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Review

A systematic literature review of diabetes self-management education features to improve diabetes education in women of Black African/Caribbean and Hispanic/Latin American ethnicity

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ABSTRACT

Objective: This systematic literature review aims to identify diabetes self-management education (DSME) features to improve diabetes education for Black African/Caribbean and Hispanic/Latin American women with Type 2 diabetes mellitus.
Methods: We conducted a literature search in six health databases for randomized controlled trials and comparative studies. Success rates of intervention features were calculated based on effectiveness in improving glycosolated hemoglobin (HbA1c), anthropometrics, physical activity, or diet outcomes. Calculations of rate differences assessed whether an intervention feature positively or negatively affected an outcome.
Results: From 13 studies included in our analysis, we identified 38 intervention features in relation to their success with an outcome. Five intervention features had positive rate differences across at least three outcomes: hospital-based interventions, group interventions, the use of situational problem-solving, frequent sessions, and incorporating dietitians as interventionists. Six intervention features had high positive rate differences (i.e. $\geq$50%) on specific outcomes.
Conclusion: Different DSME intervention features may influence broad and specific self-management outcomes for women of African/Caribbean and Hispanic/Latin ethnicity.
Practical implications: With the emphasis on patient-centered care, patients and care providers can consider options based on DSME intervention features for its broad and specific impact on outcomes to potentially make programming more effective.

1. Introduction

The North American prevalence of diabetes mellitus (DM) reached 10.2% in 2010, and is estimated to reach 12.1% by 2030. This is an increase of 42.4% in the number of adults who will have diabetes [1]. There is a growing ethnic disparity in the prevalence of diabetes and its related complications. In the United States, the 2004/06 national survey data indicated that the prevalence of diabetes was greater in non-Hispanic Blacks (11.8%) and Hispanics (10.4%) compared to non-Hispanic whites (6.6%) [2]. In Ontario, the most populated province in Canada, the Black population has higher rates of diabetes (11.6%) than the White population (7.3%) [3]. Furthermore, recent immigrants from Latin America and the Caribbean (9.8%) have the second highest prevalence rates of diabetes compared with long-term residents and recent Western Europe and North America immigrants (5.2%) in Ontario [4]. Overall, North America has a growing ethnic population at an elevated risk of developing diabetes.

In addition to high prevalence rates, persons of Hispanic/Latin and African/Caribbean backgrounds in North America are at higher risk for poor glycemic control and diabetes-related complications. Non-Hispanic Blacks with diabetes have poorer glycemic control, higher blood pressure, and a higher risk of diabetes complications compared with non-Hispanic Whites and Mexican Americans [5]. For instance, Latin Americans and African Americans tend to have substantially higher mean glycosolated hemoglobin (HbA1c) levels than Caucasians [6], and accordingly are at a higher risk of complications such as coronary heart disease [6], retinopathy [7], end-stage renal disease [7,8] and death [6,8].

Although certain ethnic minorities are vulnerable to developing diabetes and related complications, the risks appear to be higher in women than men. African/Caribbean and Hispanic/Latin American

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immigrant women in Ontario have higher rates of diabetes compared with men from the same country [4]. Research shows that women living with diabetes may be at higher risk for developing cardiovascular disease (CVD) [9,10] than men, and that mortality from both coronary heart disease [11,12] and stroke [13] is greater in women than men with diabetes. The prevalence of mental illness such as depression and anxiety disorders is also greater in women compared to men living with diabetes [14,15]. The impact of these disorders adversely affects self-care behaviours, glycemic control, quality of life, and diabetes complications [14–17]. The greater risk of complications in women compared to men may be due to differences in how women experience and manage their diabetes.

While it is well established that diabetes self-management education (DSME), a complex health intervention, is generally effective at enhancing self-care behaviors [18–21], improving glycemic control [22], lowering health care costs [23], and improving quality of life [18,20], the specific impact of DSME features on outcomes have not been thoroughly evaluated [24] particularly for specific cultural and gendered populations. For instance, research shows that women have different self-management education needs compared with men. Latin American women are said to be better suited to and more successful with interventions that incorporate family, peers, and *promotoras* (i.e., community health workers) for social support [25]. South Asian women find it harder than men to discuss their problems with male physicians or to participate in mixed-gender education groups [26]. These findings suggest that men and women with diabetes may have different DSME needs and that different cultures may respond better to various DSME intervention features than others. A better understanding of which intervention features are associated with improved outcomes by gender and culture can be used to target interventions to specific populations to enhance learning, skills building, and diabetes management more effectively than a standardized DSME program.

Given the rising prevalence of diabetes among women from certain ethnic backgrounds and women's greater risk of diabetes complications compared with men, the goal of our study was to systematically review the literature to identify DSME features associated with various self-management outcomes. For women of African/Caribbean or Hispanic/Latin ethnicity living in industrialized countries. The impetus for our research was to help direct the development of a new government-funded DSME program at a community health center specifically tailored for women from high-risk ethnic groups for diabetes. The results from this study are intended to help diabetes educators and health practitioners learn how best to deliver DSME to achieve the desired self-management outcomes.

2. Methods

2.1. Search strategy

Key words used to search for relevant articles included: adult, Type 2 DM, patient care management, patient education, patient-centered care, ethnic groups, and competency-based education. A library technician searched for relevant articles published in English from 1980 to 2008 in Medline, Embase, Cinahl, Cochrane Library, HealthStar, PsycInfo, and ProQuest Nursing & Alliance Health. Using women as a key search term was not recommended due to the high probably of excluding studies that sampled primarily women. Thus, the search strategy was broad (sensitive) to include as many relevant articles through subsequent manual screening. Reference lists of relevant reviews and articles and tables of contents from *Diabetes Care* and *Diabetes Educator* were thoroughly reviewed to ensure all relevant studies were obtained. Lastly, researchers in the field were contacted to identify relevant gray literature; however, no new resources were identified.

2.2. Inclusion criteria

Studies were limited to randomized controlled trials and comparative studies. Primary studies that provided outcomes of DSME interventions initially for three ethnic groups (i.e., African/Caribbean, Hispanic/Latin and South Asian women) in industrialized countries were reviewed. Articles had to focus on participants diagnosed with Type 2 DM who were over 18 years of age. Given the few numbers of diabetes self-management interventions conducted exclusively with Black African/Caribbean and Hispanic/Latin American women with Type 2 DM, we included studies that had a sample of a minimum of 70% women (representing the majority of the samples) or reported analyses by sex. Studies were excluded if the articles were not peer-reviewed and did not provide enough information about the type of program to analyze the intervention's features. Lastly, we excluded articles that focused solely on groups of subjects with a specific co-morbidity (e.g., those only with heart disease, kidney disease, stroke, etc.), and reports of intervention feasibility. We were also unable to find studies for South Asian women (as stipulated in the inclusion and exclusion criteria) and thus unable to include this population of women in the review. Fig. 1 shows the selection process of this review.

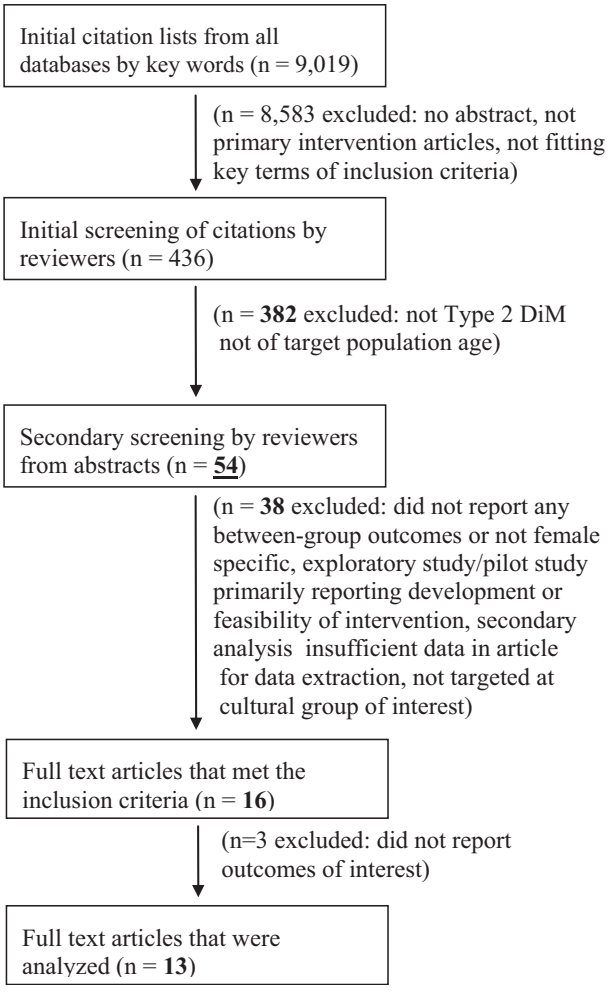

Fig. 1. Selection process of studies based on search strategy (1980–2008).

2.3. Data extraction

Abstracts were independently screened by two of the authors (L.M. and V.C.) to determine eligibility for inclusion in the review. After the authors (L.M. and V.C.) retrieved eligible articles, each author was responsible for extracting half of the articles. A data extraction form was adapted from the literature [27,28] for this purpose. Following data extraction, the two authors exchanged articles, read them, and reviewed the corresponding data extraction sheet performed by the other person to ensure data extraction accuracy. There were few discrepancies between the two reviewers in the extracted data that were resolved in consensus discussion with the lead author (E.G.).

This review examined the following intervention features of DSME: (i) intervention setting, (ii) intervention format, (iii) mode of delivery, (iv) education strategies, (v) duration-length of intervention, (vi) intensity-frequency of session, (vii) type of interventionist, (viii) content delivered to the participants, and (ix) intervention design (Table 2).

2.4. Validity assessment

Quality assessment [29,30] was conducted by two of the authors (L.M. and V.C.) to review the clarity of the study aims, the adequacy of details about the sample, the rating of the study design, the clarity of the methodology, and the reliability and validity of the measures and tools. Scores were allocated based on the presence of potential bias in these components as reported in the articles. The accumulated score was divided by the number of components in the scoring for the quality of the studies. A study with a final score of 75% or more was considered "good quality", between 51 and 74% "fair", and a 50% or less "poor".

2.5. Data analysis

Due to the heterogeneity of populations, interventions, and measured outcomes, we could not conduct a meta-analysis. We therefore used a recently described method to identify specific intervention features likely to be associated successfully or unsuccessfully with the outcome of interest [31]. Interventions were analyzed based on their success in producing a significant change (p-value ≤ 0.05) in outcomes, in the hypothesized direction [31]. Outcome measures of interest were HbA1c levels, anthropometrics, physical activity, and diet outcomes. Studies that reported at least one of the four outcomes were included in the analysis. These four outcomes were selected based on what most studies investigated, although instruments measuring these outcomes varied across studies. For instance, anthropometrics consisted of various measures including body mass index, thigh skinfold, body weight, tricep skinfold, waist-to-hip ratio, total body fat, percent body fat, trunk fat, and fat-free mass. Diet was assessed with a desirable change in any of the following: total kilocalorie intake, dietary risk score, mean vegetable consumption, fruit consumption, consumption of five fruits and vegetables per day, fried food consumption, healthy eating plan adherence, fat-related dietary habits, dietary fat intake, dietary cholesterol intake, kilocalories from saturated fat, and percent kilocalories from fat. When a study used several instruments to measure an outcome (e.g., diet), at least 60% (an arbitrary cut-off) of the measures must have reported significant positive results to be considered a success for that outcome. Only post-test outcome data were used for all analysis.

A rate difference determines which intervention feature has a positive or negative association with an outcome [31]. A rate difference was estimated for each intervention feature identified in the review using the following steps. First, a success rate was calculated for both the intervention with and without the feature. The success rate for the intervention feature (SRWF) is the number of studies reporting on the intervention having the feature of interest associated with a positive participant outcome, divided by all the studies reporting on intervention with the feature regardless of outcome; the specific formula used was: number of studies with feature with positive outcome/all studies with feature. Second, a success rate without a feature (SRWoF) is the number of studies reporting on the intervention without the feature of interest with a positive participant outcome, divided by all the studies without the feature regardless of outcome; the formula was: number of studies without feature with positive outcome/all studies without the feature. Third, rate differences were calculated for each intervention feature, by subtracting the success rate with feature (SRWF) from the success rate without the feature (SRWoF). The higher a positive rate difference the more likely that feature has a successful association on the outcome.

As an example, the following explains how the rate difference of 66.67% for the intervention feature related to setting of intervention delivery (i.e., home-based) on diet outcomes was calculated in Table 2. Three out of six studies reported an intervention with a home-based setting and three studies did not. Two out of three studies indicated a positive effect of the intervention with the feature on diet outcome and none of the three studies without the feature found a positive effect on diet outcome; accordingly, the rate difference was: SRWF − SRWoF = (2/3) − (0/3) = 66.67%. Since this number is positive, the results suggest that the feature of home-based setting had a positive association with diet outcomes. The higher a positive rate difference the more likely that feature has a successful association on the outcome.

3. Results

3.1. Description of studies

Thirteen studies were analyzed. Study characteristics can be found in Table 1. Ten articles [19,32–40] were randomized controlled trials; the remaining three [41–43] were cohort studies including both an intervention group and a comparison group. Eight studies included African/Caribbean American [19,32,33,36,38,41–43] participants. Three studies [37,39,40] included mixed cultural groups composed mainly of African American and some Caucasian participants. Two of the studies had Hispanic/Latin American participants [34,35]. Five articles had exclusively women participants [38–40,42,43]. One study had sex-stratified results (but the sample was also comprised of more than 70% women [35]). The remaining studies had at least 70% women participants [19,32–34,36,37,41]. With regards to quality, only one article received a rating of "Fair" [43], all other articles were rated as "Good" (see Table 1). Because only 13 studies met our inclusion criteria, we were unable to stratify our analysis by ethnic group as originally planned.

3.2. Analysis of features

Table 2 displays the intervention features that have positive success rate differences for HbA1c, anthropometrics, physical activity, and diet outcomes.

3.3. HbA1c levels

Ten studies reported on HbA1c levels [19,32–34,36,38–42]; three of these studies [32,36,39] indicated positive effects. A total of 37 intervention features were included in this analysis, of which 18 were associated with a positive success rate difference (see Table 2).

Table 1
Summary table of reviewed articles.

Author(s)	Cultural group	Theoretical basis	Study objective(s)	Study design	Setting	Interventionist(s)
Agurs-Collins et al. [32]	100% African American	Social Action Theory.	To evaluate a weight loss and exercise program designed to improve diabetes management.	Randomized Control Trial (RCT).	Urban hospital in Washington, DC.	A nurse and exercise physiologist.
Anderson [41]	96% African American	Empowerment Behavior Change Model.	To explore the impact of a problem-based empowerment intervention.	Randomized Control Group Pre-test/post-test Design.	Community of Detroit.	A nurse and a dietician who are certified diabetes educators.
Anderson-Loftin et al. [33]	100% Black African	None.	To test the effects of a culturally competent dietary self-management intervention on physiological outcomes and dietary behaviors.	RCT.	Diabetes education centre in a community hospital and by telephone calls in South Carolina.	A nurse case manager certified as a diabetes educator.
Corkery et al. [34]	Latin American: 75% Puerto Rico, 5% Mainland U.S., 20% Other	None.	To explore factors that influence completion of diabetes education program with bicultural community health worker (CHW) and impact of completion of this program on patient knowledge, HbA1c control, and patient self-care practices.	RCT.	Tertiary care teaching hospital in New York City, New York.	Intervention group: CHW and diabetes education certified nurse. Control group: Diabetes education certified nurse.
Elshaw et al. [35]	100% Latin American	None.	To assess the impact of culturally specific, intensive diabetes education program on dietary patterns; To assess nutrient consumption relative to the Recommended Dietary Allowances.	RCT.	Church hall and health clinic in Harlingen and Brownsville, Texas.	Local Mexican-American, bilingual nurses with a background in nutrition.
Gary et al. [19]	100% African American	Precede-Proceed for modification theories and health services research.	To determine whether multifaceted, culturally sensitive, primary care-based behavioral intervention implemented by nurse case manager (NCW) and/or community health care worker (CHW) could improve HbA1C and diabetic control.	Randomized Control Trial. 4 groups: C (control group), I_1 (NCM group), I_2 (CHW group), and I_3 (NCM & CHW group); all groups receive standard care.	Physician's office, clinic or by telephone for NCM interventions, home or telephone for CHW intervention in Baltimore, Maryland.	NCM and trained community-worker.
Jaber et al. [36]	100% African American	Pharmaceutical Care Model.	To assess the effectiveness of a pharmaceutical care model on the treatment outcome measures.	RCT.	University-affiliated internal medicine outpatient clinic in Detroit, Michigan.	Pharmacist
Keyserling et al. [42]	100% African American	Behavior Change Theory.	To determine whether a culturally appropriate clinic- and community-based intervention will increase moderate-intensity physical activity (PA).	Randomized Trial. 3 groups: I_1 (clinic & community based intervention group), I_2 (clinic intervention group), and I_3 (minimal intervention)	Primary care practices, including 5 community health centers, and the general medicine clinic at an academic centre in Chapel Hill, North Carolina.	Dietician and trained community-worker
Mayer-Davis et al. [37]	82% African American and 18% Non-Hispanic White	None.	To develop, implement, and evaluate a primary care based lifestyle intervention for weight management that was designed to improve metabolic control.	RCT. 3 groups: I_1 (intensive-lifestyle intervention), I_2 (reimbursement-lifestyle intervention), and C (usual care).	Two primary health care centers in South Carolina. Telephone calls used when participants could not attend.	Dietician

McNabb et al. [43]	100% Black African/ Caribbean	PATHWAYS Program (behavior oriented small group program for obese inner-city women).	Not stated.	Matched Comparison Group Trial. 2 groups: Intervention group and comparison group (usual care drawn from charts).	Unclear/unspecified location in Chicago, Illinois.	Unclear/unspecified.
Skelly et al. [38]	100% African American	Symptom- Focused Management Model.	To evaluate effects of a culturally focused intervention on symptom distress, diabetes knowledge, perceived quality of life, HbA1c levels, self-care practices and participant satisfaction.	RCT.	In the home in Chapel Hill, North Carolina.	Nurse.
Smith et al. [39]	41% African American, 59% Unspecified	Motivational interviewing.	To examine whether the addition of motivational interviewing strategies to a behavioral obesity intervention enhances adherence and glucose control.	RCT.	Unclear/unspecified in Birmingham, Alabama.	Dietician, psychologist and exercise physiologist.
West et al. [40]	39% African American, 61% Caucasian	Motivational interviewing.	To determine whether adding motivational interviewing to a behavioral weight control program improves weight loss outcomes and glycemic control.	RCT.	Hospital/Clinic in Birmingham, Alabama.	Diabetes educator, dietician, behaviorist, exercise physiologist, and clinical psychologist.

Author(s)	Duration and frequency	Study population	Quality assessment	Self-management behaviors results	Metabolic control results
Agurs-Collins et al. [32]	6-month intervention. 12 90-min. weekly group sessions for first 3 months, and 6 90-min. biweekly group sessions for following 3 months	$N=55$: Intervention Group (I)($N=30$) and Control Group C($N=25$); mean age: 61.7 years, urban, 77% female.	Good	At 6 months: (1) Physical Activity: n.s. between groups. (2) Dietary Intake: n.s. between groups.	At 6 months: (1) HbA1c: - in I. (2) Blood Lipids: n.s. between groups. (3) Blood Pressure: - in I. (4) Weight: - in I. (5) BMI: - in I. (6) Waist-to-hip Ratio: n.s. between groups.
Anderson [41]	1.5 month intervention. 6 weekly 2-h. group sessions. Measurement at 1.5 months and 1 year.	$N=239$: I ($N=125$) and C ($N=114$); mean age: 61.0 years, urban, 82% female, mean education, mean duration of diabetes: 8.5 years.	Good	N/A	At 1.5 months: (1) HbA1c: n.s. between groups. (2) Serum Cholesterol: n.s. between groups. (3) Weight: n.s. between groups. (4) Mean blood Pressure Level and Using Insulin: n.s. between groups.
Anderson-Loftin et al. [33]	6-month intervention. 4 weekly 1.5 h. group classes. 1 months after classes, 4 monthly 1 h. peer-professional discussion groups.	$N=65$; mean age: 57.3 years, rural, 76.5% female, mean duration of diabetes: 8.4 years.	Good	At 6 months: (1) Dietary Fat Behavior: - in I.	At 6 months: (1) HbA1c: n.s. between groups. (2) Cholesterol: n.s. between groups. (3) BMI: - only in I.
Corkery et al. [34]	At patient's pace. Typically 3.4 months one-on-one sessions. Measurement at mean 7.7 months	$NN=40$: I ($N=24$) and C ($N=16$); mean age: 52.8 years, 74% female.	Good	At 7.7 months: (1) DSME Program Completion: sig. + in completion in I. (2) Diabetes Self-care Behaviors: n.s. between groups.	At 7.7 months: (1) HbA1c: n.s. between groups.

Table 1 (*Continued*)

Author(s)	Duration and frequency	Study population	Quality assessment	Self-management behaviors results	Metabolic control results
Elshaw et al. [35]	2-month intervention. 2 h. group weekly sessions for 8 weeks. Measurement at 2.5 months and 3.5 months	$N = 104$; where men $N = 31$ and women $N = 73$; mean age: men = 62.7 years and women = 60.5 years, 71% female.	Good	N/A	At 2.5 and 3.5 months: (1) Weight: n.s. between women of both groups.
Gary et al. [19]	24-month intervention. C: on-going group sessions; NCM group (I_1): C plus NCM 45-min. one-to-one visits 3 times a year; CHW group (I_2): C plus CHW 45 – 60 min. one-to-one visits 3 times a year; NCM & CHW group (I_3): C plus NCM 45 min. one-to-one visits 3 times a year and CHW 45 – 60 min. one-to-one visits 3 times year.	$N = 149$: C ($N = 25$), I_1 ($N = 29$), I_2 ($N = 32$), I_3 ($N = 28$); mean age: 59 years, urban, 76.5% female, mean duration of diabetes: 9 years.	Good	At 24 months: (1) Dietary Risk: n.s. between groups. (2) Leisure-time Physical Activity Index: n.s. between groups.	At 24 months: (1) HbA1c: n.s. between groups. (2) HDL: n.s. between groups. (3) LDL: n.s. between groups. (4) Triglycerides: n.s. between groups. (5) Systolic Blood Pressure: n.s. between groups. (6) Diastolic Blood Pressure: n.s. between groups. (7) BMI: n.s. between groups.
Jaber et al. [36]	4-month intervention. Visits from pharmacist every 2–4 weeks. Daily self-monitoring and recording of blood glucose.	$N = 39$: C ($N = 22$), I ($N = 17$); mean age: 61.6 years, urban, 69% female, mean duration of diabetes: 6.5 years.	Good	N/A	At 4 months: (1) Glycosolated Hemoglobin: - in I. (2) Fasting Plasma Glucose: - in I. (3) Blood Pressure, Lipid Profile, Renal Parameter, and Weight: n.s. between groups.
Keyserling et al. [42]	I_1: 12-month intervention with individual counseling visits, 3 group sessions and monthly phone calls. I_2: 6-month intervention with individual counseling, 2 group sessions and monthly phone calls. I_3: pamphlets. Measurement at 12 months (for I_2 and I_3).	$N = 200$: I_1 ($N = 67$), I_2 ($N = 66$), I_3 ($N = 67$); mean age: 59 years, 100% female, mean duration of diabetes: 10 years	Good	At 12 months: (1) Physical Activity: + in I_1 and I_2. (2) Dietary Outcomes: n.s. between groups.	At 12 months: (1) Glycosolated Hemoglobin: n.s. between groups. (2) Weight, Total and HDL Cholesterol: n.s. between groups.
Mayer-Davis et al. [37]	I_1 (Intensive-Lifestyle): 12-month intervention. 16 1 h. weekly sessions for 4 months, biweekly for next 2 months, and monthly for last 6 months; with a sequential pattern of 3 group sessions following an individual session. I_2 (Reimbursement Life-style): 12-month intervention. 4 1 h. sessions where 3 are group sessions and 1 is individual session. C (Usual care): 1 individual session at the beginning of the study. Measurement at 6 months and 12 months	$N = 152$; mean age: 60 years, rural, 80% female, mean duration of diabetes: 11 years	Good	N/A	At 6 months: (1) HbA1c: n.s. compared to C. (2) Lipid Profile, Blood Pressure: n.s. between groups. (3) BMI: - compared to C. (4) Weight: - in I_1. At 12 months: (1) Weight: n.s. between groups

McNabb et al. [43]	4.5-month intervention. 12 weekly group sessions with 6 weekly reinforcement group problem-solving sessions. Measurement at 4.5 months (for within comparisons) and 12 months	$N = 10$; mean age: 57 years, urban, 100% female, mean duration of diabetes: 9 years.	Fair	N/A	At 12 months: (1) Weight: - in I.
Skelly et al. [38]	3-month intervention. 6 1-h. biweekly one-to-one visits (2 pre-intervention visits and 4 module sessions).	$N = 41$: I ($N = 23$), C ($N = 18$); mean age: 61.9 years, rural, 100% female, mean duration of diabetes: 11.9 years.	Good	At 3 months: (1) Diabetes Self-care Practices: + in I. (2) Exercise: n.s. between groups.	At 3 months: (1) HbA1c: n.s. between groups.
Smith et al. [39]	4-month intervention. I: 16 group sessions and 3 individual motivational interviewing sessions over 4 months C: 16 group sessions over 4 months	$N = 16$; mean age: 62.4 years, 100% female, mean duration of diabetes: 6.7 years.	Good	At 4 months: (1) Attendance, Diary Submission, SMBG: + in I. (2) Reported Exercise and Reported Caloric Intake: n.s. between groups.	At 4 months: (1) HbA1c: - in I. (2) Weight: n.s. between groups.
West et al. [40]	18-month intervention. 1) Weight management program: 42 group sessions which met weekly for 6 months, biweekly another 6 months, and monthly for the following 6 months 2) Motivational interviewing (follow-up intervention): 5 45-min. one-to-one sessions at 0, 3, 6, 9, 12 months Measurement at 18 months (post-intervention).	$N = 217$: I ($N = 109$), C ($N = 108$); mean age: 53 years, 100% female, mean duration of diabetes: 5 years.	Good	At 18 months: (1) Treatment Attendance: group attendance n.s. between groups. (2) Diaries submitted and its Quality: + in I.	At 18 months: (1) Glycemic Control: in African American women: n.s. between groups. (2) Weight: for African American women: n.s. between groups.

3.4. Anthropometrics

Eleven studies [19,32,33,35–37,39–43] reported anthropometrics outcomes; three of these [32,33,43] obtained positive effects. Seventeen of the 38 intervention features were associated with a positive success rate difference (see Table 2).

3.5. Physical activity

Five studies [19,32,38,39,42] reported on physical activity; only one [42] had a positive effect. Thirty-four intervention features were included in the analysis, of which 12 were associated with a positive success rate difference (see Table 2).

3.6. Diet

Six studies [19,32,33,35,38,42] reported on dietary outcomes; two [33,38] had positive effects. Thirty-six intervention features were included in the analysis, of which 11 were associated with a positive rate difference (see Table 2).

Refer to the online supplemental data for more information on percent success rate differences (Table 3) and analysis of features within each individual outcome (Tables 4–7).

4. Discussion and conclusion

4.1. Discussion

DSME programs are complex interventions with various content and delivery components necessary for the education and skills building required for diabetes self-management. However, limited efforts have been made to investigate which intervention features are associated with a positive outcome, specifically for women of diverse ethnic backgrounds. Studies mainly concentrated on glycemic control (i.e., HbA1c levels) (10 studies) or anthropometric outcomes (11 studies), as opposed to behavioral outcomes such as diet (5 studies) and physical activity (5 studies). Since behavioral outcomes strongly reflect the lifestyle changes needed to achieve the desirable metabolic outcomes [18,44], it is imperative to understand how intervention features affect these intermediary outcomes as well.

Only five (of 38) intervention features had positive success rate differences for at least three of the outcomes examined in this review: hospital-based intervention setting; group intervention format; situational problem-solving; high intensity (10 or more intervention sessions); and incorporating dietitians as interventionists.

Because of their broad influence, we recommend the features that demonstrate success across multiple outcomes in DSME programming for the populations of interest. Many of these features are also recommended in DSME programming for the general population by the American Diabetes Association (ADA) and the Canadian Diabetes Association (CDA). Specifically, group programming and situational problem-solving are recommended by both national organizations [45,45], as these features are shown to be effective in improving HbA1c outcomes [46]. Furthermore, the CDA recommends nutritional counseling of clients with diabetes by a dietitian, either one-on-one or in small group settings, to lower HbA1c levels [45]. A recent study supports this recommendation; it found that visits by a dietitian are associated with lower hospitalization rates and charges in persons of varied cultural backgrounds compared to diabetes classes and one-on-one visits from non-dietitian health professionals [47]. Our analysis suggests that incorporating dietitians has positive success rate differences on anthropometrics, and physical activity, in addition to HbA1c.

Table 2
Positive success rate differences (%) in HbA1c, anthropometrics, physical activity, and diet outcomes ($N = 13$ studies).

Feature	Outcome			
	Diet	Anthropometrics	Physical activity	HbA1c
Intervention setting				
Community-based: delivered within the participants' community (e.g., community center, YMCA) ($n = 3$)			100[a]	
Home-based: delivered in the home ($n = 4$)	66.67[a]	16.67[a]		
Hospital-based: delivered in a clinic affiliated with a hospital (e.g., outpatient ambulatory clinic) ($n = 8$)		28.57	50[a]	33.33
Primary care-based: delivered in a primary care setting (e.g. physician's office) ($n = 1$)				
Intervention format				
One-on-one: intervention is delivered individually to the participant by the interventionist ($n = 11$)	40		N/A	N/A
Group: intervention is delivered to a group ($n = 9$)		33.33	33.33[a]	8.33
Mode of delivery				
Face-to-face: Intervention is delivered face-to-face with patients ($n = 13$)	N/A	N/A	N/A	N/A
Written Literature: Intervention uses written material to deliver knowledge (e.g., handbook) ($n = 4$)		35.71[a]		25[a]
Telephone: Intervention is delivered by phone ($n = 4$)			50[a]	
Audio-Visual: Intervention uses educational videos to deliver knowledge ($n = 1$)			Not present	Not present
Education strategies				
Didactic: intervention uses a unidirectional lecture-based teaching strategy ($n = 9$)		3.57		50
Goal-Setting Dictated: intervention has a fixed goal for participants to achieve as determined by the intervention ($n = 9$)			25[a]	50
Goal-Setting Negotiated: intervention has a mutually-agreed goal by the participant and interventionist ($n = 9$)	50[a]		25[a]	
Situational Problem-Solving: intervention is aimed at increasing participants' problem-solving ability related to their diabetes management ($n = 9$)	50[a]	37.50	25[a]	
Peer-led Discussion: participants initiate diabetes-related topics/components they want to focus on during group sessions ($n = 1$)	Not present		Not present	
Interactive Discussion Groups: participants discuss and/or share content in a group setting, facilitated by an interventionist ($n = 5$)		60		4.76[a]
Feedback: interventionists provide specific feedback for participant s to aid in monitoring aspects of their own management (e.g. diet and exercise feedback) ($n = 5$)				60
Diaries and Reports: a specific type of feedback activity, where food diaries, physical activity logs, and SMBG logs were used by participants to record specific intervention components ($n = 4$)				75[a]
Duration				
Short Duration: length of intervention is < 6 months ($n = 7$)	25[a]			20
Long Duration: length of intervention is $\geq$6months ($n = 6$)		13.33	33.33[a]	
Intensity				
Low Intensity: participant participates in less than 10 intervention sessions ($n = 7$)	50[a]			
High Intensity: participant participates in equal or more than 10 intervention sessions ($n = 6$)		13.33	33.33[a]	33.33[a]
Interventionist				
Nurse: intervention delivered by nurse ($n = 5$)	50[a]	8.33[a]		
Dietitians: intervention delivered by dietitian ($n = 7$)		28.57	33.33[a]	8.33
Community Peer Worker: intervention delivered by community peer worker ($n = 3$)			50[a]	
Multidisciplinary Team: intervention is delivered by two or more types of interventionists ($n = 7$)		28.57	25[a]	
Content/specific components of intervention				
Psychosocial: intervention taught psychosocial related content ($n = 3$)	80[a]			
Diet: intervention taught diet related content ($n = 11$)	N/A	30	N/A	37.50
Exercise: intervention taught exercise related content ($n = 9$)			N/A	42.86
SMBG: intervention taught self-management of blood glucose (SMBG) content ($n = 5$)	25[a]			30[a]
Medication Adherence: intervention encouraged medication adherence ($n = 3$)	25[a]			
Recognition of Complications: intervention taught recognition of diabetes related complications ($n = 3$)			Not present	21.43[a]
Foot care: intervention taught foot care related content ($n = 4$)				
Supervised Exercise: patients participate in physical activity as part of the intervention sessions ($n = 1$)		80[a]		75[a]
Intervention design				
Language Tailoring: intervention included interventionists, discussions, materials or resources in the target dialect/language ($n = 4$)		54.17[a]		4.76[a]
Cultural Tailoring: intervention included interventionists, recipes, beliefs, values that belongs to target culture of interest ($n = 8$)	50[a]	50		
Needs Assessment: assesses each participant's individual needs formally for designing the content of the intervention before or during the initial sessions ($n = 6$)		35.71[a]	33.33[a]	
Individualized Assessment: assesses each participant's individual need throughout the intervention for tailoring the content of the intervention throughout the intervention (i.e., patient-centered care) ($n = 2$)	Not present		Not present	25[a]

N/A: Success rate difference is not applicable because one of the success rate is missing to calculate success rate differences. Not present: Success rate and success rate differences are not present because feature is not present for that specific outcome. Empty cells indicate negative success rate differences.

[a] Success rate difference is based on less than 5 studies so interpretation should be cautioned.

We are unsure why hospital-based interventions appear more successful across outcomes. However, hospital-based settings are more likely to have high-intensity sessions, in our review, which was found to be more successful on HbA1c, anthropometric, and physical activity. There is some evidence to suggest that high-intensity interventions or greater patient-provider contact hours is an important DSME feature that positively affects glycemic control [31,44]. Also, hospital-based interventions (eight studies) have been studied more than community (three studies) or home (four studies) based interventions. As the current trend in North America is to move DSME into community settings, understanding how this feature affects certain outcomes is imperative.

Tailoring DSME is suggested to improve diabetes-related outcomes [46]. Providing evidence on intervention features that have a high rate difference for the specific outcome of interest can facilitate tailoring (see Table 2). To illustrate, incorporating peer workers as interventionists and using the telephone as a means of delivering education had a positive rate difference of 50% for physical activity. Community peer workers are reported to be important interventionists for women in ethnic minorities, as they often provide social support and act as a liaison between the participants and health care professionals [48,49]. The use of telephone for improving physical activity is supported by a meta-analysis that reported delivery of diabetes self-management coaching via telephone had a positive effect on exercise [45]. Phone contact is convenient, simple and inexpensive; it may also be useful in reaching individuals who have barriers traveling to programs.

Interventions that have psychosocial content (e.g., discuss quality of life with participants, and include empowerment or motivational interviewing) had a positive rate difference of 80% with diet outcomes. The relationship between diet and psychosocial issues is particularly relevant for women from high-risk ethnic groups living with DM. Interventions that focus on psychosocial support and self-management have proved successful in some studies among Hispanic populations because they address emotions and beliefs about diabetes and deal with the question of how adjusting one's lifestyle may conflict with cultural norms [50]. Another study suggests that African American women have difficulty complying with diet because of poor psychosocial adjustment and denial of the severity of the disease [51] and thus, DSME programming that incorporates psychosocial coping strategies may be effective in improving dietary behaviors.

Using diaries and providing feedback to participants both have over 50% positive rate differences for HbA1c outcomes in our findings. Providing feedback and using diaries or logs may be useful in improving HbA1c because they are tools that may allow interventionists and patients to discuss barriers and find solutions to overcome self-management challenges. In a randomized trial, a graphical representation of HbA1c level for patients and physicians to use as a log and point of feedback for every visit has been found to decrease HbA1c levels in inner-city patients compared to those who did not use the logs [52]. This feature may be effective because it facilitates communication and overcomes some language, culture and literacy barriers due to its graphic nature [52].

As mentioned earlier, DSME interventions have proven to be generally effective; however, the proportion of intervention studies that report positive effects for HbA1c, anthropometrics, physical activity, and diet was less than one-third in our review. Perhaps the features used in these interventions are somewhat traditional that worked well in mainstream population, which may not benefit women from high-risk ethnic groups living with DM. For instance, intervention features that address broader community issues (e.g., cultural group cohesion and social support) may be more beneficial on outcomes than the more traditional features (e.g., written educational resources, didactic teaching styles). Cultural appropriateness of an intervention is advanced when "surface structures" such as language tailoring of brochures is supplemented with "deep structures" such as addressing cultural history, values, and norms [53]. Intervention data available for this review largely focuses on these aforementioned "surface structures" and only some data were available on "deep structure" features (i.e., individualized assessment, needs assessment, cultural tailoring). Future research needs to assess the effectiveness of both surface and deeper structures within DSME programming for women from high-risk ethnic groups living with DM.

Research on gender differences within ethno-cultural populations is important given the potential impact of gender roles, cultural norms, beliefs and values on women and their health management. We advocate that future program evaluations include a gender-based analysis, which will provide valuable information to better tailor and deliver services to a growing population of individuals at greater risk for diabetes and its complications.

The heterogeneity in study populations, interventions, and measurements of health outcomes limited our ability to conduct a meta-analysis. Thus our calculation is based on rate differences and not the effect size. The handful of studies (n = 13) that fit our criteria limited our ability to stratify our analysis by cultural group. Generally, searching for gender-specific information was challenging, as most DSME interventions are delivered and evaluated for both men and women without a gender-based analysis or stratification. We acknowledge that the populations we aggregated have different cultural values, beliefs, and experiences. However, these groups of women living with diabetes may have some parallel self-management experiences, given that they may share social similarities because of their gender and ethno-cultural experiences, which may influence the self-management processes. Given the small number of studies, our conclusions about the success of various intervention features should be interpreted with caution.

4.2. Conclusion

Although the provision of DSME is pervasive and is recommended as a critical resource to assist and support diabetes self-management among individuals, we have little understanding of intervention features that promote behavior change and in turn improve clinical outcomes, particularly in ethnically diverse populations. This comprehensive review provides insight into how DSME interventions can be made more effective by placing emphasis on intervention features that are potentially successful at achieving specific outcomes in women of African/Caribbean and Hispanic/Latin ethnicity. While five intervention features (i.e., hospital-based intervention setting; group intervention format; situational problem-solving; frequent sessions; or incorporating dietitians as interventionists) have a positive and broad impact on three out of the four outcomes assessed, other features also have a strong positive effect on specific outcomes that should be considered.

4.3. Practical implications

Given the results from our systematic literature review, we propose that the balance between tailoring care and optimizing resources can be achieved by prioritizing common intervention features that have a positive yet broad effect on outcomes, and then tailoring intervention features based on patients' personal

goals or specific health outcomes of interest. This would allow additional flexibility in how DSME interventions are delivered and personalized. Selecting intervention features that are most suitable for an individual is a more patient-centered approach in delivering DSME.

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Conflict of interest

The authors of this review have no relevant conflict of interests to disclose.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.pec.2013.03.007.

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