FEATURE ARTICLE

Improving Referrals to Diabetes Self-Management Education in Medically Underserved Adults

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OBJECTIVE | Electronic health records (EHRs) and clinical decision-support algorithms improve diabetes care. This quality improvement (QI) project aimed to determine whether an electronic diabetes education referral protocol using the Diabetes Self-Management Education and Support for Adults With Type 2 Diabetes: Algorithm of Care (DSMES Algorithm) and protocol training would increase the proportion of adult patients with type 2 diabetes at a federally qualified health center electronically referred for diabetes self-management education and support (DSMES).

DESIGN AND METHODS | The EHR was modified to include the DSMES Algorithm and questions regarding prior participation in diabetes education. Protocol trainings were conducted. Data were obtained via retrospective chart review. A one-sample *t* test was used to evaluate the statistical difference between the electronic referral (e-referral) rates of the pre-intervention and intervention groups.

RESULTS | Completion of the DSMES Algorithm was positively associated with e-referrals to diabetes education ($P<0.001$). The intervention group had a higher rate of e-referral for DSMES than the pre-intervention group (31 vs. 0%, $P<0.001$).

CONCLUSION | E-referral protocols using the DSMES Algorithm and protocol training may aid in the identification and documentation of self-care needs of medically underserved patients with type 2 diabetes and improve e-referrals to DSMES. Of clinical importance, these findings translate into active patient engagement, team-based care, and information-sharing. Additional work is needed to determine whether the e-referral rate is sustained or increases over time. Further investigations should also be explored to evaluate the impact of e-referral protocols and algorithms on participation in DSMES.

The Centers for Disease Control and Prevention estimates that 30.3 million Americans, or 9.4% of the U.S. population, have diabetes (1). Diabetes is associated with life-threatening complications, including kidney failure, blindness, lower-extremity amputations, and cardiovascular disease (2). People with diabetes spend an estimated $13,700 per year on health care, which is 2.3 times higher than the annual cost of health care for people without diabetes (1). With the increasing cost of diabetes care and risk of developing devastating complications, achieving glycemic goals should be a priority for patients, health care professionals (HCPs), organizations, and community leaders.

The majority of diabetes care is completed by patients (3,4). The American Diabetes Association (ADA) recommends diabetes self-management education and support (DSMES) for all people with diabetes at diagnosis and refresher diabetes education as needed (3). DSMES is an effective intervention used to teach patients the skills necessary to achieve glycemic targets and cope with the day-to-day stresses of the disease. It is positively associated with improvement in self-care skills and clinical outcomes, reductions in disease-related complications and hospital admissions, lower health care costs, healthy coping, and decreased diabetes-related distress (2,4,5). People with diabetes who do not participate in DSMES are four times more likely to develop diabetes-related complications than those who participate in DSMES (2).

DSMES is significantly underused in the United States and perhaps even more underused in medically underserved areas of the country, which can be disproportionally affected by diabetes (1,5,6). Despite the proven benefits of DSMES, referral rates to diabetes education programs are low (2,5,7,8). A retrospective cross-sectional study of 3,967 patients with prediabetes and diabetes at primary care

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clinics within a large academic medical system found an overall diabetes education referral rate of 12.6% (7).

Healthy People 2020 objectives included an aim to increase the proportion of people with diabetes who receive formal diabetes education from 53.1% in 2012 to 58.4% by 2020 (6). One of the primary reasons why patients do not participate in DSMES is the lack of advocacy or a recommendation from providers (2,9). Some of the barriers limiting providers' ability to consistently refer patients to diabetes education include time constraints and competing priorities; limited resources and access to programs; a lack of knowledge about the necessity, recommended timing, and success of DSMES interventions; and absence of effective referral processes (2,5). The ADA recommends the use of effective diabetes education referral processes to increase the likelihood that all patients with diabetes receive formal diabetes education (5). Electronic health records (EHRs) and clinical decision-support (CDS) systems improve the processes and outcomes of diabetes care (10). CDS algorithms help guide decision-making and reduce the need for HCPs to rely on memory to follow evidence-based guidelines (10).

Current evidence suggests that using multiple intervention strategies to improve diabetes care is more successful than using a single intervention strategy (10,11). Chambers et al. (11) found a significant positive trend in the average number of referrals to diabetes prevention programs among patients at federally qualified health centers (FQHCs) after clinical staff members were educated on how to use the electronic referral system (11). Adequate training on the use of EHRs and CDS systems increases user rates, which could support consistent e-referrals to DSMES (10,11).

The Diabetes Self-Management Education and Support for Adults With Type 2 Diabetes: Algorithm of Care (DSMES Algorithm) is an evidence-based graphic used to guide referrals to diabetes education according to patients' needs, goals, and life experiences (12). The algorithm identifies four critical times to assess the self-care needs of patients and refer them to DSMES. The algorithm also pinpoints essential self-care skills for each critical time, which can be used by providers, clinical support staff, diabetes educators, and individuals with diabetes to focus the delivery and receipt of diabetes education (12).

Despite well-documented evidence of low referrals to DSMES, data on interventions that help providers consistently refer patients to DSMES are limited. Furthermore, the effectiveness of the DSMES Algorithm in medically underserved populations is unknown, and existing literature does not address the use of the DSMES Algorithm as a fillable document within an EHR. This quality improvement (QI) project aimed to determine whether an electronic diabetes education referral protocol using the DSMES Algorithm within an EHR system and protocol training would significantly increase the proportion of adult patients with type 2 diabetes at an FQHC who were electronically referred to free community-based DSMES compared with traditional practices that did not include the use of the EHR and evidence-based guidance.

Design and Methods

The target FQHC, a patient-centered medical home (PCMH), provides health care services to underserved communities in west central Georgia. The patient population is largely uninsured (48%), racial/ethnic minority (78%) adults (66%), with multiple comorbidities, complex social histories, and limited resources. In 2015, the prevalence of patients with diabetes at the FQHC was 14%, which was nearly 5 percentage points higher than the national prevalence rate of diabetes for the same year (1). The percentage of patients at the FQHC with an A1C >9% or who had not had an A1C test during past year increased from 40% in 2015 to 48% in 2016. In the 2013–2016 period, 18.7% of Americans with diabetes had an A1C >9%, and the *Healthy People 2020* target for this measure is 16.2% (13).

Before implementation of the QI project, the target FQHC did not have a formal diabetes education referral process. Most patients with type 2 diabetes received in-office survival education facilitated by HCPs and clinical support staff, including licensed practical nurses and medical assistants. It is likely that staff discussed DSMES programs with patients but did not document those discussions or create referrals in the EHR.

A multidisciplinary implementation team was organized and consisted of clinical staff and personnel from the information technology and EHR departments. The FQHC's executive board and the institutional review board of the University of Alabama at Birmingham approved the activities of this QI project. Permission to use and convert the DSMES Algorithm to a portable document format (PDF) for use within the EHR was granted by the ADA.

HCP Buy-In

Five months before the implementation of the project, the team led a presentation on readiness for change to inform HCPs and staff members of the problem, the benefits of DSMES, and the QI project intervention and goals. HCPs completed a survey at the end of the presentation to determine their interest in using the DSMES Algorithm as a

fillable document within the EHR to improve referrals to diabetes education. All providers in the clinic's Medical Department ($n = 5$) agreed to participate in the project.

Modification of the EHR

Two changes were made to the EHR. A click-box formatted section of questions related to diabetes education was added to the history of present illness (HPI) section, and the DSMES Algorithm was added as a fillable PDF. During visits for type 2 diabetes, clinical support staff asked patients questions regarding prior participation in diabetes education, and their answers were documented in the HPI questionnaire. Patients were asked if they had participated in DSMES previously and, if so, how long ago. HCPs completed the DSMES Algorithm by using the ink-edit function of the EHR to place a check mark by boxes corresponding to the appropriate critical times of assessment and the associated self-care needs of the patient. HCPs were asked to consider a referral to diabetes education if any boxes on the DSMES Algorithm were selected.

Indications for a referral to diabetes education followed the DSMES Algorithm guidelines: at diagnosis of type 2 diabetes, after annual assessment, at the onset of complications of diabetes, and when transitions in life or care occurred (11). Patients were educated on the benefits of diabetes education and encouraged to participate in a free community-based DSMES class held at a local hospital. At discharge, patients were given a visit summary and printed class information.

Protocol Trainings

Training sessions on the electronic diabetes education referral protocol were held at 3 months and 1 month before project implementation. HCPs and clinical support staff were educated on the benefits of DSMES and changes in the EHR. The team distributed talking points for clinical staff to use to encourage participation in DSMES. HCPs completed pre- and post-tests to measure uptake of the information. All HCPs scored at least 80% on the post-test.

Data Source

A retrospective chart review of clinic EHR data from patient encounters was performed. All medical providers, including physicians and nonphysician advance practice providers qualified by educational training/licensure to care for adult patients and employed by the FQHC, were eligible to participate. HCPs were excluded if they were not licensed to care for adult patients, not employed by the FQHC, or elected not to participate in the QI project.

Adult patients (≥19 years of age) who were fluent in English, had type 2 diabetes (*International Classification of Diseases,* 10th edition, codes E11–E11.9), and were seen by a participating HCP in the Medical Department at least once during the pre-intervention period (28 January through 24 March 2018) or the intervention period (28 January through 24 March 2019) were selected for inclusion. Patients were excluded if they were not patients at the target clinic, were <19 years of age, did not have a diagnosis of type 2 diabetes, or did not speak English as their primary language.

De-identified data were collected from the organization's EHR. Pre-intervention data were obtained from the records of 482 patients with type 2 diabetes, of whom 27 were excluded. A random sample of 209 patients was selected from the remaining 455 eligible patients. Data were evaluated 1 month after implementation of the electronic diabetes education referral protocol and at the completion of the 2-month intervention period. During the intervention period, 400 patients with type 2 diabetes were evaluated, of whom 28 were excluded. Of the remaining 372 eligible patients, 188 were randomly selected for inclusion. Sample sizes for the pre-intervention and intervention groups were calculated using the precision of the estimate, with a 95% CI, an SD of 0.5, and a margin of error of ± 5%.

Data collected for the pre-intervention group during the specified period included the number of unique adult patients with type 2 diabetes, the number of e-referrals to DSMES, and each patient's age, sex, and A1C. In addition to the abovementioned measures collected for the pre-intervention group, data collection for the intervention group also included the number of patients with completed HPI questionnaires and completed DSMES Algorithms.

A1C levels were categorized as glycemic stability (<7%), suboptimal glycemic stability (7–9%), and poor glycemic stability (>9%). Following Centers for Medicare & Medicaid Services meaningful use reporting strategies, if an A1C was not documented during the measurement period, within the 6 months before a patient's visit, A1C was recorded as >9% (13). Patients were noted to have been referred to DSMES if the referral was created in the EHR.

Data Analysis

All analyses were conducted using SPSS, v. 25, statistics software. A one-sample *t* test was used to compare the diabetes education e-referral rate of the pre-intervention and intervention groups. A χ^2 or independent-samples *t* test was used to compare demographic characteristics and A1C levels of the pre-intervention and intervention groups. Additionally, χ^2 tests were used to evaluate the association

TABLE 1 Attributes of Participants in the Pre-Intervention and Intervention Groups

	Overall (n = 397)	Pre-Intervention (n = 209)	Intervention (n = 188)	P
Mean age, years (SD)	57.23 (12.3)	57.90 (12.3)	56.49 (12.2)	0.255
Female sex	59.4 (236)	62.7 (131)	55.9 (105)	0.166
Mean A1C, % (SD)	8.2 (2)	8.1 (2)	8.3 (2)	0.270
Glycemic stability	33.8 (134)	35.9 (75)	31.4 (59)	–
Suboptimal glycemic stability	27.5 (109)	24.9 (52)	30.3 (57)	–
Poor glycemic stability	38.8 (154)	39.2 (82)	38.3 (72)	–
Referral to diabetes education	14.6 (58)	0 (0)	30.9 (58)	<0.001

Data are % (n) unless otherwise indicated. P <0.05 is significant.

between completion of the DSMES Algorithm and e-referral to diabetes education and the association between glycemic stability and e-referral to diabetes education.

Results

Characteristics of the pre-intervention and intervention group patients are shown in Table 1. There was no significant difference between the mean ages (t[395] = 1.141, P = 0.255), sex (χ^2 [1, n = 397] = 1.914, P = 0.166), or A1C levels (t[395] = −1.105, P = 0.270) of the pre-intervention and intervention groups. On average, patients were middle-aged, and most were female. The average A1Cs of the pre-intervention and intervention groups were 8.1 and 8.3%, respectively. Approximately 39% of patients in both groups had poor glycemic stability (A1C >9%). The intervention group had a significantly higher e-referral rate to DSMES than the pre-intervention group (31% [n = 58] vs. 0% [n = 0]) (t[187] = 9.134, P <0.001).

Predictors of referral to diabetes education among intervention group participants are shown in Table 2. Patients with suboptimal and poor glycemic stability (A1C 7–9 and >9%, respectively) were more likely to be electronically referred to DSMES (45.6 and 30.6%, respectively) (χ^2 [2, n = 188] = 11.171, P = 0.004) compared with 16.9% of those with stable glycemia. Completion of the HPI questions (χ^2 [1, n = 188] = 30.298, P <0.001) and the completion of the DSMES Algorithm (χ^2 [1, n = 188] = 108.48, P <0.001) were positively associated with e-referrals to diabetes education. HCPs were significantly more likely to complete the DSMES Algorithm when the HPI questions related to previous diabetes education were completed by clinical support staff (χ^2 [1, n = 188] = 39.670, P <0.001).

Discussion

A significant increase in the number of e-referrals to DSMES was observed among patients with type 2 diabetes at the FQHC after implementation of an electronic diabetes education referral protocol. The protocol combined the use of multiple intervention strategies, including an assessment of HCP readiness for change, use of the DSMES Algorithm within the EHR, and protocol training to promote change in referral practices and improve e-referrals to diabetes education.

TABLE 2 Intervention Group Predictors by Referral to Diabetes Education

	Referral (n = 58)	No Referral (n = 130)	P
A1C stability level			0.004
Glycemic stability	16.9 (10)	83.1 (49)	
Suboptimal glycemic stability	45.6 (26)	54.4 (31)	
Poor glycemic stability	30.6 (22)	69.4 (50)	
HPI questions completed	63.8 (37)	22.3 (29)	<0.001
DSMES Algorithm completed	87.9 (51)	10 (13)	<0.001

Data are % (n). P <0.05 is significant.

These results are consistent with other studies that found an increase in referrals to diabetes education when EHRs are used and HCPs are adequately trained on how to use the system (11,14). The findings are also consistent with previous studies suggesting that e-referral systems, clinical support staff involvement, and the use of CDS algorithms improve the care of patients with chronic conditions (11,14,15).

Clinical support staff engagement may decrease missed opportunities to refer patients to DSMES. In an article describing key aspects of outpatient CDS systems, O'Connor et al. (10) identified clinical support staff as possibly the best members of the health care team to respond to CDS prompts in light of HCP multitasking and time constraints. Therefore, adding standing orders that allow clinical support staff to enter e-referrals may further increase referrals to DSMES. Moreover, HCP referral practices may be improved by collaborations with contractual care managers such as chronic care management nurses, home health care nurses, and social workers (8).

CDS tools such as the DSMES Algorithm are used to collect information related to risk of complications and expedite action and shared decision-making (5,10). The positive association between e-referrals to diabetes education and completion of the DSMES Algorithm is consistent with evidence that using assessment tools in the management of chronic conditions improves appropriateness of referrals and decreases referral latency (16).

The HPI questionnaire and the DSMES Algorithm assisted in the identification and documentation of self-care needs of medically underserved patients with type 2 diabetes and facilitated dialogue among HCPs, clinical support staff, and patients about the necessity and benefits of DSMES. Of clinical importance, these findings translate into active patient engagement, team-based care, and information-sharing, all of which have been found to improve diabetes care (5,17). Forwarding electronic DSMES Algorithms to diabetes educators can help in the development of unique education plans for patients with type 2 diabetes. Further investigations are needed to evaluate the association between the use of the DSMES Algorithm and patient participation in diabetes education programs.

The results of the QI project suggest that patients with suboptimal and poor glycemic stability are more likely to receive an e-referral to DSMES, which is similar to findings of previous studies (8). In a study evaluating the impact of the Medical Home Model of Care on referrals to diabetes education, patients were more likely to be referred when their A1C was elevated (8). The authors proposed that HCPs might delay referrals to diabetes education for patients who are at or near their glycemic goal.

It is currently recommended that patients with prediabetes and lower A1C levels participate in formal diabetes education to prevent progression to diabetes and decrease the risk of diabetes-related complications (8). However, patients with adequate knowledge of diabetes, slightly elevated blood glucose levels, and low risk of complications may not need diabetes education (9). Therefore, HCPs may be more likely to refer patients with poor glycemic stability, and these patients may have a higher likelihood of accepting the referral, whereas patients with optimal and suboptimal glycemic stability may be more likely to refuse the referral.

Previous studies have found that patients refuse referrals to DSMES because of fear of group education and functional limitations (6,9). Consequently, patients with low socioeconomic status and multiple comorbidities such as those common in underserved communities may be even more likely to refuse referrals to diabetes education, thereby potentially increasing the number of patients in this project who were not referred to DSMES. For this reason, Schafer et al. (9) recommend the use of more individualized approaches to education in patients with multiple comorbidities and functional limitations.

A study conducted by Krall et al. (18) found that direct access to diabetes educators in a PCMH significantly increased referrals to (18.4 vs. 13.4%) and participation in (34.9 vs. 26.1%) diabetes education compared with patients referred to hospital-based diabetes educators. Therefore, staffing diabetes educators at community health centers and offering onsite group and individual DSMES services may increase referrals to and participation in DSMES (2,5,8).

Although the observed post-intervention referral rate of this project was significant, it is still low. Adding CDS system reminders that automatically prompt users to refer patients to diabetes education and using electronic referral interfaces with pre-populated fields may further increase e-referrals to DSMES (10,11).

Organizations may also consider adding opt-out language to referral strategies similar to opt-out HIV testing, which has proven successful in increasing HIV testing rates. In this strategy, patients are referred to DSMES after they receive notification that the referral will be entered and that they have the option to decline (19).

Evidence suggests that patients are more likely to participate in DSMES if an HCP recommends it (9). However, referrals to diabetes education remain low, and diabetes education programs are forced to shut down each year because of low

participation (5). Focusing attention on improving access to diabetes education programs in medically underserved communities and implementing referral strategies that target patients with poor glycemic stability may mitigate DSMES program closures and prevent diabetes-related complications. Additional research is needed to identify effective strategies and interventions that increase referrals to DSMES in medically underserved areas of the United States and in the country at large.

Limitations

Diabetes education referral protocols using EHRs and algorithms may increase e-referrals to DSMES among patients with type 2 diabetes in medically underserved areas. However, the data from this project and the conclusions drawn from them have limitations. Data-capturing difficulties led to an inability to obtain only billable medical encounters for patients with type 2 diabetes. Therefore, the total number of patients with type 2 diabetes evaluated during the pre-intervention and intervention periods may be overestimated. Hence, samples sizes for the pre-intervention and intervention groups were calculated using narrow CIs and low margins of error, thereby increasing the number of patients included in the random sample and increasing the precision of the estimate.

Before implementation of the electronic diabetes education referral protocol, HCPs did not follow a formal process to refer patients to DSMES and may have verbally recommended DSMES, although the option to use the electronic referral system for diabetes education was available. Hence, the actual referral rate of the pre-intervention group is unknown and could have been underestimated, which would have overestimated the significance of the increase in e-referrals to DSMES observed in the intervention group. Additional work is needed to determine whether the e-referral rate is sustained or increases over time to add reliability to the statistical significance of the project interventions.

This project collected data on e-referrals to diabetes education. The number of referred patients who participated in diabetes education is unknown. Consequently, conclusions regarding the impact of electronic diabetes education referral protocols on participation in DSMES cannot be determined. Additionally, data were not collected after the readiness-to-change presentation or after protocol trainings. Thus, the true point of change in referral practices among HCPs is unknown and may have occurred before the DSMES Algorithm and HPI questionnaire was activated in the EHR.

Finally, this project was conducted among medically underserved adults receiving care at an FQHC. Additional research in other populations is needed to improve the generalizability of its findings.

Clinical Relevance

DSMES is a crucial aspect of diabetes care. Protocol training and modification of the EHR to include the DSMES Algorithm may increase documentation of discussions about diabetes education and improve e-referrals to formal diabetes education. Including questions regarding prior participation in DSMES in the assessment of patients with type 2 diabetes and involving clinical support staff may also increase the likelihood that HCPs will refer patients to diabetes education. In this project, HCPs were more likely to refer patients with suboptimal or poor glycemic stability. Of note, these patients may be more likely to accept the referral to DSMES.

Electronic diabetes education referral protocols using the DSMES Algorithm may improve uptake of diabetes education services, decrease program closures, and subsequently improve health outcomes in patients with type 2 diabetes. Further investigations should be explored to evaluate the impact of e-referral protocols and CDS algorithms on participation in DSMES.

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DUALITY OF INTEREST

No potential conflicts of interest relevant to this article were reported.

AUTHOR CONTRIBUTIONS

As the sole author, T.L.J. is the guarantor of this work and, as such, had full access to all data in the project and takes responsibility for the accuracy of the data analysis and overall integrity of the project findings.

PRIOR PRESENTATION

A poster of this work was presented at the American Association of Diabetes Educators annual meeting in Houston, TX, 9–12 August 2019.

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