Evaluating Morse Fall Scale Cutoff Scores to Predict Inpatient Falls

Rebecca Creech Tart, PhD, Adina Kulcsar, MMS, PA-C

Catawba Valley Medical Center, Hickory NC 28602

Introduction

According to The Joint Commission, which has tracked sentinel events since 1995, patient fall-related events are the 6th most frequently reported adverse event in acute care facilities[1]. Changes to reimbursement from payers for adverse events, of which injury as a result of a fall while hospitalized is one, has intensified awareness of the criticality of the problem[2].

Hospital fall prevention programs have been widely established, and fall risk assessment tools are key components of these programs. This facility utilizes the Morse Fall Scale (MFS)[3] to identify fall risk – one of a limited number of validated assessment tools available in 2003 when it was selected. Other fall risk tools have since undergone validity testing[4-5]. MFS does not specify fall risk cutoff scores nor how many risk categories to use; each facility is responsible for determining its fall risk categories[3]. In January 2004, a 3-fall risk category system with threshold scores of $\geq$25 and $\geq$51 was implemented at this facility. However, inpatient falls continued to be a patient safety concern.

Purpose: This research was designed to determine the optimal MFS cutoff score for predicting medical inpatient fall risk after evaluating the efficiency of a 2-risk category system versus 3 categories. Reliability of the determined cutoff point was then evaluated in subsequent calendar years in the same patient population.

Methodology

Study Design

Descriptive correlational study including model testing design
Conducted retrospectively
IRB approved

Sample

Subjects: N=6489 general medicine inpatients (2005, 2009 and 2010)
Falls: N=61 patients who fell while hospitalized during study

Data Collected

First recorded medical unit MFS score, age, gender, no. of falls & assessors

Statistical Analyses

Mean, standard deviation (SD), frequency, chi squared tests, Spearman rank order correlation coefficient (r_s), ANOVA, sensitivity, specificity, positive predictive value (PPV), receiver operator characteristic (ROC) curve; *p* values were calculated at 95% confidence to determine significance

$$\text{Sensitivity} = \frac{\text{no. high risk patients who fell}}{\text{total no. patients who fell}}$$

$$\text{Specificity} = \frac{\text{no. low fall risk patients who did not fall}}{\text{total no. patients who did not fall}}$$

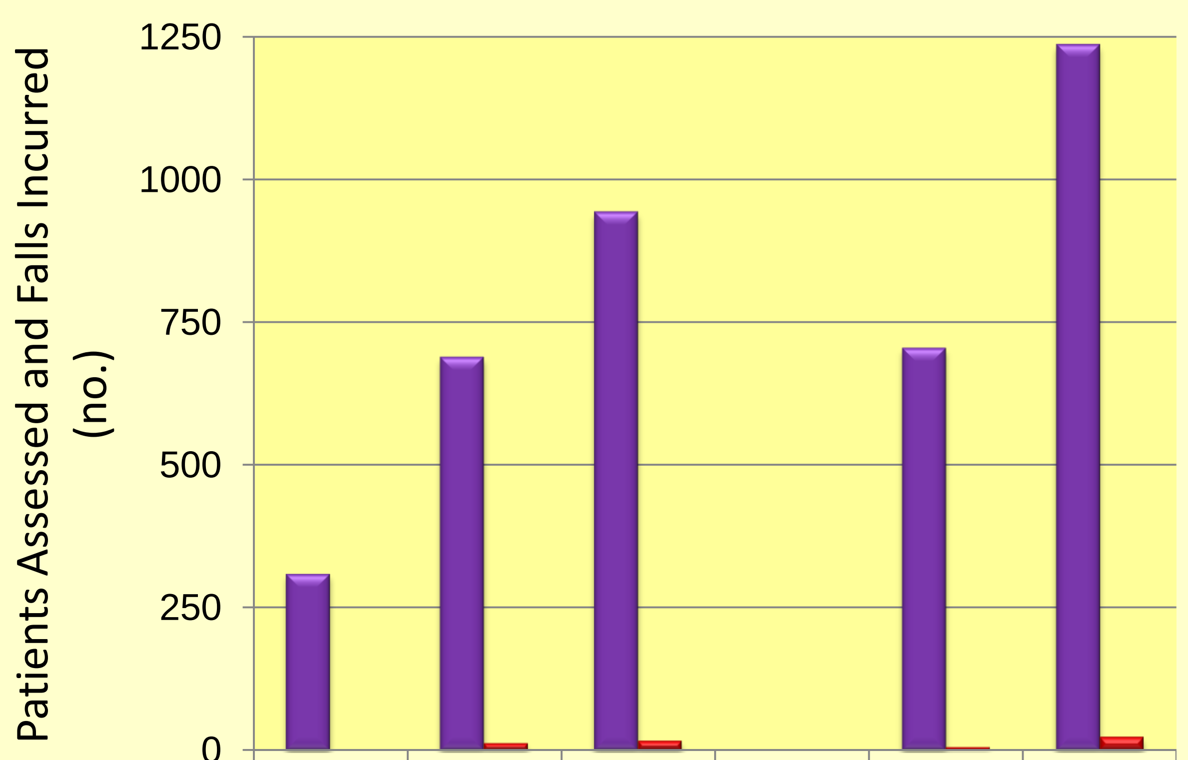
$$\text{PPV} = \frac{\text{no. high risk patients who fell}}{\text{total no. high risk patients}}$$

Demographics, Falls Incurred & MFS Assessors

Descriptor	Sample N=6489	CY 2005 n=1939	CY 2009 n=2309	CY 2010 n=2241	*p* Value
Gender (n)					0.0406
Female	3613	1119	1288	1206	
Male	2876	820	1021	1035	
Age (yr)					0.6647
Mean (SD)	65.2 (17.9)	65.5 (18.0)	65.2 (17.5)	65.0 (18.1)	
Range	16-104	16-100	18-101	17-104	
Subjects who fell (n)	61	26	20	15	
Subject Assessors (n)	279	67	105	107	

- Among general medicine unit patients, females (55.7%) outnumbered males over the total study interval and in each calendar year (CY)
- Distribution of the genders between the 3 years was significantly different (*p*=0.041), while subject mean ages were similar (*p*=0.665)
- Fewer medical patients fell in 2009 than in 2005, and even fewer fell in 2010 than in 2009

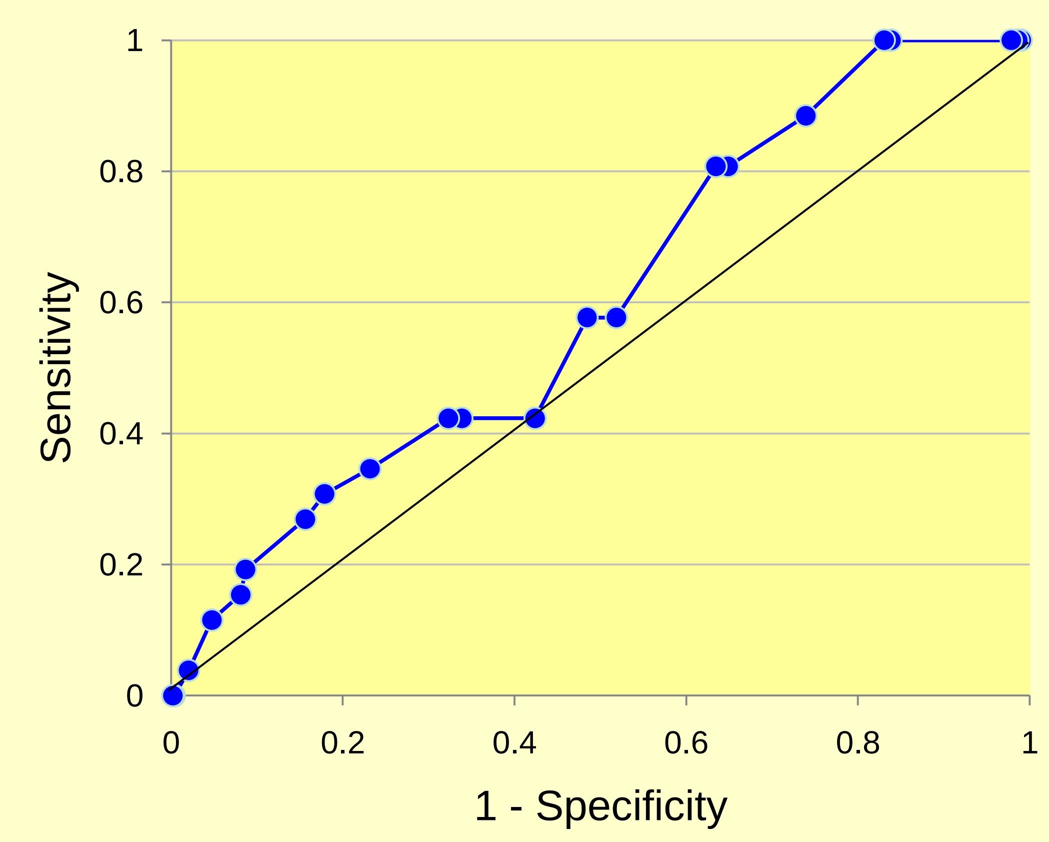
Correlation Analysis of 2- and 3-Fall Risk Systems



	STD	MOD	HIGH		LOW	HIGH
Patients	309	688	942		704	1235
Falls	0	11	15		5	21

- 2005 data evaluated to determine feasibility of replacing the 3-fall risk system (<25 standard, $\geq$25-50 moderate, and $\geq$51 high fall risk) with a simpler 2-fall risk system (<45 low fall risk and $\geq$45 high fall risk)
- 26 general medicine patients who fell had actual MFS assessments of moderate or high fall risk with none scored as standard fall risk
- Redistribution of MFS scores with >45 as high and <45 as low risk resulted in 6/11 moderate risk patients who fell being classified as high fall risk
- Spearman rank order correlation coefficients were ~identical
  - 3-fall risk categories with two threshold scores: **r_s=0.9794**
  - 2-fall risk categories with a single threshold score: **r_s=0.9786**

ROC Curve Analysis: Sensitivity and Specificity of all Potential MFS Cutoff Points



- Discriminating power of the MFS fall risk assessment tool evaluated by plotting sensitivity and 1-specificity coordinates for each potential cutoff point on the scale for 2005 data
- Optimal MFS cutoff score=45 (cutoff point of $\leq$40 for low risk population) was determined, which represents a 40% increase in sensitivity over the previous 3-fall risk category system high risk cutoff score
- MFS ROC curve lies close to the non-discriminating reference line, which depicts equal sensitivities and specificities for cutoff points

Optimal MFS Cutoff Score Reliability Testing

Validity Measure	Reliability Over Time			
	2005	2009	2010†	2010‡
Sensitivity (%) at MFS cutoff score 45	80.8	90.0	73.3	91.7
Specificity (%) at MFS cutoff score 45	36.5	34.6	33.7	33.7
PPV (%) at MFS cutoff score 45	1.67	1.19	0.74	0.74

† basis: 15 falls
‡ basis: 12 falls; further investigation revealed 3 occurrences were accidental or unanticipated physiological falls, which cannot be predicted by the MFS (Morse, 1997)

- Optimal MFS cutoff score, determined from 2005 data, was found to be reliable when MFS scores and falls in the general medicine patient population in 2 subsequent calendar years were evaluated
- With 2010 data adjusted for falls not predictable by the MFS, the cutoff score =45 had similar strong sensitivities and low specificities over time
- Sensitivity is key to identifying fall-prone patients; however, MFS=45 classifies ~65% of medical inpatients that do not fall as 'at risk' for falling with PPV that are extremely low

SUMMARY

Conclusions

- 2-fall risk categories were as effective as 3 categories in predicting the likelihood a patient would fall, and the simpler system is more manageable for nurses implementing fall prevention strategies
- Hospital policy revision and staff education occurred in 2006; annual fall risk prevention competency was thereafter instituted for all nurses
- MFS is not a highly accurate predictor of general medicine inpatient falls
- Optimal MFS cutoff score of 45 was shown to be reliable over time in this acute care setting with nurses possibly becoming more adept at administering the fall risk assessment tool with increasing experience

Limitation

- Initial MFS score may or may not equate with MFS score at the time of fall

IMPLICATIONS

- Comparison with MFS validity research of others
  - Kim et al[5] confirmed strong specificity (88%) of the MFS at a cutoff score of $\geq$25[7], but low specificity (48%); at an MFS cutoff score of $\geq$40, a sensitivity of 68% and specificity of 76% was identified
  - O'Connell and Myers[6] reported for MFS score=45, a sensitivity=83% and specificity=29%
  - This study confirmed an MFS cutoff score=45 as quite sensitive (81-92%) with lower specificity(34-37%) than some reports and higher than others
- Fall risk assessment in the acute care setting
  - Two nurses conducted fall risk assessments on all subjects in the Kim et al[5] study; although great for tool reliability, this is not a real world scenario
  - Initial patient MFS scores determined by nurses (N=279) and abstracted from the electronic medical record were utilized in this study
  - Similar sensitivity and lower specificity values were observed in routine practitioner-generated, patient fall risk assessments
- Lessons learned
  - Crucial to maintaining patient safety is education; lower incidence of falls in 2010 is not contributable to the simpler risk assessment system alone – mandatory education and frequent fall prevention emphasis are responsible

REFERENCES

1. The Joint Commission. Sentinel event data event type by year. 2011. Available at: http://www.jointcommission.org/SentinelEvents/Statistics/. Accessed June 25, 2011.
2. The Centers for Medicare and Medicaid Services. CMS expands the list to 10 hospital-acquired conditions for reduced payment. 2008. Available at: http://www.cms.hhs.gov/. Accessed September 23, 2008.
3. Morse, JM. *Preventing Patient Falls*. Thousand Oaks, CA: Sage Publications;1997.
4. Ivziku D, Matarese M, Pedone C. Predictive validity of the Hendrich fall risk model II in an acute geriatric unit. *Int J Nurs Stud*. 2011;48(4):468-474.
5. Kim EAN, Mordiffi SZ, Bee WH, et al. Evaluation of three fall-risk assessment tools in an acute care setting. *J Adv Nurs*. 2007;60(4):427-435.
6. O'Connell B, Myers, H. The sensitivity and specificity of the Morse Fall Scale in an acute care setting. *J Clin Nurs*. 2002;11:134-136.
7. Morse J, Morse R, Tylko S. Development of a scale to identify the fall-prone patient. *Can J Aging*. 1989;8:366-377.

CONTACT INFORMATION

Rebecca Creech Tart, PhD rtart@catawbavalleymc.org
Adina Kulcsar, MMS, PA-C akulcsar@live.com