

Evidence-Based Care Practices in Older Adults Who Have Fallen

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ABSTRACT:

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BACKGROUND: Falls in adults aged ≥ 65 years are the leading cause of injury-related deaths and nonfatal injuries. The American and British Geriatrics Societies (AGS/BGS) published an updated clinical practice guideline in 2010 to encourage performance of fall risk assessment and management in everyday practice.

OBJECTIVE: To assess how current fall risk assessment and management practices align with the 2010 AGS/BGS guideline.

DESIGN: A retrospective study.

SETTING: Oregon Health and Science University (OHSU), a large academic medical center in Portland, Oregon.

PARTICIPANTS: Study participants were outpatients of OHSU's Internal Medicine clinic, aged 65 to 95 years, who received medical care for a fall occurring between October 1, 2010 and March 31, 2012.

MEASUREMENTS: Directed by the 2010 AGS/BGS guideline recommendations, healthcare provider performance of fall risk assessments and prescribed interventions was abstracted from medical records for a period of 12 months following the most recent fall.

RESULTS: Five modifiable fall risk factors (postural hypotension, vision, feet/footwear, muscle strength, and gait/balance) were assessed, on average, 47% of the time. When a fall

risk factor was identified as being present, healthcare providers recommended an evidence-based intervention, on average, 73% of the time. Two risk factors were addressed infrequently—prescription medications associated with high fall risk (17%) and home safety evaluation (24%). Use of a geriatric risk assessment template and geriatric specialty both strongly correlated with healthcare provider assessment of fall risk factors.

CONCLUSION: Although the frequency of intervention is encouraging, assessment aimed at identifying the presence of modifiable fall risk factors remains modest overall. Opportunities exist for improving the quality of care of older adults at high risk of falls via increasing provider attention to identifying modifiable fall risk factors in these patients.

Key words: Accidental Falls; Geriatric Assessment; Physician's Practice Patterns; Practice Guideline as Topic; Risk Assessment

INTRODUCTION

Falls are the leading cause of injury-related deaths as well as nonfatal injuries in adults, aged 65 years and older, in the United States (U.S.).¹ The consequences of a fall can be devastating and costly.² Falls in older adults are associated with a loss of independence, decreased mobility, early admission to long-term care facilities and increased risk of early death.^{1,3} Each year, accidental falls result in more than 2 million emergency department visits and 20,000 deaths.⁴ Annually, the direct medical cost of falls (in 2010 dollars) is over \$30 billion. Rising healthcare costs and an aging population underscore the need to decrease falls and reduce fall risk in older adults.

Studies have identified numerous risk factors associated with falls.⁵⁻⁷ Risk factors are classified as intrinsic, directly associated with an individual's health, or extrinsic, associated with a person's environment.⁸ Intrinsic risk factors include visual impairment, lower extremity muscle weakness, balance problems and chronic diseases. Extrinsic factors include trip hazards, absence of handrails on stairways, poor lighting, and slippery surfaces. Some risk factors are modifiable, e.g., lower extremity muscle weakness and postural hypotension, and others non-modifiable, e.g., age and history of a prior fall.⁹

Most falls in older adults result from a combination of risk factors.¹⁰⁻¹³ A multifactorial approach to assess and manage modifiable fall risks has been identified as an effective intervention to prevent falls in community-dwelling older adults.^{6,9,14,15} The U.S. Preventive Services Task Force's (USPSTF) review of the management of individuals following a fall concluded that a multifactorial risk assessment and follow-up intervention was effective in reducing repeat occurrences of falls.¹⁶⁻²⁰

The American and British Geriatric Societies (AGS/BGS) published an updated

clinical guideline in 2010 to promote fall risk assessment and management among healthcare providers (physician, physician assistant, nurse practitioner).²¹ A multifactorial fall risk assessment is recommended for all older adults who report two or more falls in the prior 12 months, sustain one fall with an injury, or have impaired gait or balance. Compared to the 2001 guideline, the updated guideline recommends a more in-depth fall risk assessment that includes a focused history, complete medication review, appropriate physical and neurological examination, functional assessment, gait and balance assessment, feet and footwear evaluation, and environmental assessment. Each identified risk factor is addressed with an individually tailored plan of care, which may include for example, physical therapy, balance or Tai Chi class, medication optimization, or referrals to appropriate specialists.

Authors of a meta-analysis of interventions for the prevention of falls found the number of subjects needed to screen to prevent 1 fall per year was 16 for a single intervention and 11 for a multidisciplinary intervention.¹⁴ The cost-effectiveness of fall risk evaluation and management has prompted insurers to adopt this screening as a health status indicator. For example, the Centers for Medicare and Medicaid Services now use the National Quality Forum's falls screening measure (NQF 0101) as part of their Physician Quality Reporting System. This program ties Medicare reimbursement to provider and healthcare system performance.

Although effective evaluation and intervention has been shown to reduce falls, healthcare providers have been slow to integrate fall prevention recommendations into clinical practice.²²⁻²⁷ In a retrospective study, Rubenstein et al., found only 20% of primary care providers documented appropriate physical examination following a fall and just 30% of medical records contained specific recommendations for reducing the risk of future falls.²⁵ A

qualitative study found a small fraction (8%) of 67 surveyed physicians based their fall prevention practices on clinical guidelines.²⁴

This study is the first to report how U.S. healthcare providers use fall prevention measures with community-dwelling older adults who have fallen since the advent of the USPSTF guidelines and the most recent update of the AGS/BGS guidelines, using the latter guidelines as the standard of care. Analyzing healthcare providers' use of fall prevention measures following the dissemination of national best practice guidelines can direct future efforts to improve evaluation and management of falls.

METHODS

Setting

This study was conducted at Oregon Health and Science University (OHSU), a large academic medical center located in Portland, Oregon, that provides care to residents of Oregon and southwest Washington. The Internal Medicine clinic did not have a formal falls screening protocol in place during the time of this study. The institutional review boards of the University of Washington and OHSU approved the study.

Study Sample

Study subjects were outpatients of the Internal Medicine clinic, aged 65 to 95 years, who had a documented fall between October 1, 2010 and March 31, 2012, nine months following publication of the latest AGS/BGS guideline. The focus on post-fall care processes was chosen because a history of a fall in an older adult is a strong predictor of future falls and should serve to trigger fall risk evaluation and management. Patients were eligible for the study if they had one fall with an injury or two or more falls in the prior 12 months (as determined by chart review). The index fall, the fall after which fall prevention practices were examined, was either a fall that resulted in medical care or a fall that was reported during an internal medicine office visit. If more than one fall occurred, the most recent fall within the study period was used as the index fall. The following International Classification of Diseases, 9th Revision, (ICD-9) codes were used to determine probable history of a fall, as has been done in previous studies with this outcome:^{28,29} 920-924 (contusions with intact skin surfaces), 831-834 (dislocations), E880-E888 (unintentional/accidental fall injuries), V15.88 (history of falls, falls frequently), 802-829 (fractures) and 844-848 (sprains and strains).

Several groups were excluded from this study: patients treated at OHSU's Emergency Department but who did not have an Internal Medicine clinic office visit within three months after their fall; non-ambulatory patients, as modifications to the AGS/BGS recommended fall risk assessments would have been necessary; and patients with dementia, as there is insufficient evidence to recommend for or against fall prevention interventions in these individuals.²¹

The healthcare providers of patient subjects were faculty and residents at the OHSU Internal Medicine clinic (n=42) providing primary care services. Of these providers, 35 were general internists, including 17 faculty and 18 residents. The other seven providers—four faculty and three residents—were geriatric specialists, defined as internal medicine specialists focusing in geriatric care. General internists and geriatric residents matriculate through the same internal medicine residency program. Residents serve as primary care providers (PCPs) to their own patient panels. The geriatric track, a subset of the residency program, focuses on training to care for older adults with complex illnesses. Urgent visits sometimes required patients to be seen by a healthcare provider other than their PCP.

Data Collection

OHSU, an integrated healthcare system, uses an electronic health record (EHR) system. Records from OHSU's medical specialists, emergency department, lab, and ancillary healthcare providers, i.e., physical therapists, are readily accessible to PCPs. We abstracted all primary care office visits for three months following the index fall. In prior studies assessing quality of medical care for older adults, authors have reviewed healthcare provider management of specific medical conditions for a three-month time frame.^{27,30} In order to include all fall risk assessments that might have been performed in relation to the index fall,

we also abstracted Medicare Wellness Visits and primary care office visits coded for fall(s) or balance problem 4 to 12 months after a fall.

Reliability of data collection was confirmed through dual abstraction by the primary researcher of 5% of charts, which showed no discrepancies between abstractions. A review of 10% of charts by a second researcher established inter-rater reliability of 94%. An expert panel of trained geriatric specialists, blinded to the subjects' identities, guided the primary investigator in study design, execution and analysis.

Patient Level Variables

The following comorbid conditions, identified as fall risk factors in prior research and common in older adults, were abstracted from the EHR: cardiovascular disease, history of cerebrovascular accident, mild cognitive impairment, depression, diabetes mellitus, gait disturbance, hypertension, incontinence, osteoarthritis, osteoporosis, Parkinson's disease, vertigo and visual impairment.^{5,6,9,31-38}

The number of falls, emergency department visits and hospitalizations were collected for a 12-month period following the index fall. The number of falls included the index fall, patient-reported falls, and medically attended falls recorded in the medical record. Emergency department visits and hospitalizations included all care received at OHSU and care received at other healthcare facilities if reported in an Internal Medicine clinic visit note.

Fall Risk Assessment and Management Variables

Healthcare provider fall risk assessments and interventions were abstracted from office visits for a three-month time period from the date of the index fall. The selection of fall risk assessments and interventions for abstraction was based on the 2010 AGS/BGS updated clinical guideline for prevention of falls in older adults (Table 1).²¹ If a risk factor was

identified (i.e., determined to be present) during an assessment, the medical record was then reviewed for evidence of an appropriate intervention. Some aspects of routine medical examinations—general physical examination, neurological examination, and heart rate and rhythm—were not included in the abstraction.

Some fall risk assessments typically occur as part of ongoing routine care, e.g., annual labs or specialty office visits. To account for this, the following fall risk interventions were abstracted for 12 months after the index fall: monofilament examination; vitamin D lab test; office visits to ophthalmology and podiatry; and referrals to physical therapy for lower extremity problems or impaired gait/balance. Ophthalmology/optometry consults, podiatry consults and monofilament examinations were counted as assessments and interventions (Table 1).

A Medicare Wellness Visit is a covered Medicare benefit that includes fall risk evaluation as part of a health risk assessment. A geriatric consult occurs when a general internist refers a patient to a geriatric specialist for a more detailed examination. A geriatric establish care visit occurs when a patient establishes a geriatric specialist as their primary care provider. These three types of visits all use templates to evaluate geriatric conditions, including history of falls and risk for falls. They were grouped together as “focused evaluations” for purposes of analyses.

Medication use was abstracted in several ways. First, all prescribed medication, including over the counter medications, were counted and totaled. Second, patients prescribed medications associated with a high risk for falls were identified (Appendix A).³⁹⁻⁴⁵ The medical record of these patients was reviewed for evidence of a dosage reduction, a

recommendation to adjust dosage, or documentation of necessity of the prescription in the medical record.

Data Analysis

Patients of internal medicine specialists and geriatric specialists were compared on demographic and health characteristics, baseline fall-related characteristics and fall-related healthcare use. Chi-square and *t*-tests were used to test for between-group differences on these variables. The primary dependent variable was the “fall risk assessment score”, created by summing the fall risk factor assessments performed by the PCP, with higher numbers representing more risk factors assessed (range, 0-8). The following risk factor assessments were included in the score: description of fall, postural hypotension, lower extremity muscle weakness, gait and/or balance, visual acuity, feet and/or footwear, vitamin D and environmental hazards. Bivariate correlation coefficients were calculated for the fall risk assessment score and independent variables of interest. Independent variables were patient and treatment characteristics hypothesized to influence the number of assessments PCPs performed. Results were considered statistically significant at $p < .05$. The data were analyzed using SPSS software, version 22.0 (SPSS Inc., Chicago, IL).

RESULTS

Patient and Treatment Characteristics

A total of 256 patients were identified as having fallen during the study period. Ineligible patients included patients seen in the emergency room but not seen for follow up in clinic within 3 months of their fall (n=99), non-ambulatory patients (n=4) and patients with dementia (n=37). The remaining 116 patients were community dwelling and had either one fall with an injury or 2 or more falls without injury.

Table 2 shows baseline demographic, health and fall-related characteristics of the 116 patients overall and by PCP specialty. The mean age was 79 (± 8) years, 68% were female and 10% were non-white. Two hundred forty-nine falls were recorded in the 12-month period of medical record abstraction beginning with the index fall date; 186 falls were reported during a primary care office visit, 45 falls received care in the emergency department, and 18 falls required hospitalization. Sixty percent of all emergency department visits and 46% of all hospitalization recorded in the chart notes during the 12-month abstraction period were fall-related.

Over the 12-month abstraction period, 80% percent of the patients had 1 or 2 falls, 16% had 3-6 falls, and 4% had more than 10 falls. During the same time period, 73% of patients averaged up to 1 primary care office visit per month, 21% averaged 1.5 visits, and 6% averaged 2.5 visits. Patients seen by the geriatric specialists were significantly older, had more office visits and a greater number of fall risk factors assessed as compared to patients seen by general internists.

Fall Risk Assessments

Fall risk factor assessments and interventions performed by the healthcare providers are summarized in Table 3. Documentation of completed fall risk factor assessments ranged from 30% for feet/footwear evaluation and postural hypotension to 67% for fall description. Lower extremity muscle strength, gait/balance and vision assessments were each performed in about half of the study sample. One quarter of the 62 gait/balance assessments were a standardized performance test, either a Timed Up and Go test or Romberg test.

Interventions

Interventions for identified fall risk factors were prescribed 73% of the time, on average. Intervention frequency varied by risk factor, from 17% (for adjustment of medication associated with high fall risk) to 98% (for addressing a vision problem). Of the 27 patients with a gait or balance problem, most were referred to physical therapy, half were referred to a community exercise class or received a recommendation to exercise regularly, and a third received an assistive device prescription or recommendation. Several patients (n=18) with gait or balance issues received more than one intervention; a single patient received no interventions. Seven of 8 patients with postural hypotension had medications adjusted, received diet/hydration recommendations or were monitored on an ongoing basis.

Ophthalmology/optometry consults or eye clinic visits were recorded as an assessment, a problem, and an intervention. Vision specialists performed thirty-five of the 63 vision exams. PCPs performed assessments by subjective report of visual acuity; no examinations with eye charts were performed during primary care visits.

A comparable method was used to abstract performance on feet/footwear variables. Podiatry consults and monofilament exams were recorded as assessments, problems and

interventions. Half of the 33 feet/footwear assessments were monofilament exams performed on patients with diabetes mellitus.

Twenty-five percent of patients (30% of patients in the internal medicine group and 10% of patients in the geriatric group) had a prescription for a medication associated with a high risk of fall at the time of their fall (Appendix B, High Fall Risk Medication List). The PCP received credit for an intervention if the medication was reduced or changed, if an attempt was made to reduce the medication, or if prescription of the medication was justified in the medical record. This type of medication management occurred only five times, the lowest intervention rate of all abstracted fall risk factors.

Fall Risk Assessment Score and Correlation with Independent Variables

The mean fall risk assessment score was 3.9 ± 1.7 . Geriatric providers averaged significantly more assessments than internal medicine providers [4.6 ± 1.4 vs. 3.6 ± 1.8 ($P=.007$)]. The majority of patients (60%) received 3 to 5 assessments, 22% received 0 to 2 assessments, and 18% received 6 to 8 assessments. Two patients did not receive any assessments and one received all eight assessments.

Table 4 shows correlations between the fall risk assessment score and patient characteristics and care delivery variables. The number of primary care office visits in the three-month abstraction period showed the strongest correlation with the fall risk assessment score. Fifteen of the 21 patients (71%) who received between 6 and 8 fall risk factor assessments also had at least 3 office visits, whereas 10 of the 11 patients (91%) who received 0 or 1 fall risk factor assessment had only 1 or 2 office visits.

Other factors also had significant positive correlations with the fall risk assessment score: provider specialty in geriatrics; occurrence of a focused evaluation (Medicare Wellness

Visit, geriatric consult, or geriatric establish care visit); number of falls; number of prescription medications; depression and diabetes mellitus. All 30 patients treated by a geriatric specialist received at least two of the eight fall risk factor assessments and 17 patients (57%) had 5 or more assessments. In contrast, 11 of the 86 patients (13%) treated by general internists received less than two fall risk factor assessments and 29 patients (34%) had 5 or more assessments. There were 16 focused evaluations: 4 Medicare Wellness Visits, 4 Geriatric consults and 8 Geriatric establish care visits. All patients who underwent a focused evaluation received at least 3 fall risk factor assessments, while 25 of the 100 patients (25%) who did not undergo a focused evaluation received less than 3 fall risk factor assessments. Of note, neither the presence of a gait disturbance nor a diagnosis of Parkinson's disease was significantly correlated with the fall risk assessment score.

DISCUSSION

This study is one of only three^{25,27} published in the last decade to use medical record review to examine primary-care-practice implementation of recommended guidelines^{20,21} for management of fall risk in older adults. We found that five modifiable fall risk factors (postural hypotension, vision, feet/footwear, muscle strength, and gait/balance) were assessed 47% of the time, on average. When a fall risk factor was identified as being present, healthcare providers recommended an evidence-based intervention 73% of the time, on average. However, two fall risk factors – prescription of medications associated with a high fall risk and home/environmental safety – were addressed infrequently (in 17% and 24% of the study sample, respectively). Use of a geriatric risk assessment template and geriatric specialty were both highly correlated with provision of guideline-recommended management of fall risk factors.

We located two published studies that examined management of fall risk in clinical practice. One was a Belgian study of general practitioners who self-recorded performance of fall risk assessments and interventions in older adults who had fallen.²⁷ In a comparison of outcomes, our research shows a higher rate of performance on analogous assessments for two modifiable fall risk factors: postural hypotension (30% in our study vs. 6% in the study conducted in Belgium) and home safety (24% vs. 12%); and a similar frequency for performance of any type of gait or balance evaluation (53% vs. 56%).²⁷ Intervention rates for identified fall risk factors cannot be compared, as interventions were not defined by the study conducted in Belgium and reimbursement for medical services may be different across two national healthcare systems.

In another study, using U.S. data from the late 1990s, fall risk assessments and interventions were abstracted for a subset of 69 patients who had fallen.²⁵ Our study found a higher frequency of performance on analogous assessments for two modifiable fall risk factors: postural hypotension (30% in our study vs. 6% in the earlier study) and standardized gait or balance evaluation (27% vs. 10%).²⁵ Our overall assessment average is similar to prior studies documenting management of falls in vulnerable elders, wherein healthcare providers performed evidence-based fall risk assessments and interventions less than 50% of the time.^{25,26,46} The frequency of intervention on identified fall risk factors was higher in our study compared to the prior study (73% vs. 30%).²⁵

In our study, use of office visit templates designed for review of geriatric conditions was positively correlated with number of fall risk factors assessed. One example is a Medicare Wellness Visit. The visit template includes medication review, detailed physical exam, fall history, home safety questions, muscle strength assessment and gait evaluation. Use of a geriatric-focused template is also likely to elicit health issues associated with increased fall risk such as nocturia, fear of falling and activities of daily living limitations. These types of templates may improve healthcare provider implementation of prevention guidelines in the context of busy primary care practice.

Geriatric specialists performed more fall risk assessments, prescribed fewer medications associated with falls, and saw patients more frequently than general internists. These findings are not surprising, as geriatric specialists are trained to address complex, multi-factorial health issues of older adults. A history of falls or high fall risk is a recognized geriatric syndrome.^{47,48} Authors of an observational study found geriatricians scored higher than generalists on appropriate medication prescribing and geriatric syndrome assessments.⁴⁹

In addition, academic geriatric medicine leaders agree that care by a geriatrician is most beneficial for vulnerable older adults with one or more geriatric syndromes.⁵⁰ Geriatric specialists in this study saw patients more frequently and were therefore provided more opportunities to perform fall risk assessment and management.

The percent of patients prescribed medications associated with a high risk for falls (25%) was lower in the present study compared to other studies that have evaluated use of psychotropic drugs and fall rates (32% to 52%).^{41,43} However, reducing or modifying the prescription of these medications had the lowest intervention rate (17%) of all measures. The medication classes abstracted in this study, psychotropic and anticholinergic medications, are commonly prescribed for older adults.^{51,52} Interventions to reduce prescription of psychotropic medications in older adults have been shown to be both cost-effective and effective in reducing the number of falls.^{19,53,54}

Our results suggest that increasing provider awareness of clinically relevant domains of fall risk assessment and encouraging use of available clinical tools, in particular those focusing on the role of medications and medication management post-fall, is warranted. Evidence-based resources for healthcare providers include: online and mobile apps include the AGS 2012 Updated Beers Criteria for Potentially Inappropriate Medication Use for Older Adults and UpToDate®; a tool kit for the Screening Tool of Older People's potentially inappropriate Prescriptions (STOPP) and the Screening Tool to Alert doctors to Right i.e. appropriate, indicated Treatments (START) criteria; and a comprehensive review of medication risk and optimization specific to fall risk in *Clinics in Geriatric Medicine*.⁵⁵⁻⁵⁹

Home safety was also addressed infrequently, only 24% of the time. Home safety evaluations can occur as an outpatient therapy benefit⁶⁰ but many healthcare providers are not

aware that occupational therapists are trained to perform home safety evaluations.

Furthermore, a patient who is not homebound can receive a single home visit for a safety evaluation through a home health agency without the full complement of home health services. The low rate of prescribed home safety evaluations in this study suggests a need for improved awareness of Medicare benefits for home safety evaluations.

The importance of a post-fall examination for management of risk of future falls cannot be overstated. An older adult who has fallen is two to three times more likely to fall again within a year.⁶¹ Randomized controlled trials have demonstrated the effectiveness of a multifactorial falls risk assessment and management program in older adults who have fallen.^{14,19} Adopting new clinical practice patterns to evaluate and address multifactorial health conditions can be challenging for PCPs facing competing demands and time constraints. In order to assist healthcare providers, The Centers for Disease Control and Prevention has developed a tool kit that gives health care providers and the clinical teams they work with the information and tools they need to assess and address their older patients' fall risk.⁶² The tool kit includes structured forms to guide the completion of assessments of key modifiable fall risk factors (e.g., postural hypotension, strength and balance deficits), including those that were assessed infrequently by providers in our study.

Limitations of this study include data collection based entirely on retrospective medical record review, which depends on accurate documentation within the EHR. Measures to prevent falls may have been discussed during a primary care office visit but not recorded. Although not central to the primary focus of this study, data were collected on the prevalence of falls in this population. While every effort was made to collect accurate data on fall events and all emergency department visits and hospitalizations over the 12-month follow-up period,

some utilization outside of the health system may have not been identifiable through the EHR. Likewise, patients discharged to a rehabilitation center after a hospitalization for management of a fall injury were not captured if they did not have a primary care office visit within three months of their fall. Lastly, given that the study site was an academic-medical-center-based clinic with a well-developed EHR, findings may not be reflective of the healthcare received by community-dwelling older adults in other types of environments.

CONCLUSION

This study provides important new findings regarding the current state of medical care provided to community-dwelling older adults who have recently fallen. While the high frequency of intervention on identified fall risk factors is encouraging, assessment of modifiable risk factors remains modest overall. Attention to high risk medications known to increase fall risk is especially low. Our study suggests a number of opportunities for increasing healthcare provider awareness of fall risk factors that are within the purview of primary care: high risk medication review and reduction, referral for home safety evaluation, assessment for symptoms and signs of postural hypotension, and brief gait, strength, and balance assessments. In addition, use of the Medicare Wellness Visit and home safety evaluation in primary care practice, existing reimbursable resources are underutilized and should be encouraged to help facilitate optimization of care for this very common geriatric syndrome.

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Appendix A. High Fall Risk Medications Included in Medical Record Review ⁴²⁻⁴⁶	
Benzodiazepines	Tricyclics
Chlordiazepoxide	Doxepin
Clonazepam	Amitriptyline
Clorazepate	Nortriptyline
Diazepam	Desipramine
Flurazepam	Imipramine
Estazolam	Anticholinergic
Lorazepam	Diphenhydramine
Triazolam	Hydroxyzine
Alprazolam	Meclizine
Midazolam	Amitriptyline
Oxazepam	Cyclobenzaprine
Temazepam	Methocarbamol
Non-benzodiazepene Hypnotics	
Zaleplon	
Zolpidem	
Eszopiclone	

Table 1. Definitions of Abstracted Fall Risk Assessments and Interventions

Fall Risk Assessments	Assessment Definition	Criteria for a Positive Assessment	Interventions for a Positive Assessment
Detailed Description of Fall ^a	Documented descriptors of fall: time, circumstance, direction, injuries, symptoms, and other consequences	At least 3 of the 6 descriptors were documented	Fall descriptor determines targeted interventions
Postural Hypotension ^a	Measure blood pressure after lying for 3 minutes. Repeat blood pressure measurements after 1-3 minutes standing	A drop in systolic BP ^b of ≥ 20 millimeters of mercury or diastolic BP ^b of ≥ 10 millimeters of mercury between position changes	Medication adjustment Address hydration/diet Plan for continued monitoring
Lower Extremity Muscle Weakness ^a	Lower extremity manual muscle test Sit to stand ability noted. Timed Up and Go test	4+/5 or less on manual muscle test Difficulty performing sit to stand test due to lower extremity muscle weakness	Referral to community exercise class Recommended participation in a regular exercise program

		Timed Up and Go \geq 15 seconds	Referral to physical therapy for gait or lower extremity problem ^c
Gait and/or Balance ^a	Standardized test i.e. Timed Up and Go or Rhomberg	Timed Up and Go \geq 15 seconds	Referral to physical therapy for gait or lower extremity problem ^c
	Observation of gait or balance	Performance-Oriented Mobility Assessment score of \leq 24	
	Patient's report of gait/balance problems	Impaired gait or balance noted by provider	Referral to community exercise class
		Impaired gait or balance reported by patient	
Visual Acuity ^a	Vision exam	Documentation of vision deficit/recent change in visual acuity	Ophthalmology or optometry consult ^c
	Reported changes in vision		
	Ophthalmology or optometry	Ophthalmology or optometry	

	consult ^c	consult ^c	
Feet and/or footwear ^a	Feet/footwear exam	Foot deformity present	Podiatry consult or monofilament test ^c
	Sensory examination of feet.	Inadequate footwear	
	Podiatry consult or monofilament test ^c	Decreased sensation	Address proper foot wear and care of feet
		Podiatry consult or monofilament test ^c	
Environmental Hazards ^a	Discussion of home environment.	Home safety hazards identified	Refer for home safety evaluation Recommend removal of fall hazards
Vitamin D ^a	Query current vitamin D use	Inadequate vitamin D intake/exposure	Vitamin D supplement \geq 800 IU/day ^{c,d}
	Test vitamin D blood levels	Vitamin D lab results < 30 nanograms per milliliter	25-hydroxy vitamin D levels 30-70 nanograms per milliliter ^c
Prescribed	Medication list reviewed for	Prescribed \geq 1 medication in	Medication reduction

medications

prescription of high fall risk meds

Appendix A

attempted

associated with high

risk for fall

^aIncluded in fall risk assessment scale during analysis

^bBP = blood pressure

^cReferral or consult made within 12 months of index fall

^dIU = International Unit

Table 2. Baseline Demographic and Health Characteristics, Fall-Related Healthcare Utilization, and Comorbidities of Study Sample, Overall and by Healthcare Provider Specialty

Variable	Total Sample (n=116)	General Internist Subgroup (n=86)	Geriatric Specialist Subgroup (n=30)	P-Value ^a
Demographic and Health Characteristics				
Female, %	68	65	77	.35
Age, mean±SD ^a	78.6 ± 7.7	77.2 ± 6.9	82.7 ± 8.6	.001
Non-white, %	9.5	12.8	0	.09
Fall-Related Healthcare Utilization				
Average number of falls ± SD ^{b, c}	2.2 ± 2.33	2.2 ± 2.62	2.1 ± 1.21	.90
Average number of fall-related emergency department visits ^c	0.39	0.36	0.47	.38
Emergency department visits due to a fall, % ^c	60.0	54.4	77.8	
Average number of fall-related hospitalizations ^c	0.16	0.17	0.10	.29

Hospitalizations due to a fall, % ^c	46.2	46.9	42.9	
<hr/>				
Patient Health-Related Characteristics				
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Primary care office visits in 3 months post index fall, number, mean±SD ^{b, d}	2.8 ± 1.8	2.5 ± 1.7	3.5 ± 2.0	.01
Medications, number, mean±SD ^b	13.0 ± 6.1	12.6 ± 6.2	14.3 ± 5.8	.20
<hr/>				
Comorbidities, % ^e				
<hr/>				
Co-morbidities, number, mean±SD ^b	4.3 ± 2.0	4.1 ± 1.9	4.7 ± 2.4	.15
≥4 co-morbidities, %	62.1	61.6	63.3	1.00
≥7 co-morbidities, %	1613.8	10.5	23.3	.15
Cerebrovascular accident ^f	8.6	8.1	10.0	1.00
Mild cognitive impairment ^g	12.9	9.3	23.3	.10
Depression ^h	39.7	36.0	50.0	.26
Diabetes mellitus	20.7	24.4	10.0	.16
History of fall(s) or gait disturbance ⁱ	38.8	36.0	46.7	.42
Osteoporosis	27.6	23.3	40.0	.13
Parkinson's Disease	9.5	7.0	16.7	.23

Vertigo ^j	7.8	5.8	1.3	.35
Visual Impairment ^k	47.4	46.5	50.0	.91

^aIndependent-samples *t*-test

^bSD = standard deviation

^c12 months from date of fall, including index fall

^dAll primary care office visits in first 3 months plus Medicare Wellness Visits and primary care office visits coded for fall or balance problem 4-12 months post-fall

^ePresent in patient “Problem List” within the electronic health record

^fTransient ischemic attack, cerebral infarct, cerebrovascular disease

^gMemory loss

^hBipolar disorder, dysthymia

ⁱAbnormal gait, balance problem, falls frequently, at risk for falls

^jDizziness, giddiness, long-standing (≥ 6 months) Benign Paroxysmal Positional Vertigo

^kCataract, poor vision post-cataract removal, diabetic retinopathy, glaucoma, macular degeneration, legal blindness, or senile nuclear sclerosis

TABLE 3. Fall Risk Factor Assessments and Interventions Performed with Study

Sample ^a	Assessment	Risk Factor	Interventions
	Performed (%)	Present (%)	Prescribed (%)
Fall description in medical record	78 (67.2)	N/A	N/A
Postural hypotension	35 (30.2)	8 (22.9)	7 (87.5)
Vision (during primary care office visit, ophthalmology/ optometry consult or eye clinic visit)	63 (54.3)	57 (90)	56 (98.2)
Feet/footwear (during primary care office visit, monofilament exam or podiatry consult)	33 (28.4)	29 (87.9)	26 (89.7)
Lower extremity muscle strength and PT ^b referral	59 (50.9)	18 (30.5)	16 (88.9)
Gait/Balance	62 (53.4)	27 (42.9)	26 (96.3)
Gait/balance problem and PT ^b referral		27 (42.9)	24 (88.9)
Gait/balance problem and exercise recommended		27 (42.9)	15 (55.6)
Gait/balance problem and assistive device recommended		27 (42.9)	10 (37.0)
Home modification (provider recommendations or home health referral)	Combined assessment and intervention		28 (24.1)
Vitamin D \geq 800 IU/day ^c prescribed or 25-	Combined assessment and		92 (79.3)

hydroxy vitamin D lab test ordered	intervention		
Prescribed medication(s) associated with high fall risk	N/A	29 (25.0)	5 (17.2)

^aNumber of subjects = 116

^bPT = physical therapist

^cIU = International Unit

Table 4. Bivariate Correlations of Fall Risk Assessment Score^a by Patient, Provider and Care Delivery Characteristics

Variable	Correlation	
	Coefficient	<i>P</i> -Value ^b
Patient		
Age at fall	-.004	.962
Gender (Male)	-.034	.715
Number of Internal Medicine clinic office visits	.514	<.001
Number of falls	.251	.007
Number of prescribed medications	.273	.003
Provider		
Geriatric specialist	.248	.007
Care Delivery		
Focused evaluation ^c	.289	.002
Comorbidities^d		
Cerebrovascular accident ^e	.058	.534
Mild cognitive impairment ^f	.058	.534
Depression ^g	.253	.006
Diabetes mellitus	.259	.005
History of fall(s) or gait disturbance ^h	.172	.066
Osteoporosis	.046	.624
Parkinson's Disease	.177	.058
Vertigo ⁱ	.077	.409

Visual impairment^j

.170

.068

^aNumber of fall risk factor assessments performed by PCP, range, 0-8

^b2-sided Pearson correlation coefficients

^cIncludes Medicare Wellness Visit, geriatric consult visit, and geriatric establish care visit

^dPresent in patient “Problem List” within the electronic health record

^eTransient ischemic attack, cerebral infarct, cerebrovascular disease

^fMemory loss

^gBipolar disorder, dysthymia

^hAbnormal gait, balance problem, falls frequently, at risk for falls

ⁱDizziness, giddiness, long-standing (≥ 6 months) Benign Paroxysmal Positional Vertigo

^jCataract, poor vision post-cataract removal, diabetic retinopathy, glaucoma, macular degeneration, legal blindness, or senile nuclear sclerosis