

Multisystem Healthcare Use among U.S. Veterans with Pulmonary Hypertension

To the Editor:

Multisystem healthcare use in the United States is common, owing to complicated payment plans, provider specialization, and isolated public and private networks. Although delivery of health care across multiple organizations can have positive effects, such as increased access to care, it may also lead to fragmented care, which can threaten the quality of care and increase costs. For patients with pulmonary hypertension (PH), a serious cardiopulmonary condition with high morbidity and mortality, highly coordinated care is vital to mitigate rates of missed or delayed diagnosis (1, 2) and to optimize outcomes. Clinical practice guidelines therefore recommend the diagnosis, classification, and management of PH be implemented through a multidisciplinary approach (3, 4).

The extent to which this integration of care for PH is being realized on a national level is currently unknown. We sought to characterize the prevalence of multisystem use among Veterans with PH and determine the location of diagnostic testing versus treatment among dual users as a marker of potentially fragmented care. We hypothesized that 1) multisystem healthcare use is common among Veterans with PH, 2) Veterans are more likely to receive diagnostic testing in the community because of financial incentives to perform procedures, and 3) treatment is more common in Veterans Health Administration (VA) because of lower patient copayments for medications.

Methods

To conduct this retrospective cohort analysis, we first linked national patient-level data maintained by VA National Data Systems and the Centers for Medicare and Medicaid Services from January 1, 2006, to December 31, 2015. We then constructed a cohort of all Veterans with PH defined by at least two visits linked to an *International Classification of Diseases, 9th Revision* or *International Classification of Diseases, 10th Revision* diagnosis code for PH (416.xx or I27.0, I27.2x). We restricted our sample to Medicare-eligible Veterans, defined by age ≥ 65 years or indication of eligibility in the Medicare denominator file. The Edith Nourse Rogers Memorial VA Hospital Institutional Review Board approved this study.

We identified the source of PH-associated care, defined as outpatient clinic visits linked to a PH diagnosis code, which we categorized as “VA-only care” (all PH-associated visits in VA), “Medicare-only care” (no PH-associated visits in VA), or “dual PH care” (PH-associated visits in both VA and Medicare). Our primary outcomes were receipt of any pulmonary vasodilator within 6 months before the first appearance of the PH

Supported by VA HSR&D IIR 15-115 and by resources from the Edith Nourse Rogers Memorial Veterans Hospital and the VA Boston Healthcare System; National Institutes of Health Institutional Training Grant T32 HL007035 (K.R.G.); and a Parker B. Francis Fellowship and a VISN 1 Career Development Award (S.T.R.).

The views expressed in this article do not necessarily represent the views of the Department of Veterans Affairs or the United States Government.

diagnosis code or any time after diagnosis and receipt of diagnostic testing including right heart catheterization (RHC) and echocardiogram before initial diagnosis.

We assessed baseline patient characteristics including age, sex, race, geographic location, comorbidities, disease severity, and healthcare utilization across VA-only, Medicare-only, and dual-care groups. We calculated proportions of patients in each group who had received diagnostic testing or therapy and compared differences in rates of diagnostic tests and treatment by source of care using chi-square test of independence. Among the dual-care group, we identified the location of diagnostic testing and treatment.

Results

Of 225,175 Veterans with PH in our cohort, 97% were male, 82% were white, and the mean age was 76.8 years. Patients in the VA-only group were younger and less likely to be white than those in the Medicare-only group. Most Veterans received at least some PH care in the community, with 161,474 (71.4%) having PH visits in Medicare only and 30,378 (13.5%) having PH visits in both VA and Medicare (Table 1).

Use of echocardiography was high across all three groups, ranging from 88.3% in the Medicare-only group to 92.4% in the VA-only group (Table 2). Conversely, use of RHC was low across all groups: 19.4% in the VA-only group, 22.9% in the Medicare-only group, and 30.4% in the dual-care group. Rates of PH treatment were also low across all groups: 3.5% VA-only patients, 1.8% Medicare-only patients, and 9.7% dual-care patients, with phosphodiesterase-5-inhibitors most commonly prescribed (94.3%). Among dual-care patients, most RHCs (56.7%) were performed in the community; however, most treatment (68.3%) was received through the VA (Figure 1). Of those who underwent both RHC and treatment ($n = 1,771$), 585 (33%) received diagnostic and therapeutic care in discordant locations.

Discussion

We found that most Veterans in our study received some portion of their PH care in the community, with a considerable proportion receiving care through both VA and Medicare. This is consistent with prior studies showing high rates of multisystem use among Veterans, a trend that is increasingly common since the implementation of several policies expanding Veterans' access to non-VA health care (5, 6).

We found that among Veterans with PH visits in both VA and the community, most received diagnostic testing in the community, but those who received treatment were more likely to get it through the VA. A third of dual-use Veterans with both a diagnostic procedure and treatment received diagnostic versus therapeutic care in discordant locations. In this highly complex disease, this discordance in location of care may reflect the appropriate referral of patients with PH to expert referral centers. However, if systems are not in place to ensure coordination of care across the two systems, it could increase the potential for suboptimal or redundant care. Indeed, Veterans who participate in multisystem care often experience worse outcomes, including higher rates of readmissions, unsafe prescribing, and mortality (6–9), likely reflecting the challenges in

Table 1. Demographic characteristics among U.S. Veterans by source of care

Baseline Patient Characteristics	VA Only (n = 33,323)	Medicare Only (n = 161,474)	Dual Care (n = 30,378)
Age, yr, mean (SD)	73.4 (9.9)	78.1 (9.4)	74.0 (9.9)
Male sex	32,302 (96.9)	157,560 (97.6)	29,330 (96.6)
Race			
White	25,189 (75.6)	136,432 (84.4)	23,817 (78.4)
Black	5,157 (15.5)	12,442 (7.7)	4,351 (14.3)
Hispanic	1,268 (3.8)	2,174 (1.3)	624 (2.1)
Geographic location			
North Atlantic	8,625 (25.9)	44,388 (27.5)	7,763 (25.6)
Southeast	6,189 (18.6)	28,993 (18.0)	5,437 (17.9)
Midwest	7,695 (23.1)	42,461 (26.3)	7,788 (25.6)
Continental	4,902 (14.7)	21,932 (13.6)	4,284 (14.1)
Pacific	5,912 (17.7)	18,733 (11.6)	5,106 (16.8)
Comorbidities, mean (SD)	9.8 (5.2)	10.9 (5.6)	10.2 (5.4)
Comorbid conditions			
Neurological disorder	1,401 (4.2)	13,870 (8.6)	1,191 (3.9)
Mental health disorder	1,473 (4.4)	4,209 (2.6)	1,180 (3.9)
Substance abuse	14,581 (43.8)	13,833 (8.6)	9,141 (30.1)
Malignancy	6,214 (18.6)	35,485 (22.0)	5,264 (17.3)
HIV or HCV infection	2,057 (6.2)	11,813 (7.3)	1,947 (6.4)
Chronic liver disease	1,845 (5.5)	5,426 (3.4)	1,434 (4.7)
Chronic kidney disease	18,717 (56.2)	82,715 (51.2)	16,456 (54.2)
COPD	14,539 (43.6)	73,190 (45.3)	14,391 (47.4)
Heart failure	13,603 (40.8)	81,916 (50.7)	13,943 (45.9)
Obstructive sleep apnea	3,816 (11.5)	20,294 (12.6)	3,704 (12.2)
Disease severity			
Acute right heart failure*	11,396 (34.2)	47,720 (29.6)	10,335 (34.0)
Acute respiratory failure*	5,064 (15.2)	21,074 (13.1)	4,983 (16.4)
Healthcare utilization, [†] mean (SD)			
Inpatient hospitalizations	2.0 (3.5)	2.1 (3.3)	2.2 (3.7)
ED visits	1.5 (1.1)	1.2 (1.1)	1.4 (1.2)
Outpatient visits	45.4 (45.8)	44.1 (36.5)	44.9 (42.8)

Definition of abbreviations: COPD=chronic obstructive pulmonary disease; ED=emergency department; HCV=hepatitis C virus; HIV=human immunodeficiency virus; SD=standard deviation; VA=Veterans Health Administration.

Data presented as n (%) unless otherwise noted.

*Within 90 days before diagnosis.

[†]In the year before diagnosis.

coordinating care and sharing management plans across healthcare systems (10).

This study has several limitations. As our cohort was limited to Veterans older than 65 years of age, it may not be generalizable

to all patients with PH. However, as recent cohort studies suggest that the general PH population is aging (11, 12), determining how PH care is delivered to older patients is valuable. Without additional physiologic data, we were unable to

Table 2. Patterns of pulmonary hypertension evaluation and treatment among U.S. Veterans by source of care

	VA Only (n = 33,323)	Medicare Only (n = 161,474)	Dual Care (n = 30,378)	P Value
PH Evaluation				
Echocardiogram	30,797 (92.4)	142,530 (88.3)	27,556 (90.7)	<0.01
Risk ratio (95% CI)	Reference	0.96 (0.95–0.96)	0.98 (0.98–0.99)	
RHC	6,456 (19.4)	36,995 (22.9)	9,241 (30.4)	<0.01
Risk ratio (95% CI)	Reference	1.18 (1.15–1.21)	1.57 (1.53–1.61)	
V/Q scan	9,005 (27.0)	21,146 (13.1)	6,812 (22.4)	<0.01
Risk ratio (95% CI)	Reference	0.48 (0.47–0.50)	0.83 (0.81–0.85)	
PH Treatment				
Pulmonary vasodilators	1,176 (3.5)	2,708 (1.7)	2,932 (9.7)	<0.01
Risk ratio (95% CI)	Reference	0.48 (0.44–0.51)	2.73 (2.56–2.92)	
Receipt of treatment without confirmatory RHC	747 (2.2)	2,052 (1.3)	1,468 (4.8)	<0.01

Definition of abbreviations: CI=confidence interval; PH=pulmonary hypertension; RHC=right heart catheterization; V/Q=ventilation-perfusion; VA=Veterans Health Administration.

Data presented as n (%) unless otherwise noted.

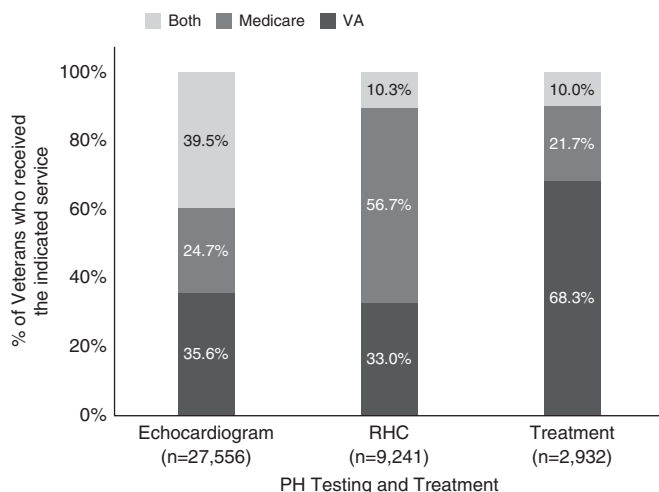


Figure 1. Location of diagnostic and therapeutic care among Veterans with dual pulmonary hypertension (PH) care ($n = 30,378$). RHC = right heart catheterization; VA = Veterans Health Administration.

identify the World Health Organization PH classification. This limits our ability to interpret the appropriateness of PH treatment or sharing of care across healthcare systems. For example, guidelines recommend PH expert involvement in management of patients with groups 1 and 4 PH, which may require referral outside the VA.

This national analysis reveals a discordance in the location of diagnostic testing and treatment among Veterans with PH who participate in multisystem care. Further studies are warranted to determine the impact of multisystem use on clinical outcomes, including hospitalizations and mortality. To ensure high-quality care for patients with PH, organizational efforts must prioritize care coordination across health systems.

Author disclosures are available with the text of this letter at www.atsjournals.org.

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References

- Maron BA, Choudhary G, Khan UA, Jankowich MD, McChesney H, Ferrazzani SJ, *et al.* Clinical profile and underdiagnosis of pulmonary hypertension in US veteran patients. *Circ Heart Fail* 2013;6:906–912.
- Deaño RC, Glassner-Kolmin C, Rubenfire M, Frost A, Visovatti S, McLaughlin VV, *et al.* Referral of patients with pulmonary hypertension diagnoses to tertiary pulmonary hypertension centers: the multicenter RePHerral study. *JAMA Intern Med* 2013;173:887–893.
- McLaughlin VV, Archer SL, Badesch DB, Barst RJ, Farber HW, Lindner JR, *et al.*; American College of Cardiology Foundation Task Force on Expert Consensus Documents; American Heart Association; American College of Chest Physicians; American Thoracic Society, Inc; Pulmonary Hypertension Association. ACCF/AHA 2009 expert consensus document on pulmonary hypertension a report of the American College of Cardiology Foundation Task Force on Expert Consensus Documents and the American Heart Association developed in collaboration with the American College of Chest Physicians; American Thoracic Society, Inc.; and the Pulmonary Hypertension Association. *J Am Coll Cardiol* 2009;53:1573–1619.
- Galiè N, Humbert M, Vachiery JL, Gibbs S, Lang I, Torbicki A, *et al.* 2015 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension: The Joint Task Force for the Diagnosis and Treatment of Pulmonary Hypertension of the European Society of Cardiology (ESC) and the European Respiratory Society (ERS): endorsed by: Association for European Paediatric and Congenital Cardiology (AEPC), International Society for Heart and Lung Transplantation (ISHLT). *Eur Respir J* 2015;46:903–975.
- Department of Veterans Affairs. Expanded access to non-VA care through the Veterans Choice Program: final rule. *Fed Regist* 2015;80:66419–66429.
- Gellad WF, Thorpe JM, Zhao X, Thorpe CT, Sileanu FE, Cashy JP, *et al.* Impact of dual use of Department of Veterans Affairs and Medicare part D drug benefits on potentially unsafe opioid use. *Am J Public Health* 2018;108:248–255.
- Rinne ST, Elwy AR, Bastian LA, Wong ES, Wiener RS, Liu CF. Impact of multisystem health care on readmission and follow-up among veterans hospitalized for chronic obstructive pulmonary disease. *Med Care* 2017;55:S20–S25.
- Wolinsky FD, Miller TR, An H, Brezinski PR, Vaughn TE, Rosenthal GE. Dual use of Medicare and the Veterans Health Administration: are there adverse health outcomes? *BMC Health Serv Res* 2006;6:131.
- Tarlov E, Lee TA, Weichle TW, Durazo-Arvizu R, Zhang Q, Perrin R, *et al.* Reduced overall and event-free survival among colon cancer patients using dual system care. *Cancer Epidemiol Biomarkers Prev* 2012;21:2231–2241.
- Rinne ST, Resnick K, Wiener RS, Simon SR, Elwy AR. VA provider perspectives on coordinating COPD care across health systems. *J Gen Intern Med* 2019;34:37–42.
- Berra G, Noble S, Soccia PM, Beghetti M, Lador F. Pulmonary hypertension in the elderly: a different disease? *Breathe (Sheff)* 2016;12:43–49.
- Hoepfer MM, Huscher D, Ghofrani HA, Delcroix M, Distler O, Schweiger C, *et al.* Elderly patients diagnosed with idiopathic pulmonary arterial hypertension: results from the COMPERA registry. *Int J Cardiol* 2013;168:871–880.

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