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Research: Educational and psychological aspects Translation of the Diabetes Prevention Program for diabetes risk reduction in Chinese immigrants in New York City

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Abstract

Aims—To evaluate the effectiveness and feasibility of implementing a linguistically and culturally tailored Diabetes Prevention Program among Chinese immigrants with prediabetes living in New York City.

Methods—A total of 60 Chinese immigrants with prediabetes were randomized into either a Diabetes Prevention Program lifestyle intervention ($n=30$) consisting of 12 bi-weekly core sessions and six monthly post-core sessions or the control intervention ($n=30$), consisting of quarterly mailing of diabetes prevention information. Each Diabetes Prevention Program intervention session lasted 1.5–2 h and covered topics such as healthy eating, physical activity, stress reduction and problem-solving skills. Outcomes such as percent change in weight, BMI, and HbA_{1c} concentration were assessed at baseline, 6 and 12 months. A mixed-effects linear regression was applied to test the intervention effect at months 6 and 12. Data were collected in the period 2012–2013 and analysed in 2014.

Results—The participant attrition rate was < 5% (2 out of 60) at 12 months. There was a significantly greater percent weight loss in the intervention group (–3.5 vs. –0.1%; $P=0.0001$) at 6 months, which was largely maintained at 12 months (–3.3 vs. 0.3%; $P=0.0003$).

Conclusions—Participants in a Diabetes Prevention Program-based intervention achieved greater weight loss and improvements in HbA_{1c} concentration than control participants. Evaluation of the Chinese Diabetes Prevention Program curriculum in a larger trial is warranted.

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Competing interests

None declared.

Introduction

The number of Asian immigrants [1,2] in the USA increased fourfold between 1980 and 2010 [3,4], with much of this migration coming from China [5]. New York City Health and Nutrition Examination Survey data indicate that Asians have a higher prevalence of diabetes at a lower relative body weight than other population groups and that almost half of the NYC Asian Americans have diabetes or prediabetes [6]. A community-based health screening of Chinese immigrants in NYC yielded a prediabetes (not adjusted for age) prevalence of 37% in women and 57% in men [7].

The DaQing Study, the Finish Diabetes Prevention Study and the Diabetes Prevention Program (DPP) have shown that a lifestyle intervention focusing on a lower energy intake and increased physical activity can dramatically reduce the incidence of diabetes [8–10]. The National Diabetes Prevention Program has established standards for implementing the DPP intervention in community settings [11], but DPP prevention programs for Chinese-speaking immigrants are lacking. The authors used a community-based participatory research approach [12] to modify the DPP and conducted a pilot trial.

Methods

Study design and participants

We conducted a randomized controlled trial in patients recruited from medical practices within the Chinese American Independent Practice Association (CAIPA), in collaboration with the Chinese Community Partnership for Health of New York Presbyterian-Lower Manhattan Hospital (formerly named New York Downtown Hospital). Eligibility criteria included having prediabetes [HbA_{1c} 39–46 mmol/mol (5.7–6.4%)], having a BMI ≥ 23 kg/m², having no medical conditions for which the DPP lifestyle intervention would be contraindicated, receiving care from a CAIPA practice, speaking Chinese and a willingness/ability to provide informed consent. Enrolment and analysis numbers are provided in Fig. 1.

Intervention

The DPP curriculum was adapted for the study based on feedback from three focus groups of Chinese participants with prediabetes and one advisory group meeting of CAIPA physicians and community leaders. Modifications included reorganizing the DPP 16-session core curriculum [13], including more information about Asian diabetes risk disparity, following each intervention with a physical activity session (e.g. walking group or tai chi), inviting family members to attend sessions, providing measuring cups (especially rice bowls for portion control), as well as culturally and linguistically tailoring.

The modified lifestyle programme, consisting of 12 bi-weekly core sessions and six monthly follow-up sessions, was conducted in Chinese (Mandarin or Cantonese) by trained lifestyle coaches at a community site that could accommodate an exercise programme. Each session lasted 1.5–2 h. Anthropometric measures and fasting blood specimens were obtained at baseline, 6 months and 12 months to evaluate weight and cardiometabolic changes. The study protocol was approved by the institutional review boards of the Albert Einstein

College of Medicine and the former New York Downtown Hospital. Signed informed consent was obtained from all study participants.

Statistical analysis

The data were collected in the period 2012–2013 and analysed in 2014. To evaluate the efficacy of the intervention, we used percent changes from baseline values as the dependent variable to adjust for baseline differences. Then, we applied mixed-effects linear regression in which the intervention group indicator, time and time-by-group effects were considered fixed, and subject-specific intercepts were considered random, to take into account within-subject outcome correlations over 6 and 12 months for statistical inference. The analyses were conducted using SAS version 9.3 (SAS Institute Inc., Cary, NC, USA). In addition, we used the Reach, Efficacy, Adaptation, Implementation and Maintenance (RE-AIM) framework to evaluate the feasibility and acceptability of the pilot intervention [14]. The sample size of 30 participants per group was determined based on assessment of recruitment feasibility within the study period; however, considering a conservative 20% attrition rate, a minimally detectable effect size was estimated to be a difference of 0.8 SD in mean weight change at 6 months between the intervention and the control groups, with 80% power and a two-sided type I error rate of 5%.

Results

The baseline demographic measurements were similar between the control ($n=30$) and intervention groups ($n=30$) except for plasma glucose and triglyceride levels (Table 1). The intervention had a significant overall effect on percent weight loss (-3.5 vs. -0.1% ; $P=0.0001$) at 6 months, which was largely maintained at 12 months [-3.3 vs. 0.3% ; $P=0.0003$ (Table 2)]. Other significant differences in percent changes from baseline between groups included: HbA_{1c} change at 12 months (0.1 vs. 3.8%); BMI change at 6 months (-4.2 vs. -0.3%); changes in body fat at 6 months (-7.1 vs. -0.3%) and 12 months (-7.0 vs. -1.6%); waist circumference changes at 12 months (-2.4 vs. 1.7%). Although the intervention did not have significant effects on the other cardiometabolic variables, the directions of trends were all favourable.

The RE-AIM evaluation indicated the following. *Reach*: from the initial patient response of 304 patients, 60 patients were randomized (~20% of those interested/randomized), and 58 participants (97.7%) completed both 6- and 12-month follow-up, with 100% (30/30) retention in the intervention group and 93.3% (28/30) retention in the control group. *Effectiveness*: as shown above, we observed significant changes in our primary outcomes such as percent change in weight and BMI, and secondary outcomes including percent reduction in HbA_{1c} concentration; however, it should be noted that the percent weight loss observed in the present study in Chinese immigrants is about half of what was achieved in the DPP. *Adoption*: although this pilot study was not set up to measure setting or agency-level adoption, it was well accepted by the participants, as our records indicated that the overall attendance for core intervention sessions was 89.2 and 55.8% at the 6-monthly post-core sessions. *Implementation*: for this pilot study, the authors mainly focused on delivery fidelity; for example, the first author attended all study sessions, and fidelity assessment

(observation) indicated that the intervention components (core and post-core) were delivered as planned. Methods for assessing the content fidelity of lifestyle coaches' intervention delivery included lifestyle coaches' self-report and participant feedback; however, these were mostly informal and not quantitative measures. *Maintenance*: the primary outcome for the study was weight change at 6 months. In addition, our findings indicated that significant intervention effects were sustained at 12 months.

Discussion

While the DPP has been translated and implemented in different settings [15–19] and populations, including minorities [16], to our knowledge, this is the first study to show that a culturally appropriate and acceptable translation of the DPP curriculum is promising for diabetes prevention in Chinese immigrants at high risk of developing diabetes. According to the pilot findings, one of the most important observations was the weight reductions achieved in Chinese immigrants. The study participants had relatively low BMI values at baseline (25.8 and 26.3 kg/m² for the control and intervention group, respectively); yet, a small but significant and clinically meaningful 3.5% weight reduction [20], loss of ~2.4 kg (5.4 lbs) on average, was observed at 6 months and maintained at 12 months, although the original DPP achieved a 7% reduction [21] and others have reached an average 4–6% reduction [22,23]. The use of an Asian-specific BMI threshold of 23 kg/m² for overweight status [24] in the present study seems justified as a valid criterion for Chinese immigrants.

The authors speculate that several factors might explain this lower, yet significant, level of effectiveness with this adaptation. First, many of the Chinese immigrants in our study held more than one job with long working hours. Changing the weekly meetings to a biweekly format contributed to the low attrition rate. Second, having well-trained and bilingual health coaches is important. According to our exit surveys, one of the key factors that participants liked about the programme was the quality of the coaches. They thought the coaches were knowledgeable and very approachable in helping them make changes. Third, the participants liked the translated DPP curriculum. They felt the language and examples used to be culturally and linguistically appropriate. Fourth, the monthly, post-intervention maintenance sessions were able to keep them engaged and sustain the changes. Other factors, such as having a conveniently located meeting place, an informal buddy system, and the use of self-monitoring tools (e.g. pedometer) are also vital to the success of the intervention.

The study had a very low attrition rate (3.3%); only two participants from the control group dropped out, while there was a 100% retention rate for the intervention group at the end of 12 months. This suggests that the revised DPP was acceptable and effective in terms of facilitating lifestyle changes in Chinese immigrants.

The present study has several limitations. First, it was a pilot study with 60 participants. There is a need to increase the generalizability of the findings by increasing the sample size and by including Chinese immigrants whose primary dialects are not Mandarin or Cantonese. Second, the cost data for the study were not formally collected; however, the authors estimated these would be similar to other programmes offered in communities such

as those attending the YMCA [23]. Confirmation of cost-effectiveness of the study is warranted to ensure long-term sustainability [25].

In summary, significant findings of weight reduction and smaller increases in HbA_{1c} concentration at 12 months were observed in this group of Chinese immigrants. Although results from this linguistically and culturally tailored DPP intervention seem promising, the findings need to be confirmed in a larger-scale study.

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What's new?

- Previous epidemiological studies have indicated a high prevalence of impaired fasting glucose among Chinese immigrants, one of the fastest growing groups of first-generation immigrants in the USA.
- To our knowledge, this National Institutes of Health-funded project is one of the first to evaluate the acceptability and feasibility of implementing a culturally and linguistically appropriate Diabetes Prevention Program lifestyle intervention in Chinese immigrants with prediabetes.
- Findings indicated that there was a very low participant attrition rate (< 5%) and that the intervention achieved greater weight loss and improvements in HbA_{1c} than did the control intervention at 12 months.

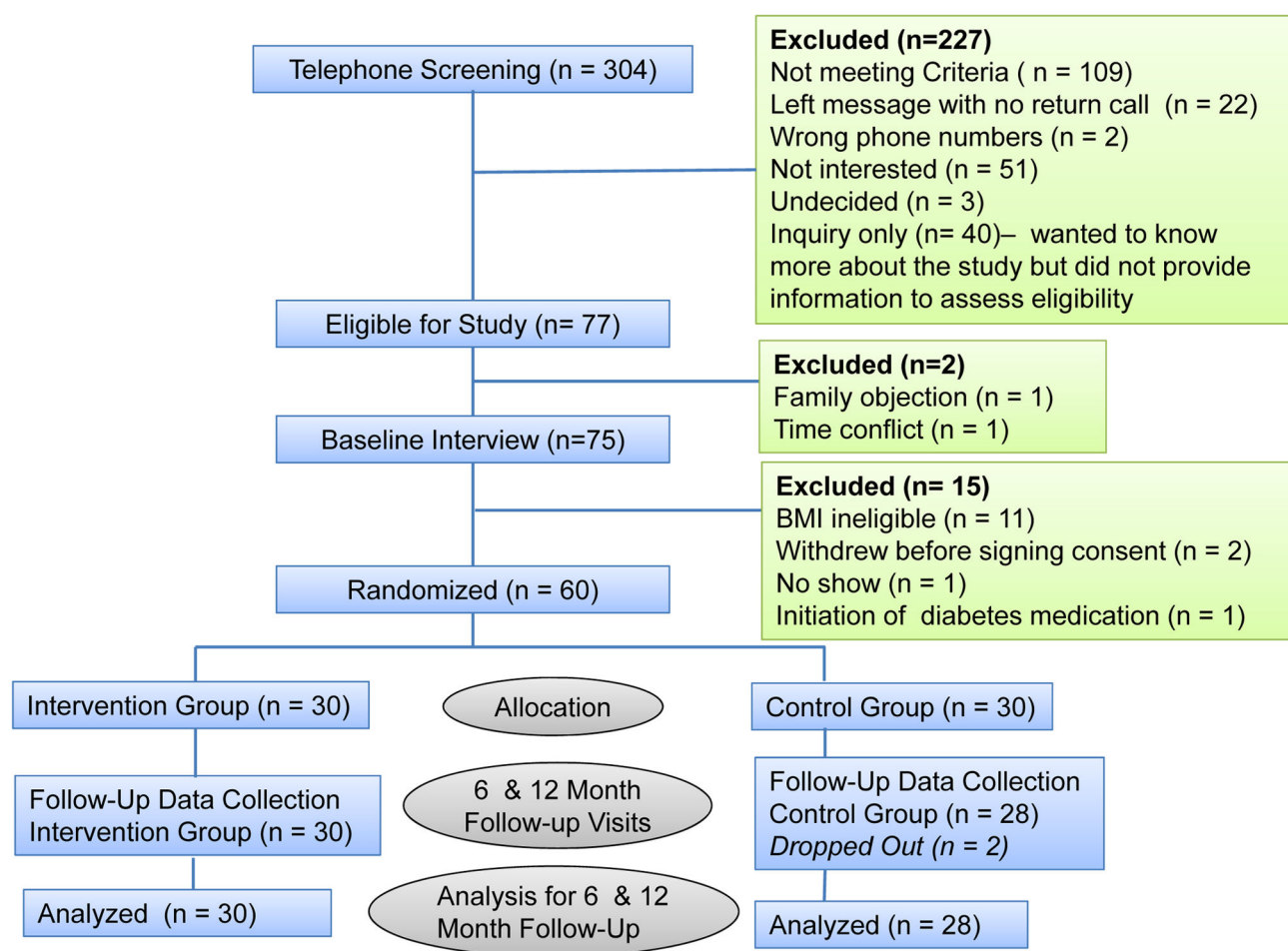


FIGURE 1.
CONSORT flow diagram of study participants
Consolidated Standards of Reporting Trials (CONSORT) flow diagram of study participants.

Table 1

Baseline demographic and clinical characteristics of the study participants

| Variable | Control group (N=30 [*]) | Intervention group (N=30 [*]) |
|---|------------------------------------|---|
| Women, n (%) | 15 (50) | 19 (63.3) |
| Age, years | 60.9 (12.2) | 56.8 (9.5) |
| Weight, kg (control group, N = 29) | 65.8 (9.7) | 69.2 (11.3) |
| BMI, kg/m ² | 25.8 (2.3) | 26.3 (2.4) |
| % body fat | 27.0 (6.4) | 29.4 (6.3) |
| Waist circumference, cm (control group N = 27; intervention group, N =24) | 89.7 (8.4) | 91.7 (8.6) |
| HbA _{1c} | | |
| mmol/mol | 42 (3) | 44 (4) |
| % | 6.0 (0.3) | 6.2 (0.4) |
| Glucose [†] , mmol/l | 5.7 (0.7) | 6.1 (0.5) |
| Cholesterol, mmol/l | 4.7 (0.9) | 4.9 (1.1) |
| Triglycerides [†] , mmol/l | 1.2 (0.7) | 1.6 (0.7) |
| HDL cholesterol, mmol/l | 1.4 (0.3) | 1.4 (0.3) |
| LDL cholesterol, mmol/l | 2.8 (0.8) | 2.8 (1.0) |
| Systolic blood pressure, mmHg | 126.6 (18.3) | 127.1 (13.6) |
| Diastolic blood pressure, mmHg | 78.1 (9.7) | 78.6 (9.5) |

Data mean (SD) unless otherwise stated.

^{*} Except where indicated.[†] $P < 0.05$.

Table 2

Comparison of percent change in weight and metabolic characteristics by treatment arm

| | Estimated percent change (SE) at 6 months | | Estimated percent change (SE) at 12 months | |
|--------------------------------|---|-----------------------|--|-----------------------|
| | Intervention, <i>n</i> =30 | Control, <i>n</i> =28 | Intervention, <i>n</i> =30 | Control, <i>n</i> =28 |
| Weight, kg | -3.5 (0.7)** | -0.1 (0.6) | -3.3 (0.7)** | + 0.3 (0.6) |
| BMI, kg/m ² | -4.2 (1.3)* | -0.3 (1.4) | -3.2 (1.3) | -0.3 (1.4) |
| % body fat | -7.1 (1.8)** | +0.3 (1.6) | -7.0 (1.8)* | -1.6 (1.5) |
| Waist circumference, cm | -1.7 (1.4) | -1.6 (1.3) | -2.4 (1.4)* | +1.9 (1.3) |
| HbA _{1c} , mmol/mol | -3.0 (1.0) | -0.9 (1.3) | +0.1 (1.0)* | +3.8 (1.3) |
| Glucose, mmol/l | -2.9 (1.6) | -2.1 (1.6) | -4.8 (1.6) | -1.6 (1.6) |
| Cholesterol, mmol/l | -4.6 (2.8) | 0.8 (2.6) | -9.9 (2.8) | -8.0 (2.6) |
| Triglycerides, mmol/l | -10.8 (5.8) | 2.7 (6.3) | -11.1 (5.8) | 3.9 (6.3) |
| HDL cholesterol, mmol/l | 4.7 (2.5) | 7.8 (2.4) | 3.2 (2.5) | 0.8 (2.4) |
| LDL cholesterol, mmol/l | -6.3 (5.1) | -1.8 (3.8) | -11.3 (5.2) | -13.3 (3.8) |
| Systolic blood pressure, mmHg | -2.9 (1.9) | -0.9 (2.2) | -2.0 (1.9) | -1.5 (2.2) |
| Diastolic blood pressure, mmHg | -3.1 (2.0) | -5.2 (2.0) | -3.2 (2.0) | -4.4 (2.0) |

Estimated percent changes, standard errors (SE) and *P* values were obtained based on application of mixed-effects linear models.

* *P*<0.05,

** *P*< 0.01.