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Depression and Risk for Adverse Falls in Older Home Health Care Patients

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Abstract

Because falls are highly prevalent, harmful events for older adults, identification of patients at risk is a high priority for home health care agencies. Using routine administrative data, we demonstrated that patients with depressive symptoms on the Outcome and Assessment Information Set are at risk for falls. A prospective case-control study that matched 54 patients who experienced an adverse fall with 854 controls showed that patients who fell had twice the odds of being depressed (odds ratio = 1.90, 95% confidence interval = 1.01 to 3.59). Bowel incontinence, high medical comorbidity, stair use, injury and poisoning, memory deficit, and antipsychotic medication use were also predictors, but no association was found for antidepressant medications. These data suggest the potential benefit of including depression screening for multifactorial fall prevention interventions.

Fall prevention is critical to home health care patients and to the agencies that provide their care. For home health care patients, as with community-dwelling older adults in general, falls are associated with increased morbidity, serious injury, mortality, risk of nursing home placement, and financial burden (Englander, Hodson, & Terregrossa, 1996; King & Tinetti, 1995; Sattin, 1992; Tinetti, Doucette, Claus, & Marottoli, 1995; Tinetti & Williams, 1997). For home health care agencies certified by the Centers for Medicare & Medicaid Services (CMS), fall prevention has clear clinical importance and organizational relevance in that adverse falls (i.e., falls that trigger emergent care) is one of Medicare's quality indicators and is associated with increased costs. Thus, for both patients and providers, timely identification of patients at high risk for falls, as well as modifiable risk factors to include in fall risk assessments, are important.

LITERATURE REVIEW

Most recommended fall prevention and intervention programs are physically oriented, focusing on exercise, increased mobility, and environmental assessment (Close et al., 1999; Koch, Gottschalk, Baker, Palumbo, & Tinetti, 1994; Province et al., 1995; Tinetti, 2003; Tinetti et al., 1993, 1994; Vu, Weintraub, & Rubenstein, 2004). Few, if any, explicitly

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address the mental health of older adults. One reason depression has not been a focus of fall prevention interventions is that most previous research on fall risk has excluded depression or used it only as a covariate without considering depression as a potential target for fall prevention. Tinetti (2003) recommended a multifactorial approach to fall prevention, but her recommendations only include depression with respect to assessing the use of antidepressant medications.

Although depression screening has not been examined as an integral part of fall risk assessment and management, depression has the characteristics of a desirable target for primary care prevention interventions. Depression is prevalent among home health care patients (Bruce et al., 2002; Cesari et al., 2002) and can be effectively treated in older adults (Alexopoulos, 2005; Bruce et al., 2004; National Institutes of Health [NIH] Consensus Development Panel on Depression in Late Life, 1992).

The current research team previously reported preliminary data suggesting that depression increases the risk for adverse falls in home health care patients but did not have an adequate sample to control for medication use or several other risk factors prevalent in this population (Sheeran, Brown, Nassisi, & Bruce, 2004). Home health care agencies certified by the CMS are required to assess all Medicare patients with the standardized Outcome and Assessment Information Set (OASIS) at the start of care. Thus, the OASIS administered at the start of care offers an opportunity for routine and timely identification of patients at high risk for depression and falls and, ultimately, those who would benefit from fall risk reduction interventions.

The problem of falls is pervasive among home health care patients. Home health care patients are at especially high risk (Lewis, Moutoux, Slaughter, & Bailey, 2004; Sattin, 1992) because they have several risk factors associated with falls in long-term care facilities (Kron, Loy, Sturm, Nikolaus, & Becker, 2003; Rubenstein, Josephson, & Robbins, 1994; Vu et al., 2004), including weakness and gait and balance problems, but they live in less controlled environments. Many patients initiate home health care following a hospitalization. Compared with other discharged patients (8.4%), patients who initiate home health care report a significantly higher rate of falls in the month immediately following hospitalization (20.2%) (Mahoney, Sager, Dunham, & Johnson, 1994). Besides depression, home health care patients also have many of the predisposing and precipitating risk factors for falls as do other community-dwelling older adults (King & Tinetti, 1995; Sattin, 1992; Tinetti, 2003; Tinetti, Inouye, Gill, & Doucette, 1995; Tinetti, Speechley, & Ginter, 1988), such as acute and chronic illnesses, incontinence, multiple medications, prior history of falling, cognitive and visual impairments, problems with ambulation, and environmental hazards.

PURPOSE OF THE STUDY

The goal of this research was to determine whether depression would be an appropriate target for preventive fall interventions in home health care patients. Therefore, we tested the hypothesis that depressive symptoms independently predict adverse fall events after controlling for other significant risk factors identified through start of care OASIS and medication administrative data. Because multifactorial fall prevention interventions have been found to be most effective in reducing both the risk for falling and the monthly rate of falling in adults age 60 and older (Chang et al., 2004), we examined the independent effect of depression on falls in a multifactorial model.

METHOD

Sample

Study participants were from a certified regional home health care agency serving Westchester county. The agency is a traditional, not-for-profit, certified home health agency serving a 450-square-mile county north of New York City. The study used 2 years (March 2001 to December 2002) of the agency's clinical and administrative data from their Medicare-mandated, start of care OASIS. This study received approval from the College's Institutional Review Board. Because the study entailed an analysis of an existing data set and participants were not identifiable, recruitment and consent procedures were not applicable.

The research team had previously reported a preliminary analysis of data from 1 year (March 2001 to February 2002) (Sheeran et al., 2004), so we structured this study to first replicate the Year 1 analysis with a second year of data (March 2002 to December 2002) before proceeding to analyze the aggregate data set. Consistent with the CMS method for reporting adverse fall events, we did not use an age restriction. However, all of the falls had involved patients older than age 60. This age group comprised 90% of the original population of 5,167 patients (n = 2,859 from Year 1 and n = 2,308 from Year 2).

Procedures

A case-control design was selected for this study because adverse fall events are rare, with an annual national rate of 1.7 per 100 (U.S. Department of Health and Human Services [USDHHS], 2001). In the case-control study design, the cases (those patients with an adverse fall event) are identified first, and then controls (those patients without an adverse fall event) are matched to the cases. By identifying the study sample according to case definition, the issue of low power due to the low prevalence of adverse falls in the overall population is mitigated in the sample analysis.

The design is described as a prospective, matched case-control study. It is prospective because risk factors were collected prior to the occurrence of adverse fall events and thus were stored as part of the administrative data. Most case-control studies are retrospective in which risk factor information is collected historically (i.e., after the designation of cases). In addition, we chose a matched design because the matching of multiple controls allowed us to improve on the power of the case-control study.

Cases—To ensure comparability of cases and controls, each study year included cases who had a first admission within the given study year. Cases were identified by agency documentation of an adverse fall event, defined by the CMS as a fall resulting in an emergent care episode requiring hospital admission, emergency department treatment, or primary care treatment for fall-related injury (USDHHS, 2001). For an adverse fall event to be recorded, the patient had to receive emergent care after start of care or resumption of care.

Controls—Controls were matched to cases by enrollment month, gender, age (±3 years), and duration of care (equal to or greater than the cases). These matching variables were selected to equalize the risk of falls among well-established risk factors (e.g., gender, age, season of year) and to ensure controls had at least the same amount of time as the cases for the opportunity to fall. Because falls often precipitate home care discharge, controls were not expected to have a duration of care comparable to cases.

During the 2 years of the study, there were a total of 59 cases among the total agency data of 5,167 patient admissions. Of these, 54 cases of adverse events were matched to 854 controls. No matches could be found for 5 cases, who were among the oldest old (ranging in age from 81 to 95), were mostly women, and had exceptionally long durations of care.

The replication analysis determined whether the association between depression and adverse falls was comparable in the Year 1 and Year 2 data. In Year 1, 25 cases were matched to 415 controls. In Year 2, 29 cases were matched to 439 controls. Given replication, analysis of the aggregate data set tested the primary hypothesis that depression symptoms identified on the OASIS independently predicted adverse fall risk after controlling for other factors.

Measures

Data on independent risk factors that could potentially confound the association between depression and adverse falls were assessed from the start of care OASIS and medication records. Beginning in the summer of 1999, home health agencies were federally mandated to administer the OASIS to all patients receiving skilled care. The OASIS is part of the outcome-based, quality improvement programs to develop a patient-centered system of outcome measures and outcome improvement methods for home health care (Shaughnessy, Crisler, Schlenker, & Arnold, 1997). An RN usually performs an OASIS assessment within 24 hours of a home care referral.

In this study, depression was indicated by either depressed mood or anhedonia (Items M0590 or M0600) on the OASIS. These variables are the two key gateway symptoms for a diagnosis of major depressive disorder (American Psychiatric Association, 1994). In reviewing other risk factors for falls identified in community and long-term care studies, we evaluated seven domains:

- Sociodemographic variables.
- Medical status.
- Medications.
- Functional impairment
- Cognitive impairment.
- Behavioral problems.
- Environmental hazards.

Medication data are not included in the OASIS, but medications (in particular, antidepressant agents) have been implicated as a risk factor for falls in previous studies (American Geriatrics Society, British Geriatrics Society, & American Academy of Orthopaedic Surgeons Panel on Falls Prevention, 2001; Leipzig, Cumming, & Tinetti, 1999; Tinetti, 2003). Therefore, we obtained medication use data from a separate agency file and merged the information with the OASIS data. Medications were categorized into the following groups: antidepressants, benzodiazepines, antipsychotics, other psychopharmaceuticals (psychological or central nervous system agents), anticonvulsants, vasodilators, and total count of medications.

Data Analyses

To describe the sample, we used univariate analyses with means and standard deviations for continuous variables and frequencies and percentages for categorical variables. For the replication matched case-control analysis, we examined unadjusted odds ratios. For the aggregate data matched casecontrol study, we used a forward selection method to build the

multivariable model. Our main interest was to examine depression as an independent predictor of falls in the context of other independent predictors. Therefore, we were most concerned about evaluating the importance of depression in a multifactorial model of significant risk factors than specifically evaluating confounding, which does not use a test of statistical significance.

We selected important predictors determined by a priori criteria, where empirically influential and robust predictors would remain in the final model profile. Risk factors were eligible for inclusion in the multivariable model if they were associated with an adverse fall event in a bivariate model with $p < 0.20$. To be included in the final model, eligible risk factors were systematically added to the model and then removed if they did not maintain a $p < 0.10$. Variables used as matching criteria were implicitly controlled. Analyses were performed with SAS software, version 8.2, using the Cox proportional hazards regression analysis (PHREG procedure) to fit conditional logistic regression models.

A sensitivity analysis was conducted because patient admissions could include more than one admission for an individual patient during the 2-year period. To ensure unbiased results, we reexamined the data without repeats using the same conditional logistic regression analysis. Of the 908 patient admissions, 55 patients had repeated admissions. We selected only the most recent admission per patient, removing 77 observations. There were 831 individuals, including 51 cases and their controls, with unique observations for reanalysis.

RESULTS

Patient Population

Of the total agency patient population ($N = 5,167$) during the 2 years from March 2001 to December 2002, 90% were age 60 and older (mean age = 76.4, $SD = 13.6$ years), 26% had depression (depressed mood or anhedonia), 65% were women, and 78% were Caucasian.

For the prospective, matched case-control study of the aggregated study years, 54 cases were included who had a prior start of care OASIS within the 2-year period and who were matched to 854 controls by enrollment month, gender, age (±3 years), and duration of care (i.e., time in care prior to the fall). Of the 908 patients in the case-control study, all were age 58 and older (mean age = 81.3, $SD = 6.2$ years). They were predominantly women (88.2%) and Caucasian (85.8%). Approximately 40% of the case-control sample reported living alone at the start of care, and more than half lived with a spouse or significant other (27.2%) or other family member (27.1%). Twenty-five percent reported depressed mood or anhedonia at start of care, thereby meeting our criterion for depression.

Table 1 presents the matched characteristics comparing cases with controls. As expected, the matched variables of age, gender, and enrollment period were close in magnitude. The greater duration of care among controls, compared with cases, reflects the matching criterion necessitating that a control have duration of care (in days) equal or greater to cases to ensure equal risk exposure.

Depression as a Predictor of Falls

The rate of depression at admission was 40.7% for patients who experienced an adverse fall event (22 of 54 cases) compared with 23.5% for patients who did not fall (201 of 854 controls). The replication analysis showed comparable results for Year 1 and Year 2 data, where in Year 1, the unadjusted odds ratio was 2.4 ($p < 0.05$) and in Year 2, the unadjusted odds ratio was 2.6 ($p < 0.05$). In the aggregate 2-year data set, the multivariable logistic regression model tested whether the effect of depression was independent of other risk factors for falls.

The risk factors from the OASIS eligible for inclusion in the multivariable model on the basis of a bivariate association with an adverse fall event of $p < 0.20$ included mental disorders, nervous system disorders, respiratory system disorders, genitourinary system disorders, injury and poisoning, stairs inside the home that must be used (e.g., to get to toileting, sleeping, eating areas) and are not a barrier to independent mobility, urinary and bowel incontinence, medical comorbidity, cognitive impairment (both ordinal measure and binary memory deficit measure), surgical wounds, individual activities of daily living (ADLs) and instrumental ADLs, and summation of any ADL dependence.

Table 2 presents the final model of depression and other predictors from the forward selection model-building approach where these risk factors maintained a $p < 0.10$. Six independent predictors of adverse fall events, besides depression, remained in the multivariable model, including bowel incontinence, high medical comorbidity, stairs that must be used, injury and poisoning, memory deficit, and antipsychotic medication use. The multivariable model confirmed that patients who fell (i.e., cases) had approximately twice the odds of being depressed at the start of home health care than did those who did not fall (i.e., controls) (odds ratio = 1.90, 95% confidence interval = 1.01 to 3.59). Sensitivity analysis examining the 831 unique older adult patients supported these findings.

Given prior reports that antidepressant medication use is associated with falls, we further investigated this possible association. In this sample, 33.3% of patients who fell used antidepressant agents compared with 22.6% of those who did not fall ($\chi^2 = 3.27$, $df = 1$, $p = 0.071$). However, antidepressant agent use was not statistically significant in the multivariable model ($p = 0.645$). We also did not find evidence that anti-depressant agent use confounded or mediated the effect of depressive symptoms on falls (Baron & Kenny, 1986).

DISCUSSION

This study has two major findings. First, in a typical population of older adults starting home health care, depressive symptoms were associated with a two-fold risk of an adverse fall event during the patient's episode of care. This risk was independent of medical, medication, environmental, and functional factors. Second, the study shows that these high-risk patients can be identified using routinely obtained clinical and administrative data.

The findings suggest that depression is an appropriate target for a fall prevention intervention with home health care patients, in combination with screening for other important risk factors. In home health care, depression may be a particularly effective target because it is prevalent among older home health care patients (Bruce et al., 2002; Cesari et al., 2002) and can be successfully treated in older adults (Alexopoulos, 2005; Bruce et al., 2004; NIH Consensus Development Panel on Depression in Late Life, 1992).

The study findings also suggest that patients with depressive symptoms warrant monitoring for fall risk, independent of antidepressant agent use. This implies that directly screening for depression is essential in a fall risk assessment and management program, as opposed to using antidepressant medication use as a proxy for depression. In this study, antidepressant agents did not confound or mediate the relationship between depression and adverse falls, nor did they predict falls in this sample. In contrast, antipsychotic medication use was an independent risk factor for adverse falls. Most (73%) patients taking antipsychotic agents had evidence of cognitive impairment reported in the OASIS, suggesting that use of antipsychotic agents in this population was primarily for treatment of neuropsychiatric symptoms of dementia (Herrmann & Lanctôt, 2006; Schneider, Dagerman, & Insel, 2006). This further emphasizes the necessity of a separate screening instrument for depression, in

conjunction with monitoring the use of high-risk psychotropic medications, as part of a multifactorial fall prevention intervention.

Evidence that depression contributes to fall risk is consistent with the documented association between depression and disability (Bruce, 2001; Ormel, Rijsdijk, Sullivan, van Sonderen, & Kempen, 2002; Tinetti, Inouye, et al., 1995) and the increased risk for falls among frail older adults (Cesari et al., 2002; Kron et al., 2003; Rubenstein et al., 1994; Sheeran et al., 2004; Tinetti, 2003; Tinetti, Inouye, et al., 1995; Tinetti et al., 1988; Vu et al., 2004). The inclusion of depression is also consistent with the examination of basic neurological function as part of a fall evaluation by the American Geriatrics Society, the British Geriatrics Society, and the American Academy of Orthopaedic Surgeons Panel on Falls Prevention (2001).

Adverse fall events are less common than the falls typically measured by other studies (1.7% versus 30% to 40%) (American Geriatrics Society, the British Geriatrics Society, and the American Academy of Orthopaedic Surgeons Panel on Falls Prevention, 2001; Sattin, 1992; Tinetti, 2003). They are also more serious. By requiring that a fall lead to emergent care (USDHHS, 2001), we restricted our outcome to falls that have an obvious clinical consequence to a population with heightened frailty and medical comorbidity.

As important, an adverse fall is one of the indicators used by the CMS in its outcome-based quality improvement initiative for home health care agencies. Given that home health care agencies certified by the CMS are evaluated, in part, by their rate of adverse falls, our study findings have clear relevance to agencies and suggest potential value in placing greater priority on detection and management of geriatric depression. Currently, CMS policy does not identify depression as a risk factor for adverse fall events. These findings suggest that increased reimbursement for mental health care by the CMS could decrease adverse outcomes and improve patient care.

STRENGTHS AND LIMITATIONS

The use of administrative data in this analysis is both a limitation and strength. By using administrative data, we were unable to confirm the validity of the depression assessments, quantify depression severity, or identify the mechanism through which depression increases the risk of falls. Therefore, other studies that provide such information are needed to replicate and better inform these findings. Another limitation is that the data come from a single agency, which may limit the generalizability of the findings. However, the agency is similar to other certified home health care agencies in the United States, and the study sample characteristics are similar to national norms (Munson, 1999). The fact that the findings from the Year 2 data replicated those from Year 1 further supports the relevance of these findings to other agencies.

On the other hand, the strength of administrative (routine clinical) data is that these data are readily available in “real world” practice and could be applied routinely to identify high-risk patients or patients in need of interventions. This study demonstrates the effective use of such data in identifying depression and other important risk factors for clinically meaningful outcomes, such as falls. In lieu of expecting nurses practicing in the real world to incorporate scientific measures into their already lengthy assessments, one approach is to find ways to make routinely collected data as useful as possible to improve the mental health care of older adults. Recent research from our team has shown that a nursing intervention (Training in the Assessment of Depression [TRIAD], a three-group, nurse-randomized trial) for depression assessment led to appropriate referrals and better clinical outcomes in patients with depression (Bruce et al., 2007). The intervention was integrated naturally into routine practice and developed by training nurses in use of the depression section of the OASIS.

Such an approach emphasizes the importance of the nurse's role as the assessor of the gateway symptoms for a diagnosis of major depressive disorder.

CONCLUSION

The increased risk for adverse falls in home health care patients with depression suggests the potential value of including depression screening in a multifactorial fall prevention intervention. Although the mechanisms by which depression increases fall risk are unknown, we speculate that specific consequences of depression, such as impaired concentration, inactivity, or nonadherence to physical therapy, are potential targets for intervention. This study supports depression screening for fall risk during the intake OASIS, highlighting the inclusion of depression and the benefit of using routinely collected data as part of a multifactorial fall risk assessment and management program for home health care patients.

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TABLE 1

Matching Characteristics for Cases and Controls

Variable	Cases (*n* = 54)	Controls (*n* = 854)	*p* Value[a]
Age (years)			0.340
Mean ± *SD*	82.1 ± 7.3	81.3 ± 6.1	
Range	61 to 98	58 to 99	
Women (%)	79.6	88.8	0.044
Enrollment period (%)			0.189
Fall	33.3	34.1	
Winter	3.7	12.9	
Spring	31.5	23.9	
Summer	31.5	29.2	
Duration of care (days)			<0.001
Mean ± *SD*	27.7 ± 17.7	41.3 ± 16.3	
Range	1 to 59	2 to 119	

Note. Fall = September to November; Winter = December to February; Spring = March to May; Summer = June to August.

[a]Statistical tests included *t* test for continuous variables and chi-square test for categorical variables.

TABLE 2

Predictors of an Adverse Fall Event Among Older Home Health Care Patient Admissions

Variable	Odds Ratio	95% CI	*p* Value
Depressive mood or anhedonia	1.90	1.01 to 3.59	0.048
Bowel incontinence	2.68	1.24 to 5.79	0.012
High medical comorbidity[a]	1.95	1.04 to 3.67	0.038
Stairs that must be used[b]	6.20	1.43 to 26.91	0.015
Injury and poisoning	2.67	1.40 to 5.08	0.003
Memory deficit	2.03	0.96 to 4.28	0.065
Antipsychotic medication use	2.17	0.90 to 5.20	0.083

Note. CI = confidence interval.

[a]Defined by a count of *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death* (ICD-9) (World Health Organization, 1977) diagnoses ≥5.

[b]Stairs inside home that must be used (e.g., to get to toileting, sleeping, eating areas) and are not a barrier to independent mobility.