

UCLA

UCLA Previously Published Works

Title

Ensuring Equitable Care in Diabetes Management Among Patients of Health Resources & Services Administration-Funded Health Centers in the United States.

Permalink

<https://escholarship.org/uc/item/8w35h9b5>

Journal

Diabetes Spectrum, 36(1)

ISSN

1040-9165

Authors

Pourat, Nadereh

Chen, Xiao

Lu, Connie

et al.

Publication Date

2023

DOI

10.2337/ds22-0016

Peer reviewed



Ensuring Equitable Care in Diabetes Management Among Patients of Health Resources & Services Administration–Funded Health Centers in the United States

Nadereh Pourat,^{1,2} Xiao Chen,¹ Connie Lu,¹ Weihao Zhou,¹ Brionna Hair,³ Joshua Bolton,³ and Alek Sripiatana³

¹UCLA Center for Health Policy Research, Los Angeles, CA; ²Department of Health Policy and Management, UCLA Fielding School of Public Health, Los Angeles, CA; ³Office of Quality Improvement, Bureau of Primary Health Care, Health Resources & Services Administration, U.S. Department of Health and Human Services, Rockville, MD

AIM | To explore whether there are racial/ethnic differences in diabetes management and outcomes among adult health center (HC) patients with type 2 diabetes.

METHODS | We analyzed data from the 2014 Health Center Patient Survey, a national sample of HC patients. We examined indicators of diabetes monitoring (A1C testing, annual foot/eye doctor visits, and cholesterol checks) and care management (specialist referrals, individual treatment plan, and receipt of calls/appointments/home visits). We also examined diabetes-specific outcomes (blood glucose levels, diabetes-related emergency department [ED] visits/hospitalizations, and diabetes self-management confidence) and general outcomes (number of doctor visits, ED visits, and hospitalizations). We used multilevel logistic regression models to examine racial/ethnic disparities by the above indicators.

RESULTS | We found racial/ethnic parity in A1C testing, eye doctor visits, and diabetes-specific outcomes. However, Hispanics/Latinos (odds ratio [OR] 0.26), non-Hispanic African Americans (OR 0.25), and Asians (OR 0.11) were less likely to receive a cholesterol check than Whites. Non-Hispanic African Americans (OR 0.43) were less likely to have frequent doctor visits, while Hispanic/Latino patients (OR 0.45) were less likely to receive an individual treatment plan.

CONCLUSION | HCs largely provide equitable diabetes care but have room for improvement in some indicators. Tailored efforts such as culturally competent care and health education for some racial/ethnic groups may be needed to improve diabetes management and outcomes.

In 2018, more than 34 million Americans, or 10.5% of the U.S. population, had type 2 diabetes, and the number of adults diagnosed with diabetes has more than doubled in the past 20 years (1). Another 96 million Americans have prediabetes and are at high risk for developing type 2 diabetes (1). Not managing type 2 diabetes can result in morbidity, avoidable health care use, decreased quality of life, and premature death (2,3). Type 2 diabetes is the leading cause of lower-limb amputations, new cases of blindness, and kidney failure among adults in the United States (1). The total direct and indirect cost of type 2 diabetes was estimated to be \$327 billion in 2017 (4). These costs include

\$7.8 million in hospital discharges associated with type 2 diabetes in 2016 (4).

The burden of type 2 diabetes is disproportionately higher among some racial/ethnic groups. Data show that non-Hispanic American Indian/Alaska Native (AI/AN; 14.7%), Hispanics/Latino (12.5%), non-Hispanic African American (11.7%), and non-Hispanic Asian-American (9.2%) adults have a higher prevalence of type 2 diabetes than non-Hispanic White adults (7.5%) (4). Non-Hispanic AI/ANs are twice as likely to have type 2 diabetes as non-Hispanic Whites, and half of Hispanic/Latino individuals and non-Hispanic African American

Corresponding author: Nadereh Pourat, pourat@ucla.edu
<https://doi.org/10.2337/ds22-0016>

This article contains supplementary material online at <https://doi.org/10.2337/figshare.20493261>.

©2022 by the American Diabetes Association. Readers may use this article as long as the work is properly cited, the use is educational and not for profit, and the work is not altered. More information is available at <https://www.diabetesjournals.org/journals/pages/license>.

women are predicted to develop type 2 diabetes (5). Racial/ethnic minorities disproportionately experience type 2 diabetes-related complications, including diabetic retinopathy, lower-extremity amputation, and end-stage renal disease (6,7). Furthermore, racial/ethnic minorities are more likely than non-Hispanic Whites to have diabetes-related hospitalizations and emergency department (ED) visits (8,9).

Many type 2 diabetes–related complications are avoidable (1). Much of type 2 diabetes management is conducted in the primary care setting, and guidelines recommend more frequent primary care visits based on individual treatment and disease severity (10). Routine monitoring of blood glucose levels with A1C testing and foot and dilated eye exams can prevent or mitigate complications of type 2 diabetes (10). Appropriate and timely outpatient care can help prevent negative diabetes-related outcomes such as avoidable hospitalizations, all-cause mortality, and related expenditures (11). Furthermore, type 2 diabetes management in primary care has been associated with positive care outcomes, including improved glycemic targets, meeting of blood pressure and cholesterol goals, and positive changes in patient self-management behavior (12).

However, data show racial/ethnic disparities, including higher A1C levels and lower rates of A1C testing for Hispanic/Latinos and non-Hispanic African Americans (13). The literature also shows lower rates of annual foot and eye exams among Hispanic/Latinos and non-Hispanic Asians (14). Moreover, non-Hispanic African Americans with type 2 diabetes were found to be more likely to see a specialist and to have both diabetes-related and all-cause ED visits and were less likely to visit a doctor's office compared with non-Hispanic Whites (15,16).

As premier safety-net providers, Health Resources & Services Administration (HRSA)-funded health centers (HCs) delivered primary care to >28 million low-income and uninsured patients in 2020, 62% of whom were racial/ethnic minorities (17). One in seven patients have type 2 diabetes, which is not well managed in one-third of these individuals (17,18). The mission of HCs is to improve health and advance health equity in access to quality primary health care services regardless of patients' ability to pay. Consistent with the American Diabetes Association's (ADA's) published standards of diabetes care (10), HCs are required to report annually the percentage of patients with diabetes who have an A1C level >9%, or did not have an A1C test conducted (i.e., diabetes that is not well managed) (10,17).

Existing literature has shown mixed results on diabetes quality improvement and patient experiences of care by race/ethnicity in HCs. One study observed disparities in

A1C levels among Hispanic/Latino and non-Hispanic African American HC patients compared with non-Hispanic Whites (19). Another study found differences in type 2 diabetes quality of care, with non-Hispanic Asian HC patients reporting worse care experiences (20). On the other hand, HCs also have been shown to provide better type 2 diabetes care than private physicians and have adopted a culture of quality improvement that has been shown to improve type 2 diabetes care processes and outcomes (21,22). Despite these findings, there is a gap in the literature on whether HCs have addressed racial/ethnic disparities by appropriately providing type 2 diabetes management with subsequent improved outcomes of care.

The purpose of this study was to explore whether racial/ethnic differences exist in 1) type 2 diabetes management, 2) type 2 diabetes–related outcomes, and 3) indicators of high utilization of health services. We expected that all HC patients with type 2 diabetes, regardless of race/ethnicity, would be found to receive diabetes management because HCs are held accountable for their performance and have delivered culturally competent care (18). However, we expected some differences in diabetes-related outcomes and high service utilization rates because factors other than diabetes management by HCs (e.g., variations in disease severity) may determine outcomes (23).

Subjects, Materials, and Methods

Data Sources

We used data from the 2014 Health Center Patient Survey (HCPS), which was sponsored by the HRSA Bureau of Primary Health Care. HCPS was a cross-sectional, nationally representative in-person survey of patients served by HCs. Interview questions focused on sociodemographic characteristics, health conditions and behaviors, and access to and utilization of health care services. The HCPS oversampled patients who identified as non-Hispanic Asian, non-Hispanic AI/AN, or non-Hispanic Native Pacific Islander and those ≥65 years of age to improve the representation of these groups. A three-stage sampling design to select HC organizations, sites, and patients was used to obtain the sampling frame. A total of 169 HC organizations, 520 sites within those HCs, and a random sample of patients who entered the sites and those with at least one prior visit to the HC in the past year were eligible to participate in the survey. A total of 7,002 patient interviews were completed. The response rate was 66% of the total patients initially identified and 91% among patients confirmed to be eligible.

We also included data from the 2014 Uniform Data System (UDS), an administrative data set reported by all HC

organizations that includes information on HC patient demographics, size and staffing, types of services delivered, clinical quality measures, and revenues. UDS captures aggregate information at the HC organization level rather than individual delivery sites within the organization. UDS data were merged with the HC where each respondent was interviewed (24). For our study, we restricted the sample to adult HC patients who were ≥ 18 years of age ($n = 5,592$), diagnosed with nongestational diabetes by a health care professional ($n = 1,199$), and identified the HC where they were interviewed as their usual source of care ($n = 1,129$). We also restricted our analysis to 858 patients with type 2 diabetes and excluded 271 respondents with type 1 diabetes because of potential differences in management of such patients. We lacked data on whether patients had other forms of diabetes; therefore, such patients may have been included in our sample. We also excluded 22 respondents who were non-Hispanic Native Hawaiian or Pacific Islander and other race/ethnicity because of heterogeneity (e.g., rates of type 2 diabetes, care-seeking patterns, and provider interactions) of these groups and our inability to study them separately due to their sparse sample size (25). Thus, our final analytical sample was 836 patients.

Dependent Variables

Diabetes management indicators were selected from the ADA's standards of care (10). We examined receipt of at least two A1C tests annually (vs. fewer or none), foot examination (i.e., seen or talked with a foot doctor in the past year vs. not), eye examination (i.e., seen or talked with an eye doctor in the past year vs. not), and timely cholesterol check (i.e., patient's last cholesterol check by a provider was less than 1 year vs. ≥ 1 year ago). We also examined care management interventions such as receipt of a referral to a specialist (vs. no referral), individualized treatment plan (vs. no individualized plan), and a telephone call; an appointment with the nurse; or a home visit from the HC to teach diabetes self-care (vs. no self-care services) (10).

We also examined three negative diabetes-related outcomes, including being told by a provider at the last visit that blood glucose levels were too high (vs. too low or just right), having a diabetes-related hospitalization or ED visit within the past year (vs. none), and being very confident in ability to manage diabetes (vs. somewhat/not too/not at all confident). We considered confidence in diabetes management independent of diabetes management indicators because confidence could be affected by primary care interventions such as health education and provider counseling. We also examined indicators of high service use, including five or more outpatient visits to the HC in the past year (vs. fewer), any all-cause ED visits in

the past year (vs. none), and all-cause hospitalization after an ED visit (vs. not hospitalized or did not visit an ED). We chose to examine five or more primary care visits because most patients with well-managed diabetes may require up to four visits in quarterly intervals (26). A detailed description of dependent variable construction and survey questions are presented in Supplementary Table S1.

Independent Variables

Our primary independent variable of interest was race/ethnicity, which included non-Hispanic White, Hispanic/Latino, non-Hispanic African American, non-Hispanic Asian, and non-Hispanic AI/AN.

We used Andersen's model of health care utilization to control for other determinants of utilization organized by predisposing, enabling, and need factors (27). Predisposing factors included self-reported age (18–44 vs. 45–64 or ≥ 65 years), sex, education (high school graduate or equivalent or more education vs. less than high school education), employment status (employed vs. unemployed or not in the labor force), area of residence (urban vs. rural), and U.S. Census region of residence (Northeast vs. South, Midwest, and West). Enabling factors included health insurance status (Medicaid vs. uninsured or other), federal poverty guideline (≥ 100 vs. 101–199 or $\geq 200\%$), and length of time the patient had been a patient at the HC as a measure of continuity of care (< 1 vs. 1–3 or ≥ 3 years).

Need factors included self-reported weight status (underweight or normal weight vs. overweight/obesity). Patients were considered to have underweight or normal weight if their BMI was < 25 kg/m², overweight if their BMI was 25–29.9 kg/m², or obesity if their BMI was ≥ 30 kg/m². Other need determinants included self-rated health status (fair or poor vs. excellent, very good, or good); needing help with activities of daily living; diagnosis of hypertension, asthma, or cardiovascular disease; length of time the patient had been diagnosed with diabetes (within the past 2 years vs. longer); and insulin use. HC characteristics were included as additional control variables. These included the number of HC patients in the last year as a measure of HC size and revenue per capita to quantify success in generating revenues.

Analytic Methods

We created generalized multilevel structural equation logistic regression models to assess the relationship of race/ethnicity and the dependent variables while controlling for other confounding factors. We included respondents with complete responses to all of the variables studied and excluded those with any missing data. We weighted

the analyses to account for the complex survey methodology of the HCPS. We further rescaled the weights to reduce the influence on the results of HCs that had a large number of patients. We discuss results with probability values of 0.05 or less in the text. Analyses were conducted using Stata, v. 16.0, statistical software.

Results

Sample characteristics overall and by race/ethnicity are displayed in Table 1. Patients in our sample were mostly middle-aged (45–64 years [54%]), were high school graduates (65%), and lived in the Southern region of the U.S. (35%). They were also predominately Medicaid insured (46%), poorer (59% at $\leq 100\%$ of the federal poverty guideline), long-term users of the HC (59% at > 3 years). Many had a co-occurring hypertension diagnosis (81%) and reported fair or poor health (65%). There were statistical differences in predisposing and need characteristics between racial/ethnic groups. For example, more non-Hispanic Whites had a high school education or more, fewer Asians reported having obesity weight status, more African Americans and Whites had hypertension, more non-Hispanic Whites had cardiovascular disease, and more non-Hispanic Whites and African Americans used insulin than other groups.

Data on diabetes management showed high rates of A1C testing (76%), eye doctor visits or contacts (73%), cholesterol checks (87%), and having an individual treatment plan (68%) in the last year (Table 2). But, the rate of foot doctor visits was lower (38%). Data on diabetes outcomes showed that more than half (54%) had blood glucose levels that were too high, although about half reported having high confidence in diabetes self-management (49%) and fewer (13%) reported diabetes-related ED visits or hospitalizations in the past year. General outcomes included high rates of five or more HC visits (44%), one or more all-cause ED visits (54%), and all-cause hospitalization after an ED visit (45%).

Table 3 presents the association of race/ethnicity and all dependent variables from regression models. We found racial/ethnic differences among several diabetes management variables. Non-Hispanic African American (odds ratio [OR] 0.25), Hispanic/Latino (OR 0.26), and non-Hispanic Asian (OR 0.11) patients with diabetes all had lower odds of having a cholesterol check < 1 year ago compared with non-Hispanic Whites. Non-Hispanic AI/AN had higher odds (OR 2.55) of foot doctor visits than non-Hispanic White patients. Hispanic/Latinos had lower odds (OR 0.45) of receiving an individual diabetes management plan. There were no significant racial/ethnic differences in diabetes-related outcomes. However, non-Hispanic African American patients had lower

odds (OR 0.43) of having five or more office visits than non-Hispanic White patients. Full regression model results are displayed in Supplementary Tables S2–S4.

Discussion

Our analyses showed racial/ethnic parity in several indicators and some disparities for specific groups in several other indicators for HC patients with type 2 diabetes. Our findings of racial/ethnic parity in most of the diabetes management indicators (A1C, eye doctor visits, and specialist referrals) counters the existing literature that shows disparities, with fewer A1C tests and foot doctor visits for Hispanics/Latinos (13–15,23,28). Not all patients may require an exam by a podiatrist, although disparities in rates of exams are noteworthy. Our finding of more foot doctor visits among non-Hispanic AI/ANs is consistent with the literature (14,23,29). This finding may be because AI/ANs suffer disproportionately from diabetes-related limb amputations and are less likely than Whites to check their feet for sores or irritation (6,29). The variations in underlying severity or levels of self-care may require further effort to manage some populations with type 2 diabetes. Our finding that Hispanic/Latino patients had a lower likelihood of receiving an individualized treatment plan was supported by a study of the older adult population in California (30). Our finding of disparities in cholesterol checks for nearly all racial/ethnic groups was consistent with the literature (31,32).

Although our findings of parity in diabetes management are positive indicators of equitable treatment of all HC patients, variability among racial/ethnic groups in type 2 diabetes-related adverse outcomes suggests that parity in care management procedures such as eye doctor visits and specialist referrals may not be enough. For example, non-Hispanic African American and Hispanic populations are more likely to develop diabetic retinopathy, and non-Hispanic Native Americans have the highest prevalence rate of diabetic retinopathy (6). Our findings suggest that eye examinations may be low among populations that are at particular risk of diabetic retinopathy. Other research has indicated the importance of primary care provider coordination with eye care providers and the provision of health education to ameliorate barriers to eye care (33,34).

Our findings of parity in type 2 diabetes-related outcomes (high blood glucose levels, ED visits, and hospitalizations) were also positive given the existing evidence that indicates higher rates of these outcomes among non-Hispanic African American populations because of greater severity of disease and lower socioeconomic status (16,35). Parity in self-care confidence in our data may reflect the cultural competence

TABLE 1 Sample Characteristics by Race/Ethnicity

	Total	Non-Hispanic White	Non-Hispanic African American	Hispanic or Latino	Non-Hispanic Asian	Non-Hispanic AI/AN	P
Sample size, n (%)	836 (100)	220 (26)	188 (22)	301 (36)	43 (5)	84 (10)	
<i>Predisposing characteristics</i>							
Age, years							0.409
18-44	24	21	32	27	0	13	
45-64	54	55	48	57	52	57	
≥65	22	24	20	16	48	31	
Female sex	53	52	52	58	71	55	0.812
Education attainment							0.033
Less than high school	35	27	36	60	37	46	
High school graduate or more	65	73	64	40	63	54	
Employment status							0.012
Unemployed or not in labor force	76	84	63	60	79	83	
Employed	24	16	37	40	21	17	
Residence status							0.062
Urban	34	27	45	44	85	45	
Rural	66	73	55	56	15	55	
Region							<0.001
Northeast	12	5	26	23	45	15	
South	35	39	42	13	3	34	
Midwest	22	29	16	4	0	5	
West	31	27	16	61	52	46	
<i>Enabling characteristics</i>							
Insurance status							0.672
Medicaid	46	42	48	55	50	57	
Uninsured	27	31	21	21	30	10	
Other	28	28	31	24	20	33	
Federal poverty guideline, %							0.954
≤100	59	60	58	56	75	57	
101-199	26	26	29	27	17	31	
≥200	15	15	13	17	8	13	
Length of time at HC (continuity), years							0.127
<1	12	14	5	9	17	12	
1-3	29	34	26	18	9	15	
>3 years	59	52	68	73	74	73	
<i>Need characteristics</i>							
Weight status based on BMI, kg/m ²							0.002
<25.0 (underweight/normal weight)	10	10	3	13	69	8	
25.0 to 29.99 (overweight)	19	17	12	33	20	10	
≥30 (obese)	71	72	85	54	11	82	
Self-assessed health status							0.751
Excellent/very good/good	35	34	39	33	27	49	
Fair/poor	65	66	61	67	73	51	
Need help with activities of daily living	39	42	34	30	27	51	0.349
Has hypertension	81	85	83	66	67	74	0.052
Has asthma	18	14	33	17	12	20	0.015
Has cardiovascular disease	26	36	9	9	10	34	<0.001
Diagnosed with diabetes in past 2 years	20	17	25	25	20	14	0.557
Insulin use	50	56	46	36	4	40	0.012

CONTINUED ON P. 74 ›

CONTINUED FROM P. 73

TABLE 1 Sample Characteristics by Race/Ethnicity

	Total	Non-Hispanic White	Non-Hispanic African American	Hispanic or Latino	Non-Hispanic Asian	Non-Hispanic AI/AN	P
<i>HC characteristics</i>							
HC patients, n	36,259	30,774	42,134	47,995	50,784	45,624	<0.001
HC revenue per capita, \$	741	702	721	841	1,076	1,097	<0.001

Data are % unless otherwise indicated. Analyses were conducted using χ^2 or t tests, as appropriate. Source: 2014 HCPS and 2014 UDS. Sample included adult patients ≥ 18 years of age who reported the HC as their usual source of care, were not pregnant, and had a diagnosis of type 2 diabetes.

of HC providers and the provision of diabetes health education and literacy assistance to HC patients (36). HCs have chiefly aimed to provide diabetes education and tools for self-management through their clinics (37,38).

HCs have been addressing procedural clinical care strategies for several decades, and these practices are one possible explanation for the parity findings. Health Disparities Collaboratives in many HCs aim to reduce health disparities and improve chronic care and are reported to improve clinical processes in the short term and clinical processes and outcomes in the long term (22).

Although we expected to find disparities in high levels of service use (i.e., multiple HC visits), the direction of differences observed was unanticipated. We found a lower likelihood of having five or more HC visits for non-Hispanic African Americans. Other studies, however, found that non-Hispanic African Americans had more outpatient visits than non-Hispanic Whites and that non-Hispanic African Americans and Hispanics were more likely to have all-cause ED visits and hospitalizations (16,23,35). In one study, the higher number of outpatient visits for African Americans and Hispanic/Latinos was attributable to greater severity of diabetes (39).

TABLE 2 Diabetes Management, Diabetes Outcomes, and General Outcomes by Race/Ethnicity

	Total	Non-Hispanic White	Non-Hispanic African American	Hispanic or Latino	Non-Hispanic Asian	Non-Hispanic AI/AN	P
Sample size, n (%)	836 (100)	220 (26)	188 (22)	301 (36)	43 (5)	84 (10)	
<i>Diabetes management</i>							
A1C (≥ 2 tests in past year)	76	77	84	66	44	64	0.081
Seen/talked with a foot doctor in past year	38	36	40	38	58	50	0.723
Seen/talked with an eye doctor in past year	73	77	71	62	80	78	0.273
<1 year since cholesterol check	87	91	80	80	84	82	0.122
Received specialist referral	16	14	21	21	6	24	0.487
Received individualized treatment plan	68	71	73	57	38	62	0.164
Received call, appointment, or visit to teach diabetes self-care	39	37	32	52	46	41	0.330
<i>Diabetes outcomes</i>							
Blood glucose too high at last visit with a provider	54	53	54	61	51	49	0.803
Hospitalization or ED visit in the past year	13	14	12	10	2	11	0.703
Very confident in self-management	49	46	55	54	67	52	0.719
<i>General outcomes</i>							
≥ 5 visits to HC in past year	44	48	31	46	32	56	0.265
Any all-cause ED visits	54	57	57	45	21	48	0.366
All-cause hospitalization after ED	45	50	37	31	64	49	0.278

Data are % unless otherwise indicated. Analyses were conducted using χ^2 tests. Source: 2014 HCPS and 2014 UDS. Sample included adult patients ≥ 18 years of age who reported the HC as their usual source of care, were not pregnant, and had a diagnosis of type 2 diabetes.

TABLE 3 Adjusted Regression Models of Diabetes Management, Diabetes Outcomes, and General Outcomes by Race/Ethnicity

	Non-Hispanic African American	Hispanic or Latino	Non-Hispanic Asian	Non-Hispanic AI/AN
<i>Diabetes management</i>				
A1C (≥ 2 tests in past year)	0.74	0.45	0.35	0.48
Seen/talked with a foot doctor in past year	1.33	1.42	1.66	2.55*
Seen/talked with an eye doctor in past year	1.11	0.59	0.96	2.92
<1 year since cholesterol check	0.25**	0.26*	0.11*	0.36
Received specialist referral	2.05	1.31	2.51	1.79
Received individualized treatment plan	1.15	0.45*	0.66	0.86
Received call, appointment, or visit to teach diabetes self-care	1.73	1.79	2.22	0.48
<i>Diabetes outcomes</i>				
Blood glucose too high at last visit with a provider	0.82	1.38	2.60	0.80
Hospitalization or ED visit in the past year	1.32	2.01	4.29	1.20
Very confident in self-management	1.53	1.16	0.32	0.96
<i>General outcomes</i>				
≥ 5 visits to HC in past year	0.43*	0.61	1.80	1.15
Any all-cause ED visits	0.85	0.53	0.37	0.72
All-cause hospitalization after ED	0.31	0.91	0.49	1.12

Data are ORs using non-Hispanic White as the reference category. *Statistically significant at $P < 0.05$. **Statistically significant at $P < 0.01$. Source: 2014 HCPS and 2014 UDS. Sample included adult patients ≥ 18 years of age who reported the HC as their usual source of care, were not pregnant, and had a diagnosis of type 2 diabetes.

Limitations

The HCPS was a cross-sectional survey and did not allow for causal inference. Survey responses were self-reported and subject to recall and acquiescence bias. For example, patients who remembered their diabetes diagnosis may have had greater disease severity and were more likely to remember receiving diabetes care management from the HC or to report lower confidence in managing their diabetes. We were unable to study all racial/ethnic groups such as non-Hispanic Native Hawaiians and Pacific Islanders because of their small sample sizes. In addition, the number of patients with type 1 diabetes was very small for reliable estimates, and we were therefore unable to assess diabetes management or outcomes for these patients by race/ethnicity. We also lacked data on severity of diabetes to assess whether our findings of parity were desirable given the disproportionate burden of type 2 diabetes by race/ethnicity.

Conclusion

Collectively, our findings indicate racial/ethnic parity in most and disparity in some indicators of care for some HC patients with type 2 diabetes. Further research is needed to assess whether provision of diabetes care management for

each racial/ethnic group is commensurate with patients' diabetes severity.

Addressing disparities identified in the time since last cholesterol check, the provision of individualized treatment plans, and the number of HC visits in this study requires additional action. More research is needed to examine reasons for such disparities. For example, lower rates of recent cholesterol checks may have been the result of lower rates of laboratory orders by providers or the result of patient factors such as limited access to a laboratory. For the former, approaches such as strengthening providers' compliance with guidelines may be required; for the latter, providing transportation or other means of improving access may be required.

More recent initiatives and awards by HRSA have focused on improving the quality of diabetes care and diabetes management among HCs (40,41). HRSA, through its Health Disparities Reducer category, provides quality improvement awards to HCs that have demonstrated improvement across racial/ethnic groups for a number of outcomes, including diabetes management, hypertension management, and low birth weight (41). Including additional reporting of quality of care by race/ethnicity can further highlight disparities and promote actions to address them. In addition, HCs

have moved toward greater use of telehealth and community health workers for type 2 diabetes self-management patient support (42,43). These efforts are likely to improve overall type 2 diabetes outcomes but may have a differential effect on racial/ethnic groups. For example, socioeconomic differences in access to devices with cameras and Internet access may exacerbate disparities, whereas the involvement of community health workers may ameliorate disparities. Similarly, awards and initiatives should address effectively reducing racial/ethnic disparities in both the severity and outcomes of type 2 diabetes.

The mission of HRSA-funded HCs includes “improving the health of the nation’s underserved communities and vulnerable populations by assuring access to comprehensive, culturally competent, quality primary health care services” (44). Within this context, our results indicate the likelihood of progress with room for improvement.

FUNDING

This research was funded by the U.S. Department of Health and Human Services, Health Resources & Services Administration, under contract number HSH2502013000231. The views expressed in this publication are solely the opinions of the authors and do not necessarily reflect the official policies of the U.S. Department of Health and Human Services or the Health Resources & Services Administration, nor does mention of the department or agency names imply endorsement by the U.S. government.

DUALITY OF INTEREST

At the time of this study, B.H. and J.B. were employees of the U.S. Department of Health and Human Services, which funded this study, and A.S. is an employee of the same department. No other potential conflicts of interest relevant to this article were reported.

AUTHOR CONTRIBUTIONS

N.P. and A.S. conceived of the study. N.P. and X.C. directed the statistical analysis and interpreted the data. N.P. drafted the manuscript. C.L. and W.Z. assisted with analysis and interpretation of the data. All authors reviewed and revised the manuscript critically for intellectual content and approved the final manuscript for submission. N.P. is the guarantor of this work and, as such, had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

PRIOR PRESENTATION

Data pertaining to this study were previously presented at the virtual AcademyHealth Annual Research Meeting in June 2021 and the virtual American Public Health Association Annual Meeting & Expo in October 2021.

REFERENCES

- Centers for Disease Control and Prevention. What is diabetes? Available from <https://www.cdc.gov/diabetes/basics/diabetes.html>. Accessed 23 May 2022
- American Diabetes Association Professional Practice Committee. 2. Classification and diagnosis of diabetes: *Standards of Medical Care in Diabetes—2022*. *Diabetes Care* 2022;45 (Suppl. 1):S17–S38
- Baena-Díez JM, Peñafiel J, Subirana I, et al.; FRESCO Investigators. Risk of cause-specific death in individuals with diabetes: a competing risks analysis. *Diabetes Care* 2016;39: 1987–1995
- Centers for Disease Control and Prevention. *National Diabetes Statistics Report, 2020: Estimates of Diabetes and Its Burden in the United States*. Atlanta, GA, Centers for Disease Control and Prevention, U.S. Department of Health and Human Services, 2020
- Centers for Disease Control and Prevention. Diabetes fast facts. Available from <https://www.cdc.gov/diabetes/basics/quick-facts.html>. Accessed 12 March 2020
- Spanakis EK, Golden SH. Race/ethnic difference in diabetes and diabetic complications. *Curr Diab Rep* 2013;13:814–823
- O’Connell J, Yi R, Wilson C, Manson SM, Acton KJ. Racial disparities in health status: a comparison of the morbidity among American Indian and U.S. adults with diabetes. *Diabetes Care* 2010;33:1463–1470
- Cook CB, Naylor DB, Hentz JG, et al. Disparities in diabetes-related hospitalizations: relationship of age, sex, and race/ethnicity with hospital discharges, lengths of stay, and direct inpatient charges. *Ethn Dis* 2006;16:126–131
- Menchine MD, Wiechmann W, Peters AL, Arora S. Trends in diabetes-related visits to US EDs from 1997 to 2007. *Am J Emerg Med* 2012;30:754–758
- American Diabetes Association. *Standards of Medical Care in Diabetes—2022* abridged for primary care providers. *Clin Diabetes* 2022;40:10–38
- Kim S. Burden of hospitalizations primarily due to uncontrolled diabetes: implications of inadequate primary health care in the United States. *Diabetes Care* 2007;30:1281–1282
- Stellefson M, Dipnarine K, Stopka C. The chronic care model and diabetes management in US primary care settings: a systematic review. *Prev Chronic Dis* 2013;10:E26
- Canedo JR, Miller ST, Schlundt D, Fadden MK, Sanderson M. Racial/ethnic disparities in diabetes quality of care: the role of healthcare access and socioeconomic status. *J Racial Ethn Health Disparities* 2018;5:7–14
- Peraj E, Subhani MR, Jeong J, Vaknin OS, Twarog JP. Characteristics among adult patients with diabetes who received a foot exam by a health care provider in the past year: an analysis of NHANES 2011–2016. *Prim Care Diabetes* 2019;13: 242–246
- Vaccaro JA, Anderson K, Huffman FG. Diabetes self-management behaviors, medical care, glycemic control, and self-rated health in U.S. men by race/ethnicity. *Am J Men Health* 2016;10:NP99–NP108
- Taylor YJ, Spencer MD, Mahabaleshwar R, Ludden T. Racial/ethnic differences in healthcare use among patients with uncontrolled and controlled diabetes. *Ethn Health* 2019;24: 245–256
- Health Resources & Services Administration. National Health Center Program Uniform Data System (UDS) awardee data. Available from <https://data.hrsa.gov/tools/data-reporting/program-data/national>. Accessed 11 March 2021
- Health Resources & Services Administration. Diabetes and health centers. Available from <https://bphc.hrsa.gov/qualityimprovement/clinicalquality/diabetes.html#2018-uds>. Accessed 6 April 2020
- Cole MB, Wright B, Wilson IB, Galárraga O, Trivedi AN. Longitudinal analysis of racial/ethnic trends in quality outcomes in community health centers, 2009–2014. *J Gen Intern Med* 2018;33:906–913

20. Leung LB, Vargas-Bustamante A, Martinez AE, Chen X, Rodriguez HP. Disparities in diabetes care quality by English language preference in community health centers. *Health Serv Res* 2018;53:509–531
21. Sadowski D, Devlin M, Hussain A. Better care at safety net providers? Utilization of recommended standards of diabetes care for rural Latinos in one Midwestern state. *J Health Care Poor Underserved* 2011;22:995–1013
22. Chin MH. Quality improvement implementation and disparities: the case of the health disparities collaboratives. *Med Care* 2010;48:668–675
23. Chandler RF, Monnat SM. Racial/ethnic differences in use of health care services for diabetes management. *Health Educ Behav* 2015;42:783–792
24. Laukaityte I, Wiberg M. Importance of sampling weights in multilevel modeling of international large-scale assessment data. *Commun Stat Theory Methods* 2018;47:4991–5012
25. Bacong AM, Holub C, Porotesano L. Comparing obesity-related health disparities among Native Hawaiians/Pacific Islanders, Asians, and Whites in California: reinforcing the need for data disaggregation and operationalization. *Hawaii J Med Public Health* 2016;75:337–344
26. Centers for Disease Control and Prevention. Your diabetes care schedule. Available from <https://www.cdc.gov/diabetes/managing/care-schedule.html>. Accessed 11 March 2021
27. Andersen RM, Davidson P. Improving access to care in America: individual and contextual indicators. In *Changing the US Health Care System: Key Issues in Health Services Policy and Management*. Andersen R, Rice T, Kominski G, Eds. San Francisco, CA, Jossey-Bass, 2007, p. 3–31
28. Hooks-Anderson DR, Crannage EF, Salas J, Scherrer JF. Race and referral to diabetes education in primary care patients with prediabetes and diabetes. *Diabetes Educ* 2015;41:281–289
29. Littman AJ, Knott CJ, Boyko EJ, Hawes SE. Associations between racial and ethnic groups and foot self-inspection in people with diabetes. *Diabetes Care* 2020;43:956–963
30. Kim G, Ford KL, Chiriboga DA, Sorkin DH. Racial and ethnic disparities in healthcare use, delayed care, and management of diabetes mellitus in older adults in California. *J Am Geriatr Soc* 2012;60:2319–2325
31. Harris MI. Racial and ethnic differences in health care access and health outcomes for adults with type 2 diabetes. *Diabetes Care* 2001;24:454–459
32. Kenik J, Jean-Jacques M, Feinglass J. Explaining racial and ethnic disparities in cholesterol screening. *Prev Med* 2014;65:65–69
33. Walker EA, Basch CE, Howard CJ, Zybert PA, Kromholz WN, Shamoon H. Incentives and barriers to retinopathy screening among African-Americans with diabetes. *J Diabetes Complications* 1997;11:298–306
34. Heisler M, Smith DM, Hayward RA, Krein SL, Kerr EA. Racial disparities in diabetes care processes, outcomes, and treatment intensity. *Med Care* 2003;41:1221–1232
35. Jiang HJ, Stryer D, Friedman B, Andrews R. Multiple hospitalizations for patients with diabetes. *Diabetes Care* 2003;26:1421–1426
36. Rosal MC, Ockene IS, Restrepo A, et al. Randomized trial of a literacy-sensitive, culturally tailored diabetes self-management intervention for low-income Latinos: Latinos en Control. *Diabetes Care* 2011;34:838–844
37. Chin MH, Drum ML, Guillen M, et al. Improving and sustaining diabetes care in community health centers with the health disparities collaboratives. *Med Care* 2007;45:1135–1143
38. Welch G, Allen NA, Zagarins SE, Stamp KD, Bursell S-E, Kedziora RJ. Comprehensive diabetes management program for poorly controlled Hispanic type 2 patients at a community health center. *Diabetes Educ* 2011;37:680–688
39. Mayo-Gamble TL, Lin HC. Healthcare utilization and diabetes management programs: Indiana 2006–2010. *Am J Manag Care* 2014;20:e461–e468
40. Latham E, Bruggeman J. *Diabetes Quality Improvement Initiative: Performance Improvement Analysis*. Rockville, MD, Health Resources & Services Administration Bureau of Primary Health Care, 2020
41. U.S. Department of Health & Human Services. HHS awards \$107 million to support health center quality improvement. Available from <https://www.hhs.gov/about/news/2019/08/20/hhs-awards-107-million-dollars-to-support-health-center-quality-improvement.html>. Accessed 8 April 2020
42. Davis RM, Hitch AD, Salaam MM, Herman WH, Zimmer-Galler IE, Mayer-Davis EJ. Telehealth improves diabetes self-management in an underserved community: Diabetes TeleCare. *Diabetes Care* 2010;33:1712–1717
43. Hargraves JL, Ferguson WJ, Lemay CA, Pernice J. Community health workers assisting patients with diabetes in self-management. *J Ambul Care Manage* 2012;35:15–26
44. Health Resources & Services Administration. What is a health center? Available from <https://bphc.hrsa.gov/about/what-is-a-health-center/index.html>. Accessed 11 March 2021