

Variations in VA and Medicare Use Among Veterans With Diabetes

Impacts on Ambulatory Care Sensitive Conditions Hospitalizations for 2008, 2009, and 2010

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Introduction: VA and Medicare use among older Veterans has been considered fragmented care, however, it may represent access to needed care.

Methods: The population studied were Veterans with diabetes, age 66 years and older, dually enrolled in VA and Medicare.

Data Source/Study Setting: We conducted a dynamic retrospective cohort study with 2008, 2009, and 2010 as the outcome years (Ambulatory Care Sensitive Conditions Hospitalization (ACSC-H) or not). We analyzed administrative data to identify comorbidities; ambulatory care utilization to identify variations in use before hospitalization. We linked 2007 primary care (PC) survey data to assess if organizational factors were associated with ACSC-H.

Measures and Analysis: We identified ACSC-Hs using a validated definition. We categorized VA/Medicare use as: single system; dual system: supplemental specialty care use; or primary care use. Using

hierarchical logistic regression models, we tested for associations between VA/Medicare use, organizational characteristics, and ACSC-H controlling for patient-level, organizational-level, and area-level characteristics.

Results: Our analytic population was comprised of 210,726 Medicare-eligible Veterans; more than one quarter had an ACSC-H. We found that single system users had higher odds of ACSC-H compared with dual system specialty supplemental care use (odds ratio, 1.14; 95% confidence interval, 1.09–1.20), and no significant difference between dual-system users. Veterans obtaining care at sites where PC leaders reported greater autonomy (eg, authority over personnel issues) had lower odds of ACSC-H (odds ratio, 0.74; 95% confidence interval, 0.59–0.92).

Discussion: Our findings suggest that earlier assumptions about VA/Medicare use should be weighed against the possibility that neither VA nor Medicare may address complex Veterans' health needs. Greater PC leader autonomy may allow for tailoring of care to match local clinical contexts.

Key Words: Veterans, Medicare, hospitalizations, services, utilization, professional autonomy

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Older adults (age above 65 y) with diabetes may frequently require care outside the primary care/patient centered medical home, from specialists (eg, cardiologists, endocrinologists, nephrologists, ophthalmologists), and allied health professionals (pharmacists, nutritionists), for optimal diabetes management.¹ These patients obtaining care from multiple providers, in multiple settings, may be at risk for receiving fragmented care if the providers caring for the same patient function autonomously, with little or no communication among providers.² Lack of coordinated care has been found to be associated with poor health outcomes,^{3–6} including preventable hospitalizations and higher health care costs.⁷ Care coordination, defined as a set of practitioner behaviors and systems intended to bring together health services, patient needs, and information in order to achieve safe, effective, patient-centered, timely, efficient, and equitable health care, may be needed to avoid wasted time and effort, and lost information and resources due to duplicated, redundant, or unnecessary care.³

Veterans Affairs (VA) primary care (PC) providers face major challenges in coordinating care for older Veterans with diabetes for many reasons, including older patient age, greater medical complexity, challenges maintaining good control of diabetes, or prevalence of diabetes-related complications, and use of multiple VA and Medicare providers. More than 75% of Medicare-eligible Veterans utilize both VA and Medicare providers for health care.⁸ To date, the studies that have examined the impact of dual (VA/Medicare) use on health outcomes assumed that dual use represented fragmented or uncoordinated care between VA and Medicare providers, resulting in poor health outcomes.^{9–13} However, it is possible that dual VA/Medicare use may be beneficial for Veterans if such care fills unmet needs for specialty care. For example, VA providers may offer mental health care not readily available in community settings, while Medicare providers may offer more timely access to specialty care than VA providers. Therefore, we need to assess distinct variations in VA and Medicare use to better understand how these variations may impact outcomes in care.

Our secondary aim is to understand the role that organizational factors may play in improving patient outcomes. Using national primary care organizational survey data, we assessed if VA primary care clinic characteristics intended to support coordinated care in VA are associated with quality of care, to identify organizational policies or promising practices that present opportunities for improved care for patients with diabetes. This is particularly relevant in the Veterans Health Administration, where most Veterans with diabetes have their diabetes managed in primary care.

Ambulatory Care Sensitive Condition Hospitalizations (ACSC-Hs) has been the subject of research with smaller cohorts and shorter study periods.^{6,14} Our study is the first to assess patients with diabetes physical and mental health status for 2 years of care preceding a hospitalization (ACSC-H or not), as well as an array of patient-level factors (eg, comorbid conditions, poor control of diabetes, and diabetes-related complications) and organizational and area-level factors, that may also impact likelihood of ACSC-H.

METHODS

Study Design

We adopted a dynamic retrospective cohort design with calendar years 2008–2010 serving as the outcome years and preceding 2 years serving as the baseline years. (eg, 2006 and 2007 as baseline for 2008), for 5 years of data (2006–2010). For assessing variations in VA and Medicare utilization (eg, single system use, dual system supplemental specialty care use or dual primary care use), we measured outpatient care utilization in the 6 months before the first hospitalization (ACSC-H or not). We also assessed different time periods (12 mo, 2 y) preceding hospitalization, but decided on 6 months as being most proximal to the variable of interest (ACSC-H or not).

Population Studied (Patient Inclusion/Exclusion Criteria)

Our study population consisted of Veterans with diabetes who were 66 years of age or older and dually enrolled in VA and Medicare during baseline and outcome years. To

identify patients with diabetes we modified the method published by Miller et al.¹⁵ We identified diabetes from both VA records and Medicare claims data. Veterans having at least 1 inpatient stay or 2 outpatient face-to-face visits associated with an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis code for diabetes mellitus (250.xx) during the baseline period were included in the study.

We defined face-to-face visits as in-person encounters involving a clinician with independent decision-making capacity. VA face-to-face primary care and specialty outpatient visits were identified using stop codes. Medicare face-to-face outpatient visits were identified using Current Procedural Terminology codes. We identified a total of 1,051,053 patients in 2008, 1,140,790 patients in 2009, and 1,160,978 patients in 2010 who fit our inclusion criteria. Exclusion criteria, as well as the number of patients excluded are shown in Table 1. After application of exclusion criteria, a total of 210,726 unique subjects were included in the study for at least 1 outcome year during the study period. The study population size for each outcome year (2008, 2009, and 2010) are listed in Table 2.

Data Sources

Patient-level Data (2006–2010)

The data we used for this study included demographic summary, inpatient, outpatient, and long-term care file extracts from: VA Corporate Data Warehouse (CDW) production tables, Managerial Cost Accounting System (MCA, formerly DSS) tables, and the VA Information Resource Center (VIREC) Medicare data files. We also used Medicaid long term care files from VIREC and VA laboratory data from CDW and DSS. We used records from 2006 to 2010. We linked patient level data from the various sources based on unique patient identification numbers.

We merged together smaller groups of VA and Medicare users into 3 categories. Classification of ambulatory care (face-to-face visits) are described in greater detail in the Appendix (Supplemental Digital Content 1, <http://links.lww.com/MLR/B759>).

Organizational Factors Data

Clinical Practice Organizational Survey (CPOS), Primary Care Module (2007)

We surveyed PC directors (or other locally designated clinical leaders if no PC director was available) at all VA primary care clinics serving 4000 or more unique patients and delivering 20,000 or more outpatient visits in fiscal year 2006, based on patient caseload and workload derived from the VA Outpatient Clinic File.¹⁶ This included 153 VA medical center (VAMC) clinics and 97 large community-based outpatient clinics. Geographically distinct sites within integrated VA health care systems that met these criteria were surveyed separately since their organizational features differed from the parent facility.

Key informants were identified using a standardized protocol, whereby trained field staff contacted the Offices of Director and Chief of Staff at each VA medical center, informed them of the upcoming survey and requested identification and complete contact information of the PC leader (eg, director or

TABLE 1. Patient Inclusion/Exclusion Criteria

Reason for Exclusion	2008 Cohort		2009 Cohort		2010 Cohort	
	Number Excluded	Number Remaining in Cohort	Number Excluded	Number Remaining in Cohort	Number Excluded	Number Remaining in Cohort
VHA and Medicare dually enrolled Veterans with Diabetes (initial cohort)		1,687,256		1,826,490		1,882,937
Aged 66 and older	636,203		685,700		721,959	
Died before start of outcome year	142,155	1,051,053	208,970	1,140,790	212,607	1,160,978
Lacked continuous Medicare parts A and B coverage during study period	139,901	908,898	144,164	931,820	155,556	948,371
More than 1 mo of HMO coverage during study period	170,277	768,997	181,772	787,656	184,437	792,815
Any hospice use during study period	8313	598,720	9171	605,884	9794	608,378
At least 1 stay at a skilled nursing facility during study period	21,363	590,407	21,477	596,713	21,364	598,584
A hospital stay of > 180 days during study period	603	569,044	676	575,236	720	577,220
Did not reside in the United States	4509	568,441	4170	574,560	4039	576,500
Did not have a face-to-face PC visit at a surveyed VHA facility during the baseline period	211,012	563,932	223,927	570,390	230,175	572,461
Was not hospitalized during outcome year	254,940	352,920	252,902	346,463	250,573	342,286
Did not have an outpatient visit during the 6 mo before first hospitalization	21,522	97,980	20,719	93,561	939	91,713
Study cohort: VHA and Medicare dually enrolled Veterans with diabetes		76,458		72,842		90,774

HMO indicates Health Maintenance Organization; PC, primary care; VHA, Veterans Health Administration.

chief) or, if none existed, the clinical leader most familiar with the primary care program at each eligible site under their jurisdiction.¹⁷ Survey packets were also accompanied by an endorsement letter from the Chief Consultant for Primary Care of the VA Office of Patient Care Services. Surveys were fielded through express mail as well as emailed MSWord® versions capable of online completion and forwarding to multiple designees as needed. Repeat mailings were sent to nonresponders after 4 weeks, with email and telephone follow-up from research and Primary Care staff, resulting in a 90% response rate. Returned surveys were reviewed for completeness, 100% double data entered, and compared for accuracy, with discrepancies resolved in joint review. To link patient level data to clinic level data, we designated a VA facility for each Veteran as their primary facility based on utilization.

Other Data Sources

We also used clinic size information from the VA National Patient Care Database (NPCD) and county level measures from the Area Health Resources Files.¹⁸

Measures

Dependent Variable: ACSC-H

We used the Agency for Healthcare Research and Quality's (AHRQ) Prevention Quality Indicators (PQI) version 5.0 definition of an ACSC-H.¹⁹ Using ICD-9-CM codes, we identified ACSC-H from VA inpatient records and Medicare inpatient claims during outcome years 2008–2010. We categorized an inpatient stay as an ACSC-H if it was associated with any of the following conditions: (1) diabetes short-term complications; (2) diabetes long-term complications; (3) chronic obstructive pulmonary disease (COPD); (4) asthma; (5) hypertension; (6) congestive heart failure; (7) dehydration; (8) bacterial pneumonia infections; (9) urinary tract infections; (10) angina without a procedure; (11) uncontrolled diabetes; and (12) lower extremity amputations. Individuals were categorized as having an ACSC-H or not, a 0/1 or binary outcome.

Key Independent Variable

Variations in VA and Medicare Use: Single System, Dual System Supplemental Specialty Care Use, and Dual System Primary Care Use.

TABLE 2. Patient Characteristics for Medicare-eligible Veterans With Diabetes Hospitalized in 2008, 2009, or 2010 by Type of Medicare and VA Use

	2008				2009				2010			
	All	Dual System Supplemental Specialty Care Use	Single System	Dual System Primary Care Use	All	Dual System Supplemental Specialty Care Use	Single System	Dual System Primary Care Use	All	Dual System Supplemental Specialty Care Use	Single System	Dual System Primary Care Use
Sample of hospitalized veterans												
Frequency	76,458	13,879	40,038	22,541	72,842	13,025	38,919	20,898	90,774	16,179	49,496	25,099
Percent		18.2	52.4	29.5		17.9	53.4	28.7		17.8	54.5	27.7
ACSC-H												
Yes												
Frequency	21,281	3728	11,690	5863	20,063	3426	11,220	5417	27,819	4817	15,878	7124
Column %	27.8	26.9	29.2	26.0	27.5	26.3	28.8	25.9	30.7	29.8	32.1	28.4
Sociodemographic characteristics												
Age category												
66–74												
Frequency	33,610	6272	17,744	9594	30,548	5509	16,604	8435	34,068	6181	18,824	9063
Column %	44.0	45.2	44.3	42.6	41.9	42.3	42.7	40.4	37.5	38.2	38.0	36.1
75–84												
Frequency	37,204	6586	19,312	11,306	35,939	6425	18,823	10,691	45,805	8143	24,574	13,088
Column %	48.7	47.5	48.2	50.2	49.3	49.3	48.4	51.2	50.5	50.3	49.7	52.2
85+												
Frequency	5644	1,021	2982	1641	6355	1091	3492	1772	10,901	1855	6098	2948
Column %	7.4	1.3	3.9	2.2	8.7	1.5	4.8	2.4	12.0	2.0	6.7	3.3
Sex												
Male												
Frequency	75,371	13,700	39,396	22,275	71,790	12,823	38,314	20,653	89,489	15,958	48,750	24,781
Column %	98.6	17.9	51.5	29.1	98.6	17.6	52.6	28.4	98.6	17.6	53.7	27.3
Female												
Frequency	1087	179	642	266	1052	202	605	245	1285	221	746	318
Column %	1.4	0.2	0.8	0.4	1.4	0.3	0.8	0.3	1.4	0.2	0.8	0.4
Race/ethnicity												
Non-Hispanic White												
Frequency	68,209	12,396	35,079	20,734	64,464	11,506	33,831	19,127	79,896	14,229	42,933	22,734
Column %	89.2	89.3	45.9	27.1	88.5	15.8	46.4	26.3	88.0	15.7	47.3	25.0
Non-Hispanic Black												
Frequency	5089	892	3121	1076	5286	966	3248	1072	6890	1240	4238	1412
Column %	6.7	6.4	7.8	4.8	7.3	7.4	8.4	5.1	7.6	7.7	8.6	5.6
Hispanic												
Frequency	2346	441	1361	544	2335	441	1372	522	2949	531	1713	705
Column %	3.1	3.2	3.4	2.4	3.2	3.4	3.5	2.5	3.2	3.3	3.5	2.8
Other												
Frequency	814	150	477	187	757	112	468	177	1039	179	612	248
Column %	1.1	1.1	1.2	0.8	1.0	0.9	1.2	0.9	1.1	1.1	1.2	1.0
Marital status												
Married												
Frequency	55,831	10,261	28,150	17,420	52,657	9479	27,092	16,086	64,236	11,597	33,811	18,828
Column %	73.0	73.9	70.3	77.3	72.3	72.8	69.6	77.0	70.8	71.7	68.3	75.0

Veteran enrollment/priority status												
Severely disabled												
Frequency	12,122	2532	6059	3531	12,488	2585	6320	3583	16,882	3485	8662	4735
Column %	15.9	18.2	15.1	15.7	17.1	19.9	16.2	17.2	18.6	21.5	17.5	18.9
Moderately disabled												
Frequency	10,811	1926	5779	3106	10,471	1929	5662	2880	13,390	2454	7368	3568
Column %	14.1	13.9	14.4	13.8	14.4	14.8	14.6	13.8	14.8	15.2	14.9	14.2
Not disabled, low income												
Frequency	22,837	3986	13,041	5810	20,512	3517	12,140	4855	25,186	4190	15,135	5861
Column %	29.9	28.7	32.6	25.8	28.2	27.0	31.2	23.2	27.7	25.9	30.6	23.4
Not disabled, copayment required												
Frequency	30,688	5435	15,159	10,094	29,371	4994	14,797	9580	35,316	6050	18,331	10,935
Column %	40.1	39.2	37.9	44.8	40.3	38.3	38.0	45.8	38.9	37.4	37.0	43.6
Medicaid coverage												
Yes												
Frequency	3859	695	2338	826	3666	614	2329	723	5108	867	3237	1004
Column %	5.1	5.0	5.8	3.7	5.0	4.7	6.0	3.5	5.6	5.4	6.5	4.0
Veterans' zipcode by rurality												
Urban												
Frequency	46,289	8109	24,445	13,735	43,973	7561	23,618	12,794	55,481	9434	30,593	15,454
Column %	60.5	58.4	61.1	60.9	60.4	58.1	60.7	61.2	61.1	58.3	61.8	61.6
Rural												
Frequency	28,677	5451	14,805	8421	27,453	5182	14,524	7747	33,626	6371	18,017	9238
Column %	37.5	39.3	37.0	37.4	37.7	39.8	37.3	37.1	37.0	39.4	36.4	36.8
Highly rural												
Frequency	1492	319	788	385	1416	282	777	357	1667	374	886	407
Column %	2.0	2.3	2.0	1.7	1.9	2.2	2.0	1.7	1.8	2.3	1.8	1.6
Clinical characteristics												
Hemoglobin A1c levels												
< 7%												
Frequency	38,075	7396	18,925	11,754	37,355	7173	18,999	11,183	45,959	8687	23,916	13,356
Column %	49.8	53.3	47.3	52.1	51.3	55.1	48.8	53.5	50.6	53.7	48.3	53.2
≥ 7%; < 8%												
Frequency	16,323	3172	8175	4976	15,425	2929	8001	4495	19,333	3708	10,191	5434
Column %	21.4	22.9	20.4	22.1	21.2	22.5	20.6	21.5	21.3	22.9	20.6	21.7
≥ 8%; < 9%												
Frequency	5032	975	2651	1406	4485	878	2351	1256	5758	1136	3162	1460
Column %	6.6	7.0	6.6	6.2	6.2	6.7	6.0	6.0	6.3	7.0	6.4	5.8
≥ 9%												
Frequency	2908	568	1626	714	2737	502	1617	618	3406	602	2033	771
Column %	3.8	4.1	4.1	3.2	3.8	3.9	4.2	3.0	3.8	3.7	4.1	3.1
Unknown												
Frequency	14,120	1768	8661	3691	12,840	1543	7951	3346	16,318	2046	10,194	4078
Column %	18.5	12.7	21.6	16.4	17.6	11.9	20.4	16.0	18.0	12.7	20.6	16.3
Documented insulin use												
No												
Frequency	56,192	10,311	28,681	17,200	52,162	9487	27,255	15,420	62,802	11,381	33,489	17,932
Column %	73.5	74.3	71.6	76.3	71.6	72.8	70.0	73.8	69.2	70.3	67.7	71.5

(Continued)

TABLE 2. Patient Characteristics for Medicare-eligible Veterans With Diabetes Hospitalized in 2008, 2009, or 2010 by Type of Medicare and VA Use (*continued*)

	2008				2009				2010			
	All	Dual System Supplemental Specialty Care Use	Single System	Dual System Primary Care Use	All	Dual System Supplemental Specialty Care Use	Single System	Dual System Primary Care Use	All	Dual System Supplemental Specialty Care Use	Single System	Dual System Primary Care Use
Yes												
Frequency	17,222	3330	9051	4841	17,430	3263	9259	4908	23,601	4450	12,734	6417
Column %	22.5	24.0	22.6	21.5	23.9	25.1	23.8	23.5	26.0	27.5	25.7	25.6
Unknown												
Frequency	3044	238	2306	500	3250	275	2405	570	4371	348	3273	750
Column %	4.0	1.7	5.8	2.2	4.5	2.1	6.2	2.7	4.8	2.2	6.6	3.0
Diabetes complications severity index												
0 complications												
Frequency	6422	1081	3675	1666	6102	1036	3564	1502	6952	1142	4168	1642
Column %	8.4	7.8	9.2	7.4	8.4	8.0	9.2	7.2	7.7	7.1	8.4	6.5
1 complication												
Frequency	17,582	3215	9352	5015	16,338	2897	8962	4479	19,249	3538	10,631	5080
Column %	23.0	23.2	23.4	22.3	22.4	22.2	23.0	21.4	21.2	21.9	21.5	20.2
2 complications												
Frequency	20,774	3857	10,817	6100	19,536	3542	10,358	5636	24,144	4352	13,167	6625
Column %	27.2	27.8	27.0	27.1	26.8	27.2	26.6	27.0	26.6	26.9	26.6	26.4
3–7 complications												
Frequency	31,680	5726	16,194	9760	30,866	5550	16,035	9281	40,429	7147	21,530	11,752
Column %	41.4	41.3	40.5	43.3	42.4	42.6	41.2	44.4	44.5	44.2	43.5	46.8
Documented mental health disorders												
Serious mental illness and/or depression												
Yes												
Frequency	12,959	2311	6926	3722	12,551	2267	6751	3533	17,095	2995	9431	4669
Column %	17.0	16.7	17.3	16.5	17.2	17.4	17.4	16.9	18.8	18.5	19.1	18.6
Generalized anxiety disorder												
Yes												
Frequency	5117	832	2724	1561	5014	865	2648	1501	6775	1099	3670	2006
Column %	6.7	6.0	6.8	6.9	6.9	6.6	6.8	7.2	7.5	6.8	7.4	8.0
Other clinical conditions												
Diagnosis of cancer												
Yes												
Frequency	21,078	3741	10,841	6496	20,760	3618	10,834	6308	27,790	4920	15,010	7860
Column %	27.6	27.0	27.1	28.8	28.5	27.8	27.8	30.2	30.6	30.4	30.3	31.3
Chronic obstructive pulmonary disease												
Yes												
Frequency	24,298	4279	12,870	7149	23,294	4022	12,486	6786	30,864	5291	16,796	8777
Column %	31.8	30.8	32.1	31.7	32.0	30.9	32.1	32.5	34.0	32.7	33.9	35.0
Asthma												
Yes												
Frequency	6652	1131	3469	2052	6382	1131	3329	1922	8477	1391	4520	2566
Column %	8.7	8.2	8.7	9.1	8.8	8.7	8.6	9.2	9.3	8.6	9.1	10.2

Infected diseases												
Yes												
Frequency	55,883	9891	28,936	17,056	53,788	9400	28,338	16,050	68,188	11,880	36,846	19,462
Column %	73.1	71.3	72.3	75.7	73.8	72.2	72.8	76.8	75.1	73.4	74.4	77.5
Dementia												
Yes												
Frequency	5575	944	3074	1557	5664	955	3154	1555	9145	1507	5251	2387
Column %	7.3	6.8	7.7	6.9	7.8	7.3	8.1	7.4	10.1	9.3	10.6	9.5
Lifestyle factors												
Tobacco use												
Yes												
Frequency	5606	960	3195	1451	5495	934	3154	1407	7391	1273	4332	1786
Column %	7.3	6.9	8.0	6.4	7.5	7.2	8.1	6.7	8.1	7.9	8.7	7.1
Alcohol or drug use												
Yes												
Frequency	1969	334	1122	513	1923	319	1154	450	2724	467	1599	658
Column %	2.6	2.4	2.8	2.3	2.6	2.5	3.0	2.2	3.0	2.9	3.2	2.6
Body mass index												
Underweight/normal												
Frequency	11,104	2046	5811	3247	10,366	1842	5627	2897	13,924	2486	7779	3659
Column %	14.5	14.7	14.5	14.4	14.2	14.1	14.5	13.9	15.3	15.4	15.7	14.6
Overweight												
Frequency	28,142	5208	14,451	8483	26,316	4838	13,714	7764	32,402	5838	17,366	9198
Column %	36.8	37.5	36.1	37.6	36.1	37.1	35.2	37.2	35.7	36.1	35.1	36.7
Obese												
Frequency	29,423	5431	15,188	8804	27,985	5066	14,826	8093	33,308	6121	17,790	9397
Column %	38.5	39.1	37.9	39.1	38.4	38.9	38.1	38.7	36.7	37.8	35.9	37.4
Morbidly obese												
Frequency	3397	592	1861	944	3388	649	1824	915	4257	770	2334	1153
Column %	4.4	4.3	4.7	4.2	4.7	5.0	4.7	4.4	4.7	4.8	4.7	4.6
Unknown												
Frequency	4392	602	2727	1063	4787	630	2928	1229	6883	964	4227	1692
Column %	5.7	4.3	6.8	4.7	6.6	4.8	7.5	5.9	7.6	6.0	8.5	6.7

ACSC-H indicates Ambulatory Care Sensitive Condition Hospitalization.

To identify variations in use of VA and Medicare, we calculated the percentage of visits in a health care system out of the total visits to VA and Medicare providers. We then derived the following 3 types of VA and Medicare use:

Single System Use. If Veterans had primary and specialty care predominantly in the same system (>75% of visits), we classified them as single system users.

Dual System Supplemental Specialty Care Use. Veterans who obtained over 75% of their primary care in 1 system but received <75% of specialty care from the same system.

Dual System Primary Care Use. If Veterans obtained between 25% and 75% of their primary care visits in either system, we classified them as having dual primary care use.

Patient Characteristics

We controlled for Veterans sociodemographics, for example, age, sex, race/ethnicity, and marital status. Veterans were classified as moderately (10%–50% service connected disability) or severely (60%–100% service connected disability) disabled. Among the Veterans with no compensable service connected disability (0%), they were classified into 2 groups: those with higher incomes required to pay copayments for VA services, and those considered low income or indigent. For clinical complexity, we controlled for diabetic control and chronic health conditions, including glycemic control (HbA1C level), insulin use, and Diabetes Complications Severity Index (DCSI).²⁰ We also controlled for recorded diagnoses (ICD9-CM code) of the following conditions: cancer, COPD, asthma, infectious diseases, and dementia. For mental health status, we used previously published algorithms²¹ to identify diagnoses of generalized anxiety and serious mental illness, which included schizophrenia, bipolar disorder, depression, and other psychoses. We also controlled for clinically relevant lifestyle behaviors (eg, tobacco and alcohol use, and body mass index). Using each respondent's residential zip code, we classified the Veteran's residence as urban, rural, or highly rural based on the definitions set by VA's Office of Rural Health.²²

Organizational Factors

We tested for associations between primary care clinic-level characteristics thought to improve care coordination, by measuring primary care clinic autonomy, information flow, and coordination with VA specialists outside primary care that could influence the likelihood of an ACSC-H.

Primary Care Director Authority Over Clinic Operations

We asked PC directors how much authority they have regarding administrative and clinical aspects of their program. The response options were: complete authority = 4, no authority = 1. We derived an average for the scores. We hypothesized that greater authority or autonomy would be associated with higher quality of care, and lower likelihood of ACSC-H among hospitalized patients with diabetes.

Health System Practices to Improve Information Flow

We asked PC directors how much of the time PC providers were promptly notified (within 1–2 d) of urgent care visits, emergency department/room visits, or subspecialty

consult results. The response options were always/almost always = 5; to never/almost never = 1. We hypothesized that frequent notifications would lower odds of ACSC-H.

Implementation of Primary Care–Mental Health Integration Programs

We asked primary care directors if they had fully implemented any of Primary Care–Mental Health Integration (PC-MHI) programs (eg, Translating Initiatives in Depression into Effective Solutions, Behavioral Health Lab, Health Psychologist or co-located mental health). If PC directors reported full implementation, we coded their response 1; other responses were coded as 0. We hypothesized that fully implemented PC-MHI programs would lower odds of ACSC-H.

Care Coordination Agreements With Endocrinology Clinics

We asked primary care directors to what extent their primary care program had implemented any service agreements between primary care and endocrinology clinics. Response options were fully implemented, partially implemented, planned, or neither implemented nor planned. We dichotomized the measure, fully implemented = 1; other responses = 0. We hypothesized that the presence of fully implemented agreements would lower odds of ACSC-H.

Care Coordination Problems With Mental Health Clinics

We asked PC directors if primary care providers in his/her clinic encountered problems coordinating care with mental health clinics. Response options were always = 5, never = 0 having problems coordinating care. We dichotomized the measure, always/often = 1, other responses = 0. We hypothesized that problems coordinating care with mental health would be associated with higher odds of ACSC-H.

Primary Care Clinic Controls

We controlled for clinic size or workload (eg, number of male patients at primary care clinic, reported in 1000s).

Statistical Analyses

With ACSC-H as a binary measure (0/1), we used a hierarchical logistic regression that controlled for clustering of patients within sites to test for associations between ACSC-Hs and variations in VA and Medicare use, primary care organizational and clinic-level characteristics, patients' sociodemographic, clinical complexity, and lifestyle factors. An alpha of 0.05 was used for all tests of significance.

RESULTS

Description of the Study Population

Our analytic study population of hospitalized Veterans included 72,842 patients (27.5% with an ACSC-H) in 2009 (Table 2). The cohorts were older (majority were 75 y or older), mostly male (1.4% women Veterans), and non-Hispanic white (88%). Most Medicare-eligible Veterans were married (71% or more in cohorts). Most were not poor (5% were covered by Medicaid), and most lived in urban areas (60% or more). The

results were similar across all 3 cohorts, so for the remainder of the study, we report the 2007–2009 results only.

For variations in VA and Medicare use, slightly more than half of the study population were characterized as single-system user (53.4%). Approximately one fifth (17.9%) had dual system supplemental specialty care use; more than one quarter (28.7%) of the sample reported dual system primary care use.

Description of Study Population by ACSC-H

In reviewing differences in variation in VA and Medicare use and ACSC-H, ACSC-H were more prevalent among Veterans with single-system use compared with Veterans with dual system use (either dual system supplementary specialty care use, or dual system primary care use). We compared the demographic and clinical characteristics of Medicare-eligible Veterans with diabetes with and without an ACSC-H. Veterans with an ACSC-H were also more frequently low income, severely disabled or enrolled in Medicaid, and less frequently model. Veterans with an ACSC-H more frequently lived in a rural area.

Veterans with an ACSC-H more frequently had poor control of their diabetes (eg, HbA1c > 7%), and were more likely to be on insulin. The ACSC-H group had a higher number of diabetes-related complications (3–7 DCSI complications), on average. In terms of mental health, the group with an ACSC-H had higher prevalence of serious mental illness, depression, and anxiety. There was no difference in cancer prevalence rates; however, the group with ACSC-H had higher rates of COPD, asthma, infectious disease, and dementia. For lifestyle factors, tobacco and alcohol use were much more frequent among the Veterans with an ACSC-H, and they were more frequently obese or morbidly obese.

Description of Organizational Factors

For primary care clinic characteristics (Table 3), most primary care clinic directors reported higher degrees of authority over personnel issues, but not as much over administrative and clinical issues, and relatively little authority over care external to primary care. On average, PC directors reported receiving prompt notifications for care provided to their patients in approximately 2 of 3 settings outside primary care (ER, urgent care, specialty consults). About 1 of 3 PC directors reported fully implemented primary care-mental health integration programs, and fully implemented service agreements with endocrinology clinics. Few PC directors reported frequent care coordination problems with mental health clinics.

Multivariable Logistic Regression Predicting an ACSC-H

Patient-level, organizational and area-level differences are shown in Table 4.

Variations in VA and Medicare Use and ACSC-H

When we compared variations in use, we found that Veterans with single system use had higher odds of ACSC-H compared with dual system specialty supplemental care [odds ratio (OR), 1.14; 95% confidence interval (CI), 1.09–1.20]. We failed to detect statistically significant difference in odds

TABLE 3. Organizational, Clinic and Area Characteristics (2007)

Clinic and Area Characteristics	Frequency	Percentage	Mean	SD
PC director authority				
Personnel issues			4.0	1.9
Administrative and clinical issues			2.9	1.5
Care external to primary care			1.3	1.5
Health system practices to improve information flow				
No. settings where providers are promptly notified			1.9	1.1
Implementation of Primary Care-Mental Health Integration program				
No program; program planned; program partially implemented	133	59.1		
PC-MHI program fully implemented	87	38.7		
Skipped question/no response	5	2.2		
Implementation of service agreements with Endocrinology Clinics				
Partially implemented/no service agreement	96	42.7		
Fully implemented service agreement	76	33.7		
No endocrinology clinic available on-site	49	21.8		
Skipped question/no response	4	1.8		
Care coordination challenges with mental health clinics				
Always/often	23	10.4		
Never/rarely/sometimes	198	89.6		
Skipped question/no response	4	1.8		
Primary care clinic size/workload				
No. unique male patients in 1000s			25.6	17.8
Area level characteristics				
Percent persons in poverty (county level of VA site)			13.2	4.7
Total number of hospital (county level of VA site)			8.8	16.3

PC indicates primary care; PC-MHI, Primary Care–Mental Health Integration; SD, standard deviation; VA, Veterans Affairs.

of ACSC-H between dual system supplemental specialty care users and dual system primary care users.

Primary Care Organizational Factors and ACSC-H

For organizational factors, we found that Veterans seeking care at sites where PC directors reported greater authority over personnel issues had lower odds of an ACSC-H (OR, 0.74; 95% CI, 0.59–0.92). We also found that frequent care coordination problems with mental health clinics were associated with lower odds of ACSC-H (OR, 0.97; 95% CI, 0.95–0.99).

For patient-level characteristics, we found that older age was associated with higher odds of an ACSC-H, as was minority race (non-Hispanic blacks were more likely to have had an ACSC-H compared with non-Hispanic whites). Unmarried Veterans had higher odds of an ACSC-H, compared with married Veterans. Disabled and low-income Veterans had higher odds of an ACSC-H; as did Veterans living in rural or highly rural areas. In general, Veterans with poorer health had higher odds of ACSC-H. Presence of other comorbidities (COPD, dementia) were all associated with higher odds of ACSC-H, as was tobacco use. Overweight

TABLE 4. Multivariate Hierarchical Logistic Regression Models, Predicting Likelihood of an Ambulatory Care Sensitive Conditions Hospitalization, Controlling for Clustering of Patients Within VA Sites, Variations in VA and Medicare Use, and Organizational Factors, Patients' Sociodemographic, Clinical Complexity and Lifestyle Factors

	Predicting ACSC Hospitalization in 2009		
	Odds Ratio	95% Confidence Limits	
Variations in VA and Medicare use			
Dual System—Supplemental Specialty Care	Reference		
Single System	1.14	1.09 1.20	
Dual System—Primary Care Use	0.99	0.94 1.04	
Sociodemographic characteristics			
Age category			
66–74	Reference		
75–84	1.28	1.24 1.33	
85+	1.62	1.52 1.72	
Sex			
Female	Reference		
Male	1.07	0.93 1.23	
Race/ethnicity			
Non-Hispanic White	Reference		
Non-Hispanic Black	1.14	1.07 1.22	
Hispanic	0.95	0.80 1.12	
Other	0.90	0.81 0.99	
Marital status			
Married	Reference		
Not married	1.12	1.08 1.17	
Veteran enrollment status/disability			
Not disabled, co-payment required	Reference		
Severely disabled	1.15	1.09 1.21	
Moderately disabled	1.07	1.01 1.12	
Not disabled, low-income	1.22	1.17 1.28	
Medicaid coverage			
No	Reference		
Yes	1.13	1.05 1.22	
Veterans' zip code by rurality			
Urban	Reference		
Rural	1.07	1.02 1.11	
Highly rural	1.30	1.15 1.47	
Clinical characteristics			
Hemoglobin A1c levels			
<7%	Reference		
≥7%; <8%	1.15	1.10 1.20	
≥8%; <9%	1.26	1.17 1.35	
≥9%	1.43	1.31 1.56	
Unknown	1.00	0.96 1.06	
Documented insulin use			
No	Reference		
Yes	1.37	1.31 1.43	
Unknown	0.89	0.81 0.97	
Diabetes Complications Severity Index			
0 complications	Reference		
1 complication	1.19	1.11 1.29	
2 complications	1.36	1.26 1.47	
3–7 complications	1.64	1.53 1.77	
Documented mental health disorders			
Serious mental illness and depression			
No	Reference		
Yes	1.06	1.01 1.11	
Anxiety			
No	Reference		
Yes	1.07	1.00 1.14	

(Continued)

TABLE 4. Multivariate Hierarchical Logistic Regression Models, Predicting Likelihood of an Ambulatory Care Sensitive Conditions Hospitalization, Controlling for Clustering of Patients Within VA Sites, Variations in VA and Medicare Use, and Organizational Factors, Patients' Sociodemographic, Clinical Complexity and Lifestyle Factors (continued)

	Predicting ACSC Hospitalization in 2009		
	Odds Ratio	95% Confidence Limits	
Other clinical conditions			
Diagnosis of cancer			
No	Reference		
Yes	0.95	0.92 0.99	
Diagnosis of chronic obstructive pulmonary disease			
No	Reference		
Yes	1.88	1.82 1.95	
Diagnosis of asthma			
No	Reference		
Yes	1.28	1.21 1.36	
Infectious disease			
No	Reference		
Yes	1.23	1.18 1.28	
Dementia			
No	Reference		
Yes	1.08	1.01 1.15	
Lifestyle behaviors			
Tobacco use			
No	Reference		
Yes	1.17	1.10 1.25	
Alcohol or drug use			
No	Reference		
Yes	1.01	0.92 1.13	
Body mass index			
Underweight/normal	Reference		
Overweight	0.86	0.81 0.90	
Obese	0.92	0.87 0.97	
Morbidly obese	1.10	1.00 1.20	
Unknown	0.99	0.91 1.07	
Organizational factors, clinic and area characteristics			
PC director authority			
Personnel issues	0.74	0.59 0.92	
Administrative and clinical issues	0.98	0.92 1.04	
Care external to primary care	0.98	0.93 1.03	
Health system practices to improve information flow	0.98	0.93 1.02	
Implementation of Primary Care-Mental Health Integration program			
No program; program planned	Reference		
PC-MHI program fully implemented	1.00	0.99 1.02	
Implementation of service agreements with Endocrinology Clinic			
Partially implemented/no service agreement	Reference		
Fully implemented service agreement	0.99	0.93 1.06	
Care coordination challenges with mental health clinics			
Never/rarely/sometimes	Reference		
Always/often	0.97	0.95 0.99	
Primary care clinic size/workload			
No. unique patients (in 1000s)	1.00	1.00 1.01	
Area level characteristics (VA site county level)			
Percent of persons in poverty	1.00	1.00 1.00	
Total number of hospitals	1.00	1.00 1.00	

Bold indicates statistically significant values.
PC indicates primary care; PC-MHI, Primary Care–Mental Health Integration; VA, Veterans Affairs.

individuals had lower odds of ACSC-H, compared with underweight or normal weight individuals. The results varied for obese and morbidly obese individuals. We failed to detect statistically significant differences in odds of ACSC-H for clinic size or area-level characteristics.

DISCUSSION

Our study analyzed 5 years of national data linked with multiple sources to identify variations in VA and Medicare use (single system, dual system supplemental specialty care use, and dual primary care use) among hospitalized Medicare-eligible Veterans with diabetes, and assessed associations with ACSC-H. We found the study population to be very old and medically complex (substantial comorbid conditions, poor control of diabetes, greater burden of diabetic complications, and mental health conditions) with a substantial proportion living in rural or highly rural areas. As such, the risk of ACSC-H would be high, and could be attributed to any number of patient-level, organizational, or area-level factors. Here we focused on 2: patient-level (eg, use of VA and Medicare providers) and organizational factors to assess impacts of factors thought to promote care coordination. As we speculated in the introduction, single system use was associated with higher odds of ACSC-H compared with those with dual system specialty care use. We also found that there were statistically significant unadjusted differences in DCSI, comorbidities, and glycemic control by variations in VA and Medicare use. Taken together these findings suggest that hospitalized Veterans with diabetes may be so clinically complex that they benefited from having more providers involved in their care, despite the risk of care fragmentation. These findings may have implications for other medically complex patient populations (high-risk, high-need), where typical assumptions about coordinated care may not be as important as availability of intensive clinical management.

There was limited evidence that Veterans obtaining care at sites where PC directors reported greater autonomy (eg, authority over personnel matters) had better outcomes. This was opposite of what was found in an earlier study of organizational factors influence on access to cancer screening, where greater authority over personnel matters was associated with lower performance on cancer screenings.²³ However, these findings were similar to another study of organizational factors' association with CRC screenings, where, in general, greater clinical authority or autonomy was associated with improved performance.²⁴ These findings may indicate that given diverse contexts, PC leaders may need greater autonomy to best serve the needs of local patient populations. We also found that PC clinic directors reporting frequent care coordination problems with mental health clinics had lower odds of ACSC-H. It could be that PC providers experiencing difficulties in coordinating care took better care of patients with mental health diagnoses, and that patients benefited from this additional care management, but we lack data to test this hypothesis.

Strengths and Limitations

Ours is the first study of ACSC-H to assess health status for 2 years preceding the index hospitalization. In addition to our study of variations of VA and Medicare use, we

controlled for many significant sociodemographic, organizational and area-level characteristics associated with ACSC-H.

While pairwise comparisons of smaller VA and Medicare groups validated our categories, they were not homogenous. Another limitation is that VA and Medicare record use of health care very differently. In particular, primary care may be provided by many different Medicare providers, not just by physicians in internal medicine or family medicine. Ideally, future studies would compare organizational characteristics for VA and Medicare primary care providers. However, our primary care organizational data is only available for VA clinics; we cannot explore the prevalence or impact of organizational factors on Medicare providers.

CONCLUSION

The finding that variations in VA and Medicare use are associated with outcomes provides further support to earlier studies that contend that quality of care studies for Veterans must account for Veterans' extensive use of health care outside VA. We need to understand why dual system users benefitted, while single-system users struggled. We also need a better understanding of how Medicare-eligible Veterans interact with VA and Medicare providers to improve care and ensure the best outcomes possible.

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