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SPECIAL ISSUE: LINKING VA AND NON-VA DATA TO ADDRESS US VETERAN HEALTH SERVICES ISSUES

Dual Use and Hospital Admissions among Veterans Enrolled in the VA's Homeless Patient Aligned Care Team

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Objective. To examine the association between reliance on VA outpatient care and hospital admissions among Medicare-eligible Veterans enrolled in the Homeless Patient Aligned Care Team (H-PACT).

Data Sources/Study Setting. Registry of H-PACT enrollees linked to VA and Medicare utilization data for 2013.

Study Design. After assigning Veterans to two groups according to whether they received >90 percent of outpatient care in VA (higher reliance) or <90 percent of outpatient care in VA (lower reliance), generalized linear models with inverse probability of treatment weights were used to estimate the association of reliance with Medicare and VA-financed hospital admissions.

Principal Findings. Compared with higher reliance Veterans, lower reliance Veterans had an equivalent number of annual VA hospitalizations (0.63 vs. 0.50; $p = .14$) but substantially greater Medicare hospitalizations (0.85 vs. 0.08; $p < .001$). Among Veterans in the highest tertile of outpatient visits, we observed statistically similar rates of VA hospital use but over 10-fold greater rates of Medicare-financed hospitalizations (1.31 for lower reliance vs. 0.15 for high reliance; $p < .001$).

Conclusions. Among Veterans receiving integrated care in VA's H-PACT, dual use of Medicare and VA outpatient care is strongly associated with acute hospitalizations financed by Medicare. Linking VA and non-VA data may identify a subset of homeless Veterans with fragmented outpatient care who are at increased risk of poor outcomes.

Key Words. Veterans, Medicare, homelessness, dual utilization, primary care

Homelessness is common among the Veteran population. Approximately 40,000 Veterans are homeless on any given night, and nearly one-fifth of homeless males in the United States are military Veterans (US Department of Housing and Urban Development 2016). Compared with persons with stable housing, homeless persons, including homeless Veterans, suffer from higher

rates of serious physical and mental health conditions, frequent hospitalizations and emergency department visits, and early mortality (Gelberg et al. 1990b; Hibbs et al. 1994; Hwang et al. 1997; Hwang 2001; Kushel, Vittinghoff, and Haas 2001; Kushel et al. 2002; O'Toole et al. 2003; Hastings et al. 2011; Baggett et al. 2013; Aldridge et al. 2017). Despite their increased burden of chronic and treatable conditions, homeless persons underuse outpatient care, often because the use of ongoing outpatient care must compete with the more immediate needs of food and shelter (Gelberg et al. 1997; O'Toole et al. 1999, 2015). Addressing the health care and social needs of homeless Veterans is an urgent priority for the Veterans Affairs (VA) health care system (O'Toole et al. 2016).

In 2011, VA implemented the Homeless Patient Aligned Care Team (H-PACT), a population-based medical home model adapted to meet the care need of homeless Veterans. H-PACT provides low-barrier, multidisciplinary care featuring open-access wrap-around services and supports (O'Toole et al. 2016). Colocated primary care, mental health, social work case management, housing services, donation-based food pantries, and on-site showers and laundry facilities are provided within H-PACT. In fiscal year 2017, there were 65 H-PACT teams across the VA network actively serving approximately 20,000 patients. Veterans are enrolled in H-PACT through various referral mechanisms including street and community provider outreach, emergency department, and other hand-offs, as well as through walk-in visits.

H-PACT operates under an accountable care model, which means that the program assumes responsibility for meeting the health care needs of a defined population with the goal of improving quality, improving health outcomes, and reducing health expenditures (O'Toole et al. 2016). In other words, H-PACT is premised on managing and coordinating the entirety of its enrolled population's health needs. However, Veterans may elect to enroll in alternative sources of coverage and seek care from non-VA providers, and federal policy has expanded funding for Veterans to receive care outside VA. For instance, the Veterans' Access to Care through Choice, Accountability, and

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Transparency Act of 2014 (VA Choice) directs VA to finance care with non-VA providers for Veterans who live more than 40 miles from the nearest VA facility and for Veterans who are unable to schedule an appointment within 30 days.

The ability to receive care from VA and non-VA sources may enhance access to care. In contrast, the concurrent use of multiple health systems may also lead to fragmented, duplicative, and potentially unsafe care; challenge the ability of programs like H-PACT to coordinate care; and compromise health outcomes, especially if VA and non-VA providers are unable to share health information effectively (Pizer and Gardner 2011; Trivedi et al. 2012, 2016; Cooper et al. 2015; Thorpe et al. 2017). Dual use may be a particular concern for homeless Veterans given the complex health care needs, high use of acute care services, and the importance of integrating primary care, behavioral health care, and social services for this population (LaCoursiere Zuccherro, McDannold, and McInnes 2016). Unfortunately, there is limited understanding of dual use of VA and non-VA care for homeless Veterans.

Therefore, the objective of this study was to characterize patterns of dual use and determine the association of dual use of VA and Medicare outpatient services with the use of hospital care among homeless Veterans enrolled in H-PACT. We focus on Medicare-eligible homeless Veterans given prior evidence that compared to younger homeless populations, older homeless adults in the United States are more likely to have a record of military service, chronic medical conditions, unmet health care needs, functional impairment, and high utilization of acute medical services (Gelberg, Linn, and Mayer-Oakes 1990a; Garibaldi, Conde-Martel, and O'Toole 2005; Brown et al. 2012).

METHODS

Study Design, Sources of Data, and Study Population

Among Veterans enrolled in H-PACT in 2013, we examined the association between reliance on VA for outpatient care and the use of hospital care. We obtained a registry of all Veterans ($n = 8,937$) enrolled in the H-PACT program as of January 1, 2013 and linked these data to Medicare and VA data using a scrambled social security number. Medicare claims data linked to the VA unique identifier (VHA's scrambled SSN) were obtained from the VA Information Resource Center (VHA Directive 1153, 2016; VA System of Records Notice 97VA10P1, 2015). H-PACT enrollees may have transitioned to other forms of VA primary care after January 1, 2013, but the data did not

include indicators of disenrollment from H-PACT. The VA Corporate Data Warehouse provided information on the use of VA outpatient and inpatient care (Fihn et al. 2014; US Department of Veterans Affairs 2014). The 2013 Medicare Cost and Use file provided information on enrollment in Medicare, chronic conditions, and the use of Medicare-financed outpatient and inpatient services (Hynes et al. 2007; US Department of Veterans Affairs 2011; VA Information Resource Center 2015).

We identified 2020 Veterans across 39 H-PACT care teams who were simultaneously enrolled in the Medicare program for 12 months in 2013 (Figure 1). Persons enrolled for one or more months in Medicare Advantage were excluded ($n = 295$) from the primary study cohort as health utilization data are not available for managed care enrollees. Thus, our primary study cohort included 1,725 Veterans dually enrolled in VA H-PACT and Medicare fee-for-service.

Measures

Our primary study outcomes were VA- and Medicare-financed acute inpatient admissions. Acute inpatient admissions included medical and surgical hospitalizations to acute care hospitals and excluded nonacute admissions to long-term care hospitals, inpatient psychiatric facilities, and inpatient rehabilitation facilities.

Our main independent variable was VA outpatient reliance, defined as the number of VA ambulatory visits divided by the sum of VA and Medicare ambulatory visits. Our measure of VA reliance assessed all VA and Medicare outpatient visits and therefore included VA visits that occurred outside the H-PACT model. We used previously described approaches to define outpatient visits in VA and Medicare (Trivedi et al. 2012; Yoon et al. 2017). Specifically, in VA we defined outpatient visits as unique combinations of patients, dates of service, and clinic locations. We excluded emergency, diagnostic, laboratory, pharmacy, and home care services. To capture fee-basis outpatient visits, we used a unique identifier for vendor in place of clinic location. To measure Medicare outpatient visits, we used a similar approach that summed Part B outpatient encounters and hospital outpatient visits, excluding emergency visits.

We assigned Veterans into two groups according to whether they received 90 percent or more of outpatient care in the VA (higher reliance) or less than 90 percent of outpatient care in the VA (lower reliance). This threshold was guided by prior studies of VA reliance (Pizer and Gardner 2011; Trivedi et al. 2012; Cooper et al. 2015) and by our primary study objective to

Figure 1: Construction of Study Cohort

compare the use of acute hospital care among homeless veterans in H-PACT who received outpatient care in both VA and Medicare and those who were exclusively or nearly exclusively reliant on VA care. A sensitivity analysis that used a more stringent definition of higher reliance yielded similar findings, as did a sensitivity analysis that excluded mental health visits from the reliance calculation.

Covariates included age, sex, race/ethnicity (white/black/other), the number and type of Elixhauser comorbid conditions, the number of outpatient visits (in both VA and Medicare), VA enrollment priority, the duration of prior enrollment in H-PACT, and dual Medicaid coverage. VA enrollment priority refers to the Veteran's eligibility for VA health benefits. The VA assigns enrollment priority on the basis of the presence and degree of service-connected disability, income, features of military service, eligibility

for Medicaid coverage, and receipt of VA pension benefits, among other factors (US Department of Veterans Affairs 2016). We selected these covariates because we hypothesized that they would be important correlates of the use of hospital care.

Analyses

We compared the characteristics of Veterans according to whether they had higher reliance or lower reliance for VA outpatient care. Next, we used propensity score methods with inverse probability of treatment weights to compare the use of VA and Medicare-financed hospital care among Veterans with higher and lower reliance for VA outpatient care (Austin 2011). The propensity score is the probability of a Veteran being in the higher reliance group, given his or her observable characteristics as described above. Specifically, we modeled each Veteran's probability of being in the higher reliance group including the covariates listed above. We then calculated the inverse probability of treatment weights using the propensity score. The weight is equal to the inverse probability of receiving the treatment that was actually received. The weights were trimmed and stabilized with a mean of 1.

Following the approach of Garrido et al. (2014), we plotted the distribution of propensity scores for higher and lower reliance Veterans and observed satisfactory overlap across the entire sample (see Appendix SA2). We achieved balance within blocks of the propensity score after splitting the sample into eight blocks. Mean standardized differences for all covariates before and after applying inverse probability of treatment weights are shown in Table 1. After applying weights, the standardized differences were 0.04 or less for all covariates. We also achieved a covariate balance within the eight blocks of the propensity score (Appendix SA2).

We constructed generalized linear models with inverse probability of treatment weights to estimate the association of reliance with Medicare and VA-finance hospital admissions. The models specified a negative binomial distribution and identity link, with robust standard errors clustered by VA Medical Center. In sensitivity analyses, we revised our cutpoint of higher reliance to 100 percent and eliminated VA mental health outpatient visits from the calculation of reliance. To understand how the relationship of reliance with hospital admissions varied according to the intensity of outpatient visits, we conducted stratified analyses in three tertiles of the total number (VA and Medicare) of outpatient visits during the year. We conducted a sensitivity analysis after excluding mental health visits from the reliance calculation for two

Table 1: Characteristics of Veterans enrolled in the Homeless PACT, According to Reliance on VA Outpatient Services

	Full Sample				After Applying Inverse Probability of Treatment Weights			
	VA Outpatient Reliance < 90%	VA Outpatient Reliance ≥ 90%	p Value	Standardized Difference	VA Outpatient Reliance < 90%	VA Outpatient Reliance ≥ 90%	p Value	Standardized Difference
N	514	1,211			514	1,211		
Mean Age, years (SD)	61.2 (11.0)	59.5 (9.7)	.003	0.16	59.90 (11.22)	59.96 (9.62)	.91	0.01
Male, %	96	97	.13	0.08	97	97	.92	0.01
Race, %								
White	56	51	.012	0.16	51	52	.88	0.03
Black	40	47			46	45		
Other	4	2			3	3		
Hypertension, %	19	19	.67	0.02	19	19	.92	0.01
Substance abuse disorder, %	14	14	.86	0.01	15	14	.84	0.01
Alcohol disorder, %	17	17	.90	0.01	15	17	.51	0.04
Psychosis/schizophrenia %	18	16	.41	0.04	16	17	.80	0.01
Depression, %	9	9	.75	0.02	9	9	.92	0.01
Diabetes, %	9	8	.45	0.04	7	8	.56	0.03
Chronic lung disease, %	9	8	.79	0.01	7	8	.64	0.02
Priority status %			.09	0.16			1.00	0.03
Group 1	14	18			18	17		
Group 2	3	4			4	4		
Group 3	11	10			10	10		
Group 4	3	2			2	2		
Group 5	66	64			63	64		
Groups 6, 7, 8	3	2			2	2		
Months enrolled in H-PACT program, %			.66	0.08			1.00	0.02

continued

Table 1. Continued

	Full Sample				After Applying Inverse Probability of Treatment Weights			
	VA Outpatient Reliance < 90%	VA Outpatient Reliance ≥ 90%	p Value	Standardized Difference	VA Outpatient Reliance < 90%	VA Outpatient Reliance ≥ 90%	p Value	Standardized Difference
0-6 months	19	18			18	18		
7-12 months	22	19			19	20		
13-18 months	18	21			21	20		
19-24 months	16	16			16	16		
>24 months	25	26			26	25		
Medicaid enrollment, %	57	26	<.01	0.67	36	35	.78	0.01
Mean number of Medicare outpatient visits (SD)	32.8 (45.6)	0.5 (1.6)	<.01	1.00	27.0 (39.9)	0.6 (1.8)	<.01	0.94
Mean number of VA outpatient visits (SD)	28.0 (34.8)	50.2 (52.8)	<.01	0.50	25.3 (31.1)	53.1 (56.6)	<.01	0.61
Mean number of total outpatient visits (SD)	60.6 (60.6)	50.7 (53.3)	<.01	0.17	52.3 (55.0)	53.7 (57.2)	.64	0.03

reasons. First, approximately half of all VA outpatient encounters in our cohort were mental health visits (see Results). Second, prior research has reported that the large majority of mental health visits among dually enrolled Veterans occur in VA, which would lead to increased VA reliance when mental health visits are included in the reliance calculation (Liu et al. 2010). Providence VA Medical Center's IRB approved the study protocol.

RESULTS

Characteristics of the Study Population

Compared to Veterans with higher reliance ($n = 1,211$), Veterans with lower reliance ($n = 514$) were slightly older (mean age 61.2 vs. 59.5; $p < .001$), less likely to be black (40 percent vs. 47 percent; $p = .01$), and more likely to be dually enrolled in Medicaid (57 percent vs. 26 percent; $p < .001$) (Table 1). We did not detect significant differences in the distribution of enrollment priority categories, gender, prior months of enrollment in H-PACT, or in the prevalence of the seven most common comorbid conditions (hypertension, drug dependence, alcohol dependence, psychiatric illness, depression, diabetes, and chronic lung disease).

Across the entire cohort, 83.5 percent of outpatient visits occurred in VA and the mean reliance was 70 percent (25th to 75th percentile: 0–1). 17.4 percent of hospitalizations occurred in VA, and the mean inpatient reliance was 14 percent (25th to 75th percentile: 0–0). Among VA outpatient visits, 47 percent were mental health visits. The mean number of VA mental health visits in the higher reliance cohort was 31.8 (25th to 75th percentile: 4–42). The mean number of VA mental health visits in the lower reliance cohort was 15.1 (25th to 75th percentile: 1–17.5).

Veterans with lower reliance had a mean of 32.8 annual Medicare-financed outpatient visits (interquartile range 6–40) and 28.0 VA annual outpatient visits (interquartile range 6–35). Veterans with higher reliance had a mean of 50.2 annual VA visits (interquartile range 15–66) and just 0.5 Medicare-financed visits (interquartile range 0–0). Applying inverse probability of treatment weights balanced all patient characteristics and the total number of annual outpatient visits (VA and Medicare combined). Of note, the distribution of outpatient visits for the higher reliance and lower reliance groups differed by design, with a mean of 99 percent of outpatient visits in the higher reliance group occurring in VA and a mean of 48 percent of outpatient visits

occurring in VA in the lower reliance group. Standardized differences were <5 percent for all covariates.

Outcomes

Table 2 shows unadjusted rates of acute hospitalizations in VA and Medicare, according to reliance on VA outpatient care. Veterans with lower outpatient reliance on VA made 1.49 annual hospitalizations (95 percent CI 1.26–1.71), while those with higher VA reliance experienced a mean of 0.59 annual hospitalizations (95 percent CI 0.49–0.69). We observed nonsignificant differences in VA-financed hospitalizations between Veterans with higher and lower reliance. However, Veterans with lower VA reliance had substantially more Medicare-financed hospitalizations (0.85 hospitalizations [95 percent CI: 0.72–0.98] for lower reliance Veterans vs. 0.08 hospitalizations [95 percent CI 0.06–0.11] for higher reliance Veterans).

Adjusted analyses are shown in Table 3. Compared with higher reliance Veterans, lower reliance Veterans had an equivalent number of annual VA hospitalizations (0.55 vs. 0.50; $p = .53$) but substantially greater Medicare hospitalizations (0.71 vs. 0.10; $p < .001$). We observed a graded relationship in the association between higher reliance and rates of Medicare-financed hospitalization according to the tertile of outpatient visit intensity. For instance, among Veterans in the highest tertile of outpatient visits, we observed statistically similar rates of VA hospital use but a ninefold greater rate of Medicare-financed hospitalizations (1.31 for lower reliance vs. 0.15 for higher reliance; $p < .001$).

We observed similar findings in sensitivity analyses that excluded mental health visits from the calculation of outpatient reliance and that used a

Table 2: Unadjusted Mean Annual Number of VA- and Medicare-financed Acute Care Hospitalizations among VA Homeless PACT Enrollees, according to VA Outpatient Reliance

	<i>VA Outpatient Reliance < 90%</i>	<i>VA Outpatient Reliance ≥ 90%</i>	<i>p Value*</i>
Total VA- and Medicare-financed acute care hospitalizations (95% CI)	1.49 (1.26–1.71)	0.59 (0.49–0.69)	<.001
VA-financed acute care hospitalizations (95% CI)	0.63 (0.48–0.78)	0.50 (0.41–0.59)	.14
Medicare-financed acute care hospitalizations (95% CI)	0.85 (0.72–0.98)	0.08 (0.06–0.11)	<.001

* p Value refers to a comparison between higher reliance and lower reliance Veterans.

Table 3: Adjusted Mean Annual Number of VA- and Medicare-financed Acute Care Hospitalizations among VA Homeless PACT Enrollees, according to VA Outpatient Reliance and Tertile of Annual Outpatient Visits

		<i>VA Outpatient Reliance < 90% Number of Hospitalizations (95% CI)</i>	<i>VA Outpatient Reliance ≥ 90% Number of Hospitalizations (95% CI)</i>	<i>p Value*</i>
Overall	Medicare acute hospitalizations	0.71 (0.60–0.82)	0.10 (0.08–0.12)	<.0001
	VA acute hospitalizations	0.55 (0.39–0.71)	0.50 (0.41–0.58)	.53
Low intensity (0–22 visits)	Medicare acute hospitalizations	0.21 (0.12–0.31)	0.06 (0.05–0.08)	.008
	VA acute hospitalizations	0.27 (0.11–0.43)	0.24 (0.19–0.28)	.77
Medium intensity (23–55 visits)	Medicare acute hospitalizations	0.64 (0.51–0.78)	0.07 (0.05–0.09)	<.001
	VA acute hospitalizations	0.50 (0.26–0.73)	0.51 (0.40–0.62)	.93
High intensity (>55 visits)	Medicare acute hospitalizations	1.31 (1.04–1.58)	0.15 (0.10–0.21)	<.001
	VA acute hospitalizations	1.17 (0.70–1.63)	0.72 (0.54–0.90)	.06

Table 4: Sensitivity Analyses of Adjusted Mean Annual Number of VA- and Medicare-financed Acute Care Hospitalizations among VA Homeless PACT Enrollees by Reliance, after Excluding Mental Health Visits and Changing the Threshold of Higher Reliance to 100%

		<i>Sensitivity Analysis 1: Excluding VA Mental Health</i>		<i>Sensitivity Analysis 2: Changing Threshold of Higher Reliance to 100%</i>	
		<i>VA Outpatient Reliance < 90% Number of Hospitalizations (95% CI)</i>	<i>VA Outpatient Reliance ≥ 90% Number of Hospitalizations (95% CI)</i>	<i>VA Outpatient Reliance < 100% Number of Hospitalizations (95% CI)</i>	<i>VA Outpatient Reliance 100% Number of Hospitalizations (95% CI)</i>
Medicare acute hospitalizations		0.45 (0.39–0.51)	0.11 (0.09–0.12)	0.53 (0.47–0.59)	0.09 (0.08–0.11)
VA acute hospitalizations		0.44 (0.34–0.54)	0.60 (0.45–0.75)	0.44 (0.33–0.56)	0.55 (0.46–0.64)

more restrictive threshold of 100 percent to characterize Veterans with higher reliance (Table 4). Specifically, after excluding mental health visits from the calculation of outpatient reliance, Veterans with lower reliance had four times more Medicare-financed hospitalizations than did Veterans with higher reliance. Veterans who exclusively received outpatient care in VA had approximately one-sixth the number of annual Medicare-financed hospitalizations as that observed for Veterans with <100 percent VA outpatient reliance.

DISCUSSION

We studied the dual use of VA and non-VA services among Medicare-eligible Veterans in H-PACT, an innovative care model that integrates medical care, social, and housing services tailored to the needs of homeless Veterans. Our study has four main findings. First, we observed a high intensity of outpatient visits, particularly mental health visits, among homeless Veterans enrolled in H-PACT, likely driven by the high prevalence of medical and behavioral health conditions and complex social needs of this cohort. Second, among this cohort of Veterans dually enrolled in VA and traditional Medicare, the large majority (83.5 percent) of outpatient care was delivered in the VA: 1211 of the 1725 individuals in our cohort were almost exclusively reliant on VA care and received <1 Medicare-financed visits during the year. Approximately 514 who we classified as having lower reliance still received half of their outpatient visits in the VA. Third, we observed an association of lower VA reliance with substantially increased rates of Medicare-financed, but not VA-financed, acute care hospitalizations, with the lower reliance group experiencing a 10-fold greater rate of Medicare-financed hospitalization. Fourth, the association between lower reliance and greater Medicare-financed hospitalizations was particularly strong among homeless Veterans with a higher intensity of total outpatient visits.

Our study cannot demonstrate a causal relationship between lower VA reliance and increased rates of hospitalizations. Veterans with lower reliance may have had worse health status or other risk factors that may have predisposed them to acute care events. Although we adjusted for comorbid conditions and the total number of outpatient visits which are important correlates of hospital admission, there may have been unobserved confounders that were unavailable in our data that may account for the relationship between reliance and hospital care. Nevertheless, our finding of an association between less reliance on the VA and markedly increased non-VA hospitalizations among homeless Veterans has important implications for VA clinicians and policy makers. Our study suggests that the splitting of outpatient care across VA and non-VA providers may identify a population at particularly high risk of hospitalization and that coordination and case management efforts could be targeted to such Veterans. Population health models, like H-PACT, often focus care coordination efforts for Veterans who at a higher risk of hospitalization and in the period following hospitalization during which patients are at increased risk of poor outcomes (O'Toole et al. 2016).

The findings also demonstrate the importance of sharing and linking VA and non-VA data. Dual enrollment of older homeless Veterans in more than one insurance program is common and introduces the risk for both poorly coordinated and redundant care. These care patterns are extremely difficult to track and measure through means other than linked data set analyses. For instance, the use of VA data in isolation would fail to identify homeless Veterans who receive care outside the VA and, equally importantly, miss a large fraction of hospital care for those enrolled in H-PACT. The period after hospital discharge carries an elevated risk of death and other adverse events for homeless persons (Doran et al. 2013; Aldridge et al. 2017). Therefore, a stronger, more cohesive link between VA and non-VA care data also has the potential to improve patient outcomes by enhancing postdischarge planning and aftercare. Conversely, inadequate sharing of information could compromise efforts to identify and improve postdischarge outcome for homeless Veterans who have recently been hospitalized (LaCoursiere Zuccherro, McDannold, and McInnes 2016).

A major strategic objective for VA is to enhance coordination of VA and non-VA care (Veterans Health Administration 2014). Our study suggests that such coordination may be particularly needed for homeless Veterans. The success of these initiatives may require integrating health information from VA and non-VA providers to identify homeless Veterans who receive fragmented outpatient care and are at higher risk for acute hospitalizations.

Dual use of VA and non-VA care is likely to increase in the near future. The recent Veterans Choice Act expanded opportunities for Veterans to receive VA-financed care from private-sector providers if Veterans live more than 40 miles from the nearest VA care or who are unable to make an appointment for VA care within 30 days. Further, the Affordable Care Act extended health insurance to many low-income adults who previously lacked coverage, including eligible Veterans (Kizer 2012). Such care may expand access and choice and promote timely care for Veterans. However, the findings of our study and others have raised concerns about the potential for multiple system use to have negative consequences. Specifically, the receipt of simultaneous care from more than one health care system may be associated with worse quality of care, including care fragmentation, duplicated services, and unsafe prescribing (Hester, Cook, and Robbins 2005; Kizer 2012; Trivedi et al. 2012; Thorpe et al. 2017). Further, dual use has also been associated with increased hospitalizations, mortality, and higher spending, although one study did not find an association between dual use and worse control of blood pressure,

cholesterol, and diabetes (Wolinsky et al. 2006, 2007; Jia et al. 2007; Pizer and Gardner 2011; Cooper et al. 2015).

Our study extends prior research on dual use in two main ways. First, we focus on dual use among a population of older homeless Veterans who have substantial, complex and often unmet social and health care needs, a high burden of addictive and psychiatric disorders, and suffer adverse outcomes stemming from uncoordinated care (Kushel, Vittinghoff, and Haas 2001; Baggett et al. 2010; Aldridge et al. 2017). Second, our study examined enrollees in a VA population health management program that assumes accountability for integrating and coordinating medical, behavioral, and social services, and provides a substantial number of outpatient visits to enrollees by managing the entirety of homeless Veterans' service needs. Even among this population of H-PACT enrollees with high reliance on VA care, some Veterans make substantial use of private-sector ambulatory and hospital services.

Limitations

Our study has limitations. First, the study was not designed to draw causal inferences about the relationship between multiple system use and hospitalizations. Second, we exclusively examined dual use among homeless Veterans enrolled in traditional Medicare. Therefore, our findings are specific to homeless Veterans who were enrolled in H-PACT and Medicare but may not generalize to homeless Veterans with Medicaid coverage or those who lack other sources of insurance coverage. Third, we do not characterize the types of outpatient services received in Medicare, whether the homeless Veterans in our study were receiving primary care from both VA and non-VA providers, or enrollment in care management programs or accountable care organizations outside VA. Such studies are urgently needed.

More broadly, assessing the use of specific services, including outpatient visits, across health systems raises important challenges if each system uses distinct data processes and procedures to classify and code such encounters (Burgess et al. 2010). In other words, measuring the use of health services depends on the context of the health system in which the service is delivered. We classified VA and non-VA outpatient visits using approaches consistent with other studies (Trivedi et al. 2012; Yoon et al. 2017) but acknowledge that our findings regarding VA reliance and use of services may vary with alternative choices to classifying and aggregating VA- and Medicare-financed encounters.

Finally, distance from the VA has been reported in prior studies as a powerful predictor of multiple system use (Burgess and DeFiore 1994; Hynes et al. 2007; Petersen et al. 2010). We did not include distance from the Veterans' residence to the nearest VA facility as the H-PACT program was designed for Veterans with unstable housing.

CONCLUSION

Among Veterans receiving integrated care in VA's H-PACT, dual use of Medicare and VA outpatient care is common and strongly associated with the use of acute hospital care financed by Medicare. Although our design cannot make causal inferences between VA reliance and hospital admissions, the findings suggest that linking VA and non-VA data may identify a subset of homeless Veterans with fragmented outpatient care who have increased risk of poor outcomes. Efforts to enhance coordination and integration of VA and non-VA care may be particularly needed for homeless Veterans.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix SA1: Author Matrix.

Appendix SA2: Summary of Propensity Score Methods.