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DEPRESSION AND FUNCTIONAL RECOVERY AFTER A DISABLING HOSPITALIZATION IN OLDER PERSONS

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Abstract

OBJECTIVES—To determine the association between depression and functional recovery among community-living older persons who had a decline in function after an acute hospital admission.

DESIGN—Prospective cohort study.

SETTING—General community in greater New Haven, Connecticut, from March 1998 to December 2008.

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None of the authors has any conflicts of interest including specific financial interests and relationships and affiliations relevant to the subject matter or materials discussed in this manuscript. There is no disclosure to report.

Author Contributions:
Lisa C. Barry performed the data analysis, wrote the first draft of the paper, and contributed to revising the paper; she had full access to the data in the study and takes †responsibility for the integrity of the data and the accuracy of the data analysis. Terrence E. Murphy provided consultation regarding the statistical analysis and contributed to manuscript writing and its revision. Thomas M. Gill helped plan the study, including instrumentation, and revised the manuscript.

Conflict of Interest Disclosures:

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	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X		
Grants/Funds		X		X		X		
Honoraria		X		X		X		
Speaker Forum		X		X		X		
Consultant		X		X		X		
Stocks		X		X		X		
Royalties		X		X		X		
Expert Testimony		X		X		X		
Board Member		X		X		X		
Patents		X		X		X		
Personal Relationship		X		X		X		

PARTICIPANTS—Seven-hundred fifty four persons, aged 70 years or older.

MEASUREMENTS—Hospitalization and disability in essential activities of daily living (ADLs) and mobility were assessed each month for up to 129 months, and depressive symptoms were assessed every 18 months using the Center for Epidemiologic Studies of Depression (CES-D) Scale. Functional recovery was defined as returning to the community within 6 months at or above the pre-hospital level of ADL function and mobility, respectively.

RESULTS—A decline in ADL function and mobility was observed following 42% and 41% of the hospitalizations, respectively. After controlling for several potential confounders, clinically significant depressive symptoms (CES-D ≥20) was associated with a lower likelihood of recovering mobility function (HR= 0.79; 95%CI 0.63, 0.98), but not ADL function (HR= 0.91; 95%CI 0.75, 1.10), within 6 months of hospitalization.

CONCLUSION—Following a disabling hospitalization among community-living older persons, those with pre-existing depression may be less likely to recover their pre-hospitalization level of mobility function, but not ADL function. Yet, the reasons remain to be elucidated.

Keywords

Depression; hospitalization; functional decline; recovery

OBJECTIVE

An estimated 8% to 20% of older persons living in the community experience clinically significant depressive symptoms, often referred to as depression.[1] Prior research indicates that depression is associated with an increased risk of functional disability following hospitalization in this population.[2, 3] However, far less is known about the role of depression on recovery of function after an acute hospital admission, with the exception of recovery from catastrophic events, such as stroke[4] or hip fracture.[5]

Previous studies evaluating this association have primarily focused on recovery of activities of daily living (ADLs).[2, 6, 7] Results from these studies are mixed, with one study finding no association between depression and recovery of ADL function[6] and the others indicating that depressed persons were less likely to recover ADL function. These studies are limited, however, in that they were unable to assess functional status immediately before and after hospitalization,[2, 6, 7] included women only,[6] or did not account for the competing risk of death.[2, 6, 7] Furthermore, although disability in mobility occurs frequently following hospitalization,[8] the association between depression and recovery of mobility function in this setting has not been previously evaluated.

The objective of this prospective cohort study was to determine the association between depression and functional recovery among community-living older persons who had a decline in function after an acute hospital admission (i.e., a disabling hospitalization). We hypothesized that depression would be associated with a lower likelihood of recovering ADL function and mobility function following hospitalization. To test this hypothesis, we used data from a unique cohort of older persons who had monthly assessments of hospitalization and disability in essential ADLs and mobility together with assessments of depressive symptoms every 18 months for more than ten years. Elucidating the relationship between depression, a condition amenable to both pharmacologic and non-pharmacologic treatment, and recovery of functional outcomes following hospitalization could inform clinical decision-making and help improve the likelihood of recovery in this vulnerable population.

METHODS

Study Population

Participants were members of the Precipitating Events Project (PEP), a longitudinal study of 754 initially non-disabled, community-living persons aged 70 years or older.[9] Participants were identified from 3,157 age-eligible members of a health plan in New Haven, Connecticut. The primary inclusion criteria were English speaking and requiring no personal assistance with bathing, dressing, transferring from a chair, and walking across a room. The participation rate was 75.2%.[9] The Human Investigation Committee at Yale University approved the study.

Data collection

Between March 23, 1998 and December 31, 2008, comprehensive face-to-face assessments were completed at baseline and subsequently at 18-month intervals for 108 months, while telephone interviews were completed monthly for up to 129 months. Deaths were ascertained from the local obituaries and/or from an informant during a subsequent telephone interview. Four hundred and five (53.7%) participants died (median follow-up of 68 months) and 35 (4.6%) dropped out of the study (median follow-up of 24 months). Data were otherwise available for 99.2% of the 66,425 monthly telephone interviews.

During the baseline assessment, data were collected on demographic characteristics, including age, sex, race, and years of education. During each of the comprehensive assessments, data were collected on several clinical factors including medical comorbidity, cognitive status, physical frailty, social support, and antidepressant medication use. Table 1 provides further description of the measures used to assess these variables. The amount of missing data for the aforementioned variables was less than 1% in the baseline assessment and less than 5% in all subsequent assessments.

Assessment of depressive symptoms—During each comprehensive assessment, frequency of depressive symptoms in the previous week was assessed with the 11-item Center for Epidemiologic Studies – Depression (CES-D) scale.[10] Scores, transformed to be compatible with the full 20-item instrument,[11] ranged from 0 to 60 with higher scores indicating more depressive symptoms. Scores ≥20 were considered as “clinically significant depressive symptoms” or “depressed” mood. This cutpoint increases the specificity for identifying major depression according to Diagnostic and Statistical Manual-IV (DSM-IV) criteria.[12] Data on depression were complete for 100% of the participants at baseline and 95%, 93%, 91%, 90%, 89%, and 88% of the non-decedents at 18, 36, 54, 72, 90, and 108 months, respectively.

Ascertainment of Hospital and Nursing Home Admissions—During the monthly telephone interviews, participants were asked whether they had stayed overnight in a hospital since the last interview (i.e., during the past month). The accuracy of these reports, based on an independent review of hospital records among a subgroup of 94 participants, was high (kappa = 0.94). Hospitalized participants provided the primary reason for their admission. These reasons were subsequently grouped into distinct diagnostic categories.[13] Participants were also asked whether they had been admitted to a nursing home during the past month; if yes, the interviewer noted whether the participant was currently in a nursing home. The accuracy of this information was almost perfect (kappa = 0.96).

Assessment of ADL disability and mobility disability—ADL disability and mobility disability were assessed during the monthly telephone interviews.[14] To assess ADL disability, participants were asked if they needed help from another person or if they were

unable to bathe, dress, transfer from a chair, and walk across a room. Mobility disability was assessed by asking participants if they needed help from another person "to walk a quarter of a mile (about 2 or 3 blocks)" and "to walk up a flight of stairs." Participants who responded "yes" to a specific question were considered to be disabled in that task. Each month, participants were assigned an ADL disability "score" (range 0 to 4) and a mobility disability "score" (range 0 to 2), denoting the total number of ADL and mobility disabilities, respectively.

Recovery of Pre-hospital Function—Recovery of pre-hospital function was defined as returning to the community within 6 months at or above the pre-hospital level of ADL or mobility function. This was determined by comparing the number of disabled ADLs or mobility disabilities during the first monthly interview that was completed after hospital discharge with that during the monthly interview that was completed immediately prior to the hospitalization. A 6-month time period is often used to predict recovery after a disabling hospitalization.[6, 14]

Assembly of the Analytic Samples—To evaluate the effect of depression on recovery of ADLs and mobility, respectively, we assembled two analytic samples. A detailed description of the assembly of the samples is provided in Appendix Figure 1. To make full use of our longitudinal data, participants were allowed to contribute more than one observation (i.e., qualifying hospital admission) to the respective analytic sample; hence, the unit of analysis was participant-hospitalizations. To be included as a qualifying admission, an acute hospitalization had to: (1) occur among participants living in the community; and (2) be followed by a decline in ADL function or mobility as compared with the level of ADL function or mobility, respectively, in the month immediately preceding the hospitalization. Of the 1,723 potentially eligible person-hospitalizations, 730 (42.4%) and 714 (41.4%) were followed by a decline in ADL function and mobility, respectively. Of these qualifying admissions, we selected only the first qualifying admission within each 18-month interval. We chose this approach to ensure that these admissions were the closest to the assessments of depression. To enhance clarity, these qualifying admissions will subsequently be referred to as "index" admissions. Hypothetically, a participant who remained in the study for the entire follow-up period could have contributed up to 7 index admissions (i.e., one from each 18-month interval) to the analysis. The final ADL and mobility samples included 623 and 624 index admissions, respectively, among 430 and 448 participants.

Statistical Analysis

We used descriptive statistics to determine the demographic, physical, cognitive, and social characteristics preceding the first index hospitalization of the 430 and 448 participants who contributed to the ADL and mobility analytical samples, respectively. In subsequent analyses, the unit of analysis for both samples was participant-hospitalizations rather than participants. To evaluate the unadjusted associations between depression and recovery of function, we used competing risk Cox models in which participants were simultaneously at risk for recovery and death.[15] The Cox models yield hazard ratios (HR), which represent the likelihood of recovery in the presence vs. absence of depression. The primary multivariable models were adjusted for demographic characteristics (i.e., age, sex, race, education, and living alone), clinical factors (i.e., number of chronic conditions, cognitive status, physical frailty), social support, ADL or mobility disability "score" prior to hospitalization, the number of months between the depression assessment and the index hospitalization, and the number of nonqualifying hospitalizations in each interval that preceded the index hospitalization. In secondary models, we controlled for antidepressant medication use in addition to the aforementioned variables. With the exception of sex, race, and education,

each of the variables was treated as a time-dependent covariate. These analyses were subsequently re-run with depression as a continuous variable. Values for depression and the time-dependent covariates in the Cox models were taken from the face-to-face assessments that immediately preceded each index hospitalization; the median (interquartile range) number of months between these assessments and the index hospitalizations was 8 (4–13) and 9 (4–13) for the ADL and mobility samples, respectively. Because the association between depression and functional recovery could be affected by an earlier, nonqualifying hospitalization, we subsequently restricted the analyses to only the 524 (84.1%) and 544 (87.2%) index admissions in the ADL and mobility samples, respectively, that represented the first hospitalizations (i.e., not preceded by any nonqualifying hospitalizations) in each 18-month interval.

To address the small amount of missing data for depressive symptoms and the covariates, as well as for the monthly disability data, we used multiple imputation with 50 random draws per missing observation, accounting for the potential correlation among repeated measures. The probability of missingness was imputed based on a GEE logistic regression model; and values for disability (present or absent) for each of the four essential ADLs and the two mobility items were imputed for each missing month sequentially from the first month to either the person's death or the end of follow-up.

All statistical tests were two-tailed, and *p*-values less than .05 were considered statistically significant. Analyses were performed using SAS version 9.2 (SAS Institute, Cary, NC).

RESULTS

Table 1 presents the characteristics preceding the first index hospitalization of the 430 and 448 participants who contributed hospitalizations to the ADL and mobility samples respectively. In both samples, the average age was approximately 82 years, and the majority of participants were female and white. Among the participants who experienced a decline in ADL function after hospitalization, 223 (60.4%) were physically frail and 99 (23.2%) were depressed. Among the participants who experienced a decline in mobility function after hospitalization, 229 (51.1%) were physically frail and 77 (17.3%) were depressed.

Table 2 provides information on the primary reason for hospitalization in each sample. Infection (pneumonia, urinary tract infection, etc.), cardiac (coronary heart disease, congestive heart failure, arrhythmia, etc.), and other medical (kidney disease/dialysis, dementia/delirium, etc.) were the most common diagnostic categories. Stroke and hip fracture each accounted for approximately 5%–6% of the hospitalizations. In the ADL sample, recovery, non-recovery and death were observed following 368 (59.3%), 145 (23.3%), and 108 (17.4%) of the hospital admissions, respectively. The corresponding values for the mobility sample were 410 (65.8%), 139 (22.3%), and 74 (11.9%).

The results of the primary multivariable analyses are shown in Table 3. Depression was significantly associated with a 21% reduction in the likelihood of recovering mobility function within 6 months of hospitalization (adjusted HR= 0.79; 95%CI 0.63, 0.98). While depression was significantly associated with a lower likelihood of recovering ADL function in the unadjusted model (HR= 0.78; 95%CI 0.66, 0.94), this association did not hold up in the adjusted model (HR= 0.91; 95%CI 0.75, 1.10). After additional adjustment for use of an antidepressant medication, the results were consistent but slightly attenuated. Depression remained significantly associated with recovery of mobility function (adjusted HR= 0.80; 95%CI 0.64, 0.99), but not ADL function (adjusted HR= 0.93; 95%CI 0.77, 1.13). Depression, operationalized as a continuous variable, was associated with a 2% reduction in the likelihood of recovering mobility function with every 1-point increase in depression score (adjusted HR = 0.98; 95%CI 0.97, 0.99), but was not associated with recovery of ADL

function (adjusted HR = 0.99; 95%CI 0.98, 1.01). To ensure that our findings were not driven by the known association between depression and recovery following stroke and hip fracture, we re-ran our primary models after omitting these conditions. The effect sizes changed only modestly: 0.95 and 0.82 for recovery of ADL and mobility function, respectively. Finally, the results were comparable when the samples were restricted to only those first hospitalizations in each 18-month interval that were qualifying hospitalizations. Depression was associated with a lower likelihood of recovering mobility (adjusted HR= 0.72; 95%CI 0.56, 0.92), but not ADL function (adjusted HR= 0.95; 95%CI 0.76, 1.18).

DISCUSSION

In this longitudinal study of older persons, which included multiple assessments of depressive symptoms and monthly assessments of functional status over the course of more than 10 years, we evaluated the effect of depression on functional recovery after a disabling hospitalization. We found that depression is associated with a significantly lower likelihood of recovering mobility function, but not ADL function, within 6 months after hospitalization.

Although ADL function is necessary for the maintenance of independence in older persons, maintaining mobility in this population is also an important goal of clinical medicine and public health. Older persons who lose independent mobility are at higher risk for social isolation,[16] morbidity,[17] and mortality.[17] While the association between depression and recovery from mobility disability has been previously established for major disabling events such as a stroke or hip fracture,[4, 5] these events represent only a small proportion of disabling hospitalizations, as evidenced in the present study and prior work.[8] Among older persons with disabling hospitalizations resulting from an array of conditions, we found that depressed participants were less likely to recovery mobility function than those without depression, even after hospitalizations from stroke and hip fracture were omitted.

The association between depression and recovery of mobility function persisted after adjustment for factors such as cognitive status and physical frailty that have previously been found to be associated with decline in mobility function.[18, 19] Because these factors were assessed at the same time as depression, we could control for them as potential confounders, yet we were precluded from evaluating them as mediators of any causal relationship between depression and recovery of mobility function after a disabling hospitalization. Assessment of mediation requires that the independent variable temporally precede the potential mediator.[20] Studies are needed to evaluate potential mechanisms, such as apathy,[21, 22] through which depression may impede recovery of mobility.

With one exception,[6] prior studies indicate that depressed older persons are less likely to recover ADL function after an acute hospital admission.[2, 7] There are at least two potential explanations for why a significant association between depression and ADL recovery was not found in the current study. First, the frequency of the disability assessments in our study enabled us to ascertain episodes of both functional decline and recovery that may have been disproportionately missed in prior studies, which have had much longer intervals, i.e., at least 1 year, between pre- and post-hospitalization disability assessments.[7] Second, in contrast to prior studies, which included only survivors in the analysis[2] or included deaths as part of the censored group,[7] we treated death as a competing outcome in our analyses. Results may be biased when death is not handled properly in longitudinal analyses of functional outcomes.[23]

Because depression was assessed prior to hospitalization, we could not confirm participants' depression status during the hospital admission or immediately following the hospitalization. Persistence of depression over time among the majority of our study participants, however,

suggests that the participants who were depressed prior to their hospitalization(s) were also depressed during the hospital admission. Furthermore, whereas we controlled for the number of months between the depression assessments and the subsequent hospitalizations, long intervals between these assessments may have attenuated the relationship of depression and functional recovery. The association between depression and recovery of mobility function, however, remained significant, albeit stronger, when the sample was limited to only the first (qualifying) hospitalization in each 18-month interval, which minimized the interval between the assessment of depression and the index hospitalization. The availability of a depression assessment prior to hospitalization could be considered a strength since patients who may have been too sick to complete an in-hospital assessment were not excluded,[2] thereby enhancing the generalizability of our findings. Additionally, because depression was assessed prior to the acute event, it was unlikely that participants' depression scores were falsely inflated due to symptoms of physical illness such as fatigue or weight loss.[24]

Prior evidence from the stroke literature indicates that pharmacological treatment of depression may enhance recovery of mobility function.[25] In the current study, depression remained significantly associated with recovery of mobility function after adjustment for use of an antidepressant medication. Because information was not available on the dose, dosing schedule, adherence, indication, or start of treatment, future studies should evaluate the effect of these treatment characteristics on functional recovery.

Several other potential limitations warrant comment. First, in the absence of a diagnostic measure, we were unable to determine the prevalence of major depression among the study participants. To address this limitation, we used a cutpoint of ≥20 on the CES-D to minimize the likelihood of misclassifying older persons as having high depressive symptoms, as previously recommended.[12] Second, our assessments of ADL and mobility function were based on self-report rather than performance-based measures. Yet, these two strategies have comparable validity in older persons.[26] Third, because our study did not include data on the receipt of rehabilitation following hospitalization, we were unable to evaluate if this factor had an effect on the association between depression and functional recovery. Lastly, although our participants were members of a single health plan in a small urban area, several factors enhance the generalizability of our findings. These include a high participation rate, low rate of attrition for reasons other than death, and nearly complete ascertainment of ADLs and mobility function.

CONCLUSIONS

Following a disabling hospitalization among community-living older persons, those with pre-existing depression may be less likely to recover their pre-hospitalization level of mobility function, but not ADL function. Yet, the reasons remain to be elucidated. In future work, we plan to evaluate whether the relationship between depression and functional recovery in older persons may be bi-directional.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Not applicable.

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References

1. Blazer DG. Depression in late life: review and commentary. J Gerontol A Biol Sci Med Sci. 2003; 58:249–65. [PubMed: 12634292]
2. Covinsky KE, Fortinsky RH, Palmer RM, Kresevic DM, Landefeld CS. Relation between symptoms of depression and health status outcomes in acutely ill hospitalized older persons. Ann Intern Med. 1997; 126:417–25. [PubMed: 9072926]
3. Marengoni A, Aguero-Torres H, Cossi S, et al. Poor mental and physical health differentially contributes to disability in hospitalized geriatric patients of different ages. International Journal of Geriatric Psychiatry. 2004; 19:27–34. [PubMed: 14716696]
4. Hadidi N, Treat-Jacobson DJ, Lindquist R. Poststroke depression and functional outcome: A critical review of literature. Heart Lung. 2009; 38:151–62. [PubMed: 19254633]
5. Lenze EJ, Munin MC, Dew MA, et al. Adverse effects of depression and cognitive impairment on rehabilitation participation and recovery from hip fracture. International Journal of Geriatric Psychiatry. 2004; 19:472–8. [PubMed: 15156549]
6. Boyd CM, Ricks M, Fried LP, et al. Functional decline and recovery of activities of daily living in hospitalized, disabled older women: the Women's Health and Aging Study I. J Am Geriatr Soc. 2009; 57:1757–66. [PubMed: 19694869]
7. Ostir GV, Goodwin JS, Markides KS, et al. Differential effects of premorbid physical and emotional health on recovery from acute events. J Am Geriatr Soc. 2002; 50:713–8. [PubMed: 11982673]
8. Hirsch CH, Sommers L, Olsen A, Mullen L, Winograd CH. The natural history of functional morbidity in hospitalized older patients. J Am Geriatr Soc. 1990; 38:1296–303. [PubMed: 2123911]
9. Gill TM, Desai MM, Gahbauer EA, Holford TR, Williams CS. Restricted activity among community-living older persons: incidence, precipitants, and health care utilization. Ann Intern Med. 2001; 135:313–21. [PubMed: 11529694]
10. Radloff L. The CES-D scale: a self-report depression scale for research in the general population. Appl Psychol Meas. 1977; 1:385–481.
11. Kohout FJ, Berkman LF, Evans DA, Cornoni-Huntley J. Two shorter forms of the CES-D (Center for Epidemiological Studies Depression) depression symptoms index. J Aging Health. 1993; 5:179–93. [PubMed: 10125443]
12. Lyness JM, Noel TK, Cox C, King DA, Conwell Y, Caine ED. Screening for depression in elderly primary care patients. A comparison of the Center for Epidemiologic Studies-Depression Scale and the Geriatric Depression Scale. Arch Intern Med. 1997; 157:449–54. [PubMed: 9046897]
13. Ferrucci L, Guralnik JM, Pahor M, Corti MC, Havlik RJ. Hospital diagnoses, Medicare charges, and nursing home admissions in the year when older persons become severely disabled. JAMA. 1997; 277:728–34. [PubMed: 9042845]
14. Hardy SE, Gill TM. Recovery from disability among community-dwelling older persons. Jama. 2004; 291:1596–602. [PubMed: 15069047]
15. Therneau, TM.; Grambsh, PM. Modeling Survival Data: Extending the Cox Model. New York: Springer-Verlag; 2000.
16. Quadri P, Tettamanti M, Bernasconi S, et al. Lower limb function as predictor of falls and loss of mobility with social repercussions one year after discharge among elderly inpatients. Aging-Clinical & Experimental Research. 2005; 17:82–9. [PubMed: 15977454]
17. Keeler E, Guralnik JM, Tian H, et al. The impact of functional status on life expectancy in older persons. J Gerontol A Biol Sci Med Sci. 2010; 65:727–33. [PubMed: 20363833]

18. Davis DH, Rockwood MR, Mitnitski AB, Rockwood K. Impairments in mobility and balance in relation to frailty. Archives of Gerontology & Geriatrics. 2010 (in press).

19. Inouye SK, Studenski S, Tinetti ME, et al. Geriatric syndromes: clinical, research, and policy implications of a core geriatric concept. J Am Geriatr Soc. 2007; 55:780–91. [PubMed: 17493201]

20. Kraemer HC, Stice E, Kazdin A, Offord D, Kupfer D. How do risk factors work together? Mediators, moderators, and independent, overlapping, and proxy risk factors. Am J Psychiatry. 2001; 158:848–56. [PubMed: 11384888]

21. Lenze EJ, Munin MC, Dew MA, et al. Apathy after hip fracture: a potential target for intervention to improve functional outcomes. J Neuropsychiatry Clin Neurosci. 2009; 21:271–8. [PubMed: 19776306]

22. Mayo NE, Fellows LK, Scott SC, et al. A longitudinal view of apathy and its impact after stroke. Stroke. 2009; 40:3299–307. [PubMed: 19713543]

23. Berry SD, Ngo L, Samelson EJ, et al. Competing risk of death: an important consideration in studies of older adults. J Am Geriatr Soc. 2010; 58:783–7. [PubMed: 20345862]

24. Foelker GA Jr, Shewchuk RM. Somatic complaints and the CES-D. J Am Geriatr Soc. 1992; 40:259–62. [PubMed: 1538046]

25. Gainotti G, Antonucci G, Marra C, Paolucci S. Relation between depression after stroke, antidepressant therapy, and functional recovery. Journal of Neurology, Neurosurgery & Psychiatry. 2001; 71:258–61.

26. Guralnik JM, Ferrucci L, Guralnik JM, Ferrucci L. Assessing the building blocks of function: utilizing measures of functional limitation. American Journal of Preventive Medicine. 2003; 25:112–21. [PubMed: 14552934]

Table 1

Characteristics Preceding the First Index Hospitalization of the Participants Contributing to the ADL and Mobility Samples.

Characteristic	ADL Sample (n=430)	Mobility Sample (n=448)
Age, mean years (SD)	82.3 (5.4)	81.7 (5.5)
Women, n (%)	264 (61.4)	269 (60.0)
White, n (%)	386 (89.8)	400 (89.3)
Education, mean years (SD)	11.8 (2.9)	11.9 (2.8)
Number of chronic conditions, mean (SD) *	2.3 (1.3)	2.1 (1.2)
Cognitive status, mean (SD) †	25.7 (3.5)	26.1 (3.1)
Physical frailty, n (%)‡	223 (60.4)	229 (51.1)
Social support, mean (SD)§	21.6 (6.0)	22.0 (5.9)
Antidepressant medication use, n (%)¶	53 (12.3)	53 (11.8)
Depression, n (%)#	99 (23.2)	77 (17.3)

SD = Standard Deviation; ADL = Activities of Daily Living

* Includes 9 self-reported, physician-diagnosed chronic conditions: hypertension, myocardial infarction, congestive heart failure, stroke, diabetes mellitus, arthritis, hip fracture, chronic lung disease, and cancer (other than minor skin cancer).

† Assessed by the Folstein Mini-Mental State Examination (MMSE), with lower scores indicating worse cognitive status (range 0 to 30).

‡ Assessed using a rapid gait test in which participants were instructed to walk a 10-foot (3.048-m) course “as fast as it feels safe and comfortable,” turn around, and walk back. Participants who completed the task in >10 seconds were considered to be physically frail.

§ Determined by the Medical Outcomes Study Social Support Survey, with higher scores indicating higher social support (range 0 to 28).

¶ Ascertained by review of all pill bottles or a medication list. Trazodone and Amitriptyline were not coded as antidepressants because they are commonly used for other indications, including sleep and pain.

Determined using the Center for Epidemiological Studies - Depression Scale; Depressed = score >20.

Table 2

Reasons for Hospitalization.

Reason for Hospitalization	ADL Sample (N=623)* n (%)	Mobility Sample (N=624)† n (%)
Infection	101 (16.2)	105 (16.8)
Cardiac	93 (14.9)	107 (17.1)
Fall-related injury‡	46 (7.4)	37 (5.9)
Arthritis	44 (7.1)	37 (5.9)
Stroke	39 (6.3)	33 (5.3)
Hip fracture	35 (5.6)	33 (5.3)
Cancer	31 (5.0)	35 (5.6)
Pulmonary	19 (3.0)	22 (3.5)
Gastrointestinal bleeding	15 (2.4)	12 (1.9)
Peripheral artery disease	12 (1.9)	10 (1.6)
Dehydration	8 (1.3)	11 (1.8)
Diabetes	7 (1.1)	7 (1.1)
Psychiatric	3 (0.5)	3 (0.5)
Other		
Medical	109 (17.4)	105 (16.8)
Surgical	53 (8.5)	61 (9.8)
Unknown	3 (0.5)	6 (0.9)

ADL = Activities of Daily Living

*430 participants contributed 623 participant-hospitalizations to the ADL sample, with 296 (68.8%), 89 (20.7%), 37 (8.6%), and 8 (1.9%) participants contributing 1, 2, 3, and 4 hospitalizations, respectively.

†448 participants contributed 624 participant-hospitalizations to the mobility sample, with 325 (72.5%), 88 (19.6%), 22 (4.9%), 10 (2.2%), 2 (.4%), and 1 (.2%) participants contributing 1, 2, 3, 4, 5, and 6 hospitalizations, respectively.

‡Does not include hip fracture.

Table 3

Association Between Depression and Functional Recovery Within 6 Months Following a Disabling Hospitalization.

	ADL Function						Mobility Function					
	Unadjusted			Adjusted†‡			Unadjusted			Adjusted†‡		
	Hazard Ratio	95% CI	p-value	Hazard Ratio	95% CI	p-value	Hazard Ratio	95% CI	p-value	Hazard Ratio	95% CI	p-value
Non-depressed	1.0	-	-	1.0	-	-	1.0	-	-	1.0	-	-
Depressed*	0.78	0.66, 0.94	0.03	0.91	0.75, 1.10	0.31	0.69	0.56, 0.86	<0.001	0.79	0.63, 0.98	0.03

ADL = Activities of Daily Living; CI = Confidence Interval

*Between 58% to 85% of the participants who were depressed at any given face-to-face assessment prior to their disabling hospitalization were also depressed at their subsequent face-to-face assessment, for both the ADL and mobility samples, respectively.

†The median (interquartile range) number of months between the face-to-face assessments and the index hospitalizations was 8 (4–13) and 9 (4–13) for the ADL and mobility samples, respectively. A total of 228 (36.6%) and 238 (38.1%) of the hospitalizations in the ADL and mobility samples, respectively, occurred within 6 months of the previous face-to-face assessment. An additional 227 (36.4%) and 206 (33.0%) of the hospitalizations in the ADL and mobility samples, respectively, occurred between 7 and 12 months following the previous face-to-face assessment.

‡Adjusted for age, sex, race, education, number of chronic conditions, cognitive status, physical frailty, social support, antidepressant medication use, number of ADL or mobility tasks disabled prior to hospitalization, number of months between the depression assessment and the index hospitalization, and number of hospitalizations in each 18-month interval prior to the index hospitalization.