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Baseline Prevalence Study of Hendrich II Fall-Risk Assessment Tool at a Local Community Hospital

Emanuelle Vasconcelos Barbosa Borba Pontual
evasconcelosbarbosab@usfca.edu

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University of San Francisco

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Each year, 700,000 to 1,000,000 people in the United States fall in hospitals; 30%–35% of those sustain injuries, and 20% of falls will cause serious traumatic injuries. Yet, research shows that close to one-third of these falls could be prevented (National Council on Aging, 2017). This paper presents the analyses of a fall-risk tool, Hendrich II fall risk model (HFRM II) utilization in a local community hospital. This tool is a common fall-risk tool and is used in a significant number of hospitals worldwide. Despite using this tool and having implemented fall interventions, the hospital still experiences significant number of patient falls. Extensive review of literature and statistical analysis of 106 patients' assessments practices were used to determine the current assessment skills for falls and PMAT. The aim was to understand if RNs are using the tool appropriately and should a new tool be suggested. To answer these questions, three students of the University of San Francisco assessed 106 patients of this hospital over a period of 2 months. They used the same Hendrich II tool that was used by RNs. These data were compared with the data collected by RNs. The data collected in the hospital showed that RNs were failing to properly use the HFRM II. In addition, an in-depth literature review on fall tools was conducted; according to this review, the HFRM II's effectiveness was in line with that of other fall tools.

Literature Review

According to the Centers for Disease Control and Prevention (CDC; 2017), 2.8 million older people are treated in emergency departments for fall injuries. Furthermore, 20% of falls will cause serious trauma injuries. In addition to health concerns, falls are also responsible to $31 billion in annual medical costs. Tools for predicting falls in health care facilities and hospitals are extremely necessary and can decrease costs related to fall injuries, as well reduce the risks associated with falls and improve patient quality of life. One of such tool is the HFRM (Hendrich, Nyhuis, Kippenbrock, & Soja, 1995). This tool was developed in an epidemiological research setting and used the following risk factor metrics: confusion, altered elimination patterns, altered mobility, history of falls, dizziness or vertigo, and depression. The tool is used to determine the risk of falls in an oncological unit. The original sensitivity of the tool was 77% and the specificity was 72%; the reliability was 95%. According to Heinze, Halfens, and Dassen (2008), when they tried to replicate the usage of this tool in a geriatric hospital, they found the tool was not reliable enough and generated ambiguous results depending on the health professional using the tool. In 2007, Hendrich updated her tool and created the HFRM II (Hendrich, 2007). This tool was originally developed to predict falls in older adults, but it is currently being used to assess fall risks in other types of patients (e.g., pregnant women, children). The tool comprises eight independent fall-risk factors. Each factor has a specific grade. If, after the assessment, a patient has a grade greater than 5, he or she has a high risk of falling. The factors are confusion, depression, dizziness, altered elimination, male gender, usage of antiepileptics, usage of benzodiazepines, and poor performance in rising from a seated position. These metrics were identified by Dr. Ann Hendrich using evidence-based practice; they have a high correlation with the risk of fall. She used statistical tests (e.g., correlation) to find this set while discarding other metrics (e.g., history of falls). The idea was to find a pragmatic and reliable fall predictor that should not impose a considerable overhead in a RN workload. According to Hendrich, the main characteristic of her tool is its simplicity; the tool can be administered in less than 5 minutes when an RN is assessing his or her patients. Because of this simplicity, many hospitals around the world started to use this tool. Ivziku, Matarese, and

Pedone (2011) conducted a quantitative research in a geriatric hospital in Italy to assess the reliability of the HFRM II on older patients. They studied 179 elderly patients during a period of 8 months in a geriatric acute-care unit. RNs received training to administer the HFRM II. All patients were screened within 24 hours of admission. The results of this study corroborated prior evidence that the HFRM II is a valid tool to predict the risk of falls in geriatric patients. In fact, the study showed the HFRM II is a reliable tool (the inter-rate reliability was 0.87) for geriatric patients; moreover, the HFRM II in the study presented a high sensitivity (i.e., the test was able to identify patients that had a higher risk of falling). However, this study contradicted the original HFRM II research with respect to specificity. In this 2011 study, the HFRM II model showed a low specificity (i.e., the proportion of false-positive fallers). The authors argued that a confounder could have affected the specificity in the study. The fall-prevention mechanism in place in the unit might have affected this variable. Once RNs realized a patient was at risk of falling, they implemented a fall-prevention mechanism, creating a treatment paradox, and consequently decreased the risk of the patient falling, which reduced the specificity of the results. Finally, RNs were able to perform the test on patients in 1 minute on average. The researchers also observed that the factors that most affected fall risk were depression, incontinence, and vertigo. Another international study (Nassar, Helou, & Madi, 2014) compared the predictive fall risks of the HFRM II versus the Morse Fall Scale (MFS) in an acute care setting in Lebanon. A total of 1,815 patients (1,036 males and 779 females) were observed in this study. Patients were 18 years or older (the average age was 56 years), and they were screened for falls after 2 hours of admission. Five nurses were trained in both fall assessment tools. In addition, these five nurses independently applied both screening methods to each patient. The MFS tool uses 6 fall-risk factors: history of falling, presence of secondary diagnosis, usage of ambulation aid, intravenous therapy, type of gait, and mental status. Each metric has a different weight; a patient has a high risk of falling if he or she scores 51 or higher in the MFS tool. According to this research, both tools were tested in a large sample population, so the results could be generalized to the whole patient population in the Middle East. The results found that patients with ambulatory-assistance devices had a higher risk of falling according to both tools. Furthermore, HFRM II showed a higher correlation with actual falls than the MFS. In addition, the HFRM II presented a sensitivity of approximately 55% and 90% specificity, whereas the MFS had a sensitivity of 36.9% and a specificity of 54%. In general, both scales were good at predicting whether a patient had a low risk of falling. As shown by its sensitivity and specificity, the HFRM II's results are better and more reliable than those of the MFS. The MFS had a low specificity. In other words, the MFS test will allocate resources to potential non-fallers. Moreover, it took 3.5 minutes to complete the HFRM II, and 2 minutes to complete the MFS. This study also found that the HFRM II had a lower sensitivity than the original used in Hendrich's research. The authors (Nassar, Helou, & Madi, 2014) inferred that the lower sensitivity was due to their sample population being younger than the sample used in the original Hendrich research. The authors concluded by recommending the HFRM II as a tool to predict the risk of falling in acute care settings. However, this tool is only used in an assessment step of nursing practice. It's value is in guiding nurses to activate falls prevention protocol. In addition, fall assessments using this tool should be performed routinely because patients' conditions are always changing. Razmus, Wilson, Smith, and Newman (2006) compared the HFRM II and MFS for use in predicting the risk of fall in children. They concluded that the risk factors that neither scale may be suitable for inferring the risk of falling in children. For instance, it can sometimes be difficult to a health care professional to assess the confusion and disorientation of small children, and this is a risk factor used in the HFRM II. Furthermore, administering the Get Up and Go Test might be a challenge when dealing with young children. In the end, the authors decided to create a different tool to assess the risk of falls in pediatric units. In addition, the authors stressed that nurses should apply different interventions for avoiding falls in young children, including training parents about falling risks and addressing environmental hazards. The beds at hospitals, for example, are not typically adapted for small children and may increase the risk of falling. In addition to the HFRM II and MFS, other risk fall tools have been developed in the last few years. The STRATIFY tool is a fall prediction tool for elderly patients (Oliver, Britton, Seed, Martin, & Hopper, 1997). In the original study, the authors assessed 116 patients with an age greater than or equal to 65 years for 21 fall-risk metrics. From these 21 metrics, the authors selected four that were more correlated with fall risk: history of falling, patient agitation, frequent toileting, and problems with transfer and mobility. The tool had a specificity of 68% and a sensitivity of 92%. Furthermore, the tool results had three possible values: low risk, moderate risk, and high risk of falling. Narayanan, Dickinson, Victor, Griffiths, and Humphrey (2016) studied fall tools in all mental health institutions in the United Kingdom. This study discovered that 42 of 46 mental institutions used some version of the STRATIFY tool. Despite that, many of the examined institutions reported inconsistent predictive accuracy with respect to the tool. Narayanan et al. (2016) concluded that the STRATIFY selected metric for predicting fall risk might not be adequate for use in mental health institutions. Another tool for predicting fall risk in elderly patients is the FROP-Com screening tool (Russel, Hill, Blackberry, Day, & Dharmage, 2008). The tool comprises 13 fall-risk metrics (falls history, medications, medical conditions, sensory loss, feet and footwear, cognitive status, continence, nutrition, environment, functional behavior, function, balance, and gait/physical activity) in the format of 28 questions and physical examinations. In addition to being a risk calculator, the tool provides a recommendation for interventions with respect to the risk factors registered. The sensitivity of the tool is 67.1% and the specificity is 66.7%. The tool was developed when studying 344 community-dwelling older people who had a previous history of falling. The authors concluded their tools have a relatively good capacity for predicting falls and is relatively simple to use in situations where time is limited. This is the ideal test for multidisciplinary team implementation of falls prevention program and should be given serious consideration should an organization have such team working on this issue. It is time prohibitive for nursing alone.

Analysis of Fall-Risk Tools

There are many fall-risk tools currently being used by hospitals, health clinics, rehabilitation centers, and long-term care facilities. Table 1 summarizes the most common ones. As it can be observed from this table, the sensitivity (i.e., ability to detect falls when they are present) and specificity (i.e., ability to identify correctly the absence of falls) vary greatly among these tools. Furthermore, most of these tools range from 5 to 8 questions; the only exception is the FROP-Com tool, which contains 28 questions. When designing a fall-risk tool, there is a tradeoff between simplicity and comprehensiveness. If the tool incorporates too many risk factors, it will be very hard to integrate into an everyday nursing process. However, if the tool does not cover the most important risk factors, it may not be a reliable predictor of fall risk.

Table 2 depicts the most common fall-risk factors that appear in the literature and how they are related to eight fall tools.

Table 1

Fall-Risk Tools

Tool	Sensitivity	Specificity	# of Questions	Reputation
Schmid (Schmid, 1989)	93%	78%	5	Cited by 138
STRATIFY (Oliver et al., 1987)	92%	68%	7	Cited by 689
Downtown (Nyberg & Gustafson, 1996)	91%	27%	5	Cited by 121
Hendrich II (Hendrich, Bender, & Nyhuis, 2003)	75%	73.90%	8	Cited by 335
Morse Fall Scale (Morse, Morse, & Tylko, 1989)	72%	51%	6	Cited by 302
FRAT (Stapleton et al., 2009)	70.20%	68.80%	6	Cited by 33
John Hopkins (Poe, Cvach, Gartnell, Radzik, & Joy, 2005)	69%	60%	7	Cited by 78
FROP-COM (Russell, Hill, Blackberry, Day, & Dharmage, 2008)	67.10%	66.70%	28	Cited by 99

As can be observed from below Table 2, most tools cover the following metrics: cognitive/confusion/agitated/mental health, fall history, gait/balance/mobility/strength, medication, and urinary/bowel incontinence/elimination. Another observation is that in general, each tool covers between 20%–35% of the risk factors. So, the main differences in these tools is how each tool weights the risk factors. As described in the introduction, the hospital selected for this study uses the HFRM II. This seems a reasonable choice because this tool has a strong reputation into the health community. The original article on Hendrich II (Hendrich et al., 2003) has been cited 335 times. Furthermore, this tool is known for its reliability in predicting fall risk, as well as the fact that it is very simple to use. Its sensitivity and specificity are in line with the other fall-risk tools; moreover, it tracks the most important risk factors (as shown in table 2) and seems simple enough to be added to a nursing process.

Table 2

Tools and Fall Risk Factors

Factor\Tool	MFS	HFRM II	STRATIFY	FRAT	FROP-COM	Downtown	Johns Hopkins	Schmid	Total	Proportion Per Tool (%)
Cognitive/confusion/agitation/mental health	1	1	1	1	1	1	1	1	8	100.00
Fall history	1		1	1	1	1	1	1	7	87.50
Gait/balance/mobility/strength	1	1	1		1	1	1	1	7	87.50
Medication		1		1	1	1	1	1	6	75.00
Urinary/bowel incontinence/elimination		1	1		1		1	1	5	62.50
Sensory loss			1		1	1			3	37.50
Patient care equipment	1				1		1		3	37.50
Depression		1		1					2	25.00
Medical conditions	1				1				2	25.00
Dizziness/vertigo		1			1				2	25.00
Gender		1							1	12.50
Environmental hazards					1				1	12.50
IV therapy	1								1	12.50
Footwear					1				1	12.50
Nutrition					1				1	12.50
Low/high body mass index					1				1	12.50
Age							1		1	12.50
Functional behavior					1				1	12.50
Undertreated pain									0	0.00
Fear of falling									0	0.00
Total	6	7	5	4	14	5	7	5		
Proportion Per Factor (%)	30	35	25	20	70	25	35	25		

Hospital Data Analysis

The goal of this study is to evaluate if the HFRM II was being correctly used by RNs at a local community hospital. Despite of the use of this tool and fall interventions, falls still occur in this hospital. During the fall 2017 semester, three students of the University of San Francisco received training on fall-risk best practices as well as the HFRM II tool. These students, independent of the hospital's staff, applied the HFRM II tool with patients who had been previously assessed for fall risk by RNs. The main objective was to determine whether there were statistical differences between the HFRM II data collected by the students and the data collected by the RNs. To this end, the students collected data from 7 hospital units. The data were then grouped with the data collected by RNs. In the aggregated data, there were 106 patient entries. This data set contained the result of the HFRM II assessment performed by the students and by the RNs for each patient. The data comprised the following:

- Confusion, disorientation, impulsivity (4)
- Symptomatic depression (2)
- Altered elimination (1)
- Dizziness, vertigo (1)
- Male gender (1)
- Any administered antiepileptics (2)
- Any administered benzodiazepines (1)
- Get Up and Go Test (0, 1, 3, or 4)
- Total (0 to 16 points)

Note that there were some criteria for data exclusion when aggregating the data collected by students and RNs, the causes of exclusion were:

- Patients for whom RNs collected data but students were unable to
- Patients for whom students collected data but RNs were unable to
- Patients whom RNs identified as too combative or otherwise unable to participate in assessment due to other factors
- Patients who were on strict bedrest

Table 3 contains the average values collected by the RNs and students from all 7 units. From this table it is possible to note that few patients presented “Confusion, disorientation, impulsivity,” or “Depression.” Furthermore, few patients had taken antiepileptics or benzodiazepines. The main conclusion that can be draw from Table 3 is that students and RNs significantly differed in the following categories: symptomatic depression; dizziness, vertigo; any administered antiepileptics; any administered benzodiazepines; and the Get Up and Go Test.

Table 3

Average Values—Aggregated Data—All Units

All Units (106 patients)		
Aggregated Data		
	Mean (Students)	**Mean (RNs)**
Confusion, disorientation, impulsivity (4)	0.377	0.34
Symptomatic depression (2)	0.038	0.075
Altered elimination (1)	0.368	0.368
Dizziness, vertigo (1)	0.33	0.028
Male gender (1)	0.425	0.434
Any administered antiepileptics (2)	0.264	0.208
Any administered benzodiazepines (1)	0.217	0.123
Get Up and Go Test	1.292	1.764
Hendrich total value	3.311	3.472
PMAT	3.65	3.688

To have a more in-depth analysis, Table 4 presents the amount of discrepancies from data collected from students and RNs from the same patients.

Table 4

Discrepancies of Values Measured by RNs vs. Students

	Total Discrepancies (in 106)	Difference (%)	Similarity (%)
Confusion, disorientation, Impulsivity (4)	9	8.491	91.509
Symptomatic depression (2)	6	5.66	94.34
Altered elimination (1)	32	30.189	69.811
Dizziness, vertigo (1)	36	33.962	66.038
Male gender (1)	1	0.943	99.057
Any administered antiepileptics (2)	13	12.264	87.736
Any administered benzodiazepines (1)	22	20.755	79.245
Get Up and Go Test (4)	64	60.377	39.623
Hendrich total value (16)	81	76.415	23.585
PMAT	66	62.264	37.736
High risk of falling according to HFRM II	26	24.528	75.472

From the Table 4, it is possible to see the students and RNs got similar results in the following metrics:

- Confusion, disorientation, impulsivity (91% of the results are similar)
- Symptomatic depression (94% similar results)
- Male gender (99% similar results—surprisingly, one patient was categorized as male by the students and female by the RNs)

And they got different results from the below metrics:

- Altered elimination (30% of the results are different)
- Dizziness, vertigo (34% of the results are different)
- Any administered antiepileptics (12% of the results are different)
- Any administered benzodiazepines (20% of the results are different)
- Get Up & Go test (60% of the results are different)
- Hendrich Total Score (78% of the results are different)

- Risk of falling (if total greater than 5; 25% of the results are different)

25% of the time, students and RNs differ about whether a patient is at risk of falling. When the conflict arises, students determine that the patient is at risk of a fall, whereas RNs will say the patient will not fall. Another important value that can be observed from Table 4 is that there are big discrepancies in the Get Up and Go Tests conducted by RNs and students. This part of the tool requires a physical assessment of the patient, and this might have a significant impact on whether the patient is at risk of a fall or not.

Z-tests were performed by the students to further study if the values measured by RNs were significantly different from those collected by the students. In this analysis, a confidence level of 95% (i.e., alpha = 0.05) was used. These tests showed that with 95% confidence the values of “dizziness, vertigo” measured by RNs have a significant statistical difference to those measured by students. Furthermore, the “Get Up and Go” values measured by RNs also showed a significant statistical difference to those values measured by the students. This generated a red flag about how the RNs were conducting the HFRM II assessment.

Table 5 depicts the percentage of patients considered at risk of falling as measured by students and RNs. It can be observed that the students said 29% of the 106 patients were at risk of falling, whereas the RNs categorized 25% of the patients as being at risk of a fall.

Table 5

Proportion of Patients with Risk of Fall

	Students (%)	**RNs (%)**
Patients with High Risk of Falling (HFRM II greater than 5)	29.20	25.50

Finally, the hospital also uses a PMAT test to check whether a client has compromised mobility and which tools should be used to mobilize the patient; that, in turn, can indicate the risk of falling. As can be seen in Table 6, RNs did not perform the PMAT 40% of the time.

Again, this is a physical examination that might require extra time. Students executed the PMAT in 97% of cases. In 60% of cases where PMAT was evaluated by both RNs and Students, the results were similar.

Table 4

Lack of PMAT Test

	# Lack of PMAT	Lack of PMAT (%)	PMAT (%)
Students	3 in 106	2.83	97.17
RNs	42 in 106	39.623	60.377

Conclusion

To summarize, a local community hospital uses the HFRM II fall-risk tool. According to the literature, this tool is reliable, simple, and commonly used in health care settings to predict the risk of falls. Despite using this tool, this hospital still has patients who fall. A performance improvement project was conducted to check whether RNs are using this tool correctly. To this end, three students from the University of San Francisco assessed patients for fall risk over the course of 2 months. The data showed that the hospital's RNs can improve on two components: assessing dizziness and vertigo, and Get Up and Go Test. A possible explanation for this situation is that in a busy RN's workload, there is no uniformity of approach as of how to do it, this part of the HFRM II plus PMAT consumes too much of the RN's time; consequently, it is not being executed correctly. Another possibility for the increased number of falls is that the nursing interventions the hospital adopts when a patient is deemed at risk of falling are not implemented uniformly. As for future research, the hospital should compute the specificity and sensitivity of HFRM II on its premises and reanalyze its fall-prevention policies.

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