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Revealing the Tension: The Relationship Between High Fall Risk Categorization and Low Patient Mobility

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Abstract

Background: Using an inpatient fall risk assessment tool helps categorize patients into risk groups whom can then be targeted with fall prevention strategies. While potentially important in preventing patient injury, fall risk assessment may unintentionally lead to reduced mobility among hospitalized patients. Here we examined the relationship between fall risk assessment and ambulatory status among hospitalized patients.

Methods: We conducted a retrospective cohort study of consecutively admitted adult patients (n=48,271) to a quaternary urban hospital that provides care for patients of broad socioeconomic and demographic backgrounds. Non-ambulatory status, the primary outcome, was defined as a median Johns Hopkins Highest Level of Mobility <6 (i.e., patient walks less than 10 steps) throughout hospitalization. The primary exposure variable was the Johns Hopkins Fall Risk

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Assessment Tool (JHFRAT) category (Low, Moderate, High). The capacity to ambulate was assessed using the Activity Measure for Post-Acute Care (AM-PAC). Multivariable regression analysis controlled for clinical demographics, JHFRAT items, AM-PAC, comorbidity count, and length of stay.

Results: 8% of patients at low risk for falls were non-ambulatory, compared to 25% and 54% of patients at moderate and high risk for falls, respectively. Patients categorized as high risk and moderate risk for falls were 4.6 (95% CI: 3.9–5.5) and 2.6 (95% CI: 2.4–2.9) times more likely to be non-ambulatory compared to patients categorized as low risk, respectively. For patients with high ambulatory potential (AM-PAC 18–24), those categorized as high risk for falls were 4.3 (95% CI: 3.5–5.3) times more likely to be non-ambulatory compared to patients categorized as low risk.

Conclusions: Patients categorized into higher fall risk groups had decreased mobility throughout their hospitalization, even when they had the functional capacity to ambulate.

Keywords

Inpatients; accidental falls; health services research; quality improvement

Introduction

Up to 1 million falls are reported in U.S. hospitals each year, making falls the most commonly reported adverse event.[1–3] Falls also contribute largely to the cost of health care, with studies showing that inpatient fall injuries increase cost of care by approximately $7,000 per fall.[1,2,4] Additionally, patients who fall during hospitalization are more likely to have longer length of stay (LOS) and higher needs for post-acute care services (e.g., skilled nursing facilities).[5] Over the last two decades, particularly since the implementation of the Center for Medicare and Medicaid Services Hospital-Acquired Conditions Reduction Program, researchers have attempted to generate strategies that significantly reduce in-hospital falls.[6]

Per national evidence-based fall prevention guidelines, an essential first step to reduce in-hospital falls is to use a risk-assessment tool.[7] Our institution uses the Johns Hopkins Fall Risk Assessment Tool (JHFRAT), which assess potential risk in 7 clinical domains (age, fall history, mobility, elimination, mental status changes, medication, and patient care equipment) and assesses similar domains as other commonly used inpatient fall assessment tools (e.g., Morse Fall Scale, Hendrich Fall Risk Model).[8] The JHFRAT tool categorizes patients as low, moderate or high fall risk and can help target fall-reduction tactics and interventions by the care team. But categorizing patients into higher fall risk groups may also have undesired consequences.

Researchers have suggested that heightened focus on falls prevention may lead to unintentional reduction in patient mobility; in part, due to the use of strategies such as bed and chair alarms.[9–11] Patients, their families, and nursing staff may also be more hesitant to engage patients in out of bed mobility once they are identified as having higher risk for falls.[9–13] Limiting mobility further due to fall risk is concerning, especially given existing problems with immobility in most hospitals. Bedrest is already common among hospitalized

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patients and has been shown to be closely linked to poor clinical outcomes (e.g., higher incidence of delirium, pressure injuries), higher cost of care, disability, and mortality.[9]

Despite the apparent impact of fall risk assessment on patient mobility, this relationship has not been studied using clinical data. Hence, the objective of this study was to examine the relationship between patient fall risk categorization and mobility levels during hospitalization. In addition, we examined differences in mobility among patients with similar capacity for mobilization but with different fall risk assessment scores. These findings will help inform the way fall reduction strategies are considered in the context of safe patient mobility in the hospital.

Methods

Institutional Setting and Study Population

We conducted a retrospective cohort study of consecutively admitted adult patients to a quaternary large urban academic medical center (1,000 beds) between January 1, 2017 and September 30, 2019. All general adult medical, surgical and neuroscience units were included except the emergency department, post-operative recovery units, intensive care units, and inpatient psychiatry. Also, patients were excluded if they had a fall documented during their hospital stay, <0.3% of the sample (n=135), since a fall is likely to introduce difficulty in measuring changes in care that would confound the relationship between fall risk and a patients' ambulatory status. This study was approved by the Johns Hopkins Medicine Institutional Review Board.

Ambulatory Status

The primary outcome in this study was ambulatory status during the hospital stay, measured using the Johns Hopkins-Highest Level of Mobility (JH-HLM). The JH-HLM is a valid and reliable 8-point ordinal scale that quantifies a patient's highest level of patient mobility on a daily basis.[14,15] The levels of the JH-HLM are (1) lying in bed, (2) bed activities (e.g. rolling), (3) sitting at edge of bed, (4) transferring to chair/commode, (5) standing for ≥1 minute, (6) walking ≥10 steps, (7) walking ≥25 feet, and (8) walking ≥250 feet. Documentation of JH-HLM is a hospital-wide policy for nurses at least once per shift and internal reports show that daily documentation rates for the units in this study were >90%. Since JH-HLM could be documented more than once per day, we identified the maximum JH-HLM score per patient day and then calculated the median JH-HLM score across admission days for each patient. Patients were considered non-ambulatory if they had a median JH-HLM score <6 as this would indicate that they ambulated less than 10 steps on at least half of the days they were hospitalized. Patients were excluded if the primary outcome (ambulatory status) was missing.

Fall Risk Assessment

The patients' fall risk was evaluated using the Johns Hopkins Fall Risk Assessment Tool (JHFRAT).[8] This is a widely used, valid, and reliable tool for fall risk stratification during hospitalization for the adult population.[16,17] The JHFRAT includes 7 items considered to influence the risk of falls including age, fall history, urinary frequency and/or incontinence,

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medications (e.g., PCA/opiates, anticonvulsants, anti-hypertensives, diuretics, hypnotics, laxatives, sedatives, and psychotropics), equipment that tethers patient (e.g., lines, tubes), mobility, and cognition. In routine care, the sum of individual items (i.e., total JHFRAT score) is used to stratify patients' fall risk into three categories (i.e., low fall risk: <6 points; moderate fall risk: 6–13 points; high fall risk: >13 points). At our institution, the JHFRAT was completed at least once per shift by nursing. The highest fall risk category documented 48 hours after hospital admission provided the most complete and consistent assessment for all patients and was used for all data analyses as the primary independent variable. The total JHFRAT scores are also used to establish fall prevention strategies or interventions. Hence, after nurses score the JHFRAT tool, they then select possible fall prevention interventions. At our institution, these interventions include reorientation, pharmacy review, protective devices, room change for improved visibility, the need for physical therapy consult, constant observation 24-hour observer, bed or chair exit alarm, bedside commode, elimination schedule, supervised ADL/sitting/toileting, low bed, and safety rounds. We identified the following interventions as interventions potentially limiting patient mobility from the nursing team: (1) bed or chair exit alarm, (2) need for physical therapy consultation, (3) 24-hour observer, and (4) bedside commode. For the analysis, we calculated the number of fall prevention interventions selected by nurses per day of hospitalization.

Additional Variables (Covariates)

A key covariate of ambulatory status is the patient's functional capacity for mobility. In this study, the patients' level of function was measured using the Activity Measure for Post-Acute Care (AM-PAC) Inpatient Mobility Short Form; a 6-item short form used to score the level of assistance needed to complete six basic mobility tasks (e.g., move up in bed, transfer from bed to chair).[18,19] The AM-PAC is valid when scored using clinicians' judgement and overall assessment for those items not observed. Items are scored on a scale ranging from 1–4 with overall raw scores between 6–24, higher scores indicate higher levels of mobility or higher potential for independent ambulation. As part of routine care, nursing staff documented AM-PAC on admission and at least three times a week (Monday, Wednesday, Friday) during the study period. For this study, the lowest AM-PAC score obtained by nursing within the first 24 hours of hospital admission was used to characterize a patient's ambulatory potential. Low ambulatory potential was defined as AM-PAC raw scores between 6–17 and high ambulatory potential was defined as AM-PAC raw scores between 18–24. These levels were chosen based on prior research we have conducted related to patient's expected level of mobility based on their functional capacity.[20]

Other variables were included in our analysis based on their potential to influence ambulatory status in the hospital including LOS, sex, race (white, black, other), payer (Medicare, Medicaid, other), primary admission diagnosis, and comorbidity index.[21] The individual JHFRAT items were also included as covariates, recoded as binary variables to represent presence or absence of a specific fall risk factor (e.g., age=0 represented patients younger than 60 years old).

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Data Sources

All data was obtained from the electronic medical records. Clinical data obtained for this study, including fall risk assessment and mobility scores, are already used in hospital reporting and have been extensively validated via manual chart review (unpublished). For this study, we also performed a manual chart audit on a sample of records (n=110 patients; 2,190 total records). It was confirmed that the fall risk assessment and mobility scores entered in the electronic medical record matched the data extracted in all cases.

Statistical Analysis

Demographic and clinical characteristics of the patients were summarized with frequencies and percentages for categorical variables and medians and interquartile ranges (IQRs) for continuous variables. Chi-square tests (categorical data) and Wilcoxon rank-sum tests (continuous data) were used to examine baseline differences between ambulatory and non-ambulatory patient groups. We utilized a series of univariable and multivariable logistic regressions to estimate the odds of patients being non-ambulatory (primary outcome) as a function of the fall risk category (primary independent variable) and demographic and clinical characteristics. Univariable logistic regressions were performed for each variable, including covariates, with ambulation status as the dependent variable to calculate unadjusted odds ratios (OR) and 95% confidence intervals (95% CI). A multivariable regression model including all covariates was then used to calculate adjusted ORs and 95% CI. We also examined whether the relationship between fall risk and ambulation status was potentially moderated by ambulatory potential (i.e., AM-PAC score). To do this, we created a second model that included interaction terms between the three-level fall risk categories for patients with high ambulatory potential (AM-PAC score ≥18). Lastly, we compared the number of fall prevention interventions per day of hospitalization for patients in different fall risk groups and by ambulation status using a Kruskal-Wallis test. All analyses were conducted using SAS® version 9.4 (2016, Cary, NC).

Results

We identified 48,271 patients meeting our inclusion criteria between January 1, 2017 and September 30, 2019 (Table 1). The resultant cohort was 49% female, 56% Caucasian, had a median age of 58 years (IQR: 45–68), and 36% had Medicaid. The median JHFRAT score among those in our cohort was 8 (IQR: 5–10; indicative of moderate fall risk), and 75% of the patients included had raw AM-PAC scores 18–24 (indicative of high ambulatory potential). The average LOS was 5 days (IQR: 3–9). Statistically significant differences were found between ambulatory and non-ambulatory patients for all variables and covariates (Table 1).

In our unadjusted analysis, only 8% of patients with low risk of falls (JHFRAT <6) were non-ambulatory (Figure 1). In turn, 25% and 54% of patients with moderate (JHFRAT 6–13) and high (JHFRAT >13) risk of falls were non-ambulatory, respectively. For patients with high ambulatory potential (AM-PAC 18–24), 25% and 54% of patients categorized as moderate and high fall risk were non-ambulatory, respectively.

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In our multivariable regression analysis, we found that patients classified as high risk for falls (JHFRAT ≥13) had 4.6 (95% CI: 3.9–5.5) greater odds of being non-ambulatory than those classified as low risk for falls (JHFRAT < 6), when controlling for ambulatory potential and all other covariates (Table 2). We also found that those at moderate risk for falls had 2.6 (95% CI: 2.4–2.9) greater odds of being non-ambulatory than those at low risk for falls.

Additionally, we found significant associations between patient ambulatory status and individual JHFRAT items. Bowel or urine incontinence and equipment that tethers patients were associated with higher odds of non-ambulatory status (OR: 1.3 [95% CI: 1.2–1.3]; OR: 1.1 [95% CI: 1.1–1.2], respectively). Conversely, medications linked with fall risk were associated with patients being more ambulatory (non-ambulatory status OR: 0.9 [95% CI: 0.8–0.9]).

For patients with high ambulatory potential (AM-PAC 18–24), those categorized as high and moderate risk for falls had 4.3 (95% CI: 3.5–5.3) and 2.9 (95% CI: 2.6–3.2) greater odds of being non-ambulatory compared to similar patients with low risk for falls, respectively (Table 3).

For all patients, the median (IQR) number of fall risk interventions per day was 3 (2.5, 3.8). A greater number of fall risk interventions were seen in the non-ambulatory compared to ambulatory patients (median (IQR): 3.6 (2.9, 4.5) vs. 2.9 (2.4, 3.5), respectively, $p<0.001$). (Table 4). Further, as fall risk increased so did the number of fall prevention interventions per day. For patients at moderate to high fall risk, more interventions with the potential to limit mobility were seen than those at low fall risk.

Discussion

In this study we examined the relationship between in-hospital fall prevention strategies and patient ambulation by evaluating the association between patients' risks for falls and their actual ambulatory status throughout their hospitalization. We found that patients who had the functional capacity to ambulate and were categorized as moderate to high fall risk, ambulated less often than patients with similar functional capacity but were categorized as low risk for falls. Also, patients categorized as high risk for falls who were non-ambulatory received the highest number of interventions that we considered likely to limit mobility. These results reveal the paradox between fall risk prevention and mobility promotion where ongoing efforts (i.e., fall risk assessments and interventions) to reduce in-hospital falls may, at least in part, decrease mobility among patients who have the capacity for ambulation.

There are several factors that may contribute to decreased mobility among those identified as high risk for falls. For example, it is possible that clinicians are more hesitant to mobilize patients classified as high risk for falls compared to those at lower risk for falls. This is supported by previous studies that have reported both patients and nurses cite concerns about falling as a barrier to patient mobility.[13,22,23] However, studies examining mobility promotion interventions have not reported any increases in falls, with a recent systematic review reporting that mobility promotion programs may decrease the number of falls

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among hospitalized older adults.[24,25] Additional training on safe patient handling, as well as appropriate mobility facilitation skills may improve the confidence of clinicians to mobilize patients considered to be at moderate or high risk for falls.

It is also possible that individual items used to calculate patient fall risk on the JHFRAT are also barriers to patient mobility, which is supported by the results reported in Table 4. For example, patients with equipment that tethers them to the bed or wall (e.g., negative pressure wound therapy) are considered risk factors for falls on the JHFRAT. Tethering equipment may also have a detrimental effect on patient mobility levels, as they often need to be disconnected or carried out of the room to achieve higher mobility scores, and patients may be unable to do so independently. Given the additional time and personnel resources that managing tethering equipment may take, it is possible that clinicians and patients prefer to stay in bed or limit mobility to the bedside. As such, patient care teams should consider minimizing tethering equipment (e.g., lines, tubes, drains) to those considered absolutely necessary, and review the need of each tethering equipment every day. When equipment must be used, the patient care team should attempt to minimize the negative impact of the equipment on mobility. For example, using equipment and placement that promotes mobility such as IV poles with handles), smaller urine collection bags, ensuring mobility assistive devices such as walkers are available and environments with adequate spaces to mobilize are provided.[26–29]

Decreased mobility among patients at moderate to high fall risk could be related to the fall risk reduction strategies used for patients in these fall risk categories. For example, interventions such as bed/chair exit alarms and constant observers are more commonly used among patients categorized as high risk for falls and may discourage patients from getting out of bed or chairs to ambulate.[30] Clinicians need to balance the impact on patient mobility levels when determining appropriate fall reduction interventions for each patient. To date, there is weak or contrary evidence that exit alarms are an effective means to prevent falls, even if some staff or individuals at risk may be helped or reassured by them. The routine use of alarms is not included in clinical practice guidelines for fall prevention strategies, as well as the use of technology like movement sensors, virtual sitters, and/or continuous virtual monitoring.[31–34] A patient-centered approach that identifies all modifiable risk factors for each patient, and addresses each factor appropriately using evidence-based interventions is recommended but continues to be a gap in practice.[35] It is also important to note that there is a scarcity of studies that systematically evaluate specific fall risk interventions and their impact on patient outcomes by fall risk category. To our knowledge, there is not a valid and reliable algorithm to assist in the selection of optimal fall risk interventions. Hence, the use of specific falls prevention interventions is based on nursing clinical expertise, representing an important gap in research and clinical practice.

The results of this study highlight two seemingly competing priorities – falls reduction and mobility promotion. Falls reduction strategies generally take a defensive approach by eliminating opportunities for patients to fall, which was associated with reduced patient mobility in our cohort. Since the deleterious effects of reduced patient mobility have been extensively demonstrated, our results present an opportunity for improving in-hospital care. It is possible to envision a more synergistic approach between falls prevention and

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mobility promotion where a culture of safe patient mobility substitutes for a singular focus on falls prevention. This approach is supported by previous studies that show increased mobility does not lead to increased falls and may actually reduce the number of falls among hospitalized patients.[24,25] Although the mechanism by which mobility promotion reduces falls has not been elucidated, it is possible that it stems from (1) additional training for clinical staff regarding safe patient handling, (2) increased patient mobility leading to improved overall physical function, and/or, (3) more frequent, staff assisted patient mobilization decreasing patients' attempts to mobilize out of bed independently. Towards this vision, at our institution we strongly advocate for incorporating safe patient mobility into fall prevention plan but gaps in practice continue to exist. Additional studies should examine the use of safe mobility promotion to reduce falls, especially given the benefits of increased patient mobility.

In terms of falls reduction strategies, a recent initiative[36] focused on generating international guidelines for falls prevention and management recommends replacing scored fall risk tools for comprehensive fall risk assessments, tailored education for fall risk prevention, and personalized prevention strategies based on the factors, behaviors or situations identified.[34,37] The authors of the global guidelines argue that scored fall risk tools are time consuming, do not help in identifying underlying risk factors, and are not essential to reduce falls rates.[38,39] In this study, we used a scored fall risk tool (i.e., JHFRAT) and we provide further evidence of the potential negative consequences of fall risk scoring and broad categorization. In turn, best practice for fall prevention should include comprehensive fall risk assessments, tailored education to the unique hospital environment, as well as the particular needs of the patients and caregivers.[40,41] For patients with mobility limitations, in particular, using an approach where a patient's mobility capability is considered to guide a daily mobility milestone (e.g. the Johns Hopkins Mobility Goal Calculator) has been shown to help promote mobility in a safe manner.[20,42]

This study has multiple strengths including a robust patient sample and the inclusion of measures for both ambulatory potential and ambulatory status throughout hospitalization. Most hospitals in the United States do not document any measure of mobility while fall risk assessments and interventions are documented regularly.[43] As such, this study may be difficult for other hospitals to replicate. Although mobility is not currently recognized as a quality metric like falls, we believe our results suggest that it should be considered.[9,10]

There are several limitations to this study. First, despite our large sample and broad patient population, this is a single site study, which may limit the generalizability of our findings. For example, our sample is comprised of a younger population (median: 58 years old), but who still may be vulnerable to the negative consequences of immobility during hospitalization.[44] Moreover, the sequelae of immobilization are likely to be even more significant on an older population. Second, we designated patient's mobility status and fall risk over the patient's hospitalization, which may not fully account for the dynamic nature of a patient's status over time. Finally, the data used in this study represent practices prior to the pandemic. Although we are seeing practice patterns return to pre-pandemic levels, we recognize that larger systemic changes (i.e., staff turn-over, staff shortages) continue to be

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issues that may further worsen mobility levels. Examination of these system-level changes, as the state of the healthcare field recovers post-pandemic, need to be examined furthered.

Conclusion

Patients categorized as being at higher risk for falls are significantly less likely to be ambulatory during their inpatient stay compared to patients at lower risk for fall with similar levels of ambulatory potential. Even patients who have the capability to be more mobile but are categorized as higher fall risk, are less ambulatory. Given the importance of patient mobility levels on patient outcomes and cost of care, hospitals should consider clinical staff training and fall reduction strategies that promote mobility even among those considered to be at higher risk of falls.

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References

1. Joint Commission. Preventing falls and fall-related injuries in health care facilities. Sentin Event Alert. 2015;(55):1–5.
2. Agency for Healthcare Research and Quality. National Scorecard on Hospital-Acquired Conditions Updated Baseline Rates and Preliminary Results 2014–2017.
3. Mion LC, Chandler AM, Waters TM, et al. Is it possible to identify risks for injurious falls in hospitalized patients? Jt Comm J Qual Patient Saf. 2012;38(9):408–413. doi:10.1016/s1553-7250(12)38052-5 [PubMed: 23002493]
4. Venema DM, Skinner AM, Nailon R, Conley D, High R, Jones KJ. Patient and system factors associated with unassisted and injurious falls in hospitals: an observational study. BMC Geriatr. 2019;19(1):348. doi:10.1186/s12877-019-1368-8 [PubMed: 31829166]
5. Hill AM, Jacques A, Chandler AM, Richey PA, Mion LC, Shorr RI. In-Hospital Sequelae of Injurious Falls in 24 Medical/Surgical Units in Four Hospitals in the United States. Jt Comm J Qual Patient Saf. 2019;45(2):91–97. doi:10.1016/j.jcjq.2018.08.005 [PubMed: 30269964]
6. Health Research & Educational Trust. Preventing Patient Falls: A Systematic Approach from the Joint Commission Center for Transforming Healthcare Project.; 2016.
7. Degelau J, Belz M, Bungum L, et al. Prevention of Falls (Acute Care). Inst Clin Syst Improv. Updated April 2012.
8. Poe SS, Dawson PB, Cvach M, et al. The Johns Hopkins Fall Risk Assessment Tool: A Study of Reliability and Validity. J Nurs Care Qual. 2018;33(1):10–19. doi:10.1097/NCQ.0000000000000301 [PubMed: 28968337]

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

9. Wald HL, Ramaswamy R, Perskin MH, et al. The Case for Mobility Assessment in Hospitalized Older Adults: American Geriatrics Society White Paper Executive Summary. J Am Geriatr Soc. Published online October 1, 2018. doi:10.1111/jgs.15595
10. Growdon ME, Shorr RI, Inouye SK. The Tension Between Promoting Mobility and Preventing Falls in the Hospital. JAMA Intern Med. 2017;177(6):759–760. doi:10.1001/jamainternmed.2017.0840 [PubMed: 28437517]
11. Brown CJ, Redden DT, Flood KL, Allman RM. The underrecognized epidemic of low mobility during hospitalization of older adults. J Am Geriatr Soc. 2009;57(9):1660–1665. doi:10.1111/j.1532-5415.2009.02393.x [PubMed: 19682121]
12. Lim SH, Ang SY, Ong HK, et al. Promotion of mobility among hospitalised older adults: An exploratory study on perceptions of patients, carers and nurses. Geriatr Nur (Lond). 2020;41(5):608–614. doi:10.1016/j.gerinurse.2020.03.015
13. Dermody G, Kovach CR. Barriers to Promoting Mobility in Hospitalized Older Adults. Res Gerontol Nurs. 2018;11(1):17–27. doi:10.3928/19404921-20171023-01 [PubMed: 29370443]
14. Hoyer EH, Young DL, Klein LM, et al. Toward a Common Language for Measuring Patient Mobility in the Hospital: Reliability and Construct Validity of Interprofessional Mobility Measures. Phys Ther. 2018;98(2):133–142. doi:10.1093/ptj/pzx110 [PubMed: 29106679]
15. Hiser S, Chung CR, Toonstra A, et al. Inter-rater reliability of the Johns Hopkins Highest Level of Mobility Scale (JH-HLM) in the intensive care unit. Braz J Phys Ther. Published online August 8, 2020. doi:10.1016/j.bjpt.2020.07.010
16. Kim YJ, Choi KO, Cho SH, Kim SJ. Validity of the Morse Fall Scale and the Johns Hopkins Fall Risk Assessment Tool for fall risk assessment in an acute care setting. J Clin Nurs. doi:10.1111/jocn.16185
17. McKechnie D, Pryor J, Fisher MJ. Predicting falls: considerations for screening tool selection vs. screening tool development. J Adv Nurs. 2016;72(9):2238–2250. doi:doi:10.1111/jan.12977 [PubMed: 27101943]
18. Jette DU, Stilphen M, Ranganathan VK, Passek SD, Frost FS, Jette AM. Validity of the AM-PAC “6-Clicks” inpatient daily activity and basic mobility short forms. Phys Ther. 2014;94(3):379–391. doi:10.2522/ptj.20130199 [PubMed: 24231229]
19. Jette DU, Stilphen M, Ranganathan VK, Passek S, Frost FS, Jette AM. Interrater Reliability of AM-PAC “6-Clicks” Basic Mobility and Daily Activity Short Forms. Phys Ther. 2015;95(5):758–766. doi:10.2522/ptj.20140174 [PubMed: 25504489]
20. Klein LM, Young D, Feng D, et al. Increasing patient mobility through an individualized goal-centered hospital mobility program: A quasi-experimental quality improvement project. Nurs Outlook. 2018;66(3):254–262. doi:10.1016/j.outlook.2018.02.006 [PubMed: 29705382]
21. Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity measures for use with administrative data. Med Care. 1998;36(1):8–27. [PubMed: 9431328]
22. Hoyer EH, Brotman DJ, Chan KS, Needham DM. Barriers to early mobility of hospitalized general medicine patients: survey development and results. Am J Phys Med Rehabil. 2015;94(4):304–312. doi:10.1097/phm.0000000000000185 [PubMed: 25133615]
23. Brown CJ, Williams BR, Woodby LL, Davis LL, Allman RM. Barriers to mobility during hospitalization from the perspectives of older patients and their nurses and physicians. J Hosp Med. 2007;2(5):305–313. doi:10.1002/jhm.209 [PubMed: 17935241]
24. Hshieh TT, Yue J, Oh E, et al. Effectiveness of multicomponent nonpharmacological delirium interventions: a meta-analysis. JAMA Intern Med. 2015;175(4):512–520. doi:10.1001/jamainternmed.2014.7779 [PubMed: 25643002]
25. Hoyer EH, Friedman M, Lavezza A, et al. Promoting mobility and reducing length of stay in hospitalized general medicine patients: A quality-improvement project. J Hosp Med. 2016;11(5):341–347. doi:10.1002/jhm.2546 [PubMed: 26849277]
26. Constantin S, Dahlke S. How nurses restore and maintain mobility in hospitalised older people: An integrative literature review. Int J Older People Nurs. 2018;13(3):e12200. doi:10.1111/opn.12200 [PubMed: 29770560]

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

27. Geelen SJG, van Dijk - Huisman HC, de Bie RA, et al. Barriers and enablers to physical activity in patients during hospital stay: a scoping review. Syst Rev. 2021;10(1):293. doi:10.1186/s13643-021-01843-x [PubMed: 34736531]
28. Geelen SJG, Giele BM, Engelbert RHH, et al. Barriers to and solutions for improving physical activity in adults during hospital stay: a mixed-methods study among healthcare professionals. Disabil Rehabil. 2022;44(15):4004–4013. doi:10.1080/09638288.2021.1879946 [PubMed: 33605171]
29. Koenders N, Marcellis L, Nijhuis-van der Sanden MW, Satink T, Hoogeboom TJ. Multifaceted interventions are required to improve physical activity behaviour in hospital care: a meta-ethnographic synthesis of qualitative research. J Physiother. 2021;67(2):115–123. doi:10.1016/j.jphys.2021.02.012 [PubMed: 33753014]
30. Hempel S, Newberry S, Wang Z, et al. Hospital Fall Prevention: A Systematic Review of Implementation, Components, Adherence, and Effectiveness. J Am Geriatr Soc. 2013;61(4):483–494. doi:10.1111/jgs.12169 [PubMed: 23527904]
31. Fehlberg EA, Lucero RJ, Weaver MT, et al. Impact of the CMS No-Pay Policy on Hospital-Acquired Fall Prevention Related Practice Patterns. Innov Aging. 2017;1(3):igx036–igx036. doi:10.1093/geroni/igx036 [PubMed: 29911187]
32. Oliver David. Do bed and chair sensors really stop falls in hospital? | The BMJ. BMJ. 2018;360(k433). Accessed October 13, 2022. https://www.bmj.com/content/360/bmj.k433
33. Coussement J, De Paepe L, Schwendimann R, Denhaerynck K, Dejaeger E, Milisen K. Interventions for preventing falls in acute- and chronic-care hospitals: a systematic review and meta-analysis. J Am Geriatr Soc. 2008;56(1):29–36. doi:10.1111/j.1532-5415.2007.01508.x [PubMed: 18031484]
34. Montero-Odasso M, van der Velde N, Martin FC, et al. World guidelines for falls prevention and management for older adults: a global initiative. Age Ageing. 2022;51(9):afac205. doi:10.1093/ageing/afac205 [PubMed: 36178003]
35. Simpson JM. Lord SR, Sherrington C and Menz HB, Falls in Older People: Risk Factors and Strategies for Prevention, Cambridge University Press, 2001, 250 pp pbk £29·95, ISBN 0521 589 649. Ageing Soc 2001;21(5):667–675. doi:10.1017/S0144686X02258511
36. Montero-Odasso M, van der Velde N, Alexander NB, et al. New horizons in falls prevention and management for older adults: a global initiative. Age Ageing. 2021;50(5):1499–1507. doi:10.1093/ageing/afab076 [PubMed: 34038522]
37. Oliver D Falls risk-prediction tools for hospital inpatients. Time to put them to bed? Age Ageing. 2008;37(3):248–250. doi:10.1093/ageing/afn088 [PubMed: 18456789]
38. Jellett J, Williams C, Clayton D, Plummer V, Haines T. Falls risk score removal does not impact inpatient falls: A stepped-wedge, cluster-randomised trial. J Clin Nurs. 2020;29(23–24):4505–4513. doi:10.1111/jocn.15471 [PubMed: 32945020]
39. Oliver D, Healey F, Haines TP. Preventing falls and fall-related injuries in hospitals. Clin Geriatr Med. 2010;26(4):645–692. doi:10.1016/j.cger.2010.06.005 [PubMed: 20934615]
40. Dykes PC, Adelman J, Adkison L, et al. Preventing falls in hospitalized patients: Engage patients and families in a three-step prevention process to reduce the risk of falls. Am Nurse Today. 2018;13(9):8–14.
41. Hill AM, McPhail SM, Waldron N, et al. Fall rates in hospital rehabilitation units after individualised patient and staff education programmes: a pragmatic, stepped-wedge, cluster-randomised controlled trial. The Lancet. 2015;385(9987):2592–2599. doi:10.1016/S0140-6736(14)61945-0
42. McLaughlin KH, Young D, Friedman LA, Peters J, Vickery G, Hoyer EH. An interprofessional examination of the Johns Hopkins Mobility Goal Calculator among hospitalized postsurgical patients. Nurs Health Sci. 2022;24(3):735–741. doi:10.1111/nhs.12972 [PubMed: 35780301]
43. Montgomery CD, Pereira DE, Hatcher JB, Kilbury D, Ballance S, Bradham T, Duggan MC, Welch SA. Improving the assessment and documentation of patient mobility using a quality improvement framework. Geriatric Nursing. 2021 Mar 1;42(2):325–30. [PubMed: 33561614]
44. Hanlon P, Nicholl BI, Jani BD, Lee D, McQueenie R, Mair FS. Frailty and pre-frailty in middle-aged and older adults and its association with multimorbidity and mortality: a prospective analysis

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of 493 737 UK Biobank participants. Lancet Public Health. 2018;3(7):e323–e332. doi:10.1016/S2468-2667(18)30091-4 [PubMed: 29908859]

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Key Points

- Patients categorized into higher fall risk groups had decreased mobility throughout their hospitalization.
- Even when patients had the functional capacity to ambulate, fall risk categorization had a negative impact in their mobility.
- Patients categorized as high risk for falls who were non-ambulatory received the highest number of interventions that we considered likely to limit mobility (i.e., bed or chair exit alarm, need for physical therapy consultation, 24-hour observer, and bedside commode).

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Why does this matter?

These results reveal the paradox between fall risk prevention and mobility promotion where ongoing efforts (i.e., fall risk assessments and interventions) to reduce in-hospital falls may, at least in part, decrease mobility among patients who have the capacity for ambulation. Given the importance of keeping patients mobile to improve outcomes, hospitals should consider optimizing safe handling equipment, clinical staff training, and fall reduction strategies that promote mobility in a safe manner.

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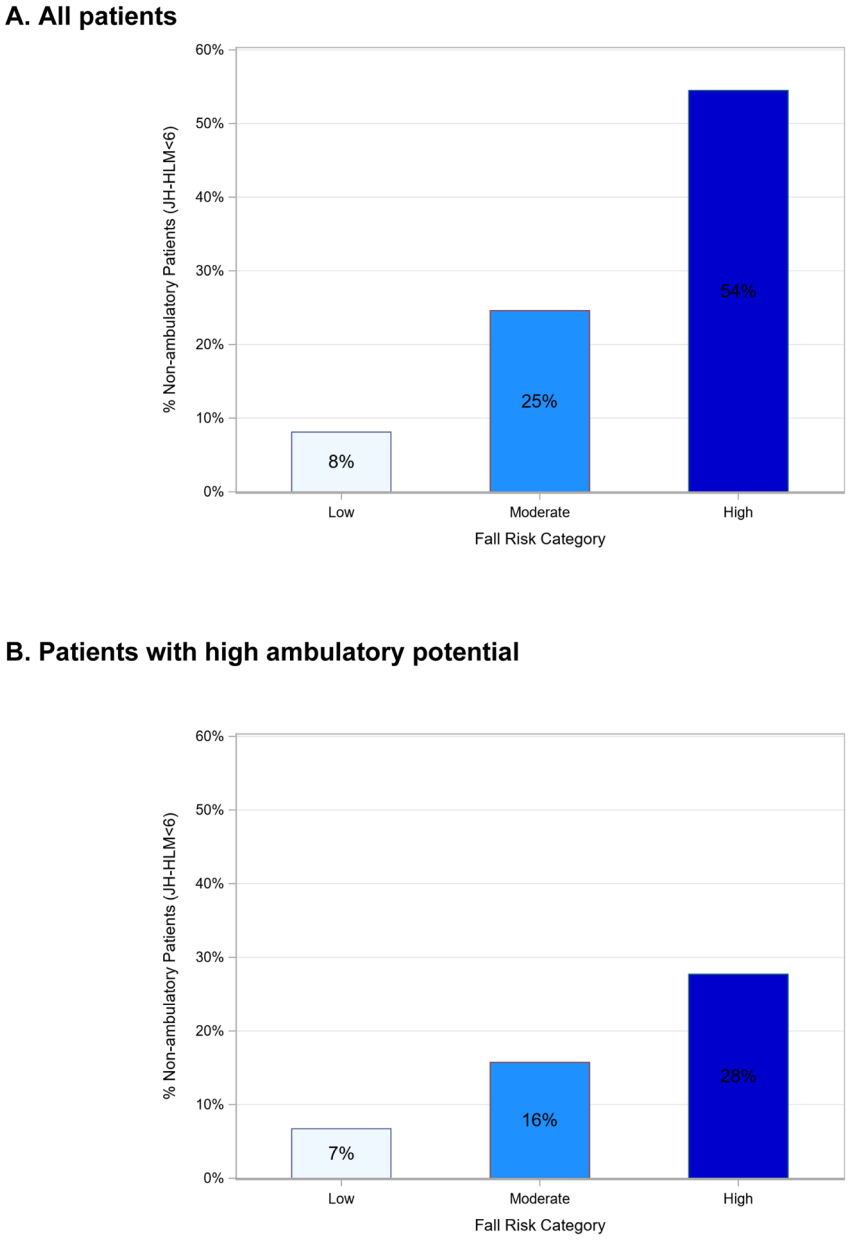

Figure 1. Percent of Patients Non-Ambulatory During Hospitalization by Fall Risk Category

(A) Percent of all patients who were non-ambulatory by fall risk category (Low fall risk: 1,118 of 13,817; Moderate fall risk: 7,556 of 30,838; High fall risk: 1,902 of 3,496). (**B)** Percent of patients with ambulatory potential but were non-ambulatory during hospitalization, by fall risk category (Low fall risk: 885 of 1274; Moderate fall risk: 3,410 of 8369; High fall risk: 362 of 1,005). Fall risk was assessed using the Johns Hopkins Fall Risk Assessment Tool. Non-ambulatory status was measured using the Johns Hopkins Highest Level of Mobility with median scores less than 6. The Activity Measure for Post-Acute Care (AM-PAC) was used to measure high ambulatory capacity (AMPAC 18–24).

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Table 1.

Patient characteristics[1]

Characteristic	Total (N=48,271)	Ambulatory status		
		Ambulatory[2] (N=37,660)	Non-ambulatory (N=10,611)	p-value
Sex				<0.001
Male	24,483 (50.7)	19,141 (50.8)	5,342 (50.3)	
Female	23,788 (49.3)	18,519 (49.2)	5,269 (49.7)	
Race				<0.001
African American	17,196 (35.8)	12,512 (33.3)	4,684 (44.5)	
Caucasian	26,264 (54.7)	21,214 (56.5)	5,050 (47.9)	
Other	4,591 (9.6)	3,793 (10.1)	798 (7.6)	
Payor				<0.001
Medicare	9,397 (19.5)	7,176 (19.1)	2,221 (20.9)	
Medicaid	17,408 (36.1)	12,743 (33.8)	4,665 (44.0)	
Other	21,466 (44.5)	17,741 (47.1)	3,725 (35.1)	
Ambulatory potential				<0.001
Low (AM-PAC: 6–17)	11,910 (24.7)	5,991 (15.9)	5,919 (56.0)	
High (AM-PAC: 18–24)	36,241 (75.3)	31,584 (84.1)	4,657 (44.0)	
JHFRAT Items				
Age ≥ 60	21,762 (45.1)	16,140 (42.9)	5,622 (53.0)	<0.001
Fall history	3,391 (7.0)	2,196 (5.8)	1,195 (11.3)	<0.001
Elimination urgency, frequency or incontinence	7,319 (15.2)	4,219 (11.2)	3,100 (29.2)	<0.001
Medication-fall risk drugs	41,097 (85.1)	31,597 (83.9)	9,500 (89.5)	<0.001
Equipment-tethers patient	37,675 (78.0)	28,465 (75.6)	9,210 (86.8)	<0.001
Impaired cognition	3,411 (7.1)	1,527 (4.1)	1,884 (17.8)	<0.001
Impaired mobility	25,619 (53.1)	16,589 (44.0)	9,030 (85.1)	<0.001
JHFRAT total score, median (IQR)	8 (5,10)	7 (5,10)	10 (8,12)	<0.001
Age in years, median (IQR)	58 (45,68)	57 (44,67)	61 (48,71)	<0.001
Comorbidity count, median (IQR)	3 (2,5)	3 (2,5)	4 (2,6)	<0.001
Length of stay in days, median (IQR)	5 (3,9)	5 (3,8)	6 (4,11)	<0.001

[1]Statistics given as N(%) unless otherwise noted. Race missing for 78 ambulatory patients and 142 non-ambulatory patients. AM-PAC mobility score missing for 41 ambulatory patients and 77 non-ambulatory patients.

[2]Ambulatory patients were defined as having a median JH-HLM score of 6 or higher during their hospitalization.

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Table 2.

Odds ratios for non-ambulatory status[1] during hospitalization

Effect	Univariable		Multivariable	
	Adjusted Odds Ratio (95% CI)	P-value	Adjusted Odds Ratio (95% CI)	P-value
Fall risk (Reference: Low)				
High	13.53 (12.36,14.81)	<.001	4.64 (3.90,5.51)	<.001
Moderate	3.68 (3.44,3.93)	<.001	2.60 (2.36,2.86)	<.001
Ambulatory potential[2] (Low vs high)	6.70 (6.39,7.02)	<.001	4.48 (4.25,4.73)	<.001
JHFRAT items				
Age ≥ 60	1.31 (1.28,1.34)	<.001	0.99 (0.96,1.02)	0.468
Fall history	1.15 (1.14,1.17)	<.001	0.99 (0.97,1.01)	0.390
Elimination urgency, frequency or incontinence	1.69 (1.65,1.73)	<.001	1.26 (1.22,1.30)	<.001
Medication (fall risk drugs)	1.12 (1.10,1.13)	<.001	0.90 (0.88,0.92)	<.001
Equipment (tethers patient)	1.53 (1.50,1.56)	<.001	1.14 (1.11,1.17)	<.001
Cognition (impaired)	1.48 (1.45,1.52)	<.001	1.06 (1.03,1.09)	<.001
Sex (female vs male)	1.02 (0.98,1.06)	0.381	0.93 (0.88,0.97)	0.003
Race (Reference: Caucasian)				
African-American	1.57 (1.50,1.65)	<.001	1.64 (1.55,1.73)	<.001
Other	0.88 (0.81,0.96)	0.003	0.99 (0.91,1.09)	0.878
Payor (Reference: Other)				
Medicaid	1.47 (1.39,1.56)	<.001	1.39 (1.29,1.49)	<.001
Medicare	1.74 (1.66,1.83)	<.001	1.18 (1.11,1.26)	<.001
Number of comorbidities	1.18 (1.16,1.19)	<.001	1.06 (1.05,1.07)	<.001
Length of hospital stay, days	1.04 (1.04,1.04)	<.001	1.02 (1.01,1.02)	<.001

[1] Non-ambulatory status defined as patients with median JH-HLM scores <6 throughout hospital stay.

[2] Ambulatory potential was determined by the Activity measure for Post-Acute Care (Low: AM-PAC 6–16; High: AM-PAC: 18–24).

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Table 3.

Interaction terms from model including interaction between high ambulatory potential[1] and fall risk[2] categories

Effect		Odds Ratio (95% CI)
High ambulatory potential (AM-PAC 18–24)	Fall Risk High vs Low	4.31 (3.52,5.27)
	Fall Risk Moderate vs Low	2.86 (2.58,3.16)
	Fall Risk High vs Moderate	1.51 (1.29,1.77)

[1]Ambulatory potential was determined by the Activity measure for Post-Acute Care (Low: AM-PAC 6–16; High: AM-PAC: 18–24).

[2]Fall risk categories were determined using the Johns Hopkins Fall Risk Assessment Tool (moderate fall risk: 6–13 points; high fall risk: >13 points).

Fall risk group bivariable and multivariable p<0.001; interaction between fall risk group and AMPAC mobility group multivariable p<0.001.

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Table 4.

Number of fall prevention interventions per day by ambulatory status[1] and fall risk category[2]

	Fall Risk Category	Total	Ambulatory Status		
			Ambulatory	Non-ambulatory	P-value
All fall prevention interventions	Low	2.9 (2.4,3.3)	2.9 (2.4,3.3)	3.1 (2.5,3.8)	<.001
	Moderate	3.0 (2.5,3.8)	2.9 (2.4,3.6)	3.5 (2.8,4.3)	<.001
	High	4.5 (3.7,5.5)	4.3 (3.4,5.4)	4.6 (3.9,5.5)	<.001
	Total	3.0 (2.5,3.8)	2.9 (2.4,3.5)	3.6 (2.9,4.5)	<.001
Fall prevention interventions that limit mobility[3]	Low	0.0 (0.0,0.0)	0.0 (0.0,0.0)	0.0 (0.0,0.4)	<.001
	Moderate	0.1 (0.0,0.5)	0.0 (0.0,0.4)	0.5 (0.0,0.9)	<.001
	High	0.9 (0.4,1.3)	0.8 (0.3,1.3)	1.0 (0.6,1.4)	<.001
	Total	0.0 (0.0,0.5)	0.0 (0.0,0.3)	0.5 (0.0,1.0)	<.001

[1]Ambulatory status defined using the Johns Hopkins Highest Level of Mobility (JH-HLM). Non-ambulatory status represents patients with median JH-HLM scores<6.

[2]Fall risk categories were determined using the Johns Hopkins Fall Risk Assessment Tool (moderate fall risk: 6–13 points; high fall risk: >13 points).

[3]Fall prevention interventions that limit mobility: bed or chair alarm, perceived need for physical therapy consult, 24-hour observer, and bedside commode.

All comparisons p<0.001 (Wilcoxon rank-sum test for 2 level; Kruskal-Wallis test for 3 or more levels)