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# Diabetes Self-Management Education and Association With Diabetes Self-Care and Clinical Preventive Care Practices

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## Abstract

**Purpose:** The purpose of the study is to assess self-reported receipt of diabetes education among people with diabetes and its association with following recommended self-care and clinical preventive care practices.

**Methods:** We analyzed data from the 2017 and 2018 Behavioral Risk Factor Surveillance System for 61 424 adults (≥18 years) with self-reported diabetes in 43 states and Washington, DC. Diabetes education was defined as ever taking a diabetes self-management class. The association of diabetes education with self-care practices (daily glucose testing, daily foot checks, smoking abstention, and engaging in leisure-time physical activity) and clinical practices (pneumococcal vaccination, biannual A1C test, and an annual dilated eye exam, influenza vaccination, health care visit for diabetes, and foot exam by a medical professional) was assessed. Multivariable logistic regression with predicted margins was used to predict the probability of following these practices, by diabetes education, controlling for sociodemographic factors.

**Results:** Of adults with diabetes, only half reported receiving diabetes education. Results indicate that receipt of diabetes education is associated with following self-care and clinical

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preventive care practices. Those who did receive diabetes education had a higher predicted probability for following all 4 self-care practices (smoking abstention, daily glucose testing, daily foot check, and engaging in leisure-time physical activity) and all 6 clinical practices (pneumonia vaccination, biannual A1C test, and an annual eye exam, flu vaccination, health care visit, and medical foot exam).

**Conclusions:** The prevalence of adults with diabetes receiving diabetes education remains low. Increasing receipt of diabetes education may improve diabetes-related preventive care.

Diabetes is a serious chronic disease affecting more than 34 million (1 in every 10) US adults.[1] Individuals with diabetes are at risk for developing serious complications, including renal failure, vision impairment, blindness, lower extremity amputations, myocardial infarction, and stroke. Preventing these serious and costly complications requires lifestyle modification and consistent management of blood glucose, lipids, and blood pressure. Glycemic targets can be achieved through daily monitoring of blood glucose levels, regular physical activity, adopting a dietary pattern that is recommended for diabetes management, and taking medications if needed. Diabetes care and education specialists (DCES) and other health care professionals can work as a team with individuals living with diabetes to achieve the necessary education, self-efficacy, and empowerment for effective diabetes self-management.

Accredited by the Association of Diabetes Care and Education Specialists (ADCES) and recognized by the American Diabetes Association (ADA), diabetes self-management education and support (DSMES) is an evidence-based patient-centered approach that provides the knowledge, skills, and abilities necessary for diabetes self-care and empowers individuals to sustain health-promoting behaviors that can prevent or delay diabetes complications and improve quality of life.[2,3] In response to the growing public health issue of diabetes-associated complications, mortality, and economic costs,[1,3] the ADA, ADCES, and the Academy of Nutrition and Dietetics recommend that all persons with diabetes receive DSMES services at the time of diagnosis and as needed thereafter.[2] Evidence has shown that diabetes-related complications are 4 times more likely to develop in people who do not receive DSMES compared to those who do.[4] The need for DSMES is continuing to grow because the number of people living with diabetes in the United States has increased in the last 3 decades[5]; however, studies have shown that uptake of DSMES remains critically low.[2]

Improving referral to and enrollment in DSMES for individuals with diabetes may depend in part on generating a strong evidence base for the effectiveness of these programs. Some of the benefits of DSMES have been documented, including improving knowledge, clinical outcomes, and quality of life for adults living with diabetes.[2,3,6,7] One study found that compared to those who did not participate in DSMES, those who participated in DSMES were 1.5 times more likely to improve clinical outcomes such as receiving retinal eye exams and nephropathy screening, being prescribed antihypertensive medications, and achieving control of blood pressure, cholesterol, and A1C.[8] Notably, the studies that have investigated this relationship have been clinic-based or state-specific, yielding results that are not generalizable to the US population.[6,7,9,10] For example, one study using North Carolina

data from the Behavioral Risk Factor Surveillance System (BRFSS) showed that among adults with diabetes, receiving DSMES was associated with following 7 of 8 preventive care measures: blood glucose self-monitoring, self-check of feet, physical activity, receiving an annual eye exam and flu shot, having a foot exam by a health professional, and having at least 2 A1C tests in the past 12 months.[11]

To address these gaps in the literature, the present study utilizes BRFSS data from 43 states to (1) assess self-reported receipt of diabetes education among US adults with diabetes, (2) examine sociodemographic disparities in receipt of diabetes education, and (3) examine the association of receiving diabetes education with following 10 recommended self-care and clinical preventive care practices. This is the first published study to examine these research questions using a large sample of adults derived from the majority of US states.

## Research Design and Methods

### Study Population and Data

This analysis was performed using data from the 2017 and 2018 BRFSS. The BRFSS is an annual, state-based, random-digit-dial telephone survey that uses multistage, stratified sampling to select a representative sample of the noninstitutionalized US adult population (≥18 years) in 50 states, the District of Columbia (DC), and selected US territories. BRFSS is conducted by state and territorial health departments, with data-processing assistance by the US Centers for Disease Control and Prevention, to monitor health conditions, risk behaviors, health care access, and use of preventive services. BRFSS data-collection protocols are reviewed by the US Centers for Disease Control and Prevention's Institutional Review Board (Protocol No. 2988) and the Office of Management and Budget (OMB No. 0920–1061 Exp. Date 3/31/2021). BRFSS data are not subject to institutional review board approval because data are deidentified. Each year, BRFSS includes a standard set of questions in the core modules used by all states and territories and optional modules that states can elect to use. Data from the diabetes optional module was used, which was implemented in 43 states (Alabama, Alaska, Arizona, California, Colorado, Delaware, Florida, Georgia, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, Wyoming) and DC. The median response rate for combined landline and cell phone data was 45.9% in 2017 and 49.9% in 2018.[12,13] These states had a combined sample size of 457 888 adults age 18 years or older, and 63 272 of these adults had a self-reported diabetes diagnosis. Respondents who were missing data on diabetes education participation (n = 1848; 2.9%) were excluded from this analysis, yielding a final analytic sample of 61 424 adults with self-reported diabetes.

### Diabetes Status and Diabetes Self-Care and Preventive Service Outcome Measures

Self-reported diabetes diagnosis (either type 1 or 2) was determined using the question, "Has a doctor, nurse, or other health professional ever told you that you have diabetes?" Those reporting prediabetes or borderline diabetes or people who were told they had diabetes

only during pregnancy were not considered to have diabetes. The exposure variable was receipt of diabetes education, defined as a "yes" response to the question asked to people with diabetes, "Have you ever taken a course or class in how to manage your diabetes yourself?" Because the BRFSS question for diabetes education is general and may include other forms of diabetes self-management education in addition to the accredited/recognized DSMES program, any reference to diabetes self-management education, including DSMES, will hereafter be called "diabetes education." The outcomes investigated in this analysis are following 10 recommended diabetes-related preventive care practices. Four self-care practices were assessed: daily glucose testing, daily self-exam of feet, abstaining from smoking, and engaging in leisure-time physical activity (defined as participating in any physical activity or exercise during the past 30 days other than their regular job). Six clinical practices were assessed: pneumococcal vaccination, biannual A1C test, and annual dilated eye exam, influenza vaccination, health care professional visit for diabetes, and foot examination.

### Sociodemographic Characteristics and Other Controlling Variables

Sociodemographic characteristics included sex, age (18–44 years, 45–64 years, ≥65 years), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic other), marital status (married/domestic partnership, not married), education (< high school, high school/GED, ≥ some college), employment status (employed, not employed, homemaker, retired), health insurance status (insured, not insured), disability status (any disability, no disabilities), and county status (rural, urban). Any disability was defined as having 1 or more of the following types of disabilities: vision impairment, hearing impairment, cognitive disability, mobility disability, self-care disability, or independent living disability.

### Statistical Analysis

Multivariable logistic regression models with predicted margins were used to calculate the predicted probability of engaging in these 10 practices, by diabetes education participation, and controlling for age, sex, race/ethnicity, education, marital status, employment status, health insurance status, disability status, and county status (differences considered significant at $P < .05$). The denominator for all models was adults with self-reported diabetes. Chi-square tests were used to examine whether prevalence of diabetes education participation and the prevalence of following the 10 practices differed by various sociodemographic characteristics. Additionally, for each person, the number of preventive practices followed was summed, and we present the distribution of this variable by receipt of diabetes education. All analyses accounted for complex survey design and sampling weights. Weighted analyses were performed using STATA version 16.

## Results

The majority of the survey respondents with self-reported diabetes diagnosis were 45 years and older (88.2%), non-Hispanic White (59.1%), married (53.4%), high school graduates or had some college education (78.3%), insured with health insurance (92.7%), living with a disability (51.2%), and living in an urban county (91.8%; Table 1). Half (52.0%) of those with diabetes reported having ever participated in diabetes education (Table 2). There were

statistically significant differences in the prevalence of having received diabetes education by sex, race/ethnicity, marital status, education, employment status, health insurance status, and county status (several $\chi^2$ tests of significance at the level of $P < .05$). Participation was lowest among Hispanics (42.6%), those with less than a high school education (36.9%), and the uninsured (39.5%; Table 2). For self-care practices, there was a statistically significant difference in the prevalence of following each practice across several sociodemographic characteristics (Table 3); for all 4 self-care practices, there was a statistically significant difference by education, employment status, and disability status (several $\chi^2$ tests of significance at the level of $P < .05$). Similarly, for clinical preventive practices, there was a statistically significant difference in the prevalence of following each practice across several sociodemographic characteristics (Table 4), but it was only by health insurance status that the prevalence of following the practice differed significantly for all 6 clinical practices ($P < .05$).

In unadjusted analyses of diabetes education participation and following self-care and clinical preventive practices, those who participated had a higher predicted probability for all 10 practices (several $\chi^2$ tests of significance at the level of $P < .01$). Similarly, after adjusting for sociodemographic factors, those who participated in diabetes education had a higher predicted probability of all 4 self-care practices: being a current nonsmoker (86.6% [95% CI, 85.1–88.1] vs 88.8% [95% CI, 87.9–89.7]), engaging in leisure-time physical activity in the last month (57.3% [95% CI, 55.4–59.2] vs 66.3% [95% CI, 64.9–67.7]), daily self-monitoring of blood glucose (52.5% [95% CI, 50.7–54.4] vs 70.3% [95% CI, 68.8–71.8]), and daily self-exam of feet (52.4% [95% CI, 50.6–54.2] vs 62.3% [95% CI, 60.6–64.0]; (several $\chi^2$ tests of significance at the level of $P < .01$); Table 5). Those who participated in 73.0–75.9]), flu vaccination (51.9% [95% CI, 50.1–53.7] vs 57.8% [95% CI, 56.0–59.5]), health care visit for diabetes (85.9% [95% CI, 84.5–87.3] vs 92.2% [95% CI, 91.3–93.1]), and medical foot examination (68.3% [95% CI, 66.5–70.1] vs 83.0% [95% CI, 81.8–84.2]; (several $\chi^2$ tests of significance at the level of $P < .01$); Table 5). Overall, those who received diabetes education followed a higher number of preventive care practices compared to those who had not received diabetes education. Among those who received diabetes education, 1 in 4 followed 9 to 10 preventive care practices compared to 1 in 10 among those who never received diabetes education. More than 80% of those who received diabetes education followed 6 or more preventive care practices compared to 61% among those who had not participated in diabetes education (Figure 1).

## Conclusions

In this cross-sectional analysis of US adults with self-reported diabetes, a positive association was found between self-report of receiving diabetes education and following recommended diabetes self-care and clinical preventive care practices. Those who received education had a higher predicted probability for following all 10 recommended self-care behaviors and clinical practices. However, the present study found that only half of adults with diabetes had ever received education on managing their diabetes. Differences in the prevalence of receiving diabetes education by sex, race/ethnicity, marital status, education, employment status, health insurance status, and county status were also observed; the lowest

rates were observed among Hispanics, the uninsured, and those with less than a high school education.

The results of this study support the benefits of diabetes education and affirm that diabetes education participation is an important part of quality diabetes care.[6] These results are consistent with findings from clinic-based and single-state studies, which have shown a positive association between receiving diabetes education and following preventive care practices.[6,7,11,14,15] The study using North Carolina BRFSS data demonstrated that receiving diabetes education was associated with following numerous preventive care measures: self-monitoring of blood glucose, self-check of feet, engaging in physical activity, receiving an annual eye exam and flu shot, having a foot exam by a health professional, and having 2 or more A1C tests in the last 12 months.[11] The present findings confirm these results and also add evidence for 2 additional practices (smoking abstention and receiving a pneumonia shot) that seem to be absent from the existing literature. An important practice found to be associated with receipt of diabetes education is having a biannual A1C test. The present results indicate that 81% of adults who participated in diabetes education followed biannual A1C testing recommendations, compared to 71% among those who did not receive education. A previous study had found that participation in diabetes education is also associated with improvements in A1C levels, with an average A1C reduction of 0.45% to 0.57%.[2] Frequent A1C testing and tight glycemic control are critical because poor glycemic control is one of the strongest predictors of disease progression and development of diabetes complications.[6]

Despite the benefits, low program utilization remains a major challenge to diabetes education. The present study found a low rate of participation in diabetes education, consistent with 2 other studies[11,16]; however, the results in this study were higher than estimates than have been previously reported using health insurance claims data.[3,17] For example, claims data studies in recent years have shown that only 5% to 8% of Medicare beneficiaries utilize diabetes education services.[3,17] The difference in findings is likely due to the fact that BRFSS asks a general question about receipt of diabetes education rather than specifically ascertaining whether the respondent participated in an ADCES-accredited or ADA-recognized DSMES program.

In the analysis of characteristics associated with following clinical preventive practices, uninsured adults had a significantly lower prevalence of following all 6 clinical practices. Studies have shown that adults with diabetes who are underinsured or uninsured report lower rates of receiving diabetes education and following preventive care practices.[18–21] Those findings are consistent with the present results in which the uninsured were identified as a group with particularly low diabetes education participation, with only 39.5% reporting receipt of these services. However, studies have also shown that receipt of diabetes education and clinical preventive practices is low even among those with health insurance (either private, Medicaid, or Medicare); only 7% of privately insured individuals utilize diabetes education services.[18,19,22] Other factors contributing to low utilization may include lack of provider referral, geographic constraints to access such as living in rural areas, inconvenience related to time of services, language barriers, low health literacy, lack of cultural appropriateness in diabetes education, lack of transportation, or unwillingness to

participate.[7,20,21,23–25] Despite the benefits of diabetes education, provider referral remains low.[26] Raising awareness of the benefits of diabetes education among providers and people with diabetes and providing convenient times to attend are critical strategies to increase utilization. It is also important to better understand and address other structural and interpersonal barriers to receiving diabetes education to increase utilization.

Studies have consistently documented disparities in receipt of diabetes education across a number of sociodemographic characteristics.[3,15,16,20,21,23–25] This study showed a lower participation among individuals who were of ethnic minority, uninsured, living in rural counties, and had less than a high school education. Results show that Hispanic individuals had a lower rate of participation in diabetes education than non-Hispanic White and non-Hispanic Black respondents. This is consistent with findings from previous studies that found racial and ethnic minority groups with lower incomes, especially Spanish-speaking Hispanic immigrants, were less likely to engage in diabetes education.[21,23,24] Lower educational attainment and proficiency of the English language have also been identified as key factors that hinder the ability of Mexican immigrants to the United States to successfully manage diabetes complications compared to other foreign-born and US-born persons of Mexican heritage.[23] These findings underscore the need for education to be individualized and culturally and linguistically appropriate in addition to designing material at the appropriate literacy level.[15,23] Furthermore, expanding the availability of diabetes education in community settings, strengthening community-clinical linkages, and integration of community health workers as part of the care team are strategies that may address sociodemographic disparities in accessing diabetes education.[3,27,28] Under the supervision of a DCES, community health workers and other lay health workers can coordinate care and provide ongoing support for behavior change and are particularly effective at reaching populations experiencing health disparities.[28]

Additionally, disparities in the prevalence, treatment, and management of diabetes among rural communities have also been documented. Despite rural communities experiencing higher diabetes prevalence rates than their urban counterparts, adults living in rural areas were less likely to report participation in diabetes education.[20,25,29] The present study found a statistically significant but small difference by rural/urban status (52% vs 48%). Although the findings of lower participation in diabetes education in rural communities may be marginal, rural communities present their own unique challenges in receiving diabetes education, such as a lack of health care specialists and program availability in rural communities. This can create transportation challenges for rural residents due to the increased travel distance required to receive care.[20,25] One study found that 62% of nonmetropolitan counties did not have diabetes education programs.[29] The use of innovative telemedicine methods could enable cost-effective delivery of diabetes education and present opportunities to expand education and provide appropriate broadband access and cell coverage within rural communities. In addition, expanding incentive programs to recruit allied health professionals to practice in rural communities could be a promising strategy to provide care to underserved and rural populations.[30]

The findings in this report are subject to several limitations. First, BRFSS consists of self-reported data and can be subject to recall and reporting bias. Second, BRFSS is

only administered to noninstitutionalized adults, thus excluding those living in long-term care facilities where the prevalence of diabetes is estimated to be higher than that in the general population. Third, the outcome was defined as self-reported ever having received an education course in diabetes self-management. This is more general than participation in ADCES-accredited/ADA-recognized

DSMES and therefore may not capture consistent curriculum and standardized education for all survey respondents. Finally, it is likely that people who are more health conscious will be more likely to participate in diabetes education; thus, it cannot be concluded that receipt of diabetes education leads to improved self-management. Nevertheless, diabetes education does educate participants on the benefits of following such practices and therefore may have a positive influence. This study has important advantages over previous research because it reports on 10 self-care and clinical preventive care practices and the analysis was carried out using a large sample of adults derived from 43 US states.

The present study found that only half of adults with diabetes reported having ever received diabetes education. This analysis also demonstrated that receipt of diabetes education was positively associated with following self-care and clinical preventive care practices. It was found that approximately 4 in 5 adults who received diabetes education (compared to 3 in 5 who did not) followed 6 to 10 practices that are recommended by ADA due to their association with improved health outcomes for individuals with diabetes. Policy modifications such as reimbursement policies and expanding health insurance coverage for diabetes education could aid in increasing access and utilization.[14,19,26,31] Promoting the importance of diabetes education among health care professionals and developing strategies to improve referral mechanisms and access and utilization may be particularly important strategies for underserved communities and racial and ethnic minority groups. These strategies can help expand the benefits of diabetes education and improve health care utilization, clinical outcomes, and overall quality of life for people with diabetes.

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IM researched data and wrote the manuscript. EL and IM analyzed the data. All authors reviewed/edited the manuscript. The authors declare that they have no conflicts of interest relevant to this article. An abstract form of this study was presented at the 2020 American Diabetes Association Scientific Sessions.

## References

1. Centers for Disease Control and Prevention. National diabetes statistics report. 2020. Accessed June 4, 2020. https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf
2. Powers MA, Bardsley J, Cypress M, et al. Diabetes self-management education and support in type 2 diabetes: a consensus report of the American Diabetes Association, the Association of Diabetes Care & Education Specialists, the Academy of Nutrition and Dietetics, the American Academy of Family Physicians, the American Academy of PAs, the American Association of Nurse Practitioners, and the American Pharmacists Association. Diabetes Educ. 2020;46(4):350–369. doi:10.1177/0145721720930959 [PubMed: 32510275]
3. Beck J, Greenwood DA, Blanton L, et al. 2017 national standards for diabetes self-management education and support. Diabetes Educ. 2017;43(5):449–464. doi:10.1177/0145721717722968 [PubMed: 28753378]

4. Kent D, Melkus GD, Stuart PW, et al. Reducing the risks of diabetes complications through diabetes self-management education and support. Popul Health Manag. 2013;16(2):74–81. doi:10.1089/pop.2012.0020 [PubMed: 23405872]
5. Menke A, Casagrande S, Geiss L, Cowie CC. Prevalence of and trends in diabetes among adults in the United States, 1988–2012. JAMA. 2015;314(10):1021–1029. doi:10.1001/jama.2015.10029 [PubMed: 26348752]
6. Chrvala CA, Sherr D, Lipman RD. Diabetes self-management education for adults with type 2 diabetes mellitus: a systematic review of the effect on glycemic control. Patient Educ Couns. 2016;99(6):926–943. doi:10.1016/j.pec.2015.11.003 [PubMed: 26658704]
7. Freeman K, Hanlon M, Denslow S, Hooper V. Patient engagement in type 2 diabetes. Diabetes Educ. 2018;44(4):395–404. doi:10.1177/0145721718784262 [PubMed: 29972097]
8. Brunisholz KD, Briot P, Hamilton S, et al. Diabetes self-management education improves quality of care and clinical outcomes determined by a diabetes bundle measure. J Multidiscip Healthc. 2014;7:533–542. doi:10.2147/JMDH.S69000 [PubMed: 25473293]
9. Johnson TM, Richards J, Churilla J. Care utilization patterns and diabetes self-management education duration. Diabetes Spectr. 2015;28(3):193–200. doi:10.2337/diaspect.28.3.193 [PubMed: 26300613]
10. Santorelli ML, Ekanayake RM, Wilkerson-Leconte L. Participation in a diabetes self-management class among adults with diabetes, New Jersey 2013–2015. Prev Chronic Dis. 2017;14:170023. doi:10.5888/pcd14.170023
11. Luo H, Bell RA, Cummings DM, Chen Z. Diabetes preventive care practices in North Carolina, 2000–2015. Prev Chronic Dis. 2018;15:E35. doi:10.5888/pcd15.170316 [PubMed: 29565787]
12. Centers for Disease Control and Prevention. The behavioral risk factor surveillance system 2017 summary data quality report. 2017. Accessed May 15, 2020. https://www.cdc.gov/brfss/annual_data/2017/pdf/2017-response-rates-table-508.pdf
13. Centers for Disease Control and Prevention. The behavioral risk factor surveillance system 2018 summary data quality report. 2018. Accessed May 15, 2020. https://www.cdc.gov/brfss/annual_data/2018/pdf/2018-response-rates-table-508.pdf
14. Hernandez-Tejada MA, Campbell JA, Walker RJ, Smalls BL, Davis KS, Egede LE. Diabetes empowerment, medication adherence and self-care behaviors in adults with type 2 diabetes. Diabetes Technol Ther. 2012;14(7):630–634. doi:10.1089/dia.2011.0287 [PubMed: 22524548]
15. Boakye EA, Varble A, Rojek R, et al. Sociodemographic factors associated with engagement in diabetes self-management education among people with diabetes in the United States. Public Health Rep. 2018;133(6):685–691. doi:10.1177/0033354918794935 [PubMed: 30223759]
16. Gumbs JM. Relationship between diabetes self-management education and self-care behaviors among African American women with type 2 diabetes. J Cult Divers. 2012;19(1):18–22. [PubMed: 22611838]
17. Strawbridge LM, Lloyd JT, Meadow A, Riley GF, Howell BL. One-year outcomes of diabetes self-management training among Medicare beneficiaries newly diagnosed with diabetes. Med Care. 2017;55(4):391–397. doi:10.1097/MLR.0000000000000653 [PubMed: 27753746]
18. Lundeen EA, Wittenborn J, Benoit SR, Saaddine J. Disparities in receipt of eye exams among Medicare part B fee-for-service beneficiaries with diabetes—United States, 2017. MMWR Morb Mortal Wkly Rep. 2019;68(45):1020–1023. doi:10.15585/mmwr.mm6845a3 [PubMed: 31725705]
19. Shaw K, Killeen M, Sullivan E, Bowman P. Disparities in diabetes self-management education for uninsured and underinsured adults. Diabetes Educ. 2011;37(6):813–819. [PubMed: 22021026]
20. Hale NL, Bennett KJ, Probst JC. Diabetes care and outcomes: disparities across rural America. J Community Health. 2010;35(4):365–374. doi:10.1177/0145721711424618 [PubMed: 20386968]
21. Ryan JG, Jennings T, Vittoria I, Fedders M. Short and long-term outcomes from a multisession diabetes education program targeting low-income minority patients: a six-month follow up. Clin Ther. 2013;35(1):43–53. doi:10.1016/j.clinthera.2012.12.007
22. Li R, Shrestha SS, Lipman R, Burrows NR, Kolb LE, Rutledge S. Diabetes self-management education and training among privately insured persons with newly diagnosed diabetes—United States, 2011–2012. MMWR Morb Mortal Wkly Rep. 2014;63(46):1046–1049.

23. Smith-Miller CA, Berry DC, Miller CT. Diabetes affects everything: type 2 diabetes self-management among Spanish-speaking Hispanic immigrants. Res Nurs Health. 2017;40(6):541–554. doi:10.1002/nur.21817 [PubMed: 28877552]
24. Toobert DJ, Strycker LA, King DK, Barrera M, Osuna D, Glasgow RE. Long-term outcomes from a multiple-risk-factor diabetes trial for Latinas: ¡Viva Bien! Transl Behav Med. 2011;1(3):416–426. doi:10.1007/s13142-010-0011-1 [PubMed: 22022345]
25. Ross S, Benavides-Vaello S, Schumann L, Haberman M. Issues that impact type-2 diabetes self-management in rural communities. J Am Acad Nurse Pract. 2015;27(11):653–660. doi:10.1002/2327-6924.12225
26. Strawbridge LM, Lloyd JT, Meadow A, Riley GF, Howell BL. Use of Medicare's diabetes self-management training benefit. Health Educ Behav. 2015;42(4):530–538. doi:10.1177/1090198114566271 [PubMed: 25616412]
27. Sepers CE, Fawcett SB, Lipman R, Schultz J, Colie-Akers V, Perez A. Measuring the implementation and effects of a coordinated care model featuring diabetes self-management education within four patient-centered medical homes. Diabetes Educ. 2015;41(3):328–342. doi:10.1177/0145721715577638 [PubMed: 25801900]
28. Albright A, Araujo R, Brownson C, et al. American Association of Diabetes Educators position statement: community health workers in diabetes management and prevention. Diabetes Educ. 2009;35(3):48S–52S. doi:10.1177/0145721709339140
29. Rutledge SA, Masalovich S, Blacher RJ, Saunders MM. Diabetes self-management education programs in nonmetropolitan counties—United States, 2016. MMWR Morb Mortal Wkly Rep. 2017;66(10):1–6. doi:10.15585/mmwr.ss6610a1 [PubMed: 28081055]
30. Center for Health Workforce Studies. State incentive programs that encourage allied health professionals to provide care for rural and underserved populations. 2019. Accessed July 27, 2020. https://depts.washington.edu/fammed/chws/wp-content/uploads/sites/5/2019/12/State-Incentive-Programs-Allied-Health-FR-2019.pdf
31. Caspersen CJ, Thomas GD, Boseman LA, Beckles GL, Albright AL. Aging, diabetes, and the public health system in the United States. Am J Public Health. 2012;102(8):1482–1497. doi:10.2105/AJPH.2011.300616 [PubMed: 22698044]

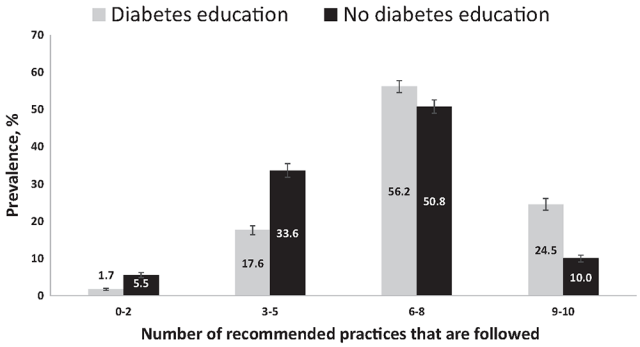


**Figure 1.**

Number of recommended practices followed, by participation in diabetes education—Behavioral Risk Factor Surveillance System, 2017–2018.

**Table 1.**

Characteristics of the Study Population (n = 61 424 With Self-Reported Diabetes) in 43 States and the District of Columbia—Behavioral Risk Factor Surveillance System, 2017–2018

| Characteristic | Prevalence, % (95% CI)[a] |
|---|---|
| Sex (n = 61 355) | |
| Male | 50.0 (48.8–51.2) |
| Female | 50.0 (48.8–51.2) |
| Age (n = 61 424) | |
| 18–44 y | 11.8 (11.0–12.7) |
| 45–64 y | 44.3 (43.1–45.5) |
| ≥65 y | 43.9 (42.7–45.0) |
| Race/ethnicity (n = 61 424) | |
| White, non-Hispanic | 59.1 (57.8–60.4) |
| Black, non-Hispanic | 15.2 (14.5–15.9) |
| Hispanic | 17.2 (16.0–18.4) |
| Other, non-Hispanic | 8.5 (7.5–9.8) |
| Marital status (n = 61 114) | |
| Married/domestic partnership | 53.4 (52.2–54.6) |
| Not married[b] | 46.6 (45.4–47.8) |
| Education (n = 61 216) | |
| < High school | 21.7 (20.6–22.8) |
| High school/GED | 30.8 (29.8–31.9) |
| ≥ Some college | 47.5 (46.3–48.7) |
| Employment status (n = 61 006) | |
| Employed | 32.4 (31.3–33.5) |
| Not employed | 24.1 (23.2–25.1) |
| Homemaker | 5.7 (5.1–6.4) |
| Retired | 37.7 (36.6–38.9) |
| Health insurance status (n = 61 245) | |
| Insured | 92.7 (92.2–93.3) |
| Not insured | 7.3 (6.7–7.8) |
| Disability status[c] (n = 59 368) | |
| Any disability | 51.2 (50.0–52.5) |
| No disabilities | 48.8 (47.5–50.0) |
| Urban/rural county status[d] (n = 61 424) | |
| Urban | 91.8 (91.4–92.1) |
| Rural | 8.2 (7.9–8.6) |

[a]Weighted percentages may not add to 100% because of rounding.

[b]Single, widowed, divorced, separated, or never married.

[c]Any disability is defined as having 1 or more of the following types of disabilities: vision impairment, hearing impairment, cognitive disability, mobility disability, self-care disability, or independent living disability.

[d] Based on National Center for Health Statistics urban-rural classification scheme for counties: https://www.cdc.gov/nchs/data_access/urban_rural.htm. Urban includes large central metro, large fringe metro, medium metro, small metro, and micropolitan counties. Rural includes noncore counties.

**Table 2.**

Diabetes Education Participation by Characteristics of the Study Population in 43 States and the District of Columbia—Behavioral Risk Factor Surveillance System, 2017–2018

| Characteristic | % (95% CI)[a] | |
|---|---|---|
| | Taken Diabetes Education Course (n = 33 730) | Never Taken Diabetes Education Course (n = 27 694) |
| Total (n = 61 424) | 52.0 (50.8–53.2) | 48.0 (46.8–49.2) |
| Sex (n = 61 355) | | |
| Male | **50.2 (48.5–52.0)** | **49.8 (48.0–51.5)** |
| Female | **53.9 (52.3–55.5)** | **46.1 (44.5–47.7)** |
| Age (n = 61 424) | | |
| 18–44y | 50.5 (46.5–54.4) | 49.5 (45.6–53.5) |
| 45–64y | 53.1 (51.3–54.9) | 46.9 (45.1–48.7) |
| ≥65 y | 51.4 (49.6–53.2) | 48.6 (46.8–50.4) |
| Race/ethnicity (n = 61 424) | | |
| White, non-Hispanic | **53.8 (52.7–54.9)** | **46.2 (45.1–47.3)** |
| Black, non-Hispanic | **56.2 (53.8–58.6)** | **43.8 (41.4–46.2)** |
| Hispanic | **42.6 (38.8–46.5)** | **57.4 (53.5–61.2)** |
| Other, non-Hispanic | **51.4 (44.1–58.7)** | **48.6 (41.3–55.9)** |
| Marital status (n = 61 114) | | |
| Married/domestic partnership | **54.4 (52.6–56.1)** | **45.6 (43.9–47.4)** |
| Not married[b] | **49.3 (47.7–50.9)** | **50.7 (49.1–52.3)** |
| Education (n = 61 216) | | |
| < High school | **36.9 (34.1–39.8)** | **63.1 (60.2–65.9)** |
| High school/GED | **50.7 (48.7–52.7)** | **49.3 (47.3–51.3)** |
| ≥ Some college | **60.0 (58.4–61.6)** | **40.0 (38.4–41.6)** |
| Employment status (n = 61 006) | | |
| Employed | **52.4 (50.2–54.5)** | **47.6 (45.5–49.8)** |
| Not employed | **49.3 (47.1–51.5)** | **50.7 (48.5–52.9)** |
| Homemaker | **47.6 (41.7–53.6)** | **52.4 (46.4–58.3)** |
| Retired | **54.6 (52.7–56.6)** | **45.4 (43.4–47.3)** |
| Health insurance status (n = 61 245) | | |
| Insured | **53.1 (51.8–54.4)** | **46.9 (45.6–48.2)** |
| Not insured | **39.5 (36.0–43.2)** | **60.5 (56.8–64.0)** |
| Disability status[c] (n = 59 368) | | |
| Any disability | 51.0 (49.4–52.5) | 49.0 (47.5–50.6) |
| No disabilities | 53.4 (51.5–55.3) | 46.6 (44.7–48.5) |
| Urban/rural county status[d] (n = 61 424) | | |
| Urban | **52.4 (51.1–53.7)** | **47.6 (46.3–48.9)** |
| Rural | **48.3 (46.0–50.6)** | **51.7 (49.4–54.0)** |

[a]Weighted percentages may not add to 100% because of rounding. Chi-square tests were used for each variable to examine differences in having taken a diabetes education course by sociodemographic characteristics. Bold indicates a statistically significant difference ($P < .05$) in diabetes education course participation by sociodemographic characteristics.

[b]Single, widowed, divorced, separated, or never married.

[c]Any disability is defined as having 1 or more of the following types of disabilities: vision impairment, hearing impairment, cognitive disability, mobility disability, self-care disability, or independent living disability.

[d]Based on National Center for Health Statistics urban-rural classification scheme for counties: https://www.cdc.gov/nchs/data_access/urban_rural.htm. Urban includes large central metro, large fringe metro, medium metro, small metro, and micropolitan counties. Rural includes noncore counties.

**Table 3.**

Prevalence of Following Diabetes Self-Care Preventive Practices by Characteristics of the Study Population Among Adults With Diabetes in 43 States and the District of Columbia—Behavioral Risk Factor Surveillance System, 2017–2018

| Characteristic | Following Self-Care Preventive Practices, % (95% CI)[a] | | | |
|---|---|---|---|---|
| | Current Nonsmoker (n = 59 196) | Engages in LeisureTime Physical Activity[b] (n = 58 521) | Glucose Checked by Patient, Family, or Friend ≥1 time/d (n = 60 145) | Feet Checked for Sores by Patient, Family, or Friend ≥1 time/d (n = 59 109) |
| Total | 85.6 (84.8–86.5) | 61.0 (59.9–62.1) | 61.5 (60.3–62.7) | 57.4 (56.1–58.7) |
| Sex | | | | |
| Male | 84.9 (83.4–86.2) | **64.6 (62.9–66.3)** | **59.2 (57.5–60.8)** | **55.2 (53.4–57.0)** |
| Female | 86.4 (85.4–87.2) | **57.5 (55.9–59.1)** | **63.8 (62.1–65.4)** | **59.6 (57.8–61.3)** |
| Age | | | | |
| 18–44 y | **75.8 (71.6–79.6)** | **66.9 (62.6–70.9)** | 63.4 (59.7–67.0) | **48.4 (44.4–52.3)** |
| 45–64 y | **82.0 (80.9–83.1)** | **61.0 (59.3–62.7)** | 61.0 (59.2–62.7) | **61.1 (59.3–62.8)** |
| ≥65 y | **91.9 (90.7–92.9)** | **59.5 (57.8–61.1)** | 61.5 (59.8–63.2) | **56.1 (54.2–58.0)** |
| Race/ethnicity | | | | |
| White, non-Hispanic | 84.9 (84.1–85.7) | **59.8 (58.7–60.9)** | **60.0 (58.8–61.1)** | **57.3 (56.1–58.4)** |
| Black, non-Hispanic | 84.4 (82.6–86.0) | **57.7 (55.1–60.1)** | **66.7 (64.4–69.1)** | **69.5 (67.2–71.8)** |
| Hispanic | 88.2 (84.7–91.0) | **62.7 (58.5–66.7)** | **62.7 (58.8–66.5)** | **52.5 (48.3–56.6)** |
| Other, non-Hispanic | 87.8 (82.0–91.9) | **73.0 (67.1–78.2)** | **60.5 (53.4–67.2)** | **46.1 (38.7–53.7)** |
| Marital status | | | | |
| Married/domestic partnership | **89.1 (87.9–90.2)** | **63.8 (62.1–65.4)** | **59.4 (57.6–61.1)** | 56.6 (54.7–58.4) |
| Not married[c] | **81.6 (80.3–82.8)** | **58.0 (56.4–59.5)** | **64.0 (62.4–65.5)** | 58.3 (56.7–60.0) |
| Education | | | | |
| < High school | **81.6 (79.0–84.0)** | **51.5 (48.4–54.7)** | **64.3 (61.3–67.2)** | **56.1 (52.9–59.3)** |
| High school/GED | **83.6 (81.8–85.1)** | **57.5 (55.6–59.4)** | **63.6 (61.8–65.5)** | **60.3 (58.3–62.3)** |
| ≥ Some college | **88.7 (87.8–89.5)** | **67.5 (66.0–68.9)** | **59.0 (57.3–60.6)** | **56.2 (54.5–58.0)** |
| Employment status | | | | |
| Employed | **86.0 (84.2–87.6)** | **66.7 (64.6–68.7)** | **55.4 (53.3–57.5)** | **55.7 (53.6–57.9)** |
| Not employed | **75.5 (73.8–77.1)** | **50.3 (48.1–52.6)** | **69.0 (66.9–71.0)** | **61.9 (59.5–64.1)** |
| Homemaker | **88.5 (84.9–91.3)** | **63.8 (57.7–69.4)** | **58.6 (52.4–64.5)** | **54.7 (48.5–60.8)** |
| Retired | **91.2 (89.8–92.3)** | **62.5 (60.7–64.3)** | **62.6 (60.7–64.4)** | **56.5 (54.4–58.6)** |
| Health insurance status | | | | |
| Insured | **86.1 (85.2–87.0)** | **61.5 (60.3–62.7)** | **62.5 (61.3–63.7)** | 57.5 (56.1–58.8) |
| Not insured | **79.5 (76.6–82.1)** | **55.6 (51.6–59.5)** | **48.5 (44.6–52.5)** | 57.2 (53.2–61.1) |
| Disability status[d] | | | | |
| Any disability | **82.7 (81.7–83.7)** | **51.0 (49.5–52.5)** | **64.9 (63.4–66.4)** | **61.1 (59.5–62.6)** |
| No disabilities | **88.7 (87.2–90.0)** | **71.6 (69.9–73.2)** | **58.2 (56.4–60.0)** | **53.6 (51.6–55.6)** |
| Urban/ rural county status[e] | | | | |
| Urban | **85.9 (84.9–86.7)** | **61.6 (60.4–62.9)** | 61.6 (60.3–62.8) | **57.0 (55.7–58.4)** |

| Characteristic | Following Self-Care Preventive Practices, % (95% CI)[a] | | | |
|---|---|---|---|---|
| | Current Nonsmoker (n = 59 196) | Engages in LeisureTime Physical Activity[b] (n = 58 521) | Glucose Checked by Patient, Family, or Friend ≥1 time/d (n = 60 145) | Feet Checked for Sores by Patient, Family, or Friend ≥1 time/d (n = 59 109) |
| Rural | **83.1 (81.4–84.7)** | **54.1 (51.8–56.5)** | 60.9 (58.5–63.2) | **61.4 (59.0–63.8)** |

[a]Weighted percentages may not add to 100% because of rounding. Chi-square tests were used for each self-care preventive practice to examine differences by sociodemographic characteristics. Bold indicates a statistically significant difference ($P < .05$) in following each self-care preventive practice by sociodemographic characteristics.

[b]Leisure-time physical activity was categorized as participating in any physical activity or exercise during the past 30 days other than their regular job.

[c]Single, widowed, divorced, separated, or never married.

[d]Any disability is defined as having 1 or more of the following types of disabilities: vision impairment, hearing impairment, cognitive disability, mobility disability, self-care disability, or independent living disability.

[e]Based on National Center for Health Statistics Urban-Rural Classification Scheme for Counties: https://www.cdc.gov/nchs/data_access/urban_rural.htm. Urban includes large central metro, large fringe metro, medium metro, small metro, and micropolitan counties. Rural includes noncore counties.

**Table 4.**

Prevalence of Following Clinical Preventive Practices by Characteristics of the Study Population Among Adults With Diabetes in 43 States and the District of Columbia—Behavioral Risk Factor Surveillance System, 2017–2018

| Characteristic | Following Clinical Preventive Practices, % (95% CI)[a] | | | | | |
|---|---|---|---|---|---|---|
| | Had Dilated Eye Exam in Last Year (n = 60 336) | Received Flu Shot in Last Year (n = 57 413) | Ever Had Pneumonia Shot (n = 55 393) | Seen a Health Professional for Diabetes in Last Year (n = 59 374) | A1C Checked by Health Professional ≥2Times in Last Year (n = 57 214) | Feet Checked for Sores by Health Professional in Last Year (n = 59 185) |
| Total | 69.0 (67.9–70.2) | 54.9 (53.6–56.1) | 62.9 (61.7–64.1) | 89.0 (88.1–89.7) | 75.2 (74.1–76.3) | 75.2 (74.1–76.3) |
| Sex | | | | | | |
| Male | 69.0 (67.4–70.7) | **53.4 (51.6–55.2)** | **60.1 (58.2–61.9)** | 89.2 (88.0–90.3) | **74.0 (72.2–75.7)** | 75.7 (74.0–77.3) |
| Female | 69.1 (67.6–70.6) | **56.3 (54.7–57.9)** | **65.7 (64.1–67.3)** | 88.7 (87.5–89.8) | **76.6 (75.1–78.0)** | 74.7 (73.2–76.2) |
| Age | | | | | | |
| 18–44 y | **56.1 (52.1–59.9)** | **41.4 (37.3–45.6)** | **38.3 (34.2–42.6)** | 88.5 (86.6–90.2) | **66.6 (62.4–70.6)** | **62.4 (58.1–66.4)** |
| 45–64 y | **64.1 (62.3–65.8)** | **49.3 (47.5–51.1)** | **50.9 (49.1–52.8)** | 89.6 (88.3–90.7) | **75.5 (73.9–77.0)** | **75.5 (73.9–77.0)** |
| ≥65 y | **77.5 (76.0–79.0)** | **63.8 (62.1–65.5)** | **80.2 (78.8–81.5)** | 88.4 (87.0–89.7) | **77.4 (75.6–79.1)** | **78.5 (76.8–80.0)** |
| Race/ethnicity | | | | | | |
| White, non-Hispanic | **69.3 (68.2–70.3)** | **56.0 (54.9–57.2)** | **67.9 (66.8–69.0)** | 88.9 (88.1–89.7) | **77.8 (76.9–78.8)** | **76.1 (75.1–77.0)** |
| Black, non-Hispanic | **72.8 (70.7–74.9)** | **50.0 (47.4–52.5)** | **57.3 (54.7–59.8)** | 90.1 (88.2–91.8) | **75.9 (73.8–77.9)** | **80.4 (78.3–82.4)** |
| Hispanic | **64.5 (60.6–68.2)** | **52.4 (48.1–56.7)** | **47.4 (43.0–51.9)** | 88.6 (86.1–90.7) | **66.3 (62.0–70.3)** | **70.0 (66.0–73.6)** |
| Other, non-Hispanic | **69.7 (62.3–76.2)** | **60.3 (52.6–67.6)** | **66.9 (60.5–72.8)** | 87.7 (81.0–92.3) | **72.2 (64.2–79.0)** | **70.6 (62.9–77.3)** |
| Marital status | | | | | | |
| Married/domestic partnership | **71.0 (69.4–72.6)** | 55.4 (53.5–57.2) | **61.8 (60.0–63.6)** | 89.6 (88.4–90.7) | **76.6 (74.9–78.2)** | **76.7 (75.0–78.2)** |
| Not married[b] | **66.8 (65.2–68.4)** | 54.3 (52.7–55.9) | **64.3 (62.7–65.8)** | 88.1 (86.9–89.2) | **73.5 (71.9–75.1)** | **73.5 (72.0–75.0)** |
| Education | | | | | | |
| < High school | **61.8 (58.7–64.8)** | 53.0 (49.8–56.3) | **55.1 (51.6–58.5)** | 88.3 (86.2–90.1) | **68.0 (64.6–71.3)** | **68.4 (65.3–71.4)** |
| High school/GED | **69.0 (67.0–70.9)** | 53.7 (51.7–55.7) | **63.5 (61.6–65.3)** | 89.2 (87.9–90.5) | **74.6 (72.5–76.5)** | **77.0 (75.2–78.7)** |
| ≥ Some college | **72.3 (70.8–73.7)** | 56.4 (54.8–58.1) | **66.0 (64.4–67.5)** | 89.1 (87.8–90.2) | **78.4 (77.0–79.8)** | **77.3 (75.8–78.8)** |
| Employment status | | | | | | |
| Employed | **63.5 (61.4–65.6)** | **48.5 (46.3–50.7)** | **46.3 (44.0–48.6)** | 89.2 (88.0–90.3) | **71.9 (69.8–73.9)** | **72.9 (70.9–74.8)** |
| Not employed | **64.4 (62.1–66.5)** | **50.4 (48.1–52.7)** | **61.2 (58.9–63.5)** | 89.0 (87.1–90.8) | **75.9 (73.8–78.0)** | **74.0 (71.8–76.1)** |

| Characteristic | Following Clinical Preventive Practices, % (95% CI)[a] | | | | | |
|---|---|---|---|---|---|---|
| | **Had Dilated Eye Exam in Last Year (n = 60 336)** | **Received Flu Shot in Last Year (n = 57 413)** | **Ever Had Pneumonia Shot (n = 55 393)** | **Seen a Health Professional for Diabetes in Last Year (n = 59 374)** | **A1C Checked by Health Professional ≥2Times in Last Year (n = 57 214)** | **Feet Checked for Sores by Health Professional in Last Year (n = 59 185)** |
| Homemaker | **64.1 (57.7–70.0)** | **54.4 (48.1–60.6)** | **54.6 (47.8–61.2)** | 90.4 (87.2–92.9) | **74.6 (69.4–79.1)** | **70.7 (64.9–76.0)** |
| Retired | **77.5 (75.8–79.1)** | **63.1 (61.2–65.0)** | **78.8 (77.3–80.2)** | 88.6 (87.1–89.9) | **78.0 (76.0–79.8)** | **78.8 (77.0–80.6)** |
| Health insurance status | | | | | | |
| Insured | **70.8 (69.6–71.9)** | **56.6 (55.3–57.9)** | **65.1 (63.9–66.4)** | **89.9 (89.1–90.7)** | **77.0 (75.8–78.2)** | **76.6 (75.4–77.7)** |
| Not insured | **46.7 (42.7–50.7)** | **31.7 (28.3–35.4)** | **32.9 (29.4–36.6)** | **76.8 (73.0–80.2)** | **52.0 (47.8–56.1)** | **58.1 (54.1–61.9)** |
| Disability status[c] | | | | | | |
| Any disability | 68.9 (67.5–70.3) | 56.0 (54.5–57.4) | **68.0 (66.4–69.5)** | 88.7 (87.6–89.8) | 76.4 (75.0–77.8) | 75.7 (74.4–77.0) |
| No disabilities | 69.2 (67.4–71.0) | 53.7 (51.8–55.7) | **57.5 (55.6–59.5)** | 89.0 (87.8–90.2) | 74.4 (72.4–76.2) | 74.8 (72.9–76.7) |
| Urban/rural county status[d] | | | | | | |
| Urban | **69.4 (68.2–70.6)** | **55.3 (54.0–56.6)** | **63.2 (61.9–64.5)** | 89.0 (88.1–89.8) | 75.4 (74.2–76.6) | **75.6 (74.4–76.8)** |
| Rural | **65.0 (62.7–67.2)** | **50.0 (47.7–52.4)** | **60.0 (57.6–62.4)** | 89.0 (87.3–90.4) | 73.0 (70.7–75.2) | **71.0 (68.7–73.3)** |

[a] Weighted percentages may not add to 100% because of rounding. Chi-square tests were used for each clinical preventive practice to examine differences by sociodemographic characteristics. Bold indicates a statistically significant difference ($P < .05$) in following each clinical preventive practice by sociodemographic characteristics.

[b] Single, widowed, divorced, separated, or never married.

[c] Any disability is defined as having 1 or more of the following types of disabilities: vision impairment, hearing impairment, cognitive disability, mobility disability, self-care disability, or independent living disability.

[d] Based on National Center for Health Statistics urban-rural classification scheme for counties: https://www.cdc.gov/nchs/data_access/urban_rural.htm. Urban includes large central metro, large fringe metro, medium metro, small metro, and micropolitan counties. Rural includes noncore counties.

**Table 5.**

Predicted Probabilities of Following Diabetes-Related Self-Care Practices Among Adutts With Diabetes, by Participation in Diabetes Education—Behavioral Risk Factor Surveillance System, 2017–2018

| Practice | Prevalence Among All Adults With Diabetes % (95% Cl) | Predicted Probabilities of Diabetes-Related Self-Care Practices[a] | | | | | |
|---|---|---|---|---|---|---|---|
| | | Unadjusted Diabetes Education Participation % (95% CI) | | | Adjusted[b] Diabetes Education Participation % (95% CI) | | |
| | | Yes | No | *P* Value | Yes | No | *P* Value |
| Seff-care preventive practices Current nonsmoker (n = 59 196) | 85.6 (84.8–86.5) | 87.2 (86.4–88.1) | 83.9 (82.4–85.3) | .000 | 88.8 (87.9–89.7) | 86.6 (85.1–88.1) | .003 |
| Engages in leisure-time physical activity[c] (n = 58 521) | 61.0 (59.9–62.1) | 65.9 (64.5–67.3) | 55.6 (53.8–57.4) | .000 | 66.3 (64.9–67.7) | 57.3 (55.4–59.2) | .000 |
| Glucose checked by patient, family, or friend ≥1 time/d (n = 60 145) | 61.5 (60.3–62.7) | 69.5 (68.1–70.9) | 52.7 (50.9–54.6) | .000 | 70.3 (68.8–71.8) | 52.5 (50.7–54.4) | .000 |
| Feet checked for sores by patient, family, or friend ≥1 time/d (n = 59 109) | 57.4 (56.1–58.7) | 62.2 (60.6–63.8) | 52.1 (50.2–54.0) | .000 | 62.3 (60.6–64.0) | 52.4 (50.6–54.2) | .000 |
| Clinical preventive practices | | | | | | | |
| Ever had pneumonia shot (n = 55 393) | 62.9 (61.7–64.1) | 69.2 (67.7–70.7) | 55.9 (54.1, 57.8) | .000 | 71.3 (69.7–72.9) | 57.9 (56.1–59.6) | .000 |
| A1C checked by health professional ≥2times in last year ( n = 5 7 214) | 75.2 (74.1–76.3) | 81.1 (79.9–82.3) | 68.3 (66.4–70.3) | .000 | 81.0 (79.7–82.2) | 70.5 (68.6–72.4) | .000 |
| Had dilated eye exam in last year (n = 60 336) | 69.0 (67.9–70.2) | 74.1 (72.7–75.6) | 63.4 (61.7–65.2) | .000 | 74.4 (73.0–75.9) | 65.1 (63.2–67.0) | .000 |
| Received flu shot in last year (n = 57 413) | 54.9 (53.6–56.1) | 57.7 (56.1–59.4) | 51.7 (49.9–53.6) | .000 | 57.8 (56.0–59.5) | 51.9 (50.1–53.7) | .000 |
| Seen a health professional for diabetes in last year (n = 59 374) | 89.0 (88.1–89.7) | 92.1 (91.3–93.0) | 85.5 (84.1–86.8) | .000 | 92.2 (91.3–93.1) | 85.9 (84.5–87.3) | .000 |
| Feet checked for sores by health professional in last year (n = 59 185) | 75.2 (74.1–76.3) | 82.9 (81.7–84.0) | 66.8 (65.0–68.7) | .000 | 83.0 (81.8–84.2) | 68.3 (66.5–70.1) | .000 |

[a] Ten separate logistic regression models were used to calculate the predicted probabilities for the 10 self-care practices.

[b] Models adjusted for age, sex, race/ethnicity, education, marital status, employment status, health insurance status, disability status, and urban/rural status.

[c] Leisure-time physical activity was categorized as participating in any physical activity or exercise during the past 30 days other than their regular job.