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## Original Study

# Patient-Reported Outcomes in Functioning Following Nursing Home or Inpatient Rehabilitation



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## A B S T R A C T

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**Keywords:**

Functional impairment  
skilled nursing facility  
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care transitions

**Objectives:** Our study examines factors associated with patient-reported outcomes in functioning among Medicare beneficiaries who reported receiving rehabilitation services in a nursing home or inpatient (ie, hospital or rehabilitation facility) setting in the prior year.

**Design:** Data are from the 2015 and 2016 rounds of the National Health and Aging Trends Study (NHATS), a longitudinal study of a nationally representative sample of Medicare beneficiaries aged 65 years and older.

**Setting and Participants:** A total of 479 participants in the 2016 sample who reported receiving rehabilitation services in a nursing home or inpatient setting in the past year.

**Measures:** Bivariate and logistic regression analyses examined the association of demographic, socioeconomic status, and health variables (from the 2015 interview) and rehabilitation characteristics (from the 2016 interview) with patient-reported improvement in “functioning and ability to do activities” while receiving rehabilitation services in the past year.

**Results:** Among Medicare beneficiaries who received rehabilitation services in nursing home or inpatient settings, 33.4% (weighted percent) reported no improvement in functioning while they were receiving rehabilitation. In a regression analysis that accounted for demographics, those with a high school education or less (compared with those with a college degree), instrumental activities of daily living impairments, certain primary conditions for rehabilitation, less than 1-month total duration of rehabilitation services, and no outpatient rehabilitation services had greater odds of reporting no improvement.

**Conclusions/Implications:** Our weighted sample represents approximately 2.3 million Medicare beneficiaries who received rehabilitation services in nursing home or inpatient settings. In this sample, 1 in 3 reported no improvement in functioning, with differences in patient-reported outcomes across socioeconomic status, health status, and rehabilitation characteristics domains. Consideration of characteristics across these domains may be clinically pertinent, but investigation as to why these differences are present and whether services can be optimized to further improve patient-reported outcomes is warranted.

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Millions of Medicare beneficiaries receive rehabilitation services yearly. These services include physical, occupational, and speech therapy, and are often delivered in skilled nursing facilities (SNFs) or

inpatient settings (eg, rehabilitation units in acute care hospitals or stand-alone inpatient rehabilitation facilities).<sup>1–3</sup> Medicare pays 100% of the payment for the first 20 days of qualified SNF care and a

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copayment from days 21 to 100 (but does not pay for stays longer than 100 days).<sup>3</sup> Although older adults have a strong preference for living in the community,<sup>4,5</sup> episodes of acute illnesses<sup>6,7</sup> and impairments in function<sup>8–11</sup> increase their risk for institutionalization for long-term care. Rehabilitation services thereby perform a critical role in helping older adults maintain independence as these services aim to restore, sustain, or limit decline in functioning<sup>12</sup> and often occur in the post-acute care context following a hospitalization.<sup>13</sup> In 2014, 1.7 million fee-for-service Medicare beneficiaries were admitted to SNFs (often for short-term skilled nursing and rehabilitation services for post-acute care) and 339,000 received inpatient rehabilitation facility services, which totaled \$28.6 billion and \$7 billion in Medicare payments, respectively.<sup>3</sup> Despite recent calls for an increased focus on patient-centered endpoints and treatment goals,<sup>14–17</sup> relatively little is known regarding patient-reported outcomes of older adults who receive rehabilitation services.<sup>1</sup> We, therefore, seek to examine patient-reported outcomes in a national representative sample of Medicare beneficiaries who reported receiving SNF or inpatient rehabilitation services in the year of follow-up.

Patient-reported outcomes are increasingly relied upon to complement medical tests and examination findings to enhance patient care and outcomes.<sup>14</sup> There are numerous advantages of patient-reported outcomes – they can be used to assess the severity of symptoms, track outcomes, prioritize treatment discussions and treatment decisions, monitor general health and well-being, and more fully engage patients in their care.<sup>14</sup> Patient-reported outcomes also facilitate a more holistic assessment of patients.<sup>14</sup> Demographic factors are relevant to patient-reported outcomes as increasing age and male sex are associated with increased medical comorbidities among older adults.<sup>18</sup> In addition, older adults with a low socioeconomic status (SES) have a “double burden of disease”; they are more likely to have more medical comorbidities and, even compared with higher SES older adults with a similar disease burden, they are more likely to have worse patient-reported outcomes.<sup>19</sup> Likewise, medical comorbidity and depression are also associated with worse patient-reported outcomes.<sup>20</sup> With few exceptions, patient-reported outcomes related to rehabilitation have not been evaluated using contemporary data.<sup>1,21</sup>

Our study seeks to build on prior work by examining patient characteristics associated with patient-reported lack of functional improvement among Medicare beneficiaries who received nursing home and inpatient rehabilitation services. We hypothesize that demographic (eg, increased age, male sex), socioeconomic (eg, living alone, less education, Medicaid status), health status (eg, impairments in daily activities, presence of anxiety or depression), and rehabilitation characteristics (eg, shorter duration of rehabilitation treatment) will be associated with patient-reported lack of improvement in functioning during rehabilitation.

## Methods

### Study Population

The National Health and Aging Trends Study (NHATS) is a longitudinal cohort study that examines a nationally representative sample of Medicare beneficiaries aged 65 years and older with annual interviews beginning in 2011.<sup>22</sup> NHATS is publicly available, is administered in English and Spanish, and oversamples older age groups and Black individuals. Proxy respondents were used when Medicare beneficiaries were unable to respond for themselves. In 2015 NHATS added questions regarding rehabilitation services<sup>22</sup> that were repeated in 2016. For the 2015 and 2016 interviews, NHATS had an unweighted response rate of 76.8% and 90.6%, respectively.<sup>22</sup> The Johns Hopkins Bloomberg School of Public Health Institutional Review Board approved NHATS. Of the 7276 NHATS interview participants in 2016, 6380 had information on whether they received any

rehabilitation services. Of the 6380 people with information on rehabilitation services, 479 had information on change in functioning and reported receiving nursing home or inpatient rehabilitation services in the past year, which was determined by this question: “In the last year, did you receive rehab as an overnight patient in a hospital, nursing home, or rehab facility?”<sup>23</sup> Our study examines these 479 participants, which represents a weighted sample of 2,281,563 older adult Medicare beneficiaries.

### Measures

#### Dependent variable

NHATS participants were asked: “While you were receiving rehab services in the last year, did your functioning and ability to do activities improve, get worse, or stay about the same?”<sup>23</sup> We dichotomized this variable, recording whether participants reported that their functioning and ability to do activities did not improve (ie, “stayed about the same,” “got worse,” “varied/up and down”; = 1) or improved (=0).<sup>23</sup> This variable was collected in the 2016 interview and dichotomized because of a limited sample size (only 11 and 12 participants reported that their functioning varied or got worse, respectively).

#### Independent variables

We include variables spanning demographics, socioeconomic status, health status, and rehabilitation characteristics domains—domains that have been associated with patient-reported outcomes.<sup>1,19,20</sup> With the exception of the rehabilitation characteristics that were evaluated in the 2016 interview, independent variables were determined at the 2015 interview. All independent variables were based on self- or proxy-report ( $n = 404$  and  $n = 75$ , respectively); proxy interviews occurred when the sampled NHATS Medicare beneficiaries could not respond to the interview questions (eg, because of a physical or cognitive problem).<sup>22</sup> Independent variables were treated as unordered dummy variables with a reference category.

Demographic variables included location of residence, respondent age, a binary indicator for “female” or “male,” race, and living arrangement. Reference groups were living in the community, 65–74 years old, female sex, white non-Hispanic race and ethnicity, and living with spouse/partner and maybe others.

SES variables included education and Medicaid status. Reference groups were college degree and not having Medicaid.

Health status variables included self-reported measures of physical and mental health. Heart disease, arthritis, lung disease, stroke, cancer, and dementia were recorded as present if participants reported that a doctor had ever told them they have one of these conditions (at the 2015 or an earlier NHATS interview).<sup>23</sup> Activities of daily living (ADL) impairments<sup>24</sup> were present if participants reported either having difficulty with performing the following activities or that they “can’t do/don’t do” the following activities without help: eating, transferring out of bed, transferring out of chairs, walking inside, going outside, dressing, bathing, or toileting. ADL was dichotomized into the presence or absence of ADL impairment. Instrumental activities of daily living (IADL) impairments<sup>25</sup> were present if the participants reported that they were unable to perform the following activities: prepare meals, do laundry, do light housework, shop for groceries, manage money, take medicine, or make phone calls. IADL was dichotomized into the presence or absence of IADL impairment. The 2-item Patient Health Questionnaire, a validated depression screening instrument,<sup>26</sup> evaluated depressive symptoms; the 2-item Generalized Anxiety Disorder scale, a validated anxiety screening instrument,<sup>27</sup> evaluated anxiety symptoms. NHATS slightly modified the 2-item Patient Health Questionnaire and 2-item Generalized Anxiety Disorder to examine the prior 1-month period and scored both from 2–8 (rather than the

traditional 0–6 scoring)<sup>22</sup>; for the NHATS scoring, scores of 5 or higher indicate the presence of clinically significant depressive or anxiety symptoms. Reference groups were as follows: not present for each of the listed health conditions, no ADL or IADL impairment, and no clinically significant depressive or anxiety symptoms present.

Patient-reported rehabilitation characteristics include (1) the reason participants received rehabilitation services in the last year (surgical vs nonsurgical), (2) the main condition for which participants received surgery or rehabilitation services, (3) the number of months altogether participants received rehabilitation services, (4) whether participants received rehabilitation services in outpatient or home settings, and (5) whether the participants were still receiving rehabilitation services.<sup>23</sup> Reference groups were reason for rehabilitation services is surgical; main condition for rehabilitation is a fracture, sprain, or other injury or hip, knee, or other joint replacement; less than 1 month duration of rehabilitation services; and yes for receiving rehabilitation services in the outpatient and home settings.

### Statistical Analyses

We used bivariate and multivariable analyses to estimate the associations of the demographic, SES, health status, and rehabilitation variables with the binary, patient-reported measure of no improvement in functioning among Medicare beneficiaries who received nursing home or inpatient rehabilitation services. We relied upon the Rao-Scott F-adjusted  $\chi^2$  statistic<sup>28</sup> to examine sample characteristic differences by whether participants reported no improvement in their functioning. We then conducted a multivariable logistic regression analysis to test our hypotheses with patient-reported no improvement serving as our outcome (absence of improvement = 1, presence of improvement = 0). The regression model included proxy interview status and all the demographic variables and, because of our relatively small sample size, we only included SES, health status, and rehabilitation characteristic variables that were associated the outcome of no improvement at a *P* value of .10 or less. A priori, we decided to include all of the demographic variables because demographic characteristics have been shown to be associated with health status and a multitude of health outcomes.<sup>10,29</sup> To calculate population-weighted adjusted estimates, we utilized SAS survey procedures (v 9.4, SAS Institute, Inc, Cary, NC). Per NHATS technical guidance,<sup>22</sup> we applied the round 5 analytic weights as well as the stratification and cluster variables to adjust for complex sampling design and nonresponse. In the multivariable analyses, we used list-wise deletion to manage participants who were missing covariate data (multivariable regression sample size was 443). In addition, 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” and computes variance estimates by analyzing the non-missing values as a domain or subpopulation. All percentages are weighted values.

## Results

### Bivariate Analyses

Among the Medicare beneficiaries in NHATS with information on utilization of rehabilitation services and patient-reported outcomes in the 2016 interview, 6.6% (weighted percent) reported using inpatient rehabilitation services in the prior year. One-third of these (33.4%; weighted percent) reported no improvement in functioning during their rehabilitation treatment. Demographic, SES, and health status characteristics were determined at the 2015 interview. There were differences in SES, health status, and rehabilitation domains between those who did and did not report improvement in functioning at the 2016 follow-up interview (Table 1). In the bivariate analyses, those

who reported no improvement were more likely to have a proxy respondent (*P* = .042), less formal education (*P* = .021), IADL impairment (*P* < .001), and anxiety (*P* = .017), and were less likely to have rehabilitation for surgical reasons (*P* < .001) and outpatient (*P* < .001) and home (*P* = .024) services. There were also differences in the main condition for rehabilitation and duration of rehabilitation services across patient-reported improvement groupings. Specific medical conditions, ADL impairment, or clinically significant depression were not associated with patient-reported outcomes (Table 1).

### Multivariable Analysis

We next conducted a multivariable analysis that accounted for proxy interview status, all the demographic variables, and included SES, health status, and rehabilitation characteristics that were associated with patient-reported absence of improvement in the bivariate analyses at a *P* value of .10 or less (Table 2). In this regression analysis, no demographic variables were associated with our outcome. Compared with those with a college degree, however, Medicare beneficiaries with a high school education or less had greater odds (odds ratio = 2.17; 95% confidence interval 1.08–4.36) of reporting no improvement in functioning. Similarly, Medicare beneficiaries with IADL impairments, whose primary condition for rehabilitation was “other musculoskeletal condition” or a cardiovascular condition, with less than 1 month of rehabilitation services in total for the prior year, and who did not receive outpatient rehabilitation services were more likely to report no improvement in functioning (Table 2).

## Discussion

While there are numerous advantages of patient-reported outcomes (eg, tracking outcomes, prioritizing treatment discussions and decisions),<sup>14</sup> relatively little is known regarding patient-reported outcomes of older adults who receive rehabilitation services.<sup>1</sup> Our analyses suggest that, of the approximately 2.3 million Medicare beneficiaries (weighted sample size) who reported receiving nursing home or inpatient rehabilitation services, 1 in 3 reported no improvement in their functioning and ability to do activities. Among those who received rehabilitation in a nursing home or inpatient setting, we found that a lower level of education, IADL impairment (prior to receiving rehabilitation services), primary rehabilitation reason of “other musculoskeletal” or a cardiovascular condition, shorter rehabilitation duration, and absence of outpatient rehabilitation were associated with greater odds that patients would report no improvement in their functioning.

Our findings are largely congruent with prior studies that either examined rehabilitation settings across all settings<sup>1</sup> or focused on nonpatient reported functional outcomes.<sup>30</sup> For these studies,<sup>1,30</sup> older age, less education, dementia, decreased functional capacity, and shorter duration of rehabilitation services were associated with absence of functional improvement from rehabilitation. Another recent study found no significant racial differences with regard to improvement in function or goals met by rehabilitation.<sup>21</sup> Nonetheless, there are considerable socioeconomic disparities in the quality of healthcare services received.<sup>29</sup> It is, therefore, somewhat concerning that Medicare beneficiaries with a high school education or less were more likely to report no improvement in functioning compared with college graduates. Health literacy can be a substantial barrier to effective medical care,<sup>29</sup> and perhaps those with less education had a lower level of health literacy which may have affected their expectations for rehabilitation outcomes and/or negatively impacted their ability to participate in and receive the full benefits of rehabilitation services.

The reason why IADL, but not ADL impairment is associated with an increased risk of no self-reported improvement is uncertain. One

**Table 1**  
Characteristics of Medicare Beneficiaries Aged 65 Years and Older who Received Rehabilitation in a Nursing Home or Inpatient Facility, Stratified by Patient-Reported Improvement Status (N = 479)

	Improved N = 321		Did Not Improve N = 158		P value <sup>†</sup>
	N* (%)	SE	N* (%)	SE	
Interview type, at the 2016 interview					
Proxy interview					.042
Yes	36 (8.5)	2.1	39 (15.5)	2.9	
No	285 (91.5)	2.1	119 (84.5)	2.9	
Demographics, at the 2015 interview					
Age in years					.242
65–74	88 (42.1)	3.4	41 (40.6)	5.8	
75–84	138 (39.8)	3.0	60 (34.2)	4.9	
85+	95 (18.1)	2.2	57 (25.3)	3.1	
Sex					.619
Female	205 (61.1)	3.2	95 (58.5)	4.2	
Male	116 (38.9)	3.2	63 (41.5)	4.2	
Race and ethnicity					.494
White, non-Hispanic	231 (84.7)	2.3	112 (83.8)	3.1	
Black, non-Hispanic	66 (8.3)	1.5	27 (6.5)	1.6	
Hispanic or other	18 (6.9)	1.8	14 (9.7)	2.8	
Location of residence					.059
Community	289 (91.2)	1.7	133 (84.4)	3.5	
Nursing home or non-nursing home residential care	32 (8.8)	1.7	25 (15.6)	3.5	
Living arrangement					.247
Alone	125 (35.9)	3.1	67 (36.2)	5.0	
With spouse/partner and maybe others	139 (49.0)	3.2	55 (41.7)	4.4	
With others only	57 (15.2)	2.2	36 (22.0)	3.5	
Socioeconomic status, at the 2015 interview					
Education					.021
High school degree or equivalent or less	146 (41.2)	2.8	85 (53.0)	4.1	
Some college or vocational training	71 (25.6)	2.7	39 (28.0)	4.3	
College degree	98 (33.2)	2.5	31 (18.9)	4.0	
Medicaid					.170
Yes	49 (14.8)	2.2	30 (21.3)	4.2	
No	258 (85.2)	2.2	118 (78.7)	4.2	
Health status, at the 2015 interview					
Presence of self-reported conditions					
Heart disease					.359
Yes	89 (24.0)	2.9	51 (28.7)	4.1	
No	232 (76.0)	2.9	106 (71.3)	4.1	
Arthritis					.053
Yes	253 (78.1)	3.1	109 (67.8)	4.7	
No	68 (21.9)	3.1	49 (32.2)	4.7	
Lung disease					.417
Yes	78 (26.0)	2.4	34 (22.4)	3.3	
No	243 (74.0)	2.4	124 (77.6)	3.3	
Stroke					.266
Yes	62 (16.8)	2.5	35 (22.9)	4.8	
No	258 (83.2) <sup>v</sup>	2.5	123 (77.1)	4.8	
Cancer					.874
Yes	109 (34.2)	3.3	50 (35.1)	4.9	
No	212 (65.8)	3.3	108 (64.9)	4.9	
Dementia or Alzheimer's					.209
Yes	28 (7.0)	1.5	24 (10.1)	2.3	
No	293 (93.0)	1.5	134 (89.9)	2.3	
ADL					.061
Impairments Present	105 (28.8)	3.2	69 (38.7)	4.7	
Impairments Absent	208 (71.2)	3.2	82 (61.3)	4.7	
IADL					<.001
Impairments present	111 (29.2)	2.6	87 (51.3)	4.7	
Impairments absent	201 (70.8)	2.6	62 (48.7)	4.7	
Depression					.427
Present	54 (17.8)	2.3	37 (20.8)	3.5	
Absent	263 (82.2)	2.3	120 (79.2)	3.5	
Anxiety					.017
Present	40 (13.8)	2.7	35 (25.7)	4.5	
Absent	276 (86.2)	2.7	120 (74.3)	4.5	
Rehabilitation characteristics, at the 2016 interview					
Reason for rehabilitation					<.001
Surgical	176 (62.4)	3.2	70 (44.9)	4.4	
Nonsurgical	145 (37.6)	3.2	88 (55.1) <sup>v</sup>	4.4	
Main condition for rehabilitation					.003
Fracture, sprain, or other injury or hip, knee, or other joint replacement	149 (49.5)	3.9	49 (25.8)	3.6	
Other musculoskeletal condition	40 (11.0)	2.1	21 (15.1)	4.0	

(continued on next page)

Table 1 (continued)

	Improved N = 321		Did Not Improve N = 158		P value <sup>†</sup>
	N* (%)	SE	N* (%)	SE	
Stroke or transient ischemic attack	23 (6.3)	1.6	11 (5.8)	2.0	
Heart attack, heart condition, or vascular disease	39 (10.4)	1.6	28 (17.4)	4.2	
Other	70 (22.9)	3.0	48 (36.0)	5.1	
Total months of rehab services in past year					<.001
Less than 1 month	56 (15.7)	2.1	49 (41.4)	5.8	
1–3 months	195 (64.0)	3.3	75 (43.9)	5.3	
4–5 months	37 (13.5)	2.3	14 (5.7)	1.8	
6+ months	31 (6.8)	1.7	17 (9.0)	2.8	
Outpatient rehab services in past year					<.001
Yes	144 (51.4)	3.1	44 (29.4)	5.0	
No	176 (48.6)	3.1	113 (70.6)	5.0	
Home rehab services in past year					.024
Yes	188 (55.7)	3.3	76 (42.4)	4.8	
No	131 (44.3)	3.3	81 (57.6)	4.8	
Current rehab services					.341
Yes	79 (23.9)	3.0	40 (19.2)	3.6	
No	239 (76.1)	3.0	117 (80.8)	3.6	

SE, standard error.

\*The sum of the cells for certain characteristics is less than 321 and 158 for the “improved” and “did not improve” grouping, respectively, because some participants are missing data.

<sup>†</sup>P values determined by Rao-Scott F adjusted  $\chi^2$  statistic and are comparing self-reported improvement status between group (did and did not improve) differences.Table 2  
Logistic Regression Analyses of Characteristics of Medicare Beneficiaries Aged 65 Years and Older who Received Rehabilitation in a Nursing Home or Inpatient Facility With Patient-Reported Improvement Status (1 = Did Not Improve; 0 = Improve) Serving as the Outcome, N = 442

	Odds Ratio (95% Confidence Interval)*
Interview type	
Proxy interview, yes	1.18 (0.50–2.78)
Demographics	
Age in years (ref = 65–74)	
75–84	0.72 (0.36–1.43)
85+	0.76 (0.38–1.52)
Sex, male	1.37 (0.76–2.46)
Race and ethnicity (ref = white, non-Hispanic)	
Black, non-Hispanic	0.58 (0.25–1.35)
Hispanic or Other	1.61 (0.58–4.46)
Location of residence (ref = community)	
Nursing home or non-nursing home residential care	1.02 (0.38–2.71)
Living arrangement (ref = with spouse/partner and maybe others)	
Alone	1.19 (0.57–2.50)
With others only	1.43 (0.67–3.04)
Socioeconomic status	
Education (ref = college degree)	
High school degree or equivalent or less	2.17 (1.08–4.36)
Some college or vocational training	1.85 (0.93–3.68)
Health status	
Arthritis, present	0.69 (0.38–1.24)
Activities of daily living, impairments present	0.73 (0.42–1.26)
Instrumental activities of daily living, impairments present	3.10 (1.71–5.62)
Anxiety, present	1.76 (0.78–4.00)
Rehab characteristics	
Reason for rehabilitation in the past year, nonsurgical (ref = surgical)	1.41 (0.78–2.54)
Main condition for rehabilitation (ref = fracture, sprain, or other injury or hip, knee, or other joint replacement)	
Other musculoskeletal condition	3.01 (1.34–6.75)
Stroke or transient ischemic attack	1.39 (0.39–4.98)
Heart attack, heart condition, or vascular disease	2.52 (1.07–5.92)
Other	1.64 (0.79–3.40)
Total months of rehab services in past year (ref = less than 1 month)	
1–3 months	0.35 (0.17–0.69)
4–5 months	0.36 (0.13–0.98)
6+ months	0.59 (0.19–1.82)
Outpatient rehab services in past year, no	1.93 (1.03–3.64)
Home rehab services in past year, no	1.38 (0.78–2.43)

Multivariable logistic regression model included proxy interview status, all demographic variables, and socioeconomic status, health status, and rehabilitation characteristics that were associated with patient-reported outcomes in the bivariate analyses at a P value of .10 or less; the odds ratio examines no improvement in functioning as the outcome (reference group is improvement in functional status is present).

\*Intervals based on 95% Wald confidence limits.



possibility is that perhaps ADL limitations are more amenable to rehabilitation than are IADL impairments, especially because IADL involve more complex tasks that may be particularly sensitive to cognitive status. In an intervention involving in-home health and rehabilitation services, ADL difficulties improved by 49% compared with 29% improvement in IADL difficulties.<sup>31</sup>

Rehabilitation services totaling less than 1 month in duration and absence of outpatient rehabilitation services were also associated with no improvement in functioning. Effective rehabilitation for some, therefore, may be a longer-term process that extends months and spans nursing home, inpatient, outpatient, and/or in-home settings. In addition, for many Medicare beneficiaries, outpatient and in-home rehabilitation services likely co-occur with other services (eg, health aides, home nursing) that are complementary with rehabilitation. Innovative efforts involving in-home health and rehabilitation services have successfully decreased functional impairment and home hazards in community-dwelling older adults.<sup>31</sup> As about 1 in 5 community-dwelling Medicare beneficiaries report receiving any rehabilitation services in the prior year,<sup>1</sup> more closely integrating rehabilitation across service settings (and with other health and social services) offers promise in improving outcomes in Medicare beneficiaries who desire to maintain their independence.

Our study has several strengths. First, the NHATS dataset consists of a large, nationally representative sample of older adult Medicare beneficiaries and contains recent information on rehabilitation services and associated patient-reported outcomes. Second, we examined factors associated with patient-reported outcomes among Medicare beneficiaries who had received nursing home and inpatient rehabilitation services in the prior year, a topic for which relatively little is known, and which could help inform future efforts to optimize rehabilitation services. Third, our study included a longitudinal dataset and examined health status (eg, medical conditions, functional impairment, mental health) prior to use of rehabilitation services. This temporal ordering allowed us to more meaningfully examine which factors may affect patient-reported outcomes than would be possible with cross-sectional data.

Our study has limitations as well. First, our sample size is relatively small, which impacts our ability to identify potential differences in demographics, SES, health status, and rehabilitation characteristics. Second, we were unable to differentiate between nursing home, hospital-based, and rehabilitation facility settings as they were grouped together as a single item in the questionnaire, or to examine patient-reported outcomes specific to a rehabilitation setting.<sup>23</sup> Third, our independent variables consisted of self-reported data, which have some potential limitations (eg, some medical conditions may be under-reported as strokes can go unrecognized<sup>32</sup>). In addition, it is unclear how our patient-reported outcome is associated with objective assessments of function. Furthermore, to continue to receive rehabilitation services, patients must show adequate progress in meeting their rehabilitation goals. The duration of rehabilitation services is thereby at least in part due to patients improving, and it is possible that issues related to Medicare payment may limit access to rehabilitation services that may be necessary to achieve optimal outcomes. Future studies linking patient-reported rehabilitation outcomes and duration of services with objective clinical assessments of function would be informative and help to reduce any effects on our estimates from this potential “reverse causality.” Although we did not have clinical assessments of rehabilitation outcomes, patient-reported health status is important in representing the patient’s perspective and worse self-reported health has been associated with disability<sup>33</sup> and an increased risk for hospitalization<sup>34</sup> and mortality.<sup>35,36</sup> Fourth, even though we have an item assessing the total duration of rehabilitation services, we are limited in our ability to examine the dose of such services in greater depth. Fifth, our analyses only considered whether functional impairment was present and did not assess the

severity of physical dysfunction using a tool such as the Barthel Index.<sup>37</sup> Sixth, another outcome we could have examined is whether participants met all or most of their rehabilitation goals. We did not include this item partly because the meaning of meeting rehabilitation goals can be unclear since, in addition to improving function, rehabilitation goals could be to sustain or limit decline in functioning. In addition, participants who were receiving rehabilitation services at the time of the NHATS interview were excluded from the “goals met” variable, which would have reduced our sample size and adversely affected our ability to detect clinically meaningful results. Lastly, we did not examine some contextual factors (eg, nursing home or inpatient rehabilitation facility characteristics) that may affect rehabilitation outcomes.

## Conclusions/Relevance

Our findings lead to more questions: does health literacy play a role in patient-reported outcomes? Are those with IADL impairments less able to engage in and thereby benefit from rehabilitation services? How do contextual factors and the dose of rehabilitation services affect patient-reported outcomes? Would patient-reported outcomes among this population be improved if: (1) more of these patients received rehabilitation services longer and/or in outpatient or home settings? or (2) if patient-centered rehabilitation targets were more incorporated into treatment planning? Answers to these questions have important clinical implications for the millions of Medicare beneficiaries who yearly receive rehabilitation services in nursing home and inpatient settings.

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