A Resilience Intervention for Adults with Type 2 Diabetes: Proof-of-Concept in Community Health Centers

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Abstract

Background: Given the psychological stress associated with managing type 2 diabetes (T2D), resilience-promoting interventions may particularly benefit populations experiencing high levels of stress (e.g., racial/ethnic minority and lower-income individuals). Federally qualified Community Health Centers (CHCs) primarily serve these patients and are therefore ideal settings for resilience-promoting T2D programs. This proof-of-concept study tested the Resilience-Based Diabetes Self-Management Education (RB-DSME) intervention within a CHC.

Methods: Thirty-five patients with T2D (M age = 51 years, 71% female, 60% Hispanic, 69% annual household income <$20,000) at two clinics within the CHC completed the RB-DSME, consisting of eight bi-weekly classes and two monthly support groups. In this treatment-only design, resilience resources, self-management behaviors, and physical and mental health outcomes were measured at baseline and 6-months.

Results: Attendance ($M = 7.66/10$) and program satisfaction ($M = 6.79/7$) were high. Participants improved adaption to stress ($d = .67$), adaptive coping ($d = .60$), diabetes empowerment ($d = .57$) and finding positive meaning ($d = .85$). Large increases in self-management behaviors ($d = 1.38$) and number of steps ($d = 1.11$) were also observed. Participants lowered A1C from baseline ($M = 8.79\%$) to 6 months ($M = 8.11\%$; $d = .50$), along with diabetes distress ($d = 1.31$), depressive symptoms ($d = .80$), and general perceived stress ($d = .55$).

Conclusions: This study demonstrated the ability of the RB-DSME to improve resilience resources, self-management behaviors, and health outcomes among racial/ethnic minority and lower-income patients with T2D at clinics within a CHC. A larger, randomized trial should more rigorously test the RB-DSME in this clinical setting.

Keywords

Resilience; diabetes; stress; health disparities; self-management

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Introduction

Type 2 diabetes (T2D) is the 6th leading cause of disability [1] and 7th leading cause of death in the United States (U.S.) [2], accounting for the highest healthcare spending among all disease categories for adults [3]. Racial/ethnic minority and lower socioeconomic status (SES) individuals have a higher prevalence of T2D and morbidity and mortality associated with the disease [4,5]. Diabetes-related complications are relatively common among these groups, often with dire consequences (e.g., high prevalence of end-stage renal disease, retinopathy, and depression) [6]. Yet, this unremitting accumulation of damage is largely preventable. Impactful interventions addressing T2D disparities are urgently needed and align with the National Institutes of Health, World Health Organization, and United Nations' goals to develop effective, tailored behavioral interventions to promote health in populations that experience health disparities [7,8].

The Obesity-Related Behavioral Intervention Trials (ORBIT) model for behavioral treatment development is a systematic framework for designing, refining, and testing such interventions [9]. The transdisciplinary ORBIT model facilitates the translation of basic behavioral science results to clinical application through a series of phases including defining, refining, proof-of-concept, pilot testing, efficacy testing, and effectiveness research [9]. The remainder of this introduction discusses phase Ia (define) and phase Ib (refine) before introducing the current study (phase IIa: proof-of-concept).

Literature Review: ORBIT Phase Ia (Define)

Health disparities in T2D may be partially explained by stress-related difficulties in practicing self-management behaviors. Acute and chronic stressors associated with T2D are often compounded by general life stressors (e.g., financial challenges, difficulty securing employment, discrimination), which worsen T2D by reducing adherence to diabetes self-management behaviors [10,11], causing insulin resistance, T2D-related complications, and subsequently diminishing physical and mental health [12,13]. In addition to these life stressors, perceived stress is also a risk factor for disparities in T2D [12,14]. Low-income individuals with T2D report perceived stress as a primary obstacle to healthy eating [15], and African American women with T2D serving multiple caregiver roles report high levels of perceived stress (e.g., difficulty saying "no", putting family needs ahead of self) that inhibit self-management behaviors [16]. Along with perceived stress, depression is also associated with poorer diet, less physical activity, and lower adherence to diabetes medication [17].

In addition to inhibiting self-management behaviors, perceived stress can also impair T2D control via biological pathways, which in turn negatively impact individuals' physical and mental health. According to the allostatic load model, the hypothalamic pituitary adrenal (HPA) axis is the primary biological pathway by which perceived stress influences disease [18]. The stress response, although initially adaptive, can become problematic if engaged excessively over the long-term [19]. For example, elevated levels of cortisol in scalp hair, a biomarker of chronic stress exposure, are associated with higher A1C among African American adults with T2D [20]. If a perceived threat persists long-term, the stress can

contribute to the onset of depression via endocrine and immune system pathways [21,22], and impair health [23].

Although perceived stress can contribute to elevated diabetes risk, it also represents a modifiable T2D determinant [12]. The impact of perceived stress on T2D self-management can be attenuated by resilience resources, offering an innovative approach to self-management aligned with global strategic plans for more research examining the role of resilience in health [7,8]. Resilience is the ability to adapt in the face of adversity to promote positive outcomes [24,25], and describes a constellation of attributes [26–30] that reflect one's resolve to succeed despite adversity (e.g., determination, confidence, personal strength [27], positive adaptation to stress [28,29], emotional regulation [31,32], and supportive relationships [24,33]). Higher levels of resilience resources are associated with enhanced diabetes self-management behaviors and improved A1C in the face of diabetes distress [34–36].

Intervention Development and Target Population: ORBIT Phase Ib (Refine)

Resilience can be developed to improve adaptation to stress and utilized in interventions to improve diabetes-related health outcomes. Our Resilience-Based Diabetes Self-Management Education (RB-DSME) intervention helps participants transfer learned resilience skills that they employ in other facets of their lives to their daily diabetes self-management. Racial/ethnic minority and lower-SES individuals may particularly benefit from resilience-infused diabetes programming because they experience high levels of life stressors and perceived stress [37] which can compound T2D-associated stressors and compromise T2D outcomes [38–40]. The RB-DSME has previously demonstrated outstanding recruitment and retention in predominantly African-American church settings and has shown clinically meaningful improvements in T2D health indicators [41,42].

In the U.S., federally qualified Community Health Centers (CHCs) serve a high proportion of racial/ethnic minority individuals and patients with lower SES and are therefore ideal locations to deliver resilience-based diabetes programming. Furthermore, diabetes programs offered by CHCs can improve glucose control and decrease medical expenditures by reducing emergency department visits and lowering inpatient costs due to diabetic complications. Thus, conducting the RB-DSME intervention in CHCs is a promising opportunity to integrate resilience programming in a high-risk clinical setting to address disparities in T2D.

In order to tailor the existing RB-DSME curriculum to the CHC setting and patient population, we conducted informal RB-DSME sessions in the context of group medical visits with a small group of patients (*N*=9). Classes were led by a board-certified endocrinologist, with assistance from the clinical extended health team (i.e., nurse, clinical pharmacist, behavioral health counselor). The RB-DSME was well-received, and clinically significant improvements were found over a six-month period (i.e., average change in A1C from 9.7% to 8.0%; unpublished data). Patients valued the instruction from a physician, the assistance from the extended health team, and the partnership with CHC staff, and suggested that bi-weekly classes were an optimal meeting frequency for the program.

The Current Study: ORBIT Phase IIa (Proof-of-Concept)

The findings above suggested that the RB-DSME may be feasible in CHCs. According to the ORBIT model, the next appropriate step is a proof-of-concept using a treatment-only design to determine if the treatment merits more rigorous and costly testing. This type of study can determine if clinically significant improvements under ideal conditions can be produced that warrant using a randomized design. Thus, our next step was to conduct the current proof-of-concept study, which tested the RB-DSME intervention's ability to improve clinically relevant outcomes for patients with T2D at two clinics within a large federally qualified CHC in central Texas. We hypothesized that participants receiving the RB-DSME would have enhanced resilience resources, T2D self-management behaviors, and T2D physical and mental health outcomes at 6 months post-study entry compared to baseline.

Methods

Study Design

The proof-of-concept of the RB-DSME intervention at two clinics within a federally qualified CHC was examined using a treatment-only pretest-posttest design. Primary health outcomes were measured at baseline prior to the start of the intervention, and again at six months post-study entry. Two clinics participated, each hosting two small groups, for a total of four groups. The intervention was designed to help participants use resilience resources to effectively manage their T2D. All classes were taught by a board-certified endocrinologist with assistance from the extended health team (i.e., nurse, clinical pharmacist, behavioral health counselor). The program included eight bi-weekly class sessions followed by two monthly support group sessions.

Participants and Procedures

Participants were a convenience sample (N=42) of patients diagnosed with T2D who received care at two clinics within a CHC in Central Texas. Recruitment flyers were posted onsite and given to health care providers to share with their patients. Participants either contacted study staff directly or were referred by their physician. Participants were required to meet the following inclusion criteria: 1) diagnosed with T2D; 2) between 18 and 75 years old; and 3) not currently participating in another diabetes self-management program. Individuals were excluded if they were pregnant/lactating or had a medical condition for which changes in diet and activity would be contraindicated (e.g., kidney failure requiring dialysis and special dietary requirements, peripheral vascular disease severe enough to preclude walking three times/week). We did not experience difficulty in enrolling participants; over 80% of individuals who expressed a desire to participate in the program attended baseline data collection and participated.

In total, 42 participants completed the baseline assessment, comprising the four small groups of approximately 10 people per group. Seven participants discontinued the intervention and did not complete the 6-months data collection, resulting in a final analytic sample of N=35 (Figure 1). Eighty-six percent of completers had a high school degree/GED or higher

educational attainment, while 43% of non-completers had a high school degree/GED or higher. The analytic sample was 71% female (25 women, 10 men), diagnosed with T2D an average of 13 years (range: 1 month-39 years), and ranged in age from 26 to 72 years with a mean age of 51 years. The most frequently reported demographic characteristics of participants were: Hispanic (60%), separated/divorced (40%), completed high school (46%), household income $19,999 or less (69%), and unemployed and not looking for work (37%). Descriptive information of the study sample is presented in Table 1.

Collection of survey and physiological data at baseline and at 6-months took approximately one hour to complete. All study variables for each participant were assessed during a single study visit. Questionnaires were self-administered, with assistance provided to those with literacy limitations. Physiological data were collected by a trained technician. Participants received $20 cash for completing baseline testing and an additional $20 for completing the 6-month follow-up testing, in compensation for their time. If needed, a one-day bus pass valued at $2.50 was also provided for each trip to the clinic to participate in the study. Written informed consent was obtained from all participants, and the study protocol was approved by the Institutional Review Board of the sponsoring university.

Measures

Participant characteristics included age, sex, race/ethnicity, marital status, education, employment, household income, length of T2D diagnosis, and diabetes-related medication use. A measure of participants' satisfaction with the RB-DSME intervention was assessed with the following item answered on a 7-point Likert scale ranging from 1 (*extremely dissatisfied*) to 7 (*extremely satisfied*): "How satisfied were you with the diabetes program?" All survey measures (resilience resources, T2D self-management behaviors, and T2D physical and mental health outcomes) are listed below. Unless stated otherwise, these measures were calculated as the mean of all items and asked participants to reflect over the past three months, corresponding with the three months indexed by retrospective A1C assessment.

Resilience Resources

Resilience resources were assessed using four indicators: 1) adaptation to stress; 2) adaptive and maladaptive coping strategies; 3) finding positive meaning; and 4) diabetes empowerment. Adaptation to stress was measured using the 6-item Brief Resilience Scale (BRS) [43], which assesses the capacity of an individual to bounce back or recover from stress. Respondents reported the degree to which they felt statements such as, "I tend to bounce back quickly after hard times," and "It does not take me long to recover from a stressful event," described themselves. Response options ranged from 1 *(strongly disagree)* to 5 *(strongly agree)*. Internal consistency for the BRS was high at baseline ($\alpha = .88$) and follow-up ($\alpha = .85$).

Coping strategies were measured using a shortened version of the Brief Coping Orientations to Problems Experienced Scale (Brief COPE), including one item from each of the fourteen subscales included in the Brief COPE [44]. Participants were asked to what extent they utilized specific cognitive and behavioral coping strategies on a scale from 1 *(not at all)* to

4 *(a lot)*. Items were grouped into two commonly used subsets: adaptive and maladaptive coping strategies [45]. Adaptive coping strategies included planning, positive reframing, active coping, religion, acceptance, instrumental support, and emotional support, and maladaptive coping strategies included venting, behavioral disengagement, self-distraction, humor, substance use, denial, and self-blame. Partitioning the Brief COPE into these two broader coping strategies is consistent with prior research [45]. In patients with T2D, adaptive coping strategies have been associated with greater resilience and maladaptive coping strategies with lower resilience [46]. Adaptive coping strategies have also been associated with enhanced T2D self-management behaviors, whereas maladaptive coping strategies have been associated with greater depressive symptoms [47]. Internal consistency alpha coefficients for the adaptive and maladaptive coping subscales were .80 and .63, respectively, at baseline and .82 and .71, respectively, at follow-up.

Finding positive meaning was measured using a shortened version of the Positive Meaning Scale (PMS) [48]. Two items measured the extent to which participants found positive meaning in the context of their disease: "Did anything good come out of dealing with your diabetes?" and "Do you think it is likely that there is something to learn from your experience with diabetes?". Response options ranged from 0 *(definitely no)* to 3 *(definitely yes)*, and internal consistency was marginal at baseline ($\alpha = .59$) and high at follow-up ($\alpha = .81$).

Diabetes empowerment was measured using the 8-item Diabetes Empowerment Scale – Short Form (DES-SF) [49], operationalized as participants' self-efficacy in managing their diabetes. Sample items included, "I can try out different ways of overcoming barriers to my diabetes goals," and "I know the positive ways I cope with diabetes related stress." Participants responded on a 5-point Likert scale from 1 *(strongly disagree)* to 5 *(strongly agree)*. Reliability was high at baseline ($\alpha = .82$) and follow-up ($\alpha = .87$).

T2D Self-Management Behaviors

Self-management behaviors were assessed using two indicators: a self-report survey of self-management, and a pedometer to measure physical activity. Diabetes self-management was assessed using the 13-item Self-Care Inventory-Revised (SCI-R) [50], which measured perceived adherence during the past two months to self-management behaviors such as checking blood glucose levels, eating correct food portions, reading food labels, and keeping clinic appointments. Responses were assessed on a 5-point Likert scale ranging from 1 *(never)* to 5 *(always)*. The SCI-R's internal consistency was marginal at baseline ($\alpha = .69$) and acceptable at follow-up ($\alpha = .71$).

Physical activity was measured with wrist-worn MOVABLE pedometers (Brecksville, OH), computer-synced at the beginning of each T2D class. Average steps per day were assessed over a 2-week period at baseline and at 6 months follow-up.

T2D Health Outcomes

Health outcomes were assessed using six indicators. A1C, blood pressure, and body mass index (BMI) served as indicators of physical health. Diabetes distress, general perceived stress, and depressive symptoms served as indicators of mental health.

A1C was determined through finger prick capillary blood collection measured on a DCA Vantage Analyzer (Siemens, Tarrytown, NY). This method meets the National Glycohemoglobin Standardization Program certification criteria for a total coefficient of variation <3% in the clinically relevant range [51]. Blood pressure was measured using an Omron model HEM-712C Automatic Inflation Blood Pressure Monitor (Omincron, Philadelphia, PA). Following a 5-minute rest period, three measurements were taken using the subject's right arm and averaged. BMI was calculated using the formula: BMI = (weight in kg)/(height in m)^2. Body weight was measured using a Tanita Professional Digital Scale (Model BF350). Participants wore street clothes and no shoes; coats and belts were removed. Height was determined using a portable stadiometer (Seca 214).

Indicators of mental health included diabetes distress, general perceived stress, and depressive symptoms. The brief Diabetes Distress Scale (DDS2) [52] was used to measure patients' level of distress related to their diabetes care. Participants responded to two items on a Likert scale from 1 (*not a problem*) to 6 (*serious problem*): "Feeling overwhelmed by the demands of living with diabetes" and "Feeling that I am often failing with my diabetes regimen." Internal consistency was high at baseline (α = .90) and follow-up (α = .84).

General perceived stress was measured using the 4-item Perceived Stress Scale (PSS-4) [53], which measured the appraised stressfulness of the respondent's life situations on a Likert scale from 0 (*never*) to 4 (*very often*). Sample items included, "How often have you felt that you were unable to control the important things in your life?" and "How often have you felt difficulties were piling up so high that you could not overcome them?" The internal consistency of the PSS-4 was high (α = .81) at baseline and adequate at follow-up (α = .68).

Depressive symptoms were measured using the 9-item Patient Health Questionnaire (PHQ9) [54], which assessed depressive symptoms experienced (e.g., depressed mood, feelings of guilt, worthlessness, restless sleep). Sample items included, "feeling tired or having little energy," "little interest or pleasure in doing things," and "trouble concentrating on things, such as reading the newspaper or watching television," with responses ranging from 0 (*not at all*) to 3 (*nearly every day*). The PHQ9 measure had strong internal consistency at baseline (α = .89) and follow-up (α = .90).

Resilience-Based Diabetes Self-Management Education (RB-DSME) Intervention

The RB-DSME contains all core aspects of DSME [55], including signs and symptoms of T2D, long-term diabetes complications, how to use a glucometer, monitoring and interpreting blood glucose values, carbohydrate counting, healthy eating in social situations, benefits of physical activity, understanding medications, and daily T2D self-management (Table 2, left column). The RB-DSME builds on foundational resilience resources (e.g., self-efficacy, social support) in standard DSME, infusing novel resilience resources (adaptation to stress, finding positive meaning, adaptive coping, coping with discrimination, emotional regulation) into the RB-DSME curriculum (see Table 2, right column). Throughout the classes, resilience resources are integrated into each DSME component to overcome barriers to implementation and adherence.

Active learning strategies demonstrate how stressful situations can be used as opportunities to grow and improve control over T2D self-management. The RB-DSME uses the phrase *Please Take Care of Self* to describe core strategies individuals use to enhance their resilience resources. These strategies include having a Positive mindset [56], focusing on Tiny behavior changes [57], creating Community support via cheerleaders (e.g., family/friends) and coaches (e.g., healthcare providers) [24,58], and fostering a Supportive internal (e.g., emotional regulation) and external (e.g., home, work, community) environment [59,60]. In the support group sessions, participants discuss personal challenges and solutions to long-term control of T2D using a more informal approach.

Statistical Analysis

Paired-samples t-tests were conducted to assess changes in all study variables from baseline to 6 months post-study entry, with p-values adjusted using the Benjamini-Yekutieli procedure [61]. All analyses were performed using SPSS Statistics version 25 (IBM Corporation, Armonk, NY) and were conducted using the 35 participants who completed both data collections. Demographic characteristics were compared between those who dropped out and those who completed the study. Participants completing the study had higher education attainment than those who dropped out ($t[40] = 2.25$, $p < .05$). No other demographic differences were found between completers and non-completers.

Treatment effect sizes (Cohen's *d*) were calculated by dividing the mean paired difference by the standard deviation paired difference. Bootstrap resampling (5000 iterations) was used [62]. In an exploratory test of dose-response to the intervention, multiple linear regression was performed with number of classes attended as the predictor and A1C at 6-months as the outcome, controlling for baseline A1C.

Results

The average program attendance across all 4 RB-DSME intervention groups was high ($M = 7.66$ sessions out of 10, SD = 1.49). Participants' rating of overall class satisfaction was highly positive ($M = 6.79$ on a 7-point scale, SD = .48), with 94.3% of participants indicating a continued interest in attending monthly support group sessions. Approximately 25% percent ($n = 9$) of participants reported a decrease in their prescription diabetes medication (e.g., lower dosage, fewer medications) after completing the program.

As shown in Table 3, significant increases in most resilience resources (adaption to stress, adaptive coping, finding positive meaning, and diabetes empowerment) were reported; however, maladaptive coping did not improve significantly. Treatment effect sizes for adaption to stress ($d = .67$), adaptive coping ($d = .60$), and diabetes empowerment ($d = .57$) exceeded Cohen's convention of .50 for a medium effect. The effect size of $d = .85$ for finding positive meaning exceeded Cohen's .80 cutoff for a large effect [63]. Participants also reported large significant increases in self-reported diabetes management behaviors ($d = 1.38$) and average steps per day ($d = 1.11$).

Of the T2D physical health outcomes assessed, only A1C improved significantly, decreasing from baseline ($M = 8.79\%$, SD = 1.97, range: 5.2–14.2%) to six months ($M = 8.11\%$, SD =

1.64, range: 5.7–11.4%), indicating a medium-sized treatment effect ($d = .50$). Participants reported a significant decrease in all three mental health measures from baseline to six months, including large effects for diabetes distress ($d = 1.31$) and depressive symptoms ($d = .80$) and a medium effect for general perceived stress ($d = .55$). In the assessment of a dose-response relationship between intervention participation and A1C, RB-DSME attendance was not associated with A1C, although the standardized coefficient was of the expected direction and magnitude ($\beta = -0.38$, $p = 0.13$).

Discussion

This study tested the proof-of-concept of the RB-DSME intervention delivered to lower income and racial/ethnically diverse minority adults attending two clinics within a large federally qualified CHC. Attendance, retention, and program satisfaction were high for all groups. Participants noted that having the classes and support groups taught by the CHC endocrinologist with assistance from the extended health team contributed to their high attendance and satisfaction with the program. The convenient location of classes in CHC clinics, where participants regularly visited for their medical appointments, enhanced comfort and ease of attendance. Significant improvements were observed for resilience resources (adaptation to stress, finding positive meaning, adaptive coping, diabetes empowerment), self-management behaviors (self-management behaviors, physical activity), and T2D physical (A1C) and mental (diabetes distress, perceived stress, depressive symptoms) health outcomes. Collectively, these results provide support for the ability of the RB-DSME to improve T2D-related psychosocial, behavioral, and clinical outcomes when delivered in a CHC setting.

Individuals with T2D engage in chronic disease management in the face of a plethora of daily challenges; thus, the use of resilience resources are vital to effectively control the disease. In the present study, RB-DSME participants increased adaptation to stress, a resilience resource and dynamic process in which individuals exhibit positive adaptation despite stressful experiences [43,64], which may reduce adverse effects and complications from the disease. An advantage of the RB-DSME curriculum, in addition to addressing T2D risks and vulnerabilities, is the focal emphasis on identifying and fostering strengths that support healthy behaviors. This benefit was exemplified in the present study by participants significantly enhancing their ability to find positive meaning within the context of T2D. Consistent with our previous work [41, 65], and that of adult survivors of various types of cancer [66], finding positive meaning may help sustain coping efforts and facilitate long-term adjustment. Indeed, positive emotional health is consistently associated with T2D self-management behaviors and improved health outcomes [67].

In addition to improvements in adaptation to stress and finding positive meaning, RB-DSME participants also reported engaging in more adaptive coping strategies (e.g., taking action, reframing, planning, seeking social support) at the conclusion of the intervention. Despite differences in age, gender, ethnicity, cultural background, education, and SES, participants shared their struggles openly with others in the program and worked collaboratively to reframe their thinking and recommit to their T2D self-management goals. Adaptive coping strategies can improve a patient's psychological adjustment to having T2D [68].

We hypothesize that reframing difficult situations into opportunities for personal growth fostered a belief in participants' ability to positively impact their life circumstances. This speculation is aligned with the significant increase in participants' diabetes empowerment, and is consistent with literature noting the importance of empowering patients to enhance their diabetes self-care and advocate for themselves when interacting with medical providers [69,70].

Individuals possessing high levels of resilience resources have the capacity to maintain diabetes self-management behaviors in the face of mounting diabetes distress [71]. Supporting this assertion, RB-DSME participants in the current study increased self-reported T2D self-management behaviors and physical activity, both with large effect sizes. This finding is consistent with our previous work in African-American church settings, in which RB-DSME participants enhanced their physical activity and diabetes self-care [41, 72]. In those studies, we posited that participants' high resilience resource scores combined with a resilience resource-promoting environment (e.g., focus on finding positive meaning from setbacks through storytelling) accounted for behavioral improvements. In addition to the resilience-promoting environment of the RB-DSME, the CHC setting in the present study enabled participants access to members of the expanded health team (i.e., clinical pharmacist, nurse, behavior health counselor) who provided valuable educational information and social support. This enhanced network of support staff may have further contributed to behavioral improvements of RB-DSME participants.

Although the only significant improvement in physical health outcomes in the present study was for A1C, the magnitude of the reduction (from 8.8% to 8.1%) is promising. This improvement is superior to the mean A1C reduction of −0.31% found in a meta-analysis of 20 randomized controlled trials of DSME delivered among racial/ethnic minority groups [73]. In considering results of resilience interventions, we are aware of only one other study testing a resilience intervention to enhance T2D health outcomes, which also lowered A1C among participants. However, baseline A1C was already at recommended levels (6.7%) and the sample consisted overwhelmingly of non-Hispanic Whites [74]. Importantly, participants in the current study who also decreased medication use (n=9) lowered their A1C from 8.7% to 7.2%, suggesting that behavior modification, rather than intensification of medications by the physician or clinical pharmacist was the primary driver of improvement in A1C. In sum, preliminary clinical benefits of the RB-DSME were supported.

Complementing the impact of the RB-DSME intervention on A1C are the benefits on mental health outcomes. Participation in the RB-DSME intervention resulted in significant decreases in diabetes distress, general perceived stress, and depressive symptoms from baseline to 6-months. This is noteworthy, as individuals with T2D experience high levels of stress and depressive symptoms [13,23]. These adverse mental health consequences are associated with impaired T2D self-management behaviors, higher risk for cardiovascular disease, and mortality [75]. Reducing stress-related outcomes may thus allow individuals with T2D to adopt and adhere to self-management behaviors more easily, ultimately improving T2D health outcomes and associated complications.

Given the clinically significant A1C reduction achieved in the current proof-of-concept study, the next phase of research according to the ORBIT model is a larger, randomized controlled pilot trial (Phase IIb) [9]. In this future study, the RB-DSME would be tested against a control group receiving usual diabetes care in an attempt to replicate the clinically significant A1C reduction over and above important confounding factors (e.g., passage of time, nonspecific attention). The randomized Phase IIb pilot study will also test whether the usual diabetes care control group is appropriate for a larger efficacy trial (e.g., minimal dropouts, credible to participants). The positive findings of the present study will allow us to proceed confidently and systematically to a more rigorous and resource-intensive test of the RB-DSME's impact on A1C among individuals with T2D in CHCs.

The study findings may have broader implications for T2D treatment in underserved communities and group medical visits in the U.S. and abroad. Our RB-DSME intervention was delivered in the format of group medical visits, which shift the power relationship between patients and health-care providers, creating a patient-centered, interprofessional environment that promotes patient confidence in disease management [76]. Group medical visits often lower A1C [77] and have been successfully used for diabetes treatment in Canada, Europe, and China [78], so the RB-DSME could be integrated into existing group medical visit infrastructure in those countries. Interventions adopting the group medical visit format, such as the RB-DSME, may be especially useful for CHCs, which often lack the resources of traditional clinical settings. The results of our study support a need for expanded and sustainable T2D programming in CHCs, the adoption of which has been hampered by funding constraints in the U.S. Although CHC-equivalent agencies are less common in countries with free and/or universal healthcare, increasing healthcare reach to marginalized communities is a growing global priority. For instance, the European Union (EU) is currently undertaking substantial efforts toward greater health equity for its citizens [79], so healthcare access for underserved populations in the EU will likely increase in the future. This initiative may result in more opportunities to treat underserved patients with T2D in a similar manner to CHCs. Policy changes supporting viable funding and reimbursement models for resilience-promoting diabetes programs could lead to a greater reach in underserved communities to achieve health equity [80].

The findings and implications of this proof-of-concept study should be considered in light of several study limitations. First, the lack of a control group does not provide strong causal evidence for observed treatment effects, given that participants could have improved on variables of interest due to factors outside of the program. Second, the use of self-report survey data has inherent limitations, such as the potential for untruthful or inaccurate responses due to the lack of self-awareness or fatigue. Third, response rate for participation in the study was not assessed, which could have informed future recruitment efforts for similar programs. Finally, the study may have been underpowered to test the large number of variables in the relatively small sample size. Despite these limitations, this study documented the ability of the RB-DSME intervention to enhance resilience resources, T2D self-management behaviors, and T2D health outcomes among lower SES and racial/ethnic minority patients at two clinics within a federally qualified CHC. A larger, randomized study is necessary to more rigorously test the impact of the RB-DSME in this setting.

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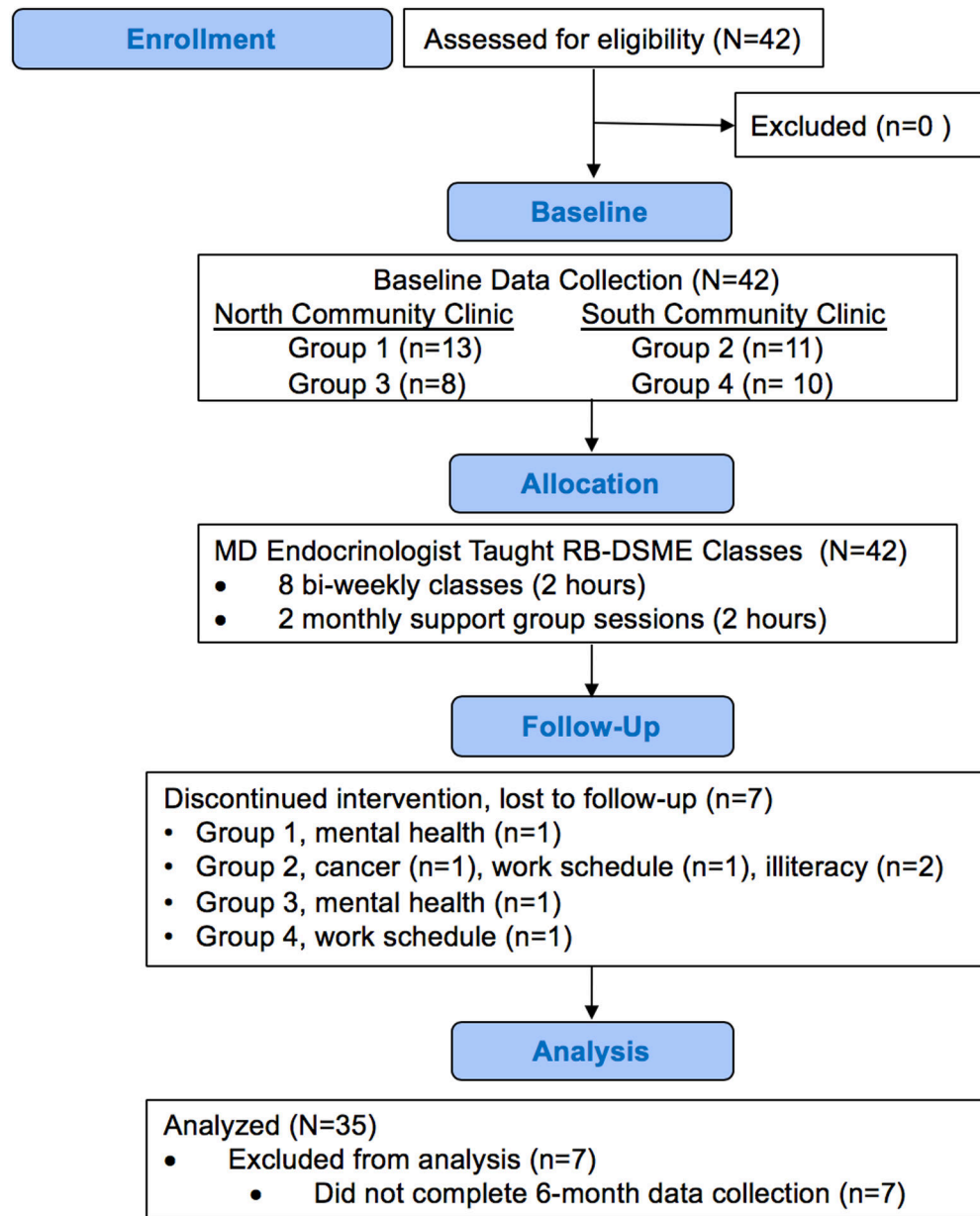
Figure 1.
Participant flowchart

Table 1.

Descriptive statistics of the study sample

Participant Characteristics	N	M (SD) or %
Age	35	51.03 (11.09)
Sex (females)	25	71.4%
Race/Ethnicity		
Non-Hispanic White	6	17.1%
Hispanic or Latino	21	60.0%
African American	5	14.3%
Other	3	8.6%
Marital Status		
Never Married	5	14.3%
Married	13	37.1%
Separated/ Divorced	14	40.0%
Widowed	3	8.6%
Education		
Less than High School	5	14.3%
High School Diploma	16	45.7%
Some College/Technical School	9	25.7%
College Graduate (Degree)	2	5.7%
Graduate Degree	3	8.6%
Employment		
Employed Full or Part Time	7	20.0%
Unemployed/Laid Off & Looking for Work	7	20.0%
Unemployed & Not Looking for Work	13	37.1%
Homemaker	2	5.7%
Retired	6	17.1%
Household Income		
$19,999 or less	24	68.6%
$20,000 to $39,000	9	25.7%
$40,000 to $59,000	1	2.9%
$60,000 to $79,000	1	2.9%
Diabetes Diagnosis Length (years)	35	12.58 (8.49)
Diabetes-Related Medication Use		
Oral Meds and/or Non-insulin Injectable	8	23%
Insulin	10	28%
Both	14	40%
None	3	9%

Table 2.

Overview of the resilience-based diabetes self-management education intervention

The RB-DSME Includes All Aspects of Traditional DSME (left column) Infused with Resilience Resources (right column)	
Week 1. What is Diabetes?	
• Why you have T2DM and what you know; client goals & wishes • The role of sugar and the role of insulin • Signs & symptoms of diabetes • Confirming a diagnosis of diabetes • Long term complications of diabetes	• Definitions: diabetes distress, perceived stress • Introduce resilience resources; emotions associated with T2DM • Practicing resilience; positive outcomes in the face of adversity • Emotional regulation; adaptation to adversity; coping strategies • Positive meaning: what good has come from your T2DM diagnosis?
Week 2. Getting Your Glucometer to Work for You	
• How to use your glucometer; challenges to testing blood glucose • Desired values when testing - blood glucose and A1C • Troubleshooting values that are too high or too low (self-efficacy	• Awareness of maladaptive coping strategies (e.g., denial, fatalism) • Applying adaptive coping strategies (e.g., taking action, planning, reframing, social support, spiritual coping) to manage blood glucose
Week 3. Carbs Count!	
• Understanding the link between blood glucose and food intake • What foods have carbohydrates & what foods are carb-free • The technique of carb counting • Glycemic index and load • Troubleshoot values that are too high or too low	• Emotional regulation strategies for overeating, especially at family and social gatherings • Applying adaptive coping strategies (e.g., taking action, planning, reframing, social support) in making healthy food choices • Focus on cultural food preferences and diabetes self-management
Week 4. Eating Made Easy! The Healthy Plate	
• The carb section of the healthy plate • The food groups and what each group consists of • Number of servings per day & serving sizes for each food group • Cultivating social support from family and friends for food choice • Relationship between knowledge and self-efficacy in making healthier food choices	• Cultivating social support, with emphasis on healthier culturally preferred foods prepared (e.g., at socials gatherings) • Continue applying adaptive coping strategies (e.g., positive reframing, planning, social support) in making healthy food choices • Offer sample healthy, culturally preferred snacks while discussing portion control and other nutrition principles • Link food choices to cultural context/preferences
Week 5. A Step Towards Success	
• The benefits of regular physical activity • Strategies for adding steps (baseline, build) • T2DM and physical activity: when to monitor your blood glucose • How to create a supportive external environment (e.g., fitness partner(s), community resources).	• Explain the link between physical activity and emotional regulation • Using physical activity to foster mindfulness (emotional regulation, positive meaning, adaptive coping, adaptation to stress) • Accountability provided by peers (social support) for performing regular physical activity
Week 6. Understanding Medications	

The RB-DSME Includes All Aspects of Traditional DSME (left column) Infused with Resilience Resources (right column)	
• Understand each medication you take and why • Important other powerful free medications (e.g. activity) • A review of long term complications of diabetes	• Address the cultural belief that God will take care of one's diabetes versus personal responsibility and spiritual coping • Coping with discrimination in healthcare settings (e.g., don't go to doctor, lack of access to medicine, feelings of intimidation)
Week 7. Grocery Store Shopping and Dining Out	
• Choosing healthier options at the grocery store • Learning how to enjoy dining out while making healthy choices • Simple nutritious recipes on a budget • Reading food labels	• Emotional regulation strategies for reducing impulsive shopping • Emphasize practical adaptive coping strategies (e.g., planning) for healthier food choices to serve at social gatherings • Adaptation to stress: making healthy choices in social settings
Week 8. Putting it All Together	
• Daily and yearly diabetes self-management responsibilities • Alcohol and diabetes; anxiety, depression and diabetes • Taking care of yourself when sick	• Finding positive meaning in the adversity of being sick (e.g., reflection, renewal, reemphasis on self care) • Self-efficacy for implementing resilience resources despite adversity
Support Groups	
• Assessment and knowledge gaps • Setting short and long-term goals; Community resources • Group problem solving of personal barriers to self-management • Grocery store tour, recipe sharing, cooking demonstration	• Informal group discussions; problem solving framed within cultural preferences • Historical cultural factors that influence health/health behaviors • Continual application of resilience resources for ongoing life stress

Table 3.

Baseline and six months means, standard deviations, and effect sizes for all study variables

Study Variables	Baseline		Six Months			
	M	SD	M	SD	t	Cohen's d
Resilience Resources						
Adaption to Stress	3.06	.91	3.67	.66	3.92***	.67
Adaptive Coping	2.79	.73	3.20	.59	3.47***	.60
Maladaptive Coping	1.85	.57	1.79	.56	−.78	.13
Finding Positive Meaning	1.87	.67	2.44	.56	5.03***	.85
Diabetes Empowerment	3.57	.83	4.08	.70	3.32**	.57
T2D Self-Management Behaviors						
Self-Report Behaviors	3.15	.59	3.87	.55	8.02***	1.38
Physical Activity - Steps	3950	2181	5625	2419	6.59***	1.11
T2D Health Outcomes						
Physical						
A1C	8.79	1.97	8.11	1.64	−2.92**	.50
Systolic Blood Pressure	131.74	15.26	129.50	17.64	−.62	.11
Diastolic Blood Pressure	76.38	11.47	77.35	10.74	.40	.07
Body Mass Index	68.24	19.71	68.25	19.78	.00	.00
Mental						
Diabetes Distress	3.90	1.34	2.57	1.16	−7.61***	1.31
Perceived Stress	1.83	.83	1.33	.70	−3.23**	.55
Depressive Symptoms	12.41	7.30	6.59	5.64	−4.68***	.80

Note.

*
$p < .05$,

**
$p < .01$,

***
$p < .001$