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## Late-Life Depressive and Anxiety Symptoms Following Rehabilitation Services in Medicare Beneficiaries

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### Abstract

**Objectives:** To determine whether patients who received rehabilitation services have an increased risk for having late-life depressive or anxiety symptoms within the year following termination of these services.

**Design:** Population-based, longitudinal cohort.

**Setting:** The National Health and Aging Trends Study (NHATS) is an annual survey of a nationally representative sample of Medicare beneficiaries aged 65 years and older.

**Participants:** 5,979 2016 NHATS participants.

**Measurements:** The PHQ-2 and GAD-2 assessed for clinically significant depressive and anxiety symptoms. Interview questions addressed rehabilitation site as well as demographic characteristics, socioeconomic status, and health and functioning variables.

**Results:** The prevalence of depressive and anxiety symptoms was higher in older adults who had received rehabilitation services in the prior year and varied by site: No rehabilitation (depressive and anxiety symptoms): 10.4% and 8.8%; nursing home or inpatient rehabilitation: 38.8% and 23.8%; outpatient rehabilitation: 8.6% and 5.5%; in-home rehabilitation: 35.3% and 20.5%; multiple rehabilitation sites: 20.3% and 14.4%; and any rehabilitation site: 18.4% and 11.8%. In multiple logistic regression analyses, compared to no rehabilitation services, nursing home or inpatient and in-home rehabilitation services were associated with an increased risk of having subsequent depressive symptoms (OR=3.51, 95% CI: 1.85–6.63; OR=2.15, 95% CI: 1.08–4.30, respectively), but not anxiety symptoms.

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**Conclusions:** Older adults who receive rehabilitation services are at-risk for having depressive and anxiety symptoms after these services have terminated. As mental illness is associated with considerable morbidity and may affect rehabilitation outcomes, additional efforts to identify and treat depression and anxiety in these older adults may be warranted.

### Keywords

Post-acute care; care transitions; epidemiology; disability

## OBJECTIVE

In the United States, millions of older adults receive rehabilitation services in skilled nursing, inpatient, outpatient, and in-home settings. In 2014, skilled nursing facilities (SNFs) admitted 1.7 million fee-for-service Medicare beneficiaries (often for post-acute care that included short-term skilled nursing and rehabilitation services), 339,000 received services in inpatient rehabilitation facilities, and about 3.4 million received services in in-home settings.<sup>1</sup> With the increasingly number of medically complex older adults receiving rehabilitation services in post-acute care settings, developing interventions that enhance quality of care and improve outcomes could have considerable public health benefits.

In particular, among older adults in inpatient rehabilitation units and SNFs, depression prevalence estimates range from 25.1% to 57.5%<sup>2–8</sup> and is associated with a variety of negative effects including functional impairment,<sup>9, 10</sup> lower quality of life,<sup>9</sup> increased medical problems,<sup>11–13</sup> poor adherence to medical treatment,<sup>14</sup> and suicide attempts and death by suicide.<sup>15, 16</sup> Furthermore, late-life depression can negatively impact rehabilitation participation, outcomes, and adherence to treatment.<sup>17</sup> Older adults with depression who were admitted to inpatient rehabilitation facilities had a longer length of stay,<sup>6, 7</sup> had less functional improvement from admission to discharge,<sup>18</sup> and were less likely to be independent two months after discharge.<sup>7</sup> Among patients receiving rehabilitation for a stroke, depressed patients were more likely to have longer inpatient stays,<sup>19, 20</sup> less efficient use of rehabilitation services,<sup>20</sup> greater disability,<sup>21</sup> and cognitive impairment or dementia<sup>22, 23</sup> and had a higher risk of subsequent stroke.<sup>23</sup> Depression also increased all-cause mortality by 3- to 4-fold after discharge from rehabilitation for coronary events.<sup>24</sup> Overall, depression represents a significant problem among older adults and can have substantial adverse effects on rehabilitation for a variety of illnesses and conditions.

Even though late-life anxiety is associated with physical disability, increased risk for cognitive impairment and dementia, worse quality of life, and increased healthcare utilization,<sup>25</sup> less is known about anxiety than depression in rehabilitation settings. Anxiety appears to be common in these settings, however, as anxiety symptoms were present in a large proportion of inpatient rehabilitation patients with a hip fracture (35.5%)<sup>26</sup> or a spinal cord injury (prevalence ranged from 17–60% during the admission).<sup>27</sup>

Additionally, relatively little is known about depression and anxiety following rehabilitation services. In stroke and spinal cord injury patients, depression symptoms improved from admission to rehabilitation facility to discharge<sup>19</sup> and at 6-month,<sup>28</sup> 1-year,<sup>29</sup> and 2-year follow-up.<sup>27</sup> There is some uncertainty, however, in the trajectory of depressive symptoms as

other studies have found that depression and anxiety symptoms worsened between admission and discharge in spinal cord injury patients<sup>27</sup> and depression did not change between admission and 12-month follow-up in stroke patients.<sup>30</sup> Although late-life depression and anxiety appear to be common in patients who use rehabilitation services, it is uncertain whether depression or anxiety persist after receiving rehabilitation services.

Despite the considerable morbidity associated with depression and anxiety among older adults receiving inpatient rehabilitation services, to our knowledge, no study has examined the association between rehabilitation services with subsequent late-life depressive and anxiety symptoms in a national sample of older adults receiving rehabilitation for a wide variety of conditions. Broadly characterizing late-life depressive and anxiety symptoms following receipt of rehabilitation services in different settings will provide some indication as to whether the quality of care for depression and anxiety in those receiving rehabilitation could be further optimized. Optimizing depression and anxiety treatment during and following rehabilitation treatment could have a variety of benefits such as improved functional recovery and decreased disability. Using data from the National Health and Aging Trends Study (NHATS), a cohort study of a nationally representative sample of Medicare beneficiaries, our objective is to determine whether older adults who received rehabilitation services have an increased risk for depressive and anxiety symptoms and whether this risk varies by rehabilitation site. We hypothesize that older adults who receive rehabilitation have an increased risk for clinically significant depressive and anxiety symptoms even after accounting for demographic characteristics, socioeconomic status, and health status and functioning characteristics.

## METHODS

### Participants

NHATS is a cohort study that conducts interviews annually to examine a nationally representative sample of Medicare beneficiaries aged 65 years and older.<sup>31</sup> NHATS is administered in English and Spanish, oversamples older age groups and Black individuals, and is publicly available. When Medicare beneficiaries were unable to respond for themselves proxy respondents were interviewed. The 2015 and 2016 NHATS interviews included questions regarding rehabilitation services.<sup>31</sup> NHATS had an unweighted response rate of 76.8% in 2015 and 90.6% in 2016.<sup>31</sup> The Johns Hopkins Bloomberg School of Public Health Institutional Review Board approved NHATS protocols. This question determined rehabilitation site: ***“In the last year, did you receive rehab: a) as an overnight patient in a hospital, nursing home, or rehab facility, b) at an outpatient center, clinic, or facility or at a doctor’s office or therapist’s office, c) at home, or d) somewhere else?”***<sup>32</sup> As we aim to examine depressive and anxiety symptoms following rehabilitation in different settings rather than during receipt of these services, we excluded 2016 participants who reported that they were still receiving rehabilitation services (N=313) and/or reported receiving services elsewhere (N=35). Of the 7,276 NHATS participants in 2016, our study consisted of 5,979 (weighted N=32,567,771) older adults who had information on rehabilitation site and psychiatric symptoms.

## Measures

**Depressive and anxiety symptoms.**—The two-item Patient Health Questionnaire (PHQ-2), a validated depression screening instrument,<sup>33</sup> and two-item Generalized Anxiety Disorder (GAD-2) scale, a validated anxiety screening instrument,<sup>34</sup> evaluated depressive and anxiety symptoms at the 2015 and 2016 interviews. NHATS slightly modified the PHQ-2 and GAD-2 to examine the prior one month period.<sup>31</sup> Both the PHQ-2 and GAD-2 were scored from 2 to 8 with scores of 5 or higher indicating the presence of clinically significant depressive or anxiety symptoms. We dichotomized clinically significant depressive and anxiety symptoms as being either present or absent.

**Independent variables.**—We included variables spanning demographics, socioeconomic status (SES), and health and functioning status domains – domains which have been associated with late-life depression and/or anxiety.<sup>35</sup> All variables were based on self- or proxy-report (n=5,636 and n=343, respectively). For stable variables such as sex, race and ethnicity, and education, we used information from when it was reported in either the 2011 or 2015 interviews (the first NHATS interview occurred in 2011 and the NHATS cohort was replenished in 2015). For more dynamic variables such as age and number of medical conditions, we included data from the most recent interview in 2016. With the exception of number of medical conditions, variables were treated as unordered dummy variables with a reference category.

Demographic variables included respondent age (65–74, 75–84, 85+), sex (female, male), race and ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic or Other), and living arrangement (alone, with others); sex and race and ethnicity were determined at the 2015 baseline interview, and age and living arrangement were assessed at the 2016 follow-up interview.

SES variables included education (high school degree or equivalent or less, some college or vocational training, college degree) and Medicaid status (present, absent); education was determined at the 2011 or 2015 interviews, and Medicaid status was assessed at the 2016 followup interview.

Health status and functioning variables included self-reported measures of physical and mental health. We coded medical conditions as being present if older adults reported that, at the 2016 or an earlier interview, a doctor had ever told them they have one of the following conditions: heart attack, heart disease, high blood pressure, arthritis, osteoporosis, diabetes, lung disease, stroke, or cancer with totals ranging from 0 to 9.<sup>32</sup> We considered dementia separately. We examined changes in ability to perform self-care activities (eating, bathing, toileting, dressing) as well as household activities (laundry, shopping, meal preparation, banking) from the 2015 to the 2016 interview (coded as being better, the same, or worse). We examined the change in functioning because a primary role of rehabilitation services is to restore, sustain, or limit decline in functioning<sup>36</sup> and from concern that an association between rehabilitation services and depressive and anxiety symptoms may be affected by a change in a patient's functional impairment status.

**Statistical Analyses**—We conducted bivariate and multiple logistic regression analyses to examine the associations of the site of rehabilitation services as well as demographic, SES, and health and functioning status variables with the presence of clinically significant depressive and anxiety symptoms. In bivariate analyses, we used the Rao-Scott F adjusted chi-square statistic for categorical covariates and F statistic for continuous covariates<sup>37</sup> to examine sample characteristic differences across depressive and anxiety symptom groupings. We subsequently conducted logistic regression analyses<sup>37</sup> with our outcomes being the presence of either clinically significant depressive or anxiety symptoms (present=1, absent=0). The base logistic regression model included rehabilitation site (no rehabilitation, nursing home or inpatient rehabilitation, outpatient rehabilitation, in-home rehabilitation, multiple settings). Our multiple logistic model included demographic characteristics, proxy interview status, SES, and health and functioning domains. To calculate population-weighted adjusted estimates that accounted for complex sampling design and nonresponse, we utilized SAS survey procedures (version 9.4, SAS Institute, Inc., Cary, NC). Per NHATS technical guidance,<sup>31</sup> we applied the Round 5 analytic weights as well as the stratification and cluster variables. We used list-wise deletion in the regression analyses to manage participants missing covariate data, and we applied the “nomcar” option in SAS’s survey procedures to account for participants with missing data, which treats these participants as being not missing completely at random. All percentages are weighted values.

## RESULTS

### Sample Characteristics by Depression and Anxiety Status

Among our sample, 16.5% (unweighted N=971) reported receiving rehabilitation services in nursing home or inpatient, outpatient, and/or in-home settings in the prior year. A higher proportion of Medicare beneficiaries who received these rehabilitation services had clinically significant depressive and anxiety symptoms at follow-up than those who did not receive these services (depression: 18.4% vs. 10.4%, Rao-Scott F adjusted chi-square statistic=39.56, degrees of freedom=1, 56,  $p<0.001$ ; anxiety: 11.8% vs 8.8%, Rao-Scott F adjusted chi-square statistic=4.34, degrees of freedom=1, 56,  $p=0.042$ ). Depressive and anxiety symptoms also varied by rehabilitation site: 1) Depressive symptoms: no rehabilitation: 10.4%, nursing home or inpatient facility: 38.8%, outpatient: 8.6%, in-home: 35.3%, and multiple sites: 20.3% (Rao-Scott F adjusted chi-square statistic=33.84, degrees of freedom=4, 224,  $p<0.001$ ); and 2) anxiety symptoms: no rehabilitation: 8.8%, nursing home or inpatient facility: 23.8%, outpatient: 5.5%, in-home: 20.5%, and multiple sites: 14.4% (Rao-Scott F adjusted chi-square statistic=11.13, degrees of freedom=4, 224,  $p<0.001$ ).

There were differences between those with and without depressive and anxiety symptoms. Depressed and anxious older adults were more likely to have had a proxy interview, be in an older age group, be non-white, be living alone, have less formal education, have Medicaid, have more self-reported medical conditions, have dementia, have reported decreased functioning in self-care and household activities, have depressive and anxiety symptoms at

baseline, and have anxiety or depressive symptoms at follow-up, respectively. Anxiety, but not depressive symptoms were associated with female sex (Table 1).

### Depressive and Anxiety Symptom Covariates

We next conducted logistic regression analyses with clinically significant depressive or anxiety symptoms serving as our outcomes (Table 2). In the unadjusted models, compared to those who did not receive rehabilitation services, older adults who received rehabilitation in nursing home or inpatient, in-home, or multiple sites had increased odds for having clinically significant depressive and anxiety symptoms. In the multiple logistic regression models adjusting for demographic characteristics, proxy interview status, SES, and health and functioning domains, the odds ratio point estimates for nursing home and inpatient, in-home, and multiple rehabilitation sites were attenuated and remained associated with depressive symptoms, but not anxiety symptoms. Covariates associated with depressive symptoms included non-Hispanic Black race and ethnicity, living alone, high school degree or equivalent or less, some college or vocational training, having Medicaid, number of medical conditions, worse ability for self-care, baseline depressive symptoms, and co-occurring anxiety symptoms. Covariates associated with anxiety symptoms included having a high school degree or equivalent or less, having some college or vocational training, number of medical conditions, ability for self-care and household activities, baseline depressive and anxiety symptoms, and co-occurring depressive symptoms (Table 2).

## DISCUSSION

Among the 2016 NHATS cohort, 16.5% (weighted N=5,363,738) reported receiving rehabilitation services in a nursing home or inpatient, outpatient, and/or in-home setting. Compared to the general NHATS cohort, clinically significant depressive and anxiety symptoms were more common among older adults who had used rehabilitation services. Depressive and anxiety symptoms were especially prevalent among those who received rehabilitation in nursing home or inpatient and in-home settings with depressive symptoms being more than three times as prevalent and anxiety more than twice as prevalent when compared to those who did not receive rehabilitation. The increased level of depressive and anxiety symptoms in patients following termination of rehabilitation services is congruent with prior research that found elevated depression and anxiety in rehabilitation settings<sup>2-8, 26, 27</sup> and home care services<sup>38, 39</sup> and is expected given the association of late-life mental illness with functional impairment and medical comorbidity.<sup>25, 35</sup> Many with depressive or anxiety symptoms at follow-up in 2016 also had depressive or anxiety symptoms at baseline in 2015, suggesting that depression and anxiety may be persistent and have a chronic course in some. However, even after accounting for a wide range of other potential mediators and moderators (including baseline depressive and anxiety symptoms), older adults who received rehabilitation services in nursing homes or inpatient settings or in-home settings had a more than three- and two-fold greater odds, respectively, for having depressive symptoms at follow-up. This finding is consistent with our hypothesis and is concerning given that the effect sizes are large and clinically meaningful and that millions of older adults receive these services yearly.<sup>1</sup> While there was evidence of a clinically meaningful association between rehabilitation services in subsequent anxiety symptoms in



the bivariate analyses (ORs ranged from 0.60 to 3.24), rehabilitation site did not remain associated with anxiety symptoms in multiple logistic regression analyses. This suggests that the higher prevalence of anxiety among older adults who had received rehabilitation services may be due to other factors such as medical comorbidity, functional impairment status, and anxiety at baseline.

Older adults receiving rehabilitation often do so following an acute medical illness, and post-acute care is now the fastest growing Medicare spending category.<sup>40</sup> From 1996 to 2010, the proportion of hospitalized patients discharged to a post-acute care facility increased by 49%,<sup>41</sup> and millions also receive post-acute care in other settings such as in their homes.<sup>1</sup> With the large number of older adults receiving rehabilitation services and our findings that clinically significant late-life depressive and anxiety symptoms can be highly prevalent following rehabilitation, the impetus to develop interventions that enhance quality of care and to improve outcomes is substantial. Efforts targeting late-life depression and anxiety in rehabilitation settings, however, have been rather limited. Psychiatric interventions in rehabilitation settings often are disease-specific (e.g., stroke<sup>21, 42</sup>) or consist of small studies that have had varied success.<sup>43, 44</sup> One randomized controlled trial of cognitive behavioral therapy for prevention of depression in older adults in nursing homes showed improvement in depressive symptom scores at 6-month follow up.<sup>45</sup> Nonetheless, the potential to deliver targeted late-life depression and anxiety interventions to patients receiving rehabilitation is considerable, especially since patients often receive care in these settings longer than they do in acute care settings.<sup>1</sup> Additionally, late-life interventions do not have to be limited to a single setting as many nursing home and inpatient rehabilitation patients will transition to receiving home health services. There is also active discussion on how to possibly integrate interventions across settings such as to more closely link home care services with primary care.<sup>46</sup> To date, home-based interventions involving rehabilitation providers have shown promise in improving functional impairment and depression in older adults.<sup>47</sup>

Our study has several strengths. First, we relied upon a dataset that consists of a nationally representative sample of older adult Medicare beneficiaries. Second, we examined a heterogeneous sample of older adult Medicare beneficiaries who received rehabilitation in a variety of settings, a topic for which relatively little is known. Third, the longitudinal dataset allowed us to examine factors at baseline and follow-up, which facilitated a more meaningful examination of the risk that older adults receiving nursing home and inpatient rehabilitation services have for clinically significant depressive and anxiety symptoms.

Our study has limitations to consider as well. First, hospital-based, nursing home, and rehabilitation facility settings were grouped together in the questionnaire, and we were unable to examine these settings individually.<sup>32</sup> Second, the relatively small sample size limits our ability to examine subgroups of participants with much granularity. Third, we rely on self-reported data which may be inaccurate; however, older adults have been found to accurately report rehabilitation services utilization over the past year.<sup>48</sup> Fourth, our analyses did not account for contextual factors that may be relevant in identifying possible opportunities and barriers to depression and anxiety assessment and treatment in these settings. Fifth, depression and anxiety were not assessed with a diagnostic psychiatric

interview. The PHQ-2 and GAD-2, however, performed well when validated against a structured mental health professional interview.<sup>33, 34</sup> Sixth, although the PHQ-2 and GAD-2 were initially validated to examine a two-week timeframe, they were modified in NHATS to examine a one-month period. It is possible that this modification may be associated with a decreased sensitivity and increased specificity compared to the two-week timeframe because a one-month timeframe is a more rigorous standard. Lastly, we are unable to examine the timing of rehabilitation services in much detail as dates of these services are not available in the dataset.

## CONCLUSIONS

Our study's finding that rehabilitation patients – particularly those who received nursing home or inpatient or in-home rehabilitation services – are at an increased risk for having depressive and anxiety symptoms following rehabilitation is concerning. As depressive and anxiety symptoms are common in these patients, associated with considerable morbidity, and/or may interfere with rehabilitation treatment and recovery, devising interventions that target these symptoms in rehabilitation settings could have a significant public health impact. Such interventions also could benefit those who utilize rehabilitation services and whose persistent depression and anxiety are frequently under-recognized and under-treated. Additionally, compared to acute care, patients typically receive rehabilitation for longer periods of time, which is conducive towards conducting interventions in these settings. Future efforts also could examine how rehabilitation factors (e.g., duration of services, goals of therapy, therapy outcomes) may affect subsequent depression and anxiety in this population.

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## REFERENCES

1. Medicare Payment Advisory Commission: Report to the Congress: Medicare Payment Policy, Washington, DC, MedPAC, 2016
2. Mast BT, MacNeill SE, Lichtenberg PA: Post-stroke and clinically-defined vascular depression in geriatric rehabilitation patients. *Am J Geriatr Psychiatry* 2004; 12:84–92 [PubMed: 14729563]
3. Cully JA, Gfeller JD, Heise RA, et al.: Geriatric depression, medical diagnosis, and functional recovery during acute rehabilitation. *Arch Phys Med Rehabil* 2005; 86:2256–2260 [PubMed: 16344020]
4. Lenze EJ, Munin MC, Skidmore ER, et al.: Onset of depression in elderly persons after hip fracture: implications for prevention and early intervention of late-life depression. *J Am Geriatr Soc* 2007; 55:81–86 [PubMed: 17233689]
5. Feng L, Scherer SC, Tan BY, et al.: Comorbid cognitive impairment and depression is a significant predictor of poor outcomes in hip fracture rehabilitation. *Int Psychogeriatr* 2010; 22:246–253 [PubMed: 19951458]
6. Mills TL, Lichtenberg PA, Wakeman MA, et al.: Correlates of rehabilitation hospital length of stay among older African-American patients. *J Natl Med Assoc* 2002; 94:846–855 [PubMed: 12392049]



7. Webber AP, Martin JL, Harker JO, et al.: Depression in older patients admitted for postacute nursing home rehabilitation. *J Am Geriatr Soc* 2005; 53:1017–1022 [PubMed: 15935027]
8. Farner L, Wagle J, Engedal K, et al.: Depressive symptoms in stroke patients: a 13 month follow-up study of patients referred to a rehabilitation unit. *J Affect Disord* 2010; 127:211–218 [PubMed: 20933286]
9. Unutzer J, Patrick DL, Diehr P, et al.: Quality adjusted life years in older adults with depressive symptoms and chronic medical disorders. *Int Psychogeriatr* 2000; 12:15–33 [PubMed: 10798451]
10. Kutlubaev MA, Hackett ML: Part II: predictors of depression after stroke and impact of depression on stroke outcome: an updated systematic review of observational studies. *Int J Stroke* 2014; 9:1026–1036 [PubMed: 25156411]
11. Bruce ML, Leaf PJ, Rozal GP, et al.: Psychiatric status and 9-year mortality data in the New Haven Epidemiologic Catchment Area Study. *Am J Psychiatry* 1994; 151:716–721 [PubMed: 8166313]
12. Penninx BW, Beekman AT, Honig A, et al.: Depression and cardiac mortality: results from a community-based longitudinal study. *Arch Gen Psychiatry* 2001; 58:221–227 [PubMed: 11231827]
13. Diniz BS, Reynolds CF, 3rd, Butters MA, et al.: The effect of gender, age, and symptom severity in late-life depression on the risk of all-cause mortality: the Bambui Cohort Study of Aging. *Depress Anxiety* 2014; 31:787–795 [PubMed: 24353128]
14. Ciechanowski PS, Katon WJ, Russo JE: Depression and diabetes: impact of depressive symptoms on adherence, function, and costs. *Arch Intern Med* 2000; 160:3278–3285 [PubMed: 11088090]
15. Wiktorsson S, Runeson B, Skoog I, et al.: Attempted suicide in the elderly: characteristics of suicide attempters 70 years and older and a general population comparison group. *Am J Geriatr Psychiatry* 2010; 18:57–67 [PubMed: 20094019]
16. Conwell Y, Duberstein PR, Caine ED: Risk factors for suicide in later life. *Biol Psychiatry* 2002; 52:193–204 [PubMed: 12182926]
17. Vieira ER, Brown E, Raue P: Depression in older adults: screening and referral. *J Geriatr Phys Ther* 2014; 37:24–30 [PubMed: 23619921]
18. Allen BP, Agha Z, Duthie EH, Jr., et al.: Minor depression and rehabilitation outcome for older adults in subacute care. *J Behav Health Serv Res* 2004; 31:189–198 [PubMed: 15255226]
19. Loong CK, Kenneth NK, Paulin ST: Post-stroke depression: outcome following rehabilitation. *Aust N Z J Psychiatry* 1995; 29:609–614 [PubMed: 8825823]
20. Gillen R, Tennen H, McKee TE, et al.: Depressive symptoms and history of depression predict rehabilitation efficiency in stroke patients. *Arch Phys Med Rehabil* 2001; 82:1645–1649 [PubMed: 11733876]
21. Paolucci S, Antonucci G, Grasso MG, et al.: Post-stroke depression, antidepressant treatment and rehabilitation results. A case-control study. *Cerebrovasc Dis* 2001; 12:264–271 [PubMed: 11641594]
22. Kimura M, Robinson RG, Kosier JT: Treatment of cognitive impairment after poststroke depression: a double-blind treatment trial. *Stroke* 2000; 31:1482–1486 [PubMed: 10884441]
23. Krishnan KR: Depression as a contributing factor in cerebrovascular disease. *Am Heart J* 2000; 140:70–76 [PubMed: 11011351]
24. Milani RV, Lavie CJ: Impact of cardiac rehabilitation on depression and its associated mortality. *Am J Med* 2007; 120:799–806 [PubMed: 17765050]
25. Ramos K, Stanley MA: Anxiety disorders in late life. *Psychiatr Clin North Am* 2018; 41:55–64 [PubMed: 29412848]
26. Gialanella B, Prometti P, Monguzzi V, et al.: Neuropsychiatric symptoms and rehabilitation outcomes in patients with hip fracture. *Am J Phys Med Rehabil* 2014; 93:562–569 [PubMed: 24508934]
27. Kennedy P, Rogers BA: Anxiety and depression after spinal cord injury: a longitudinal analysis. *Arch Phys Med Rehabil* 2000; 81:932–937 [PubMed: 10896007]
28. Saxena SK, Ng TP, Koh G, et al.: Is improvement in impaired cognition and depressive symptoms in post-stroke patients associated with recovery in activities of daily living? *Acta Neurol Scand* 2007; 115:339–346 [PubMed: 17489945]

29. Hoffman JM, Bombardier CH, Graves DE, et al.: A longitudinal study of depression from 1 to 5 years after spinal cord injury. *Arch Phys Med Rehabil* 2011; 92:411–418 [PubMed: 21353823]
30. Clark MS, Smith DS: The effects of depression and abnormal illness behaviour on outcome following rehabilitation from stroke. *Clin Rehabil* 1998; 12:73–80 [PubMed: 9549028]
31. Kasper JD, Freedman VA: National Health and Aging Trends Study (NHATS) User Guide: Rounds 1–6 Final Release, Baltimore: Johns Hopkins University School of Public Health, 2017
32. National Health & Aging Trends Study. 2018; <http://www.nhats.org>. Accessed December 10, 2018.
33. Kroenke K, Spitzer RL, Williams JB: The Patient Health Questionnaire-2: validity of a two-item depression screener. *Med Care* 2003; 41:1284–1292 [PubMed: 14583691]
34. Kroenke K, Spitzer RL, Williams JB, et al.: Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann Intern Med* 2007; 146:317–325 [PubMed: 17339617]
35. Vink D, Aartsen MJ, Comijs HC, et al.: Onset of anxiety and depression in the aging population: comparison of risk factors in a 9-year prospective study. *Am J Geriatr Psychiatry* 2009; 17:642–652 [PubMed: 19634206]
36. Freburger JK, Holmes GM: Physical therapy use by community-based older people. *Phys Ther* 2005; 85:19–33 [PubMed: 15623359]
37. Lewis TH: Complex Survey Data Analysis with SAS. Boca Raton, FL, CRC Press, 2017, pp. 81, 109, 136
38. Pickett Y, Raue PJ, Bruce ML: Late-life depression in home healthcare. *Aging health* 2012; 8:273–284 [PubMed: 23483034]
39. Xiang X, Leggett A, Himle JA, et al.: Major depression and subthreshold depression among older adults receiving home care. *Am J Geriatr Psychiatry* 2018; 26:939–949 [PubMed: 29884541]
40. Chandra A, Dalton MA, Holmes J: Large increases in spending on postacute care in Medicare point to the potential for cost savings in these settings. *Health Aff (Millwood)* 2013; 32:864–872 [PubMed: 23650319]
41. Burke RE, Juarez-Colunga E, Levy C, et al.: Rise of post-acute care facilities as a discharge destination of US hospitalizations. *JAMA Intern Med* 2015; 175:295–296 [PubMed: 25437642]
42. Hackett ML, Anderson CS, House A, et al.: Interventions for treating depression after stroke. *Cochrane Database Syst Rev* 2008; Cd003437 [PubMed: 18843644]
43. Lenze EJ, Skidmore ER, Begley AE, et al.: Memantine for late-life depression and apathy after a disabling medical event: a 12-week, double-blind placebo-controlled pilot study. *Int J Geriatr Psychiatry* 2012; 27:974–980 [PubMed: 22173933]
44. Lakshmanan M, Mion LC, Frengley JD: Effective low dose tricyclic antidepressant treatment for depressed geriatric rehabilitation patients. A double-blind study. *J Am Geriatr Soc* 1986; 34:421–426 [PubMed: 3700932]
45. Konnert C, Dobson K, Stelmach L: The prevention of depression in nursing home residents: a randomized clinical trial of cognitive-behavioral therapy. *Aging Ment Health* 2009; 13:288–299 [PubMed: 19347696]
46. Gum AM: Half of home care recipients are depressed: how do we optimize their care? *Am J Geriatr Psychiatry* 2018; 26:950–951 [PubMed: 30017238]
47. Szanton SL, Leff B, Wolff JL, et al.: Home-based care program reduces disability and promotes aging in place. *Health Aff (Millwood)* 2016; 35:1558–1563 [PubMed: 27605633]
48. Freedman VA, Kasper JD, Jette A: Can older adults accurately report their use of physical rehabilitation services? *Arch Phys Med Rehabil* 2018; 99:1507–1513 [PubMed: 29653109]

### Highlights

- This study was designed to examine whether receipt of rehabilitation services is associated with clinically significant depressive and anxiety symptoms at follow-up among older adult Medicare beneficiaries.
- Older adults who received rehabilitation services had higher levels of depressive and anxiety symptoms at follow-up than those who did not receive these services. Even after accounting for demographic characteristics, socioeconomic status, health and functioning variables, older adults who received nursing home or inpatient and in-home rehabilitation services were at an increased risk for having subsequent depressive symptoms.
- This article adds to our understanding that older adults who received rehabilitation services are an at-risk group of having depression and anxiety following these services.

TABLE 1.

Rehabilitation Site, Demographic Characteristics, Socioeconomic Status, and Health and Functioning Status Stratified by the Presence of Clinically Significant Depressive and Anxiety Symptoms at Follow-up

Covariate (Interview Year)	Depression at Follow-up, Present			Depression at Follow-up, Absent			F statistic	P value <sup>a</sup>	Anxiety at Follow-up, Present			Anxiety at Follow-up, Absent			F statistic	P value <sup>a</sup>
	N = 791			N = 5,188					N = 620			N = 5,358				
	N	% or mean	SE	N	% or mean	SE			N	% or mean	SE	N	% or mean	SE		
<b>Rehabilitation Site (2016)<sup>c</sup></b>																
No Rehabilitation services	591	74.1	1.7	4,417	84.8	0.7	33.84	<0.001	488	79.1	2.3	4,521	84.0	0.8	11.13	<0.001
Nursing Home or Inpatient Rehabilitation	35	4.8	0.9	59	1.0	0.2			20	3.6	1.1	73	1.2	0.2		
Outpatient Rehabilitation	41	5.8	1.1	358	8.1	0.6			25	4.6	1.0	372	8.1	0.6		
In-Home Rehabilitation	52	6.6	1.1	106	1.6	0.2			35	5.0	1.0	126	2.0	0.2		
Multiple Rehabilitation Sites	72	8.7	1.1	248	4.5	0.3			52	7.8	1.1	266	4.7	0.3		
<b>Interview Type</b>																
Proxy Interview (2016) <sup>d</sup>							149.41	<0.001							66.22	<0.001
Yes	133	14.1	1.5	210	2.8	0.3			82	11.5	1.5	252	3.2	0.3		
No	658	85.9	1.5	4,978	97.2	0.3			538	88.5	1.5	5,106	96.8	0.3		
<b>Demographics</b>																
Age in Years (2016) <sup>e</sup>							23.95	<0.001							7.17	0.001
65–74	215	42.5	1.8	1,832	53.9	0.6			181	44.8	3.1	1,867	53.3	0.6		
75–84	325	38.0	1.7	2,131	33.1	0.6			243	35.7	2.6	2,214	33.4	0.6		
85+	251	19.5	1.3	1,225	13.0	0.4			196	19.4	1.6	1,277	13.2	0.4		
Sex (2015) <sup>d</sup>							1.35	0.250							12.35	<0.001
Female	474	57.3	1.8	2,982	54.6	0.8			410	62.8	2.2	3,040	54.1	0.7		
Male	317	42.7	1.8	2,206	45.4	0.8			210	37.2	2.2	2,318	45.9	0.7		
Race and Ethnicity (2015) <sup>e</sup>							23.52	<0.001							4.02	0.021
White, non-Hispanic	455	70.9	2.5	3,662	82.3	1.0			383	76.1	2.5	3,731	81.5	1.1		
Black, non-Hispanic	208	11.5	1.0	1,012	7.7	0.5			137	9.3	1.3	1,088	8.1	0.5		
Hispanic or Other	108	17.6	2.5	415	10.0	0.9			81	14.6	2.2	439	10.5	1.0		

Covariate (Interview Year)	Depression at Follow-up, Present			Depression at Follow-up, Absent			F statistic	P value <sup>a</sup>	Anxiety at Follow-up, Present			Anxiety at Follow-up, Absent			F statistic	P value <sup>a</sup>
	N = 791			N = 5,188					N = 620			N = 5,358				
	N	% or mean	SE	N	% or mean	SE			N	% or mean	SE	N	% or mean	SE		
Living Arrangement (2016) <sup>d</sup>							17.53	<0.001						4.58	0.037	
Alone	302	38.5	2.3	1,729	28.7	0.8			231	35.2	2.8	1,796	29.2	0.8		
With Others	489	61.5	2.3	3,459	71.3	0.8			389	64.8	2.8	3,562	70.8	0.8		
<b>Socioeconomic Status</b>																
Education (2011, 2015) <sup>e</sup>							46.16	<0.001						46.43	<0.001	
High School Degree or Equivalent or Less	504	60.4	2.3	2,324	40.1	1.3			408	62.8	2.8	2,426	40.5	1.2		
Some College or Vocational Training	139	21.4	1.9	1,126	23.2	0.8			104	21.0	1.9	1,155	23.1	0.7		
College Degree	130	18.3	1.8	1,642	36.6	1.4			92	16.2	2.1	1,678	36.3	1.4		
Medicaid (2016) <sup>d</sup>							125.35	<0.001						77.05	<0.001	
Yes	235	28.5	2.5	683	10.2	0.6			169	26.3	2.7	751	10.9	0.6		
No	524	71.5	2.5	4,366	89.8	0.6			414	73.7	2.7	4,472	89.1	0.6		
<b>Health and Functioning Status</b>																
Number of Self-Reported Conditions (2016) <sup>d</sup>	783	3.50	0.07	5,165	2.59	0.02	138.98	<0.001	610	3.56	0.10	5,338	2.61	0.02	<0.001	
Dementia or Alzheimer's (2016) <sup>d</sup>							197.73	<0.001						103.39	<0.001	
Yes	163	17.4	1.5	300	3.9	0.2			110	14.4	1.4	346	4.4	0.3		
No	627	82.6	1.5	4,885	96.1	0.2			508	85.6	1.4	5,010	95.6	0.3		
Change in Self-Care Activities (2015, 2016) <sup>e</sup>							63.33	<0.001						53.65	<0.001	
Better	96	14.0	1.8	471	8.6	0.5			78	12.8	1.9	487	8.9	0.5		
Same	361	58.1	3.0	3,860	81.9	0.8			291	58.5	3.3	3,935	81.5	0.8		
Worse	171	27.9	2.3	535	9.4	0.6			136	28.7	2.8	566	9.7	0.6		
Change in Household Activities (2015, 2016) <sup>e</sup>							9.97	<0.001						7.94	<0.001	
Better	139	17.9	1.6	985	20.7	0.7			116	19.5	1.6	1,007	20.5	0.7		

Covariate (Interview Year)	Depression at Follow-up, Present				Depression at Follow-up, Absent				<i>F statistic</i>	<i>P value</i> <sup>a</sup>	Anxiety at Follow-up, Present				Anxiety at Follow-up, Absent				<i>F statistic</i>	<i>P value</i> <sup>a</sup>
	N = 791				N = 5,188						N = 620				N = 5,358					
	N	% or mean	SE		N	% or mean	SE				N	% or mean	SE		N	% or mean	SE			
Same	443	54.1	2.2	3,026	59.4	0.8		340	52.5	2.3	3,131	59.4	0.8							
Worse	203	28.0	2.2	1,144	19.8	0.6		162	28.0	2.3	1,183	20.1	0.6							
Depression at Baseline (2015) <sup>d</sup>																				
Present	300	40.5	2.2	440	7.4	0.4		227	38.0	2.2	508	8.4	0.5							
Absent	476	59.5	2.2	4,714	92.6	0.4		381	62.0	2.2	4,813	91.6	0.5							
Depression at Follow-up (2016) <sup>d</sup>																				
Present																				
Absent																				
Anxiety at Baseline (2015) <sup>d</sup>																				
Present	219	30.4	2.3	360	6.5	0.4		244	42.4	2.5	336	5.9	0.4							
Absent	555	69.6	2.3	4,797	93.5	0.4		371	57.6	2.5	4,988	94.1	0.4							
Anxiety at Follow-up (2016) <sup>d</sup>																				
Present	334	43.5	2.4	279	4.7	0.3														
Absent	448	56.5	2.4	4,880	95.3	0.3														

Notes: SE: standard error

<sup>a</sup> P values determined by Rao-Scott F adjusted chi-square statistic for categorical variables or F statistic for continuous variables.

The degrees of freedom are (numerator and denominator):

<sup>c</sup><sub>4</sub>, 224

<sup>d</sup><sub>1</sub>, 56

<sup>e</sup><sub>2</sub>, 112.



TABLE 2.

Multiple Logistic Regression Analyses of Rehabilitation Site, Demographics, Socioeconomic Status, and Health and Functioning with Clinically Significant Depressive or Anxiety Symptoms at Follow-up (1=Present; 0=Absent) Serving as the Outcome

	Depressive Symptoms						Anxiety Symptoms					
	Unadjusted Model, N = 5,979			Adjusted Model, N = 5,142			Unadjusted Model, N = 5,978			Adjusted Model, N = 5,142		
	OR	95% CI <sup>a</sup>	t value <sup>b</sup>	p value <sup>b</sup>	OR	95% CI <sup>a</sup>	t value <sup>b</sup>	p value <sup>b</sup>	OR	95% CI <sup>a</sup>	t value <sup>b</sup>	p value <sup>b</sup>
<b>Rehabilitation Site (Ref = No Rehabilitation)</b>												
Nursing Home or Inpatient Rehabilitation	5.48	3.20–9.38	6.34	<0.001	3.51	1.85–6.63	3.94	<0.001	3.24	1.60–6.54	3.35	0.002
Outpatient Rehabilitation	0.82	0.55–1.23	–1.00	0.323	1.23	0.79–1.92	0.92	0.362	0.60	0.38–0.96	–2.18	0.033
In-Home Rehabilitation	4.72	3.10–7.17	7.42	<0.001	2.15	1.08–4.30	2.21	0.031	2.68	1.58–4.54	3.74	<0.001
Multiple Rehabilitation sites	2.20	1.67–2.89	5.77	<0.001	1.72	1.04–2.83	2.17	0.034	1.74	1.22–2.48	3.15	0.003
<b>Interview Type</b>												
Proxy Interview, Yes					1.38	0.68–2.79	0.91	0.365	1.18	0.42–3.33	0.32	0.748
<b>Demographics</b>												
Age in Years (Ref = 65–74)												
75–84					0.99	0.79–1.24	–0.13	0.899	1.03	0.71–1.49	0.16	0.872
85+					0.95	0.69–1.31	–0.33	0.746	1.16	0.76–1.76	0.71	0.483
Gender, Male Race and Ethnicity (Ref = white, non-Hispanic)					1.16	0.91–1.47	1.22	0.228	0.81	0.62–1.05	–1.66	0.102
Black, non-Hispanic					1.42	1.02–1.97	2.11	0.039	0.75	0.46–1.22	–1.20	0.236
Hispanic or Other					1.27	0.86–1.88	1.21	0.232	0.67	0.36–1.26	–1.26	0.212
Living Arrangement, Alone					1.39	1.03–1.88	2.22	0.030	0.95	0.66–1.35	–0.31	0.758
<b>Socioeconomic Status</b>												
Education (Ref = College Degree)					1.70	1.17–2.45	2.88	0.006	1.93	1.31–2.84	3.41	0.001
High School Degree or Equivalent or Less					1.64	1.13–2.38	2.63	0.011	1.51	1.00–2.27	2.00	0.050
Some College or Vocational Training					1.63	1.14–2.34	2.75	0.008	1.11	0.70–1.76	0.47	0.639
Medicaid, Yes												

	Depressive Symptoms						Anxiety Symptoms					
	Unadjusted Model, N = 5,979			Adjusted Model, N = 5,142			Unadjusted Model, N = 5,978			Adjusted Model, N = 5,142		
	OR	95% CI <sup>a</sup>	t value <sup>b</sup>	p value <sup>b</sup>	OR	95% CI <sup>a</sup>	t value <sup>b</sup>	p value <sup>b</sup>	OR	95% CI <sup>a</sup>	t value <sup>b</sup>	p value <sup>b</sup>
<b>Health and Functioning Status</b>												
Total number of self-reported conditions												
Dementia, Present												
Change in Self-Care Activities (Ref = Better)												
Same												
Worse												
Change in Household Activities (Ref = Better)												
Same												
Worse												
Depression at Baseline, Present												
Depression at Follow-up, Present												
Anxiety at Baseline, Present												
Anxiety at Follow-up, Present												

Notes: Unadjusted models only include rehabilitation site and adjusted multiple logistic regression models include rehabilitation site, proxy interview status, demographic variables, socioeconomic status variables; and health and functioning status variables.

<sup>a</sup>Intervals based on 95% Wald confidence limits.

<sup>b</sup>Wald Chi-square t statistic with 56 degrees of freedom and associated p-value.