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A Randomized-Controlled, Pilot Intervention on Diabetes Prevention and Healthy Lifestyles in the New York City Korean Community

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Abstract

Asian Americans experience diabetes at a higher rate than non-Hispanic whites. Diabetes prevention programs using lifestyle interventions have been shown to produce beneficial results, yet there have been no culturally-tailored programs for diabetes prevention in the Korean community. We explore the impact and feasibility of a pilot Community Health Worker (CHW) intervention to improve health behaviors and promote diabetes prevention among Korean

Americans using a randomized controlled trial. Between 2011 and 2012, a total of 48 Korean Americans at risk for diabetes living in New York City (NYC) participated in the intervention. Participants were allocated to treatment or control groups. A community-based participatory research approach guided development of the intervention, which consisted of 6 workshops held by CHWs on diabetes prevention, nutrition, physical activity, diabetes complications, stress and family support, and access to health care. Changes over 6 months were examined for clinical measurements (weight, BMI, waist circumference, blood pressure, glucose, and cholesterol); health behaviors (physical activity, nutrition, food behaviors, diabetes knowledge, self-efficacy, and mental health); and health access (insurance and self-reported health). In this small pilot study, changes were seen in weight, waist circumference, diastolic blood pressure, physical activity nutrition, diabetes knowledge, and mental health. Qualitative findings provide additional contextual information that inform ways in which CHWs may influence health outcomes. These findings demonstrate that a diabetes prevention program can be successful among a Korean American population in NYC, and important insight is provided for ways that programs can be tailored to meet the needs of vulnerable populations.

Keywords

Asian Americans; Korean Americans; Community health workers; Community-based participatory research; Diabetes prevention

Introduction

Diabetes, a group of diseases marked by high levels of blood glucose, can lead to serious complications and morbidity. Type 2 diabetes accounts for about 90–95 % of diagnosed diabetes cases. In the United States (US), diabetes affects nearly 26 million people, over 8 % of the population, and 7 million of these cases are undiagnosed [1]. However, diabetes has been shown to be preventable through dietary changes and weight loss, lifestyle changes, and increased physical activity [2].

Asian Americans experience diabetes at a higher rate than non-Hispanic whites; the Centers for Disease Control and Prevention (CDC) estimates that the risk of diagnosed diabetes from the 2007–2009 National Health and Nutrition Examination Survey (NHANES) was 18 % higher among Asian Americans compared to non-Hispanic white adults; 8.4 % of Asian Americans had diagnosed diabetes compared to 7.1 % of non-Hispanic whites [1]. Prevalence has also been shown to differ by subgroup, with the highest rates among Asian Indians and Filipinos [3–5]. The Agency for Healthcare Research and Quality (AHRQ) reports that the prevalence of diabetes among Korean Americans is higher than the prevalence among whites, although in national research, diabetes rates among Korean Americans often are low or unreported. Recent New York City (NYC) data finds the age-adjusted rate of diagnosed diabetes among Korean Americans to be 10 % [6]. In Korea, the prevalence of diabetes and impaired fasting glucose (IFG) is rising; in the past 30 years, diabetes has increased five-fold to 9–11 % [7].

Diabetes prevention programs enabling lifestyle changes have been shown to be the most effective method of preventing type 2 diabetes; in addition to lowering the risk of diabetes,

these interventions promote additional health benefits and are less costly than drug treatment [8]. The Diabetes Prevention Program (DPP), the largest diabetes prevention program to date, was conducted in a multi-ethnic US sample; the program found that diet and exercise reduced the incidence of diabetes among individuals with elevated fasting glucose by 58 % over a follow-up period of 2.8 years [2]. Positive results have also been shown in Japan, India, Finland, and China [8].

While diabetes prevention programs using a lifestyle intervention have reported beneficial results, there have been no culturally-tailored programs to prevent diabetes or promote healthful behavioral changes in the Korean community. However, findings from a randomized-controlled study promoting diabetes management among Korean Americans living in the Baltimore-Washington area support the clinical efficacy of a culturally-tailored diabetes program among Korean Americans with type 2 diabetes [9].

The purpose of this study is to explore the impact and feasibility of a pilot community health worker (CHW) intervention designed to improve health behaviors and clinical measures related to diabetes prevention among Korean Americans identified as at-risk for diabetes living in NYC. This paper presents the findings from the pilot phase of the Project RICE (Reaching Immigrants through Community Empowerment), an intervention designed to test the efficacy of a CHW program to promote diabetes prevention and healthy lifestyle changes in the Korean population.

Methods

Recruitment and Study Design

Individuals were eligible to participate in the intervention if they: (1) self-identified as Korean; (2) were identified as at-risk by an interviewer-administered diabetes risk assessment adapted from the American Diabetes Association diabetes risk test which calculates “at-risk” scores based on family history of diabetes, BMI, and other factors; and were between 18 and 75 years of age [10]. Participants were ineligible if they had confirmed diabetes from a health professional, had serious health problems (e.g. terminal illness), or had participated in a previous cardiovascular disease study. CHWs recruited subjects in-person at various community-based venues, including health fairs and cultural fairs at churches and community settings between May and July 2011. The protocol was approved by the New York University School of Medicine Institutional Review Board.

A total of 127 individuals were screened for eligibility, of whom 57 % were eligible. A total of 48 individuals consented to participate in the study and completed the baseline assessment; 25 participants were randomized to the treatment group, and 23 were randomized to the control group (see Fig. 1).

Intervention

Project RICE was guided by the the principles of community based participatory research (CBPR), in which stakeholders with various knowledge and expertise partner to understand community concerns and develop action-oriented solutions to address them. A coalition of community partners, researchers, health providers, and CHWs was developed, and coalition

members engaged as active and equal partners in the research process. The CHW and staff at the Korean American-serving community-based organization (CBO) were active members of the coalition and a unique source of community knowledge, providing critical input and guidance during all phases of the study.

The intervention was led by a trained, bilingual Korean American CHW and several programmatic staff at the CBO. Six CHW-facilitated 2-hour group sessions were held for the treatment group participants, which included the following topics: diabetes prevention overview, nutrition, physical activity, diabetes complications and other cardiovascular diseases, stress and family support, and access to health care. Sessions were held every 3 weeks in a convenient community setting. Treatment group participants also received follow-up phone calls from the CHW (2 calls after sessions one through five for a total of 10 calls over the 6 month intervention period), during which challenges and strategies for improving diet and physical activity and reducing stress were discussed. All participants received the first educational session, and participants were randomized into treatment and control groups after attending the first session.

The project curriculum was adapted from existing curricula materials validated in minority communities, including the National Heart, Lung, and Blood Institute's Healthy Heart Healthy Family [11], the DPP [2, 12] the National Diabetes Education Program's Power to Prevent and Road to Health curricula [13, 14], a diabetes management curriculum used in the NYC Bangladeshi population [15], and a diabetes management curriculum developed for the Baltimore-Washington Korean population [9]. Findings from a formative study were used to add culturally relevant topics and strategies to the curriculum; session overview and culturally-tailored components are detailed in Table 1. All curriculum materials were developed in English, translated into Korean and reviewed for accuracy by bi-lingual study staff. Group activities, physical exercise, culturally appropriate images and language, and adult learning techniques were incorporated into all sessions. Examples of culturally-tailored topics addressed in the curriculum include: discussion of diabetes prevalence and increased risks in Asian American communities; photos of typical Korean foods used during discussions about food groups and activities identifying carbohydrates, proteins, and fats; discussion of healthy elements in traditional Korean cooking and potential diabetes triggers in Korean foods; and culturally-relevant discussions about guilt and depression.

The project CHW and support staff participated in a 60-hour core-competency-based training, given over 8 days in a 3-week period in January 2011 [16]. The training focused on comprehensive skills training for CHWs, and was facilitated by two trainers associated with an independent CHW professional association. The project CHW and staff also attended approximately 30 hours of additional trainings on mental health, motivational interviewing, and other related topics.

Data Collection and Measures

Quantitative Data Collection—Study participants completed a baseline survey after consenting to be in the study and follow-up assessments were conducted at 3- and 6-months. Surveys were administered in Korean by a trained interviewer.

Primary outcomes were measured at baseline, 3-months, and 6-months, and included weight, BMI, and hip-to-waist ratio reduction, access to and utilization of care, and knowledge and practice of physical activity and healthful eating.

Demographic questions were adapted from the Census American Community Survey [17] and the Behavioral Risk Factor Surveillance Survey (BRFSS) [18]. Self-efficacy questions related to exercise, nutrition, and health-related decisions were adapted from the Bandura Self-Efficacy Scale [19]. Questions on diabetes knowledge were adapted from the Diabetes Knowledge Test and risk assessment questions from the American Diabetes Association [20, 21]. Questions on food behaviors such as portion control, preparation/buying, and planning as well as intent to engage in and motivators of physical activity, were adapted from measurement of the behavioral objectives of a weight management intervention [20]. Mental health questions were adapted from the Personal Health Questionnaire (PHQ-2) [22] and the Generalized Anxiety Disorder Scale (GAD-2) [23]. Measures used on the participant satisfaction survey were based on a review of peer-reviewed literature and were adapted from other studies. All survey questions were developed in English and translated into Korean by bilingual study staff. Questions were reviewed by project coalition members for accuracy and cultural appropriateness and culturally relevant examples were integrated.

Qualitative Data Collection—CHWs completed detailed logs during follow-up phone calls with the participants, documenting challenges to healthcare access and engaging in healthy behaviors, as well as a proposed follow-up plan by the CHW. Qualitative interviews were also conducted with the CHWs by an independent evaluator after intervention completion to assess experiences in implementing the program, including barriers and facilitators to recruitment, retention, and diabetes prevention promotion. The lead investigator and the evaluator developed interview questions using a review of relevant literature. In addition, a focus group was facilitated by an independent Korean-speaking evaluator for both active and non-active participants to assess participant satisfaction after the 6-month intervention period.

Quantitative Data Analysis and Sample

Descriptive statistics summarize and compare baseline characteristics of the treatment and control groups for all individuals randomized into the intervention. Group differences were assessed using t-tests for continuous variables and Chi square tests for categorical variables. Changes in outcome variables were reported across baseline and 6-months for all individuals with complete data. For continuous variables, mean change and standard deviation (SD) was reported, and for categorical variables, total n and percent were reported. P-values report within-group significance using paired-sample t-tests of each variable and between-group significance using paired-sample t-tests of the total change across timepoints.

A total of 25 participants were randomized to the treatment group, and 23 were randomized to the control group. Among treatment group participants, 60 % (n = 15) completed at least 4 of the 6 group educational sessions (considered completion of intervention), while 36 % (n = 9) completed all 6 sessions. Results include 21 treatment and 14 control group participants

who had complete baseline and follow-up data and completed any part of the intervention. Analyses were conducted using SPSS 19.0.

Qualitative Data Analysis—Notes from the CHW interviews, focus group transcripts, and CHW call logs were reviewed and coded by two authors for themes related to feasibility, acceptability, and changes in outcomes among pilot participants. Narrative analysis techniques were utilized whereby segments of text that relate to themes were identified and core codes and secondary codes were assigned. Relationships between codes within themes were also explored. Discrepancies in coding were resolved by discussion and consensus between the two coders.

Results

Quantitative Results

No significant differences were seen across treatment and control groups (Table 2). The group had a mean age of 59.7 (SD = 8.1), and was primarily female (64 %). The majority of individuals were not employed (retired, unemployed, or a homemaker) and married. Seventy-two percent of the sample was overweight or obese following Asian guidelines [24]; twenty-two percent of individuals were hypertensive and 52 % of individuals were pre-hypertensive.

Positive directional changes were observed for the treatment group, though none were statistically significant at $p < 0.05$ (Table 3). Mean weight decreased 1.2 lbs between baseline and 6-months. Conversely, mean weight and waist circumference increased in the control group. There was a mean decrease of 2.2 mmHg for systolic blood pressure among the treatment group, while little change was seen for the control group. A total of 23.8 % of treatment group participants lost more than 3 pounds, while 47.1 % of control group participants did not change/gained weight. Similarly, 45 % of treatment group participants decreased weight circumference by more than 1", while 70.5 % of control participants did not change/increased their waist circumference. While between group clinical changes were not significant, changes in weight and BMI approached significance ($p = 0.14$, $p = 0.12$).

Table 4 presents changes in scaled variables for self-efficacy, knowledge, and mental health between baseline and 6 months. Significant changes were seen for physical activity ($p < 0.05$); treatment group participants reported greater levels of social interaction (likelihood of involving others in physical activity) and confidence in engaging in physical activity, while changes were not significant in the control group. Positive changes were also demonstrated by both the treatment and the control groups in portion control and the preparation, planning, and buying of healthy foods, but these changes were not significant. Diabetes knowledge increased for the treatment group ($p < 0.05$), while the control group saw little to no change. The between group difference in diabetes knowledge was significant ($p < 0.05$). Measures of mental health improved for the treatment group, and GAD-2 decreased from 1.3 to 0.8 ($p = 0.17$). Conversely, mental health worsened in the control group.

Further changes in behaviors are detailed in Table 5. In the treatment group, 24 % reported not exercising at 6-months compared to 38 % at baseline; in the control group, 54 % reported not exercising at 6-months compared to 25 % at baseline. Positive changes were also seen for nutrition and food behaviors; soda/sweetened drink consumption decreased for the treatment group while no change was seen for the control group. Brown rice consumption in the past week increased from 52 to 90 % for the treatment group (often or almost always, $p < 0.05$) while little change was seen for the control group. More individuals in the treatment group reported their health as fair or poor at 6-months as compared to baseline. Insurance coverage increased from 68 to 80 % for the treatment group, while the control group remained at 57 % insured.

Individuals in the treatment arm completed questions evaluating the CHW and the program. Overall, responses about the CHW were positive. Participants thought it was most important to have the following in common with their CHWs: language (81 %), culture (74 %), and country of birth (67 %). All believed that the CHW understood their culture and that they could be honest with their CHW. Additionally, 90 % believed that the CHW helped them change their behaviors. The majority of individuals felt that the length and number of the sessions was just right, and the biggest factor preventing individuals from coming to the sessions was work schedule (48 %) followed by family obligations (29 %).

Qualitative Results

Acceptability—The project CHW shared participants' cultural backgrounds and language, and leveraged her knowledge of community resources and networks, such as churches and English language programs to increase outreach efforts and study relevance and acceptability. The CHW expressed that "being from the same culture helps overcome resistance," but more importantly, "being a native Korean speaker is key" to help overcome language barriers for this largely limited English proficient community. Prior to project implementation, some key community informants expressed concern that participants may question a CHW's role and qualifications to provide health information and lead the intervention compared to a clinician. The CHW, however, did not find this to be true; rather, she believed that "People trusted [her] as the person in charge." In addition, the CHW's connection to and training at an academic medical school facilitated trust with participants. Both the CHW and participants spoke about their relationship in warm, familial terms. For example, the CHW expressed "respect" for program participants, many of whom were older adults, and that she tried "to treat them as [her] grandparents." She referred to participants as "sun seng nim," a formal term of respect which translates to "teacher" in Korean language. Participants expressed that they felt cared for: "Not even my kids check up on me like that so I was very appreciative of her calling and taking care of me." In addition, the program was described as "valuable" and "helpful" to the community, creating a sense of duty: "I decided to participate in order to help the Korean community." Participants were also impressed and grateful that the CDC-funded program demonstrated an interest by the government in promoting the health of Korean communities: "It's very important. We think that we need to participate more so that the Korean community will receive a lot of interest."

Feasibility—Qualitative results provided insight into recruitment and retention issues and the organization and implementation of the pilot. Retention was facilitated by trust in the CHW, and assistance provided in accessing resources, such as translation or external linkages to health services and public insurance, both for participants and their friends.

Several challenges to recruitment and retention emerged, including low-turn out at screening events and difficulty scheduling screening events at community churches with busy programmatic schedules; extended travel by participants to Korea during the intervention period; and difficulty scheduling education sessions and data collection meetings. In addition, community members often believed that if they did not have symptoms of diabetes, they did not need to take steps to prevent the disease, particularly if they had insurance and a primary care physician. For example, the CHW provided: “Prevention is not important in the culture... unless they really want to be healthy or unless they have a family member with the disease.” One focus group participant shared: “I haven’t referred back to the hand-outs [given out at each education session] because currently I’m not sick and not diagnosed with anything.” The CHW also acknowledged that some participants may not be intrinsically motivated to attend sessions, but may attend “because they don’t want to let [her] down.” Participants would say: “you work so hard” and “I know it helps you,” demonstrating that motivators to participation may involve unique cultural components of a sense of obligation or guilt. It was also challenging to schedule meetings to collect survey questionnaires and clinical measurements in addition to the six group sessions. Participants with busy schedules and family obligations reported irritation with the length of surveys and sessions, as well as with the number of follow-up phone calls and goal-setting exercises. The CHW also agreed that goal-setting exercises were challenging for participants, who often asked her to assign them goals rather than develop their own personal goals.

In regards to intervention organization and implementation, facilitators included hosting sessions in community locations convenient for participants, during weekends, and offering one-on-one session makeups for participants who were unable to attend group sessions. In addition, participants reported that the sessions were “very detailed and practical” and “useful because [they] could apply to [their] real lives.”

Efficacy—Follow-up phone calls helped to reinforce key health behavior messages from educational sessions, and goal-setting exercises allowed the CHW to provide tailored advice on how to make changes to diet and physical activity. Using information gained from the CHW, participants were empowered to ask more questions of their physicians, request information about test results, and obtain referrals for appointments. Participants also reported that the Korean-language hand-outs on the content of each session were easy to understand and helpful to refer to after the sessions: “I kept forgetting what I have learned but the print-outs was helpful because I could look at them later... I made a note on the print-outs and I could bring them when I needed to ask questions.” Others reported feeling healthier or losing weight. Many reported eating smaller portions of rice and more vegetables during the follow-up calls, and were incorporating more walking into their day-to-day routines.

Discussion

Overall, Project RICE demonstrated high acceptability and suggested efficacy of a intervention aimed at improving health behaviors to promote diabetes prevention among individuals completing the pilot program. Participants reported positive feedback about the program and about the CHW, particularly regarding the linguistically- and culturally-tailored nature of the program. Moreover, the qualitative findings demonstrate some of the mechanisms through which CHWs can facilitate support by serving as a bridge to the health care system and providing culturally-and linguistically-tailored health education information. Additionally, many participants felt connected to and appreciative of the CHW's efforts, suggesting that CHWs serve a unique role in health promotion efforts. Both quantitative and qualitative findings demonstrated high appropriateness and acceptability to the target community, indicating that the pilot can be successfully translated into a full intervention.

Positive changes were seen among treatment group participants between baseline and 6 months. Individuals demonstrated a greater knowledge of diabetes, had improved self-efficacy of behaviors to improve their health (e.g. diet and exercise), and showed positive behavior change in terms of diet and exercise. Individuals in the treatment arm also showed lower self-reported health at the 6 month follow-up. This could be related to knowledge gained in the workshops and could be beneficial to changing health behaviors.

These results are consistent with other diabetes prevention and diabetes management pilot studies in Asian and minority communities that have shown improvements in diabetes knowledge, diet and physical activity behaviors, and self-efficacy through education workshops and follow-up support [9, 25, 26]. While between group clinical changes were not significant in the small study sample compared to other studies with much larger samples [9, 25], the changes in clinical measures that approached significance were encouraging.

Several feasibility barriers were highlighted after pilot implementation. Congruent with CBPR methods, challenges from the pilot study have been reviewed by the RICE Coalition and used to adapt the full intervention, which is currently being implemented. These barriers to feasibility and how they are being addressed in the full intervention are summarized in Table 6. In particular, the low retention rates in both treatment and control groups, the challenges to location and timing of the intervention components, and the cultural beliefs regarding disease prevention were addressed. For example, strategies implemented to improve retention have included: expert review of the curriculum and inclusion of more interactive activities; invitations to group activities such as walking tours, healthy cooking demonstrations, free exercise classes, and movie nights; and health education mailings to control participants on additional topics. In an effort to address cultural beliefs regarding disease prevention, a promotional video about the project and the role of CHWs is in development. In addition, future project communications will specifically address community members' perceptions about the program, stressing the partnership with medical, mental health, and social service providers, and that it serves to complement the care

received from primary care physicians. Additionally, survey and follow-up calls have been shortened and unclear questions have been removed.

Several limitations should also be mentioned. Due to a high attrition rate and loss to follow-up, there was incomplete data from participants who did not complete the pilot, thus quantitative findings are based on a small sample size. However, the sample reported in this paper is similar to or larger than several other diabetes pilot studies [27, 28], and a randomized controlled design is used. The clinical measures indicate modest improvements, suggesting that with a larger sample size there may be more substantial clinical impacts of the program.

Conclusion and Implications

This study is the first to report on the results of a pilot CHW intervention to promote diabetes prevention in the Korean American community of NYC. As such, it fills an important gap in the literature on developing culturally-tailored interventions for underserved minority communities. Study findings indicate that the CHW model is acceptable in this community and helps to promote behavior changes in nutrition and physical activity, important components of diabetes prevention. Another major strength of this study is the use of both qualitative and quantitative methods to assess the feasibility, acceptability, and outcomes of the pilot. Furthermore, few CHW program evaluations have examined the impact of the CHW on participant outcomes. Qualitative findings provide contextual information that may inform efforts to understand the mechanisms by which CHWs potentially influence health outcomes. Finally, in highlighting some of the unique challenges faced by immigrant community members in participating in health promotion projects, the study findings provide important insight into and recommendations for ways that programs can be tailored to meet the needs of minority populations.

The population size of Koreans in the US will continue to increase in coming years. Given the rising rates of diabetes among Koreans living in the US and in Korea, as well as the linguistic and access to care barriers faced by this community, effective and culturally-tailored health care interventions are needed to overcome barriers and provide support for diabetes prevention. The development, implementation, and evaluation of innovative programs that address local ethnic and cultural norms, build upon community assets, and are conducted in community-academic partnerships will provide important information to improve diabetes prevention programs and the health of communities.

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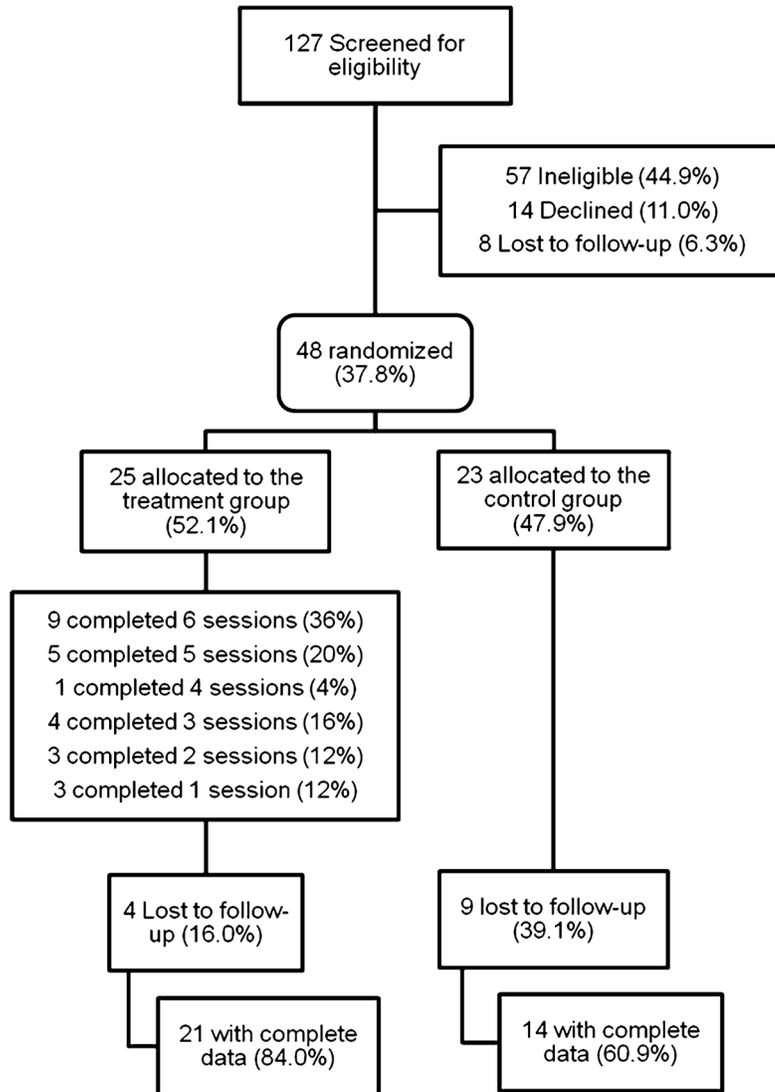


Fig. 1. Flowchart of screening, enrollment, and retention

Table 1

Culturally-tailored curriculum

Session topic	Session overview	Tailored cultural components
Diabetes/diabetes prevention overview	Diabetes information Prevention of diabetes Myths and Facts about diabetes Goal-setting	Discussion of diabetes prevalence and increased risk of diabetes in Asians Explanation of BMI and at-risk BMI in Asian communities Dispelling common cultural misconceptions regarding diabetes Incorporation of culturally appropriate images and language
Nutrition	Nutrition and Food Eating a balanced diet Overcoming barriers- Eating out and in social situations Reading a Nutrition Label Goal-setting for healthy eating	Photos of typical Korean foods Healthy elements in traditional Korean cooking such as whole grain options for rice, noodles, and bread and limiting portions of rice Identifying and limiting Korean foods high in salt Fish eaten by Koreans that are high in Omega-3 s Discussion of traditional Korean practice to eat fruits as an alternative to high fat desserts Discussion of small plates typical of Korean dining in relation to the Plate Method Managing cultural expectations for eating in other homes when invited as a guest Reading food labels in Korean and English Culturally appropriate images and language
Physical activity	Energy balance between foods and physical activity Benefits and types of exercise Preventing injuries Incorporating routines Overcoming barriers Practice activity Goal-setting	Incorporating physical activities, such as Yoga and Tai-Chi Home-based exercise/activities for seniors List of free community exercise classes Incorporation of culturally appropriate images and language
Cardiovascular disease and diabetes complications	Diabetes complications Heart disease and stroke Staying motivated and goal-setting	Discussion of blood pressure and salt in diet Review of Korean foods high in salt and fat and limiting these foods Incorporation of culturally appropriate images/language
Social support and stress management	Effects of stress on health, diet, smoking, and physical activity Stress and anger management Depression effects and management strategies Family support Goal-setting	Progressive muscle relaxation for stress relief Discussion around guilt related to family members and perceived shortcomings List of community resources/providers Incorporation of culturally appropriate images and language
Access to healthcare	Communicating with the doctor Preparing for a doctor's visit Accessing health services	Health access for undocumented immigrants Patient bill of rights and language access laws Review of NYC Health and Hospitals Corporation Options Program Health access resources in Korean Incorporation of culturally appropriate images and language

Table 2

Baseline characteristics of participants, mean (SD) or %

	Total (N = 48)	Treatment (N = 25)	Control (N = 23)	p value
Demographics				
Age	59.7 (8.1)	61.0 (8.6)	59.5 (7.0)	0.52
Female	64.3	68.0	65.2	
Born in Korea	100.0	100.0	100.0	
Years lived in US	22.6 (10.3)	22.0 (9.6)	23.5 (10.6)	0.61
Married	87.5	84.0	91.3	
Education HS	37.5	40.0	34.8	0.71
Employed	39.6	36.0	43.5	0.41
Uninsured	44.6	36.0	47.8	0.27
Annual household income				
<\$20,000	25.0	36.0	21.7	
\$20,000–\$49,999	41.1	28.0	52.2	
\$50,000	23.2	20.0	21.7	
Don't know	10.7	16.0	4.3	
Clinical variables				
Weight, lbs	138.7 (22.1)	135.8 (20.1)	138.4 (25.1)	0.69
Height, inches	63.1 (2.9)	62.9 (2.7)	63.2 (3.4)	0.72
BMI, kg/m ²				
Overall	24.3 (3.1)	24.1 (3.3)	23.9 (3.1)	0.79
Overweight, 23–27.49	55.4	44.0	60.9	
Obese, ≥27.50	16.1	16.0	13.0	
Waist circumference, inches	34.1 (3.1)	34.0 (3.5)	33.5 (2.6)	0.61
Blood pressure, mmHg				
Systolic	126.6 (17.3)	123.4 (15.0)	127.1 (16.4)	0.44
Diastolic	77.9 (11.5)	75.5 (9.0)	76.6 (11.0)	0.74
Hypertension categories				
Hypertensive	21.7	12.5	31.8	
Pre-hypertensive	52.2	58.3	45.5	
Glucose (mg/dL)	106.8 (47.4)	103.7 (24.0)	113.5 (71.2)	0.53
140 mg/dL—at risk	6.7	4.2	9.5	
Cholesterol (mg/dL)	176.1 (54.1)	180.3 (61.4)	177.8 (48.6)	0.88
Borderline high	20.0	21.7	18.2	
High	15.6	13.0	18.2	

Table 3

Changes in clinical variables at 6 months, mean (SD)

	Treatment (T) group n = 21			Control (C) group n = 14			T v. C		
	Mean BL	Mean 6 M	Change BL—6 M	P value	Mean BL	Mean 6 M	Change BL—6 M	P value	P value
Weight (lbs)	138.3 (20.9)	137.1 (21.9)	-1.2 (3.7)	0.16	138.3 (26.2)	139.0 (27.7)	0.7 (3.3)	0.45	0.14
BMI (kg/m ²)	24.5 (3.3)	24.3 (3.5)	-0.2 (0.7)	0.14	23.8 (3.4)	23.9 (3.6)	0.1 (0.6)	0.44	0.12
Waist Circumference, inches	34.3 (3.7)	33.9 (3.4)	-0.4 (2.3)	0.30	33.7 (2.8)	34.0 (2.8)	0.3 (1.2)	0.41	0.23
BP (mmHg)									
Systolic	123.3 (15.0)	121.3 (18.2)	-2.2 (15.9)	0.54	129.8 (19.6)	129.5 (13.5)	-0.3 (14.9)	0.94	0.73
Diastolic	76.0 (8.7)	77.7 (10.4)	1.7 (11.0)	0.50	78.1 (11.1)	83.0 (9.7)	4.9 (10.6)	0.11	0.40
Glucose	104.7 (26.1)	108.7 (21.8)	4.0 (30.8)	0.57	107.8 (33.8)	108.3 (17.0)	0.4 (27.4)	0.96	0.74

Table 4
Changes in Self-efficacy and knowledge between baseline and 6 months, mean (SD)

	Treatment (T) group n = 21			Control (C) Group n = 14			T vs. C		
	BL	6 M	Change BL—6 M	P value	BL	6 M	Change BL—6 M	P value	P value
Physical activity									
Social Interaction ^a	2.1 (0.7)	2.6 (0.8)	0.5 (0.9)	0.03	2.1 (0.8)	2.5 (0.9)	0.4 (1.3)	0.27	0.77
Confidence ^a	3.1 (0.6)	3.5 (0.4)	0.4 (0.7)	0.03	3.0 (0.8)	3.3 (0.5)	0.3 (0.8)	0.17	0.87
Nutrition									
Portion control ^a	2.8 (0.9)	3.0 (0.7)	0.3 (0.9)	0.21	2.6 (0.8)	2.9 (0.8)	0.3 (1.1)	0.37	0.93
Preparation/buying ^a	3.3 (0.8)	3.5 (0.5)	0.9 (0.2)	0.39	3.4 (0.6)	3.5 (0.4)	0.2 (0.7)	0.50	0.88
Planning ^a	2.0 (0.6)	2.3 (0.7)	0.3 (0.8)	0.17	1.9 (0.9)	2.0 (0.8)	0.1 (0.6)	0.52	0.53
Barriers ^b	4.8 (1.6)	5.0 (1.8)	0.2 (2.0)	0.67	4.4 (1.7)	5.1 (1.8)	0.7 (2.0)	0.20	0.46
Confidence ^c	7.0 (1.4)	7.2 (0.9)	0.2 (1.6)	0.50	6.9 (1.3)	6.8 (1.4)	-0.1 (1.7)	0.76	0.50
Diabetes knowledge ^d	9.2 (2.0)	10.9 (2.1)	1.7 (2.0)	<0.01	9.9 (2.3)	9.6 (3.2)	-0.2 (2.8)	0.78	0.03
Self-efficacy ^e	3.8 (0.9)	4.1 (0.8)	0.3 (1.0)	0.24	3.8 (1.0)	4.2 (0.8)	0.4 (1.0)	0.22	0.83
Mental health									
GAD-2 ^f	1.3 (1.7)	0.8 (1.3)	-0.5 (1.7)	0.17	0.6 (0.8)	0.9 (1.4)	0.3 (1.4)	0.44	0.15
PHQ-2 ^f	1.2 (1.5)	1.1 (1.6)	-0.1 (1.7)	0.70	0.9 (0.5)	1.2 (1.5)	0.3 (1.4)	0.45	0.43

^a 1 = lowest, 4 = highest,

^b 0 = no barriers, 7 = all barriers,

^c 0 = lowest, 8 = highest,

^d 0 = lowest, 14 = highest,

^e 1 = lowest, 5 = highest,

^f 0 = lowest risk, 6 = highest risk

Table 5

Changes in health behaviors between baseline and 6 months, n (%)

	Treatment n = 21			Control n = 14		
	BL	6 M	P value	BL	6 M	P value
Physical activity						
Do you do any sustained physical activity for 10 min or more?			1.00			0.42
Yes	16 (73.2)	16 (73.2)		11 (84.6)	10 (71.4)	
Recommended level of physical activity per week			0.45			0.40
No exercise	8 (38.1)	5 (23.8)		3 (25.0)	7 (53.8)	
<150 min per week	3 (14.3)	6 (28.6)		3 (25.0)	2 (15.4)	
150 min per week	10 (47.6)	10 (47.6)		6 (50.0)	4 (30.8)	
Nutrition						
Over the past week, how often do you drink soda or sweet drinks?			0.46			1.00
<once a week	11 (55.0)	15 (71.4)		6 (42.9)	7 (50.0)	
1–6 Times a week	6 (30.0)	5 (23.8)		7 (50.0)	7 (50.0)	
Once a day or more	3 (15.0)	1 (4.8)		1 (7.1)	0 (0.0)	
Over the past week, how often did you eat brown rice?			0.02			1.00
Almost never/sometimes	10 (47.6)	2 (10.0)		3 (21.4)	4 (28.6)	
Often/almost always	11 (52.4)	18 (90.0)		11 (78.6)	10 (71.4)	
How often did you eat fruits, instead of desserts or snacks that contain high amounts of sugar?			0.25			0.13
Almost never/sometimes	10 (47.6)	6 (30.0)		6 (42.8)	10 (71.4)	
Often/almost always	11 (52.4)	14 (70.0)		8 (57.2)	4 (28.5)	
I do not like how healthier foods taste			0.31			1.00
Agree	8 (38.1)	4 (19.0)		7 (50.0)	6 (42.9)	
Health and access						
Insurance coverage			0.34			0.34
Insured	14 (66.7)	16 (80.0)		8 (57.1)	8 (57.1)	
Self-reported health			0.64			1.00
Excellent/very good	2 (9.5)	1 (4.8)		4 (28.6)	3 (21.4)	
Good	12 (57.2)	10 (47.6)		4 (28.6)	4 (28.6)	
Fair/poor	7 (33.3)	10 (47.6)		6 (42.9)	7 (50.0)	

Table 6

Challenges and recommendations

Challenges	Recommendations
Difficulty accessing Korean immigrants due to busy work schedules	Stronger partnerships and outreach to physicians to encourage at risk patient referrals
Misperception that having a regular doctor means do not need program	Better messaging on complementary roles doctors and community health prevention programs play for provision of comprehensive optimal health care
Misperception that if not diabetic or no symptoms, do not need program	Word-of-mouth referrals—ask screening and intervention participants to refer their friends and family members
Lack of understanding regarding who CHWs are and their role in the program	Build in a break after the pilot round to build awareness in the community about the program and need for diabetes prevention—get the word out
Difficulty retaining participants due to work schedules, travel to home country	Hold more community education events on diabetes and diabetes prevention in the Korean community
	Work with Korean language media (e.g. newspapers and TV stations) about program and who CHWs are
	Develop a promotional video about the program, the role of CHWs and testimonials from participants
	Build in more incentives/prizes for retention