



# The Impact of the Affordable Care Act Medicaid Expansion on Type 2 Diabetes Diagnosis and Treatment: A National Survey of Physicians

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## Abstract

In 2014, the Affordable Care Act (ACA) provided funding for states to expand Medicaid coverage to include citizens who earned up to 138% of the federal poverty line. We sought to ascertain whether physicians practicing in Medicaid expansion states reported an increase in Medicaid or newly insured patients with type 2 diabetes in their panels, compared to physicians practicing in non-expansion states. We conducted a 55-question cross-sectional survey of 356 physicians providing outpatient care for adults with type 2 diabetes. We used adjusted multivariate logistic regression analyses to compare responses from physicians who practiced in expansion versus non-expansion states regarding whether they observed an increase since 2014 in (1) the number of Medicaid or newly insured patients with diabetes and (2) the number of additional newly or previously diagnosed patients who were newly receiving care, in their panels, adjusting for physician, practice, and patient-level characteristics, weighted for the U.S. physician population. 41% of eligible recipients responded. 64.2% of physicians who practice in an expansion state report an increase in Medicaid or newly insured patients with diabetes compared with 46.1% who practice in non-expansion states ( $p=0.05$ ; Table 2). Compared with physicians who practice in non-expansion states, physicians who practice in Medicaid expansion states are more likely to report an increase in the number of Medicaid or newly insured patients with diabetes in their practice since 2014. The increased access associated with the Medicaid expansion may improve long-term outcomes for patients with type 2 diabetes.

**Keywords** Medicaid · Access to care · Diabetes · Affordable Care Act

## Introduction

Beginning in 2014, the Affordable Care Act (ACA) provided funding for states to expand Medicaid coverage to include citizens who earned up to 138% of the federal poverty line. Due to a 2012 Supreme Court ruling, however, the decision to expand Medicaid was left to individual states. Twenty-four states chose to expand Medicaid coverage and seven used waivers to expand coverage in ways that departed substantially from the ACA's provisions. Understanding the impact of the Medicaid expansion on patients with diabetes is particularly important because diabetes has the highest level of personal health care spending in the U.S., and outcomes may improve with earlier diagnosis and better access to care [1–3].

In 2009–2010, 23% of adults ages 18–64 with diagnosed diabetes were uninsured—roughly 3.5 million Americans [4]. Of these patients, 1.5 million met income qualifications for expanded Medicaid coverage. A recent study comparing

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insurance among adults age 18–64 with diabetes in 2016 versus 2009 found a statistically significant 5% increase in coverage [5]. The Medicaid expansion also created opportunities to identify diabetes among those unaware of their disease [6]. Rates of diabetes diagnosis increased by 5% in expansion states compared with non-expansion states, and studies using laboratory and prescription data have likewise suggested that new diabetes diagnoses in Medicaid expansion states increased compared to non-expansion states [7–10].

To date, however, it is unclear how providers responded to the influx of patients with diabetes due to Medicaid expansion. Because of the program's lower reimbursement rates, physicians have historically been less likely to accept Medicaid patients [11]. It is therefore possible that only a small number of physicians accepted new Medicaid patients with diabetes into their practices. Thus, we examined whether and to what degree providers in Medicaid expansion states increased the number of patients with type 2 diabetes in their panels compared to non-expansion states.

## Methods

### Survey Administration

Beginning in May of 2016 and concluding in August of 2016, we mailed three waves of a 55-question survey about type 2 diabetes care practices to 1200 U.S. endocrinologists and primary care physicians (PCPs). We obtained addresses and practice areas through the 2016 AMA Physician Masterfile, and included physicians from 49 states and Washington D.C. (by chance, Mississippi was not represented). We stratified recipients by state expansion status and physician specialty. We mailed surveys to physicians in the 24 states that participated in Medicaid expansion (including Washington D.C.) (N = 524), the seven states that received Medicaid Expansion Waivers (N = 71), and the 201 states that did not expand Medicaid (N = 606). Forty percent of our sample (N = 480) identified their practice area in the AMA Masterfile as “endocrinology” or “diabetes”; the remainder (N = 720) listed their practice area as primary care. Upon receiving completed surveys, we excluded respondents who stated that they did not provide longitudinal outpatient care for patients with type 2 diabetes from our eligible sample (N = 182/588 received). We attempted to reduce non-response bias by conducting three mailed survey waves, including a \$10 bill in the initial survey wave, and a postcard prior to the third wave. Previous studies have shown that these methods increase response rates [12]. This study was deemed exempt by the institutional review board at the University of Chicago Medicine.

### Survey Development

The 55-question, 16-page survey gathered data on physician's attitudes and observations in a variety of salient areas in diabetes care, including medication management and glycemic goal individualization. The data presented in this paper focus on three questions that sought to assess the impact of Medicaid expansion on the provision of diabetes care in the longitudinal outpatient setting. We included the complete survey as an online-only supplementary appendix.

Questions related to access to care were on page 11 of the 16-page survey. To assess changes in patient panels, we asked: (1) in the last 2 years, have you had an increase in the number of Medicaid or newly insured patients with diabetes in your practice? If “yes”, then in the last 2 years, (2) how many of these Medicaid or newly insured patients did you newly diagnose with diabetes?, and (3) how many of these Medicaid or newly insured patients were previously diagnosed with diabetes but not receiving care? The latter two questions had the following response options: 1–10, 11–25, 26–50, 51–100, 101–200, or > 200 patients. To avoid biasing respondents, we did not mention the ACA in the survey. Because these survey questions were novel, they have not been externally validated.

### Covariates

The primary covariate was practice state, categorized as an expansion, waiver, or non-expansion state based on 2016 status. The 24 expansion states included Alaska, California, Colorado, Connecticut, Delaware, Illinois, Kentucky, Louisiana, Maryland, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, Vermont, West Virginia, Washington state and Washington D.C. The 7 waiver states included Arizona, Arkansas, Iowa, Indiana, Michigan, Montana and New Hampshire. The remaining 20 states were considered non-expansion states.

Other covariates included age, gender, race/ethnicity, years in practice, specialty, professional activity, burnout, [13] practice setting, size, insurance mix, and patient age and race/ethnicity. Because of the limited sample size, post hoc, we dichotomized years in practice ( $\geq 20$  years vs.  $< 20$  years); professional activity (research vs. no research); physician burnout (some or more vs. none); practice size ( $> 1000$  patients vs.  $\leq 1000$  patients); percent patients age  $> 65$  years, percent non-Hispanic white patients, and percent managed care ( $> 50\%$  vs.  $\leq 50\%$ ); and setting type (hospital-based clinic vs. other).

## Sample Size Calculation

In 2010, there were an estimated 209,000 primary care physicians in the U.S [14]. In 2011, there were an estimated 4841 adult endocrinologists practicing in the US [15]. We estimated that we would need a sample of 383 primary care physicians and 356 endocrinologists to ensure that our responses were nationally representative within a margin of error of 5% and 95% confidence level. Expecting a response rate of 60%, we estimated that we needed to survey 613 primary care physicians and 570 endocrinologists, or at least 1183 physicians. Of the 588 surveys we received, we considered 232 to be ineligible, including 116 that were marked as return to sender. 41% of presumed eligible recipients responded (356/868). Following the administration of the survey, newly available data found that in 2016, 289,831 primary care physicians and 7236 endocrinologists practiced in the US [16].

## Analysis and Statistical Methods

To calculate the response rate, we used the Council of American Survey Research Organizations formula, which adjusts for the estimated number of ineligible responses among non-respondents [17]. We used Chi square tests to examine associations between covariates and physicians reporting “yes” vs. “no”/“unsure” regarding an increase in the number of Medicaid or newly insured patients with diabetes in their practice. We also used multivariate logistic regressions to examine marginal effects for covariates of physicians reporting  $> 10$  versus  $\leq 10$  new patients with either newly diagnosed diabetes or previously diagnosed diabetes newly receiving care. The adjusted models included covariates with  $p \leq 0.10$  in bivariate analyses. We performed multivariate regressions for the entire sample and for subgroup analyses for primary care physicians and endocrinologists. We stratified analyses by state expansion status and physician specialty; we computed poststratification weights to the 2016 U.S. physician population by the same measures.  $p$  values  $< 0.05$  were considered statistically significant. We used the survey analysis procedures in SAS version 9.4 (SAS Institute Inc.) to perform analyses.

## Results

Our adjusted response rate was 41% ( $N = 356$ ) (Fig. 1). Respondents and non-respondents did not differ by specialty type ( $p = 0.40$ ), degree type (MD vs. DO,  $p = 0.49$ ), or census region ( $p = 0.09$ ). The response rate also did not differ between Medicaid expansion, waiver, and non-expansion states ( $p = 0.47$ ). Of the respondents, 142 (weighted percentage, 56.6%) were from expansion states, 25 (weighted percentage, 8.4%) were from waiver states, and 190 (weighted

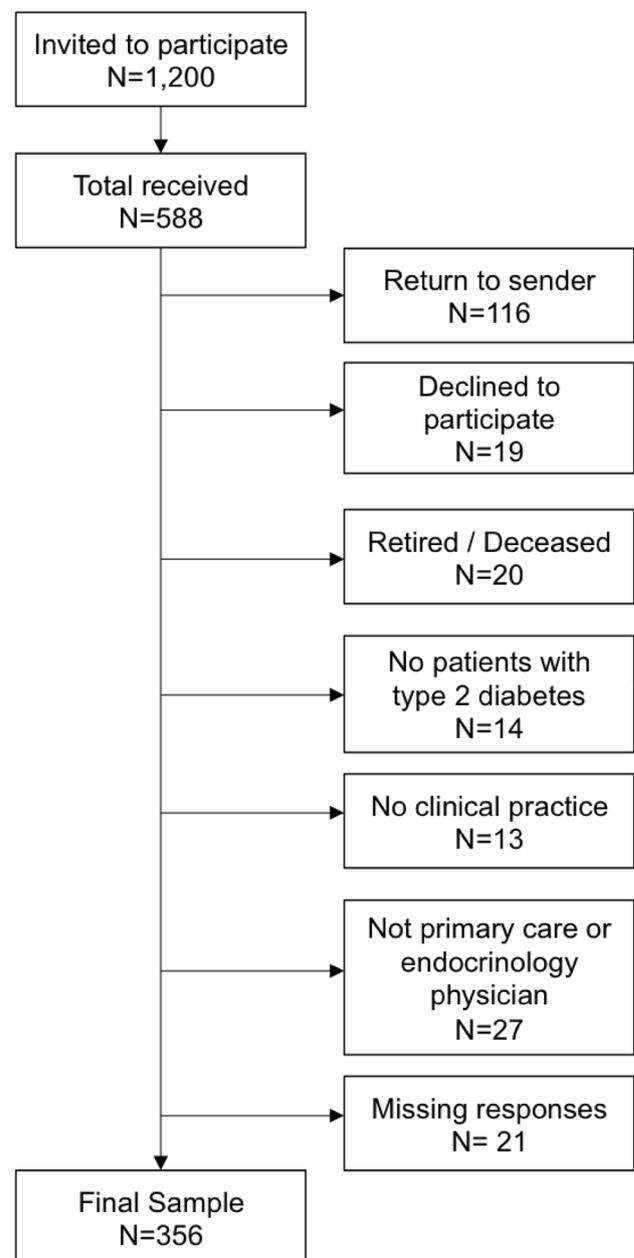


Fig. 1 Respondent flow diagram

percentage, 35.0%) were from non-expansion states. Forty-six percent ( $n = 164$ ) of respondents were endocrinologists; 193 (54%) were PCPs (Table 1).

Overall, 53.1% of physicians reported an increase in Medicaid or newly insured patients with diabetes (Table 1). A higher percentage of physicians in expansion or waiver states (60.2%) than non-expansion states (39.9%) reported such an increase ( $p = 0.01$ ). Physicians from expansion and waiver states reported increases of 1–10 newly diagnosed patients in the previous 2 years (23.2%), 11–25 (14.2%) and  $> 25$  (22.1%); physicians from non-expansion states reported

**Table 1** Physician and practice characteristics by medicaid expansion versus non-expansion states

Characteristic	Overall		Type of State				P-value
			Non-expansion (N = 188)		Expansion or Waiver (N = 168)		
	N	Weighted % (CI)	N	Weighted % (CI)	N	Weighted % (CI)	
<b>Provider characteristics</b>							
Female	139	36.4 (28.0–44.8)	69	34.9 (24.7–45.1)	70	37.2 (25.6–48.8)	0.77
Age (years)							0.79
< 40	45	11.1 (5.7–16.4)	24	7.9 (2.9–12.9)	21	12.8 (5.0–20.7)	
41–49	103	31.4 (23.4–39.4)	58	33.1 (22.6–43.6)	45	30.5 (19.5–41.5)	
50–64	148	45.4 (36.4–54.4)	82	46.4 (35.6–57.3)	66	44.8 (32.2–57.4)	
≥ 65	44	12.1 (7.2–17.0)	22	12.6 (5.8–19.3)	22	11.8 (5.2–18.4)	
Race/ethnicity							0.003
Non-Hispanic White	211	54.4 (45.7–63.2)	110	55.7 (44.9–66.4)	101	53.8 (41.7–65.8)	
Non-Hispanic Black	19	6.5 (0.0–13.2)	11	1.6 (0.0–3.6)	8	9.2 (0.0–19.1)	
Hispanic/Latino	32	9.9 (5.7–14.1)	21	14.8 (7.4–22.3)	11	7.2 (2.2–12.3)	
Asian	73	23.4 (15.8–31.1)	32	15.9 (8.2–23.6)	41	27.5 (16.6–38.3)	
Other	18	5.7 (2.1–9.3)	14	12.0 (3.9–20.1)	4	2.4 (0.0–5.6)	
Years in practice							0.93
1–9	97	18.0 (12.0–24.1)	50	20.7 (12.2–29.2)	47	16.6 (8.6–24.7)	
10–19	79	23.0 (16.2–29.9)	45	22.3 (13.3–31.3)	34	23.4 (14.1–32.8)	
20–29	97	33.0 (24.9–41.1)	48	31.6 (21.1–42.1)	49	33.7 (22.6–44.8)	
> 30	80	25.9 (17.6–34.2)	45	25.4 (16.7–34.1)	35	26.2 (14.4–38.0)	
Specialty							
Endocrinology	164	2.4 (2.2–2.7)	87	2.2 (1.7–2.7)	77	2.6 (1.9–3.3)	0.45
Family medicine	101	48.2 (39.6–56.7)	55	51.9 (41.2–62.6)	46	46.2 (34.4–57.9)	0.48
Geriatrics	15	5.5 (2.1–8.9)	10	8.8 (2.2–15.4)	5	3.8 (0.0–7.6)	0.17
Internal medicine	103	48.2 (39.6–56.9)	53	42.3 (31.7–53.0)	50	51.4 (39.6–63.2)	0.26
Other	11	4.6 (1.4–7.7)	8	11.2 (2.8–19.5)	3	1.0 (0.0–2.4)	<0.001
Burnout <sup>a</sup>							0.22
Some or more	110	32.0 (24.0–40.0)	52	26.2 (17.3–35.1)	58	35.1 (23.9–46.4)	
None	247	68.0 (60.0–76.0)	138	73.8 (64.9–82.7)	109	64.9 (53.6–76.1)	
Practice characteristics							
Size (number of patients)							0.57
1–500	79	24.9 (17.2–32.6)	42	27.6 (17.6–37.7)	37	23.4 (13.0–33.9)	
501–1000	59	17.2 (9.1–25.3)	26	11.6 (4.5–18.6)	33	20.2 (8.5–31.8)	
1001–2000	90	21.7 (15.0–28.4)	50	22.8 (13.9–31.6)	40	21.2 (12.1–30.3)	
> 2000	122	36.2 (28.1–44.3)	69	38.0 (27.8–48.3)	53	35.2 (24.2–46.2)	
Percent of patients > 65 years old							0.14
76–100%	34	11.6 (6.8–16.4)	21	16.7 (8.3–25.2)	13	9.0 (3.3–14.7)	
51–75%	100	23.5 (16.6–30.4)	56	29.6 (20.0–39.2)	44	20.4 (11.2–29.6)	
26–50%	143	38.4 (29.5–47.2)	73	30.0 (20.0–39.9)	70	42.7 (30.5–54.8)	
0–25%	72	26.5 (19.0–34.1)	36	23.8 (14.4–33.1)	36	28.0 (17.6–38.3)	
Percent of non-Hispanic white patients							0.71
76–100%	86	26.5 (19.2–33.8)	44	23.1 (13.5–32.6)	42	28.3 (18.3–38.3)	
51–75%	108	25.7 (18.6–32.8)	60	30.3 (20.7–39.9)	48	23.3 (13.8–32.8)	
26–50%	108	28.3 (19.9–36.8)	61	29.7 (20.0–39.4)	47	27.7 (15.8–39.5)	
0–25%	46	19.4 (12.1–26.7)	19	17.0 (8.6–25.3)	27	20.7 (10.5–30.9)	
Location							
Urban	159	45.7 (37.0–54.4)	80	44.5 (33.7–55.2)	79	46.4 (34.4–58.4)	0.81
Rural	149	36.9 (28.6–45.1)	81	28.3 (19.2–37.4)	68	41.5 (29.9–53.1)	0.08
Suburban	63	22.2 (15.4–29.0)	39	29.3 (19.5–39.0)	24	18.4 (9.5–27.3)	0.11

**Table 1** (continued)

Characteristic	Overall		Type of State				P-value
			Non-expansion (N = 188)		Expansion or Waiver (N = 168)		
	N	Weighted % (CI)	N	Weighted % (CI)	N	Weighted % (CI)	
<b>Type of setting</b>							
Private solo or group practice	196	55.3 (46.7–64.0)	109	56.2 (45.5–66.9)	87	54.8 (42.9–66.8)	0.87
Freestanding clinic	31	9.5 (5.0–13.9)	22	14.3 (6.5–22.0)	9	6.9 (1.5–12.2)	0.11
Hospital-based clinic	98	19.3 (11.6–27.0)	47	16.5 (8.8–24.3)	51	20.9 (9.9–31.8)	0.51
Health maintenance organization or other prepaid practice	18	6.8 (2.9–10.6)	4	2.9 (0.0–6.2)	14	8.9 (3.2–14.6)	0.08
Other	30	14.4 (8.3–20.5)	15	15.8 (6.9–24.8)	15	13.6 (5.6–21.6)	0.72
<b>Percent private insurance</b>							
76–100%	14	3.5 (0.7–6.2)	5	3.3 (0.0–7.8)	9	3.6 (0.1–7.0)	0.75
51–75%	92	22.0 (15.0–28.9)	48	19.0 (10.9–27.2)	44	23.5 (13.8–33.2)	
26–50%	135	35.8 (27.3–44.3)	73	33.4 (23.2–43.6)	62	37.1 (25.3–49.0)	
0–25%	97	38.8 (29.8–47.8)	54	44.4 (33.4–55.3)	43	35.8 (23.2–48.4)	
<b>Percent fee-for-service</b>							
76–100%	194	43.4 (35.0–51.7)	117	50.3 (39.6–61.0)	77	39.6 (28.1–51.0)	0.04
51–75%	23	8.3 (4.1–12.4)	8	4.7 (0.6–8.8)	15	10.2 (4.2–16.2)	
26–50%	23	8.2 (3.4–13.0)	5	1.4 (0.0–3.5)	18	11.8 (4.6–19.1)	
0–25%	51	18.3 (11.9–24.6)	26	23.3 (13.9–32.8)	25	15.6 (7.3–23.8)	
Missing	66	21.9 (13.9–30.0)	34	20.2 (11.4–29.1)	32	22.8 (11.5–34.2)	
<b>Percent managed care</b>							
76–100%	53	17.6 (10.8–24.4)	29	13.0 (5.8–20.1)	24	20.0 (10.4–29.6)	0.68
51–75%	66	17.8 (11.2–24.3)	32	17.6 (8.7–26.5)	34	17.9 (9.2–26.6)	
26–50%	91	30.5 (21.9–39.1)	47	34.8 (24.2–45.5)	44	28.3 (16.4–40.1)	
0–25%	117	34.1 (25.6–42.7)	65	34.6 (24.0–45.2)	52	33.9 (22.2–45.5)	
<b>“In the last 2 years, have you had an increase in the number of Medicaid or newly insured patients with diabetes in your practice?”</b>							
Yes	174	53.1 (44.7–61.6)	78	39.9 (29.6–50.2)	96	60.2 (48.7–71.7)	0.007
No	136	36.4 (28.3–44.6)	80	39.5 (28.9–50.1)	56	34.8 (23.7–45.9)	
Unsure	47	10.5 (5.7–15.2)	32	20.5 (11.7–29.3)	15	5.0 (0.0–10.6)	
<b>“In the last 2 years, how many of these Medicaid or newly insured patients did you newly diagnose with diabetes?”<sup>b</sup></b>							
0	183	46.9 (38.4–55.3)	112	60.1 (49.8–70.4)	71	39.8 (28.3–51.3)	0.04
1–10	73	18.7 (11.0–26.3)	31	10.3 (4.6–16.1)	42	23.2 (12.1–34.2)	
11–25	46	14.3 (8.6–20.1)	24	14.5 (7.1–21.9)	22	14.2 (6.3–22.1)	
> 25	51	19.3 (12.7–25.8)	21	13.9 (6.7–21.1)	30	22.1 (12.9–31.4)	
Missing	4	0.9 (0.0–2.0)	2	1.2 (0.0–3.5)	2	0.7 (0.0–2.0)	
<b>“In the last 2 years, how many of these Medicaid or newly insured patients were previously diagnosed with diabetes but not receiving care?”<sup>b</sup></b>							
0	183	46.9 (38.4–55.3)	112	60.1 (49.8–70.4)	71	39.8 (28.3–51.3)	0.04
1–10	65	20.8 (14.1–27.5)	29	17.4 (9.7–25.2)	36	22.6 (13.2–32.0)	
11–25	57	20.9 (12.9–28.9)	23	12.5 (5.5–19.4)	34	25.4 (13.9–36.9)	
> 25	50	11.0 (6.3–15.8)	24	8.9 (3.3–14.4)	26	12.2 (5.5–18.9)	
Missing	2	0.4 (0.0–1.2)	2	1.2 (0.0–3.5)	0	0.0 (0.0–0.0)	

None = “I enjoy my work. I have no symptoms of burnout” or “I am under stress and don’t always have as much energy as I did, but I don’t feel burned out.”

<sup>a</sup>Burnout: some or more = “I am definitely burning out and have one or more symptoms of burnout, e.g. emotional exhaustion” or “The symptoms of burnout that I’m experiencing won’t go away. I think about work frustrations a lot” or “I feel completely burned out. I am at the point where I may need to seek help.”

<sup>b</sup>Only respondents who answered “Yes” to the question “In the last 2 years, have you had an increase in the number of Medicaid or newly insured patients with diabetes in your practice?” were asked to answer these questions. N’s represent the number of eligible patients stratified by non-expansion versus expansion state. Response options included 1–10, 11–25, 26–50, 51–100, 101–200 or > 200 patients

**Table 2** Percentage of physicians reporting increase in Medicaid or newly insured patients with type 2 diabetes

	Unadjusted		Adjusted*	
	Weighted % (CI)	p-value	Weighted % (CI)	p-value
Expansion + waiver states		0.01		
Yes	60.2 (48.7–71.7)		–	
No	39.9 (29.6–50.2)		–	
Expansion states		0.06		0.05
Yes	60.0 (47.2–72.8)		64.2 (50.2–76.1)	
No	44.1 (34.5–53.8)		46.1 (33.0–59.7)	
Physician characteristics				
Specialty		0.26		
PCP	53.3 (44.6–62.0)		–	
Endocrinologist	46.1 (37.0–55.2)		–	
Gender		0.25		
Female	46.6 (32.2–61.0)		–	
Male	56.8 (46.6–67.1)		–	
Age group		0.76		
< 40	45.4 (19.5–71.3)		–	
41–49	47.0 (32.1–61.8)		–	
50–64	56.1 (42.2–70.0)		–	
≥ 65	54.2 (33.8–74.6)		–	
Race/ethnicity		0.01		0.002
Non-Hispanic White	42.8 (32.4–53.2)		40.1 (28.0–53.5)	
Other race/ethnicity	65.4 (52.7–78.1)		69.6 (55.6–80.7)	
Years in practice		0.54		
< 20 years	49.3 (36.8–61.7)		–	
≥ 20 years	54.6 (42.9–66.3)		–	
Burnout		0.18		
None	49.2 (38.8–59.7)		–	
Some or more	61.4 (47.3–75.5)		–	
Practice characteristics				
Size (number of patients)		0.08		0.11
≤ 1000	44.8 (29.3–60.2)		47.2 (33.3–61.6)	
> 1000	61.6 (51.8–71.5)		63.2 (48.9–75.4)	
Percent of patients > 65 years old		0.10		0.54
≤ 50%	59.0 (48.0–69.9)		58.3 (44.8–70.6)	
> 50%	45.0 (32.1–57.9)		52.3 (37.4–66.8)	
Percent of non-Hispanic white patients		0.33		
≤ 50%	50.9 (40.0–61.9)		–	
> 50%	59.3 (46.2–72.4)		–	
Location		0.04		0.004
Rural	61.6 (51.6–71.5)		68.3 (55.9–78.6)	
Urban/suburban	43.1 (29.0–57.2)		41.6 (27.9–56.6)	
Setting		0.56		
Hospital-based clinic	47.1 (23.8–70.4)		–	
Other	54.6 (45.6–63.5)		–	
Percent private insurance		0.89		
76–100%	48.3 (8.1–88.5)		–	
51–75%	55.2 (38.0–72.5)		–	
26–50%	59.3 (44.5–74.1)		–	
0–25%	52.0 (37.0–66.9)		–	
Percent fee-for-service		0.10		0.26

**Table 2** (continued)

	Unadjusted		Adjusted*	
	Weighted % (CI)	p-value	Weighted % (CI)	p-value
76–100%	51.3 (38.9–63.6)		62.8 (40.9–80.4)	
51–75%	67.7 (44.1–91.3)		35.5 (20.6–54.0)	
26–50%	74.3 (50.5–98.1)		63.6 (34.4–85.3)	
0–25%	34.0 (16.0–52.0)		65.6 (34.6–87.3)	
Unknown	59.3 (39.6–78.9)		48.5 (34.1–63.0)	
Percent managed care		0.92		
≤ 50%	54.4 (43.1–65.6)		–	
> 50%	53.4 (39.0–67.8)		–	

\*Adjusted models only included variables with bivariate  $p \leq 0.10$

fewer newly diagnosed patients ( $p = 0.04$ ). Similarly, 22.6% of physicians from expansion and waiver states reported seeing 1–10 Medicaid or newly insured patients who had previously diagnosed diabetes that was untreated. One-quarter (25.4%) of physicians in the same states saw 11–25 previously diagnosed yet untreated patients.

Bivariate analyses of an increase in Medicaid or newly insured patients with diabetes by physician and practice characteristics revealed differences by state status, physician race/ethnicity, and urbanicity (Table 2). In adjusted multivariate logistic regression analyses, 64.2% of physicians who practice in an expansion state report an increase in Medicaid or newly insured patients with diabetes compared with 46.1% who practice in non-expansion states ( $p = 0.05$ ; Table 2). Non-white physicians (69.6%) and those who practice in rural areas (68.3%) reported significant increases in the outcome measure compared with approximately 40% of white ( $p = 0.002$ ) and physicians in urban and suburban areas ( $p = 0.004$ ), respectively. The other physician and practice characteristics were not significantly associated with increase in Medicaid or newly insured patients with diabetes. In similar analyses stratified by PCPs and endocrinologists, the PCPs were nearly identical to the overall population of physicians (Table 3). However, approximately 60% of endocrinologists saw increases in these patients in larger practices ( $p = 0.003$ ) and practices in urban (rather than rural) areas ( $p < 0.001$ ). As shown in Tables 2 and 3, waiver states considered expansion states increased the difference in reported increases between expansion and non-expansion states, but the number of waiver states was too small to analyze as a separate group.

## Discussion

Compared with physicians who practice in non-expansion states, physicians who practice in states that participated in the Medicaid expansion—including those who practice in waiver states—are more likely to report an increase in the

number of Medicaid or newly insured patients with diabetes in their practice since 2014. These findings provide evidence that Medicaid expansion was associated with physicians empaneling new patients with diabetes and that this change in clinical practice was broadly enough applied, such that it was identifiable in this relatively small survey.

Our survey's findings correspond to other assessments of health insurance's impact on access to care for patients with diabetes. Analysis of the 2008 Oregon Health Insurance Experiment showed that increased Medicaid coverage was associated with increased rates of diabetes detection and medication use [18]. An early study of three states found that people with diabetes who resided in Kentucky, an expansion state, were more likely to have glucose-testing than in Texas, a non-expansion state, or Arkansas, which expanded private insurance [7]. Laboratory and pharmacy claims likewise suggest that newly identified diabetes based on HbA<sub>1c</sub> values  $> 6.4\%$ , ICD-9 diagnosis code of 250.x (diabetes), and diabetes drug prescriptions increased in Medicaid expansion states [8, 9]. In addition, health insurance coverage expanded among patients with diabetes after the ACA, specifically among adults age 18–64 years [5]. Our study expands on this literature by suggesting that Medicaid expansion was associated with physicians increasing the number of patients in their practices with diabetes. Further, our study indicates that this increase was broadly distributed across practices, signaling that providers in expansion states were willing to empanel patients on Medicaid at an elastic rate. This may be significant in light of the historical reluctance of physicians to accept Medicaid's lower reimbursement rates [11].

Two other groups of physicians—non-white physicians and those who practice in rural areas—were significantly associated with increases in the number of Medicaid or newly insured patients with diabetes. Previous research has demonstrated that black and Hispanic physicians are more likely to care for patients of concordant racial and ethnic background, as well as greater numbers of uninsured and Medicaid patients [19]. Given the higher type 2 diabetes disease burden in communities of color, [20] we reasonably

**Table 3** Percentage of physicians reporting an increase in Medicaid or newly insured patients with type 2 diabetes by specialty type

	Primary care				Endocrinology			
	Unadjusted		Adjusted*		Unadjusted		Adjusted*	
	Weighted % (CI)	p-value						
Expansion + waiver states		0.01				0.30		
Yes	60.5 (48.7–72.3)		–		48.8 (36.5–61.1)		–	
No	39.9 (29.4–50.4)		–		40.1 (29.3–51.0)		–	
Expansion states		0.06		0.06		0.15		
Yes	60.2 (47.1–73.4)		64.3 (49.9–76.6)		50.9 (38.0–63.9)		–	
No	44.3 (34.4–54.1)		46.0 (32.5–60.0)		38.4 (27.1–49.7)		–	
Physician characteristics								
Gender		0.25				0.54		
Female	46.5 (31.6–61.4)		–		49.3 (35.9–62.8)		–	
Male	57.1 (46.7–67.6)		–		43.7 (31.4–55.9)		–	
Age group		0.75				0.90		
< 40	45.1 (18.3–71.8)		–		54.5 (31.5–77.5)		–	
41–49	47.0 (31.8–62.1)		–		46.6 (29.6–63.6)		–	
50–64	56.3 (42.1–70.6)		–		45.3 (30.7–59.9)		–	
≥ 65	54.6 (33.6–75.5)		–		41.6 (15.0–68.1)		–	
Race/ethnicity		0.01		0.002		0.83		
Non-Hispanic White	42.7 (32.0–53.5)		39.5 (27.1–53.3)		45.8 (33.7–57.9)		–	
Other race/ethnicity	65.8 (52.9–78.7)		70.2 (55.8–81.4)		47.8 (33.7–61.9)		–	
Years in practice		0.55				0.60		
< 20 years	49.4 (36.6–62.3)		–		44.7 (32.3–57.1)		–	
≥ 20 years	54.7 (42.8–66.6)		–		49.7 (35.6–63.8)		–	
Burnout		0.19				0.12		
None	49.4 (38.8–60.1)		–		41.4 (30.6–52.2)		–	
Some or more	61.5 (47.0–76.0)		–		56.4 (40.7–72.0)		–	
Practice characteristics								
Size (number of patients)		0.08		0.13		0.05		0.003
≤ 1000	45.0 (29.1–60.9)		47.3 (32.9–62.2)		35.8 (22.6–49.1)		31.7 (20.4–45.6)	
> 1000	61.8 (51.7–71.9)		63.0 (48.4–75.6)		54.5 (42.4–66.6)		59.5 (47.6–70.4)	
Percent of patients > 65 years old		0.10		0.56		0.59		
≤ 50%	59.3 (48.1–70.5)		58.3 (44.4–70.9)		47.5 (36.0–58.9)		–	
> 50%	45.1 (31.9–58.2)		52.3 (37.0–67.2)		42.2 (26.9–57.6)		–	
Percent of non-Hispanic white patients		0.36				0.05		0.07
≤ 50%	51.3 (40.1–62.4)		–		37.7 (25.4–50.0)		36.9 (25.1–50.4)	
> 50%	59.4 (46.0–72.9)		–		56.2 (42.9–69.5)		53.9 (40.7–66.6)	
Location		0.03		0.003		0.003		0.0007
Rural	62.2 (52.0–72.4)		69.3 (56.5–79.7)		33.5 (22.0–45.0)		30.4 (19.8–43.6)	
Urban/suburban	42.7 (28.2–57.2)		40.4 (26.7–55.9)		58.6 (46.3–70.9)		61.0 (48.6–72.1)	
Setting		0.55				0.20		
Hospital-based clinic	46.8 (22.1–71.4)		–		53.2 (38.0–68.4)		–	
Other	54.8 (45.7–63.9)		–		40.9 (29.9–51.9)		–	
Percent private insurance		0.88				0.47		
76–100%	47.7 (6.3–89.2)		–		67.6 (32.5–100)		–	
51–75%	55.8 (38.0–73.6)		–		37.6 (21.6–53.6)		–	
26–50%	59.6 (44.3–74.9)		–		51.6 (37.7–65.4)		–	
0–25%	52.0 (36.8–67.3)		–		47.1 (24.8–69.4)		–	
Percent fee-for-service		0.10		0.26		–		

**Table 3** (continued)

	Primary care				Endocrinology			
	Unadjusted		Adjusted*		Unadjusted		Adjusted*	
	Weighted % (CI)	p-value	Weighted % (CI)	p-value	Weighted % (CI)	p-value	Weighted % (CI)	p-value
76–100%	51.6 (38.9–64.3)		48.8 (33.8–64.0)		41.3 (30.0–52.6)		–	
51–75%	67.9 (44.2–91.7)		66.1 (34.4–87.8)		46.9 (0.0–96.8)		–	
26–50%	73.8 (49.6–98.1)		62.6 (33.4–84.8)		100 (100–100)		–	
0–25%	33.7 (15.3–52.0)		34.9 (19.8–53.8)		55.1 (27.4–82.9)		—	
Unknown	59.8 (39.8–79.8)		63.5 (40.9–81.5)		38.5 (17.8–59.2)		–	
Percent managed care		0.89				0.12		
≤ 50%	54.6 (43.1–66.2)		–		42.8 (30.7–55.0)		–	
> 50%	53.3 (38.5–68.1)		–		57.8 (43.2–72.3)		–	

\*Adjusted models only included ACA expansion state and variables that were significantly related ( $p \leq 0.05$ ) to the outcome variable in unadjusted models

– Not available

anticipated a disproportionate increase in the patient panels of non-white physicians. Similarly, patients who reside in rural areas are more likely to be on Medicaid, and the Medicaid expansion had a disproportionate impact on patients in rural areas, increasing coverage rates from 21 to 26% [21].

For patients with diabetes, having health insurance coverage may be especially significant for their long-term health. Uninsured individuals with diabetes may be more than 2.5 times as likely to die as those with private insurance [3]. Earlier access to treatment may lead to earlier improvements in glycemic control, which could yield improved outcomes for decades [18]. Unfortunately, states with higher rates of undiagnosed diabetes were less likely to expand Medicaid, potentially compounding decades-long systemic disparities in diabetes care quality and serving as a negative confounder in our study [4]. Paradoxically, if efforts to repeal or weaken insurance market protections for patients with pre-existing conditions succeed, patients who have been diagnosed with diabetes because of Medicaid expansion may have greater restrictions for treatment than if Medicaid had never expanded, because these patients will now have a pre-existing medical condition.

Our response rate, while robust for a national physician survey, nevertheless introduces potential for non-response bias and was lower than we expected. However, because the survey investigated general diabetes practices, the influence of non-response bias on these specific results may be diminished. Further, respondents did not differ from non-respondents in terms of specialty type, degree type (DO vs. MD) or census region, though we did not have other specific demographics from non-respondents to analyze whether they differed from respondents otherwise. Although we intentionally asked about both Medicaid and newly insured patients in order to discern changes associated with Medicaid expansion, our findings may be confounded by nearly complete

overlap between non-expansion states and states that opted for federally facilitated marketplaces ( $n = 12$ ) or federally facilitated marketplaces with the state conducting plan management ( $n = 6$ ). Also, similar to all surveys, our results are subject to recall bias; however, this form of bias would be unlikely to be substantively different between physicians practicing in expansion states versus non-expansion states, but it could affect the effect size of our findings.

## Conclusion

Compared with physicians who practice in non-expansion states, physicians who practice in states that participated in the Medicaid expansion—including those who practice in waiver states—are more likely to report an increase in the number of Medicaid or newly insured patients with diabetes in their practice since 2014. Given that early detection and regular treatment is associated with improved outcomes, the increased access associated with Medicaid expansion may improve long-term outcomes for patients with type 2 diabetes.

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## Compliance with Ethical Standards

**Conflict of interest** None of the authors have any potential conflicts of interest, financial or otherwise.

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