Participation in Pulmonary Rehabilitation by Veterans Health Administration and Medicare Beneficiaries After Hospitalization for Chronic Obstructive Pulmonary Disease

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Background: Hospitalization with acute exacerbation of chronic obstructive pulmonary disease (COPD) is common and costly to the health care system. Pulmonary rehabilitation (PR) can improve symptom burden and morbidity associated with COPD. The use of PR among Medicare beneficiaries is poor, and the use by Veterans Health Administration (VHA) beneficiaries is unknown. We sought to determine whether participation in PR was similarly poor among eligible veterans compared with Medicare beneficiaries.

Methods: We performed a retrospective study using national VHA and Medicare data to determine the proportion of eligible patients who participated in PR after hospitalization for an acute exacerbation of COPD between January 2007 and December 2011. We also evaluated patient characteristics including demographic factors and comorbid medical history associated with participation.

Results: Over the 5-year study period, 485 (1.5%) of 32 856 VHA and 3199 (2.0%) of 158 137 Medicare beneficiaries hospitalized for COPD attended at least 1 session of PR. Among both VHA and Medicare beneficiaries, participation was higher in those who had had comorbid pneumonia or pulmonary hypertension and was lower in older patients. Although participation increased in both groups over time, it remained exceedingly low overall.

Conclusion: Pulmonary rehabilitation is significantly underused in both the VHA and Medicare populations. Although comorbid pulmonary disease is associated with higher use, the proportion of eligible patients who participate remains extremely low.

Key Words: chronic obstructive pulmonary disease • exercise • pulmonary rehabilitation • quality of care

Acute exacerbation of chronic obstructive pulmonary disease (COPD) is a common reason for hospitalization.[1,2] The financial burden of acute COPD exacerbations has been estimated to cost as much as US $50 billion annually.[3] Patients with more severe daily symptoms of COPD are more frequently hospitalized and have a higher mortality rate than patients without COPD or with less severe symptoms.[4] Patients with more severe COPD (Global Initiative for Chronic Obstructive Lung Disease [GOLD] stages 3 and 4) also have decreased mobility and are less independent in their activities of daily living.[4] In addition to advances in medical therapy, research has shown that pulmonary rehabilitation (PR), when prescribed at discharge, can improve functional status and potentially reduce readmissions for COPD.[5]

Pulmonary rehabilitation has been defined as an intervention to "improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors."[6] Cochrane reviews have shown not only a small mortality benefit but also improvements in exercise capacity and self-rated quality of life among participants in formal PR programs.[7,8] On the basis of this evidence, guidelines for treatment of patients with COPD specifically recommend PR after hospitalization.[9] However, less than 5% of Medicare beneficiaries discharged from the acute care setting for COPD exacerbations participate in PR.[10] Therefore, a major quality gap exists between this beneficial therapy and participation by eligible patients.

Approximately 500 000 veterans have a diagnosis of COPD,[11] and the Veterans Health Administration (VHA) specifically recommends PR for COPD patients with either stable disease or after hospitalization for acute exacerbation.[12] Our aims in this study were (1) to describe the proportion of veterans referred to PR after an acute exacerbation of COPD that required hospitalization to the proportion in a nonveteran US Medicare population; and (2) to identify unique factors associated with participation within each population.

METHODS

STUDY PARTICIPANTS

National VHA inpatient files were used to identify all patients who were discharged from VHA facilities with a qualifying diagnosis of COPD during years 2007-2011 (January 1, 2007-December 31, 2011). Diagnosis and procedure codes were extracted from the Department of Veterans Affairs (VA) Corporate Data Warehouse files for inpatients (inpat_inpatient, inpat_inpatientICDProcedure, inpat_inpatientCPTProcedure) and outpatients (outpat_vprocedure, outpat_vdiagnosis). All patients discharged from hospitals with a qualifying diagnosis of COPD during the study period of time were identified from a random 5% sample of Centers for Medicare & Medicaid Services (CMS) inpatient files. The CMS is the administrative agency for Medicare services.

For both VHA and Medicare beneficiaries, we used primary *International Classification of Diseases, 9th Revision, Clinical Modification* (*ICD-9-CM*) diagnosis codes to define COPD (491.x, 492.x, 493.2x, 496.x). Patients were

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The authors declare no conflicts of interest.

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DOI: 10.1097/HCR.0000000000000357

excluded if death, as indicated in the VA vital status file for veterans and in the beneficiary summary files for Medicare beneficiaries, occurred within 30 d of hospitalization. Demographic information, including income and race, were extracted from vital signs files. Comorbid conditions were defined on the basis of records of a single *ICD-9-CM* diagnosis code during an inpatient visit or based on a diagnosis code recorded at 2 separate outpatient visits in the previous 12 mo. All data files were linked using scrambled social security numbers. This study was approved by the institutional review board (IRB) at the University of California San Francisco (IRB #12-08381, Parnassus Panel).

OUTCOME ASSESSMENTS

The primary outcome was the number of unique patients who participated in 1 or more PR sessions within 12 mo after hospitalization for COPD within VHA and Medicare beneficiaries. The number of unique patients who participated in PR programs from 2007 to 2011 was determined from VHA and CMS outpatient files based on health care common procedure coding system (HCPCS) codes for PR (S9473, G0424, G0237, G0238, G0239). Both VHA and Medicare beneficiaries who participated in programs during the 12 mo following hospitalization were determined from VHA and CMS outpatient files, respectively. Veterans are entitled to receive non-VA health care (paid for by the VA) if an indicated service is not available at a nearby VHA facility. All veterans were hospitalized for COPD at a VA hospital, but subsequent participation in PR could have been at either a VHA hospital or a non-VHA facility. The number of patients who participated in non-VHA PR programs was determined from non-VA care files and from CMS data.

DATA ANALYSIS

We compared the characteristics of patients who participated in PR with those who did not participate in PR using 2-sample unpaired *t* tests for continuous variables and χ^2 tests for dichotomous or categorical variables. Percentages and mean values with standard deviations were reported for categorical and continuous variables, respectively. We also compared the characteristics of patients in VHA versus CMS who participated in PR. We used multivariable logarithmic regression to determine factors independently associated with PR participation for both groups. The α level was $<.05$ for all analyses. Analyses were performed using SAS version 9.2 software (SAS Institute).

RESULTS

Over a 5-y time period, we identified a total of 32 856 unique VHA patients and 158 137 Medicare beneficiaries who were discharged with a primary diagnosis of COPD. The annual number of veterans with a hospitalization for COPD increased from 7435 to 8922 over the 5-y period (Table 1). The number of veterans who participated in PR within 6 mo of hospital discharge increased even more over these 5 y, resulting in an increase in the proportion every year from 0.9% to 1.6% (Table 1). Overall, only 1.5% of 32 856 veterans discharged for COPD during the 5-y period participated in at least 1 PR session. Among Medicare beneficiaries, 2.0% participated in PR, with an increase from 0.6% to 3.2% over the 5-y period.

Veterans who participated in PR were more likely than nonparticipants to be younger and female, although men made up the majority (97%) of eligible patients (Table 2). Veterans who participated were more likely than nonparticipants to be white and less likely to have comorbid cerebrovascular disease, chronic kidney disease, and dementia but more likely to have had pneumonia or pulmonary hypertension.

Table 1

Eligible Patients for Pulmonary Rehabilitation and Participants in VHA and CMS, 2007-2011

	VHA		CMS	
Year	COPD Patients	PR Participants, n (%)	COPD Patients	PR Participants, n (%)
2007	7435	70 (0.9)	41 854	245 (0.6)
2008	8439	75 (0.9)	44 345	371 (0.8)
2009	8532	133 (1.6)	42 454	525 (1.2)
2010	8575	140 (1.6)	41 776	726 (1.7)
2011	8922	146 (1.6)	42 171	1332 (3.2)
Total unique	32 856	485 (1.5)	158 137	3199 (2.0)

Abbreviations: CMS, Centers for Medicare & Medicaid Services; COPD, chronic obstructive pulmonary disease; PR, pulmonary rehabilitation; VHA, Veterans Health Administration.

Medicare beneficiaries who participated in PR were more likely than nonparticipants to be younger and male (Table 3). Patients who participated were more likely than nonparticipants to be white and to have comorbid dyslipidemia, asthma, and pulmonary hypertension, have had pneumonia, and be an active smoker but were less likely to have heart failure, cerebrovascular disease, peripheral vascular disease, chronic kidney disease, and dementia.

Multivariate analysis adjusted for the previously identified covariates associated with participation or nonparticipation was conducted. Adjusting for demographics and comorbidities, older veterans were significantly less likely to participate in PR, with each decade increase in age (OR = 0.55; 95% CI, 0.47-0.63; $P < .001$) (Table 4). Among veterans, factors associated with participation included a recent diagnosis of pneumonia (OR = 2.11; 95% CI, 1.63-2.75; $P < .001$) or pulmonary hypertension (OR = 1.61; 95% CI, 1.19-2.16; $P = .002$). Medicare beneficiaries were more likely to participate in PR if they were men (OR = 1.27; 95% CI, 1.18-1.37; $P < .001$), have a history of tobacco use (OR = 1.79; 95% CI, 1.65-1.93; $P < .001$), asthma (OR = 1.63; 95% CI, 1.52-1.75; $P < .001$), pneumonia (OR = 1.41; 95% CI, 1.30-1.52; $P < .001$), and pulmonary hypertension (OR = 1.84; 95% CI, 1.70-1.99; $P < .001$). Medicare beneficiaries were less likely to participate with each decade increase in age (OR = 0.62; 95% CI, 0.59-0.66; $P < .001$), if they were black (OR = 0.47; 95% CI, 0.39-0.55; $P < .001$), or another race (OR = 0.40; 95% CI, 0.30-0.52; $P < .001$), had a history of cerebrovascular disease (OR = 0.66; 95% CI, 0.60-0.72; $P < .001$), chronic kidney disease (OR = 0.88; 95% CI, 0.81-0.95; $P = .001$), or dementia (OR = 0.39; 95% CI, 0.34-0.46; $P < .001$).

DISCUSSION

Our study is the first to date to investigate PR participation across both the VHA and Medicare populations. Overall, our results show that rates of participation in PR, defined as participating in 1 or more PR sessions within 12 mo after hospitalization for COPD, were extremely low in both VHA and Medicare beneficiaries. Participation was slightly higher in the Medicare population; however, both groups increased participation during each year of the study. We found that younger patients were more likely to participate in PR. Our findings that women veterans were more likely to participate are complicated by the very small numbers of

Table 2

Characteristics of VHA Beneficiaries Who Were PR Participants and Nonparticipants[a]

	Participants (n = 485)	Nonparticipants (n = 32 371)	OR (95% CI)	*P* Value
Demographics				
Age, y[b]	73.2 ± 6.2	76.0 ± 7.3	0.94 (0.93-0.96)	<.001
Male	465 (95.9)	31 666 (97.8)	0.52 (0.33-0.81)	.004
Race				
White	358 (73.8)	24 897 (76.9)	Reference	
Black	39 (8.0)	3 789 (11.7)	0.72 (0.51-1.00)	.05
Other	88 (18.1)	3 685 (11.4)	1.66 (1.33-2.10)	<.001
Comorbidities				
Hypertension	376 (77.5)	25 377 (78.4)	0.95 (0.77-1.18)	.64
Ischemic heart disease	203 (41.9)	14 788 (45.7)	0.86 (0.71-1.03)	.09
Dyslipidemia	284 (58.6)	19 653 (60.7)	0.91 (0.76-1.10)	.33
Diabetes mellitus	167 (34.4)	12 011 (37.1)	0.89 (0.74-1.08)	.23
Heart failure	172 (35.5)	12 061 (37.3)	0.93 (0.77-1.12)	.42
Cerebrovascular disease	51 (10.5)	4 492 (13.9)	0.73 (0.55-0.98)	.03
Peripheral vascular disease	114 (23.5)	7 702 (23.8)	0.98 (0.80-1.22)	.88
Chronic kidney disease	69 (14.2)	5 867 (18.1)	0.75 (0.58-0.97)	.03
Depression	99 (20.4)	6 336 (19.6)	1.05 (0.84-1.32)	.64
Dementia	8 (1.6)	1 374 (4.2)	0.38 (0.19-0.76)	.007
Tobacco use	176 (36.3)	10 603 (32.8)	1.17 (0.97-1.41)	.10
Asthma	86 (17.7)	5 125 (15.8)	1.15 (0.91-1.45)	.26
Pneumonia	68 (14.0)	2 308 (7.1)	2.13 (1.64-2.76)	<.001
Pulmonary hypertension	52 (10.7)	2 269 (7.0)	1.59 (1.19-2.13)	.002

Abbreviations: PR, pulmonary rehabilitation; VAH, Veterans Health Administration.

[a]Data reported as n (%) unless otherwise noted.

[b]Data reported as mean ± standard deviation.

women represented in our data, because traditionally women are less likely to participate, as was seen in the Medicare sample. There were racial differences in both groups, as black men were less likely to participate in both the VHA and Medicare populations. The strongest correlation of participation in PR among both VHA and Medicare beneficiaries was in patients who had been recently diagnosed with pneumonia or had pulmonary hypertension.

Table 3

Characteristics of CMS Beneficiaries Who Were PR Participants and Nonparticipants[a]

	Participants (n = 3 199)	Nonparticipants (n = 154 938)	OR (95% CI)	*P* Value
Demographics				
Age, y[b]	74.4 ± 6.2	78.5 ± 8.0	0.93 (0.93-0.94)	<.001
Male	1 475 (46.1)	60 565 (39.1)	1.33 (1.24-1.43)	<.001
Race				
White	3 005 (93.9)	135 829 (87.7)	Reference	
Black	139 (4.3)	12 388 (8.0)	0.51 (0.43-0.60)	<.001
Other	55 (1.7)	6 721 (4.3)	0.37 (0.28-0.48)	<.001
Comorbidities				
Hypertension	2 951 (92.2)	142 681 (92.1)	1.02 (0.90-1.16)	.74
Ischemic heart disease	2 102 (65.7)	101 760 (65.7)	1.00 (0.93-1.08)	.97
Dyslipidemia	2 538 (79.3)	107 627 (69.5)	1.69 (1.55-1.84)	<.001
Diabetes mellitus	1 425 (44.5)	69 629 (44.9)	0.98 (0.92-1.06)	.66
Heart failure	1 862 (58.2)	93 718 (60.5)	0.91 (0.85-0.98)	.009
Cerebrovascular disease	596 (18.6)	46 696 (30.1)	0.53 (0.49-0.58)	<.001
Peripheral vascular disease	1 378 (43.1)	71 436 (46.1)	0.88 (0.82-0.95)	<.001
Chronic kidney disease	1 052 (32.9)	58 417 (37.7)	0.81 (0.75-0.87)	<.001
Depression	946 (29.6)	42 901 (27.7)	1.10 (1.02-1.18)	.02
Dementia	201 (6.3)	32 036 (20.7)	0.26 (0.22-0.30)	<.001
Tobacco use	2 138 (66.8)	68 608 (44.3)	2.54 (2.35-2.73)	<.001
Asthma	1 476 (46.1)	51 127 (33.0)	1.74 (1.62-1.87)	<.001
Pneumonia	1 076 (33.6)	39 711 (25.6)	1.47 (1.37-1.58)	<.001
Pulmonary hypertension	1 101 (34.4)	34 033 (22.0)	1.86 (1.73-2.01)	<.001

Abbreviations: CMS, Centers for Medicare & Medicaid Services; PR, pulmonary rehabilitation.

[a]Data reported as number (%) unless otherwise noted.

[b]Data reported as mean ± standard deviation.

Table 4

Multivariate Associations for PR Participation in VHA and CMS Beneficiaries

	VHA (n = 32 856)		CMS (n = 158137)	
	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
Demographics				
Age, per 10-y increase in age	0.55 (0.47-0.63)	<.001	0.62 (0.59-0.66)	<.001
Male	0.49 (0.31-0.78)	.003	1.27 (1.18-1.37)	<.001
Race				
White	Reference		Reference	
Black	0.77 (0.55-1.07)	.12	0.47 (0.39-0.55)	<.001
Other	1.77 (1.39-2.24)	<.001	0.40 (0.30-0.52)	<.001
Comorbidities				
Heart failure	0.99 (0.81-1.21)	.93	0.93 (0.86-1.01)	.08
Cerebrovascular disease	0.81 (0.61-1.09)	.16	0.66 (0.60-0.72)	<.001
Peripheral vascular disease	1.08 (0.87-1.34)	.48	0.98 (0.91-1.05)	.50
Chronic kidney disease	0.84 (0.65-1.10)	.21	0.88 (0.81-0.95)	.001
Depression	0.98 (0.78-1.23)	.88	1.17 (1.08-1.27)	<.001
Dementia	0.52 (0.25-1.04)	.07	0.39 (0.34-0.46)	<.001
Tobacco use	0.89 (0.73-1.08)	.23	1.79 (1.65-1.93)	<.001
Asthma	1.06 (0.84-1.35)	.63	1.63 (1.52-1.75)	<.001
Pneumonia	2.11 (1.63-2.75)	<.001	1.41 (1.30-1.52)	<.001
Pulmonary hypertension	1.61 (1.19-2.16)	.002	1.84 (1.70-1.99)	<.001

Abbreviations: CMS, Centers for Medicare & Medicaid Services; COPD, chronic obstructive pulmonary disease; PR, pulmonary rehabilitation; VAH, Veterans Health Administration.

A 2013 joint position statement recommended PR be considered in any symptomatic patient regardless of forced expiratory volume in 1 sec (FEV_1) but was published after the dates included in our study[6]; however, it further strengthened the previous guidelines recommending PR.[9] It is unclear what the ideal proportion of patients with COPD should participate in PR, as our data have included all patients hospitalized for a COPD exacerbation, but it is possible that a portion of these patients had an FEV_1>50% at that time. However, it is generally believed that all patients who suffer from uncontrolled COPD that warrants hospitalization would likely benefit from PR and therefore the patients included in our study were eligible for PR. Despite this recommendation, it is clear that PR is seldom used in the management of COPD patients after an acute exacerbation. Given the benefits of physical activity and of specific education for symptom management, medication adherence, and other psychosocial components of a PR program in veterans, a higher proportion of veterans with COPD should be referred to and encouraged to participate in PR.[13-15] Our data could not determine the greater barrier to participation; however, literature suggests that both lack of referral and encouragement to participate play a significant role.[16,17]

Prior studies have found that barriers to participating in and adhering to a PR program are social support, provision of timely and effective feedback, proper goal setting, and ensuring that participants have a reasonable action plan and are motivated to change.[6] Providers must refer eligible patients to PR, but it has been documented that they lack knowledge related to PR benefits, how to refer, anticipated access difficulties for patients, and uncertainty about promoting increased physical activity for these patients.[17] There are numerous remaining challenges to improving PR participation, not the least of which are improving access and retaining patients who enroll by optimizing the flexibility of programs to accommodate patient clinical and personal needs.[18] Comorbid illness undoubtedly plays a major role in low participation and given the association in our results so does older age, dementia, and the presence of pulmonary hypertension. Increasing disease severity in conjunction with a lack of referral contributes to poor participation.[19]

In the VHA, population access to programs should not be a barrier, as a single-payer model can provide PR to all who qualify. However, understanding which patients to refer remains an issue. Although the VHA guidelines for patients with COPD make specific mention of PR, it is not highlighted, nor is it a performance metric; thus, attention is not raised to the level necessary. We used a large window of 12 mo after hospitalization to account for any delays in accessing a program or improvement in comorbid illness; yet, despite this, participation was very low. While having comorbid pulmonary disease such as pulmonary hypertension or recent pneumonia increases the odds of participating, nonpulmonary comorbidities decrease one's odds of participating. Whether this is due to provider bias of referral or patient factors that prioritize other health care issues is unknown.

Our study has several limitations. First, this is a descriptive study and any associations we described between covariates and participation in PR need to be further investigated to determine what, if any, causal relationship may exist. Second, we included all patients with a discharge diagnosis of COPD, of which only a portion would meet the guideline recommendation at the time of at least moderate COPD. However, since all patients in our study were hospitalized for uncontrolled COPD symptoms, they would likely all have benefited from PR. Third, we relied on *ICD-9-CM* coding to identify patients with COPD and determine what hospitalizations involved a COPD exacerbation. Misattribution of diagnoses could potentially bias our estimates. Fourth, we did not identify referrals but only participation. Therefore, it is unknown from our analysis whether patients are being referred at a significantly higher rate; however, with such poor participation, we do not expect this to be the case. Finally, some patients may have participated in PR due to ongoing management of their COPD and not necessarily due to a COPD hospitalization.

In summary, patients hospitalized with COPD from both the VHA and Medicare populations are extremely unlikely to participate in PR, although it has been shown to improve quality of life and activity levels and may confer a small mortality benefit. Specific modifiable barriers to its use were not identified in this study. However, increasing awareness among providers and patients about the benefits of PR could help improve the health of many veterans. Delivery of PR could be improved with standardized referral for all eligible patients, and it should also be initiated as early as possible after hospitalization for acute exacerbation. Further study is needed to elucidate the best way to promote and deliver PR to patients in the VHA system.

ACKNOWLEDGMENT

Dr Schopfer is funded by NIH NCATS KL2 TR000143. Dr Whooley is funded by grants from Veterans Affairs (QUE 15-283) and Patient-Centered Outcomes Research Institute (CDRN-1306-04819 and IH-1304-6787).

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