safe sleep practices throughout an infant's hospitalization. Across studies for neonates and infants, there appeared to be moderate quality evidence demonstrating that a multicomponent safe sleep bundle to include visual displays, standardized sleep sacks, policy creation or revisions, and/or the development of a specific criteria order set improves compliance and adherence to safe sleep practices in a hospital setting.

METHODS

The 24-bed level III NICU was located at a large joint military medical facility, with an average census of 10 infants and approximately 150 to 200 NICU admissions annually. The project was estimated to impact a total 50 infants or more and 70 clinical staff members in the 14-week period. Random crib audits performed, between August and September 2020, revealed that 93% to 94% of infants were sleeping in supine position, 47% to

69% had a flat sleeping surface, and 18% to 59% had no additional items in the crib; while overall safe sleep compliance with inclusion of all above categories ranged from 18% to 41%. All hospitalized infants included in this article were not at risk during the time of assessment because they were continuously being monitored. Also, the Institutional Review Board did not deem this study as research; thus, the need for ethics approval was waived.

The MAP-IT framework was used to develop a quality improvement model based on AAP guidelines highlighting evidence-based practices for a safe sleep environment. MAP-IT (Mobilize, Assess, Plan, Implement, Track) is a framework that can be used as a tool to facilitate the implementation of process improvement projects to achieve national health objectives.¹² The implementation team worked closely with key stakeholders with engagement of administrators, physicians, nurses, and the project leader. Administrators included the nurse manager, assistant nurse manager, nursing informatics officer, and the clinical nurse specialist. The medical director and all bedside nursing staff were additional stakeholders. Team members communicated regularly via e-mail and met in person on a monthly basis for the duration of the project. The team collaborated with unit stakeholders for revision of the unit's safe sleep policy, creation of visual cues for staff, modification of the electronic health record (EHR), procurement of materials, and the development of a tool for auditing cribs. Informal interviews of physicians and nurses coupled with a literature search were performed to identify facilitators and barriers impacting proposed implementation strategies.

All registered nurses in the NICU completed training and received education on the revised unit safe sleep policy. Nursing training and education consisted of one-on-one informational sessions with every staff member specifically highlighting policy updates. This was followed by a question-and-answer discussion addressing expectations and targeted project outcomes. The policy included background information on SIDS and SUID events in the preterm population; it also highlighted AAP recommendations for reducing the risk of sleep-related infant deaths. The creation of policy guidelines was based on an extensive literature review, expert opinions, and numerous team discussions with the ambition of transitioning clinically stable infants 32 weeks or more post-menstrual age to safe sleep practices. Safe sleep practices included the following components: sleeping in a supine position on a flat surface and a crib free of additional items (ie, extra blankets, clothing, stuffed toys, diapers, wipes, other loose items, and positioning devices). Policy information was also reiterated in a PowerPoint shared with clinical staff via e-mail, in-person discussions, and posted on the unit bulletin board.

"Safe sleep" crib cards based on AAP recommendation were created with 2 options: (1) standard and (2) special circumstance (see Supplemental Figure 1, available at: <http://links.lww.com/ANC/A140>). Each card listed safe sleep practices pertinent to individual patient needs. Nursing staff were responsible for placing safe sleep cards on eligible infants' bedsides agreed upon by the medical team with consideration of infants 32 weeks or more post-menstrual age. In addition, premade safe sleep certificates were presented to parents and caregivers of infants transitioned to safe sleep practices (see Supplemental Figure 2, available at: <http://links.lww.com/ANC/A141>). These infants were also issued standardized sleep sacks to replace loose blankets. Lastly, nursing informatics created a safe sleep order set in the EHR for providers to specify standard or nonstandard safe sleep options for eligible infants; this coincides with the safe sleep crib cards visually displayed at the bedside. The safe sleep order set is displayed in the EHR's treatment flowsheet.

During implementation, the structure measures assessed clinical staff education of each component of the safe sleep bundle to include the provider order set, crib cards, parental certificates, standardized sleep sacks, and updated policy; while the process measures assessed the utilization of each component. Random crib audits were performed daily by "safe sleep" champions each shift assessing the outcome measure of improved safe sleep compliance for eligible infants 32 weeks or more post-menstrual age (see Supplemental Figure 3, available at: <http://links.lww.com/ANC/A142>). The findings from these audits were assessed for variation, which allowed for analysis in the progression of trends from baseline data (see Supplemental Figure 4, available at: <http://links.lww.com/ANC/A143>). The majority of strategies and tactics focused on providing frequent guidance and clinical supervision as well as taking into account staff feedback throughout the implementation process. Continuous feedback coupled with clinical observations directed adjustments especially with regard to the allowance of a bulb suction in the infant's sleeping area. This change significantly improved safe sleep compliance after consideration of the safety concerns from clinical staff.

To protect human subjects during the implementation process, the daily safe sleep audit forms contained no patient identifiers. Confidentiality and privacy of NICU clinical staff were maintained by incorporation of only a total percentage of staff trained, which was collected via an education sign-off sheet.

RESULTS

Shared Mental Model

The concept of a shared mental model refers to a shared understanding among members that

facilitates the achievement of goals.¹³ Prior to implementation of the safe sleep bundle in September 2020, NICU nurses had followed safe sleep practices only 18% of the time. Despite awareness of current AAP recommendations, clinical staff continued to model inconsistent behaviors with safe sleep practices, which became apparent when infants were preparing for discharge. This observation made clinicians wary with how such practices would translate home once families and caregivers were discharged from the hospital setting. Staff education, along with an updated unit policy, influenced nursing beliefs and practices that led to behavior modifications toward transitioning infants to a supine position. Safe sleep education was provided to all staff members with a completion rate of 87% (40 out of 46 nurses). The maintenance of educational strategies was a collaborative effort that included daily reminders from the nursing manager and “safe sleep” champions, as well as in-services highlighting the importance of consistency with modeling safe sleep practices at all times. A shared decision-making model was used to determine the optimal time for transitioning each infant to safe sleep practices with discussions initiated as early as 32 weeks post-menstrual age during daily multidisciplinary rounds. This conversation engaged the entire medical team and encouraged a collective effort among staff.

Crib Audits

Descriptive statistics were used to quantitatively describe and summarize components of the safe sleep bundle, while run charts were used to assess data trends and patterns pre- and post-implementation. An unpaired *t* test was also utilized in the analysis to demonstrate statistical significance. In total, 194 infant observations were screened for safe sleep compliance between August 2020 and December 2020 with an average postmenstrual age of 37¹/₄ weeks. We excluded 28 infants due to clinical instability or those assessed prior to 32 weeks post-menstrual age. Thus, 166 infants were included in the final analysis, with 78 pre-intervention and 88 post-intervention. Eligible infants who were being held or not positioned in their sleeping environment were reassessed at a later time once in their sleeping position. Within a 14-week implementation period, data collected from random unit audits showed a significant increase of NICU nurse compliance with safe sleep practices, from 18% to 100% ($P = .029$). This compliance was characterized by infants positioned back to sleep, head of bed (HOB) flat, no additional items in sleeping area, and correct provider order in the patient’s EHR. Infants categorized as nonstandard were considered compliant under special circumstances with a written order specifying nonstandard practices to accommodate individual clinical needs in the NICU. Individual categories of

compliance also showed significant improvements with an increase in the rate of supine positioning from 94% pre-intervention to 100% after a 14-week implementation period ($P < .00001$). Infants positioned with HOB flat increased from 47% to 100% ($P = .006$) and the absence of additional items in the crib increased from 18% to 100% ($P = .004$).

DISCUSSION

The effect of the intervention was robust. Implementation of a safe sleep bundle, along with ongoing support and coaching from the project leader and champions, improved the consistency of infant positioning and promoted a safe sleep environment in a level III NICU. Incorporation of the care bundle promoting AAP recommendations led to increased nursing compliance adhering to safe sleep practices. Infants had to be compliant in all 3 categories of safe sleep practices with inclusion of a provider order set to help guide the modeling of safe sleep behaviors for each patient. The order set was a driving force that inspired accountability for actions of clinical staff pertaining to following and maintaining safe sleep practices. This was a major revelation during the implementation phase, as it became evident that unit staff consistently adhered to and advocated for an order set if none was in place or when adjustments had to be made. This ultimately shifted unit culture with nursing actions reflecting proactive attitudes and advocacy with transitioning infants to safe sleep practices. This was consistent with published literature, which highlighted the importance of engaging nursing staff and its effectiveness in supporting unit initiatives. Engagement of nursing staff in organizational initiatives is of the utmost importance, especially when promoting change and endorsing a healthy work environment.¹⁴ The unique environment of the NICU encompasses patients in different clinical courses with varying developmental and supportive needs. The AAP recommends pre-term infants be kept primarily in the supine position as early as 32 weeks post-menstrual age to prepare for back-to-sleep positioning once discharged home. We chose 32 weeks post-menstrual age as the period to begin discussions with transitioning infants to safe sleep; however, eligible infants with specific medical conditions required modifications to the standard safe sleep order set to permit side-lying and prone positioning as well as HOB elevation and use of positioning aids. Infants included in this initiative with special circumstance considerations were post-operative infants, infants with significant chronic lung disease, those with severe gastroesophageal reflux, and patients with craniofacial defects. While standards of care for newborn health highlight the importance of safe sleep practices to reduce the risk of SUID events such as SIDS, the timing for

transitioning premature infants in the NICU is inconclusive and at times based on professional opinion and clinical judgment.

Collaboration and involvement with key stakeholders were imperative to the initiative's success. Multitier interventions with inclusion of administration, providers, and bedside clinicians allowed for transparency in addition to a unified feeling of pride and ownership for the achievement of project goals. Additionally, initiatives were supported by the development of an applicable yet practical data collection system, which was designed to be user friendly and not overly time-consuming for team members. This allowed for accurate and repeatable measurements of performance throughout the implementation period. Lastly, institutional support and endorsement of evidence-based practices were essential for the implementation of strategies. Accessibility to resources to include printing materials and wearable sleep sacks kept costs to a minimum and enhanced project design.

Limitations

There were several limitations to this project. First, data collection included a convenience sample at a single facility, which took place over a limited period of 14 weeks. The short timeframe coupled with a single location limited the sample size, thus possibly impacting the generalizability of the findings. Second, the bundle included a multifaceted approach occurring simultaneously; therefore, it is unknown which component had the most effective interventional strategy or greatest impact on nursing compliance. Third, different team members performed audits at varying intervals allowing for subjectivity with individual interpretations of certain elements within the crib audit tool. Fourth, there was no pre- and postdata collected assessing the efficacy of

nursing education and the extent of impact on clinical practice. Lastly, we did not collect data on parental observations in the NICU and how those observations may impact behaviors at home. While modeling by clinicians can impact how parents and caregivers practice safe sleep behaviors after discharge, it is not definitively established. Further studies are needed to determine the extent of influence witnessing clinical staff compliance to safe sleep practices and how that translates to parental and caregiver adherence in a home environment.

CONCLUSION

Incorporation of a safe sleep bundle into routine care can improve NICU nurse compliance with safe sleep practices in a hospital setting. The bundle included collaboration with updating a unit policy, creation of bedside crib cards and parental certificates, utilization of sleep sacks, and development of a provider order set. These interventions coupled with multilevel inclusion of administration, providers, and bedside clinicians improved adherence to safe sleep recommendations and generated a safer sleeping environment for NICU patients. Nursing education was the catalyst that created a shared mental model with implementation strategies and enriched outcomes. It is still unknown which intervention had the greatest significance on improved compliance, but the multifactorial approach positively impacted adherence and consistency with safe sleep practices modeled by clinical staff. These role-modeling behaviors can improve adherence to a safe sleep environment for hospitalized infants.¹⁰ This initiative highlights the importance of prioritizing safe sleep practices early on in a neonate's clinical course. Acknowledgment and standardization of safe sleep practices requires a joint commitment from leadership and clinicians. This collective effort

Summary of Recommendations for Practice and Research

What we know:

- Approximately 3500 infants die in the United States every year from sleep-related infant deaths.
- Sudden infant death syndrome (SIDS) remains the leading cause of death for US infants 1 month to 1 year of age.
- Premature infants have increased risk of sudden unexpected infant death after discharge.
- Compliance with safe sleep practices role-modeled by clinical staff is endorsed by the American Academy of Pediatrics (AAP) and can aid in reducing the risk of sleep-related infant deaths.

What needs to be studied:

- Measurement of parental knowledge or change behaviors to assess impact of observing compliance with safe sleep practices of clinical staff.

What we can do today:

- A multifactorial approach can leverage successful strategies for improving safe sleep compliance.
- Incorporation of a care bundle promoting AAP recommendations can lead to increased nursing compliance with safe sleep practices.
- Role-modeling behaviors may reduce the risk of sleep-related infant deaths upon discharge.
- Support from key stakeholders and facility backing of evidence-based practices was essential for success of the practice change.

models recommended standards of care and presents families with safe sleep strategies to improve outcomes and reduce the risk of sleep-related infant deaths.

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