An Evidence-Based Pediatric Fall Risk Assessment Tool

for Home Health Practice

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Christiana Care Visiting Nurse Association (VNA), the largest nonprofit home health agency in Delaware, used research evidence to determine the most likely factors that influence fall injuries in infants and toddlers at home. These risk factors were incorporated into a fall risk assessment tool that classifies risk based on the rapidly evolving developmental capabilities of early childhood. Currently in use by the agency's Maternal–Child Health division, the risk assessment tool has enabled nurses to identify age-specific risks and intervene to provide for a safer home environment.

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Falls are the most common cause of pediatric injury and the leading cause of injury leading to emergency department (ED) visits (Owens et al., 2008). In terms of age distribution of those seeking ED attention for fall-related injuries, only those over age 80 require greater use of emergency services than children under age 4 (Mathers & Weiss, 1998). In infants under age 1, falls account for over half of all sustained injuries (Pickett et al., 2003) and are more often associated with head and facial injuries (Flavin et al., 2006). Across all childhood age groups, children 3 to 17 months old exhibit the highest rate of injury, and falls are the leading cause, outnumbering the number-two cause, poisoning, by nearly two to one (Agran et al., 2001).

The Joint Commission on Accreditation of Healthcare Organizations has established a National Patient Safety Goal (NPSG) focused on fall risk assessment in the context of the populations and care settings being served, including pediatric clients. Most fall-related injuries affecting infants and toddlers occur in the home environment (Dedoukou et al., 2004; Flavin et al., 2006; Monson et al., 2008). Yet, despite the likelihood of a child's home as the most frequent location for fall-related injuries to occur, literature concerning assessment and reduction of fall risk in the under age 2 population is scarce, and is largely focused on inpatient populations.

The challenge of identifying fall risk in the context of these rapidly changing circumstances formed the basis for tool design outlined in this article. Since the infant-toddler age range has been noted to pose the highest risk of falls and fall-related injury, the Christiana Care Visiting Nurse Association determined that a risk assessment tool tailored to the needs of this age group for use in a home health setting was appropriate and necessary.

A fall risk assessment program that is outpatient based and reflective of the hazards specific to the under age 2 patient population is needed to ensure safe, quality home healthcare. The organization sought to develop a fall risk assessment tool rooted in known research related to fall occurrences in this population for use by its maternal—child health nurse clinicians.

Approaches to Pediatric Fall Risk Assessment

A review of pediatric fall risk assessment tools in practice demonstrates the heightened awareness of falls and fall-related injury potential in the pediatric population. Pediatric scales have sought to identify patterns of characteristics or circumstances that influence pediatric falls, but to date they have focused primarily on hospitalized patients. Many factors shown to contribute to falls in the hospital setting do not have practical application in a home setting. Such factors include the effects of anesthesia or surgery, certain treatments and medications, environmental differences, and acute diagnoses.

At the time of this project's inception the organization's approach to fall risk assessment consisted of a modified version of the Schmid Fall Risk Assessment Tool for its adult patient population. Although the Schmid tool has established reliability and validity in adults (Schmid, 1990), tools developed and validated for adults have been shown to be unreliable predictors of falls risk in children (Child Health Corporation of America Nursing Falls Study Task Force, 2009). In research that sought to validate the Morse Fall Scale and Hendrich II Fall Risk Model for use with pediatric populations, both adult-validated scales demonstrated poor reliability when applied to child fall risk (Razmus et al., 2006). The reliance of adult fall risk tools on identification of exceptions to normal adult human developmental characteristics, such as gait, strength, balance, cognitive ability, and expected levels of autonomy, appeared to be poorly suited for adaptation to the pediatric population.

In response to the inadequacy of adult fall risk scales to reliably predict falls in children, some organizations have constructed or adopted tools and programs designed to predict risk based on characteristics that are common contributors to pediatric falls in their particular setting. The Children's Hospital of Central California considers all pediatric inpatients to be "at risk" for falling (Cooper & Nolt, 2007). They developed a comprehensive program that calls for initiation of standard interventions for all inpatients. This program calls for further classification into moderate- and high-risk categories based on the presence of certain medication and treatment regimens, cognition and safety awareness, and equipment in use (Cooper & Nolt, 2007). In addition, infants are always classified as having moderate fall risk potential in their program regardless of factors present.

The University of California-San Francisco (UCSF) Children's Hospital adapted the adult Schmid Fall Risk Assessment Tool for inpatient pediatric use by adding pediatric-specific information in the categories for medications, mentation, and elimination, as well as a history of "illness-related" falls (Atwood et al., 2005). The tool, rebranded as the "Little Schmidy," calls for implementation of standardized fall precautions when a score of 3 or greater is assessed. The UCSF program encourages nurses to implement precautions based on clinical judgment, regardless of scoring. Like the Central California tool, infants are always considered a fall risk but are excluded from standardized assessment until they begin to walk.

The General Risk Assessment for Pediatric Inpatient Falls scale* was developed by Graf (2005) based on retrospective record reviews that sought

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to explain pediatric fall risk through positive associations with a variety of clinical risk factors. These reviews revealed a positive association with length of stay, absence of intravenous therapy, physical or occupational therapy underway, seizure medications, and orthopedic diagnoses (Graf, 2005).

The Children's Hospital of Denver adapted Graf's study design and correlated age, length of stay, neurologic or orthopedic diagnosis, physical or occupational therapy, and seizure medications. These indicators were combined with other known factors into a scored fall risk assessment tool under the acronym "I'm Safe." The acronym represents the risk factors of **I**mpairment, **M**edications, **S**edation, **A**dmitting diagnosis, **F**all history, and **E**nvironment. Scores then classified patients into one of three risk categories depending on the degree of risk, and a corresponding intervention set is assigned to each of these categories (Rannie & Neiman, 2008).

The Miami Children's Hospital developed the Humpty Dumpty Pediatric Falls Assessment™ from a retrospective study of clinical criteria that accompanied falls in pediatric inpatients (Wood, 2006). The assessment tool comprises seven areas correlated with falls, including age, gender, diagnosis, cognition, environmental factors, medications, and response to surgery or anesthesia. The instrument indicates high risk at scores greater than 11 and patients scoring 7 to 11 are categorized as low risk. Both the low- and high-risk groups are assigned corresponding intervention sets for clinicians to incorporate into practice (Wood, 2006).

An important consideration that greatly affects identification of fall risk in children is the age of the child population for whom a risk assessment program is designed. Highly dependent on the child's developmental stage, fall risk behaviors are likely to change and evolve, and over very short periods. This is the primary reason why the pediatric age continuum of birth to adolescence limits the effectiveness of a "one-size-fits-all" approach to fall risk assessment. Tools in clinical use choose alternately to exclude infants from the risk calculation and treat fall risk as implied for this age group, or make no discrimination and apply the scoring equally to all pediatric patients regardless of their developmental stage. The challenge of identifying fall risk in the context of these rapidly changing circumstances formed the basis for tool design outlined later in this article. As the infant—toddler age range has been noted to pose the highest risk of falls and fall-related injury (Agran et al., 2001), the Christiana Care Visiting Nurse Association (VNA) determined that a risk assessment tool tailored to the needs of this age group for use in a home health setting was appropriate and necessary.

Performance Improvement Project

A pediatric and graduate student nurse formed a core unit acting collaboratively with performance improvement and nursing education staff over a 12-week period to adopt a fall risk tool that would effectively meet the needs of the infant—toddler home care population. Early discussions centered on requirements needed to ensure a tool's maximum effectiveness in the home setting. Ease of use was also determined to be a quality necessary for program success. The risk assessment in practice should discern factors that mitigate risk beyond everyday matters of chance and that are amenable to intervention by clinicians. Simplicity, brevity, and ease of use were also thought to facilitate accurate completion and foster acceptance by clinical staff.

A review of the organization's fall definition revealed that a fall was considered to be any unintentional change of plane, with or without injury. Morse (2009) has stated that an infant is incapable of falling and that any recorded fall event for this age group is an error. The opinion that an infant can only be dropped by an adult was considered but ultimately was not adopted. Another issue considered was the concept of "developmental falls" experienced by toddlers in the course of learning to walk (Morse, 2009). These types of falls, while routine and often benign in their consequences, were felt to be subject to some degree of intervention by clinical staff. In a home health setting, these types of falls would not likely be reported by caregivers as a fall unless an injury had occurred as a result.

A final condition for tool development was its ability to integrate into the agency's clinical software. Clinical staff are empowered to document electronically using laptop computers but have access to a paper version in the event of software downtime.

Developmental Stages of the Infant—Toddler Child

The problem of fall-related injuries in the pediatric population is closely linked to the developmental stage of the child (Flavin et al., 2006).

Figure 1. Infant–Toddler Developmental Characteristics.

- **Birth: Extremities weak with nonpurposeful movement, neck does not support the head, hands balled in fist, 100% dependency for locomotion and positioning.**
- **3 months: Infant can raise head and chest while on stomach, holds hands open or closed, grasps objects, hand-eye coordination is developing.**
- **6 months: Infant can roll from side to side, supports own head while sitting upright, able to pull self up while holding onto objects, reaches for objects beyond reach, exploring behavior begins.**
- **12 months: Infant crawls on hands and knees, can rise to a standing position, takes steps holding onto furniture or holding a person's hand, mimics adult behavior.**
- **18 months: Child can walk unassisted, runs while staring at the ground.**
- **2 years: Child can walk up and down steps, can take steps backward, opens cabinets and drawers, able to stack objects.**

Reprinted with permission from the National Network for Child Care (NNCC). Powell, J., & Smith, C.A. (1994). The 1st year. In *Developmental milestones: A guide for parents*. Manhattan, KS: Kansas State University Cooperative Extension Service.

Circumstances that pose little risk to an infant age 6 months may present a high probability of injury to an 18-month-old toddler who is exhibiting curiosity while walking. In general, falls in children under age 2 can be traced to adult supervisory lapses, environmental hazards, and exploring behavior with developing mobility (Pickett et al., 2003). The developmental milestones of early childhood occur rapidly and with little advance notice in children under age 2 (Figure 1). Interventions implemented 12 weeks ago may already be obsolete due to new abilities arising from normal childhood development. Caregivers need to be aware of expected milestones to alert themselves to newly arising risks in the home.

As a rule, a child's physical development outpaces their cognitive development during these early years (Flavin et al., 2006). The progression of developmental stages also may not parallel a child's chronological age and the possibility of developmental delay may be a factor in the child's necessity for home healthcare. Failure to anticipate developmental milestones poses a challenge for caregivers and clinicians alike in adapting their approaches to risky behaviors and environmental hazards. With these considerations in mind, it was decided that the fall risk assessment would need to offer a stratified risk profile that varied with different stages of development. The tool's design then would focus on the most likely risk scenarios that corresponded to different stages of a child's development.

Risk Scenarios

A review of literature related to pediatric fall characteristics was performed and compared with anecdotal experiences of maternal–child nurses on staff to identify common themes known to accompany pediatric falls at home. These themes would form the basis for risk factors that would be incorporated into a standardized assessment tool. Every effort was made to limit identification of risk factors to those scenarios specifically prevalent for the age group 2 years and under.

Infants being dropped from a caregiver's arms account for 8% to 15% of fall-related injuries sustained by infants and 20% of these cases require inpatient hospitalization (Dedoukou et al., 2004; Flavin et al., 2006; Pickett et al., 2003). Pediatric nurses related that this often occurs when the infant's head is not well supported when being held. It is unclear whether these instances also include dropped infants arising from co-sleeping episodes. Co-sleeping behavior was found to be a common behavior resulting in infant falls (Monson et al., 2008). This was especially the case in the early morning hours between midnight and 7 a.m. In some cases the caregivers themselves were influenced by sedative medications. Nocturnal feeding of neonates presumably accounts for the timing of such falls, and in most cases, the caregiver unintentionally fell asleep with the infant. These types of falls were found to occur from heights of 32 to 43 inches.

A risk behavior noted in hospitalized toddlers involves attempts to exit the bed or crib by climbing over rails (Monson et al., 2008). A study of fall-related injuries at home, however, did not find falls from cribs to be statistically significant (Dedoukou

et al., 2004). Falls from changing tables were found to have the highest rate of infant hospitalizations (Dedoukou et al, 2004). This may be attributable to their height and lapses in caregiver attention. Research suggests that safety straps should be used diligently any time an infant is placed in or on a changing table, high chair, or similar nursery equipment (Dedoukou et al., 2004). Pickett et al. (2003) found that 23% of injuries sustained at home by infants under 1 year of age involved falls from furniture without discriminating between cribs, changing tables, and traditional household furniture. These results were similar to research done by Flavin et al. (2006) who found a 27% injury rate resulting from furniture broadly defined.

Stairs pose a significant risk to young children who are just beginning to use their legs for locomotion. This is especially true when walkers and strollers are being used, as these have been associated with 92% of fall-related injuries involving stairways (Pillai et al., 2000). Pickett et al. (2003) found that walkers and stairways combined accounted for 17% of fall-related injuries in the home. Safety barriers such as approved child safety gates at top and bottom of stairways are known to be the most effective means of limiting these types of falls (Flavin et al., 2006).

The provision of direct supervision is the top priority for preventing falls in the young child who is mobile (Flavin et al., 2006). Even the briefest of attention lapses can have serious consequences. Caregivers often face considerable demands on their time and attention in the course of managing their household (Pickett et al., 2003). This problem is compounded when other children are present in the home who also require caregiver attention. Another potential risk is injury to a child resulting from unsupervised play with siblings and other children.

Falls related to slip and trip incidents in the home often lead to impact with hard surfaces, sometimes with sharp, pointed edges (Chang & Tsai, 2007). These types of incidents are usually related to walking or running in the home by young children who are lacking in safety awareness, with a peak at 1 year of age. The presence of tubes and tethers connecting a child to medical equipment may also add to these risks. Padding of sharp-edged furniture corners and removal of tripping hazards in the home are suggested means of reducing these types of falls (Chang & Tsai, 2007; Flavin et al., 2006).

A final factor worth noting is the transition of play activities that occurs from inside the home to outside as a child progresses from toddler to preschooler (Flavin et al., 2006). It is also during this phase that a child demonstrates an increased willingness for play activities with other children (Centers for Disease Control and Prevention, 2010). These factors were felt to be risky by the pediatric nurse.

The Infant/Toddler Home Fall Risk Tool

A bingo board design was chosen for the fall risk assessment tool (Figure 2). Its columns represent stratified stages of development arranged as four intervals of 6 months each. Each column comprises eight blocks consisting of one question each related to the previously discussed risk factors. An additional factor of high-risk diagnosis was added at the request of maternal–child nurses based on anecdotal experience and includes developmentally delayed, sensory impaired, and seizure disorder after the 1-year age group when mobility is established. The questions contained in each block are formatted so as to elicit an affirmative response when the risk factor is not present. A "no" answer indicates that the risk factor is present. Discussion centered on how many negative answers should be determinant of a fall risk greater than chance probability. The team agreed that a negative answer to any question for a specific developmental stage would benefit patients by forcing clinical interventions specifically designed to address the risk factor.

Like other pediatric fall risk programs previously discussed, a low risk level in the absence of higher level risk factors can and should be addressed with an appropriate level of safety-related interventions as is normally prudent with this age group. The intent of this risk assessment tool is to further isolate known risk factors shown to be contributors to pediatric falls so that added intervention scrutiny can be directed in a preventive fashion at those conditions.

Six months after implementation, the Infant/Child Home Fall Risk Assessment tool has proved its practical utility in assessing fall risk for this age group. Clinicians report favorably that it can be completed quickly and its results are easily interpreted to guide care planning intervention. The ability of the tool to take into account the changing developmental capabilities of this age group is felt to be particularly useful.

Figure 2. Infant/Child Home Fall Risk Tool

SOC/ROC/Recertification Assessment Addendum: Complete the assessment for the appropriate developmental age range. A "No" answer to any question indicates a fall risk.

Patient _____ Episode _____ Date _____

0–6 months	7–12 months	13–18 months	19–24 months
Does crib/bed have functioning side rails? Yes No	Does crib/bed have functioning side rails? Yes No	Does crib/bed have functioning side rails? Yes No	Does crib/bed have functioning side rails? Yes No
Is there adequate safety restraint being used on changing table, car seat, and bouncer? Yes No	Is there adequate safety restraint being used on changing table, high chair, and car seat? Yes No	Is there adequate safety restraint being used on changing table, high chair, and car seat? Yes No	Is there adequate safety restraint being used on changing table, high chair, and car seat? Yes No
Are other children absent from the environment? Yes No	Are other children absent from the environment? Yes No	Are other children absent from the environment? Yes No	Are other children absent from the environment? Yes No
Are walkways free of clutter, cords, throw rugs, and uneven surfaces? Yes No	Are walkways free of clutter, cords, throw rugs, and uneven surfaces? Yes No	Are walkways free of clutter, cords, throw rugs, and uneven surfaces? Yes No	Are walkways free of clutter, cords, throw rugs, and uneven surfaces? Yes No
Infant well supervised when lying on horizontal surfaces? Yes No	Infant well supervised when lying on horizontal surfaces? Yes No	High-risk diagnosis, i.e., developmentally delayed, sensory impaired. Yes No	High-risk diagnosis, i.e., developmentally delayed, sensory impaired. Yes No
Infant's head is well supported? Yes No	Safety gates present at top and bottom of stairways? Yes No	Safety gates present at top and bottom of stairways? Yes No	Safety gates present at top and bottom of stairways? Yes No
Parent(s) avoid co-sleeping with infant? Yes No	Parent(s) avoid cosleeping with infant? Yes No	Parent(s) avoid co-sleeping with child? Yes No	Is outdoor play equipment used safely? Yes No
Child is free of attached equipment, tubes, and tethers? Yes No	Child is free of attached equipment, tubes, and tethers? Yes No	Child is free of attached equipment, tubes, and tethers? Yes No	Child is free of attached equipment, tubes, and tethers? Yes No
Fall Risk indicated? Yes No			

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Conclusion

Infants and toddlers are more likely to experience a fall-related injury in the confines of their own home. A standardized risk assessment tool capable of identifying factors known to contribute to these types of events can lead to safer outcomes for this vulnerable population. A dependable assessment tool can only strengthen the home health nurse's ability to influence modifiable conditions and behaviors through a preventive plan of care. ☗

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The author of this article has no significant ties, financial or otherwise, to any company that might have an interest in the publication of this educational activity.

DOI:10.1097/NHH.0b013e31820799a6

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