Effective Health Care Program

Use of and access to health care by Medicare beneficiaries with diabetes: impact of diabetes type and insulin use, 2007-2011

Use of Diabetes Care Data Points # 18

Diabetes is one of the most prevalent chronic health conditions in the United States. It is a major risk factor for cardiovascular disease and the leading cause of kidney failure, nontraumatic lower extremity amputations, and blindness among adults.[1] The CDC estimates that 25.8 million people, or 8.3 percent of the United States population, had either diagnosed or undiagnosed diabetes in 2011.[2] Currently, 11.3 percent of adults age 20 and over and 26.9 percent of adults age 65 and over have diabetes.[2] Diabetes prevalence in the United States has doubled since 1995.[3] In 2010 alone, about 1.9 million people age 20 and over were newly diagnosed with diabetes.[2]

Diabetes is a condition in which the body does not produce or properly use insulin. Insulin is a hormone needed to convert sugars and starches into energy and to control blood sugar levels. Diabetes is divided into two categories: type 1 (also known as juvenile diabetes) and type 2 (also known as adult-onset diabetes). In general, people with type 1 diabetes do not produce sufficient insulin, while people with type 2 diabetes cannot properly process insulin (or are insulin resistant). Type 2 diabetes is often treated with oral medications or lifestyle changes such as improved diet and increased exercise, while type 1 diabetes typically requires use of insulin injections. However, patients with type 2 diabetes may also require insulin use to control their blood sugar levels.

Diabetes is a chronic condition that if untreated can have serious complications, such as glaucoma, neuropathy, and kidney failure.[1,4] However, complications such as these can be prevented with proper treatment and maintenance. High-quality diabetes care is important to maintain the health and stability of people with diabetes. Care for diabetes is becoming even more important with the increasing prevalence of diabetes in the United States.

In 2011, about 25 percent of the Medicare fee-for-service population had diabetes. Among Medicare beneficiaries with diabetes, approximately 14 percent had type 1, 85 percent had type 2 but did not use insulin, and less than 1 percent had type 2 diabetes and used insulin to manage their condition. Between 2007 and 2011, beneficiaries with type 2 diabetes who used insulin had the highest burden of comorbidity, hospitalization rates, and allowed payment, followed by those with type 1 diabetes. Most beneficiaries with diabetes had evaluation and management visits. Most also received needed preventive care, including HbA1c and LDL* testing, and about half received an annual flu shot and eye exam. However, beneficiaries with type 2 diabetes using insulin had the lowest rates of receipt of preventive care. Most beneficiaries with diabetes visited both primary care and specialty providers. The number of providers with whom they had contact is high, indicating potential fragmentation in both primary and specialty care.

*Hemoglobin A1c and low-density lipoprotein.

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While important, care for diabetes can be resource and time intensive. Self-care for diabetes alone may take several hours per week.[5] Care also may include taking multiple medicines to treat diabetes and conditions related to cardiovascular risk, hypertension, and dyslipidemia, along with other co-occurring chronic conditions such as depression.[6,7] In addition, individuals with diabetes typically have multiple outpatient visits, and many have one or more hospitalizations, every year.[8,9] Given all of these activities, the potential for fragmentation of care—and its association with acute or emergency utilization downstream—cannot be overlooked.[10,11]

In this report, we describe the demographic characteristics of diabetes patients in the Medicare program and report hospitalization rates, rates of key preventive care use, and rates of visits to primary care physicians and certain specialists. We stratify all analyses by diabetes type—type 1, type 2 not using insulin, and type 2 using insulin. These categories provide useful insight about the types of patients for whom changes in diabetes management may be particularly beneficial. We would like to acknowledge the leadership of the DEcIDE Diabetes Consortium in establishing the scope and objectives of this report.

METHODS

Our analysis was performed on data from 100 percent of the Medicare beneficiaries represented in the Chronic Conditions Data Warehouse (CCW) data.[12] We identified Medicare beneficiaries who had diabetes between January 2007 and December 2011. (See Figures 1-4.) Beneficiaries were age 65 or older and had Part A and Part B Medicare coverage with no Medicare Advantage for their entire period of eligibility during the reference year.

Figure 1: Medicare FFS eligibles with diabetes, by State, 2011

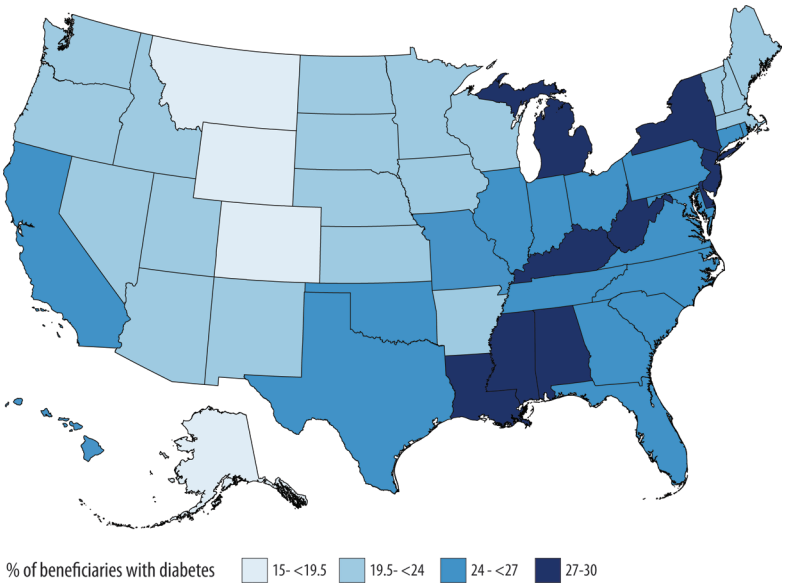


Figure 2: Medicare FFS eligibles with type 2 diabetes not using insulin, by State, 2011

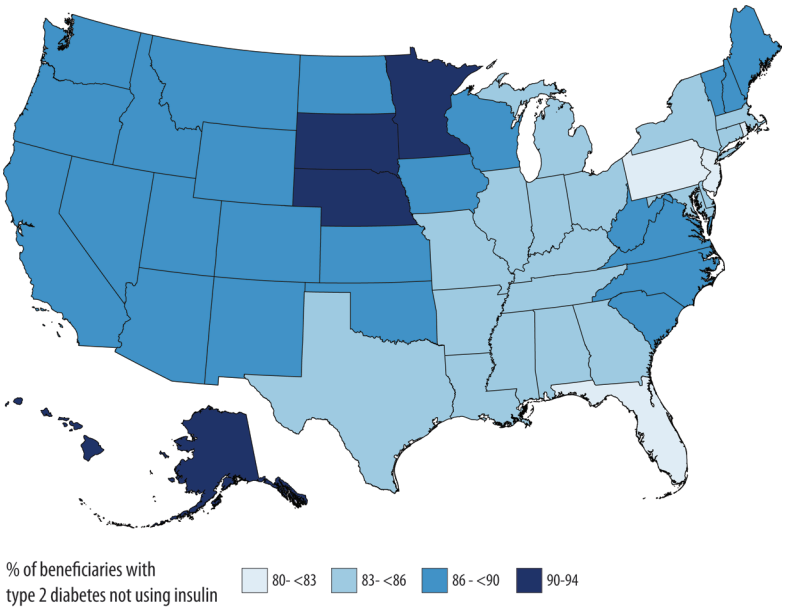
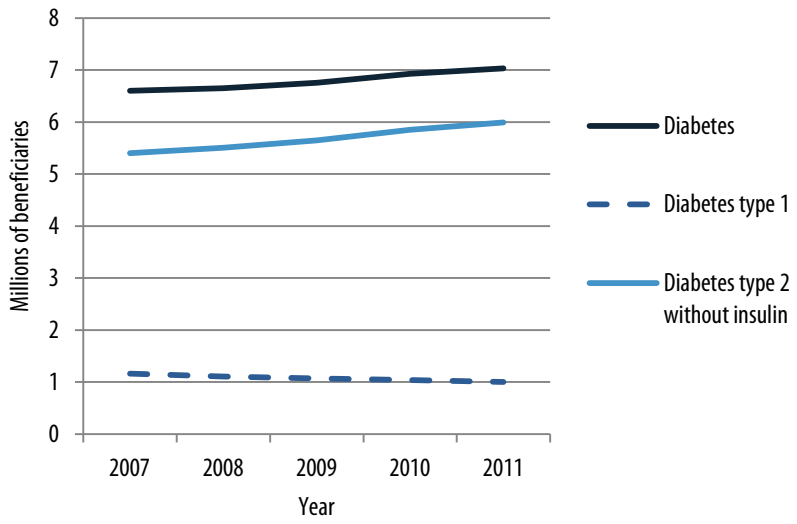
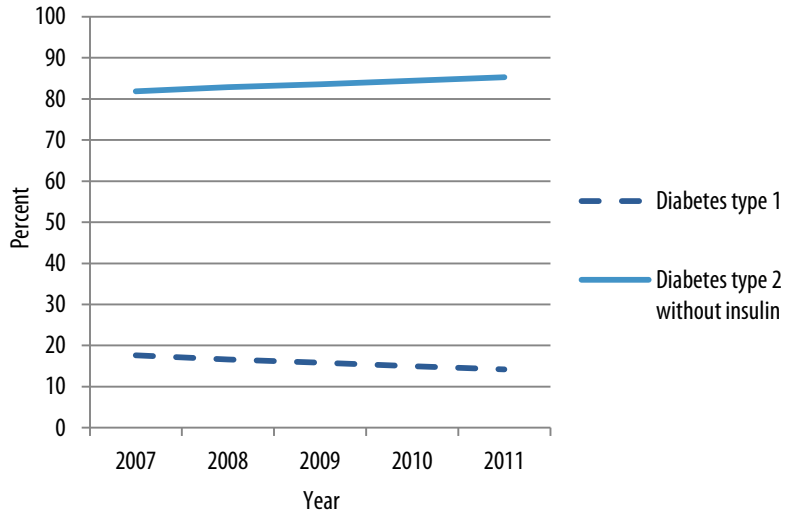


Figure 3: Number of Medicare FFS eligibles with diabetes, by type, 2007-2011*



* The number of beneficiaries with diabetes type 2 with insulin is not shown due to the small relative size of this population. The number of beneficiaries with type 2 diabetes who used insulin in 2007 was 35,900, increasing to 39,800 in 2011.

Figure 4: Percentage of diabetic Medicare FFS eligibles, by type, 2007-2011*



* The percentage of beneficiaries with diabetes type 2 with insulin is not shown due to the small relative size of this population. The percentage of all diabetic Medicare FFS beneficiaries who had type 2 diabetes with insulin use in 2007 was 0.54 %, increasing to 0.57% in 2011.

* ICD-9 = International Classification of Diseases, 9th Revision.
† HCPCS = Healthcare Common Procedure Coding System.

We assessed trends in health care services provided to beneficiaries with diabetes type 1 or type 2 across demographic factors, including age and gender. These characteristics were identified in the beneficiary summary file during the reference year. We also assessed trends based on factors such as race, region, and urbanicity as defined below. (See Tables 1 and 2.)

Diabetic type: Beneficiaries with diabetes were categorized as having diabetes type 1, diabetes type 2 with receipt of insulin, and diabetes type 2 without receipt of insulin. We used the CCW diabetes flags as the starting point for our classification. We limited our sample to persons who had at least one claim with a diagnosis of diabetes in the calendar year. Persons who had any ICD-9* diagnosis of type 1 diabetes (250.01, 250.03, 250.11, 250.13, 250.21, 250.23, 250.31, 250.33, 250.41, 250.43, 250.51, 250.53, 250.61, 250.63, 250.71, 250.73, 250.81, 250.83, 250.91, and 250.93) were classified as type 1. All other persons with a CCW diabetes flag were considered to have type 2 diabetes. Persons with type 2 diabetes who had evidence of insulin use from HCPCS† codes in either the Carrier or Durable Medical Equipment file (E0781, E0784, A4231, A4230, K0552, S5565, S5566, A4221, J1815, J1816, J1817, A4632, K0601, K0602, K0605, A4365, A5120, A4245, A4247, A6257, A6258, A4364, A4450, A9274) were considered insulin using. Thus, persons who were both type 2 diabetic and insulin using were defined as meeting this combination.

Race/ethnicity: Race and ethnicity were defined using the Research Triangle Institute Race Code, which applies a surname algorithm to assign Hispanic ethnicity.[13,14]

Age: The age categories were defined using the age of the beneficiary at the end of each reference year.

Urban/rural: We used the Core Based Statistical Area (CBSA) of the beneficiary to identify the urban region in which the beneficiary resides. Beneficiaries who do not reside in a CBSA are considered to be rural.[15]

Dual status: CMS has an established algorithm for defining the annual dual eligibility status of each beneficiary, using the monthly State Reported Dual Eligibility Status Codes. We used these algorithms to categorize beneficiaries into four groups: Full Duals had full Medicare and Medicaid coverage (including prescription drugs) during the most recent month of dual eligibility for the reference year; QMB beneficiaries had Medicaid and participated in the Qualified Medicare Beneficiary Program during the most recent month of dual eligibility for the reference year; Other/Partial Duals had Medicaid and participated in the Specified Low-Income Medicare Beneficiary Program during the most recent month of dual eligibility for the reference year, the Qualifying Individual Program, or the Qualified Disabled and Working Individuals Program; and Non-Duals had Medicare coverage only for the reference year.[16]

Comorbidities: We used the Chronic Condition Categories identified in the Medicare CCW to indicate presence of chronic conditions.[17] Based on existing literature, we provide counts of comorbidities that were related to diabetes or unrelated to diabetes in their etiology and treatment.[18-21] Related conditions include acute myocardial infarction, chronic kidney disease, heart failure, ischemic heart disease, cataract, glaucoma, stroke, and atrial fibrillation. Unrelated conditions include Alzheimer's disease, related disorders, or dementia; chronic obstructive pulmonary disease; depression; hip/pelvic fracture; osteoporosis; rheumatoid arthritis or osteoarthritis; and cancers (endometrial, breast, lung, and prostate).

Table 1: Number and percent distribution of Medicare FFS eligibles, by demography and type of diabetes, 2011

Variable		Total with diabetes (#)	Total with diabetes (%)	Type 1 diabetes (%)	Type 2 diabetes who receive insulin (%)	Type 2 diabetes who do not receive insulin (%)
Total		7,031,644	100.00	14.21	0.57	85.23
Age						
	65-69	1,638,590	100.00	14.14	0.57	85.29
	70-74	1,699,587	100.00	14.10	0.57	85.33
	75-79	1,433,292	100.00	14.36	0.57	85.07
	80-84	1,153,496	100.00	14.44	0.55	85.01
	85+	1,106,679	100.00	14.05	0.55	85.40
Race or ethnicity						
	Non-Hispanic White	5,377,197	100.00	13.55	0.61	85.85
	African American	790,005	100.00	18.86	0.45	80.69
	Hispanic	536,561	100.00	16.15	0.39	83.46
	Asian or Pacific Islander	216,468	100.00	10.29	0.46	89.24
	American Indian / Alaska Native	42,084	100.00	9.87	0.56	89.56
	Other / Unknown	69,329	100.00	12.44	0.44	87.13
Gender						
	Male	3,202,730	100.00	14.05	0.66	85.29
	Female	3,828,914	100.00	14.34	0.49	85.17
Urbanicity						
	Urban	6,352,117	100.00	14.41	0.56	85.03
	Rural	669,102	100.00	12.33	0.60	87.07
	Unknown	10,425	100.00	11.84	0.24	87.92
Medicare status						
	Full dual	1,238,070	100.00	19.69	0.64	79.67
	Partial dual	162,573	100.00	14.81	0.49	84.69
	QMB	153,746	100.00	15.34	0.47	84.18
	Nondual	5,477,255	100.00	12.92	0.55	86.53

QMB = qualified Medicare beneficiary.

Table 2: Number and type of comorbidities among Medicare FFS beneficiaries, by type of diabetes, 2011

Variable		Total with diabetes	Type 1 diabetes	Type 2 diabetes who receive insulin	Type 2 diabetes who do not receive insulin
Total		7,031,644 (100%)	999,066 (100%)	39,800 (100%)	5,992,778 (100%)
Comorbidities related to diabetes		%	%	%	%
Number	0	25.5	15.2	16.1	27.3
	1	29.9	24.3	25.8	30.9
	2-4	42.2	55.9	54.3	39.9
	5+	2.4	4.7	3.8	2.0
Type	CKD*	28.0	43.6	46.7	25.3
	AMI	1.6	2.7	1.9	1.4
	AFIB	11.9	14.6	17.2	11.4
	Heart failure	27.0	40.4	37.3	24.7
	Ischemic heart disease	47.5	60.4	56.5	45.3
	Cataract	19.3	19.4	18.3	19.3
	Glaucoma	12.9	14.0	10.9	12.7
	Stroke	6.1	9.3	6.7	5.5
Comorbidities unrelated to diabetes					
Number	0	40.8	32.5	32.4	42.2
	1	31.4	30.6	31.7	31.6
	2-4	26.5	34.7	34.2	25.1
	5+	1.3	2.2	1.7	1.2
Type	Alzheimer's disease, related disorders, or senile dementia	15.3	21.6	16.8	14.2
	Alzheimer's disease	6.8	9.4	6.8	6.4
	COPD	15.4	20.6	22.3	14.4
	Depression	15.4	21.4	21.4	14.4
	Hip / pelvic fracture	1.0	1.5	1.3	0.9
	Osteoporosis	6.7	7.9	7.9	6.6
	Rheumatoid arthritis/ osteoarthritis	35.4	40.3	37.5	34.5
	Endometrial cancer	0.4	0.4	0.7	0.4
	Breast cancer	3.4	3.5	3.6	3.3
	Lung cancer	1.3	1.3	2.6	1.2
	Prostate cancer	4.2	4.2	6.7	4.2

CKD = Chronic kidney disease, AMI = Acute myocardial infarction, AFIB = Atrial fibrillation, COPD = Chronic obstructive pulmonary disease.
*End stage renal disease (ESRD) is a subset of CKD. In 2011, 6.2% of CKD beneficiaries had ESRD.

Evaluation and management (E&M): E&M visits were defined using Berenson-Eggers type of service (BETOS) codes M1A or M1B for new or established E&M office visits.[22] E&M visits were limited to one per beneficiary per day. (See Table 3.)

Preventive care: Preventive care services were identified in the Part B institutional and noninstitutional claims using CPT codes 90724, 90658, 90659, G0008, and 90656 to identify flu shots, and CPT codes 67028, 67030, 67031, 67036, 67038, 67039, 67040, 67101, 67105, 67107, 67108, 67110, 67112, 67121, 67141, 67145, 67208, 67210, 67218, 67220, 67221, 67227, 67228, 92002, 92004, 92012, 92014, 92018, 92019, 92225, 92226, 92230, 92235, 92240, 92250, and 92260 to identify eye exams. CPT codes 83036, 83037, 3044F, 3045F, 3046F, and 3047F were used to identify HbA1c tests, and CPT codes 80061, 83700, 83701, 83704, 83715, 83716, 83721, 3048F, 3049F, and 3050F were used to identify lipid tests. (See Table 4.)

Primary care visits: Primary care visits were defined as a visit to a primary care physician specialty by HCFA* specialty codes as follows: general practitioner = 01, family practitioner = 08, internal medicine = 11, and geriatric medicine = 38.[23] Visits were limited to one per beneficiary/provider pair per day. Individual providers were identified by National Provider Identifier (NPI).[24] (See Table 5.)

Specialty care visits: Specialty care visits were defined as a visit to a non-primary care physician specialty by HCFA specialty codes as follows: podiatry = 48, optometry = 41, ophthalmology = 18, and endocrinology = 46. Visits were limited to one per beneficiary/provider pair per day. Individual providers were identified by NPI. (See Table 6.)

* HCFA = Health Care Financing Administration, the former name of the Centers for Medicare & Medicaid Services (CMS).

Hospitalizations: Hospitalizations are defined as acute care stays. Hospitalizations with procedure are based on Medicare Severity Diagnosis Related Group (MS-DRG) type of SURG.

Emergency room visits: Inpatient emergency room (ER) visits are defined as an acute care stay with a 0450-0459 revenue center code.[25] Inpatient ER visits are limited to one per hospital stay per patient. Outpatient visits are defined as a claim type of 40 (outpatient) with a 0450-0459 revenue center code. Multiple outpatient ER visits by patient by date are included.

RESULTS

Among Medicare fee-for-service (FFS) beneficiaries, about 25 percent have diabetes. The percentage of all Medicare beneficiaries with diabetes varies by State. In 2011, New York had the highest percentage of beneficiaries with diabetes at 30 percent, followed by New Jersey and Michigan (at 29.9% and 28.9%, respectively; **Figure 1**). Colorado, Montana, and Wyoming had the lowest percentages (17%, 17.5%, and 18%). Puerto Rico, not pictured in Figure 1, had a higher percentage than any State at 42.3 percent.

Among the population of Medicare beneficiaries who have diabetes, the distribution of diabetic types also varied by State. In the Medicare diabetic population in 2011, Alaska had the highest percentage classified as type 2 diabetes not using insulin, followed by Hawaii and Minnesota (92.9%, 92.2%, and 91.6%; **Figure 2**). The District of Columbia, New Jersey, and Rhode Island had the lowest percentages at 79.6, 80.6, and 81.2 percent, respectively.

From 2007 to 2011, the number of older Medicare beneficiaries who are classified as having diabetes rose from 6,599,119 to 7,031,644 (**Figure 3**).

Table 3: Number and percentage of evaluation and management visits among Medicare FFS beneficiaries, by type of diabetes, 2011

Variable	Total with diabetes	Type 1 diabetes	Type 2 diabetes who receive insulin	Type 2 diabetes who do not receive insulin
% of beneficiaries with 1+ E&M visits	93.3 %	93.0 %	95.3 %	93.3 %
Mean # of E&M visits per beneficiary with 1+ visits	10.4	12.7	16.4	10.0

Table 4: Percentage of annual preventive care services received among Medicare FFS beneficiaries, by type of diabetes, 2011

Variable	Total with diabetes (%)	Type 1 diabetes (%)	Type 2 diabetes who receive insulin (%)	Type 2 diabetes who do not receive insulin (%)
Flu shot	52.4	52.2	51.0	52.5
Eye exam	50.8	58.3	45.9	49.6
HbA1c test	83.5	88.1	77.1	82.7
LDL test	78.2	77.3	69.0	78.4

HbA1c = Glycated hemoglobin, LDL = Low density lipoprotein.

Table 5: Number and percentage of primary care visits and number of primary care providers seen annually among Medicare FFS beneficiaries, by type of diabetes, 2011

Variable		Total with diabetes	Type 1 diabetes	Type 2 diabetes who receive insulin	Type 2 diabetes who do not receive insulin
Mean # of E&M visits per beneficiary with 1+ primary care visit		5.1	5.8	6.1	5.0
% of beneficiaries with 1+ primary care visits		78.2 %	75.8 %	78.6 %	78.6 %
% number of primary care providers seen	0	21.8 %	24.2 %	21.4 %	21.4 %
	1	9.0 %	7.9 %	8.5 %	9.2 %
	2-4	39.0 %	32.6 %	33.5 %	40.1 %
	5+	30.2 %	35.3 %	36.5 %	29.3 %

Table 6: Number and percentage of specialty care visits among Medicare FFS beneficiaries, by type of diabetes and specialty type, 2011

Variable		Total with diabetes (%)	Type 1 diabetes (%)	Type 2 diabetes who receive insulin (%)	Type 2 diabetes who do not receive insulin (%)
Number of visits to a specialty care provider per beneficiary					
All specialties	0	30.9	18.0	31.4	33.0
	1	15.0	12.8	13.5	15.4
	2-4	29.3	30.0	27.3	29.2
	5-8	16.8	24.6	16.5	15.5
	9+	8.0	14.6	11.4	6.9
Podiatrist	0	68.3	48.0	62.1	71.7
	1	6.8	9.0	7.3	6.4
	2+	24.9	43.0	30.6	21.9
Opthalmologist or optometrist	0	41.8	33.8	46.6	43.1
	1	28.5	28.7	26.5	28.5
	2+	29.7	37.5	26.9	28.5
Endocrinologist	0	90.1	78.7	87.4	92.1
	1	2.2	3.5	2.6	2.0
	2+	7.6	17.8	10.0	5.9
Cardiologist	0	49.5	37.4	37.4	51.6
	1	12.3	12.2	14.0	12.3
	2+	38.3	50.4	48.6	36.2
Nephrologist	0	88.7	78.8	80.9	90.4
	1	2.0	2.9	2.8	1.8
	2+	9.3	18.3	16.3	7.8
Neurologist	0	87.3	82.5	85.6	88.1
	1	4.4	5.5	4.8	4.2
	2+	8.3	12.0	9.6	7.7
Number of specialists seen annually per beneficiary					
	0	30.9	18.0	31.4	33.0
	1	15.7	13.4	14.1	16.1
	2-4	30.9	32.0	29.3	30.8
	5+	22.5	36.5	25.1	20.1
Number of specialties consulted annually per beneficiary					
	0	29.0	15.4	28.6	31.3
	1	42.1	36.3	39.8	43.0
	2	23.4	34.6	25.0	21.5
	3	5.2	12.6	6.1	4.0
	4+	0.3	1.1	0.4	0.2

This rise was due to an increase in persons with type 2 diabetes not using insulin (5,399,954 to 5,992,778), which offset a decline in the number of persons classified as type 1 (1,163,241 to 999,066). The number and proportion of beneficiaries with type 2 diabetes using insulin remained stable over this period, while the proportion of beneficiaries classified as type 1 dropped from 17.6 percent in 2007 to 14.2 percent in 2011 (**Figure 4**).

Most beneficiaries with diabetes had type 2 diabetes without insulin use (85.2% in 2011), and the smallest proportion had type 2 diabetes with insulin use (0.57% in 2011; **Table 1**). There were no strong differences by age in the classification of beneficiaries with diabetes into the three subtypes. By race, however, there were no strong differences. The highest percentage of beneficiaries with type 1 diabetes was African American (18.9%) and the lowest percentage was American Indian/Alaska Native (9.9%). The highest percentage of beneficiaries with type 2 diabetes using insulin was non-Hispanic White (0.61%) and the lowest was Hispanic (0.39%; **Table 1**).

Women were slightly more likely to be classified as having type 1 diabetes (14.34% vs. 14.05%) and men were more likely to be classified as type 2 using insulin (0.66% vs. 0.49%).

The percentage of beneficiaries with type 1 diabetes was slightly higher in urban areas than rural areas (14.41% vs. 12.33%). Full dual-eligible beneficiaries were more likely to be classified as type 1 or type 2 using insulin than nonduals. Partial duals and others had intermediate levels of classification (**Table 1**).

The total annual mortality was 6.12 percent for beneficiaries with diabetes who died during 2011. Within this population, mortality was highest for beneficiaries with type 2 diabetes using insulin (12%), followed by beneficiaries with type 1 (7.8%). Beneficiaries with type 2 diabetes not using insulin had the lowest mortality rate (5.8%).

There were dramatically different comorbidity profiles across diabetic types. Overall, 84.8 percent of beneficiaries with type 1 diabetes and 83.9 percent of beneficiaries with type 2 using insulin had one or more comorbidities related to diabetes (CKD, AMI, AFIB, heart failure, ischemic heart disease, cataract, glaucoma, or stroke) compared with 72.7 percent of beneficiaries with type 2 diabetes not using insulin. While the frequency of diagnosis varied across diabetic types, for all three groups the most commonly noted comorbidity was ischemic heart disease, followed by chronic kidney disease and heart failure. The frequency of cataract diagnosis was comparable across all groups at 18.3 percent to 19.4 percent (**Table 2**).

The frequency of comorbidities unrelated to diabetes showed a similar pattern. About 68 percent of beneficiaries with type 2 diabetes who use insulin and with type 1 diabetes had one or more comorbidities. About 58 percent of beneficiaries with type 2 diabetes not using insulin had one or more comorbidities unrelated to diabetes (**Table 2**). Among these comorbidities, arthritis was the most common, followed by chronic obstructive pulmonary disease, depression, and Alzheimer's disease.

Almost all beneficiaries with diabetes regardless of type had contact with the health care system in the form of evaluation and management (E&M) visits across all providers (range 93%-95%).

Table 7: Rate of hospitalizations and emergency room visits per 100 Medicare FFS beneficiaries, by type of diabetes, 2011

Variable		Type 1 diabetes	Type 2 diabetes who receive insulin	Type 2 diabetes who do not receive insulin
Hospitalizations (number per 100 beneficiaries)				
	Total	84/100	111/100	43/100
	With procedure	19/100	34/100	11/100
	Without procedure	65/100	77/100	32/100
Emergency room visits (number per 100 beneficiaries)				
	Total	133/100	143/100	75/100
	Leading to hospitalization	64/100	71/100	31/100
	Not leading to hospitalization	69/100	72/100	44/100

The mean number of E&M visits per year was highest for beneficiaries with type 2 diabetes using insulin (16 visits) and lowest for beneficiaries with type 2 not using insulin (10 visits). Beneficiaries with type 1 had an intermediate number of visits (13; **Table 3**).

In addition to E&M visits, beneficiaries with diabetes consistently received at least some preventive care. Slightly more than half of all beneficiaries with diabetes received an annual flu shot (**Table 4**). Annual eye exams were most commonly received by beneficiaries with type 1 (58.3%) and less frequently received by beneficiaries with type 2 diabetes using and not using insulin (45.9% and 49.6%). Annual HbA1c testing was also highest among beneficiaries with type 1 diabetes (88.1%) and lowest among beneficiaries with type 2 using insulin (77.1%). Beneficiaries with type 2 not using insulin were intermediate at 82.7 percent. Annual LDL tests were least frequently received by beneficiaries with type 2 diabetes using insulin (69.0%) and were received at similar rates for beneficiaries with type 1 and type 2 not using insulin (77.3% and 78.4%). It is important to note that for every preventive care measure, beneficiaries with type 2 using insulin had the lowest rate of receipt of services (**Table 4**).

Use of primary care providers was high, with an average of 78.2 percent of all beneficiaries with diabetes having at least one visit (**Table 5**). The mean number of visits to a primary care provider was similar for beneficiaries with type 1 and type 2 diabetes using insulin (5.8 visits and 6.1 visits). Beneficiaries with type 2 not using insulin had a slightly lower average of 5.0 visits. While use of primary care providers may be high, beneficiaries are likely to see more than one primary care provider.

Table 8: Mean allowed payment per beneficiary among Medicare FFS eligibles, by demography and type of diabetes, 2011 ($ thousands)

Variable		Total with diabetes	Type 1 diabetes	Type 2 diabetes who receive insulin	Type 2 diabetes who do not receive insulin
Total		71.7	140.9	203.4	59.2
Age					
	65-69	72.4	160.7	250.7	56.6
	70-74	71.1	148.1	226.8	57.3
	75-79	73.2	141.9	203.6	60.7
	80-84	72.2	128.9	160.3	62.0
	85+	68.8	111.6	139.5	61.4
Race or ethnicity					
	Non-Hispanic White	62.7	116.6	192.1	53.3
	African American	121.7	229.9	293.4	95.5
	Hispanic	89.9	182.8	238.2	71.2
	Asian or Pacific Islander	63.2	155.6	164.2	52.0
	American Indian / Alaska Native	98.1	248.1	227.0	80.7
	Other / Unknown	65.2	142.6	239.1	53.3
Gender					
	Male	75.7	148.0	219.3	62.7
	Female	68.3	135.0	185.4	56.4
Urbanicity					
	Urban	71.7	141.5	201.7	59.0
	Rural	71.3	133.4	219.5	61.5
	Unknown	60.3	141.9	95.9	49.2
Medicare status					
	Full dual	126.8	217.9	217.3	103.5
	Partial dual	85.1	163.6	210.4	70.6
	QMB	84.3	160.6	233.7	69.5
	Nondual	58.4	112.9	198.9	49.4

QMB = qualified Medicare beneficiary.

About 70 percent of beneficiaries with diabetes saw two or more primary care providers, while less than 10 percent of beneficiaries who saw a primary care provider saw only one. Across all groups, about 30 percent of beneficiaries with diabetes saw five or more different primary care providers (**Table 5**).

Visits with specialists were common but not as frequent as primary care visits. Overall, approximately 70 percent of beneficiaries with diabetes made one or more visits to any specialty provider (**Table 6**). Beneficiaries with type 1 diabetes had the highest percentage of visits to a specialty provider (82%), while those with type 2 diabetes using and not using insulin had similar rates of specialist use, with 68.6 percent and 67 percent visiting one or more specialists. Among those who had specialist visits, the mean number of visits was similar across groups at 5.8 visits for type 1, 6.1 visits for type 2 using insulin, and 5.0 visits for type 2 not using insulin (data not shown in table). Most Medicare beneficiaries with diabetes who saw a specialist saw more than one specialist—68.5 percent of beneficiaries with type 1 diabetes, 54.4 percent of type 2 using insulin, and 50.9 percent of type 2 using insulin saw more than one specialist in 2011 (**Table 6**).

The most frequently seen specialists were ophthalmologists or optometrists and cardiologists. Endocrinologists were infrequently seen. For example, only 21.3 percent of Medicare beneficiaries with type 1 diabetes had a visit with an endocrinologist and 12.6 percent of beneficiaries with type 2 diabetes who used insulin had a visit with an endocrinologist. The percentage of beneficiaries who saw only one specialist was considerably lower than the percentage of beneficiaries who saw someone representing only one specialty.

For example, 42.1 percent of beneficiaries saw providers representing only one specialty but 15.7 percent saw only one specialist, which indicates that beneficiaries were seeing multiple individual providers within a specialty group.

Consistent with their comorbidity burden, the highest hospitalization rates were for beneficiaries with type 2 diabetes using insulin (111 visits per 100 beneficiaries) and lowest for beneficiaries with type 2 diabetes not using insulin (43 visits per 100 beneficiaries; **Table 7**). Beneficiaries with type 1 were intermediate at 84 visits per 100 beneficiaries. Across all three groups, the rate of medical hospitalizations only (no procedure) was greater than the rate of hospitalizations involving a procedure, but hospitalizations for beneficiaries with type 2 diabetes using insulin were more likely to involve a procedure than for other groups (34 hospitalizations per 100 beneficiaries involve procedures for this group).

Rates of emergency room use were similar for beneficiaries with type 1 diabetes and type 2 diabetes using insulin (133 per 100 beneficiaries and 143 per 100 beneficiaries; **Table 7**). Rates of use were substantially lower among beneficiaries with type 2 diabetes not using insulin at 75 visits per 100 beneficiaries. Beneficiaries with type 2 diabetes not using insulin had lower rates of ER visits leading to hospitalization (31 visits per 100 beneficiaries) while beneficiaries with type 1 and type 2 using insulin had higher rates of ER visits leading to hospitalization (64 visits per 100 beneficiaries and 71 visits per 100 beneficiaries).

Overall, allowed payment per beneficiary increased from 2007 to 2011 ($48,184 to $71,652) and is strongly related to diabetes type.

In 2011, the mean allowed payment for beneficiaries with diabetes was highest for those with type 2 diabetes using insulin ($203,446), followed by individuals with type 1 ($140,863; **Table 8**). The mean allowed payment for individuals with type 2 diabetes not using insulin was considerably lower at $59,238.This relative pattern was maintained across age, race, gender, urbanicity, and dual status category, with few exceptions.

DISCUSSION

This study of Medicare beneficiaries with diabetes illustrates some important challenges to care and care coordination for this growing population. First, while most beneficiaries with diabetes have type 2 diabetes and do not use insulin, those with type 1 diabetes or with type 2 diabetes who use insulin have disproportionately high hospitalization, emergency room use, and mortality rates. Likewise, annual Medicare allowed payments are highest for beneficiaries with type 2 diabetes using insulin and lowest for those with type 2 diabetes not using insulin. Comorbidities experienced by beneficiaries with diabetes, both related to and unrelated to diabetes, show a similar pattern. Beneficiaries with type 1 diabetes or type 2 diabetes using insulin have more comorbidities than those with type 2 diabetes not using insulin. In the case of type 2 using insulin, these associations may be influenced by the fact that insulin is likely at least a third-level intervention for glucose control. Type 2 patients on insulin have likely had insufficient benefit from lifestyle changes and oral agents and may have especially poor diabetes control. This may be due to poor adherence or a longer course of treatment for type 2, where patients have simply arrived at needing insulin therapy over time.

In spite of the patterns found in comorbidities, mortality, and inpatient or emergency utilization, we do not see signs that beneficiaries with type 1 diabetes or type 2 diabetes using insulin receive any more preventive care than beneficiaries with type 2 diabetes not using insulin. Beneficiaries with type 2 diabetes using insulin have the lowest rates of eye exams, HbA1c testing, and LDL testing. There are two potential interpretations of these patterns. The first is that an opportunity for preventive care has been missed for those who are, in fact, most needy. Alternatively, it is possible that the higher level of comorbidity and associated health care use interferes with the beneficiaries' ability to manage their preventive care. Regardless, these findings point to the need and opportunity to more effectively provide preventive care for Medicare beneficiaries with diabetes, particularly those who use insulin.

Care coordination can be difficult to quantify on a population level. In this report we see signs that point to suboptimal care coordination. For example, we found that while most beneficiaries with diabetes have contact with primary care, most also interact with multiple primary care providers and with multiple specialists.

About 80 percent of beneficiaries who had contact with primary care saw more than one provider. About 35 percent of the insulin-using diabetics (type 1 or type 2) saw five or more primary care providers. Patterns in beneficiary use of specialists pointed to a similar lack of care coordination. While most beneficiaries with diabetes saw one or more specialists, between 20 and 40 percent of those beneficiaries saw five or more different specialists. Most beneficiaries saw providers representing only one or two specialties, indicating that multiple individual specialists are being visited within health care specialties.

In spite of the strengths of this analysis, some limitations must be acknowledged. First, our classification of diabetics is based on diagnosis codes and procedure codes related to insulin use. It is possible that there is some miscategorization between type 1 and type 2 diabetes classification, though we relied on widely used algorithms. Second, our classification of providers and provider specialties is based on provider IDs. While these also link to payment, errors are possible that would lead to an overcount of individual providers. Third, we present unadjusted numbers and do not conduct statistical testing of differences in proportions. Our sample includes the entire Medicare FFS population for all study years, the full population of interest. With the large size of the full Medicare FFS population, it is likely that even small, unimportant trends would be measured as being statistically different.[26] Therefore, we chose to omit statistical testing and leave conclusions about the importance of patterns to the reader. Despite these limitations, we believe that the use of the full population and the reliance on well-established protocols supports the strengths of our conclusions.

CONCLUSION

Our examination of health care use and access to providers by Medicare beneficiaries with diabetes points to several important findings. First, use of preventive and acute care varies dramatically between beneficiaries with type 1 diabetes, type 2 using insulin, and type 2 not using insulin.

We found that most beneficiaries with diabetes have contact with both primary care and specialty providers. However, the number of distinct providers with whom they have contact is sufficiently high that it calls the reality of care coordination into question.

If programs related to encouraging care coordination are to be considered a success, reducing the number of different providers seen is a logical place to focus. In addition, it may be helpful for evaluations to take into account the number of providers seen when assessing whether attempts at care coordination lead to better preventive care and reductions in acute care use.

AUTHORS

Beth A Virnig, *PhD, MPH* [1]
Nathan D. Shippee, *PhD* [1]
Brian O'Donnell, *PhD* [2]
Jessica Zeglin, *MPH*[1]
Shriram Parashuram, *MPH*[1]

[1] University of Minnesota School of Public Health, Division of Health Policy and Management, Minneapolis, MN.

[2] Buccaneer, A General Dynamics company, Des Moines, IA.

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