

The EASE Quality Improvement Project: Improving Safe Sleep Practices in Ohio Children's Hospitals

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BACKGROUND: Despite American Academy of Pediatrics (AAP) recommendations, many hospitalized infants are not observed in the appropriate safe sleep environment. Caregivers tend to model sleep patterns observed in a hospital setting. This project assessed the change in infant safe sleep practices within 6 children's hospitals after the implementation of a statewide quality improvement program.

METHODS: The AAP recruited hospitalists from each of the state's children's hospitals and asked them to form "safe sleep teams" within their institutions. Teams used a standardized data tool to collect information on the infant's age and sleep position/environment. They collected baseline data and then weekly for the duration of the 12-month project. Teams were required to implement at least 3 Plan-Do-Study-Act cycles. We calculated changes in safe sleep practices over time. Providers received Maintenance of Certification Part IV credit for participation.

RESULTS: Teams collected 5343 audits at all participating sites. At baseline, only 279 (32.6%) of 856 of the sleeping infants were observed to follow AAP recommendations, compared with 110 (58.2%) of 189 ($P < .001$) at the project's conclusion. The presence of empty cribs was the greatest improvement (38.1% to 67.2%) ($P < .001$). Removing loose blankets (77.8% to 50.0%) ($P < .001$) was the most common change made. Audits also showed an increase in education of families about safe sleep practices from 48.2% to 75.4% ($P < .001$).

CONCLUSIONS: Multifactorial interventions by hospitalist teams in a multi-institutional program within 1 state's children's hospitals improved observed infant safe sleep behaviors and family report of safe sleep education. These behavior changes may lead to more appropriate safe sleep practices at home.

The United States has one of the highest infant mortality rates in the developed world, at 6.2 deaths per 1000 live births.¹ Ohio currently has one of the worst rates in the United States, ranking 45th in overall infant mortality.² Sleep-related deaths account for the highest percentage of these deaths behind prematurity and congenital anomalies.³ In 1992,

in response to studies from Europe and Australia, the American Academy of Pediatrics (AAP) recommended that infants be placed to sleep in a nonprone position to reduce the risk of sudden infant death syndrome (SIDS).⁴ The "Back to Sleep" campaign was initiated in 1994. Over the next several years, the SIDS rate declined, associated with the steady increase in

abstract

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Dr Macklin provided key components of the project design, helped run learning collaborative and action period calls, finalized the data collection sheet, and drafted the initial manuscript; Drs Gittelman and Denny conceptualized and designed the project, helped run learning collaborative and action period calls, finalized the data collection sheet, and reviewed and revised the manuscript; Ms Southworth coordinated data collection at all sites and reviewed and revised the manuscript; Ms Werver Arnold conceptualized and helped to design the program, helped to secure funding for the project, and reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

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TABLE 1 Characteristics of Children's Hospitals Participating in the EASE Collaborative (2014 Data)

Participating Hospitals	Bed Capacity	Annual Admissions	Number Audits Submitted	Submitted Audits/Annual Admissions, %
Akron Children's Hospital	253	10 130	424	4.19
Cincinnati Children's Hospital	628	30 848	2959	9.59
Dayton Children's Hospital	155	6466	583	9.02
Nationwide Children's Hospital	464	17 292	479	2.77
Rainbow Babies and Children's Hospital	244	9838	369	3.96
Toledo Children's Hospital	151	3788	511	1.35

the prevalence of supine sleeping.⁵ In 2011, the AAP expanded its infant safe sleep recommendations to focus on all causes of sleep-related deaths instead of only those caused by SIDS.⁶ The rate of SIDS has plateaued since 1999, whereas changes in classification have led to an increased awareness of other causes of death (eg, suffocation or asphyxia), prompting the expanded recommendations.⁷

Health care providers, including physicians and nursing staff, can play a vital role in modeling the AAP recommendations and in influencing parent and caregiver behaviors and beliefs regarding safe sleep.⁸⁻¹⁰ In a 2002 study, parents who witnessed medical providers laying their babies supine in a nursery were more than twice as likely to continue this practice at home.¹¹ Unfortunately, a recent study showed that more than half of health care providers do not model recommended safe sleep practices in the inpatient setting,¹² thus creating a disconnect between what parents are told and what they observe from health care staff.

In response to the state's poor infant mortality rate and in an attempt to improve safe sleep practices within the children's hospital setting, the Ohio Chapter of the AAP (OAAP) implemented a quality improvement (QI) safe sleep program in all hospitals affiliated with the Ohio Children's Hospital Association (OCHA). The goals of the program were to collect baseline sleep

data for admitted children at each participating hospital and to apply QI methodology with applicable staff to increase observed infant sleep behaviors and to educate families about AAP recommendations.

METHODS

Context

The OAAP initiated the EASE (Education and Sleep Environment) Injury Prevention Collaborative on January 24, 2014 with the aim of increasing observed safe sleep behaviors among infants ≤ 1 year of age in children's hospitals throughout Ohio. The Ohio AAP, OCHA, and the physician leadership team in the project were key stakeholders in planning. Six free-standing Ohio children's hospitals without internal maternity centers or well-baby nurseries conducted QI interventions and evaluations. All hospitals are in major metropolitan areas and have large regional referral bases throughout Ohio and neighboring states; all hospitals are also academic tertiary or quaternary care institutions (Table 1). Using support from OCHA, the OAAP recruited a lead pediatric hospitalist physician from each participating hospital. All physicians received Part IV Maintenance of Certification (MOC) credit for active participation.

The OAAP structured the project similar to an Institute of Healthcare Improvement (IHI) Breakthrough Series Collaborative.¹³ We, as the

leadership team, asked recruited hospitalists to form and lead multidisciplinary "safe sleep teams" composed of other staff physicians and trainees, nursing leadership, hospital administrators, child life specialists, and other health care providers, as deemed necessary.

Interventions

The collaborative's leadership team held a 2-hour on-site (with online option) learning session following baseline data collection. Through interactive lectures, the leadership team used the learning session to educate participating teams about safe sleep evidence-based guidelines, local statistics, QI principles, and utilization of Plan-Do-Study-Act (PDSA) cycles within their institutions. Hospitalist teams then had the opportunity at the end of the session to meet together and begin the construction of their key driver diagrams with assistance from AAP staff. Following the learning session, we encouraged teams to continue their work on their key driver diagrams to tailor interventions specific to the needs of their respective hospitals. We urged multidisciplinary interventions on the areas of physician and/or nursing staff education, through online modules, Grand Rounds, or resident lectures; environmental management strategies, such as the acquisition of sleep sacks to replace loose blankets; policy creation or revisions; and/or parental support and education. The OAAP required teams to complete 3 PDSA cycles during the 10-month

“action phase” of the collaborative. Hospital teams held scheduled meetings during this time to discuss progress and steps needed to meet final goals.

To further participant knowledge about safe sleep and associated areas of interest, the leadership team held monthly action period conference calls, similar to webinars, during the collaborative for all hospitalist leaders and any interested team members. We required attendance from at least 1 member of each team for 75% of all calls. The leadership team analyzed and reviewed run charts with hospitalist team members to assess the progress of both individual teams and the collaborative, to share best practices, and to identify concerns and problems. We also educated teams on safe sleep practices, infant mortality, injury prevention, QI, and resources to promote safe sleep behaviors during these hour-long calls.

Data Collection

The OAAP instructed teams to collect baseline data by conducting random safe sleep audits of patients ≤ 1 year of age admitted to the general medical/surgical units at their hospital using an audit tool from February 3 through March 31, 2014. Observers were multidisciplinary, including nursing staff, resident physicians, attending physicians, or patient care assistants, and were used per the hospitalists’ discretion. Hospitalists educated observers at each hospital by using examples (ie, PowerPoint photographs of simulated patients in unsafe and safe sleep environments) and a discussion of the audit tool components. The audit tool, developed by team investigators, asked questions regarding infants’ sleep location and position, head of bed elevation, loose items found in the sleep environment, inappropriate developmental tool

use, and family education on safe sleep (available by request). One hospital piloted the tool before dissemination for ease of use and understanding. The leadership team held each site responsible for educating observers on how to document on the tool and for its completion on a consistent basis. The teams imported paper copies of the completed tools into Survey Monkey (www.surveymonkey.com, LLC; Palo Alto, CA) at each site for data analysis and site comparisons.

We required teams to randomly audit at least 10 patients per week (total of 40 patients monthly) at each hospital during the action phase, which began on April 1, 2014. Each site had the option to limit their audits to only a few units or to include all general medical/surgical units in the hospital and could audit >10 patients weekly if time permitted. Teams audited primarily during typical “sleeping hours” of 9:00 PM to 7:00 AM and could audit patients at any point during their hospital admissions. Exclusion criteria were as follows: patients located in ICUs, including NICUs; patients with tracheostomies; ventilator or noninvasive ventilator dependence; recent spinal surgeries; or upper airway anatomic abnormalities. We also excluded infants who were found to be awake during the audit from final analysis. We included all other infants with diagnoses and conditions not stated previously for eligibility for random auditing and for inclusion in the study. Teams collected data in a similar manner after the baseline period for 10 additional months. The project concluded on January 30, 2015.

Measures

The primary objective was for each hospital to show that $>90\%$ of infants ≤ 1 year of age not meeting exclusion criteria were in a “safe sleep environment” on random weekly audits by the end of the project. We

calculated this measure by taking the number of audited infants found in appropriate sleep environments divided by the total number of audited infants. A secondary objective was for each hospital to provide safe sleep education to $>90\%$ of parents/caregivers of infants not meeting exclusion criteria at any time during admission from the hospital. We calculated this measure by taking the number of infants whose caregivers reported the occurrence of safe sleep education at the participating hospital by the time of the audit divided by the number of infants whose parents were present and awake enough at the time of the audit to answer the question.

Analysis

We determined frequencies to assess the percentage of observed infants ≤ 1 year of age found in a safe sleep environment. We considered the safe sleep environment appropriate if an infant was found sleeping in his or her crib, on his or her back, and in an environment devoid of extraneous items. Each parameter was reviewed individually, and the 3 were also combined to determine compliance with the appropriate safe sleep behaviors listed previously as a bundle. We compared baseline data from the first 2 months with data collected during the action period to assess behavior change over time. Teams also queried families about receiving safe sleep education during their hospital stay, and changes over time were reviewed. We performed 2-proportion z -tests and confidence intervals comparing proportions of specified values of each variable for baseline and treatment observations. The teams used run charts to track changes in behaviors in each institution and as a collaborative over time.

Human Subjects Review

The Nationwide Children’s Hospital Institutional Review Board exempted

this project from review due to its status as a QI project.

RESULTS

Twenty-two hospitalists from the 6 children's hospitals participated in the project. Twelve (55%) were women, and 12 (55%) were junior physicians (<35 years of age). At least 3 of 6 participating hospitals had nursing representation on their core teams, and at least 1 team used a pediatrics resident. Team members submitted 5343 total audits during the 12-month collaborative; 87.8% (4692) of these patients were included in statistical analysis. We excluded 536 of these audits when the infant was awake during the audit; we excluded another 91 audits due to incomplete information on the audit form. Twenty-four audits also were excluded due to meeting the exclusion criteria. One institution did not submit any audits for the final month of the collaborative due to lack of available observers. Two other hospitals also had intermittent difficulties with submission of necessary numbers of audits during the collaborative due to lack of available observers and were reminded, but not reprimanded, of the requirements of the project. All but 1 hospitalist team submitted the requisite number of audits by the end of the collaborative, and all teams met the 75% Action Period Call attendance requirement.

Safe Sleep Environment

By the end of the collaborative, there was a 26% increase of infants observed to be in a safe sleep environment (baseline, 279 [32.6%] of 856 to end of collaborative, 110 [58.2%] of 189) (95% confidence interval [CI] 17.91 to 33.31; $P < .001$) (Fig 1). Two institutions had improvements of ~70% (Table 2).

The greatest behavioral change was noted in the removal of excess items in the crib, with a 29% increase in bare cribs (38.1% [326/856] to 67.2% [127/189]) (95% CI 21.70 to 36.55; $P < .001$). Specifically, there was a significant increase in the presence of blanket-free cribs by the end of the collaborative, from 50.0% (428/856) to 77.8% (147/189) (95% CI 20.97 to 34.59; $P < .001$). There was no significant change in infant location from the onset to the end of the collaborative (91.6% to 89.4%) (95% CI -6.93 to 2.59; $P = .324$), as infants were found in their cribs in most audits. Similarly, there was no significant change in position (84.0% to 84.7%) (95% CI -5.03 to 6.36; $P = .913$); most infants were found on their backs during the collaborative. The most commonly cited interventions used by the hospital teams were creation or revision of an existing hospital safe sleep policy ($n = 3$); use of print materials (such as the National Institute of Child Health and Human Development Safe Sleep handout)¹⁴ presented at the time of hospital admission to educate families and caregivers on appropriate safe sleep behaviors ($n = 5$); and education on implementation of the AAP recommendations to nursing and ancillary staff through mandatory online modules, scheduled unit conference days, and institutional meetings ($n = 5$).

Family Education of Safe Sleep Practices

At baseline, 117 (48.2%) of 243 families/caregivers reported that they had received education on safe sleep practices during their admission before the audit. There was a significant increase in family-reported education of safe sleep practices by the end of the collaborative to 75.4% (46/61) (95% CI 14.76 to 39.76; $P < .001$) (Fig 2). Parents reported that direct safe sleep education by staff, primarily the

nursing staff at the time of hospital admission, was the modality used most commonly (85.3%). Other family education modalities used by institutions included brochures provided to families by nursing staff at admission,¹⁴ posters in patient rooms and unit hallways, public safety announcements on in-room televisions or tablets (such as a statewide safe sleep public service announcement),¹⁵ and digital signage in heavily trafficked areas.

DISCUSSION

To our knowledge, this is the first QI collaborative for children's hospitals in 1 state to focus on modeling appropriate safe sleep behaviors for families. As a result of this QI intervention, hospitalized infants ≤ 1 year were observed to be placed in appropriate safe sleep environments significantly more often. Although safe sleep rates did not reach our goal of 90%, significant improvement was observed over a short period of time. Rates of family/caregiver reports of safe sleep education during hospital admission also increased significantly due to interventions placed in the QI program.

Of note, our baseline data were similar to those seen in previous studies examining safe sleep behaviors in the hospital setting, with a large majority of patients found in unsafe sleep environments, primarily due to loose items in the crib.¹⁶⁻¹⁸ In particular, Mason et al¹² found that only 25% of infants in their institution were found in a safe sleep environment at baseline. Following an intense QI program, similar in process to our program, twice as many infants were found in a safe sleep environment. Placing an infant on his or her back and in a crib were the 2 recommendations that were followed most closely during our collaborative. In contrast, observing the infant in an empty crib proved to be the biggest obstacle

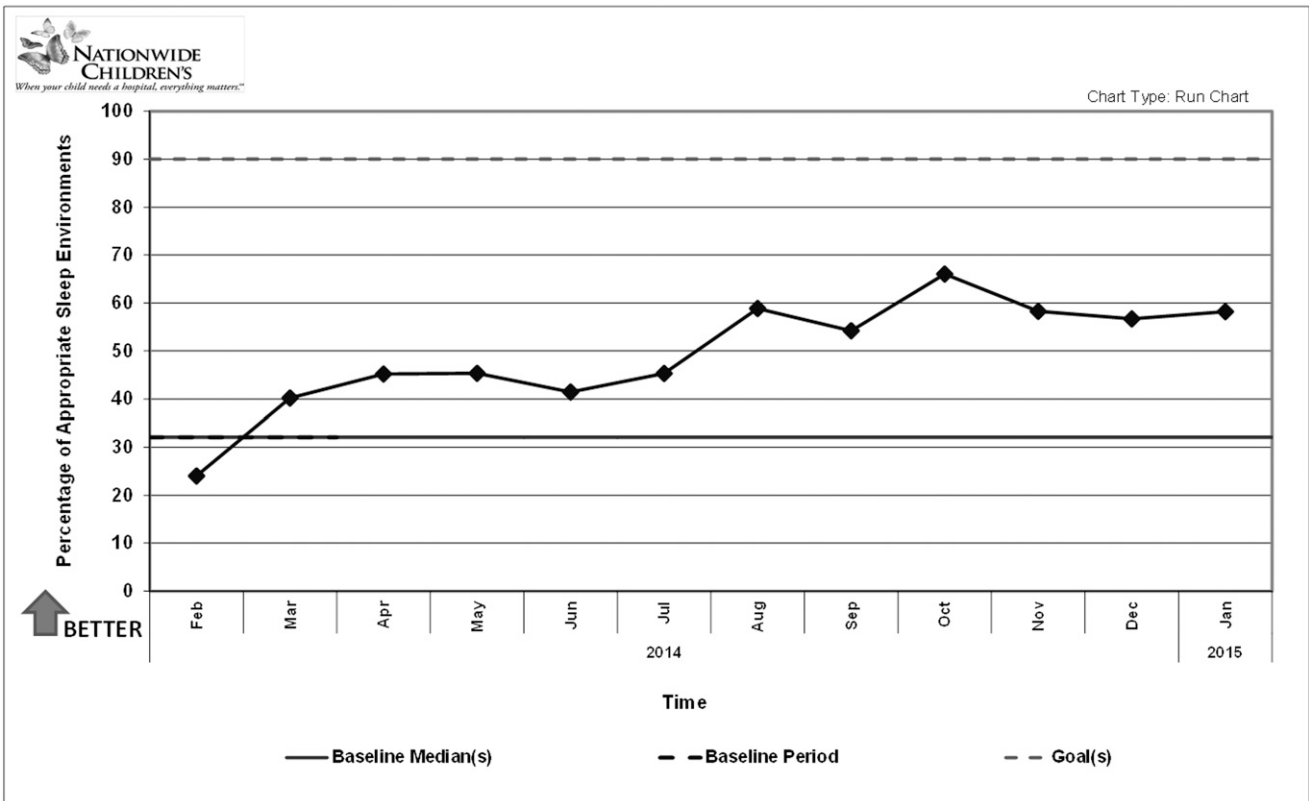


FIGURE 1 Percentage of infants in all hospitals observed to be in safe sleep environments, February 2014 to January 2015.

TABLE 2 Changes in Safe Sleep Environment and Family Reports of Safe Sleep Education for Each Hospital Participating in the EASE Collaborative

Hospitals	Change in Presence of Safe Sleep Environment, %			Change in Family Reports of Education, %		
	Preintervention	Postintervention	Total Change	Preintervention	Postintervention	Total Change
Hospital 1	20.0	56.7	36.7	64.0	95.0	31.0
Hospital 2	25.1	76.6	51.5	70.0	100.0	30.0
Hospital 3	0	71.4	71.4	0	20.0	20.0
Hospital 4	6.7	66.7	60.0	27.3	50.0	22.7
Hospital 5	4.0	73.6 ^a	69.6	0	91.7 ^a	91.7
Hospital 6	4.3	30.0	25.7	28.6	53.5	24.7

^a Data from December 2014, as no audits were submitted for final month of collaborative (January 2015).

in our study and was a key factor in our inability to reach our goal behavior rates.

In all institutions involved in the collaborative, environmental and policy changes were used to bring about significant changes in behaviors. Several institutions focused on creation or revision of existing safe sleep policies to align with the 2011 AAP guidelines. Many

hospitals partnered with HALO (www.halosleep.com; Minnetonka, MN) to provide SleepSacks for infants and to eliminate the use of loose blankets. Education for all inpatient health care providers, including physicians, nursing, and support staff, and parents and caregivers was also essential for the success of the project. Of note, the amount of change in each institution did not necessarily

correlate with that institution's final results at the end of the collaborative.

Not surprisingly, we noted that those institutions that had strong support from their administrations tended to have greater increases of safe sleep behaviors than those that did not have that support. Those teams with appropriate backing were able to purchase needed sleep

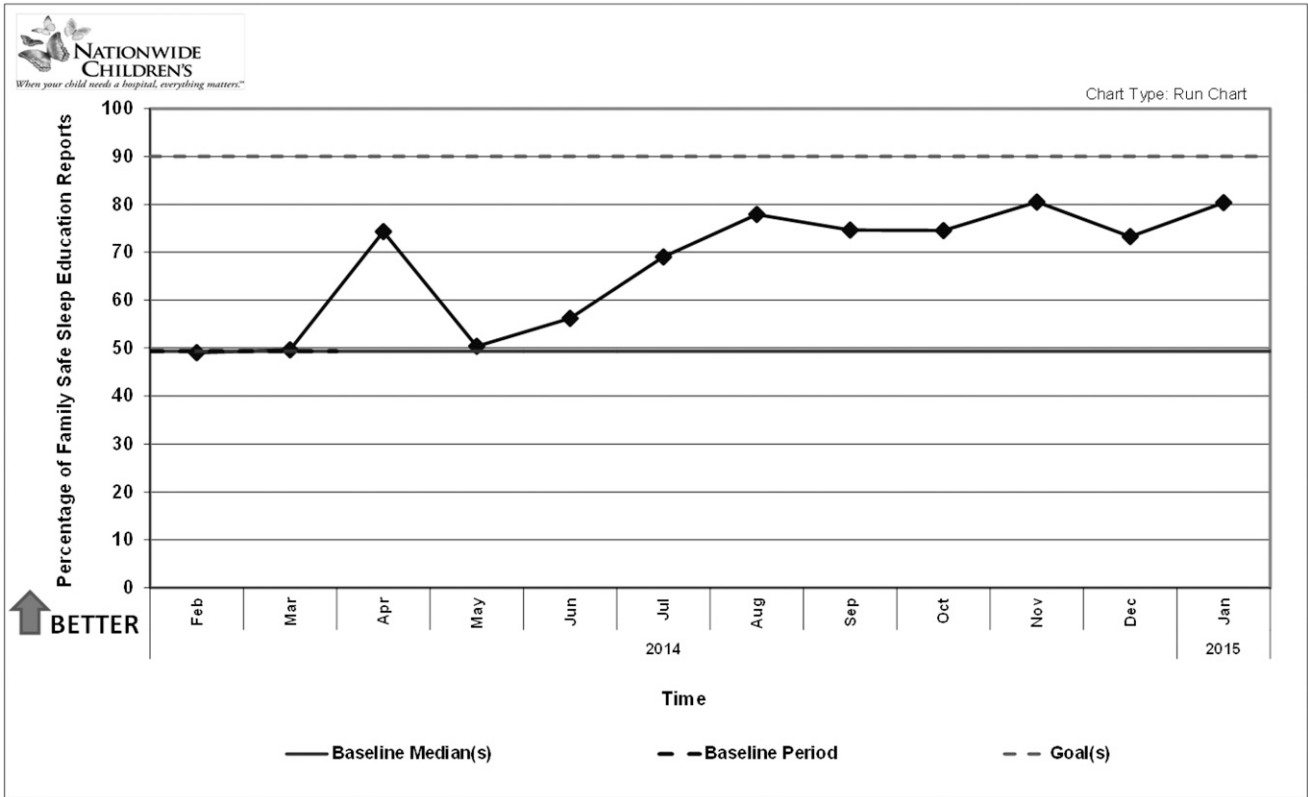


FIGURE 2
 Percentage of families who reported safe sleep education in all hospitals, February 2014 to January 2015.

sacks, easily pass hospital policy revisions, and incorporate the safe sleep behaviors into the institutions' culture and workflows; those without the vocal assistance of administration struggled to accomplish the same goals during the collaborative and did not score as highly. We surmise that a unified message regarding the importance of implementing system-wide safe sleep behaviors; from a hospital's leadership team down to the physicians, trainees, and nursing and ancillary support staff; is paramount to the success of many of our highest-rated teams and is likely a key factor for the success and sustainability of future safe sleep initiatives.

Staff buy-in and agreement with recommendations and practices also proved to be a crucial factor in improvements of safe sleep

behaviors, with higher-scoring institutions anecdotally reporting greater staff buy-in than those who did not. Physician and nursing staff were often biased by past experiences with both patients and their own children, and some found it difficult to abide with the AAP recommendations. We suspect that this is a primary reason that we did not reach our 90% goal and will work to resolve these biases in future collaboratives.

Our study had several limitations. One institution submitted most of the audits throughout the collaborative; as that institution was the highest-performing hospital at the end of the study, the volume of its submitted audits likely affected our overall rates of behavioral changes. However, one should note that each site, when analyzed independently, had

similar patterns of improvement throughout the collaborative. This site, one of the largest institutions in the collaborative, also demonstrated that large-volume data collection was possible when incorporated into daily workflow.

Also, there was no standardization of implemented changes throughout the collaborative; each hospital was allowed to execute changes and perform PDSA cycles based on its needs independent of the other hospitals. As such, it is difficult to determine which intervention had the greatest impact on the observed behavioral changes. In addition, staff from each institution self-reported their audit results, which could have led to a bias in reporting. Last, all hospitalists who participated in the collaborative received Part IV MOC Credit; had this credit not been offered, we are unsure if we would

have had the same level of physician buy-in.

CONCLUSIONS

Given our country's and state's poor infant mortality rates, it is imperative that health care professionals model appropriate infant safe sleep behaviors and provide education and recommendations on continuing these practices in the home. Our baseline data demonstrated that inpatient pediatric units in free-standing children's hospitals do not routinely follow the AAP safe sleep guidelines. By implementing a statewide QI collaborative and providing MOC Part

IV for participation, we were able to show an improvement in infant safe sleep practices and education provided in the hospital setting. Further work is needed to determine the best solutions for eliminating items in the crib.

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ABBREVIATIONS

AAP: American Academy of Pediatrics
CI: confidence interval
EASE: Education and Sleep Environment
MOC: Maintenance of Certification
OAAP: Ohio Chapter of the American Academy of Pediatrics
OCHA: Ohio Children's Hospital Association
PDSA: Plan-Do-Study-Act
QI: quality improvement
SIDS: Sudden Infant Death Syndrome

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