

Associations Between Self-Management Education and Comprehensive Diabetes Clinical Care

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Abstract

Objective. This study examines the relationship between receiving diabetes self-management education (DSME) and having higher levels of comprehensive diabetes clinical care, a summation of up to five clinical services recommended for individuals with type 2 diabetes and those who have had type 1 diabetes for ≥ 5 years.

Design. Analysis of data from a population-based, cross-sectional study.

Methods. Data for this study were from the 2007 Florida Behavioral Risk Factor Surveillance System (BRFSS), a statewide, random, cross-sectional survey of adults. A dichotomous comprehensive diabetes clinical care variable was constructed based on responses to questions from the BRFSS diabetes module, and a logistic regression model was fitted. Adjusted odds ratios (ORs) are reported.

Results. Among Florida adults with diabetes, 51.5% had received DSME. About 51.4% of adults with diabetes who received DSME had a high level of comprehensive care compared to 31.8% of those who did not receive DSME. The OR for having a high level of comprehensive care was statistically significantly higher among adults who received DSME (OR = 2.48) compared to their counterparts who did not receive DSME. Other significant covariates were having health insurance (OR = 3.65), having graduated from high school (OR = 1.55), having a college education (OR = 2.70), being 45–64 years of age (OR = 2.31), and being ≥ 65 years of age (OR = 5.29).

Conclusions. These data show that receiving DSME is positively associated with receiving higher levels of comprehensive diabetes clinical care.

The prevalence of diabetes has increased 63% since 1990 in the United States.¹ In 2007, an estimated 23.6 million people in the United States, or about 7.8%, had diabetes. The morbidity and mortality associated with diabetes has increased during the past two decades, and the direct and indirect diabetes-related health care costs nationally were $> \$174$ billion in 2007. The risk of death among those with diabetes is about twice that of those without diabetes.² Reflecting national trends, the prevalence of diabetes among Florida adults increased 64% between 1995 and 2007 to the current rate of 8.7%.¹

Diabetes is associated with disability, which diminishes health status and quality of life,³ along with a number of microvascular, macrovascular, and neuropathic complications, including nontraumatic lower-extremity amputations, blindness, renal failure, heart disease, and stroke.^{2,4} Carrying out disease self-management regimens and receiving routine clinical care are essential to reducing the risk of developing diabetes-related complications.⁵

According to the American Diabetes Association (ADA), diabetes is a complex illness that requires ongoing medical care from a physician-coordinated team.⁶ Continuous

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patient education is an integral component of care to prevent secondary complications. A growing body of research indicates that engaging in diabetes self-management behaviors and receiving routine clinical care are strongly associated with improved glycemic control.⁶

In 2005, the Centers for Disease Control and Prevention published findings from a study using 2001–2002 U.S. Behavioral Risk Factor Surveillance System (BRFSS) data, indicating that receiving diabetes self-management education (DSME) is associated with engaging in some self-care practices and receiving some types of routine clinical care.⁷ A meta-analysis assessing the effect of DSME on metabolic control showed that, after adjusting for follow-up interval and pooled effects, A1C decreased an average of 0.76% compared to the control group average reduction of 0.26%. The authors concluded that DSME improved A1C at immediate follow-up and increased contact time increased the effect.⁸

Historically, diabetes care-related literature assessing the effect of receiving DSME on diabetes care outcomes—whether these are clinical or self-care—examined the outcomes individually and not as comprehensive care constructs. People with diabetes do not attain optimal health and wellness by using any individual self-care practice or clinical-care service in isolation. Optimal health is achieved by coordinating and executing a comprehensive set of practices and services. Therefore, it is important to examine diabetes outcomes as comprehensive constructs and assess factors associated with comprehensive care.

To receive diabetes clinical services, individuals with diabetes must be aware of the existence of and need for the services, be willing to seek the services, and have access to the services. Whereas DSME increases awareness of the services recommended, the question of whether receiving DSME is associated with receiving a comprehensive set of diabetes clinical care services remains unanswered. To explore this avenue of inquiry, we constructed

a comprehensive diabetes clinical care (CDCC) variable using five diabetes-related questions from the 2007 Florida BRFSS. Subsequently, we assessed the association between receiving DSME and an increased level of CDCC, controlling for socio-demographic variables.

METHODS

The BRFSS is an ongoing, cross-sectional, population-based telephone survey of noninstitutionalized adults ≥ 18 years of age in randomly selected households in the United States and its territories. The BRFSS elicits from respondents information pertaining to a variety of disease states, risk factors, preventive health practices, and emerging health issues. BRFSS uses a multistage, complex sample design that produces cluster-correlated data.⁹ In total, 39,549 adults responded to the 2007 Florida BRFSS, of which 4,947 had been diagnosed with diabetes (type 1 and type 2 combined). The data were managed using SAS, 9.1.3 (SAS Institute Inc., Cary, N.C.) and analyzed using SAS-Callable SUDAAN 10.0 (Research Triangle Institute, Research Triangle Park, N.C.).

People were defined as diabetes cases if they answered “Yes” to the following question: “Have you ever been told by a doctor that you have diabetes?” Women who answered “Yes—but only told during pregnancy” and respondents indicating they had been told they have prediabetes were not included in this definition. The BRFSS does not discern whether a person has type 1 or type 2 diabetes. The clinical services of interest for this study were those that apply to adults with type 2 diabetes or adults who have had type 1 diabetes for ≥ 5 years.⁶ For BRFSS, individuals were deemed as having probable type 1 diabetes if they were diagnosed before 30 years of age and use insulin only.¹⁰ All others were assumed to have type 2 diabetes. In addition, respondents were asked at what age they were diagnosed with diabetes, enabling us to determine the duration of the condition. This study included all type 2 diabetic individuals and those who had probable type 1 diabetes for ≥ 5 years. Among the 4,947 Florida

BRFSS respondents in 2007 who had diagnosed diabetes, 4,888 met the case definition for this study.

The ADA recommends the following clinical services as minimum standards of care for which BRFSS questions are available: an annual dilated retinal examination, an annual foot examination by a health care professional, at least one A1C test every 6 months, an annual flu shot, and a one-time pneumonia shot. The ADA also recommends that patients with diabetes receive formal DSME within 12 weeks of diagnosis.⁵ Florida BRFSS respondents who had diabetes were asked about their history of influenza and pneumococcal vaccinations, as well as a series of questions concerning self-care practices and clinical services received. Respondents were asked how often they had had their A1C checked in the past year, how many times a health professional had checked their feet in the past year, and how long ago they had had their most recent dilated eye examination. To determine whether respondents had ever had DSME, they were asked if they had ever taken a course in how to manage their diabetes.

The CDCC variable is dichotomous and constructed using the five individual clinical variables described above. The CDCC variable indicates two levels of comprehensive clinical care: low (the individual received 0–3 services) and high (the individual received 4–5 services). The variable was dichotomized in this manner because the 50th percentile of the number of services received fell between 3 and 4. The constructed variable was tested for internal consistency, and the calculated Cronbach’s alpha was 0.70, which is the typically accepted lower boundary for this measure.^{11,12}

Demographic and socioeconomic variables were constructed based on responses by survey participants. “Don’t know” and “refused” were coded as missing. Sex had two response options: male and female. Based on responses to multiple questions concerning race and ethnicity, respondents were categorized as non-Hispanic white, non-Hispanic black, Hispanic, and other race/

Table 1. Sociodemographic Characteristics of the Study Population

Characteristics	<i>n</i> (unweighted)	Percentage (unweighted)	Percentage (95% CI (weighted)
Men	2,036	41.7	52.0 (48.8–55.2)
Women	2,852	58.4	48.0 (44.8–51.2)
White, non-Hispanic	3,721	76.6	67.8 (64.5–71.0)
Black, non-Hispanic	600	12.4	13.6 (11.5–16.0)
Hispanic	317	6.5	14.4 (11.7–17.6)
18–44 years of age	354	7.3	12.6 (10.1–15.7)
45–64 years of age	2,068	42.5	40.7 (37.5–43.9)
≥ 65 years of age	2,448	50.3	46.8 (43.6–50.0)
< High school education	918	18.9	16.1 (13.9–18.5)
High school/< 3 years of college	2,982	61.4	58.2 (55.0–61.3)
≥ 4 years of college	954	19.7	25.8 (23.0–28.7)
Married or unmarried couple	2,605	53.5	60.2 (56.9–63.3)
Had insurance	4,368	89.5	89.2 (86.8–91.2)
Had DSME	2,465	50.6	51.5 (48.3–54.8)

ethnicity (“Other”). The respondents were grouped into three age-groups: 18–44, 45–64, and ≥ 65 years. Education levels were defined as less than high school; high school and less than 4 years of college; and ≥ 4 years of college. “Marital status” was dichotomized into two categories: married (including living as an unmarried couple) versus not married, which included never married, divorced, or widowed. Respondents were asked if they had any type of health insurance coverage in the past year.

The analysis for this study was conducted in two stages. First, the distribution of high CDCC for each independent variable included in subsequent regression models was determined and χ^2 tests were performed to identify significant differences. Second, a logistic regression model was fitted with CDCC as the dependent variable and high CDCC as the event of interest to test for significant associations.

RESULTS

Table 1 shows the sociodemographic characteristics of the study popula-

tion meeting the case definition. The unweighted sample was composed of 2,036 men and 2,852 women with a mean age of 63.7 years. Nearly 77% of the respondents were non-Hispanic white, 12.4% were non-Hispanic black, and 6.5% were Hispanic. More than half of the respondents were ≥ 65 years of age, 42.5% were 45–64 years of age, and 7.3% were 18–44 years of age. Most (61.4%) had a high school diploma and up to 3 years of college, nearly 20% had ≥ 4 years of college, and 18.9% had less than a high school education. Nearly 90% of the respondents had some type of health insurance, 53.5% were married or cohabitating with a partner, and 50.6% had received some type of DSME. Table 1 also shows the weighted percentages for each socio-demographic category.

Table 2 shows the descriptive statistics for high CDCC. About 41.8% (95% CI 38.8–44.9) of Florida adults meeting the inclusion criteria had a high level of CDCC. Bivariate analysis shows that the proportion of adults with diabetes who had a high

level of CDCC varied significantly by DSME status, race/ethnicity, age-group, education level, insurance status, and marital status. About 51.4% (95% CI 47.0–55.8) of adults with diabetes who received DSME had a high level of CDCC compared to 31.8% (95% CI 27.7–36.1) of those who did not receive DSME. Forty-seven percent (95% CI 43.5–50.6) of white, non-Hispanic adults had a high level of CDCC compared to 28.7% (95% CI 22.1–36.4) of black, non-Hispanic adults and 25.6% (95% CI 17.7–35.5) of Hispanic adults. The percentage that had a high level of CDCC increased with increasing age-group and education level. About 45% of adults with diabetes who had insurance had a high level of CDCC, whereas only 13% of those without insurance had a high level. The proportion who had a high level of CDCC was about 19% higher among those who were married or living as an unmarried couple compared to their counterparts.

Table 3 shows the adjusted ORs from the final logistic regression model using CDCC as the dependent variable, after a stepwise elimination of insignificant variables was conducted. The logistic regression analysis shows that, after controlling for the listed covariates, those who received DSME had 2.5 times higher odds of having a high level of CDCC compared to their counterparts. Other significant covariates included having health insurance (OR 3.65; 95% CI 2.03–6.56), having a high school education (OR 1.55; 95% CI 1.06–2.26), having ≥ 4 years of college education (OR 2.70, 95% CI 1.74–4.17), and being 45–64 years of age (OR 2.31; 95% CI 1.24–4.32) or ≥ 65 years of age (OR 5.29; 95% CI 2.87–9.76). A pairwise examination of explanatory variables was conducted, and no significant interactions were noted.

DISCUSSION

The results from this study show that, after adjusting for age, education, and health insurance coverage, participants who reported having DSME had 2.5 times higher odds of receiving comprehensive clinical care than participants who did not

Table 2. Percentage With a High Level of CDCC by SocioDemographic Characteristics

Characteristics	Percent (95% CI)	χ^2 P value
All	41.8 (38.8–44.9)	
Men	43.5 (39.0–48.1)	0.25
Women	40.0 (35.9–44.2)	
White, non-Hispanic	47.0 (43.5–50.6)	0.00
Black, non-Hispanic	28.7 (22.1–36.4)	
Hispanic	25.6 (17.7–35.5)	
18–44 years of age	20.1 (12.5–30.7)	0.00
45–64 years of age	34.0 (29.5–38.8)	
≥ 65 years of age	54.5 (50.4–58.6)	
< High school education	28.8 (23.0–35.4)	0.00
High school/< 3 years of college	40.3 (36.4–44.3)	
≥ 4 years of college	53.8 (47.5–60.0)	
Married or unmarried couple	44.7 (40.7–48.7)	0.03
Not married	37.5 (32.9–42.4)	
Had insurance	45.2 (41.9–48.5)	0.00
No insurance	13.1 (8.2–20.2)	
Had DSME	51.4 (47.0–55.8)	0.00
No DSME	31.8 (27.7–36.1)	

Table 3. Adjusted ORs and 95% CIs by Sociodemographic Characteristics

Characteristics (Referent)	OR	95% CI
45–64 years of age (18–44 years of age)	2.31	1.24–4.32
≥ 65 years of age (18–44 years of age)	5.29	2.87–9.76
High school/< 3 years of college (< high school)	1.55	1.06–2.26
≥ 4 years of college (< high school)	2.70	1.74–4.17
Had insurance (no insurance)	3.65	2.03–6.56
Had DSME (no DSME)	2.48	1.90–3.23

report having DSME. For this study, comprehensive clinical management was measured using BRFSS questions pertaining to five key clinical services: annual foot examinations by a health care professional, annual dilated eye examinations, at least two A1C tests in the past 12 months, an annual influenza vaccination, and a one-time pneumococcal vaccination. The findings from this study are consistent with those reported in 2005 by Strine et al.,⁷ who examined

the association between receiving DSME and individual clinical and behavioral outcomes using BRFSS data. Whereas examining individual outcomes is important, it is also important to view diabetes care more comprehensively and to study factors that affect comprehensive care.

Two other variables were also strongly associated with having high-level comprehensive diabetes clinical management: having health insurance and being ≥ 65 years of age. It is

logical that having health insurance increases access to the health care system, and older age increases utilization of health care services because of declining health and the aging process. In addition, those in older age-groups are more likely to have comorbid conditions that require closer medical monitoring.¹³ These two variables are important areas for further inquiry.

Disease self-management and glycemic (metabolic) control are the cornerstones of reducing the incidence of diabetes-related complications. Routine clinical care is necessary to monitor glycemic control and detect developing complications early, which provides the best means of complication mitigation. Despite the benefits of receiving DSME, only about half of Florida adults with diabetes received this service. Florida-specific data from 2007 indicate that the proportion of patients who received DSME is significantly lower among those with less than a high school education (35.5%) compared to those who completed high school and/or had < 4 years of college (51.7%) and those who had ≥ 4 years of college (60.8%). The prevalence of diabetes is higher among those with less than a high school education compared to their counterparts in the remaining two groups (14.4, 9.0, and 6.6%, respectively). Receiving DSME did not vary by sex, race/ethnicity, age-group, insurance status, or marital status.

Studies have found that DSME is associated with improved diabetes knowledge, improved self-care behavior, improved clinical outcomes, lower self-reported weight, and improved quality of life.¹⁴ DSME is usually administered as a skills-based approach that helps individuals make informed self-management choices. DSME is typically not didactic, but is rather an ongoing process of learning and skills-building. The goals are to optimize metabolic control and quality of life, prevent complications, and control costs.¹⁵ Trends in interventions have evolved over time from education only to education and behavior models. In recent years, more attention has been

given to interventions specifically for minority populations, and the literature supports the effectiveness of DSME on psychosocial and health outcomes.¹⁶

There are a number of barriers to receiving DSME. A state-specific study in Maine found five reasons people do not attend DSME: 1) aversion to group classes, 2) feeling the information is not needed, 3) the classes are not offered at desirable times/places, 4) lack of transportation, and 5) lack of program information. Based on these findings, the authors noted that the perception of DSME is an issue that must be addressed to improve utilization.¹⁷ A literature review of DSME studies¹⁸ was conducted to assess for the use of theoretical frameworks, cultural appropriateness, and quality of instruments to measure outcomes. The authors found that theoretical frameworks were lacking, cultural indices were not incorporated, and instruments used to measure outcomes were inadequate.

Other access barriers also exist, including the presence of comorbidities among older adults, which complicates access to DSME. To minimize barriers found among the elderly, DSME should be individualized, involve care partners, and weigh the risks and benefits of practices and desired outcomes.¹⁹ In addition, access to DSME can be increased through creative avenues such as pharmacies.²⁰ New technologies offer novel venues for delivering DSME education. Effective use of technology may increase access to DSME and provide a means for ongoing maintenance.²¹

The role of social support and environmental factors also must be considered. A more comprehensive view of an individual's environmental context may shed light on new and more effective approaches to DSME and counseling, especially among minority populations with diabetes.²² Given the significant and increasing prevalence of diabetes among U.S. adults, the importance of clinical care and self-management behaviors in preventing complications, and the key role DSME plays in self-care practices and receiving

clinical care, increasing the understanding of these relationships is paramount to recommending improvements to the diabetes health system.

There are a number of limitations to this study. BRFSS is a random-digit-dialed, self-reported, cross-sectional survey and, as such, has limitations. Although a vast majority of U.S. adults (~97%) have telephone service, a higher proportion of minority and low socioeconomic-status citizens do not have coverage.²³ Therefore, these subgroups are likely underrepresented. In addition, the 2007 BRFSS protocol did not include calling cell phone numbers; therefore, those who have cell phones only (i.e., no landline home service) are not represented in the data. In recent years, cell phone-only households have increased, and these households are more likely to have young, low-income adults.²⁴ Other biases include those related to recall, survey length, and language.

The results of this study show the utility of examining diabetes care in terms of comprehensive constructs and the potential benefit of increasing access to quality DSME. Examining these data on a state level allows programs that design and implement diabetes interventions to consider and assess state-specific needs.

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