Published in final edited form as:

Diabetes Educ. 2014 July ; 40(4): 476–487. doi:10.1177/0145721714531336.

Lessons Learned from 20 Years of Diabetes Self-Management Research with Mexican Americans in Starr County, Texas

Sharon A. Brown, RN, PhD, FAAN [Centennial Memorial Professor in Nursing School of Nursing],

The University of Texas at Austin

Joseph H. Blades [Centennial Memorial Professor in Nursing School of Nursing], and

The University of Texas at Austin

Craig L. Hanis, PhD [Professor]

Human Genetics Center, School of Public Health The University of Texas Health Science Center at Houston

Abstract

Purpose—The purpose is to provide an overview of a 20-year research program aimed at testing diabetes self-management education interventions culturally tailored for Mexican Americans residing in an impoverished rural community on the Texas-Mexico border.

Methods—The research program involved focus group interviews to obtain community input, pilot testing to refine instruments and interventions, and community-based randomized controlled trials to examine intervention effects. Here the authors summarize lessons learned related to the: 1) overall effects of culturally tailored diabetes self-management education; 2) impact of culture on study design, intervention development, health outcomes, and community acceptance; 3) benefits of and findings from multiple focus groups held over time in the community; and 4) personal and cultural motivators for behavioral change that were evident among study participants.

Results—Post-intervention reductions in glycosylated hemoglobin (A1C) ranged from –1.4% to –1.7%-age points. Individuals who attended 50% of intervention sessions achieved a –6%-age point reduction in A1C. Intervention teams included bilingual Mexican-American nurses, dietitians, and *promotoras*, all recruited from the local community. Focus group interviews indicated that a traditional *promotora* model was not acceptable to the participants who wanted knowledgeable health professionals, perceived authority figures, to lead intervention sessions while *promotoras* provided logistical support. Free glucometers and strips, family participation, and interpersonal dynamics within intervention groups motivated individuals to make healthier lifestyle choices.

Conclusions—Culturally tailored diabetes interventions are effective in improving the health of socially disadvantaged minorities who bear a disproportional burden of type 2 diabetes and these interventions are cost effective.

Corresponding author: Sharon A. Brown, The University of Texas at Austin, School of Nursing, 1710 Red River Street, Austin, Texas 78701, telephone: (512) 232-4704, sabrown@mail.utexas.edu.

The authors declare that they have no conflicts of interest.

For 20 years, the authors developed and tested community-based diabetes self-management education (DSME) interventions on the Texas-Mexico border. In this paper, lessons learned from the Starr County Border Health Initiative are described related to four areas (Table 1):

- 1) whether culturally-tailored DSME interventions improved clinical outcomes of Mexican Americans who resided in an impoverished border community;
- 2) specific effects of culture that influenced the design, administration, outcomes, and community acceptance of and support for the intervention;
- 3) benefits of focus groups for evaluating intervention outcomes, community acceptance, and need for refinements; and
- 4) primary personal and cultural motivators for behavioral change that were evident among study participants.

Starr County, a typical rural border community that served as the research site for these studies, is the poorest county in Texas and one of the poorest counties in the U.S. (1,2) Hundreds of *colonias*, unincorporated communities that lack utility services, dot the landscape. (See Figures 1–4.) In 2011, the unemployment rate was estimated at 16.9%, almost 2.5 times that of the rest of the State (3). The area has been designated as medically underserved; the latest data available (2002) indicated that the ratio of population per general/family practice MD was 7,657:1 compared to 3,789:1 for the rest of the State; and the registered nurse ratio was 851:1 compared to 159:1 for the State (4). While the number of health care providers has increased over the past decade, the ratio of health care providers to the population in this and other border counties continues to lag behind the rest of the State (5). The authors designed interventions that met national standards for diabetes care and integrated specific cultural characteristics of Mexican Americans. For context, a brief description of the background literature and intervention(s) is provided below, followed by lessons learned from this body of work.

Background

In 2010, 50.5 million Hispanics resided in the U.S., comprising 16% of the U.S. population and making them the largest minority group; Mexican Americans comprise the largest Hispanic subgroup (6). Compared to non-Hispanic Whites, Hispanics tend to be diagnosed with type 2 diabetes (T2DM) at younger ages and exhibit higher blood glucose levels, lower insulin sensitivity and higher insulin response, higher rates of diabetes complications, and a lifespan shortened by 10 years (7–10). By 60 years of age, 50% of Mexican Americans have diagnosed or undiagnosed diabetes or impaired fasting glucose; these rates are increasing at alarming rates (11). Native American genetic admixture has been suggested as a factor in increased susceptibility to T2DM in Mexican Americans, perhaps contributing to ethnic differences in rates of energy expenditure and obesity, as well as patterns of body fat distribution (11–15).

Environmental factors, many of which are modifiable, also have been implicated as contributors to the diabetes epidemic, not only in Mexican Americans but across all racial/ethnic groups sedentary lifestyles, low socioeconomic status, barriers to accessing health

care, poor diet, and low health literacy about health issues and use of healthcare systems (16,17). Estimates are that 40% of the variation in obesity is due to genetic variation; 60% is due to excessive food intake and lack of physical activity (18). Mexican Americans experience numerous barriers to weight loss and glycemic control. They rely on family and *curanderos* (folk healers) for health advice and women, in particular, may subsume their own personal health needs in favor of those of their family. They may lack transportation to health care facilities and experience language differences with health care workers (19).

Brief Overview of the Interventions

The Starr County Border Health Initiative involved the development and testing of three different interventions: 1) an intensive yearlong version (“extended”); 2) a more “compressed” version that would be more translatable into clinical practice; and 3) the “compressed” version enhanced with the addition of a nurse case manager. These interventions and results of randomized clinical trials have been described elsewhere (1,2,20,26). A model, derived from meta-analyses conducted by the first author, served as the basis of all Starr County studies. The model incorporated aspects of the Health Belief Model and integrated Colquitt’s theory of training motivation (21). Diabetes health beliefs relating to ability to control diabetes, perceived benefits, social support, impact of job on diabetes, and commitment to diabetes self-management were addressed during intervention sessions. Questionnaires to measure these health beliefs, as well as diabetes-related knowledge, were extracted from the literature or developed by the research team specifically for this population (22–25). Translation and psychometric testing found both instruments to be valid and reliable measures in this population. However, the knowledge instrument that was developed for this population demonstrated superior, consistent levels of reliability (25).

The initial basic interventions were: 1) a yearlong 52-hour “extended” intervention involving 12 2-hour weekly education sessions followed by 14 2-hour biweekly support groups; and 2) a shorter 8-week, 22-hour “compressed” intervention involving 8 2-hour weekly education sessions plus 2-hour support group sessions held at 3, 6, and 12 months (2,20). In addition, the authors subsequently tested the “compressed” intervention by adding a nurse case manager (NCM) to provide individualized health guidance (26). Except for the early developmental work, all studies involved random assignment of groups to experimental or control conditions. Using study designs involving wait-listed control groups or comparisons of two interventions ensured that all study participants received a DSME intervention. Intervention sites included schools, churches, county agricultural extension offices, adult day care centers, and health clinics located throughout Starr County. Local bilingual Mexican-American nurses and dietitians provided intervention activities in Spanish; *promotoras* provided logistical support. Key elements included: 1) instruction on nutrition, self-monitoring of blood glucose, physical activity, accurate medication administration, and other self-care topics; and 2) support group sessions to promote behavior changes through individual goal setting, group problem-solving, and food preparation demonstrations.

The approach was culturally tailored in terms of language, dietary preferences, social emphasis, family participation, incorporation of cultural beliefs, and sensitivity to the socioeconomic status and lack of personal resources of study participants. For example,

typical Mexican-American foods were incorporated into dietary recommendations and food preparation demonstrations, based on healthier adaptations of favorite Mexican-American recipes. Dietitians led visits to the local grocery store to guide individuals in applying dietary information they had learned. Grocery store staff arranged “tasters” of low-fat, low-calorie foods for study participants during store visits. Support group sessions afforded opportunities for participants and their family members/friends to discuss problems in managing diabetes, express feelings about the impact of diabetes on the family, ask questions in a non-threatening environment, review previously learned information and skills, and participate in cooking demonstrations.

In every study, spouses or first-degree relatives were recruited to serve as supporters. Initial Starr County focus groups indicated that persons with diabetes, women in particular, did not perceive support from their spouses or other family members (20). The goal was to determine the impact of family support on health outcomes of study participants as well as on support persons. Supporters attended all intervention and data collection sessions. The intervention curriculum involved instruction at each session on how supporters could assist and motivate their family members to improve health habits. Thirty percent of the supporters had diabetes and they followed all recommendations given to the participants and received the benefits of the intervention, such as free glucometers and strips. Supporters without diabetes followed recommendations that applied to them, such as those relating to diet and physical activity, to prevent diabetes in these high-risk individuals. If the supporter was a family member, he/she was encouraged to assist the participant with family issues related to implementing recommendations, such as grocery shopping and meal preparation. Supporters also were instructed to walk with their family members between sessions and help problem solve regarding barriers to adopting recommendations. The same data that were collected from the participants were conducted on supporters. At data collection sessions, both participants and supporters were provided with laboratory data and at the exit interview, received health recommendations based on their laboratory findings.

The Research Field Office located in Rio Grande City, the county seat of Starr County, served as the center of operations for all projects. Research Field Office staff, some employed for more than 20 years, were trained in study measurements. They managed: patient flow through the office; basic investigational measurements, such as weights and blood pressures; and organizational activities, such as monitoring supplies, logging intervention attendance, and tracking the distribution of glucometers and strips. Lack of basic literacy necessitated that questionnaires be administered in one-to-one interviews with data collectors reading each question aloud in Spanish. Many spoke a blend of Spanish and English so questionnaire items were stated in both languages. Data collectors were instructed to: 1) create a comfortable interviewing environment; 2) read questions aloud without leading subjects to desired answers; and 3) communicate non-judgmentally about perceived negative health practices (e.g., use of unusual folk remedies). Blood samples were drawn via venipuncture, processed in the on-site laboratory, and shipped to the UT Houston laboratory for subsequent analyses.

Lesson #1. Effects of DSME Culturally Tailored for Mexican Americans

More than 1,100 individuals participated in the Starr County DSME interventions. Subjects were predominantly female (64%), obese based on BMI levels ≥ 30 , and, on average, in their mid-fifties. Individuals had elevated fasting blood glucose (FBG) and glycosylated hemoglobin (A1C) levels; on average baseline A1C levels were 12% and ranged from 6% to 18%; significantly higher than the recommended A1C of $\leq 6.5\%$. Language preference was Spanish; 90% of study participants preferred Spanish and 78% spoke Spanish at home. Approximately 25% of subjects were on insulin alone or in combination with oral hypoglycemic agents. Home remedies, such as herbal teas (e.g., teas from the *chaya* plant), garlic, and aloe vera, were commonly used to lower blood glucose (1,2,20).

The initial clinical trial (1994–1998) demonstrated statistically significant improvements in glycemic control, with the experimental group at 6 months showing a -1.4% -age point lower A1C compared to the control group (20). The condensed, more resource-efficient intervention (“compressed” versus the longer “extended” program) was also effective in reducing A1C, although the effects were not sustained as well at 12 months (2). Maximum A1C benefits were attained and maintained longer by individuals who attended $\geq 50\%$ of the sessions in the yearlong, more intensive “extended” intervention (Figure 5). At 12 months, the mean A1C of “compressed” groups had increased, while levels of “extended” groups continued to decrease, for a total reduction at 12 months of -1.7% -age points to an A1C of 9.2%. For the “compressed” intervention, which ended after 2 months, except for the 3 support groups that followed at specific intervals (3, 6, and 12 months), improvements leveled off at the end of the intervention and then diminished. In comparing the 12-month A1C of the top 10% achievers ($n=20$) in reducing A1C with the bottom 10% who were not successful, top achievers attended 57% of sessions, while the lowest group attended 37%. Top achievers reduced A1C levels by -6% -age points, compared to an increase of $+4\%$ -age points in the lowest group. These differences approached statistical significance ($p=.06$) on total number of sessions attended and were significant on support groups attended ($p=.04$). Weight loss patterns were consistent across all studies; initial small weight losses were not maintained over time. Diabetes-related knowledge, self-reported reduced fat intake, and increases in physical activity consistently improved in both the experimental and control groups; experimental groups had larger improvements in general.

Finally, the “compressed” intervention was pilot tested with the addition of a NCM to maximize program attendance and to individualize approaches to reducing remaining barriers to behavioral change (26). Findings indicated that the DSME interventions continued to be effective in improving glycemic control but more study is needed to explore further the utility of employing NCMs in rural, underserved communities. Overall, Starr County DSME studies have suggested that culturally tailored interventions are effective but continuing interventions are required in order for individuals to attain and sustain maximum health benefits (2).

Lesson #2. Impact of Culture

Recruitment and retention of minority groups for research purposes have historically been difficult, resulting in low representation of minority populations in research. In Starr County,

recruitment levels of 95% were achieved, reflecting a broad community need and interest, as well as the skill of the Spanish-speaking *promotoras* from the community who were responsible for recruitment. Further, many of these individuals had participated in other studies in the Research Field Office so this study sample may have been somewhat unique, based on selection; however, none of them had participated in any previous interventions studies. Average attendance at data collection sessions ranged from 80% to 90% over the 1-year study period. In terms of intervention attendance, 50% of study participants attended at least 50% of intervention sessions and these individuals attained the largest reductions in A1C.

Strategies used to attain these levels were to: 1) provide all aspects of the program in the preferred language of the participants, predominantly Spanish, by nurses and dietitians from the community who were trained for their roles on the project; 2) offer transportation to intervention sessions as well as to data collection; 3) arrange flexible appointment scheduling for data collection by allowing a two-week window for making up missed appointments; 4) provide telephone reminders by *promotoras* of upcoming project activities; 5) prepare healthy Mexican-American foods at each session so individuals would have opportunities to taste healthy cultural foods; 6) give immediate feedback on progress towards health goals by providing free glucometers and strips, monthly graphs of downloaded glucometer data, and certificates of recognition and other awards for high achievers; 7) involve a family member or close friend who attended intervention sessions as a supporter for the participant with diabetes; and 8) respond non-judgmentally to the use of folk remedies, which were used by ~25% of the participants (27).

When efforts were made to address cultural preferences and beliefs e.g., beliefs of “fatalism,” importance of family into intervention activities, individuals were very interested in participating. Main barriers to participation tended to relate to the challenges and stresses imposed by low socioeconomic status and few personal resources.

Lesson #3. Focus Groups

Focus groups were used to: 1) assess community needs in order to develop culturally tailored interventions; 2) obtain community input into intervention evaluation and refinement; and 3) determine the cultural acceptability of and satisfaction with interventions. Initially, recommendations were obtained from Starr County physicians, nurses, dietitians, other health care workers, local clergy, and residents with diabetes regarding the design of acceptable DSME interventions. For example, community residents advised the authors not to focus efforts on weight loss, as individuals would not participate for fear of repeating previous weight loss failures. As one resident with diabetes expressed, “If you are planning to tell us to lose weight, then stay home! We are not interested in hearing that and failing again.”

Although the start of Starr County studies pre-dated the interest in community-based participatory research (CBPR), these authors naturally were interested in incorporating community perspectives and obtaining community support. In addition to the initial focus groups, focus group interviews were used after each major clinical trial to obtain input into reasons for intervention effectiveness and areas needing refinement. Further, focus group

interviews were held prior to any redesign of the intervention, such as when a case management component was added to the previous DSME “compressed” intervention. In general, each set of focus groups involved approximately four groups of eight informants. Interview questions involved targeted inquiry into participants’ preferences for intervention components, e.g., home glucose monitoring, nutrition related activities, use of Spanish-language educational videotapes, and suggestions for how to make the intervention more culturally relevant and effective. Thus, the approaches used to obtain community input and guidance were closely aligned with the current principles for conducting CBPR long before they came into vogue (28).

A major challenge, however, was operationalizing community mandates into research grant proposals. On some occasions, community preferences were not acceptable to grant reviewers. One experience related to the community’s expressed refusal to participate in any study that incorporated dietary histories. Some individuals had participated previously in such studies and found these measures to be long and frustrating. However, grant reviewers would not accept this community perspective, labeling it as a non-scientific approach to this type of research. Thus, much to the dismay of study participants and data collectors, dietary histories were incorporated. This issue is problematic in CBPR and needs to be addressed if research partnerships with the community are desirable.

The focus group was the most valuable strategy for designing culturally tailored interventions and linking programs with community needs. Focus groups were particularly informative in refining interventions. For example, the *promotora* model was not an acceptable approach if they were going to serve as the main intervention instructors and sources of information. *Promotoras* are community members who serve, particularly in minority populations, as community liaisons, advocates, educators, mentors, outreach workers, role models, or translators. The *promotora* role is based on a Latin American community health worker model designed to reach underserved populations through peer education. *Promotoras* tend to be women tasked with providing the perspective from the community they represent, including speaking the same language, residing in the same neighborhoods, and sharing similar life experiences. The *promotora* model is a growing phenomenon in diabetes care, perceived to be part of the “safety net”; some states have developed standards for training and certification (29).

Promotoras from Starr County who had been diagnosed with T2DM were recruited and trained. The original intent was to have the nurses and dietitians provide the weekly educational portion of the interventions and then have the *promotoras* provide the biweekly support group sessions. However, focus group interviews indicated that having *promotoras* lead the intervention sessions was not acceptable to people in the community; they expressed a strong preference for having a health care professional. Thus, the *promotora* role was revised to one of collecting data, recruiting study participants, arranging intervention sites, contacting patients and their families weekly to remind them of the sessions, organizing equipment/supplies, providing transportation, assisting dietitians with food purchases and preparation, keeping attendance, and distributing glucometers and strips. *Promotoras* assisted the nurses and dietitians and provided important linkages with the local Mexican-American community.

Given the lack of care access for many individuals who participated in Starr County studies, *promotoras* naturally were sought for diabetes advice and were asked complicated treatment questions, such as appropriate medications and dosages, complex issues related to dietary principles, and interpretation of laboratory and glucometer test results. Since *promotoras* do not have formal education in diabetes and its management, they are unable to provide this information. Further, after years of conducting studies in Starr County, individuals began to confide in the authors that they perceived the *promotora* model as discriminatory. As one individual stated, “How would you like to be sent to your neighbor for health care?...You wouldn’t stand for that! Why should we?” The key point is that the lack of minority health care professionals needs to be addressed. In the meantime, a clearly defined role for the *promotora* is paramount; clear boundaries need to be established; and community acceptability of the *promotora* role needs to be assessed prior to program implementation.

Lesson #4. Motivators of Behavioral Change

Glucometers were a particularly strong incentive for individuals with diabetes. They not only valued tracking their own glucose patterns but the monitors were sometimes viewed as a “status symbol,” although this changed somewhat when diabetes supplies became a Medicare benefit in 2002. Individuals occasionally became local glucose testers for friends, relatives, and neighbors. This had implications for the integrity of the downloaded glucometer data intended for analyses so instructors cautioned study participants to only use their monitor to test their own levels. Also, as they gained experience in testing their own blood glucoses, the glucometer became a valuable educational tool in learning how their bodies reacted to specific foods, physical activity, stress, and changes in medications. Graphs of downloaded glucometer data were provided and research staff reviewed the patterns with participants during exit interviews held at the end of each data collection session.

Another motivating factor was concern for their family’s health and desire to be role models for their children. Anecdotal evidence suggested that other members of the family improved their dietary habits and lost weight as a result of their relatives being involved in the project and conveying information to family members. Study participants verbalized the significant and serious threat that diabetes posed for their children and wanted to help find ways to improve the health of future generations. It became obvious that interventions focused on an individual in isolation are doomed to failure. The family unit must be the focus of interventions because of the inherent difficulties associated with changing dietary and sedentary behaviors without the support of family members, especially if you are the food preparer for the family.

Another factor that motivated behavioral change was the group dynamics that occurred within some of the intervention groups. Some groups became very cohesive with individuals feeling socially connected to each other; and some continued to meet after the project ended. They would help each other solve problems and address barriers to implementing recommended health behaviors. In some instances, a level of competition surfaced, both between groups as well as within groups. Individuals would compare monitor results and complement each other on achievements, and in some instances would try to surpass the

glycemic improvements of their peers. The relatively recent availability of point-of-care A1C monitors should enhance this feedback and add another perspective on whether individuals are achieving glycemic goals.

Discussion

Increasing obesity will make diabetes the most prevalent health problem of the future (30). In previous Starr County DSME intervention studies, mean baseline A1C levels were consistently ~12%; A1C levels $\geq 10\%$ are associated with 3-year health care costs that are 11% higher than A1C levels $\leq 6\%$ (2,20,31). These intervention studies were informed by prior meta-analyses conducted by the first author (Brown). For example, a meta-analysis of weight loss strategies in T2DM showed a weighted mean of -2.4% -age point reduction in A1C across studies that tested diet only strategies (32). This was the largest reduction of any weight loss strategy examined, but the intensive literature search associated with this meta-analysis did not find any studies that targeted minority populations. The main goal of Starr County DSME studies was to determine if a -2.4% -age point A1C reduction could be achieved with Spanish-speaking Mexican Americans living along the Texas-Mexico border. Due to few personal resources and lack of access to care, achieving this goal would be a considerable challenge. But such individuals needed such interventions even more than those who live in urban areas with better health care access and options available for indigent groups. Even so, principles learned here would apply to other settings. The authors were able to achieve an A1C reduction of -1.7% -age points. Even greater reductions were found in individuals who attended more intervention sessions, attendance likely being a proxy for motivation and commitment. These findings indicate that a significant proportion of those individuals with diabetes who live in the poorest of conditions and who have little access to care can achieve significant health benefits from such interventions. A reduction of 1.7% -age points is accepted as significantly reducing morbidity and management costs.

The intent of this Starr County research was to determine, from a population perspective, whether a DSME intervention that focused primarily on culturally tailored dietary recommendations and glucose self-monitoring education, combined with group support for behavioral change, would improve metabolic status, independent of the medical care that individuals were receiving. Project staff did not adjust medications, but health information collected during the project was sent to each participant's physician: laboratory reports, progress letters, and diet and exercise recommendations. Physicians were notified by phone of particular health problems of their patients that needed physician attention (20). However, that many of these individuals rarely sought medical advice for their health conditions or symptoms. In fact, a significant number of study participants obtained medications, recommended by friends or relatives, in Mexico and self-medicated their diabetes with little oversight from a health care provider. Given the ~\$16,000 per capita average annual income (3), individuals could not afford clinic visits (\$65 or more per visit) plus the costs of laboratory testing and medications. So many individuals obtained a significant amount of their diabetes care in Mexico, care that was perceived to be cheaper, more "culturally sensitive," and less likely to result in a prescription for insulin rather than oral agents. (Anecdotal evidence indicated that Mexican-American communities all over the U.S. continue to obtain health care in Mexico, particularly medications.) It takes an ongoing

effort to change these self-management practices for approaches that are more safe and efficacious. Alternatively, it may be that such “self-management” practices could be incorporated into an individual’s care plan.

A major issue is whether the Starr County model is a realistic program that could be translated into clinical settings, given two concerns: 1) cost and 2) dependence of this program on the availability of Spanish-speaking nurses and dietitians. The authors’ philosophy has been to discover what type of intervention works and then find a way to implement it in a cost-effective manner. Current DSME strategies commonly used in clinical sites, such as a 30-minute referral to a dietitian following a visit with a primary care provider or brief DSME phone interventions, may be minimally effective (33). So the dilemma is whether to implement a program that is cost-effective, or “cost neutral,” but has little improvement on health or whether to implement a program that is effective but may be more costly in the short term. Our philosophy has been the latter, since it seems logical that individuals from impoverished backgrounds and who have low educational levels would require a more intensive intervention in order to change longstanding behaviors and attain health improvements. A cost of \$384 per person was estimated as the cost of providing the most intensive version of the intervention (Table 1) (2). The cost was modest, compared to the potential benefits; and the primary expenditure was the salary for a nurse or dietitian for 2 hours per week to lead a group of 10 participants. More cost savings could be attained by incorporating the program into existing clinical services.

Despite the need for diabetes health care experts to be involved in diabetes care, it indeed may be unrealistic to depend solely on a “health professional model” as the only acceptable diabetes management approach. The day-to-day self-management challenges and requisite decision-making have been well documented (34) and thus, diabetes management cannot depend solely on a model designed and implemented on sparse doctor visits, particularly in individuals who have little access to health care resources. Does that model need to be changed? The *promotora model* has been embraced as a potential partial solution to meeting the needs of underserved populations, particularly from Hispanic backgrounds; but the *promotora* role needs to be defined carefully for community acceptance. Clearly, diabetes care needs to be a joint effort among health care professionals and key community partners. Future care models need to be based on the need for a more dynamic diabetes self-management system that recognizes daily challenges of this disease.

Obviously, the ultimate self-management responsibility lies with the individual with diabetes. Across all of the Starr County studies, approximately 50 percent of the individuals attended more than 50 percent of the intervention sessions and achieved significant improvements in glycemic control. This fact alone is sufficient justification for providing these types of interventions, as they are cost-effective in the long-term. The future major challenge is to determine how to reach and motivate individuals who do not achieve improved outcomes. Further, very little is known about how such positive health changes can be maintained. Starr County data have consistently suggested that ongoing staff contact is required for individuals to sustain intervention benefits; however, it is not known how much contact may be required or at what intervals “reinoculation” self-management interventions might be most beneficial. From a weight perspective, sustainable weight loss was not

achieved; however, glycemic improvements were statistically and clinically significant without significant weight loss.

The most serious obstacle to translating this DSME program into practice is the limited availability of bilingual Hispanic nurses and dietitians. *Promotoras* are being endorsed as a solution and are being used as substitutes for health care providers in providing diabetes self-management programs (29). Focus groups held in Starr County uncovered a consistent message that *promotoras* were not acceptable as intervention providers. Starr County studies have been referenced as examples of the effectiveness of *promotoras* but due to the narrow role the authors designed, these studies do not support their use as intervention providers (33). *Promotoras* played a key role, however, and their importance should not be minimized.

It has been suggested that the authors promote diabetes self-management over medical treatment with medications. In reality, effective treatment with medications is only achievable when augmented with effective self-management. Intervention costs, even for the most intensive yearlong intervention, were modest in comparison to the benefits achieved; intervention costs are not a reasonable obstacle. Indeed, the greater obstacle is doing nothing for the costs of following that strategy are and will continue to be staggering. The appropriate treatment for diabetes is not pharmaceutical OR behavioral strategies; the two approaches are synergistic. “No medication or other therapeutic discovery currently available is likely to completely overcome unhealthy lifestyles or a lack of knowledge of self-management in persons with diabetes” (20).

Starr County is not a unique community. Many similar impoverished rural communities, Hispanic and non-Hispanic, exist across the U.S., both along the U.S.-Mexico border and in other non-border states. Starr County has health care challenges similar to other poor, “distressed” counties, for example those located in Appalachia, where individuals are at higher risk for diabetes and its complications than in other more urban and/or affluent communities (35). However, even today, there are few reported clinical trials specifically targeting Hispanics with T2DM. Culturally tailored programs similar to the Starr County program have been tested in California with Mexican Americans (36) and in Massachusetts with Puerto Ricans (37), both finding significant improvements in diabetes control. The experiences in trying to address diabetes and other health challenges in Starr County have relevance for many of these other communities also characterized by high unemployment and rates of poverty. Lastly, it is possible that these same strategies and implementations would be efficacious among those with pre-diabetes or other high-risk characteristics in delaying or preventing the onset of diabetes.

Acknowledgments

The studies described in this paper were funded by the National Institute for Diabetes and Digestive and Kidney Diseases and the Office of Research on Minority Health, National Institutes of Health, and the State of Texas. The authors gratefully acknowledge the contributions of study participants and their family members, nurses, dietitians, and community workers, all residents of Starr County, Texas, and the surrounding Texas-Mexico border areas.

References

1. Authors. Culturally competent diabetes education for Mexican Americans: the Starr County Study. *Diabetes Educ.* 1999;25:226–236. [PubMed: 10531848]
2. Authors. Dosage effects of diabetes self-management education for Mexican Americans: the Starr County Border Health Initiative. *Diabetes Care.* 2005;28:527–532. [PubMed: 15735182]
3. Texas Association of Counties. County information program: Starr County profile. Accessed on November 20, 2012 at: <http://www.txcip.org/tac/census/profile.php?FIPS=48427>
4. Texas Department of Health The health of Texans: Texas state strategic health plan. Austin, TX: Author, 2002.
5. Texas Department of State Health Services Supply trends among licensed health professions: Texas, 1980–2011, Fifth Ed. Austin, TX: Author, 2012.
6. Humes KR, Jones NA, Ramirez RR. Overview of race and Hispanic origin: 2010. U.S. Department of Commerce Census Bureau. 2011 Available at: www.census.gov/prod/cen2010/briefs/c2010br-02.pdf.
7. Almdal T, Scharling H, Jensen JS, et al. The independent effect of type-2 diabetes mellitus on ischaemic heart disease, stroke and death: a population-based study of 13,000 men and women with 20 years of follow-up. *Arch Intern Med.* 2004;164:1422–1426. [PubMed: 15249351]
8. Roper NA, Bilous RW, Kelly WF, et al. Excess mortality in a population with diabetes and the impact of material deprivation: longitudinal, population based study. *BMJ.* 2001;322:1389–1393. [PubMed: 11397742]
9. Black SA, Ray LA, Markides KS. The prevalence and health burden of self-reported diabetes in older Mexican Americans: findings from the Hispanic established populations for epidemiologic studies of the elderly. *Am J Public Health.* 1999;89:546–552. [PubMed: 10191799]
10. Harris MI, Klein R, Cowie CC, et al. Is the risk of diabetic retinopathy greater in non-Hispanic blacks and Mexican Americans than in non-Hispanic whites with type 2 diabetes? A U.S. population study. *Diabetes Care.* 1998;21:1230–1235.
11. American Diabetes Association. Implications of the United Kingdom Prospective Diabetes Study (UKPDS). *Diabetes Care.* 2002;25 Suppl 1:S28–S32.
12. Martinez-Marignac VL, Valladares A, Cameron E, et al. Admixture in Mexico City: implications for admixture mapping of type 2 diabetes genetic risk factors. *Hum Genet.* 2007;120:807–819. [PubMed: 17066296]
13. Cox NJ, Frigge M, Nicolae DL, et al. Loci on chromosomes 2 (NIDDM1) and 15 interact to increase susceptibility to diabetes in Mexican Americans. *Nat Genet.* 1999;21:213–215. [PubMed: 9988276]
14. Ethics McDermott R., epidemiology and the thrifty gene: biological determinism as a health hazard. *Soc Sci Med.* 1998;47:1189–1195. [PubMed: 9783862]
15. Hanis CL, Boerwinkle E, Chakraborty R, et al. A genome-wide search for human non-insulin-dependent (type 2) diabetes genes reveals a major susceptibility locus on chromosome 2. *Nat Genet.* 1996;13:161–166. [PubMed: 8640221]
16. Diabetes Prevention Program (DPP) Research Group. The Diabetes Prevention Program (DPP): description of lifestyle intervention. *Diabetes Care.* 2002;25:2165–2171. [PubMed: 12453955]
17. Pasala SK, Rao AA, Sridhar GR. Built environment and diabetes. *Int J Diabetes Dev Ctries.* 2010;30:63–68. [PubMed: 20535308]
18. Ravussin E, Bogardus C. Energy balance and weight regulation: genetics versus environment. *Br J Nutr.* 2000;83 Suppl 1:S17–S20. [PubMed: 10889787]
19. Marín G, Marín BV. Research with Hispanic Populations. Newbury Park, CA: Sage Publications, 1991.
20. Authors. Culturally competent diabetes self-management education for Mexican Americans: the Starr County Border Health Initiative. *Diabetes Care.* 2002;25:259–268. [PubMed: 11815493]
21. Colquitt JA, LePine JA, Noe RA. Toward an integrative theory of training motivation: a meta-analytic path analysis of 20 years of research. *J Appl Psycho.* 2000;85:678–707.

22. Given CW, Given BA, Gallin RS, et al. Development of scales to measure beliefs of diabetic patients. *Res Nurs Health*. 1983;6:127–141. [PubMed: 6556699]
23. Authors. Measuring health beliefs in Spanish-speaking Mexican Americans with type 2 diabetes: adapting an existing instrument. *Res Nurs Health*. 2002;25:145–158. [PubMed: 11933008]
24. Authors. Health beliefs of Mexican Americans with type 2 diabetes: the Starr County Border Health Initiative. *Diabetes Educ*. 2007 3;33:300–308. [PubMed: 17426305]
25. Authors. The Starr County diabetes education study: development and testing of a Spanish-language diabetes knowledge questionnaire. *Diabetes Care*. 2001;24:16–21. [PubMed: 11194219]
26. Authors. Integrating education, group support and case management for diabetic Hispanics: the Starr County Border Health Initiative. *Ethn Dis*. 2011;21:20–26. [PubMed: 21462725]
27. Authors. Symptom-related self-care of Mexican Americans with NIDDM: Preliminary findings of the Starr County Diabetes Education Study. *Diabetes Educ*. 1998;24:331–339. [PubMed: 9677951]
28. Viswanathan M, Ammerman A, Eng E, et al. Community-based Participatory Research: Assessing the Evidence Evidence Report/Technology Assessment No. 99 (Prepared by RTI–University of North Carolina Evidence-based Practice Center under Contract No. 290–02-0016). AHRQ Publication 04-E022–2. Rockville, MD: Agency for Healthcare Research and Quality, 7 2004.
29. Nichols DC, Berrios C, Samar H. Texas' community health workforce: from state health promotion policy to community-level practice. *Prev Chronic Dis*. 2005;2 Spec no:A13.
30. Barceñas CH, Wilkinson AV, Strom SS, et al. Birthplace, years of residence in the United States, and obesity among Mexican-American adults. *Obesity (Silver Spring)*. 2007;15:1043–1052. [PubMed: 17426341]
31. Gilmer TP, O'Connor PJ, Rush WA, et al. Predictors of health care costs in adults with diabetes. *Diabetes Care*. 2005;28:59–64. [PubMed: 15616234]
32. Brown SA, Upchurch S, Anding R, et al. Promoting weight loss in type II diabetes. *Diabetes Care*. 1996;19:613–624. [PubMed: 8725861]
33. Glazier RH, Bajcar J, Kennie NR, et al. A systematic review of interventions to improve diabetes care in socially disadvantaged populations. *Diabetes Care*. 2006;29:1675–1688. [PubMed: 16801602]
34. Steinhardt MA, Mamerow MM, Brown SA, et al. A resilience intervention in African American adults with type 2 diabetes: a pilot study of efficacy. *Diabetes Educ*. 2010;35:274–284.
35. Barker L, Crespo R, Gerzoff RB, Denham S, Shrewsbury M, Corneilius-Averhart D. Residence in a distressed county in Appalachia as a risk factor for diabetes, Behavioral Risk Factor Surveillance System, 2006–2007. *Prev Chronic Dis*. 2010;7:A104. [PubMed: 20712931]
36. Lorig K, Ritter PL, Villa F, Piette JD. Spanish diabetes self-management with and without automated telephone reinforcement: two randomized trials. *Diabetes Care*. 2008;31:408–414. [PubMed: 18096810]
37. Rosal MC, Ockene IS, Restrepo A, White MJ, Borg A, Olendzki B, Scavron J, Candib L, Welch G, Reed G. Randomized trial of a literacy-sensitive, culturally tailored diabetes self-management intervention for low-income latinos: latinos en control. *Diabetes Care*. 2011;34:838–844. [PubMed: 21378213]

Figure 1.
Picture of typical *colonia* setting

Figure 2.
Photo of an intervention site: local church

Figure 3.
Research Field Office, Rio Grande City, the county seat

Figure 4.
Row of houses in a more populated area of a *colonia*

Figure 5. Dosage Effects: HbA1c — compressed vs. extended 50% attendance (n=110)

NOTE: The overall sample for these analyses involved 216 individuals, predominantly female (66%), and ~50 years of age on average. The “compressed” intervention involved 12 educational sessions + 3 support group sessions; the “extended” yearlong intervention involved 12 educational sessions + 14 support group sessions. Greater overall attendance at both the educational and support sessions in the “extended” intervention was related to greater reductions in A1C over time ($t = -6.51$, $P < 0.001$) (18).

Table 1.

Lessons Learned in Diabetes Self-management Research with Mexican Americans: 20 Years of Experience in Starr County, Texas

ISSUE	LESSONS LEARNED
LESSON 1. INTERVENTION EFFECTS	
"Dosage" effect	<p>More intervention attendance resulted in greater improvements in metabolic control:</p> <ul style="list-style-type: none"> ● Attended 50% → -1.7%-age point reduction in A1C ● Highest attendees → -4%-age point reduction in A1C <p>Intervention effects diminished when program contact ended suggesting a need for "reinoculation"</p>
Intervention costs	<p>Costs of the interventions were:</p> <ul style="list-style-type: none"> ● \$384 per person for the intensive yearlong intervention (26 2-hr. sessions) ● \$131 for the shorter program (11 2-hr. sessions)
Timing of intervention	<ul style="list-style-type: none"> ● Requested weekday evening sessions, ending before dark due to decreased vision ● Preferred ongoing weekly sessions so that they could get continual guidance
Unrealistic expectations & goals	<ul style="list-style-type: none"> ● Frustrated with multiple diabetes requirements and costly treatments ● Responded better to glycemic goals rather than weight loss goals ● Chronic high glucose levels led to hypoglycemic symptoms when levels were decreased with treatment and self-management (dysregulation), a major barrier to achieving goals
Obesity – weight loss	<ul style="list-style-type: none"> ● Extremely high rates of obesity ● Failed numerous times on diabetes diets; did not like to use the word "diet" (<i>la dieta</i>) ● Did not want to participate in a project that focused on weight loss ● Weight loss had negative social implications for women; interpreted by friends and neighbors as either "having cancer or having an affair"
Dietary approaches	<ul style="list-style-type: none"> ● Required dietary recommendations based on favorite cultural foods ● Benefitted from group "tasters" of healthy foods, sometimes requiring group pressure ● Not interested in learning complicated dietary counting strategies (e.g., CHO, exchanges) ● Responded to simple dietary goals: portion control and reduction in sodium and fat content
Physical activity recommendations	<ul style="list-style-type: none"> ● Numerous environmental barriers to exercise, including unpaved streets, diabetes-related complications, family responsibilities, lack of exercise facilities, hot weather conditions ● Valued use of pedometers and simple step goals
<i>Promotora</i> model	<ul style="list-style-type: none"> ● <i>Promotoras</i> not acceptable if they provided the intervention ● Acceptable as staff support, e.g., provide transportation, prepare snacks, keep attendance
Teaching modalities	<ul style="list-style-type: none"> ● Preferred teaching strategy continues to be via videotape in Spanish ● Preferred simple instructions re all aspects of self-management ● Rejected focus on weight loss ● Responded better to demonstrations rather than didactic instructions
Intervention sites	<ul style="list-style-type: none"> ● Preferred sites as close to home as possible, e.g., church, school ● Sites needed kitchen facilities to prepare healthy snacks, conduct food preparation demonstrations ● Preferred not to meet in clinical / hospital sites
Multiple stressors as barriers	<ul style="list-style-type: none"> ● Socio-economic pressures compounded by diabetes treatment requirements were overwhelming ● Needed simplification and support
LESSON 2. IMPACT OF CULTURE	
Importance of family	<ul style="list-style-type: none"> ● Critical to have family members involved in the intervention program ● Some brought children to data collection sessions due to lack of babysitting resources
"Fatalism"	<ul style="list-style-type: none"> ● Surrounded by individuals with type 2 diabetes so expected to eventually get the disease ● Feelings of helplessness in preventing diabetes ● Differed by generation, with younger individuals professing less "fatalism"
Folk remedies	<ul style="list-style-type: none"> ● Valued recommendations from family and friends about unconventional diabetes treatments ● 30% used folk remedies (e.g., garlic, herbal teas, <i>chaya</i> plant)
Language preferences	<ul style="list-style-type: none"> ● Preferred all contact in Spanish, although some spoke English – actual language spoken was a blend between Spanish and English using local idioms ("Spanglish," "border Spanish")
Role of religion	<ul style="list-style-type: none"> ● Valued holding intervention sessions in churches ● Most participants were Catholic; support of the program by the local priest was important ● Role of religion differed by generation; younger individuals less reliant on religious beliefs
Gender differences	<ul style="list-style-type: none"> ● Traditional family roles and role expectations among older generations

ISSUE	LESSONS LEARNED
	<ul style="list-style-type: none"> ● Women reported lower social support than men for diabetes-related dietary requirements
Recruitment	<ul style="list-style-type: none"> ● Achieved 95%+ recruitment by using by local Spanish-speaking residents to recruit participants ● Eager to participate if benefits to them and their family members were evident
Social support/ personal relationships	<ul style="list-style-type: none"> ● Viewed group intervention sessions as a social outlet ● Some groups formed tight, cohesive support units, continuing to meet after official program ended ● Support from spouse and/or close family members and friends was important ● Preferred face-to-face contact versus telephone or via computer
Participation in research	<ul style="list-style-type: none"> ● Participation in research amounted to “making someone else’s career” ● Willing to participate if there were obvious benefits for them too ● Required frequent “presence” of investigators or perceived investigators to be “using them”
LESSON 3. FOCUS GROUPS	
Importance of focus groups	<ul style="list-style-type: none"> ● Critical as part of community needs assessment ● Useful as a tool for maintaining ongoing communication with the community ● Helpful in determining participant satisfaction with interventions and obtaining input into potential refinements of the intervention ● Challenge is to incorporate community recommendations and convince grant reviewers of the appropriateness of non-traditional community-recommended research approaches
LESSON 4. MOTIVATORS OF BEHAVIORAL CHANGE	
Sources of motivation	<ul style="list-style-type: none"> ● Home glucose monitors: viewed as somewhat of a status symbol; sometimes became their local glucose tester for friends, relatives, neighbors; valued as a key component of the project; seen as a valuable educational tool in learning how their bodies reacted to foods, physical activity, stress ● Graphs of downloaded glucometer data were provided, reviewed, and valued by the participants ● Concern for family’s health; desired to be a role model for their children ● Social networking with other members of their intervention group