The Humpty Dumpty Falls Scale: A Case–Control Study

Deborah Hill-Rodriguez, Patricia R. Messmer, Phoebe D. Williams, Richard A. Zeller, Arthur R. Williams, Maria Wood, and Marianne Henry

PURPOSE. *The purpose of this descriptive study was to assess whether the Humpty Dumpty Falls Scale (HDFS) identifies hospitalized pediatric patients at high risk for falls.*

DESIGN AND METHODS. *The study was a matched case–control design. A chart review of 153 pediatric cases who fell and 153 controls who did not fall were pair-matched by age, gender, and diagnosis.*

RESULTS. *High-risk patients fell almost twice as often as low-risk patients (odds ratio 1.87, confidence interval = 1.01, 3.53,* p = *.03).*

PRACTICE IMPLICATIONS. *A Falls Prevention Pediatric Program with the HDFS tool addresses the Joint Commission Patient Safety Goals, but further research is needed to examine HDFS sensitivity-specificity.*

Search terms: *Fall prevention, fall risk assessment tool, Pediatric Falls Prevention Program, Pediatric Falls Tool*

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Deborah Hill-Rodriguez, MSN, ARNP, CNS-BC, is Magnet Project and Clinical Outcomes Coordinator, Miami Children's Hospital, Miami, FL; Patricia R. Messmer, PhD, RN-BC, FAAN, is Director, Patient Care Services Research, Children's Mercy Hospitals & Clinics, and Adjunct Professor, University of Missouri-Kansas City School of Nursing, Kansas City, MO; Phoebe D. Williams, PhD, RN, FAAN, is Professor of Nursing, University of Kansas, Kansas City, KS; Richard A. Zeller, PhD, is Statistical Consultant, College of Nursing, Kent State University, Kent, OH; Arthur R. Williams, PhD, MA, MPA, is Director of Health Outcomes & Health Services Research, Children's Mercy Hospitals & Clinics, and University of Missouri-Kansas City Medical School, Kansas City, MO; Maria Lina "Bing" Wood, ARNP, MSN, is Director of Pediatric Intensive Care Unit, Miami Children's Hospital, Miami, FL; and Maryann Henry, MBA, BSN, RN, CPN, LHCRM, is Risk Management Specialist, Miami Children's Hospital, Miami, FL.

Safety in hospitals is a continuous focus and concern for healthcare providers, especially for those of pediatric patients, because pediatric patients are exposed to many tests, medications, and a new and unfamiliar environment. New exposures coupled with a patient's diagnosis, current mental status, and the dependencies of childhood produce concerns for patient safety, especially concerns about medical errors and falls (American Nurses Credentialing Center, 2005; Institute for Healthcare Improvement, 2008; Joint Commission, 2008; National Center for Patient Safety, 2008).

This paper is primarily concerned with reduction in *risks* of falls for pediatric and adolescent inpatients. While there is considerable literature on fall-reduction programs in the adult population (Sherrod & Good, 2006), little attention has been given to pediatric patients. A falls prevention program for hospitalized children should be innovative and include risk-reduction strategies, particularly education for the patient, family, and nurses. The hospitalization of children provides an opportunity to reinforce parent/caregiver information and education concerning normal psychological and motor development of small children, which is related to falls risks and other hazards both inside and outside the hospital (Agran et al., 2003; Buick & Purser, 2007; Cooper & Nolt,

2007; Graf, 2005a,b; Hill-Rodriguez, Messmer, & Wood, 2007; Macgregor, 2003; Miller & Zhan, 2004; Park, Cho, & Oh, 2004; Patterson, 1999; Powell & Tanz, 2002; Smith, 2006).

Purpose

The purpose of this study was to assess relationships between the Humpty Dumpty Falls Scale (HDFS), as currently developed, and the actual event of a fall, using a case–control design. The scale assesses pediatric inpatients' risk for falls. This study was a pilot of the HDFS, developed through literature reviews and intensive discussion among nurses with many years of pediatric and adolescent medicine inpatient experience. Case–control studies have been very helpful in the early evaluation and development of useful screening-diagnostic tools (Schlesselman, 1982; Rothman, Greenland, & Lash, 2008). Further studies of the HDFS are underway, including its use and acceptance by nurses and patients and examinations of potential improvements in its screening properties. In this report, we are exclusively concerned with whether the current HDFS high-risk score was, indeed, strongly associated with an actual fall in the case–control study.

Humpty Dumpty*

Humpty Dumpty sat on a wall,
Humpty Dumpty had a great fall.
All the king's horses and all the king's men
Couldn't put Humpty together again.

**English nursery rhyme*

Literature Review

Falls of hospitalized patients vary from 25% to 84% of all incident reports submitted to health agencies, and are the second most costly type of injury (Department of Defense Patient Safety Center, 2008). Falls have consistently been the largest single category of hospital inpatient reports published since the 1940s (MacAvoy, Skinner, & Hines, 1996; Tommasini, Talamini, Bidoli, Sicolo, & Palese, 2008). The Joint Commission's 2008 National Patient Safety Goals include the provision for patients and their families to report concerns about safety, including falls. McClure and colleagues (2007) indicated that a population-based approach to the prevention of fall-related injury can be effective, but Tzeng and Yin (2007) caution that family visitors cannot replace nurses in effectively preventing inpatient falls.

A considerable body of literature now exists concerning actions that might be taken by nurses or others to prevent or reduce pediatric patient falls (Boswell, Ramsey, Smith, & Wagers, 2001; DiLoreta, 2002; McCarter-Bayer, Bayer, & Hall, 2005; Rutledge, Donaldson, & Pravikoff, 2003; Tzeng & Yin, 2007, 2008). These actions, however, can be costly, and methods, such as pediatric risk assessment of falls, could help better target patients for such interventions or actions, thereby containing costs, improving the efficiency and effectiveness of care, and providing better safety protection to patients. Indeed, our ultimate goal for the HDFS was to provide a usable fall-risk-assessment instrument that would benefit pediatric patients.

The literature on falls in adults and in children is reviewed separately below. The literature on adults is substantial, but we will only briefly cite it here. While this literature is important in that it has influenced the desire to develop similar tools and programs for children, we will direct our attention to the modest literature directly relevant to children.

Adult/Geriatric Falls Tools

Several tools to identify at-risk patients have been developed and demonstrate valid scores within the adult population. These tools have led to programs that have reported providing some fall protection to the adult patient (Coker & Oliver, 2003; Hendrich, Bender, & Nyhuis, 2003; Milisen, 2007; Morse, 1993, 2002, 2006a,b; Tinetti, 2003). Some researchers have questioned the validity of the screening tools now available (Meyers & Nikoletti, 2003). O'Connell and Myers (2002) indicated that further work on the Morse Fall Scale was necessary to improve its sensitivity and specificity. Studies using the Tinneti Falls Risk instrument also indicated that there were opportunities to improve the assessment and management of risk factors and to improve patient education (Fortinsky et al., 2004, 2008; Tinneti, Gordon, Sogolow, Lapin, & Bradley, 2006). Attempts to use adult instruments in settings with children have been disappointing (Razmus, Wilson, Smith, & Newman, 2006).

Pediatric Falls Tools

The published pediatric literature in this area is very limited. Injuries to children are an important health concern, yet there are few population-based analyses from which to develop prevention initiatives (Pickett, Streight, Simpson, & Brison, 2003). Although falls are the leading cause of unintentional injury for children, published reports are scarce on the validation of tools that assess falls risk in the pediatric population.

Razmus et al. (2006) reported that the CHAMPS Pediatric Fall Risk Assessment Tool had four risk factors: change in mental status, history of falls, age less than 36 months, and mobility impairment, but they indicated that further study was needed to validate the tool. However, Razmus (personal communication, January 14, 2008) indicated that fall rates in

children tended to range from 2.5% to 3.0% per 1,000 patient days. Graf (2005a) developed the GRAF-PIF predictor model based on chart reviews of 200 pediatric patients who fell, matched with a control group of 100 patients who were from the facility where this current study was conducted. Graf concluded that falls in the pediatric population were associated with *anticipated physical/physiologic* factors (61%), *accidental* factors (33%), and *unanticipated physiological falls* (6%). Accidental falls in the pediatric population occurred at a 2:1 rate over adults, even with parents present 57% of the time. Children younger than 10 years had more accidental falls than adolescents, while adolescents had more physiological falls compared to the younger age groups. Unanticipated physical/physiological falls can be caused by conditions such as an undiagnosed seizure disorder or a pathological fracture. Using 2000 falls data at her facility, Graf reported that the diagnoses of respiratory/pulmonary and neurological (seizures) were associated with an increased incidence of falls.

Patients with a diagnosis of epilepsy were at the highest risk for falls in Graf's facility; seizures resulting in falls increased the likelihood of concussion and other injuries (Wirrell, Camfield, Camfield, Dooley, & Gordon, 1996). Higher seizure frequency, lack of a prolonged seizure-free interval, comorbid attention-deficit disorder, or cognitive disability may also increase the risk of injury in children with epilepsy (Wirrell, 2006).

Pediatric Falls Programs

Children under the age of 10 years have the greatest risk of fall-related death and injury because curiosity and motor skill development are associated with falls along with parental inattention (Britton, 2005; Murray et al., 2000; Safe Kids Worldwide, 2008; Tarantino, Dowd, & Murdock, 1999; Vilke et al., 2004). There is a paucity of studies regarding the effectiveness of prevention-of-fall-related injury in children (McClure, Nixon, Spinks, & Turner, 2005; Pillai, Bethel, Besner, Caniano, & Cooney, 2000). In the past, falls among hospitalized children were the result of the improper use of cot (crib) sides; that is, the sides were only partially raised or incorrectly secured (Levene & Bonfield, 1991). Most falls occurred in children younger than 5.5 years, even when parents were present.

King (1991) reported the use of a hospital discharge database for pediatric injury surveillance. Cooper and Nolt (2007) implemented a Falls Prevention Program and reported that children younger than 1 year tended to fall out of gurneys, whereas adolescents tended to fall while ambulating to or performing activities in the bathroom. Some falls were unrelated to hospital activities but were associated with the child's developmental age, such as falls on the hospital playgrounds.

Hendrich (2007) indicated that in the pediatric population (younger than 10 years), the majority of falls correlate with environmental conditions such as cribs, rails, playrooms, and well intentioned but forgetful parents who leave children unattended or the side rail down while a child is alone. The number one strategy, according to Hendrich, is to integrate injury prevention messages with developmental assessment of the child. Hendrich asserts that those children's hospitals with high case-mix index and severely ill children should see a small percentage of true intrinsic falls with similar risk factors as those in adults such as confusion, weakness, or dizziness. Halfor, Eggli, Van Melle, and Vagnair (2001), comparing outcomes between different settings, also have suggested that pediatric patient mix is critically related to falls.

The HDFS and Patient Falls Safety Protocol was developed at one metropolitan children's hospital as a component of its Humpty Dumpty Falls Prevention Program™ (see Figure 1; Hill-Rodriguez et al., 2007). The HDFS differentiates the pediatric hospital population into categories of either low or high risk for falls based on specific factors. These risk factors are the patient's age, gender, diagnosis, cognitive impairments, environmental factors (history of falls, bed placement [age appropriate or not age appropriate], equipment/furniture, and use of assistive devices), response to surgeries/sedation/anesthesia, and medication usage. Scores are assigned within each risk factor and then summed: low risk scores are 7–11 and high risk are 12–23. The focus of the current study is whether this early version of the HDFS successfully captures a fall event when its score is elevated (high risk); that is, an *actual event* or case in this study should be associated with the higher HDFS risk score.

Gap in the Knowledge

In the white paper prepared by the Pediatric Data Quality Systems Collaborative among the Child Health Corporation of America (CHCA), the Medical Management Planning (MMP), and the National Association of Children's Hospitals and Related Institutions (NACHRI), falls prevalence was not selected as one of the nursing sensitive indicators for monitoring Children's Hospitals Care Quality. The reason given for this was the issue of definition (CHCA, MMP, & NACHRI, 2007). Neither NACHRI nor CHCA collects fall-rate data on their member children's hospitals, and falls were not selected as one of the pediatric indicators of the National Database of Nursing Quality Indicators (Lacey, Klaus, Smith, & Dunton, 2006). Even the Joanna Briggs Institute's *Falls in Hospitals* does not specifically differentiate between adult and children's hospitals (1998). Oliver, Daly, Martin, and McMurdo (2004) reviewed the literature on all published reports on risk factors and risk-assessment tools for falls in hospital inpatients; they found that only two

Figure 1. Humpty Dumpty Tool and Protocol. This figure appears in color in the online version of the article [10.1111/j.1744-6155.2008.00166.x]

Humpty Dumpty Falls Prevention Program™

Preventing falls, enhancing safety.

Falls Assessment Tool
The Humpty Dumpty Scale - Inpatient

Parameter	Criteria	Score (circle)
Age	Less than 3 years old	4
	3 to less than 7 years old	3
	7 to less than 13 years old	2
	13 years and above	1
Gender	Male	2
	Female	1
Diagnosis	Neurological Diagnosis	4
	Alterations in Oxygenation (Respiratory Diagnosis, Dehydration, Anemia, Anorexia, Syncope/Dizziness, etc.)	3
	Psych/Behavioral Disorders	2
	Other Diagnosis	1
Cognitive Impairments	Not Aware of Limitations	3
	Forgets Limitations	2
	Oriented to own ability	1
Environmental Factors	History of Falls or Infant-Toddler Placed in Bed	4
	Patient uses assistive devices or Infant-Toddler in Crib or Furniture/Lighting (Tripled room)	3
	Patient Placed in Bed	2
	Outpatient Area	1
Response to Surgery/Sedation/ Anesthesia	Within 24 hours	3
	Within 48 hours	2
	More than 48 hours/None	1
Medication Usage	Multiple usage of: Sedatives (excluding ICU patients sedated and paralyzed) Hypnotics Barbiturates Phenothiazines Antidepressants Laxatives/Diuretics Narcotic	3
	One of the meds listed above	2
	Other Medications/None	1
Rev: 07/2007	TOTAL	

Date: _____

Name: _____

MR#: _____

Acct#: _____

D.O.B.: _____

Age: _____

At risk for falls if score is 12 or Above

Minimum Score 7
Maximum Score 23

☞ **Patient Falls Safety Protocol on back**

PLACE YOUR LOGO HERE

MCH-HC070725-R

Figure 1. *Continued*

Patient Falls Safety Protocol

Low Risk Standard Protocol (score 7-11)

- Orientation to room
- Bed in low position, brakes on
- Side rails x 2 or 4 up , assess large gaps, such that a patient could get extremity or other body part entrapped, use additional safety procedures.
- Use of non-skid footwear for ambulating patients, use of appropriate size clothing to prevent risk of tripping
- Assess eliminations need, assist as needed
- Call light is with in reach, educate patient/family on its functionality
- Environment clear of unused equipment, furniture's in place, clear of hazards
- Assess for adequate lighting, leave nightlight on
- Patient and family education available to parents and patient
- Document fall prevention teaching and include in plan of care

High Risk Standard Protocol (score 12 and above)

- Identify patient with a "humpty dumpty sticker" on the patient, in the bed and in patient chart
- Educate patient/parents of falls protocol precautions
- Check patient minimum every 1 hour
- Accompany patient with ambulation
- Developmentally place patient in appropriate bed
- Consider moving patient closer to nurses' station
- Assess need for 1:1 supervision
- Evaluate medication administration times
- Remove all unused equipment out of the room
- Protective barriers to close off spaces, gaps in the bed
- Keep door open at all times unless specified isolation precautions are in use
- Keep bed in the lowest position, unless patient is directly attended
- Document in nursing narrative teaching and plan of care

instruments met the criteria of prospective validation, with odds ratio (OR) analyses and sensitivity/specificity assessment. Both instruments are for adults.

Methodology

Research Design

The study purpose was to determine whether a high-risk designation on the HDFS was associated with a documented fall using a matched case–control design (Polit & Beck, 2008). During the years 2005–2006, a chart review of 308 patients was done: 153 were children who fell while hospitalized (cases) and 153 were children who did not fall (controls or control group). The cases and controls were pair-matched for age, gender, diagnosis, and unit location. One case and one control were eliminated because it was a "drop" case and not an actual fall.

Procedure

The study setting was a free-standing pediatric teaching facility. Patient data were collected from five (medical, surgical, respiratory, neurology, and oncology) in-patient units and the pediatric intensive care and cardiac intensive care units. Exclusion criteria were those falls of visitors or patient falls from the other units not included in the study, such as outpatient and the neonatal intensive care units. A selected group of advanced nurse practitioners, clinical nurse specialists, directors, and a staff nurse conducted the review of 308

charts and did the HDFS scoring. Interrater reliabilities in scoring the HDFS were all at acceptable levels (over 70% agreement).

Protection of Human Subjects

Since the study presented no more than minimal risk to subjects and utilized chart and quality occurrence report data, expedited review was granted by the facility's institutional review board. No data were gathered by the researchers directly from patients or parents.

Instrument

The HDFS was created by an interdisciplinary team comprised of expert clinical nurses from inpatient, outpatient, and emergency department areas along with risk management and rehabilitation services. Historical fall-reporting data at a metropolitan children's hospital were used. These data included process improvement data and a review of actual falls to identify parameters to be included on the scale. The HDFS safety protocol (for the prevention program) for low-risk and high-risk patients evolved from parameters with risk factors criteria and scoring matrices.

After pilot testing in all inpatient units, the instrument was comprised of seven assessment items: (a) age, (b) gender, (c) diagnosis, (d) cognitive impairments, (e) environmental factors, (f) response to surgery or sedation or anesthesia, and (g) medication usage (see Figure 1). Flavin, Dostaler, Simpson, Brison, and Pickett (2006) indicated that boys experience higher rates of injury than girls. The range of scores is 7–23 (minimum score of 7 and maximum score of 23). During the pilot study period, 13 of the 38 patients who actually fell had HDFS scores of 12–13. The score of 12 was used as the "cut point" for high risk for falls. Thus, the *low-risk protocol* was identified with scores 7–11, while a *high-risk protocol* was identified with scores of 12 and above.

The HDFS was designed to be child friendly. When children are assessed for their risk of falls, all children are identified with a potential fall risk and basic precautions are implemented at the low-risk category. A score of 12 or above indicates a pediatric patient is at-risk for falling, and this patient will have the high-risk Humpty Dumpty Falls safety protocol implemented. The high-risk safety protocol consists of Humpty Dumpty signage (Figure 2) placed in visible locations (sticker on the shirt or gown, crib, or bed and chart). The signage notifies all healthcare professionals that the child is at risk for falling and ensures that the falls safety protocol is implemented and all precautions are taken. Other fall-prevention components include medication administration review, increased assessment time frames, and placing patients closer to the nurse's station as well as providing one-to-one care when indicated.

Data Analysis

Descriptive analyses of the sample characteristics were done. The study purpose was addressed using epidemiologic case–control procedures including calculation of an OR, confidence limits, and level of statistical significance (Schlesselman, 1982).

The OR is an unbiased estimator of the relative risk of having a disease or event in a case–control study. Unfortunately, it is only an estimator because the case–control design cannot provide information about the true incidence of an event within a population, and an estimate of incidence is required to calculate the true relative risk (RR). Nevertheless, the OR often has been interpreted in a manner similar to the RR; that is, an OR > 1.0 is a marker of excess risk (McHugh, 2007; Rothman et al., 2008; Simon, 2008). Furthermore, an OR of 3.0, for example, suggests that cases have approximately three times the *risk* or *odds* of having the event occur compared to the controls.

Results

Sample Characteristics

Tables 1–3 show the sample characteristics of cases and controls pair-matched by diagnosis, age group, and gender. Table 1 also shows that, among cases, most falls occurred with children admitted with a neurological diagnosis, such as seizure disorders, followed by gastrointestinal or dehydration with vomiting, and respiratory/asthma. Children with respiratory disorders had a higher HDFS mean score of 15.16; children with neurological diagnoses had an HDFS mean score of 14.84; children with renal diagnoses had an HDFS mean score of 14.40; and children with gastrointestinal diagnoses had an HDFS mean score of 13.44.

Table 2 shows that, among cases, most falls occurred in children younger than 3 years and in those who were 13 years and older. Those younger than 3 years had the highest HDFS mean score of 15.70; the 3- to 6-year-old age group had a mean of 14.36; the 13-year and older group had a mean of 13.29; and the 7- to 12-year-old group had the lowest mean of 12.38.

Table 3 shows that falls among cases were 50% in females and 50% in males (data for gender were missing in three cases). Prior to the implementation of the Humpty Dumpty protocol, fall evidence was 0.989 and 1.0 per 1,000 patient days (2003–2004) and ranged from 0.989 to 0.989 and 1.0 per 1,000 days for the postimplementation (2005–2006). Buick and Purser (2007) reported that their outcomes were not improved significantly. Their fall rate was 0.48 preimplementation of a falls-prevention program and 0.47 postimplementation. In this institution, the fall rate for inpatients decreased significantly in 2007 to 0.56 per 1,000 patient days, which

Figure 2. (a) Humpty Dumpty Sign on At-Risk Child. (b) Humpty Dumpty Sign on Crib. (c) Humpty Dumpty Sign on Chart. This figure appears in color in the online version of the article [10.1111/j.1744-6155.2008.00166.x]

suggests that the Humpty Dumpty Falls Prevention Program™ has merit and value.

Study Purpose Addressed

Table 4 shows the OR using the current HDFS cut-off point of 12 and current scoring procedures. This table shows that children in the low-risk category were less likely to fall (37 did not fall) as compared to children in the higher risk category (115 did not fall). Conversely, there were a larger number of children with high-risk scores who fell (128) as compared to the low-risk children who fell (22). There were three missing cases for those who fell and one missing case for those who did not fall. The OR obtained was significant (OR = 1.87; 95% confidence interval = 1.01, 3.53; $p = .03$). OR of patients is 1.87 when an HDFS score is greater than or equal to 12.

Limitations

This retrospective study was conducted in one geographic setting with one hospital's falls data. The analysis included 2 years of inpatient data on actual falls with a 6-month time interval of postimplementation follow-up. Only 4 of the 308 charts reviewed had missing HDFS scores. While the HDFS captures some of the real risk of falling among hospitalized pediatric patients, further assessment of the instrument is necessary. The reported sensitivity was 0.85, the specificity was 0.24 with the positive predictive power at 0.53 and negative predictive power at 0.63; the overall percentage of patients correctly classified as to their risk of a fall was 59.3%. It is difficult to interpret the meaning of the false positives in the Humpty Dumpty Falls scores due to the intervening implementation of the Humpty Dumpty Falls Prevention Program™ and fall-reduction strategies implemented by the nursing staff. The false-negative cases (scores less than 12 among the cases who by definition did fall, $n = 22$) gave an inaccurate indication that these patients were *not* likely to fall, thereby suggesting the need for further refinement of the tool. If further refinement of the HDFS is completed and these "low-risk fallers" are captured, the sensitivity of the tool should be maintained (ability to identify children at risk for falls) while the specificity is increased (ability to identify those not at risk) (Frankenburg & Camp, 1975; Simon, 2008).

Table 1. The Humpty Dumpty Falls Scale (HDFS) by Diagnosis: Mean HDFS Fall Risk Scores of Cases and Controls

Diagnosis	Cases (*n*)	Cases' mean HDFS falls risk scores	Controls (*n*)	Controls' mean HDFS falls risk scores
2 Respiratory	19	15.16	18	15.00
1 Neurological	71	14.84	71	14.47
4 Renal	11	14.40	15	14.07
3 Gastrointestinal	18	13.44	18	13.06
5 Cardiac	8	13.50	7	15.57
6 Oncology	10	13.40	11	12.64
9 Other/Infections	10	13.20	7	12.14
8 Orthopedic	5	10.20	4	9.50
7 Surgical	1	10.00	2	9.50
Total/mean	**153**	**13.13**	**153**	**12.88**

Notes: Cases are children who fell; Controls are children who did not fall (matched for age, gender, diagnosis, and unit location with cases). Uneven observations on cases and controls arise from incomplete information on which to calculate an HDFS score. Of the 308 records, one case-matched control was dropped because it was not classified as a fall.

Table 2. The Humpty Dumpty Falls Scale (HDFS) by Age Group: Mean HDFS Falls Risk Scores of Cases and Controls

Age groups	Cases (*n*)	Cases' mean HDFS falls risk scores	Controls (*n*)	Controls' mean HDFS falls risk scores
Younger than 3 years	56	15.70	55	15.83
3–6 years	25	14.36	27	14.59
7–12 years	24	12.38	24	12.21
13 years or older	45	13.29	46	12.20
Total/mean	**150**	**13.93**	**152**	**13.70**

Table 3. The Humpty Dumpty Falls Scale (HDFS) by Gender: Mean HDFS Falls Risk Scores of Cases and Controls

Gender	Cases (*n*)	Cases' mean HDFS falls risk scores	Controls (*n*)	Controls' mean HDFS falls risk scores
Female	75 (50%)	13.37	78 (51%)	13.28
Male	75 (40%)	15.07	74 (49%)	14.64
Total/mean	**150 (100%)**	**14.22**	**152 (100%)**	**13.92**

Discussion

The significance and size of the OR in this study suggest that the HDFS identifies pediatric patients at high risk for falls. The odds of high-risk patients falling are almost twice that of low-risk patients.

In a literature review, Oliver and colleagues (2004) identified all published papers on risk factors and risk-assessment tools for falls in hospital inpatients. They found that only two instruments met the criteria of prospective validation, including OR, and required sensitivity/specificity; both studies were done on adult instruments (Morse, 1985; Oliver, 2006). The review article by Oliver and colleagues provides a table with an excellent summary of adult-falls studies where data allowed calculation of OR and confidence intervals. This study evaluates the Humpty Dumpty fall instrument properties within a pediatric population.

In 2000, using the falls data from the same facility as the current study, Graf (2005a) also reported that the diagnosis of respiratory/pulmonary and neurological (seizures) conditions were associated with increased incidence of falls. Likewise, Wirrell et al. (1996) reported that accidental injury is a serious risk in children with typical absence epilepsy. These findings are consistent with the current study; that is, patients with diagnoses of neurological conditions including epilepsy were more often among the cases (children who fell). Although the institution's case-mix index (1.52) is one of the lowest for NACHRI hospitals, some children in

Table 4. Odds Ratio of the High- and Low-Risk Groups (Children Who Fell and Those Who Did Not Fall)

	Falls	
Risk group	**Yes (did fall)**	**No (did not fall)**
High risk	128	115
Low Risk	22	37
Total	**150**	**152**

Odds ratio = 1.87; confidence interval = 1.01, 3.53; $p = .03$.

the current study who fell were confused, weak, dizzy, and experienced seizure activity.

Preventing falls in the pediatric population is difficult due to the unpredictability of falls as a result of a pediatric patient's cognition, growth, and development. It was observed that, in some cases, the nurses were not observing the patients in a holistic manner; that is, they relied on the patient's present condition only and did not assess other underlying factors (such as the factors on the HDFS) that could put patients at a higher risk for falls. The OR findings linking high-risk-falls scores and incidence of falls suggests that the HDFS is a tool that might be used to identify risks of a fall.

It was observed that, in some cases, the nurses were not observing the patients in a holistic manner; that is, they relied on the patient's present condition only and did not assess other underlying factors (such as the factors on the HDFS) that could put patients at a higher risk for falls.

A fall rate of 2.3–6.5 falls per 1,000 patient days was reported in an academic medical center; however, higher fall rates of children in adult facilities have been reported (Boyle, Miller, Gajewksi, & Dunton, 2005; Hitcho et al., 2004; Oliver, 2006). One hospital also reported a fall rate of 3.1 falls per 1,000 patient days with 3.1% of the falls with serious injury in women and infants, but it should be noted that infants were not listed separately (Fisher et al., 2005). Reported children's hospital's fall rates are well below the rates of adults, but falls may not be as carefully monitored in pediatric as compared to adult facilities. Fall rates are derived generally from voluntary reporting mechanisms. Rates may vary due to reporting rather than the actual number of falls.

Conclusions/Recommendations

The study findings suggest that the HDFS may be a valid tool for recognizing high-risk pediatric patients in the inpatient units. The findings also suggest that children with neurological (such as seizure disorders), respiratory/asthma, gastrointestinal (including dehydration or vomiting), and renal diagnoses are at high risk for falls. As to age, children younger than 3 years old and children 13 years and older with neurological diagnoses (such as seizures) may be at highest risk and should be closely monitored. Clearly, the fall-rate prevalence is high among these two groups at the study institution. The HDFS currently may be the best fall scale now available for children. The HDFS score gives healthcare providers a point of reference when assessing children at risk for falls.

Current practice does not usually identify pediatric patients who have a history of falls. Using the HDFS as part of the assessment scale on admission, on every shift, and upon change of patient level of care may increase staff awareness of patients with high-risk scores for falls. This identification process can promote staff compliance with falls education to families or guardians. A prospective study at several sites using the HDFS should be conducted to determine if its use in practice would indeed help to reduce the incidence of falls and associated costs. Measurement properties of the HDFS, including possible improvements in its predictiveness as a screening tool, should be carefully examined in prospective studies.

How Do I Apply These Findings to Nursing Practice?

Implementing a patient-falls-safety/prevention protocol should include assessment of the risk for falls in pediatric patients. This would reduce the incidence of falls and directly address important Joint Commission patient safety goals. Using tools such as the HDFS and the implementation of the Humpty Dumpty Falls Prevention Program™ might be helpful; however, use of such tools does not obviate the need for exercise of the nurse's best clinical judgment. Such judgment remains a valuable resource in decreasing the incidence of falls and falls-related injury. Properly identifying patients at risk for falls ensures that all disciplines, parents, and visitors have an increased awareness of the risk of injury to the patient. Increased awareness results in better patient outcomes, including reduction in potential issues related to increased costs and increased length of stay. Additionally, use of this tool may assist nurses in providing safe, noninvasive care, anticipatory guidance to parents and other informal caregivers, and health promotion.

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Author contact: prmessmer@cmh.edu, with a copy to the Editor: roxie.foster@UCDenver.edu

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