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### Abstract

**Background:** The Centers for Disease Control and Prevention lists accidents (unintentional injuries) as the fifth leading cause of infant mortality. Data analysis from a multihospital system of inpatient family birth centers revealed fluctuations in newborn birth admission falls rates at times above the benchmark reported in the literature.

**Purpose:** We describe a multipronged approach to address an identified safety concern. The aim of the project was to decrease the rate of newborn falls during birth hospitalization. Despite applying multiple interventions described in the literature, newborn falls were not eliminated.

**Study Design and Methods:** In this quality improvement project, a nursing leadership team was convened to review the literature, identify current and ideal states, obtain stakeholder input, identify contributing factors, and agree on standardized interventions to prevent newborn falls. The project received exempt status from the institutional review board.

**Results:** Since we started the project in 2016, there was a downward trend in newborn birth admission falls in 2017; however, based on our variable data over the last 5 years and small numbers of falls, it is difficult to conclude that any one strategy or combination of strategies has been successful. Because falls from bed with the new mother were the most common types of newborn falls, interventions were focused; however, our falls rate for newborns never fell below comparable rates in the literature.

**Clinical Implications:** More data are needed on effective interventions that can reduce the rate of newborn falls, especially those from bed while with the new mother. A comprehensive approach based on analysis of events and review of existing evidence are necessary first steps.

**Key words:** Accidental falls; Infant; Multi-Institutional systems; Newborn; Quality improvement.

# A System-Wide Approach to **PREVENTION** of **IN-HOSPITAL** **NEWBORN FALLS**

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**I**n-hospital newborn falls are rare; the exact incidence is unknown. When falls occur, physical harm to the newborn and the emotional impact for families and hospital caregivers can be devastating (American Academy of Pediatrics [AAP], 2016). Newborn falls occur when they are dropped to the floor or other surface as a result of perception errors by hospital caregivers or parents (such as fatigue level), as well as environmental elements (e.g., bed position) (Paul, Goodman, Remorino, & Bolger, 2011; Phalen & Smolenski, 2010).

## Available Knowledge

Although reports of newborn falls in the hospital are found worldwide, research is scant, predominantly limited to the past 10 years (AAP, 2016; Centers for Disease Control and Prevention, 2017). Since the Monson, Henry, Lambert, Schmutz, and Christensen (2008) report, further research has largely reinforced their initial findings (Ainsworth, Maetzold, Mog, & Summerlin-Long, 2013; Helsley, McDonald, & Stewart, 2010; Lipke et al., 2018). More data are being published that offer details and potentially successful preventative measures for newborn falls (Hodges & Gilbert, 2015; Joint Commission, 2018; Matteson, Henderson-Williams, & Nelson, 2013).



Newborn fall rates have been reported (per 10,000 live births) as: 0–5.9 (Helsley et al., 2010; Kahn, Fisher, & Hertzler, 2017; Loyal, Pettker, Raab, O'Mara, & Lipkind, 2018; Monson et al., 2008); up to 17 (Janiszewski, 2015); and 21.2 (Ainsworth et al., 2013). Helsley et al. report approximately 1,600 newborn falls annually in the United States. Rates vary due to underreporting and inadequate data collection. Underreporting by parents may occur because of embarrassment, fear of reprisal, guilt, or belief that the newborn was unharmed (Helsley et al.; Paul et al., 2011). Nurses may be reluctant to report a newborn fall for fear of disciplinary action, or because the unit culture does not support blame-free tracking of adverse events (Teuten, Bolger, & Paul, 2015).

Timing of falls and “near misses” most commonly occur between midnight and seven in the morning (Ainsworth et al., 2013; Galuska, 2011; Helsley et al., 2010; Joint Commission, 2018; Monson et al., 2008; Slogar, Gargiulo, & Bodrock, 2013; Wallace, 2015). Falls and

**The most common fall scenario is a breastfeeding mother falling asleep allowing baby to roll off the bed.**

“near misses” most commonly occurred on the second or third night after birth (Ainsworth et al., 2013; Joint Commission; Slogar et al.), with one report of a peak on the first day after birth (Monson et al.). Most falls do not lead to injury (Kahn et al., 2017; Monson et al.). Of 272 reported falls, 8.5% resulted in serious harm (skull fracture, subdural hematoma, and subarachnoid bleed) (Wallace). Falls from four feet or higher are most likely to cause injury (John, Kelly, & Vincent, 2013; Monson et al.; Paul et al., 2011). The most common scenario is a breastfeeding mother falling asleep allowing baby to roll off the bed. Other circumstances include: family member falling asleep while holding baby (Gaffey, 2015;

Helsley et al.; Matteson et al., 2013; Monson et al.; Teuten et al., 2015; Wallace); during transport from bassinets, incubators, or arms (Monson et al.); baby being unattended on a surface (Wallace); from the hands of a provider at birth, or during an unattended, precipitous birth (Monson et al.; Wallace). Reported risk factors for newborn falls include: high level of fatigue (Slogar et al.); recent pain medication administration (Galuska; Joint Commission; Slogar et al.); night shift hour (Joint Commission; Slogar et al.); prior “near miss” (Lipke et al., 2018; Slogar et al.); greater than 2 days postpartum (Galuska; Slogar et al.); current maternal substance abuse or methadone program attendance (Slogar et al.); breastfeeding or combination of breast and bottle feeding (Galuska; Loyal et al., 2018); and cesarean birth (Galuska; Janiszewski, 2015).

There are no clear guidelines or protocols for management of the newborn post fall (Helsley et al., 2010; Monson et al., 2008). Not all falls are reported immediately or at all (Simpson, 2015). Observation, rather than computerized tomography (CT), may be an appropriate option (Kahn et al., 2017; Reid, Liu, & Ortega, 2012).

Proposed interventions to minimize risk of newborn falls include risk scoring (Ainsworth et al., 2013; Helsley et al., 2010; Janiszewski, 2015; Lipke et al., 2018; Matteson et al., 2013); universal application, that is, consider all patients at risk (Galuska, 2011); increased rounding or continuous supervision (AAP, 2016; Galuska; Lipke et al.; Teuten et al., 2015); maternal rest (Slogar et al., 2013); hospital caregivers family and outpatient clinic education (Ainsworth et al.; Helsley et al.; Slogar et al.); use of a safety pledge or safety contract (AAP; Gaffey, 2015; Galuska; Helsley et al.); bed and bassinet alterations (Helsley et al.; Janiszewski), raising side rails during feedings (Ainsworth et al.); debriefing (Ainsworth et al.; Janiszewski; Teuten et al.); newborn exam, skull films, 24 hours of monitoring (Monson et al., 2008); fall algorithm (Helsley et al.; Teuten et al.); or individualized management (Ainsworth et al.). See Table 1.

## Framework

The organization typically uses the Institute for Healthcare Improvement (IHI) Plan-Do-Study-Act (PDSA) cycle to guide quality improvement projects. The “Plan” portion of the cycle began by asking the question “*How can we prevent newborn falls?*” A graduate student reviewed the current state and available literature. “Do” included a small test of change of the interventions which were then “Studied” to expose opportunities for further improvement. A comparison of pre- and postintervention time periods was analyzed. The “Act” portion of the cycle

identified opportunities for further change. A “Plan” was made for further quality improvement, and repetition of the cycle (IHI, 2017).

## Methods

### Contextual Elements

The population consisted of five hospitals with at total of 8,000 to 8,700 births annually: two high-risk perinatal centers with levels III-IV neonatal intensive care units, and three community hospitals. The reporting structure included three clinical nurse specialists and one neonatal nurse practitioner with shared clinical practice support responsibilities for the family birth centers, who report to a system-level director. Each family birth center manager reports to a site-specific chief nursing officer. The community education department is independent of the inpatient units. This presents the potential for varying levels of investment in the interventions, as well as understanding and compliance with implementation.

The health system promotes a philosophy of values; supportive, shared accountability, and of responding to the behaviors of their employees in a fair and just way (AAP). Reporting of adverse incidents is encouraged.

**TABLE 1:** Available Evidence and Implementation in the Newborn Falls Project

| Published Interventions                               | Citation (Level of Evidence <sup>a</sup> )                                                                                                                   | Implemented |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Risk assessment                                       | AAP, 2016 (III); Ainsworth et al., 2013 (II-3); Helsley et al., 2010 (II-3); Janiszewski, 2015 (III); Lipke et al., 2018 (II-3); Matteson et al., 2013 (III) | no          |
| Universal application (consider all patients at risk) | Galuska, 2011 (II-3)                                                                                                                                         | yes         |
| Increased rounding                                    | AAP, 2016 (II); Joint Commission, 2018 (III); Galuska, 2011 (II-3); Lipke et al., 2018 (II-3); Teuten et al., 2015 (III)                                     | yes         |
| Promoting maternal rest                               | Slogar et al., 2013 (II-3)                                                                                                                                   | yes         |
| Hospital team, family, outpatient education           | AAP, 2016 (III); Ainsworth et al., 2013 (II-3); Helsley et al., 2010 (II-3); Slogar et al., 2013 (II-3)                                                      | yes         |
| Use of safety pledge or contract                      | AAP, 2016 (III); Gaffey, 2015 (III); Galuska, 2011 (II-3); Helsley et al., 2010 (II-3)                                                                       | yes         |
| Bed/bassinet alterations                              | AAP, 2016 (III); Helsley et al., 2010 (II-3); Janiszewski, 2015 (III)                                                                                        | no          |
| Raising 4 side rails during feedings                  | Ainsworth et al., 2013 (II-3)                                                                                                                                | yes         |
| Case review and debriefing                            | Ainsworth et al., 2013 (II-3); Janiszewski, 2015 (III); Teuten et al., 2015 (III)                                                                            | yes         |

<sup>a</sup>Levels of Evidence as per ACOG (n.d.) Level I: Controlled trials with randomization; Level II-1: Controlled trials without randomization; Level II-2: Nonrandomized observational studies, such as cohort and case-control; Level II-3: Nonrandomized observational studies, such as cross-sectional and uncontrolled investigational; Level III: Descriptive studies, expert opinion, case studies



**Underreporting by parents may occur due to embarrassment, fear of reprisal or guilt, or belief that the newborn was unharmed.**

This may have resulted in relatively higher fall rates than those reported nationally.

## Interventions

### Awareness of Newborn Falls and Perinatal Team Education

In 2015, systemwide maternal/newborn nursing leaders adopted decreasing newborn fall rates as a shared goal for quality improvement. Due to the relatively rare occurrence of newborn falls, perinatal teams were unaware of the comparative data and reason for concern. The topic, including a literature review and systemwide data, was presented at 2015 and 2016 RN skills days. Data graphs were posted on unit huddle boards. A self-learning module (SLM) was assigned to hospital caregivers and prenatal educators to heighten awareness of the problem and risk factors, introduce the safety contract, reinforce fall prevention interventions, and offer scripting for talking with parents.

### Policies and Procedures Review

The policy guiding the standard of care for newborns in the family birth center was reviewed and found to include the following wording on newborn fall prevention: *All newborns are considered at risk for drops and the following precautions are implemented: intentional rounding will be performed to assure safe sleep environment; newborns are transported in their cribs only; bed rails are up at all times unless providing direct patient care; parents are not to sleep while holding infants- babies will be moved to bassinet as needed; educate parent/family of importance of remaining aware of surroundings while walking with infant to prevent falls; keep environment clear of hazards (i.e., by removing unnecessary equipment and furniture, providing adequate lighting).* The team was satisfied with this wording; no changes were made. Other considerations included whether to adopt published in-

hospital-developed risk scales to prioritize populations and interventions to prevent newborn falls. In the absence of a validated tool, the process improvement team elected to consider all patients at risk, and universally apply all interventions.

### Intentional Rounding

Intentional rounding was implemented to help ensure a safe sleep environment for the newborn. Every 1 to 2 hours, an assessment was made of bed rail position, to clear walkways of hazards, assess parental fatigue, assist in moving newborn to bassinet, and to reinforce education about newborn fall prevention. If anyone was found holding a newborn while sleeping, the nurse would transfer the baby to a safe sleep surface and provide/reinforce education on newborn fall prevention. In September 2016, AAP recommended monitoring new mothers according to their risk status; for example, known risk factors for newborn falls and then observing higher-risk mother-baby couplets every 30 minutes during nighttime and early morning hours. In March 2018, the Joint Commission issued an advisory on prevention of newborn falls in hospital that included hourly rounding recommendations.

### Medication Practices and Order Sets Review

The postpartum and postoperative order sets were reviewed for somnolence-inducing medications. Multimodal pain management systemwide had been adopted in September 2015; the first line for mild to moderate pain was scheduled nonsteroidal anti-inflammatory medications, plus concurrent acetaminophen. Narcotic analgesia became the second line for moderate to severe pain postoperatively, and case-by-case for vaginal birth pain. Sleeping medications had not been part of the postpartum order set for 6 years prior to the newborn falls PDSA. The order set was felt to be in line with newborn safety, so no changes were made.

### Patient Education

Existing patient education materials on newborn safety were reviewed and modified to draw attention to newborn fall risk. Reports of families being unaware of fall risk while recovering from birth led to emphasis on this information in the prenatal education curriculum as of November 2016 (Hodges & Gilbert, 2015). In August 2017, all prenatal educators viewed an SLM on safe sleep and prevention of infant falls. The patient education form in use about newborn sleep safety was modified to strengthen newborn fall prevention. The potential for parental shame was also addressed in hopes of destigmatizing reporting. Based on recommendations, described by Galuska (2011), Helsley et al. (2010), and Lipke et al. (2018), the mother and nurse now sign the form, indicating understanding of the content (AAP, 2016; Galuska; Helsley et al.). See Figure 1, Supplemental Digital Content (SDC), <http://links.lww.com/MCN/A51>.

Visual marketing materials were designed to promote newborn safety. Visual reinforcement calling out fall prevention was implemented in patient rooms, including signage in the form of mirror clings, posters, and crib cards. Fall prevention pop-ups have been added to the patient education television channel, as part of this PDSA project. See Figure 2 SDC, <http://links.lww.com/MCN/A51>.

### Medical Record Documentation

In early 2016, review of the electronic health record (EHR) was undertaken, leading to enhancements to better reflect nursing care and patient education. Newborn safety fields were added to allow documentation about safe sleep environment and interventions such as placing newborn in the bassinet if parent is sleepy. The EHR was amended to more accurately reflect the content of the patient education form, with documentation on the newborn fall prevention point, the method of education, and learner readiness and response.

### Environment

Consistent with reports in the literature, most newborn falls at all sites occurred when a newborn held by a sleeping mother in bed slipped through or around bed rails, rolling onto the floor (AAP, 2016). Low bed position was emphasized and used, but the head of the bed is often raised for comfort while feeding, causing a slope. Newborns falling from the arms of a family member were often from the chair in the mother's room.

### Equipment

Several types of beds were in use, but all birthing beds have only two side rails. Only one brand in use by the system does not create a slippage gap when all four bed rails are raised. One hospital site uses these beds and had only one newborn fall. There is, however, a potential risk that entrapment could occur (Helsley et al., 2010). The team pursued bed rail modification (including prototypes) as a potential intervention for over a year. The timeline to achieve Federal Drug Administration approval for a bed rail prototype was estimated to be more than 2 years. This project was abandoned by the vendor due

to expense. Overbed bassinet models were considered. No falls occurred during transfer into or out of a bassinet, nor would new bassinet styles eliminate the possibility of rolling off the side of the bed opposite the bassinet or while being moved. This intervention was not pursued as part of the standardized approach.

### Reporting

Since implementation of electronic safety reporting in July 2009, newborn falls have been documented using the adult fall reporting options. The team identified a need for data points to further understand the nature of newborn falls. The following points were added in November 2016: type of birth; date of birth; maternal blood loss; maternal comorbidities; maternal condition at the time last seen prior to fall (alert, drowsy); bed brand; side rails up or down; maternal medications and last dose; height of fall; condition of baby; and provider notification including exam time and orders received.

### Case Review and Debriefing

Case reviews were completed for each fall to fill in gaps in reporting, analyze staff response, and monitor patient outcomes. Once the project began, debriefing was performed after all newborn falls. Staff and family (when available) were interviewed to obtain a more in-depth history of the scenario.

### Response

Case review revealed variation in management of newborns post fall. In collaboration with pediatric neurology subspecialists and adapted from published recommendations, a systematic approach to assessment was implemented. The postfall algorithm is based on laboratory research with surrogate models of the newborn's deformable, multicomponent skull case and body weight distribution (Coats & Margulies, 2008; Kahn et al., 2017). See Figure 3. Literature supports use of physical findings and height of fall as leading indicators for cranial imaging.

## Measurement and Analysis

Retrospective, then concurrent systemwide case reviews and analysis of newborn birth admission falls from January 2013 through December 2017 were performed. Electronic safety reports submitted by hospital caregivers provided the data points. Raw number characteristics analysis included: who dropped newborn, location of fall, type of birth, time of day, and age of baby at time of event. Data showed that greater numbers of newborn falls occurred while mother was holding her newborn in her arms while in bed, particularly between 7 p.m. and 7 a.m. Based on this, the focused priority of the interventions became reduction in the incidence of newborn falls from mother's bed due to falling asleep with her newborn.

The safety performance improvement efforts (analysis and interventions) to prevent newborn falls were not designed to answer the question of whether babies born by



**FIGURE 3:** Post-Fall Algorithm

1. Immediate assessment by two registered nurses:
  - Physical assessment: hematoma, head swelling, or step-offs (depression in the skull or cranium)
  - Vital signs
  - Neurologic checks including:
    - Assessment of cry (normal tone and intensity, not high-pitched)
    - Responsiveness to voice and touch (reacts to both)
    - Infant behavioral state and adaptation to stimuli (arouses when disturbed)
    - Presence or absence of twitches, tremors and exaggerated startles
2. Notification of newborn care provider of event and initial assessment findings
3. Vital signs and neurologic checks q 30 minutes x 4, then q 1 hour x 4, then q 4 hours for 12 hours
4. Documentation including: fall, post-fall assessment, orders received in electronic medical record, event report

#### Physical assessment findings

##### Positive signs and symptoms (any time prior to discharge)

1. Unexplained loss of consciousness—any time duration (excluding sleep)
2. Behavior change per nurses or parents
3. Vomiting repeatedly
4. Exam abnormal i.e., visible injury related to fall
5. Neurologic checks indicate changes
6. Seizure

##### No signs or symptoms of injury

- Newborn care provider physical assessment per routine
- Newborn must be seen by newborn care provider prior to discharge

- Exam within 1 hr by newborn care provider
- Head CT scan if fall > 4 feet

Positive head computerized tomography

Negative head computerized tomography

Pediatric neurosurgery consult

- Resume standard care toward discharge
- Discharge newborn per order in consultation with the newborn care provider, even if 18 hr have not elapsed

cesarean are at a significant greater risk for falling than those born vaginally. Mothers who gave birth via cesarean generally receive potentially sedating medication more frequently than those who give birth vaginally. Logically, pain medication exposure and limited mobility might predispose mothers who had a cesarean to an increased risk of dropping the newborn. Vaginal birth following a prolonged or difficult labor may also increase fatigue. Sedating medications were not found to be contributory to falls in our population. These concepts provided further support for embracing universal application of falls prevention interventions.

Long-term effects of infant falls are not known due to the lack of longitudinal studies (Hodges & Gilbert, 2015). The majority of newborns incurred no apparent injury. Rates of mild (bump/bruise) to moderate injury and cranial x-rays lack sensitivity and specificity—intracranial lesions are not always associated with skull fractures, nor do skull fractures always indicate underlying intracranial pathology. Computerized tomography allows findings of epidural hemorrhage that may be initially asymptomatic. Rates of both types of imaging were similar to reported rates (Kahn et al., 2017). Additional costs incurred by 10% of newborns who sustained major injury included imaging, neurosurgical consult fees, prolonged lengths of stay, and neonatal intensive care. Only one newborn experienced an extended length of stay for neurosurgical intervention.

We are not aware of any missing data. A potential cause of missing data is use of the electronic safety reporting system as the sole source of data. Another gap is that a newborn fall occurred that the family did not report. It is also possible that a newborn fall was documented in the medical record but the hospital caregiver did not complete a safety report.

The five family birth centers participating in the project to reduce newborn birth admission falls are inpatient units within different hospitals with some shared (float) nurses but site-specific leadership. Contextual elements that interact with the interventions include leadership style and communication method among the discrete inpatient nursing units. Each site has its own individual reporting structures and unique physical layout. No formal study of associations of nursing leadership, communication, and outcome data has been performed, nor has assessment of quantitative data for consistency of intervention implementation.

## Results

Despite applying multiple interventions described in the literature, newborn falls were not eliminated. See Figures 4 and 5. There was a downward trend in newborn birth admission falls from 2016 when we started the project to 2017; however, data over the 5-year period did not allow us to draw conclusions on whether our interventions were successful as the rates were variable from year to year and the numbers of newborn falls were small. Data showed that greater numbers of newborn falls occurred while mother was holding her newborn in her arms while in bed, between 7 p.m. and 7 a.m. Upon data review, sedating medications were given to mothers within 6 hours in 56% of newborn falls. This incidence was not felt to be contributory to falls in our population. As cranial imaging was not obtained in all cases, the true incidence of skull fractures or intracranial injury is unknown. Our system's CT rates (20%) were similar to those reported by Kahn et al. (2017). The rate of mild (bump/bruise) to moderate injury was similar to the reported 90% (Kahn et al.).

## Clinical Implications and Recommendations

Although we recommend using a standardized approach based on published interventions, analysis suggests, and as others have found (Loyal et al., 2018) that even after implementing multiple interventions reported in the literature (consider all patients at risk, safety contract, intentional rounding, education, bed rails up, and case review), it may not be possible to prevent all newborn falls from occurring, particularly those from a sleepy mother's arms. Technological innovations and environmental modifications provide an area for future study. Research and development of somnolence detection devices, as used in the automobile industry, may offer safety solutions that detect drowsiness to alert mothers, family members, and hospital caregivers. Equipment to prevent falls or limit injury in adult patients such as alarms, side rail modifications, and floor pads could be adapted for use on mother-baby units. Passive devices, for example, safety garments that arrest the fall without risking entrapment, are additional areas for investigation. ✚

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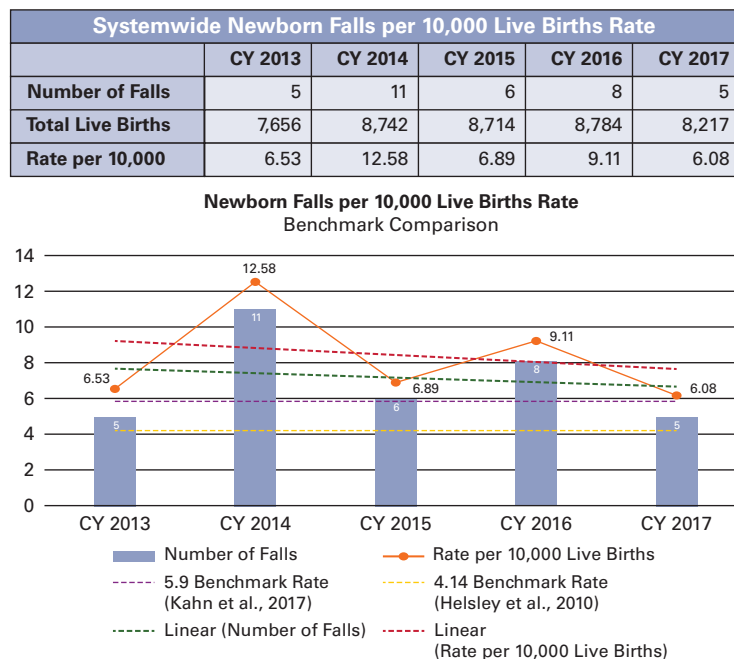
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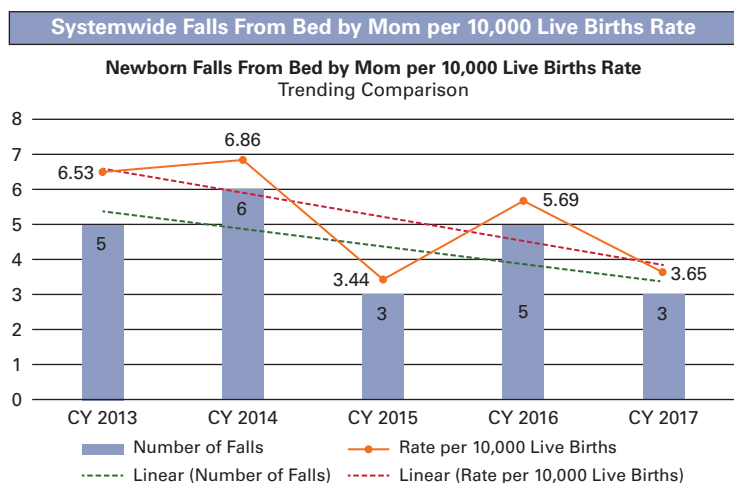
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**FIGURE 4:** Data on Systemwide Total Newborn Falls



**FIGURE 5:** Data on Systemwide Newborn Falls from Bed while with the Mother



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## Instructions for Taking the **CE Test Online**

### A System-Wide Approach to Prevention of In-Hospital Newborn Falls

- Read the article. The test for this CE activity can be taken online at [www.nursingcenter.com/ce/MCN](http://www.nursingcenter.com/ce/MCN). Tests can no longer be mailed or faxed.
- You will need to create a free login to your personal CE Planner account before taking online tests. Your planner will keep track of all your Lippincott Professional Development (LPD) online CE activities for you.
- There is only one correct answer for each question. A passing score for this test is 13 correct answers. If you pass, you can print your certificate of earned contact hours and the answer key. If you fail, you have the option of taking the test again at no additional cost.
- For questions, contact LPD: 1-800-787-8985.

Registration Deadline: March 5, 2021.

#### Disclosure Statement:

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ate Student Research Program and The Hill-Rom, Celeste Phillips Family-Centered Maternity Care Award by the Association of Women's Health, Obstetric and Neonatal Nurses. The authors and planners have disclosed no other potential conflicts of interest, financial or otherwise.

#### Provider Accreditation:

LPD will award 1.5 contact hour for this continuing nursing education activity.

LPD is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

This activity is also provider approved by the California Board of Registered Nursing, Provider Number CEP 11749 for 1.5 contact hour. LPD is also an approved provider of continuing nursing education by the District of Columbia, Georgia, and Florida CE Broker #50-1223.

#### Payment:

- The registration fee for this test is \$17.95.