

**SPECIAL ARTICLE**

# In-Hospital Newborn Falls Associated With a Sleeping Parent: The Case for a New Paradigm

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**ABSTRACT**

A newborn fall to the floor from a sleeping parent's arms in the immediate postpartum period may result in a skull fracture, head bleed, and transfer to the NICU for observation. These harmful consequences galvanized frontline clinicians to prevent these tragic accidents, but, a decade later, they continue at a stubbornly low, persistent level. In this article, I suggest that a misunderstanding of sleep science may be a barrier to effective interventions. The science of sleep is presented to inform a new paradigm that would have greater potential of eliminating dangerous newborn falls.

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**TABLE 1** NSBs With Reported Outcomes

Intervention	Lipkke et al <sup>18</sup>	Ainsworth et al <sup>13</sup>	Miner <sup>25</sup>	Galuska <sup>20</sup>	Hodges and Gilbert <sup>17</sup>	Lahey et al <sup>12</sup>	Hantske <sup>16</sup>
Parental education	X	X	X	X	X	X	X
Staff education	X	X	X	X	X	X	X
Reminder signage	X	X	X	X	X	—	X
Removing infants from sleepy moms	X	X	X	X	X	—	—
Promoting maternal rest	X	X	—	X	X	X	—
Parental safety pledge form	X	X	X	X	—	—	—
Alert person with mom at night	X	X	X	—	X	—	—
Frequent rounding and observation	X	X	X	X	—	—	—
Having moms call if sleepy	X	X	X	—	—	—	—
Debriefs	X	X	X	—	—	X	—
Maternal risk assessment	X	X	—	—	—	—	—

—, not applicable.

The past decade has seen a burgeoning literature in which investigators examine in-hospital newborn falls in the postpartum period.<sup>1–40</sup> Newborns' falls associated with a sleeping parent have resulted in skull fractures, head bleeds, and transfers to the NICU. Heartbroken parents experience agonizing waits for test results to reassure them that their new infant has not been seriously injured. Before the unintentional injury, they were proud parents cradling a newborn in their arms. After the unintentional injury, their infant is in an overwhelming, technologically complex place. They touch their infant under the watchful eyes of staff who know what they did. A deep sense of shame and feelings of being unworthy parents leave them desolate. The rarity of the event deprives them of comforting shared stories that say, "Yes, that happened to me too and it will be okay." Many keep the newborn fall a dark secret, an untold story. The mother–infant staff are devastated and wonder if they could have prevented the unintentional injury had they been more attentive. An infant was injured on their watch and, awash in their own guilt, they still need to comfort the new parents. Even if the injuries are minor, a newborn fall is a shattering experience for the infant, parents, and caregivers. Staff feel compelled to eradicate falls associated with a sleeping parent.

The starting point was understanding the circumstances leading to an infant fall. Data revealed that 50% to 100% of the newborn falls occurred during nighttime

feedings.<sup>1,2,5,7,11,15,20,24,29</sup> The prevailing wisdom was that sleeping with an infant was unsafe.<sup>41,42</sup> A sleeping parent feeding or holding an infant was interpreted as nonadherence with the American Academy of Pediatrics (AAP) safe sleep guidance.\* In the absence of science to guide them, pioneering clinicians defined the problem as the mother falling asleep with her newborn, designing targeted interventions for prevention. Using a quality improvement (QI) framework,<sup>12,13,16–18,20,25,28,29</sup> clinicians implemented multiple commonsense solutions concurrently,<sup>†</sup> which, for the purposes of this article, are referred to as newborn safety bundles (NSBs). They included parental and staff education about safe sleep practices,<sup>‡</sup> frequent rounding,<sup>¶</sup> promotion of maternal rest,<sup>¶¶</sup> parental signature on an infant safety pledge,<sup>##</sup> instruction to mothers to ask for assistance if feeling sleepy,\*\* reminder signage about safe sleep practices,<sup>††</sup> identification of high risk mothers,<sup>‡‡</sup> and assignment or request for an alert individual to be present during

\*Refs 1, 2, 6, 10, 16–21, 23–25, 29, 31, and 33–36

†Refs 1–14, 18–21, 23–25, 28–30, 32, and 34–36

‡Refs 1–14, 16–25, 28–30, 32, and 34–36

¶Refs 1, 2, 6, 8–11, 13, 14, 16–18, 21, 22, 24, 25, 29, 30, and 34–36

¶¶Refs 3, 7, 9–11, 12, 14, 15, 17–21, 30, and 35–37

##Refs 3–8, 10, 11, 13, 18–20, 22, 24, 29, 30, 34, and 35

\*\*Refs 2, 3, 6–8, 10, 13, 14, 17, 25, 30, and 36

††Refs 1–3, 6–8, 10, 13, 14, 19, 25, 29, 34, and 35

‡‡Refs 6–11, 13, 14, 17, 18, 23, 28, 32, 34–36, and 38

nighttime feedings.<sup>1,3,5,6,10,18,25,37</sup> The strategies in the NSBs (Table 1) were focused on staff detection of a sleepy mother to remove the infant before she fell asleep and educate the mother about safe sleep practices. The premise was that a well-informed mother would stay awake or call for help if she felt sleepy. Although the goal was to ensure a sleeping mother was not holding her infant, the measure of success was the absence of an infant fall.<sup>12,13,16–18,20,25,28,29</sup>

In several studies, clinicians identified cases of sleeping mothers feeding or holding their infants when staff intervened before the infant fell.<sup>7,13,16,18,21</sup> The nuance that they had detected the mother after she fell asleep, instead of before she fell asleep (as intended), was not seen as an indicator of bundle failure. In the QI studies, the researchers interpreted the lack of an infant fall as proof of success. The clinicians appreciated that a sleeping mother holding her infant was an unsafe situation, but the failure to achieve the intended goal went unnoticed. When an infant fall recurred, the staff expressed disbelief because many times they had just seen the mother awake. Because staff followed the bundle, there was nothing different they could do.<sup>12,16,18,25</sup> The new mother had been informed not to sleep with her newborn, if only she had listened. Reinforcement about safe sleep practices was the most frequently recommended preventive strategy,<sup>6,11–14,17,21</sup> and, so, for >1 decade, in the literature, it was declared that if the bundle was managed, this adverse event

**TABLE 2** Reported Outcomes Associated With NSBs

Study	Preimplementation	Time Without a Slip	Postimplementation
Galuska <sup>20</sup>	5 slips in 1 y	11 mo	Not reported
Lahey et al <sup>12</sup>	13 slips over 2 y; January 2012 to December 2013	3 immediately after implementation	0 in 2014 (partial year)
Hantske <sup>16</sup>	6 slips in 2012; 2 slips in 2013 (implementation year)	Not specified	1 in 2014 0 in 2015 (partial year)
Janiszewski <sup>28</sup>	17 falls total with 10 slips in 12 mo; March 2013 to February 2014	Not specified	7 falls total with 1 slip in 12 mo February 2014 to January 2015
Hodges and Gilbert <sup>17</sup>	5 falls in 7 mo	2 y	3 falls in one-quarter of year 3
Ainsworth et al <sup>15</sup>	7 slips in 7 mo	12 mo	5 in 2 y
Carr et al <sup>29</sup>	8 total falls with 5 from the bed with the mother in CY 2016 (implementation year)	Not specified	5 total falls, with 3 from the bed with the mother in CY 2017
Lipke et al <sup>18</sup>	2 slips in 2014; 1 in 2015	3 mo	0 infant falls in 50 mo
Miner <sup>25</sup>	Single hospital site; 4 in FY 2016	8 mo	0 in FY 2017 (partial year)

CY, calendar year; FY, fiscal year.

was preventable.<sup>III</sup> However, the data from the QI studies (Table 2) tell a different story. The evidence reveals prolonged intervals with no infant falls associated with a sleeping mother, only to have it recur.<sup>12,13,16–18,20,25,28,29</sup> The problem was not eradicated; it persisted at a stubbornly low level. In none of the studies was it explained how or why the NSB failed.<sup>12,13,16–18,20,25,28,29</sup> Why have the initiatives failed to achieve sustainable results? The science of sleep provides an answer.

## SLEEP SCIENCE

In studies on parents, it was found both mothers and fathers have critically high levels of fatigue after the birth of an infant.<sup>43–51</sup> Assuming care responsibilities for a newborn is associated with interrupted sleep, shorter sleep duration, subjectively poor sleep quality, high levels of reported fatigue, feelings of excessive daytime sleepiness,<sup>43–51</sup> decreased sensitivity toward the infant's needs,<sup>46</sup> and impaired neurobehavioral performance.<sup>43,52</sup> Sleep is a complex phenomenon, and new parents start the pregnancy with their own sleep patterns, which result in different levels of restorative sleep and baseline feelings of fatigue.<sup>49,52,53</sup> As the pregnancy progresses, there are changes in sleep patterns, known as trajectories. Prepregnancy baseline sleep influences the trajectories, but, increasingly, disrupted

sleep is a commonality across the trajectories.<sup>46,49</sup> Sleep disturbances include a decrease in total sleep time and efficiency and an increase in the time awake after sleep onset.<sup>48</sup> In 1 study, researchers found sleep disturbances peaked on postpartum day 1 through the first week, with slowly decreasing levels of exhaustion over 1 to 6 months.<sup>49</sup> In another study, researchers found that the mean sleepiness levels were highest at 1 month and that 50% of the study subjects reported excessive sleepiness at 18 weeks.<sup>50</sup> Fathers experienced higher levels of measured sleepiness than mothers and, in some instances, had a higher propensity for falling asleep than mothers.<sup>45</sup> In a study of sleepiness for in-hospital mothers after delivery, researchers found that the mothers slept, on average, 3.7 hours daily,<sup>21</sup> well below the 6 hours recommended by the National Sleep Foundation. Using a standardized, validated tool, the investigators found sleepiness scores peaked at 0400, with scores trending downward at 0700 to a level considered to be low risk. In the Bittle et al<sup>21</sup> study, 50% of the participant mothers experienced sleepiness that required interventions to ensure safe sleep conditions. They found mothers sleeping while holding their infants had higher median sleepiness scores and longer hours of sleep.<sup>21</sup>

In addition to extreme fatigue, the physiology of sleep underscores why

parents are unable to stay awake during nighttime feedings. Sleeping at night is a normal physiologic response to circadian rhythms. When the normal time to retire for the night approaches, the drive to go to sleep builds (ie, sleep pressure). Staying awake past the normal bedtime increases sleep pressure. Sleep latency is the time between intent to sleep and the onset of sleep. It is sometimes referred to as the time between “lights out” and “passed out.” The average sleep latency interval is 1 to 11 minutes.<sup>54</sup> Choosing when to electively retire to go to sleep is a decision under individual control; the onset of sleep is a physiologic response and not a decision. The physiologic response to sleepiness differs from routine nocturnal habits.

Sleepiness is defined as an overwhelming or irresistible urge to close one's eyes and go to sleep; physiologically, it peaks between 0300 and 0600,<sup>52</sup> which is consistent with the data revealing most infant falls occur at night.<sup>¶¶</sup> It also coincides with the peak sleepiness of postpartum mothers in the Bittle et al<sup>21</sup> study. The sensation of sleepiness precedes sleep by seconds. The onset of sleep occurs so rapidly that, when people awaken, they are frequently surprised because they had no intention of falling asleep. It is involuntary and unavoidable.<sup>52</sup> In one anecdotal report, it was recounted that a mother fell asleep

<sup>III</sup>Refs 1–14, 18–21, 23–25, 28–30, 32, and 34–36

<sup>¶¶</sup>Refs 2, 3, 6, 8, 12, 16, 21, 25, 30, and 37

midsentence, while speaking to a nurse. The interval between the sensation of sleepiness and sleep onset is so short it renders detection before the mother falls asleep improbable. The nurse who witnessed the patient falling asleep in midsentence detected the sleeping mother instantly but could not prevent it. This event highlights the conundrum confronting staff. When the mother fell asleep in midsentence should the infant have been returned to the bassinet? The obvious yes answer supports infant safety but may conflict with the infant's needs. If the newborn has just started to feed, is it wise to return the infant to the bassinet? A better choice would be to have an alert individual at the bedside,<sup>2,5,10,13,14,18,19,36</sup> for the duration of the feeding, to keep the newborn safe. Paternal exhaustion<sup>43-45</sup> would preclude using fathers.

Current fall prevention strategies are targeted at the intentionality of sleep, a presumption that the mother is intending to go to sleep and is fully aware about the degree of her fatigue or sleepiness. In the sleep science, it has been found that individuals are poor judges of the degree of their sleepiness and fatigue,<sup>52</sup> making it unrealistic that a new mother will alert staff if she feels sleepy. The failure to distinguish between intentional and unintentional sleep led to flawed approaches, such as parental education and frequent rounding. Fatigue and sleepiness do not involve decision-making, rendering parental education ineffective. The interval between a feeling of sleepiness and sleep onset is too rapid for detection in advance, rendering frequent rounding and expectations that a mother will call out for help futile.

The AAP safe sleep guidelines were developed to assist parents in understanding the risks of sleeping with their newborn to facilitate informed, thoughtful decisions. The guidance became entangled with newborn falls when clinicians failed to appreciate that new parents were not choosing to sleep with their newborn. Although the AAP recognizes parents may inadvertently fall asleep while feeding their infant,<sup>42</sup> neither the NSBs nor the AAP designed processes to manage

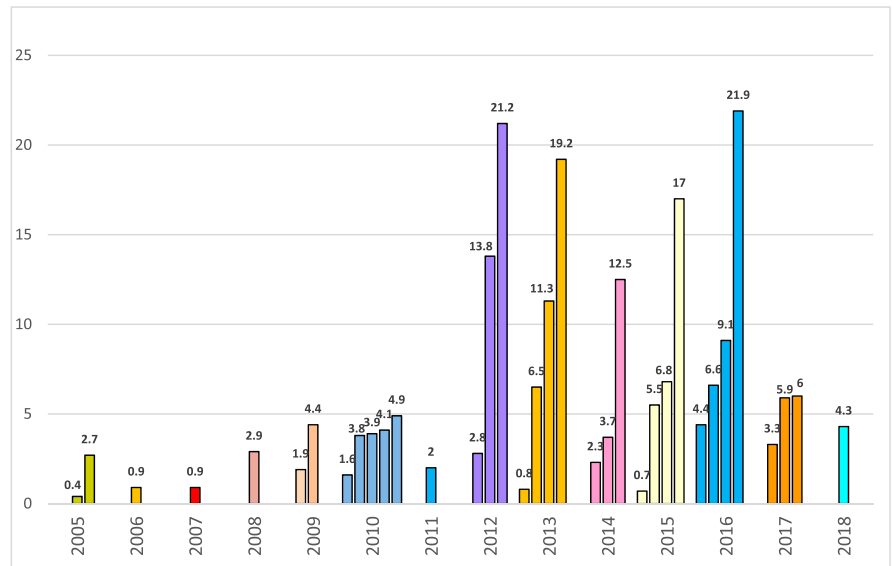


FIGURE 1 Thirteen years of infant fall rates reported in the literature.##

infant safety during unintentional sleep, the root cause of newborn falls involving a sleeping parent. New approaches are required.

### CREATING A NEW PARADIGM Defining the Problem

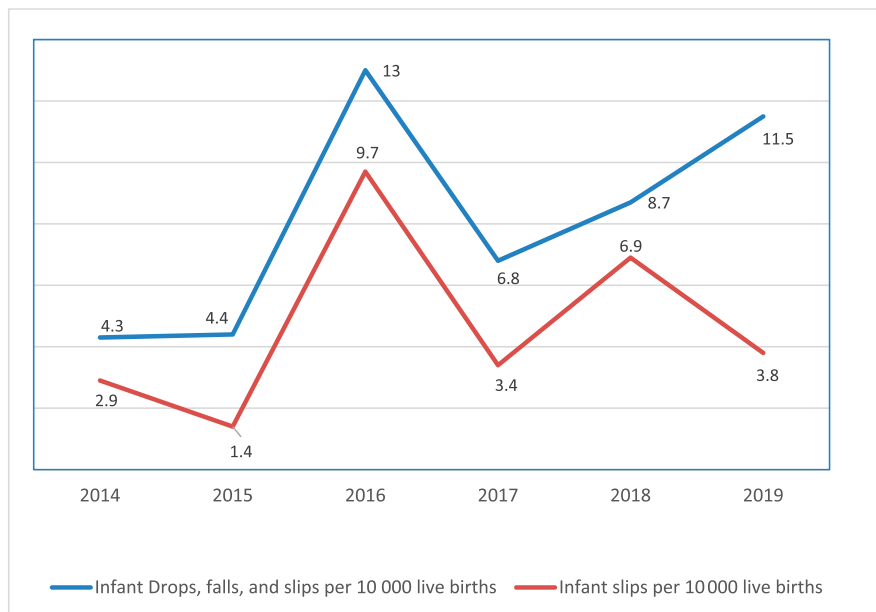
The singular focus of the NSB is on a newborn fall involving a sleeping parent, but there is no accompanying metric. In published data, all types of newborn falls are combined into 1 rate (Fig 1), obfuscating the problem. A newborn fall is “a sudden, unintentional descent, with or without injury to the patient that results in the patient coming to rest on the floor, on or against another surface, on another person or object.”<sup>55</sup> A unique definition is proposed to better illuminate a fall associated with a sleeping parent and enable establishment of a rate-based metric. A newborn slip is defined as “any individual feeding or holding an infant who falls asleep with the infant slipping to the floor or another surface with or without injury.” A newborn that slips out of a sleeping mother's arms into the bed would be categorized as a newborn slip. Currently, a newborn in the arms of a sleeping mother is categorized as an unsafe sleep

## Refs 2, 3, 6, 10, 13, 14, 16, 25, 26, 29, 30, and 37

situation<sup>7,13,16,18,21</sup> but could be considered a near miss. This definition mimics the current language by using newborn. Consideration should be given to using the term infant, instead of newborn, because slips and falls have occurred in pediatric settings.

### A Different Approach

Our institution is an urban academic medical center comprising 3 hospitals, 2 with birthing sites. In 2014, we categorized infant falls associated with a sleeping parent as a unique event (Fig 2) to better inform outcomes of our interventions. In 2016, we experienced a cluster of newborn slips when we implemented the Baby Friendly Ten Steps, including continuous rooming-in of the infant with the mother for at least 23 hours a day, encouraging on-demand, exclusive breastfeeding, and eliminating formula feeding. In response, we implemented an NSB that included parental and staff education, frequent rounding and reminder signage about safe sleep practices. Consistent with reports in the literature, we found that 1 of our hospitals went 23 months without a slip and another went 15 months. When a newborn slip reoccurred, incident investigation found we had followed the NSB, leaving us powerless to prevent the next event. We surmised our interventions



**FIGURE 2** Infant fall and slip rates reported at our hospital for 6 years.

for ensuring an awake mother were inadequate and sought answers in the sleep literature.

By the substantial evidence from sleep science, we were convinced to reframe our approach to newborn slips, moving away from the illusion that we can keep parents awake. We have identified the mechanics of newborn slips and contributory factors that, with modification, may potentially keep an infant safe when an exhausted mother, despite her best intentions, falls asleep. Identified safety threats associated with a sleeping mother include newborn slips, entrapment, and suffocation. To ensure methodologically sound solutions, we are submitting our interventions for testing to the institutional research board for approval.

### Changing Beliefs

What convinced clinicians that the NSB could prevent a newborn slip? An unexplained cluster of high-volume newborn slips often drove the implementation of the NSB; demonstrable improvement affirmed its' success, and occasional newborn slips were, postimplementation, overlooked.<sup>12,13,16,17,20,25,28,29</sup> The rarity of the event and accompanying prolonged

intervals without a newborn slip provided false reassurance that the NSB was effective, but the fatal flaw was measuring the wrong outcome. The root cause of a newborn slip is a sleeping mother holding a newborn. The frequency of a sleeping mother holding her infant was not measured, obfuscating the NSB's impact in mitigating the root cause. The clinicians did not appreciate that when the mother was asleep holding her infant, the bundle had failed. With a few exceptions,<sup>18,25,37,40</sup> the NSB limitations went unrecognized, and confidence in the NSB as the answer went unchallenged.

Belief in the effectiveness of the NSBs led to a proliferation of QI studies, with the evidence becoming ever more credible. Regulatory agencies advocated their implementation,<sup>36,56–59</sup> but the core elements of the NSBs, such as risk stratification, detection of sleepiness, and sleep prevention strategies, are unsupported by the sleep science. Data from the QI studies<sup>12,13,16–18,20,25,28,29</sup> confirm newborn slips are an unsolved mystery. To eliminate the suffering, trauma, and harm of a newborn slip, faith in an awake parent will need to be relinquished. Instead, research into other safety measures grounded in sleep science must be undertaken.

Although unintentional sleeping cannot be prevented and should not be viewed as a personal failing, discounting the sound science of the AAP safe sleep guidelines needs to be avoided. Advise parents that acceptance of accidentally falling asleep with their infant is not an endorsement of choosing to sleep with their newborn. Continue to emphasize the ABCs (Infants should sleep Alone, on their Back in their Crib). The pioneering clinicians who implemented the NSBs strove to ensure no infant was injured on their watch. The challenge in creating a new paradigm is to abandon beliefs unsupported by the science, while preserving foundational values of infant safety.

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