

ORIGINAL RESEARCH

Rehabilitation Services Use and Patient-Reported Outcomes Among Older Adults in the United States



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Abstract

Objective: To characterize rehabilitation service use among community-dwelling older adults in the United States by identifying predictors of rehabilitation utilization, patient-reported functional improvement, and rehabilitation goal attainment.

Design: Cross-sectional analysis of the 2015 National Health and Aging Trends Study, which used an age-stratified, multistage sampling design and oversampled blacks and the oldest old (≥ 85 y).

Setting: Standardized, in-person home interviews and physical performance testing.

Participants: Nationally representative sample of community-dwelling Medicare beneficiaries (N = 7487) aged ≥ 65 years.

Interventions: Not applicable.

Main Outcome Measures: Rehabilitation services use (physical therapy, occupational therapy, and speech therapy) across all settings in the last year, patient-reported functional improvement, and patient-reported rehabilitation goal attainment.

Results: Twenty percent of older adults reported rehabilitation use in the last year. In a multivariable model, rehabilitation use was significantly lower among blacks and higher among those with higher education, chronic medical conditions, pain, history of falls, and severe limitations in physical performance. Overall, 72% reported functional improvement during rehabilitation, and 75% reported meeting their goals by discharge. Improved function was associated with longer duration of rehabilitation. A significantly lower percentage of older adults with bothersome pain and severe physical limitations reported meeting rehabilitation goals.

Conclusions: Most older adults who received rehabilitation reported functional improvement and meeting rehabilitation goals. However, social disparities were evident with lower rehabilitation utilization among blacks and those with less education. Importantly, functional improvement and goal attainment did not vary by demographics or diagnoses. Longer duration of rehabilitation and improved pain management may be necessary for functional improvement and goal attainment.

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Older adults face higher risk for chronic conditions, impaired function, and disability, all of which are associated with increased health care costs and lower quality of life.¹⁻⁴ Rehabilitation services, including physical, occupational, and speech therapy, are customary approaches to prevent and treat physical impairment and disability. Understanding rehabilitation services use is essential to plan for sufficient resources for the projected doubling of the older adult population, from 43.1 million in 2012 to 83.7 million by 2050.⁵ Additionally, identification of disparities in rehabilitation service use among older adults is needed for strategies to address underserved populations and unmet need.

Comprehensive data on rehabilitation services use among community-dwelling older adults are limited. Previous investigations of rehabilitation services use have made valuable contributions, but are either now outdated, did not include the patient's perspective, and/or examined use of a single rehabilitation discipline (eg, physical therapy) or in a single practice setting. For example, Freburger and Holmes⁶ reported that 5% of community-dwelling older adults had any physical therapy in the last year, including inpatient, outpatient, and home care services; however, these informative analyses were based on data collected in 1994 through 1998 through the Medicare Current Beneficiary Survey. A recent study by Amico et al⁷ of Medicare claims data reported on a total of 4.8 million outpatient rehabilitation episodes of which 79% were for physical therapy, 15% for occupational

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therapy, and 6% for speech and language pathology. Although the study is important for documentation of length and cost of outpatient rehabilitation episodes of care, the perceptions of patients and functional outcomes were not examined. Estimates of rehabilitation utilization have also been reported according to common conditions in older adults, ranging from 8% to 10% with osteoarthritis, cancer, stroke, and postdischarge from inpatient rehabilitation.⁸⁻¹¹ Therefore, little is known about factors associated with rehabilitation use in community-dwelling older adults overall. Further, patient-reported outcomes of rehabilitation have not been examined with contemporary data, and few studies to date have described rehabilitation use by older adults that encompass the 3 major disciplines and consider all practice settings.

Considering the political and financial pressures to reform the Medicare fee-for-service payment structure, there is an urgent need to document the extent of rehabilitation use in the rapidly growing older adult population. Understanding predictors of functional improvement can help to guide strategies for optimizing outcomes from rehabilitation. Therefore, we sought to characterize rehabilitation service use among community-dwelling older adults in the United States. Specifically, we aimed to estimate the prevalence of rehabilitation service use among Medicare beneficiaries in 2015, and to identify predictors of rehabilitation use, patient-reported functional improvement, and patient-reported rehabilitation goal attainment.

Methods

We analyzed data from the 2015 National Health and Aging Trends Study (NHATS). The NHATS is a nationally representative, prospective cohort study of Medicare beneficiaries that was designed to study late-life trends in disability and to advance understanding of functional changes in U.S. adults aged ≥ 65 years.¹²

Participants

Using an age-stratified, 3-stage sample design with the Medicare enrollment database as the sampling frame, there were 8245 participants recruited for the first wave of the NHATS in 2011, with a 71% survey response rate. Proxy respondents were used in circumstances when the participant could not respond for themselves. In 2015, the sample was replenished, resulting in 4129 (50.1%) new participants in addition to 4026 from the original sample. Only community-dwelling older adults were included in the current analysis, resulting in a final sample of 7487. Written informed consent was obtained from all participants or their proxy respondents.

Measures

In-home interviews and assessments were conducted with participants or their proxy respondents during a single visit; cognitive

and physical performance measures were collected at the same time. The self-reported measures of physical capacity, activity limitations, and participation restrictions were developed by experienced health survey researchers from the Johns Hopkins School of Public Health and the University of Michigan and were field tested and validated in a pilot study of older adults.¹³

A series of questions on rehabilitation use were asked in round 5 (2015) of the NHATS (supplemental appendix S1, available online only at <http://www.archives-pmr.org/>). Participants were provided with a description of physical rehabilitation and then asked if they had received any rehabilitation services in the last year. Among those who said yes, participants were queried on the duration of rehabilitation services, the settings where they received rehabilitation services, and the surgical or medical conditions for which they had rehabilitation. Participants were provided with a list of problems and asked which one(s) they were trying to improve during rehabilitation. The same question was posed for a list of mobility limitations and activities of daily living (ADL) limitations. Outcomes of rehabilitation were assessed with the following questions: While you were receiving rehabilitation services in the last year, did your functioning and ability to do activities improve, get worse, or stay about the same? and When your rehabilitation services ended, had you met all or most of your goals?

Demographics used in the analyses included age, sex, self-reported race and ethnicity, and highest education level attained. Also, participants reported insurance coverage in addition to Medicare, including Medigap, described as a Medicare supplement, TRICARE, and/or Medicaid. Health conditions diagnosed by a medical provider were collected by self-report, including arthritis, heart disease, stroke, cancer, pulmonary disease, diabetes, and hypertension. Among other sensory and impairment symptoms, participants were asked if they experienced bothersome pain in the last month or had balance/coordination problems in the last month. Participants were also asked if they had fallen in the last year.

The Patient Health Questionnaire-4 was used to assess symptoms of anxiety and depression.^{14,15} Both the anxiety and the depression subscales consist of 2 questions for a score range of 0 to 6. A score ≥ 3 was considered positive for screening purposes on each subscale.^{14,15}

Cognitive status was assessed by (1) self-report of medical provider–diagnosed dementia or Alzheimer disease; (2) the AD8 Dementia Screening questionnaire,¹⁶ administered to proxy respondents; and (3) tests of memory, orientation, and executive function. Based on a previously established algorithm, participants were classified as having no dementia, possible dementia, and probable dementia.¹⁷

Physical performance was assessed with the Short Physical Performance Battery (SPPB).¹⁸ The SPPB derives a composite score based on gait speed, balance (progressive from feet side by side to semi-tandem to tandem stance for 10s), and time on the Five Times Sit to Stand Test. Possible score range is 0 to 12, with higher scores indicating better physical function.¹⁸ Physical function status was categorized as minimal to no limitations (10–12), mild limitations (7–9), moderate limitations (5–6), and severe limitations (0–4).

Data analysis

Statistical analyses were conducted in Stata 14.1.^a All analyses were weighted using the 2015 analytic sample weights to account for nonresponse, oversampling of subgroups (oldest old and black

List of abbreviations:

ADL	activities of daily living
CI	confidence interval
NHATS	National Health and Aging Trends Study
SPPB	Short Physical Performance Battery

persons), incomplete interviews, and replenishment of the original sample. Variance estimates, 95% confidence intervals (CIs), were calculated using Taylor series linearization that accounts for the complex sampling design.

We estimated prevalence of rehabilitation utilization for the population overall and by characteristics (eg, diagnostic reason for rehabilitation, time spent in rehabilitation, rehabilitation setting). We used adjusted Wald statistics to assess differences in rehabilitation use by demographics, supplemental health insurance, health conditions and impairments/symptoms, and physical performance based on the SPPB. We conducted Poisson regression to model factors associated with rehabilitation use in older adults. We applied analytical weights to calculate the percent prevalence and 95% CIs for patient-reported impairments, mobility limitations, and ADL limitations that were addressed in rehabilitation among older adults, and to calculate the patient-reported functional improvement during rehabilitation and patient-reported goal attainment on discharge (goals met/not met). We also used Poisson regression to evaluate predictors of patient-reported functional improvement and rehabilitation goal attainment.

Results

In 2015, an estimated 8 million community-dwelling Medicare beneficiaries (19.6%; 95% CI, 18.8–20.7) reported using rehabilitation services, including physical, occupational, and/or speech therapies, in the last year. Of those who used rehabilitation services, most of them (59.7%; 95% CI, 56.7–62.6) reported spending 1 to 3 months in rehabilitation. Over one-third of those who received rehabilitation (35.4%; 95% CI, 32.2–38.5) reported recovery from surgery as the primary reason for rehabilitation. Approximately 70% of older adults received rehabilitation services in the outpatient setting, and 36% received rehabilitation services at home (supplemental table S1).

Table 1 shows the distribution of participant characteristics according to rehabilitation service use. Utilization was significantly associated with younger age (65–74y); female sex; white race/ethnicity; higher education level; having a diagnosis of arthritis, heart disease, cancer, or stroke; and lower physical performance scores. Having supplemental insurance to Medicare (including Medicaid) was not associated with differential rehabilitation use among older adults. A diagnosis of diabetes was also not associated with rehabilitation use.

In the Poisson regression model adjusted for demographics (table 2, model 1), rehabilitation use was associated with higher age, female sex, white race/ethnicity, and higher education. With the addition of health conditions and impairments/symptoms, supplemental insurance, and physical performance in model 2, rehabilitation use was 20% lower among blacks than whites and 56% higher among those with severe physical limitations than those with minimal or no physical limitations. In contrast, the associations of rehabilitation use with higher age and female sex were no longer significant when adjusting for health, impairment, and insurance covariates into the model. Rehabilitation service use in the last year was also significantly associated with higher education level, arthritis, heart disease, cancer, pain, and a fall in the last year.

The primary targets of rehabilitation therapy, as reported by the study participants, are presented in supplemental table S2 according to categories of symptoms/impairments, mobility, and ADL. Most of those who received rehabilitation services reported rehabilitation for movement and weakness (62.5% and 54.7%, respectively). Over

Table 1 Rehabilitation services use according to demographics, supplemental insurance, and health characteristics among adults aged ≥65 years in the United States: National Health and Aging Trends Study, 2015

Characteristic	Rehabilitation in the Last Year		P
	No	Yes	
Age, y			.0001
65–69	882 (30.1)	163 (24.1)	
70–74	1432 (27.2)	322 (26.9)	
75–79	1281 (18.7)	293 (18.5)	
80–84	1091 (12.0)	304 (15.1)	
85–89	796 (7.9)	218 (9.1)	
≥90	527 (4.1)	178 (6.2)	
Sex			.0003
Women	3396 (54.1)	928 (60.3)	
Race/ethnicity			.0001
White	4008 (79.1)	1090 (85.1)	
Black	1300 (8.9)	244 (6.5)	
Hispanic	373 (4.4)	68 (3.3)	
Other	193 (7.6)	35 (5.2)	
Education			.0001
<9y	645 (8.8)	101 (5.5)	
9–11y	700 (9.3)	152 (8.1)	
High school graduate	1592 (26.2)	375 (26.3)	
Some college/vocational	1543 (29.0)	372 (26.1)	
College graduate	737 (14.4)	210 (16.2)	
Master’s or professional degree	656 (12.5)	224 (17.8)	
On Medicaid	857 (11.3)	205 (11.9)	.40
Has Medigap/Medicare supplement	3540 (61.0)	925 (63.4)	.12
Arthritis	3518 (53.0)	1086 (70.5)	<.0001
Osteoporosis	1359 (20.7)	478 (27.8)	<.0001
Heart disease	1403 (21.3)	486 (29.4)	<.0001
Diabetes	1688 (26.3)	422 (26.8)	.74
Cancer	903 (17.6)	276 (22.7)	.003
Stroke	306 (5.5)	161 (9.7)	<.0001
Pulmonary disease	1035 (16.4)	331 (20.3)	.0007
Fall in the last year	1713 (27.4)	739 (47.9)	<.0001
Balance problems	1795 (25.4)	736 (43.7)	<.0001
Bothered by pain	3070 (50.1)	1027 (69.9)	<.0001
Depressive symptoms	756 (11.5)	256 (16.0)	.006
Anxiety symptoms	606 (9.8)	211 (13.5)	.002
Cognitive status			.02
No dementia	644 (7.3)	205 (10.7)	
Possible dementia	786 (10.5)	165 (9.4)	
Probable dementia	4575 (82.2)	1104 (79.8)	
Physical performance (SPPB)			<.0001
Minimal limitations (10–12)	1163 (29.2)	198 (21.2)	
Mild limitations (7–9)	1678 (33.1)	314 (25.6)	
Moderate limitations (5–6)	1379 (21.2)	311 (22.1)	
Severe limitations (0–4)	1296 (16.5)	537 (31.1)	

NOTE. Values are n (weighted %) or as otherwise indicated.

a third of rehabilitation recipients reported treatment targeted to pain, balance, walking, self-care, and/or household tasks.

Among older adults who reported using rehabilitation services in the last year, 72.1% (95% CI, 68.90–75.10) reported functional

Table 2 Association of undergoing rehabilitation in the last year with demographics, supplemental insurance, and health characteristics among adults age ≥ 65 years in 2015

Characteristic	Model 1 (n=7288)	Model 2 (n=6541)
Age, y		
65–69	1.00	1.00
70–74	1.19 (0.99–1.42)	1.10 (0.92–1.32)
75–79	1.19 (1.05–1.33)	1.02 (0.89–1.17)
80–84	1.45 (1.25–1.68)	1.14 (0.97–1.33)
85–89	1.35 (1.12–1.64)	0.97 (0.79–1.21)
≥ 90	1.59 (1.32–1.92)	1.07 (0.96–1.19)
Sex		
Men	1.00	1.00
Women	1.21 (1.08–1.34)	1.07 (0.96–1.19)
Race/ethnicity		
White	1.00	1.00
Black	0.77 (0.64–0.92)	0.80 (0.67–0.96)
Hispanic	0.78 (0.53–1.14)	0.86 (0.65–1.13)
Other	0.78 (0.62–0.97)	0.83 (0.55–1.25)
Education		
<High school graduate	1.00	1.00
High school graduate	1.18 (0.97–1.42)	1.23 (1.01–1.50)
>High school	1.31 (1.08–1.58)	1.47 (1.18–1.82)
On Medicaid	NA	1.03 (0.83–1.28)
Has Medigap/Medicare supplement	NA	1.08 (0.95–1.23)
Has TRICARE	NA	1.17 (0.96–1.44)
Arthritis	NA	1.45 (1.25–1.68)
Heart disease	NA	1.24 (1.09–1.41)
Stroke	NA	1.22 (1.00–1.48)
Cancer	NA	1.17 (1.01–1.36)
Pulmonary disease	NA	0.97 (0.86–1.09)
Diabetes	NA	0.87 (0.75–1.01)
Hypertension	NA	0.98 (0.86–1.13)
Fall in the last year	NA	1.56 (1.39–1.76)
Bothersome pain	NA	1.48 (1.28–1.70)
Depressive symptoms	NA	1.07 (0.91–1.26)
Anxiety symptoms	NA	0.94 (0.78–1.13)
Cognitive status		
No dementia	NA	1.00
Possible dementia	NA	0.90 (0.68–1.19)
Probably dementia	NA	1.01 (0.84–1.22)
Physical performance (SPPB)		
Minimal limitations (10–12)	NA	1.00
Mild limitations (7–9)	NA	0.94 (0.76–1.15)
Moderate limitations (5–6)	NA	1.15 (0.94–1.40)
Severe limitations (0–4)	NA	1.56 (1.28–1.88)

NOTE. Values are prevalence ratio (95% CI). Both models were adjusted for age, sex, race/ethnicity, and education. Model 2 included supplemental insurance status, arthritis, heart disease, stroke, cancer pulmonary disease, diabetes, hypertension, fall history, pain, depressive symptoms, anxiety, cognitive status, and physical performance. Abbreviation: NA, not applicable.

improvement. Similarly, 75.2% reported meeting their goals by the time of discharge from rehabilitation services (95% CI, 71.70–78.44). Most older adults who reported improved function

also reported meeting their rehabilitation goals. Approximately 50% of those who reported no change in function indicated they had met their goals by the time of discharge from rehabilitation. The prevalence of these patient-reported outcomes did not vary significantly by rehabilitation setting (inpatient, outpatient, home, or other; data not shown).

Associations with patient-reported improvement in function are presented in table 3. Spending more time in rehabilitation (>1mo), higher education level, and Hispanic ethnicity were significantly associated with perceived improvement in function. Notably, older age, more severe functional limitations, and cognitive status were not associated with lower patient-reported functional outcomes. In the subset of respondents who had completed rehabilitation at the time of the interview, the perception of meeting their goals prior to discharge was significantly lower in older adults with bothersome pain and moderate to severe limitation in physical function (measured by the SPPB) than those without pain and those with minimal to no physical limitations (see table 3). Duration of rehabilitation was not associated with perception of meeting rehabilitation goals.

Discussion

In this nationally representative study, 1 out of 5 community-dwelling older adults in 2015 reported rehabilitation services use in the last year, with most receiving rehabilitation for a musculoskeletal condition. Rehabilitation use was lower in socially disadvantaged groups, including older blacks. Importantly, three-fourths of older adults who used rehabilitation services reported improved functioning and reaching their treatment goals.

Determining rehabilitation use by older adults across all settings helps with identification of unmet need and policy change outcomes on rehabilitation use among Medicare beneficiaries. Previous studies have shown that older adults are less likely to receive outpatient rehabilitation for musculoskeletal conditions than younger age groups, and those with low income and poorer health are less likely to receive physical rehabilitation services than higher income or healthier older adults.^{19,20} Thirty-nine percent of older adults have ≥ 1 disabilities,²¹ more than a third live with mobility impairment,²² and up to 47% report multiple chronic health conditions.²³ These conditions are all associated with reduced participation, lower quality of life, and less social engagement by older adults.^{24–26} Access and referral to rehabilitation are key considerations to support healthy aging and social participation, and mitigate impairment in a growing older adult population. A prevalence of 20% of older adults using rehabilitation services indicates there is likely a group of older adults who could benefit from, but do not currently access, rehabilitation services.

The lower rehabilitation use among black older adults is concerning. A report from the Institute of Medicine substantiated racial and ethnic disparities in health services overall and called for continued assessment and improved awareness about the existence of disparities.²⁷ Previous findings from studies examining racial disparities in referral and utilization of rehabilitation have been mixed. Consistent with the current study, Sandstrom et al¹⁰ found black people with osteoarthritis have significantly lower odds of receiving outpatient rehabilitation after controlling for insurance, income, and education. However, Freburger and Holmes⁶ found no evidence for disparities in physical therapy utilization among community-dwelling older adults by race/ethnicity from 1994 to 1998. Considering that disability and

Table 3 Factors associated with patient-reported improvement in function and meeting patient-reported goals of rehabilitation among adults aged ≥65 years who used rehabilitation services: National Health and Aging Trends Study, 2015

Characteristic	Patient-Reported Function Improved During Rehabilitation (n=1265)	Patient-Reported Goals Met on Discharge From Rehabilitation (n=966)
Age, y		
65–69	1.00	1.00
70–74	1.04 (0.92–1.17)	0.97 (0.86–1.09)
75–79	0.92 (0.78–1.06)	0.96 (0.86–1.08)
80–84	0.91 (0.77–1.07)	0.98 (0.85–1.13)
85–89	0.94 (0.82–1.08)	1.01 (0.90–1.15)
≥90	0.84 (0.67–1.04)	1.00 (0.81–1.24)
Sex		
Men	1.00	1.00
Women	1.04 (0.95–1.14)	1.05 (0.96–1.14)
Race/ethnicity		
White	1.00	1.00
Black	1.09 (0.98–1.21)	1.0 (0.86–1.15)
Hispanic	1.19 (1.02–1.39)	0.92 (0.71–1.20)
Other	1.02 (0.80–1.29)	1.03 (0.80–1.34)
Education		
<High school graduate	1.00	1.00
High school graduate	1.09 (0.92–1.29)	1.07 (0.89–1.27)
>High school	1.19 (1.02–1.39)	0.97 (0.81–1.17)
Arthritis	0.95 (0.86–1.04)	1.0 (0.94–1.07)
Heart disease	0.95 (0.87–1.04)	1.0 (0.92–1.08)
Cancer	1.01 (0.92–1.10)	0.96 (0.87–1.07)
Diabetes	0.99 (0.91–1.09)	1.08 (0.99–1.18)
Bothersome pain	0.94 (0.87–1.02)	0.83 (0.77–0.90)
Depressive symptoms	0.94 (0.81–1.09)	0.86 (0.72–1.02)
Anxiety symptoms	0.88 (0.72–1.07)	0.98 (0.85–1.14)
Cognitive status		
No dementia	1.00	1.00
Possible dementia	0.92 (0.75–1.13)	1.03 (0.78–1.34)
Probable dementia	0.93 (0.79–1.11)	1.11 (0.88–1.41)
Time spent in rehabilitation, mo		
<1	1.00	1.00
1–3	1.17 (1.03–1.32)	1.07 (0.96–1.20)
>3	1.22 (1.06–1.39)	1.00 (0.86–1.16)
Physical performance (SPPB)		
Minimal limitations (10–12)	1.00	1.00
Mild limitations (7–9)	1.04 (0.94–1.15)	1.03 (0.94–1.13)
Moderate limitations (5–6)	0.94 (0.83–1.07)	0.84 (0.73–0.96)
Severe limitations (0–4)	0.87 (0.75–1.01)	0.82 (0.70–0.97)

NOTE. Values are prevalence ratio (95% CI).

impairment are higher among minority populations, including blacks, rehabilitation use should meet or exceed rates seen in the general population.^{28,29} The current findings suggest that more intentional efforts are needed to ensure black older adults are referred and have access to rehabilitation services.

In the adjusted model, rehabilitation use was not associated with a diagnosis of diabetes, hypertension, stroke, or cognitive impairment. Older adults with diabetes face increased risk of cognitive dysfunction,³⁰ cardiovascular disease,³¹ stroke, and lower extremity amputation.³² Self-management of diabetes is dependent on health behaviors (eg, exercise, skin care).³³ Similarly, exercise has demonstrated efficacy for hypertension management,³⁴ poststroke function,³⁵ and maintenance of cognitive function.³⁶ Rehabilitation is one means to address barriers to health behaviors of exercise and skin care, particularly for older adults with comorbidities and functional and cognitive impairment. Additional research is needed to define barriers and limitations to rehabilitation use among older adults with chronic conditions for disease management and risk reduction of disease sequelae.

In the current study, black older adults reported functional improvement and goal attainment on par with white older adults, despite significant disparities in rehabilitation use. Similarly, the results indicate adults aged >90 years, and those with cognitive impairment, depressive symptoms, and anxiety, have the capacity for functional improvement and goal attainment with rehabilitation. However, improved strategies (eg, increasing access to rehabilitation, reducing disparities in referrals) are needed to ensure older adults with lower education, activity-limiting pain, or severe physical function impairment attain maximal benefit from rehabilitation.

Patient-reported improvement in function was significantly higher in those who spent >1 month in rehabilitation. This supports the finding by Fritz et al³⁷ of greater improvement among Medicare beneficiaries who have more outpatient physical therapy visits. The optimal length of time for a rehabilitation episode of care has not been identified. However, given the greater potential for multimorbidity and underlying impairment in older adults, sufficient time in rehabilitation is a necessary consideration to achieve patient goals.

The high percentage of participants reporting functional improvement and goal attainment highlights the value of rehabilitation for older adults. Among those who reported no change in function during rehabilitation, 50% reported meeting their rehabilitation goals. Maintenance of current level of function and slowing decline of function are noteworthy outcomes to older adults. The recent legal settlement in *Jimmo v Sebelius* (Secretary of the Department of Health and Human Services) clarifies Medicare reimbursement is permitted for maintenance of function as a rehabilitation outcome.³⁸ The improvement standard is not required for eligibility for rehabilitation under Medicare, but the degree of referral and uptake of rehabilitation for functional maintenance has yet to be determined. With a national emphasis on outcome measures to quantify rehabilitation results, outcomes that capture maintenance of function are needed.

Study limitations

There are several limitations and strengths that should be considered when interpreting the current study results. This is an observational, cross-sectional survey study reliant on participant recall of rehabilitation use in the last year. Additionally, the psychometric properties for the questions on rehabilitation services use have not yet been established. Future studies are needed to link the NHATS to Medicare claims data to improve estimates of rehabilitation services use. However, the addition of rehabilitation-related questions to the NHATS interview offers a much-needed patient-centered perspective on the effect and

outcomes of rehabilitation use among older adults. Another study limitation is that the survey questions do not differentiate between the types of therapy received (physical, occupational, and/or speech and language). Additionally, the patient-reported outcome questions pertain to the most recent episode of rehabilitation use and do not allow respondents to differentiate outcomes received for >1 episode. The strengths of this study include the collection of patient perspectives on rehabilitation outcomes, the assessment of physical performance measures, the representative sample of community-dwelling Medicare beneficiaries in the United States, and the ability to characterize rehabilitation use across all settings. These study strengths help to address gaps in knowledge. Previous studies have limited analysis to rehabilitation services use in specific patient populations or did not include physical performance measures or patient-reported outcomes.

Conclusions

The study findings provide a basis for identifying unmet rehabilitation needs for older adults in the United States. Older adults assign a high value for rehabilitation services based on perceived improvements in functioning and treatment goal attainment. Patient-reported improvements are associated with length of time in rehabilitation, an important consideration in the shift to value-based care and outcomes-based reimbursement models. However, there are concerning disparities in rehabilitation use by black older adults and older adults with chronic conditions, including diabetes and hypertension. With the addition of survey questions on rehabilitation use, data from future NHATS interviews will help to identify long-term effects of rehabilitation use and outcomes of policies to reduce disparities.

Supplier

a. Stata 14.1; Stata Corp.

Keywords

Health services for the aged; Patient reported outcome measures; Recovery of function; Rehabilitation

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Supplemental Appendix S1 Subset of NHATS Round 5 Rehabilitation Questions Used in This Analysis

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1. Physical rehabilitation services can help you improve function and the ability to carry out daily activities. Services include physical therapy, occupational therapy, and speech therapy. Rehabilitation can be received in different settings. For instance, they can be received while you are staying in the hospital, after a hospital stay in a nursing home or rehabilitation facility, at a doctor's or therapist's office or clinic, or at home. In the last year have you received any rehabilitation services?
 - Yes
 - No
 - Refused
 - Do not know
2. In the last year, for about how many months altogether did you receive rehabilitation services?
 - Less than 1mo
 - 1–3mo
 - 4–5mo
 - ≥6mo
3. In the last year, for about how many weeks altogether did you receive rehabilitation services?
 - <1wk
 - 1–2wk
 - 3–4wk
4. We are interested in the reasons you received rehabilitation in the last year. Did you receive rehabilitation to help you recover after surgery?
 - Yes
 - No
 - Refused
 - Do not know
5. Please look at this card and tell me, what was the main medical condition for which you had surgery?
 - Fracture, sprain, or injury
 - Hip, knee, or other joint replacement
 - Another musculoskeletal condition
 - Stroke or transient ischemic attack
 - Heart attack
 - Another heart condition or vascular disease
 - Breathing condition
 - Neurologic condition (eg, multiple sclerosis, Parkinson disease)
 - Cancer
 - Another condition (specify)
 - No medical condition (if volunteered)
 - Refused
 - Do not know
6. Please look at this card and tell me, what was the main medical condition for which you received rehabilitation in the last year?
 - Fracture, sprain, or injury
 - Hip, knee, or other joint replacement another musculoskeletal condition
 - Stroke or transient ischemic attack
 - Heart attack
 - Another heart condition or vascular disease
 - Breathing condition
 - Neurologic condition (eg, multiple sclerosis, Parkinson disease)
 - Cancer
 - Another condition (specify)
 - No medical condition (if volunteered)
 - Refused
 - Do not know
7. Next, please look at this card and tell me where you were trying to improve function?
 - Probe: Anywhere else?
 - Back
 - Hip(s)
 - Knees(s)
 - Feet
 - Hand(s)
 - Wrist(s)
 - Shoulder(s)
 - Head
 - Neck
 - Arm(s)
 - Leg(s)
 - Stomach
 - Mouth or throat
 - Heart
 - Other places (specify)
 - No specific place (if volunteered)
 - Refused
 - Do not know
8. Next, please look at this card and tell me which of these problems were you trying to improve?
 - Select all that apply
 - Probe: Any others?
 - Difficulty chewing or swallowing
 - Difficulty speaking or being understood
 - Pain level
 - Problem with breathing
 - Problem with strength (muscle weakness)
 - Problem with movement (range of motion)
 - Low energy level
 - Problem with balance or coordination
 - Problem with falls
 - Problem with memory
 - None of these problems
 - Refused
 - Do not know
9. Sometimes rehabilitation focuses on improving ways of moving or getting around. Please look at this card and tell me which of these were you trying to improve?
 - Probe: Any others?
 - Getting out of bed
 - Walking around inside at home
 - Leaving home to go outside
 - Walking distances outside (several blocks)
 - Climbing stairs
 - Driving
 - Using other forms of transportation
 - None of these
 - Refused
 - Do not know

10. Sometimes rehabilitation focuses on improving the ability to carry out specific activities. Please look at this card and tell me which of these activities were you trying to improve?
Probe: Any others?
Caring for self (washing up, toileting, dressing, eating)
Household tasks (shopping for groceries, preparing meals, doing laundry)
Using a computer, laptop, or tablet
Working or volunteering
Providing care to someone else
Participating in social, religious, or community activities
None of these activities
Refused
Do not know
11. Next, we are interested in where you received rehabilitation services in the last year. In the last year, did you receive rehabilitation...
As an overnight patient in a hospital, nursing home, or rehabilitation facility?
At an outpatient center, clinic, or doctor's or therapist's office?
At home?
Somewhere else?
Yes
No
Refused
Do not know
12. Which place did you last receive these services? Was it as an overnight patient in a hospital, nursing home, or rehabilitation facility?
Overnight patient in hospital, nursing home, or rehabilitation facility
Outpatient center, clinic, doctor's or therapist's office
Home
Somewhere else
Refused
Do not know
13. While you were receiving rehabilitation services in the last year, did your functioning and ability to do activities improve, get worse, or stay about the same?
Improved
Got worse
Stayed about the same
Varied/up and down (if volunteered)
Refused
Do not know
14. Are you still receiving rehabilitation services?
Yes
No
Refused
Do not know
15. When your rehabilitation services ended, had you met all or most of you goals?
Yes
No
Refused
Do not know

Supplemental Table S1 Diagnostic reasons, time spent in rehabilitation, and type of setting for rehabilitation services among community-dwelling older adults who reported rehabilitation services use in 2015 (n=1478)

Characteristic	n (weighted %)
Primary diagnostic reason for rehabilitation	
Musculoskeletal (not joint replacement)	746 (53.5)
Joint replacement	191 (14.2)
Neurologic condition/stroke	122 (7.5)
Cardiac/vascular	120 (6.8)
Pulmonary disease	64 (4.0)
Cancer	25 (1.9)
Other	192 (11.1)
Do not know/refused	18 (0.5)
Postsurgical rehabilitation	480 (35.4)
Time in rehabilitation	
<1wk	80 (6.3)
1–2wk	109 (7.2)
3–4wk	146 (10.3)
1–3mo	878 (59.7)
4–5mo	139 (9.5)
≥6mo	113 (6.9)
Setting for rehabilitation	
Inpatient	494 (32.7)
Outpatient	931 (69.7)
Home	629 (36.4)
Other	20 (1.8)

Supplemental Table S2 Patient-reported impairment, mobility limitations, and ADL limitations targeted in rehabilitation among older adults who received rehabilitation in 2015 (n=1478)

Characteristic	Weighted % (95% CI)
Impairment/symptom	
Movement/range of motion	62.5 (59.8–65.1)
Weakness	54.7 (51.2–58.1)
Pain	38.9 (35.4–42.5)
Balance	35.0 (32.2–37.8)
Falls	13.8 (12.5–15.4)
Low energy	12.8 (11.21–14.5)
Breathing	8.9 (7.5–10.5)
Memory	7.0 (5.50–8.8)
Chewing	4.0 (2.89–5.5)
Speaking	3.6 (2.62–4.8)
Mobility	
Walking distances outside	45.3 (42.0–48.7)
Walking inside	42.3 (38.9–45.7)
Climbing stairs	30.6 (27.7–33.6)
Leaving home to go outside	26.5 (23.4–29.8)
Getting out of bed	19.7 (17.2–22.5)
Driving	8.8 (7.5–10.5)
Using other transport	3.6 (2.5–5.3)
ADL	
Self-care	38.0 (34.9–41.3)
Household tasks	34.0 (30.6–37.6)
Social activity participation	17.8 (15.2–20.6)
Working/volunteering	11.6 (9.7–13.8)
Using computer/tablet	5.8 (4.1–8.2)
Caregiving	5.1 (4.1–6.4)