

Interventions to Improve Safe Sleep Among Hospitalized Infants at Eight Children's Hospitals

Stephanie Kuhlmann, DO,^a Carolyn R. Ahlers-Schmidt, PhD,^a Gloria Lukasiewicz, MS, RN,^b Therese Macasiray Truong, MSN, RN, RN-BC, CNL^c

BACKGROUND AND OBJECTIVES: Within hospital pediatric units, there is a lack of consistent application or modeling of the American Academy of Pediatrics recommendations for safe infant sleep. The purpose of this study was to improve safe sleep practices for infants in nonneonatal pediatric units with implementation of specific interventions.

METHODS: This multi-institutional study was conducted by using baseline observations collected for sleep location, position, and environment (collectively, "safe sleep") of infants admitted to pediatric units. Interventions consisted of: (1) staff education, including a commitment to promote safe sleep; (2) implementing site-generated safe sleep policies; (3) designating supply storage in patient rooms; and/or (4) caregiver education. Postintervention observations of safe sleep were collected. Eight hospitals participated from the Inpatient FOCUS Group of the Children's Hospital Association. Each site received institutional review board approval/exemption.

RESULTS: Safe sleep was observed for 4.9% of 264 infants at baseline and 31.2% of 234 infants postintervention ($P < .001$). Extra blankets, the most common of unsafe items, were present in 77% of cribs at baseline and 44% postintervention. However, the mean number of unsafe items observed in each sleeping environment was reduced by >50% ($P = .001$).

CONCLUSIONS: Implementation of site-specific interventions seems to improve overall safe sleep in inpatient pediatric units, although continued improvement is needed. Specifically, extra items are persistently left in the sleeping environment. Moving forward, hospitals should evaluate their compliance with American Academy of Pediatrics recommendations and embrace initiatives to improve modeling of safe sleep.

ABSTRACT

www.hospitalpediatrics.org

DOI:10.1542/hpeds.2015-0121

Copyright © 2016 by the American Academy of Pediatrics

Address correspondence to Carolyn R. Ahlers-Schmidt, PhD, Office of Research, University of Kansas School of Medicine–Wichita, 1010 N Kansas St, Wichita, KS 67214. E-mail: cschmidt3@kumc.edu

HOSPITAL PEDIATRICS (ISSN Numbers: Print, 2154-1663; Online, 2154-1671).

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: No external funding.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

Dr Kuhlmann helped conceptualize and design the study and drafted the initial manuscript; Dr Ahlers-Schmidt helped conceptualize and design the study, analyzed and interpreted the data, and critically revised the manuscript; Ms Lukasiewicz helped conceptualize and design the study and critically revised the manuscript; Ms Macasiray Truong aided in acquisition of data and critically revised the manuscript; and all authors approved the final manuscript as submitted.

^aDepartment of Pediatrics, University of Kansas School of Medicine–Wichita, Wichita, Kansas
^bChildren's Hospital Association, Washington, DC; and ^cUCSF Benioff Children's Hospital, San Francisco, California

With a rate of 6.17 per 1000 live births, the US infant mortality rate in 2014 ranked among the highest of industrialized nations.¹ Of the nearly 4000 infants who suddenly and unexpectedly die each year, about one-half are due to sudden infant death syndrome (SIDS).² The number of deaths attributable to SIDS decreased dramatically after the “Back-to-Sleep” campaign began in 1994.³ The rate of reduction has plateaued over recent years as other sleep-related deaths (asphyxiation, suffocation, strangulation, and bed-sharing) have reportedly increased.⁴ The “Back to Sleep” campaign was revised to “Safe to Sleep” in October 2012 based on the 2011 guidelines of the American Academy of Pediatrics (AAP). The revised campaign promotes supine sleeping and other modifiable factors regarding sleep location and environment to reduce the risk of SIDS and other sleep-related infant deaths.³

Parents learn about infant sleep in the hospital setting through direct education from physicians and nurses as well as observation of sleep position and environment.^{5,6} Proper education and modeling have previously been shown to predict adherence to safe sleep recommendations.^{7,8} In addition, hospitals may be the main source of safe sleep education for parents of African-American infants, who are at higher risk for sleep-related death.^{9,10} However, hospitals are not consistently following the 2011 recommendations.^{11,12} Several studies suggest that health care workers are either not familiar with the AAP guidelines or they do not adhere to safe sleep recommendations despite knowledge of the guidelines.^{13–15}

Postpartum hospital-based infant safe sleep education and infant safe sleep modeling have been shown to improve caregivers’ knowledge of and intention to practice safe sleep.¹⁶ Furthermore, health care professionals’ behavior in both teaching and modeling safe sleep practices can be modified.¹⁷ For example, implementation of a bundled safe sleep intervention on a well-newborn floor showed improvements in sleep position, location, and environment.¹⁸

Although hospital safe sleep modeling has been examined in the NICUs and maternal fetal units, no identified studies evaluated safe sleep compliance or promotion in

pediatric inpatient units.^{11,12} We hypothesized that by utilizing components of a bundled intervention, we could significantly improve infant safe sleep practices on general pediatrics units.

METHODS

Between March 2012 and December 2013, a multicenter nonequivalent group quasi-experimental study was conducted to evaluate the impact of an intervention to improve safe sleep as defined by safe position, location, and environment for infants in pediatric inpatient units.

Setting and Study Population

The study was initially piloted from March through June 2012 at a tertiary care community hospital. In July 2012, it was selected by the Inpatient FOCUS Group of the Children’s Hospital Association as a multicenter project. Each site obtained local institutional review board approval or exemption.

Eight hospitals, each designated as a children’s hospital within a hospital or hospital system, participated in the study (including the pilot site). There was varied geographical representation among the participating hospitals. Table 1 describes the demographic characteristics of the hospitals, including region, size, number of beds, and staffing.

A convenience sample from each institution was obtained between February and December 2013, whenever pediatric units had staff to dedicate to collecting data. All infants aged 0 to 6 months admitted to the general pediatric unit were eligible for inclusion. Because our definition of safe sleep included position, infants >6 months of age were excluded because they are likely able to roll over by themselves, making observation of initial sleep position irrelevant.¹⁹ Infants in the NICUs, PICUs, and maternal fetal units were also excluded.

Based on a previous application in a well-newborn population that improved safe sleep from 25% at baseline to 58% postintervention,¹⁸ we estimated the need to observe 41 infants per site both preintervention and postintervention to determine a difference at each site (given $\alpha = .05$ and $\beta = .20$).²⁰

Intervention

All sites used a uniform definition of safe sleep, classified as a supine position, location in a crib, and an environment free of unsafe items. Medical equipment attached to the infant (eg, intravenous tubing, nasal cannula tubing, monitor leads) was defined as safe, and equipment not attached to the infant (eg, suctioning devices, nasal saline vials, extra tubing) was defined as unsafe a priori. Pacifiers are recommended by the AAP as a strategy to reduce the risk of SIDS²¹ and were not classified as unsafe items.

Participating sites were presented with a bundled intervention consisting of a safe sleep policy, specific educational materials, and examples of processes used at the pilot test site. All sites were asked to implement the bundle as they deemed fit for their institution and to the extent that their local resources would allow. The following is the bundled intervention from the pilot site.

1. Development of a safe sleep policy for infants. A safe sleep policy for infants was developed for the general pediatric unit based on an existing NICU policy, the AAP guidelines, and an example safe sleep policy from First Candle (http://www.firstcandle.org/modelbehavior/docs/NICU_booklet1.pdf). The policy described nonelevated, supine sleep positioning for hospitalized infants; eliminated the use of any positioning devices; allowed swaddling of infants to the shoulders with 1 blanket only; and required that additional items be removed from the crib.
2. Safe sleep training for staff with written declaration of practice. Pediatric nursing staff, respiratory therapists, allied health therapists, and child life staff were required to receive training. The training was facilitated by the local SIDS network (<http://www.kidsks.org>). Content included the new policy and focused on the ABCs of safe sleep: infants should sleep alone, on their backs, and in a crib. Once staff completed training, they were asked to sign a “Declaration of Safe Sleep,” committing to practice safe sleep in their daily patient care.

TABLE 1 Characteristics of Participating Hospitals

Characteristic	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
Hospital demographics								
Department of Health & Human Services region	9	4	4	2	5	10	5	7
Size of hospital	183	158	654	603	609	82	210	730
No. of pediatric beds	36	158	100	139	124	82	72	31
Staffing ratio	1:4	1:4-5	1:4	1:4-5	1:4-5	1:3-4	1:3-5	1:5-6
Existing safe sleep policy before intervention	No	No	Yes	No	No	No	Yes	No
Intervention logistics								
Predata collection period	April–May 2013	Feb–March 2013	Nov–Dec 2012	Feb–April 2013	Feb 2013	Feb 2013	Oct–Nov 2012	Mar–April 2012
Postdata collection period	Aug–Oct 2013	Aug–Dec 2013	June–Nov 2013	May–Aug 2013	Nov–Dec 2013	Sep–Dec 2013	Mar 2013	May–June 2012
Pediatric floor								
Safe sleep education and training for staff	X	X	X	X	X	X	X	X
Staff written declaration of practice	X	—	X	—	X	X	X	X
New/revised safe sleep policy	—	—	X	—	X	X	X	X
Implemented wearable blankets	X	—	—	—	—	X	—	—
Designated storage space in hospital room	X	—	—	—	X	—	—	X
Pediatric floor families/caregiver								
Safe sleep video required of parents	X	—	X	—	X	—	—	X
Visual education tool (poster) in room	—	X	—	—	—	—	X	X
Handout provided to parents to take home	X	X	X	X	—	X	X	X

X, intervention was performed at site; —, intervention not performed at site.

3. Designated storage. Three-drawer storage carts were labeled and placed in each room to store diapers, wipes, blankets, extra linens, and feeding supplies. Staff members were instructed on the use of the carts.
4. Education for caregivers. Caregivers of infants were asked to watch the 10-minute “ABC’s of Safe Sleep” video, which was placed on the hospital’s televised educational system. This video was available in English and Spanish. Nursing staff gave brief instructions to caregivers on watching the video. In addition, staff instructed caregivers to use the designated storage carts for supplies. Families were provided a safe sleep door hanger from the National Institute of Child Health and Human Development to take home as a reminder.

Successful programs often require sites to implement core components of the intervention but allow for flexibility and adaptation to individual location needs.²² For the present study, the essential element of the intervention was safe sleep training for the staff; written safe sleep policies were recommended. All sites provided staff training, and the majority developed or revised a safe sleep policy; however, the additional components implemented varied at each site (Table 1). It is not uncommon for interventions to be customized to fit organizational abilities and needs because appropriate modifications and adaptation may improve the sustainability of a program and further engage partners.^{23,24} For example, 2 sites supplemented the original bundle by adding infant-wearable blankets during the intervention period.

Measurement

A 4-item measurement tool facilitated recorded observation of caregiver presence and infant’s sleep location, position, and environment.¹⁸ The tool had multiple choice options available for each of the 4 domains that could be circled by the recorder based on his or her observations. The tool was discussed and vetted among project participants at all sites via a conference call. Each site was responsible for designating specific staff to record observations utilizing the tool. Discrete patients were observed

at each site using the standardized form once during sleep at baseline. Caregivers were not initially made aware that their infant was being observed; however, they did receive safe sleep education during the hospital stay. Postintervention data collection occurred in a similar manner at least 1 month after the initiation of the intervention. Questions regarding measurement fidelity were addressed during monthly calls between study sites.

Statistical Analysis

All data were analyzed by using SPSS version 20.0 (IBM SPSS Statistics, IBM Corporation,

Armonk, New York). Frequencies and percentages were computed for all variables. Comparisons between preintervention and postintervention findings were made by using χ^2 tests or Fisher's exact tests for cells with <5 subjects. All tests were 2-tailed, and α was set at .05.

RESULTS

Subjects

A total of 264 infants were observed before the intervention, and 234 infants were observed postintervention (Table 2). Only 1 site was able to meet recruitment goals, with 3 sites not recruiting enough infants by

December 2014, and 4 sites having to accelerate their observations to meet demands of other projects they had undertaken. Although this scenario left us underpowered to determine differences within sites, ample power was available to determine differences for infants at all sites combined.

Sleep Position

Definitions poorly explain whether a sleeping child held by a wake adult is considered safe, as it is unclear whether the caregiver will remain awake. Due to this ambiguity, children in this position were excluded from further

TABLE 2 Summary of Safe Sleep Observations

Variable	Phase	All Sites, (%)	Site 1, (%)	Site 2, (%)	Site 3, (%)	Site 4, (%)	Site 5, (%)	Site 6, (%)	Site 7, (%)	Site 8, (%)
Outcomes										
<i>N</i> ^a	Pre	264	10	32	42	39	31	36	54	20
	Post	234	16	20	31	33	24	31	46	31
Overall safe sleep ^b	Pre	13 (4.9) ^c	0 ^c	0 ^c	3 (7) ^c	0 ^c	0 ^c	0	9 (17)	1 (5)
	Post	73 (31.2) ^c	13 (81) ^c	16 (80) ^c	15 (48) ^c	14 (42) ^c	7 (29) ^c	2 (6)	4 (9)	2 (7)
Safe position ^b	Pre	199 (86.5) ^c	10 (100)	25 (86)	28 (74) ^c	24 (75) ^c	23 (79) ^c	33 (100)	42 (86)	14 (100)
	Post	202 (96.2) ^c	15 (94)	18 (95)	25 (96) ^c	32 (97) ^c	22 (100) ^c	28 (93)	41 (95)	21 (100)
Safe location ^b	Pre	234 (88.6)	10 (100)	29 (91)	38 (91)	32 (82) ^c	29 (94)	33 (92)	49 (91)	14 (70)
	Post	210 (89.7)	16 (100)	19 (95)	26 (84)	33 (100) ^c	22 (92)	30 (91)	43 (94)	21 (68)
Safe environment ^b	Pre	17 (6.4) ^c	0 ^c	0 ^c	4 (10) ^c	1 (3) ^c	0 ^c	0	11 (20)	1 (5)
	Post	81 (34.6) ^c	13 (81) ^c	17 (85) ^c	18 (58) ^c	14 (42) ^c	8 (33) ^c	2 (6)	5 (11)	4 (13)
Suffocation items observed										
Diapers	Pre	141 (53.4) ^c	6 (60) ^c	23 (72) ^c	28 (67) ^c	34 (87) ^c	19 (61) ^c	9 (25) ^c	12 (22) ^c	10 (50) ^c
	Post	23 (9.8) ^c	1 (6) ^c	2 (10) ^c	5 (16) ^c	7 (21) ^c	4 (17) ^c	1 (3) ^c	3 (7) ^c	0 ^c
Clothes	Pre	56 (21.2) ^c	1 (10)	5 (16)	8 (19)	10 (26) ^c	10 (32) ^c	11 (31) ^c	9 (17)	2 (10)
	Post	8 (3.4) ^c	0	0	1 (3)	0 ^c	0 ^c	2 (6) ^c	3 (7)	2 (7)
Pillow	Pre	11 (4.2)	0	2 (6)	1 (2)	0	3 (10)	2 (6)	1 (2)	2 (10)
	Post	6 (2.6)	0	0	0	0	0	3 (9)	1 (2)	2 (7)
Stuffed animals	Pre	43 (16.3) ^c	5 (50) ^c	4 (13)	3 (7)	9 (23) ^c	8 (26)	9 (25)	4 (7)	1 (5)
	Post	19 (8.1) ^c	0 ^c	0	1 (3)	0 ^c	6 (25)	4 (12)	5 (11)	3 (10)
Burp cloths	Pre	68 (25.8) ^c	0	15 (47) ^c	6 (14)	0	17 (55) ^c	4 (11)	11 (20)	15 (75) ^c
	Post	14 (6.0) ^c	0	0 ^c	3 (10)	0	1 (4) ^c	1 (3)	6 (13)	3 (10) ^c
Extra blankets	Pre	204 (77.3) ^c	10 (100) ^c	29 (91) ^c	37 (88) ^c	23 (59)	26 (84) ^c	34 (94) ^c	32 (59)	13 (65)
	Post	103 (44.0) ^c	3 (19) ^c	2 (10) ^c	10 (32) ^c	13 (39)	11 (46) ^c	24 (73) ^c	24 (52)	16 (52)
Nonsuffocation items observed										
Suction bulb	Pre	48 (18.2) ^c	0	15 (47) ^c	6 (14)	9 (23) ^c	6 (19) ^c	7 (19)	2 (4)	3 (15)
	Post	4 (1.7) ^c	0	0 ^c	1 (3)	0 ^c	0 ^c	2 (6)	0	1 (3)
Wipes container	Pre	127 (48.1) ^c	6 (60) ^c	22 (69) ^c	23 (55) ^c	9 (23) ^c	21 (68) ^c	17 (47)	14 (26)	15 (75) ^c
	Post	37 (15.8) ^c	0 ^c	1 (5) ^c	4 (13) ^c	1 (3) ^c	9 (38) ^c	9 (27)	7 (15)	6 (19) ^c
Medical equipment (not in use)	Pre	66 (25.0) ^c	1 (10)	4 (13)	22 (52) ^c	8 (21)	3 (10)	11 (31) ^c	8 (15) ^c	9 (45)
	Post	13 (5.6) ^c	0	0	0 ^c	2 (6)	1 (4)	0 ^c	1 (2) ^c	9 (29)
Other	Pre	45 (17.0)	0	6 (19)	4 (10)	4 (10)	8 (26)	13 (36)	8 (15)	2 (10)
	Post	31 (13.2)	1 (6)	0	3 (10)	3 (9)	2 (8)	6 (18)	5 (11)	11 (36)

^a *N* for safe position differs: preintervention total, *N* = 230. *N* values for sites 1 through 8, respectively: 10, 29, 38, 32, 29, 33, 49, and 14. Postintervention total, *N* = 210. *N* values for sites 1 through 8, respectively: 16, 19, 26, 33, 22, 30, 43, and 21.

^b Safe position and location defined as alone, on back, and in crib. Safe environment defined as no unsafe items where the infant falls asleep. Overall safe sleep defined as meeting criteria for safe position, location, and environment, simultaneously.

^c Data represents significant (*P* < .05) differences between preintervention and postintervention observations.

analyses ($n = 68$ [20.7%] and $n = 47$ [16.6%], preintervention and postintervention, respectively).

Position data were not coded for infants who were either sitting in car seats, held, or on an adult bed ($n = 30$ [11.3%] and $n = 24$ [10.3%] preintervention and postintervention, respectively) because no position in those areas can be deemed "safe."³ Baseline data revealed a safe sleep position in 85.0% (199 of 234) of observations. Of the remaining infants, 12.8% ($n = 30$) were on their side and 2.1% ($n = 5$) were prone.

After administration of the intervention bundle, 96.2% (202 of 210) ($P < .001$) of infants were determined to have safe sleep position. Of the remaining infants, 1.9% ($n = 4$) were on their side and 1.9% ($n = 4$) were prone.

Sleep Location

Baseline data revealed a safe sleep location for 88.6% (234 of 264). Of the remaining infants, 4.2% ($n = 11$) were held by a sleeping adult, 3.4% ($n = 9$) in a bouncy/car seat, 3.0% ($n = 8$) in the caregiver's bed, and 0.8% ($n = 2$) in other unsafe positions/locations.

After administration of the intervention bundle, 89.7% (210 of 234) ($P = .692$) of infants were in a safe sleep location, a nonsignificant increase. Of the remaining infants, 0.9% ($n = 2$) were held by a sleeping adult, 5.1% ($n = 12$) were in a bouncy/car seat, 3.0% ($n = 7$) were in the caregiver's bed, and 1.3% ($n = 3$) were in other unsafe positions/locations.

Sleep Environment

Baseline data revealed 6.4% (17 of 264) of infants had a safe sleep environment with no additional items in the crib. The most common items observed in the cribs were extra blankets (77.3%; $n = 204$), diapers (53.4%; $n = 141$), and wipes (48.1%; $n = 127$).

After administration of the intervention, 34.6% (81 of 234) had a safe sleep environment with no additional objects ($P < .001$). In addition, the mean \pm SD number of items observed postintervention (1.51 ± 1.40) was significantly reduced ($P = .001$) from preintervention (3.04 ± 2.01). The most common items in cribs

postintervention were extra blankets (44.0%; $n = 103$) and wipes (15.8%; $n = 37$).

Overall Safe Sleep

Baseline data revealed 4.9% (13 of 264) of infants had safe sleep in the hospital when accounting for position, location, and environment. Postintervention, a significantly higher number had safe sleep (31.2% [73 of 234]) ($P < .001$).

Process Evaluation

After the study, 6 of the 8 sites responded to an inquiry asking for feedback on barriers to implementation and improving safe sleep (Table 3). Hospital barriers included lack of warm clothing options for infants and unsafe practices engrained in their culture (eg, use of extra blankets for warmth, use of positioning devices). Some systematic barriers reported were issues with tagging, labeling, and laundering of wearable blankets; inconsistency among health care team members with proper demonstration and knowledge of swaddling when wearable blankets were unavailable; lack of technology available to show the video in all patient rooms; and lack of time for nurses to provide caregiver education. It was also noted anecdotally that parents of infants previously hospitalized in other units, such as the NICU (which did not model AAP-recommended safe sleep practices), were less receptive to modeling safe sleep even after education by staff in the general pediatric unit. Postintervention observations did not seem to vary with regard to barriers or extent of implementation.

DISCUSSION

As professional organizations and national campaigns try to reduce sleep-related

deaths for infants by promoting risk reduction strategies,³ caregivers seem to be receiving inconsistent messaging from health care teams regarding safe sleep.^{5,6,13} Modeling of safe sleep recommendations by health care providers has been shown to increase compliance of safe sleep practices by caregivers.^{7,8,14,16} However, hospitals may not be providing consistent messaging by assuring infants sleep according to the guidelines. As infants are admitted to the hospital for illnesses such as neonatal fever or bronchiolitis, safe sleep recommendations can be reinforced and modeled for caregivers.

The present study confirmed our assumption that hospitals do not fare well in promoting safe sleep messages, as at baseline $<5\%$ of infants had safe sleep. Even postintervention, infants in safe sleep increased only to 31.2%. Five sites recorded significant increases in the number of infants in overall safe sleep and safe sleep environments, and 3 sites achieved significant improvement in position. Trends across all sites were a significant reduction in diapers and ≥ 1 other unsafe item in the crib. Although the study observed a statistically significant increase in percentage of safely sleeping infants, there is still much room for improvement.

Creating safe sleep environments with no additional items in the crib seemed to be the biggest challenge. We suspect that full-sized cribs (versus newborn bassinets) and lack of designated storage space in patient rooms may encourage storage of items in cribs. Extra blankets were the most common items present in the cribs preintervention and postintervention, which we speculate may be due to staff and

TABLE 3 Barriers According to Sites (Sites 4 and 6 Did Not Report Barriers)

Barrier	Site 1	Site 2	Site 3	Site 5	Site 7	Site 8
Cultural and language barriers	X	X	—	—	—	X
Staff buy-in/compliance	X	—	X	—	—	X
Lack of time	X	—	—	—	—	—
Storage space	—	X	X	X	X	—
Caregiver compliance/co-bedding	—	X	X	—	X	X
Temperature control/clothing options/sleep sacks	—	X	—	—	X	X
Technology	—	—	X	X	—	—

X, barrier was reported by site; —, barrier was not reported by site.

caregiver concerns about adequate temperatures in patient rooms. Two participating sites (1 and 6) added wearable blankets to their postintervention process and were able to significantly reduce the incidence of extra blankets in cribs; however, some sites reported barriers in trying to adopt wearable blankets. Other items, such as suction bulbs and nasal saline vials, may not pose a direct suffocation threat but might provide inconsistent messaging to caregivers by allowing extraneous items to remain in the crib. For all sites, opportunities remain to reduce the number of items observed in the cribs.

Our study findings suggest additional efforts are needed to improve safe sleep compliance rates in the hospital. Implementing the intervention seems to have helped all sites improve, but no singular intervention was paramount. A component we initially posited as necessary (ie, written policies) was absent at site 1, a top performer. Discussions were held with key stakeholders from each site, but factors explaining why some excelled while others struggled were unclear. We believe the positive impact from bundled, but varied, interventions remains an important and valuable outcome. However, the duration of this project was limited to a relatively small segment of time, and the literature suggests at least 1 to 2 years are needed to transform organizational culture.²⁵ Supporting this theory, the pilot site was able to make sustained improvements from 2013 through 2015 (data not reported) by extending its efforts beyond the original project through continued education and implementation of weekly audits. Future studies may benefit by utilizing quality improvement processes when attempting similar changes.

Barriers qualitatively identified by sites should be considered in future studies and/or process improvement projects. Strategies to overcome these barriers may include purchasing pajamas or wearable blankets, engaging in community education regarding safe sleep practices, purchasing storage caddies or repurposing other containers for storage of items in patient rooms, and providing additional education

of staff regarding the dangers of wedges and positioners.^{3,26}

There are several limitations to our study. Facing competing concerns, in an effort to complete the project in a timely manner, most hospitals were not able to observe the expected 41 infants. A funded project with similar aims perhaps would show more robust findings. Another limitation was that nursing staff had the potential to realize they were being observed preintervention and may have changed their behavior accordingly (ie, the Hawthorne effect); however, we believe any effect was minimal because we continued to observe unsafe positions, locations, and environments throughout the study period. In addition, observational data have limitations, and we did not collect infant age or developmental milestones, or query the parents as to how the infant was placed. It is possible infants were initially placed on their back and rolled to a position of comfort. To minimize confounding, infants were limited to those aged <6 months, and it should be noted that only 10% of SIDS-classified deaths occur in children aged ≥ 6 months.^{3,27}

Perhaps the biggest limitation was in design. This study was initially crafted to have a controlled intervention, but differences in existing practices and available resources between sites at baseline made it impractical to standardize implementation. Generalizability may have been hindered by the site-specific adaptations; however, this study was intended as observation of the bundle as it was disseminated, and the results may reflect real-world adoption of proposed interventions. Other limitations include a lack of formal inter-rater reliability assessment on the data collection form, although definitions were provided and monthly telephone calls between sites addressed any questions regarding the data collection process. Finally, sites were not asked to track or report compliance with each individual intervention, such as percentage of caregivers who viewed the videos or percentage of staff-signed declarations of practice; we were therefore unable to assess the effect of each individual intervention.

CONCLUSIONS

With national efforts to promote safe sleep environments, it is important that health care providers are delivering a consistent message to caregivers of young infants. The hospital setting is an area in which the safe sleep message can be reinforced. However, behaviors must be modeled by hospital staff to support these messages. Our baseline data indicate that pediatric units seldom follow the safe sleep guidelines as outlined by the AAP.³ By implementing a bundled approach for health care providers and infant caregivers, we were able to improve the rate of safe sleep among hospitals and reduce the number of unsafe items in the crib. Further study is necessary to determine factors to explain the disparities in effectiveness observed with this approach.

Acknowledgments

The authors thank Christy Schunn of the Kansas Infant Death and SIDS Network, Dr Brooke Mason, Melissa Novak, and Joy Nimeskern for their help on this project at the pilot test site. They also thank the participating institutions from the Children's Hospital Association, Pediatric Inpatient FOCUS Group: UCSF Benioff Children's Hospital, San Francisco, California; Arnold Palmer Hospital for Children, Orlando, Florida; Children's Hospital at Memorial Health University Medical Center, Savannah, Georgia; Children's Hospital of Illinois at OSF Saint Francis Medical Center, Peoria, Illinois; Wesley Medical Center, Wichita, Kansas; Helen DeVos Children's Hospital, Grand Rapids, Michigan; Stony Brook Long Island Children's Hospital, Long Island, New York; and MultiCare Mary Bridge Children's Hospital & Health Center, Tacoma, Washington.

REFERENCES

1. Central Intelligence Agency. The World Factbook. Available at: <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2091rank.html>. Accessed February 4, 2015
2. Centers for Disease Control and Prevention. Sudden unexpected infant death and sudden infant death. Available

- at: www.cdc.gov/sids. Accessed February 4, 2015
3. Moon RY; Task Force on Sudden Infant Death Syndrome. SIDS and other sleep-related infant deaths: expansion of recommendations for a safe infant sleeping environment. *Pediatrics*. 2011; 128(5):1030–1039
 4. Shapiro-Mendoza CK, Kimball M, Tomashek KM, Anderson RN, Blanding S. US infant mortality trends attributable to accidental suffocation and strangulation in bed from 1984 through 2004: are rates increasing? *Pediatrics*. 2009;123(2):533–539
 5. Colson ER, Bergman DM, Shapiro E, Leventhal JH. Position for newborn sleep: associations with parents' perceptions of their nursery experience. *Birth*. 2001;28(4):249–253
 6. Thompson DG. Safe sleep practices for hospitalized infants. *Pediatr Nurs*. 2005; 31(5):400–403, 409
 7. Colson ER, Levenson S, Rybin D, et al. Barriers to following the supine sleep recommendation among mothers at four centers for the Women, Infants, and Children Program. *Pediatrics*. 2006; 118(2). Available at: www.pediatrics.org/cgi/content/full/118/2/e243
 8. Brenner RA, Simons-Morton BG, Bhaskar B, et al. Prevalence and predictors of the prone sleep position among inner-city infants. *JAMA*. 1998;280(4):341–346
 9. Pickett KE, Luo Y, Lauderdale DS. Widening social inequalities in risk for sudden infant death syndrome. *Am J Public Health*. 2005;95(11):1976–1981
 10. Northington L, Graham J, Winters K, Fletcher A. Assessing knowledge of sudden infant death syndrome among African American women in two Mississippi communities. *J Cult Divers*. 2011;18(3):95–100
 11. Voos KC, Terreros A, Larimore P, Leick-Rude MK, Park N. Implementing safe sleep practices in a neonatal intensive care unit. *J Matern Fetal Neonatal Med*. 2015;28(14):1637–1640
 12. Aitken ME. Safe sleep in hospitals: challenges and successes. Children's Hospital Association. Available at: www.childrenshospitals.net/Content/ContentFolders34/EducationMeetings2/SpringConference/2013/Sessions/CA/Safe_Sleep_in_Hospitals_Challenges_and_Successes.pdf. Accessed January 30, 2015
 13. Price SK, Hillman L, Gardner P, Schenk K, Warren C. Changing hospital newborn nursery practice: results from a statewide "Back to Sleep" nurses training program. *Matern Child Health J*. 2008;12(3):363–371
 14. Bullock LF, Mickey K, Green J, Heine A. Are nurses acting as role models for the prevention of SIDS. *MGN Am J Matern Child Nurs*. 2004;29(3):172–177
 15. Aris C, Stevens TP, Lemura C, et al. NICU nurses' knowledge and discharge teaching related to infant sleep position and risk of SIDS. *Adv Neonatal Care*. 2006;6(5):281–294
 16. Goodstein MH, Bell T, Krugman SD. Improving infant sleep safety through a comprehensive hospital-based program. *Clin Pediatr (Phila)*. 2015; 54(3):212–221
 17. Raydo LJ, Reu-Donlon CM. Putting babies "back to sleep": can we do better? *Neonatal Netw*. 2005;24(6):9–16
 18. Mason B, Ahlers-Schmidt CR, Schunn C. Improving safe sleep environments for well newborns in the hospital setting. *Clin Pediatr (Phila)*. 2013;52(10):969–975
 19. Willinger M, Hoffman HJ, Wu KT, et al. Factors associated with the transition to nonprone sleep positions of infants in the United States: the National Infant Sleep Position Study. *JAMA*. 1998;280(4): 329–335
 20. MaCorr Research. MaCorr Sample Size Calculator. MaCorr Research Solutions Online. Available at: www.macorr.com/ss_calculator.htm. Accessed September 28, 2014
 21. Colson ER, McCabe LK, Fox K, et al. Barriers to following the back-to-sleep recommendations: insights from focus groups with inner-city caregivers. *Ambul Pediatr*. 2005;5(6):349–354
 22. Kilbourne AM, Neumann MS, Pincus HA, Bauer MS, Stall R. Implementing evidence-based interventions in health care: application of the replicating effective programs framework. *Implement Sci*. 2007;2:42
 23. Green LW, Glasgow RE. Evaluating the relevance, generalization, and applicability of research: issues in external validation and translation methodology. *Eval Health Prof*. 2006; 29(1):126–153
 24. Dearing JW, Kreuter MW. Designing for diffusion: how can we increase uptake of cancer communication innovations? *Patient Educ Couns*. 2010;81(suppl): S100–S110
 25. Harris KT, Treanor CM, Salisbury ML. Improving patient safety with team coordination: challenges and strategies of implementation. *J Obstet Gynecol Neonatal Nurs*. 2006;35(4):557–566
 26. Food and Drug Administration. Infant sleep positioners pose suffocation risk. Consumer updates. Available at: www.fda.gov/forconsumers/consumerupdates/ucm227575.htm. Accessed September 28, 2014
 27. First Candle. Facts on SIDS/SUID. Available at: www.firstcandle.org/cms/wp-content/uploads/2012/10/Facts-On-SIDS-SUID-2012.pdf. Accessed September 28, 2014