Evaluating a Culturally and Linguistically Competent Health Coach Intervention for Chinese-American Patients With Diabetes

Susan L. Ivey, MD, MHSA, Winston Tseng, PhD, Elaine Kurtovich, MPH, PT, Ben Lui, MD, MPH, Rosy Chang Weir, PhD, Jing Liu, MS, RD, Hui Song, MS, MPH, May Wang, DrPH, and Alan Hubbard, PhD

Abstract

Background. Type 2 diabetes is a growing concern among medically underserved Chinese Americans. However, very few interventions have been developed or adapted for Chinese Americans with diabetes.

Objective. To use a participatory research approach to evaluate the effectiveness of a culturally tailored, linguistically appropriate model for diabetes care employing health coaches to improve A1C levels among Chinese-American patients in a federally qualified health center setting.

Methods. We compared change in A1C between intervention participants (n = 46), who received a health coaching intervention, and control participants (n = 46), who received usual care over a period of ~ 6 months.

Results. Intervention participants showed a decrease in mean A1C at follow-up (–0.40%) compared to control subjects (+0.04%), although this difference was not statistically significant. At the 6-month follow-up, a significantly higher percentage of intervention participants (45.7%) had well-controlled A1C levels compared to control subjects (23.9%) (P = 0.048).

Conclusions. It is feasible to implement a culturally tailored, linguistically appropriate teamlet model of care for Chinese Americans with type 2 diabetes. Such a model may be helpful in reducing A1C levels. Given trends in A1C improvement during a 6-month pilot, future randomized trials with a larger sample capable of providing adequate statistical power to detect improvements are warranted.

The rapidly growing population of medically underserved Chinese Americans and other Asian Americans with low socioeconomic status and poor health status has not been adequately recognized, and their health status is of increasing public health concern.[1] The gaps in data and the lack of data disaggregation among Chinese and other Asian Americans mask dramatic health disparities and make it difficult to measure progress toward health disparities reduction initiatives.[2,3]

Medically underserved Chinese Americans face multiple challenges in accessing health care as a result of poverty, limited English proficiency, lack of cultural orientation in care, and lack of culturally and linguistically proficient care. Almost seven in 10 Chinese Americans (69%) are foreign-born compared to 13% of the U.S. population and 8% of whites,[4] and 46% have limited English proficiency compared to 9% of the U.S. population and 6% of whites.[4] Chinese immigrants are significantly less likely to have a usual source of medical care than U.S.-born Chinese (65 vs. 87%, respectively).[5] Additionally, recent Chinese immigrants may be unfamiliar with the U.S. health system and face challenges adjusting to that system. The lack of cultural concordance between patients and providers can lead to delays and treatment errors and ultimately to poorer health outcomes.[6–8]

There is a paucity of national data on diabetes prevalence rates in Asian subpopulations. Diabetes

Address correspondence to Susan L. Ivey, MD, MHSA, University of California Berkeley, School of Public Health, Health Research for Action, 2140 Shattuck Avenue, 10th floor, Berkeley, CA 94704-1210.

prevalence rates for Asian Americans in the United States range from 5 to 7.2% (unadjusted), 7.3% (adjusted for age and sex), and 8.4% (adjusted for age) higher than rates for non-Hispanic whites.[9–11] The incidence of diabetes among Asian Americans doubled between 1997 and 2008, the highest increase among all racial/ethnic groups.[11] McNeely and Boyko[9] reported that, although the age- and sex-adjusted prevalence is similar between Asian and white Americans, after adjusting for BMI, Asian Americans have a 60% higher adjusted prevalence of diabetes than whites.

Because of sampling issues, some recently reported diabetes prevalence rates among Chinese Americans may not be generalizable or reflect the actual overall prevalence rates for Chinese Americans. For example, some studies conducted surveys only in English and excluded a substantial portion of Chinese and other Asian Americans with limited English proficiency, and others failed to adequately address the difficulty of recruiting hard-to-reach Chinese and other Asian immigrant populations, and thus the surveys suffered from low response rates.[12]

Very few diabetes interventions have been developed and adapted for Chinese Americans or other Asian Americans.[3,13] A few studies of Asian subgroups such as Chinese, Japanese, and Vietnamese in the United States and Chinese in China and Australia suggest that personal factors such as family history, ethnicity, and language can influence diabetes care and outcomes and that culturally and linguistically appropriate treatment and health promotion programs can be effective in addressing these risk factors and improving outcomes.[13–22]

Research has shown that diabetes self-management education interventions designed specifically for underserved ethnic-specific groups (i.e., interventions that specifically incorporate sociocultural aspects) can significantly improve outcomes, including improvements in health behavior and knowledge, health status, and self-efficacy.[23–26] Patient-provider language concordance has been associated with better medication adherence, fewer missed physician visits, provision of more health education, and patient perception of better care compared to language-discordant pairs.[27–29]

Bodenheimer et al.[30–32] have proposed systems-level changes using a "teamlet" model to extend the traditional 15-minute primary care visit. The teamlet model aims to improve patient care and patients' self-management skills by expanding the visit to include one-on-one time with a trained health coach, who may be a medical assistant or other staff member, and by shifting routine tasks from physicians to the health coaches, freeing up physicians to focus on their essential tasks.[33] In the Bodenheimer model, health coaches have pre- and post-visit meetings with patients, assist physicians during the physician visit, and communicate with patients between physician visits.[33]

This original teamlet approach did not specially address cultural and linguistic factors. A patient-centered model using culturally and linguistically competent health coaches may help address barriers to treatment for racial or ethnic minorities, who may have limited English proficiency, low health literacy, or difficulty advocating for themselves or who may face a variety of systems-level barriers.

To date, this model has not been fully evaluated for its effectiveness in improving diabetes (or other chronic disease) management, nor has it been tailored for use among Chinese Americans or other Asian Americans. A few studies have reported on interventions targeting Chinese Americans with diabetes that display some of the features of the teamlet model. For example, one patient-centered diabetes education intervention tailored for Chinese Americans was successful in reducing A1C levels, systolic blood pressure, and body weight.[14] These findings suggest that Bodenheimer's teamlet model may be effective in improving diabetes treatment outcomes in Chinese Americans.

The purposes of this study were to adapt the Bodenheimer teamlet model for diabetes care among Chinese patients, to evaluate the adapted version for effectiveness in improving A1C levels in Chinese patients with diabetes over a 6-month pilot intervention period, and to assess the feasibility of implementing this care model in a federally qualified health center setting.

Study Methods

Intervention design

A community-academic partnership between Asian Health Services (AHS), a safety net community health center in Oakland, Calif.; the Association of Asian Pacific Community Health Organizations; and the University of California (UC) Berkeley, Health Research for Action Center, was initiated to address the rapidly growing Asian patient population with diabetes in the greater Oakland area served by AHS. The goal of this multidisciplinary collaboration was to design, implement, and evaluate community health strategies that could better serve this growing patient population.

We developed, implemented, and evaluated an ethnic- and language-concordant teamlet model involving the use of health coaches specifically tailored for Chinese patients with diabetes enrolled at AHS (Figure 1). The health coach role was based on the model proposed by Bodenheimer et al.[33]

As part of this pilot intervention study, AHS clinic staff in the intervention unit implemented this model, referred to as the "AHS model," with several modifications to the original Bodenheimer model:

- Instead of staffing two health coaches for every primary care physician, five health coaches worked with four physicians on the intervention unit.
- The health coaches were not present during physician visits to preserve personnel resources.
- After a physician visit, the physician communicated the care plan for any chronic or acute conditions to the health coach during a teamlet huddle.
- Nutritional counseling by a registered dietitian was added

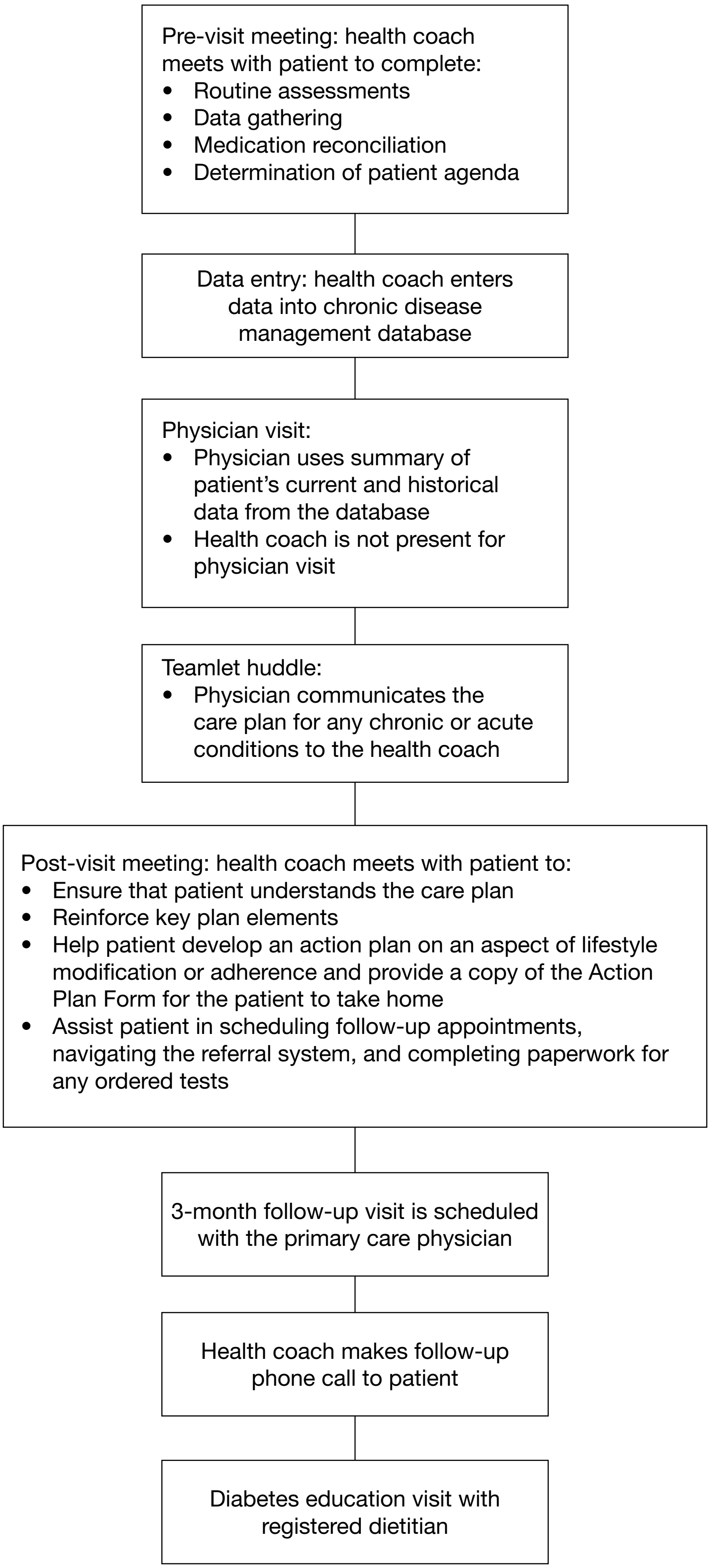

Figure 1. AHS teamlet model.

as a routine component of the intervention.

- All health coaches, the dietitian, and most physicians were ethnically and linguistically matched to their Chinese patients.

Recommendations took into account cultural implications (e.g., a Chinese cultural diet). Physicians who did not speak their patient's language would communicate with their patient through a clinic interpreter.

At AHS, the five health coaches were medical assistants (MAs) who underwent five 1-hour health coach training sessions on workflow, diabetes, nutrition, medications, and communication techniques. The trainings consisted of didactic sessions, question-and-answer sessions, and role-playing activities. After the initial 5-hour training, additional booster training sessions were provided as needed for the MAs throughout the year. During the intervention period for the study, there was no turnover in health coach personnel.

The primary responsibility of the health coaches was to ensure that patients understood their diagnosis and treatment plans, knew how to manage their conditions, received adequate education, were able to navigate the health system, and had a liaison to help communicate concerns to their physician. The protocol required the health coaches to meet with patients just before their physician visits. During these pre-visit meetings, the health coaches would perform routine patient assessments (e.g., taking vital signs), gather relevant data, conduct medication reconciliation, and elicit patients' agenda for talking with their physician. They sometimes also provided language-appropriate diabetes education materials for patients to take home to share with family members. The health coaches would then enter the data into an electronic chronic disease management database, producing a summary report used by the physicians during the physician-patient visits.

Immediately after huddles, post-visit meetings would take place between patients and health coaches. The health coaches used communication techniques such as Ask-Tell-Ask and Closing the Loop[1,34] to ensure that patients understood their care plan and to reinforce key plan elements. (Ask-Tell-Ask is a patient-directed motivational interviewing technique to provide needed information to patients and check for understanding of the information. Closing the Loop is a related technique to assess patients' understanding of new information by asking them to restate their understanding of the information.) Behavioral or self-care goals were then formulated collaboratively, captured on a Self-Management Action Plan form, and copied for patients to take home. Finally, the health coaches would assist patients in scheduling follow-up appointments, navigating the referral system, and making sure all necessary paper work was complete for any tests ordered by the physician as part of their care plan. The coach then scheduled a 3-month follow-up visit scheduled with patients' primary care physician.

As part of the pilot, patients in the intervention group were also scheduled for a face-to-face diabetes education visit (~ 30–60 minutes) with a registered dietitian ~ 2 weeks after each physician visit. In addition, ~ 1 week after each physician visit, the health coaches conducted follow-up telephone calls with patients and/or their family members to provide self-management support by reinforcing the care plan and action plan, answering basic questions, and serving as liaison to the physician to help address any patient concerns between clinic visits.

For the study, a complete intervention series would include at least three physician visits, three dietitian visits, and three follow-up phone calls from a health coach over a period of ~ 6 months. Patients enrolled in the intervention were included in the analysis regardless of the actual number of visits under an intention-to-treat approach. Control patients had usual care that consisted of no specified number of provider visits during the same time period. The mean number of chronic care physician visits during the 6 months after the baseline physician visit did not differ significantly by group (averaging 2.5 visits for both intervention- and control-group patients).

Study design

Study participants were recruited from two outpatient medical care units at AHS, a federally qualified health center that primarily serves low-income Asian Americans, many of whom are immigrants. Patients with a diagnosis of type 2 diabetes who had an upcoming chronic care physician visit were identified from each unit. One unit implemented the teamlet model (intervention unit) while the other offered usual care (control unit).

Study participants were not randomly assigned to intervention and control groups, but instead were conveniently assigned to control and intervention groups based on the medical unit where they normally received their care. The two units participating in the pilot have comparable types of patients. The intervention unit is staffed by a mix of internists and family physicians, whereas the control unit has only family physicians.

Clinic staff members screened potential participants by chart review. Inclusion criteria included being ≥ 18 years of age; a current clinic patient; Cantonese-, Mandarin-, or English-speaking; of Chinese heritage; and having an *International Classification of Diseases, 9th Revision, Clinical Modification* diagnosis of type 2 diabetes. Exclusion criteria included significantly impaired cognition or Alzheimer's disease, schizophrenia, A1C levels < 6 or > 11%, and recent history (past 6 months) of cancer (except certain types of unmetastasized skin cancer), myocardial infarction, cardiac surgery, or stroke. Eligible patients were invited to join the study, and, if interested, scheduled for an in-person interview appointment with a study research assistant.

At intake appointments, research assistants obtained informed consent for the study and conducted a baseline interview in Cantonese, Mandarin, or English, depending on the patient's preferred language. Participants recruited from the control unit received usual care for their diabetes, while participants recruited from the intervention unit began receiving care for their diabetes under the teamlet model, beginning with their next chronic care physician visit (baseline physician visit). The research assistants also abstracted relevant information from medical records around the time of the baseline interview and ~ 3–6 months after the baseline physician visit. Follow-up study interviews were conducted ~ 3–6 months after the baseline interview and were conducted either in person or over the phone.

Of the 142 potential participants who were screened and found to be eligible for the study, 97 enrolled, yielding a participation rate of 68%. Two participants were dropped from the study after the baseline interview because they no longer met eligibility requirements such as being a current AHS patient. Three participants did not have a follow-up A1C measurement after their baseline assessment, leaving a total of 92 participants (n = 46 intervention participants and n = 46 control participants) for analysis of the primary endpoint of A1C 6 months after baseline.

Data were collected between May 2009 and June 2010. The institutional review board at the UC Berkeley approved all study protocols and instruments.

Advisory committee

A Chinese Community Research Advisory Committee (CCRAC) was formed to advise the research team on the study design, implementation of the intervention, and interpretation and dissemination of the results. Members of this committee included AHS patients with diabetes and their family members, as well as professionals from the community with expertise in diabetes or experience working with the Asian-American community. The CCRAC met regularly during the study.

Study interview

Topics covered in the study interview included demographic questions (baseline visit only), time since diabetes diagnosis (baseline only),

Table 1. Characteristics of Intervention and Control Group Participants at Baseline

	Smaller Sample* (*n* = 78)		Larger Sample† (*n* = 92)	
	Control	Intervention	Control	Intervention
	n = 39	*n* = 39	*n* = 46	*n* = 46
Sex (*n* [%])				
Male	11 (28.2)	16 (41.0)	14 (30.4)	18 (39.1)
Female	28 (71.8)	23 (60.0)	32 (69.6)	28 (60.9)
Age [mean (SD)]	66.8 (11.6)	66.5 (9.8)		
Primary language spoken at home (*n* [%])				
Cantonese	31 (79.5)	24 (61.5)	37 (80.4)	30 (65.2)
Mandarin	3 (7.7)	9 (23.1)	3 (6.5)	9 (19.6)
English	0 (0)	0 (0)	0 (0)	1 (2.2)
Other	4 (10.3)	4 (10.3)	5 (10.9)	4 (8.7)
More than one language	1 (2.6)	2 (5.1)	1 (2.2)	2 (4.4)
Years living in the United States [mean (SD)]	17.8 (8.2)	15.2 (9.6)	18.2 (8.3)	16.6 (12.5)
Marital status (*n* [%])				
Married or living with partner	29 (74.4)	30 (76.9)	34 (73.9)	35 (76.1)
Divorced, separated, or widowed	9 (23.1)	8 (20.5)	11 (23.9)	10 (21.7)
Never married	1 (2.6)	1 (2.6)	1 (2.2)	1 (2.2)
Education (*n* [%])				
Less than high school graduate	30 (76.9)	24 (61.5)	32 (69.6)	30 (65.2)
High school graduate	4 (10.3)	9 (23.1)	6 (13.0)	9 (19.6)
Some college or college graduate	5 (12.8)	6 (15.4)	8 (17.4)	7 (15.2)
Health insurance status (*n* [%])				
Private insurance	0 (0)	1 (2.6)	0 (0)	3 (6.5)
Public insurance	29 (74.4)	26 (66.7)	34 (73.9)	30 (65.2)
Uninsured	10 (25.6)	12 (30.8)	12 (26.1)	13 (28.3)
Health status (*n* [%])‡				
Poor	9 (23.7)	11 (29.0)	10 (22.7)	11 (24.4)
Fair	21 (55.3)	23 (60.5)	26 (59.1)	29 (64.4)
Good	5 (13.2)	4 (10.5)	5 (11.4)	4 (8.9)
Very good	3 (7.9)	0 (0)	3 (6.8)	1 (2.2)
Excellent	0 (0)	0 (0)	0 (0)	0 (0)

**Participants with follow-up A1C tests 5–8.5 months after baseline physician visit.*
†All participants with follow-up A1C tests regardless of date of follow-up test.
‡Sum of responses is less than total number of participants because of missing responses for some participants.
Note: No statistically significant differences were found between control and intervention groups in any factor at a level of P *< 0.05, regardless of which sample was analyzed.*

Table 2. Comparison of Change in A1C in Intervention and Control Groups Between Baseline and Follow-up (Unadjusted)

	Smaller Sample* (n = 78)			Larger Sample† (n = 92)		
	Control (n = 39)	Intervention (n = 39)	*P* value‡	Control (n = 46)	Intervention (n = 46)	*P* value‡
Mean A1C [% (SD)]						
Baseline	7.62 (0.75)	7.59 (0.81)		7.62 (.075)	7.60 (1.16)	
6 months	7.65 (1.33)	7.19 (0.96)		7.63 (1.23)	7.24 (1.02)	
Difference (baseline to 6 months)	0.04 (1.44)	–0.40 (0.79)	0.1045	0.02 (1.36)	–0.36 (1.09)	0.1423
Well controlled (< 7%) at baseline [n (%)]	7 (18.0)	10 (25.6)	0.5843	9 (19.6)	13 (28.3)	0.4640
Well controlled (< 7%) at 6 months [n (%)]	11 (28.2)	18 (46.2)	0.1593	11 (23.9)	21 (45.7)	0.0480

**Participants with follow-up A1C tests 5–8.5 months after baseline physician visit.*
†All participants with follow-up A1C tests regardless of date of follow-up test.
‡P value based on t test for continuous variables and Fisher's exact test for categorical variables.

self-rated health status, adequacy of financial resources, language spoken at home, and employment status.

Medical record abstraction
Data abstracted from patients' medical records included type of health insurance (if any), height, weight, and dates and values of selected clinical tests, including A1C and systolic and diastolic blood pressure values. The baseline abstraction included the most recent A1C value from the 6 months before the baseline physician visit ("baseline A1C," the value used to screen for inclusion in the study). Follow-up abstractions recorded the results of clinical tests performed closest to the 3- and 6-month time points after the baseline physician visit.

Data analysis
Analysis of the data was conducted on two samples: a larger sample comprising 92 participants with a follow-up A1C test performed at any time during the study (range 4.1–11.2 months, mean 6.9 months) and a smaller sample of 78 participants with a follow-up A1C test performed during a tighter interval of 5–8.5 months after entering the study. In addition, the larger sample includes two participants whose baseline A1C levels were slightly outside the initial recruitment inclusion range of 6–11%.

We conducted comparisons of baseline frequencies and means of demographic characteristics between control and intervention groups using the Fisher's exact test (categorical variables) or Student's *t* test (continuous variables). Unadjusted analyses of the change in the primary outcome measure, A1C level, consisted of comparison of the mean change between the intervention and control participants using Student's *t* tests. In addition, we categorized A1C levels as controlled (< 7%) or not well controlled (≥ 7%)[35] and compared proportions in each category by group at baseline and follow-up using Fisher's exact test. These analyses were conducted using SAS statistical software (version 9.2, SAS Institute, Cary, N.C.).

For adjusted analyses, control participants were matched to participants in the intervention group according to a propensity score. For the smaller dataset (n = 78), the propensity score was based on age, years since diagnosis, health insurance status (private, public, or no insurance), and sex. For the larger dataset (n = 92), the propensity score was based on age, years since diagnosis, health insurance status (private, public, or no insurance), sex, and number of months between entering the study and A1C follow-up test.

We produced histograms demonstrating the distribution of estimated propensity scores by intervention versus control group with both the larger and smaller datasets to test the validity of estimating the adjusted mean among the intervention and control participants. Propensity score matching analyses were conducted using the psmatch2 command in Stata 10 for Windows (StataCorp, 2007, College Station, Tex.) using the nonparametric bootstrapping option to derive statistical inference.

Study Results

Participant demographics
We compared the demographic characteristics of control and intervention participants in both the smaller (n = 78) and larger (n = 92) samples and found no statistically significant differences (Table 1).

Mean change in A1C
Unadjusted analyses. The mean baseline A1C was similar among participants in the intervention (7.59%) and control (7.62%) groups for the smaller sample (n = 78) (Table 2). At follow-up 5–8.5 months after the initial physician visits during the study period, mean A1C had

decreased by 0.40% (95% CI –0.65 to –0.15) to 7.19% among intervention participants, whereas mean A1C among control participants increased slightly (+0.04%, 95% CI –0.41 to 0.49) to 7.65%. This difference between groups in the mean change in A1C did not reach statistical significance (P = 0.1045). Table 2 provides results of analysis with the larger sample (n = 92).

Adjusted analyses. When we ran the propensity score matched analyses, the mean difference in A1C from baseline and follow-up 5–8.5 months after the initial physician visit was –0.40% among intervention participants and 0.03% among control participants for the smaller sample (n = 78). The difference between these means was not statistically significant (P = 0.295). When we re-ran the analysis including all participants with a follow-up A1C regardless of time since baseline physician visit (n = 92), intervention participants showed a decrease in A1C of –0.36%, whereas control participants demonstrated an increase of 0.32%. This difference between group mean change in A1C over time demonstrated a trend in the direction hypothesized (P = 0.064).

The histograms showing the distribution of estimated propensity scores for the intervention and control groups using both the smaller and larger datasets indicated sufficient overlap between both groups so that nearly all observations can be used to derive the adjusted A1C mean estimate (data not shown). This finding provides support for estimating the adjusted mean among the intervention and control participants.

Categorical A1C

At baseline, 18.0% (95% CI 8.7–33.0) of control group participants and 25.6% (95% CI 14.4–41.2) of intervention group participants had A1C results that were considered well controlled (P = 0.5843) in the smaller sample (Table 2). At follow-up, both groups had an increase in the proportion of participants with well-controlled A1C levels, with a larger increase in the intervention group (increased to 46.2%; 95% CI 31.6–61.4) compared to the control group (increased to 28.2%; 95% CI 16.4–43.9), although this difference between groups was not significant (P = 0.1593). However, when we ran the analysis with the larger sample (including any participant with a follow-up A1C regardless of the timing of the test), we noted a statistically significant difference between the intervention group value (45.7%; 95% CI 32.2–59.8) and the control group value (23.9%; 95% CI 13.8–38.1) (P = 0.0480) (Table 2).

Discussion

This article describes the implementation and evaluation of a primary care, culturally tailored, linguistically appropriate health-coach intervention based on the Bodenheimer teamlet model, for use with Chinese-American patients with type 2 diabetes at a community clinic. We assessed the feasibility of this approach for full clinical implementation.

Our primary outcome was A1C level during a 6-month period. Although our results were not statistically significant, we did see a decrease in A1C in the intervention group at the 6-month follow-up compared to a slight increase in A1C in control participants. The direction and magnitude of this change was comparable to that seen in other intervention studies (0.4–1% change in A1C).[14,15,36–38] We believe the primary reason the difference between groups was not significant was the lack of adequate statistical power, given the small sample size in this pilot study.

The clinic staff anecdotally noted several possible mechanisms for decreased A1C levels among patients who received health coaching. Health coaches were able to catch errors in medication (e.g., a patient not taking medications or taking the wrong dosage) and correct such errors early, before patients' next physician visit ~ 3 months later. Health coaches also helped patients navigate the medical system, which increased adherence to physician recommendations. For example, a health coach assisted a patient in obtaining his medications through his health insurance. The intervention may also have prevented relapses in diet and exercise regimen adherence by providing reminders and encouragement. Health coaching, especially through the phone calls made between clinic visits, provided increased support for patients to manage their diabetes.

This study demonstrated that it is feasible to implement an adapted version of Bodenheimer's teamlet model in a community clinic with a large, medically underserved, Asian-American patient population. We were able to translate the intervention to fit the resources available at the clinic and tailor it for a specific ethnic group, Chinese Americans. The intervention was successfully and enthusiastically implemented in the unit that was selected for the intervention pilot. The intervention team maintained active interest throughout the study. AHS has since expanded the use of the culturally and linguistically concordant teamlet model, with some modifications, to include patients with other chronic conditions and other units within the clinic.

Although AHS hopes to implement this health-coach model in all of its medical units, it faces significant challenges. The cost of sustaining the model (primarily the cost of additional MAs) is one challenge. Enabling services, under which health coaching may fall, are largely unreimbursed by health insurance plans. Studies such as ours are invaluable in demonstrating the value of the health-coach model and supporting current advocacy efforts for payment reform (e.g., the Patient-Centered Medical Home initiative).[39,40]

Eighty-five percent of community health centers report that primary care visits for patients with limited English proficiency take longer than visits with English-proficient patients requiring similar care, ranging from 5 to 30 minutes longer per visit.[41] Members of minority groups who are foreign-born and have limited English proficiency have greater language and cultural barriers to receiving care. Managing comorbidities and complex medical conditions often requires enabling services such as interpretation, navigation services, or health coaching.[39] Despite these challenges, AHS and community health centers nationally have accepted the idea of leveraging use of nonphysician workers to improve chronic disease care because these services are crucial for their medically underserved patients' access to care and help to prevent emergency department visits.[42]

Another challenge was changing traditional ideas of what falls under the domain of MAs' duties; although no formal process evaluation was conducted with the study's coaches, informal feedback provided by the MAs at monthly Practice Improvement Team meetings (which ensured buy-in from physicians, MAs, and the unit clerk) indicated that some MAs were reluctant to take on the additional duties required of health coaches. On the other hand, many MAs were excited by the opportunity to become more involved in patient care and to have a greater impact on care. The incorporation of a combination of financial incentives and Practice Improvement Team meetings helped to overcome reluctance on the part of some MAs. Allowing the unit staff to see how the teamlet model was leading to improved health outcomes helped to sustain their motivation.

Feedback from patients led to booster sessions for the health coaches and new resources for patients, such as the development of new diabetes health education materials at a more appropriate literacy level and for patients' family members about how to support their relative with diabetes.

Organizational buy-in from management, physicians, and front-line staff was key, but it required significant organizational and cultural change.

Study strengths

The pilot site for this intervention was an ideal community partner given existing interest in the health-coach model, past experience with research and evaluation, and the ability to easily identify workers who could be trained to deliver care to predominantly Cantonese- or Mandarin-speaking patients. The site had a diabetes registry already in place, which facilitated identification of patients to recruit for the study.

The CCRAC was maintained throughout the process to ensure the research included the views of patients with diabetes, family members of those with diabetes, and community members. The university-based research team also held regular meetings or conference calls with the clinic-based research team, sharing in trouble-shooting as the intervention study rolled out.

Another key component was the active engagement of both a physician leader and a registered dietitian at the clinical site who gave professional guidance during the project and made organizational assessments about how the rollout was progressing (e.g., the training of health coaches and follow-up of participants). The dietitian also developed a nutrition training curriculum for the health coaches, which included in-person training sessions and observations of the dietitian by the health coaches during nutrition counseling sessions with diabetes patients.

Study limitations

With only one site, we knew workers in other units were likely aware of the intervention, and the number of Chinese patients with diabetes eligible for recruitment was small. In fact, the threat of inadequate enrollment of participants was a concern throughout the project. For example, we made mid-course corrections to enroll two additional patients in an attempt to maintain adequate power to detect a difference in our primary outcome measure. Even with this constant attention to sample size, we fell short of recruitment goals. Conducting research among medically underserved, immigrant communities can present significant challenges such as patients' lack of familiarity and experience with participating in research, language barriers, lack of transportation, and time to participate in follow-up visits, as well as health insurance restrictions on follow-up medical visits.[43–46]

The resulting lack of adequate sample size informed the choice of analysis methodology. In particular, instead of using traditional multivariate analytical procedures, we attempted to maximize statistical power by matching propensity scores based on possible confounders.

Another unanticipated issue was that, with a limited study budget, we were dependent on a physician ordering A1C tests and patients adhering to recommended intervals for testing and interviewing. This resulted in a wider range of timing for A1C measurements. We limited our main analyses to participants with a "6-month" measurement actually occurring between 5 and 8.5 months after baseline physician visits, thus reducing our effective sample size from 92 to 78.

Although this experience parallels physicians' real-world experiences of caring for patients, it makes analysis more difficult because each patient could be seen as having a slightly different "dose" of the intervention (e.g., is 5 months of the intervention less effective than 7 months?).

Our second propensity score–matched analysis included the full group of study participants, regardless of the date of determination of their follow-up A1C value, and attempts to adjust for this variation in "dose" by including the time interval between entering the study and measurement of the follow-up A1C as an additional matching criterion.

Another limitation of the study was that participants were not randomly assigned to intervention and control groups. They were conveniently assigned to intervention and control groups based on the medical unit where they normally received their care. Although randomization might be preferable in a full-scale clinical trial, we decided to proceed without randomization for several reasons. The health coaching was being implemented in only one of the units for logistical and cost considerations, as well as to prevent contamination of control participants that might occur if all participants were seen by the same staff. Randomly assigning patients to a different physician for the purpose of the pilot study would also disrupt the ongoing primary care relationship. There may be differences between these units for which we could not control (e.g., the number and types of health care providers in each unit). However, we note that our intervention and control participants were comparable in demographic and health characteristics at baseline (Table 1).

Conclusions

This pilot study suggests that health coaches may improve clinical outcomes for a medically underserved population. Although not all our findings were statistically significant, they suggest that the use of a culturally tailored, linguistically appropriate teamlet model of care for Chinese Americans with type 2 diabetes is associated with a meaningful decrease in A1C (e.g., comparable in magnitude to the addition of a diabetes medication).

We feel there was sufficient success in this study to warrant a larger trial with multiple sites extending over a longer period of time, which would have adequate power to detect an intervention-related difference in A1C levels, allow for examination of equally important clinical endpoints (e.g., blood pressure), and overcome the current study's limitation of small sample size. The teamlet model may also be a promising component for the Patient-Centered Medical Home.

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References

[1]Weir R, Tseng W, Yen IH, Caballero J: Primary health-care delivery gaps among medically underserved Asian American and Pacific Islander populations. *Public Health Rep* 124:831–840, 2009

[2]Ghosh C: Healthy People 2010 and Asian Americans/Pacific Islanders: defining a baseline of information. *Am Public Health Assoc* 93:2093–2098, 2003

[3]Ghosh C: A national health agenda for Asian Americans and Pacific Islanders. *JAMA* 304:1381–1382, 2010

[4]U.S. Census Bureau: American community survey. Washington, D.C., U.S. Census Bureau, 2007–2009

[5]Jang M, Lee E, Woo K: Income, language, and citizenship status: factors affecting the health care access and utilization of Chinese Americans. *Health Soc Work* 23:136–145, 1998

[6]Frisbie W, Cho Y, Hummer R: Immigration and the health of Asian and Pacific Islander adults in the United States. *Am J Epidemiol* 153:372–380, 2001

[7]Ngo Metzger Q, Massagli MP, Clarridge BR, Manocchia M, Davis RB, Iezzoni LI, Phillips RS: Linguistic and cultural barriers to care. *J Gen Intern Med* 18:44–52, 2003

[8]Ma GX: Between two worlds: the use of traditional and Western health services by Chinese immigrants. *J. Community Health* 24:421–437, 1999

[9]McNeely MJ, Boyko EJ: Type 2 diabetes prevalence in Asian Americans. *Diabetes Care* 27:66–69, 2004

[10]Centers for Disease Control and Prevention: National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, Ga., U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011

[11]Lee JWR, Brancati FL, Yeh HC: Trends in the prevalence of type 2 diabetes in Asians versus whites. *Diabetes Care* 34:353–357, 2011

[12]Islam NS, Khan S, Kwon S, Jang D, Ro M, Trinh-Shevrin C: Methodological issues in the collection, analysis, and reporting of granular data in Asian American populations: Historical challenges and potential solutions. *J Health Care Poor Underserved* 21:1354-1381, 2010

[13]Hawthorne K, Robles Y, Cannings-John R, Edwards A: Culturally appropriate health education for type 2 diabetes in ethnic minority groups: a systematic and narrative review of randomized controlled trials. *Diabet Med* 27:613–623, 2010

[14]Wang C, Chan S: Culturally tailored diabetes education program for Chinese Americans: a pilot study. *Nurs Res* 54:347–353, 2005

[15]Sun J, Wang Y, Chen X, Chen Y, Feng Y, Zhang X, Pan Y, Hu T, Xu J, Du L: An integrated intervention program to control diabetes in overweight Chinese women and men with type 2 diabetes. *Asia Pac J Clin Nutr* 17:514–524, 2008

[16]Fisher L, Skaff MM, Chesla CA, Chun KM, Mullan JT, Kanter RA, Gardiner PS: Disease management advice provided to African-American and Chinese-American patients with type 2 diabetes. *Diabetes Care* 27:2249–2250, 2004

[17]Liao D, Asberry P, Shofer J, Callahan H, Matthys C, Boyko E, Leonetti D, Kahn S, Austin M, Newell L: Improvement of BMI, body composition, and body fat distribution with lifestyle modification in Japanese Americans with impaired glucose tolerance. *Diabetes Care* 25:1504–1510, 2002

[18]Carr D, Utzschneider K, Boyko E, Asberry P, Hull R, Kodama K, Callahan H, Matthys C, Leonetti D, Schwartz R: A reduced-fat diet and aerobic exercise in Japanese Americans with impaired glucose tolerance decreases intra-abdominal fat and improves insulin sensitivity but not β-cell function. *Diabetes* 54:340–347, 2005

[19]Pham T: Case study 2: Asian and Pacific Islander case study: the diabetic Vietnamese population of San Diego County. In *The Social & Environmental Experience of Diabetes: Implications for Diabetes Prevention, Management and Treatment programs*: A Series of Case Studies. Samuels S, Stone-Francisco S, Clayson Z, Eds. Woodland Hills, Calif., The California Endowment, 2004, p. 1–20

[20]Fu D, Fu H, McGowan P, Shen Y, Zhu L, Yang H, Mao J, Zhu S, Ding Y, Wei Z: Implementation and quantitative evaluation of chronic disease self-management programme in Shanghai, China: randomized controlled trial. *Bull World Health Org* 81:174–182, 2003

[21]Swerissen H, Belfrage J, Weeks A, Jordan L, Walker C, Furler J, McAvoy B, Carter M, Peterson C: A randomised control trial of a self-management program for people with a chronic illness from Vietnamese, Chinese, Italian and Greek backgrounds. *Patient Educ Couns* 64:360–368, 2006

[22]U.S. Census Bureau: The Asian Population: 2000. Washington, D.C., U.S. Census Bureau, 2002

[23]Kehoe K, Melkus G, Newlin K: Culture within the context of care: an integrative review. *Ethn Dis* 13:344–353, 2003

[24]Eakin E, Bull S, Glasgow R, Mason M: Reaching those most in need: a review of diabetes self-management interventions in disadvantaged populations. *Diabetes Metab Res Rev* 18:26–35, 2002

[25]Philis-Tsimikas A, Walker C: Improved care for diabetes in underserved populations. *J Ambul Care Manage* 24:39–43, 2001

[26]Gilmer TP, Philis-Tsimikas A, Walker C: Outcomes of Project Dulce: a culturally specific diabetes management program. *Ann Pharmacother* 39:817–822, 2005

[27]Ngo-Metzger Q, Sorkin DH, Phillips RS, Greenfield S, Massagli MP, Clarridge B, Kaplan SH: Providing high-quality care for limited English proficient patients: the importance of language concordance and interpreter use. *J Gen Intern Med* 22:324–330, 2007

[28]Manson A: Language concordance as a determinant of patient compliance and emergency room use in patients with asthma. *Med Care* 26:1119–1128, 1988

[29]Traylor AH, Schmittdiel JA, Uratsu CS, Mangione CM, Subramanian U: Adherence to cardiovascular disease medications: does patient-provider race/ethnicity and language concordance matter? *J Gen Intern Med* 25:1172–1177, 2010

[30]Bodenheimer T: Helping patients improve their health-related behaviors: what system changes do we need? *Dis Manage* 8:319–330, 2005

[31]Bodenheimer T: Planned visits to help patients self-manage chronic conditions. *Am Fam Phys* 72:1454, 1456, 2005

[32]Bodenheimer T, Lorig K, Holman H, Grumbach K: Patient self-management of chronic disease in primary care. *JAMA* 288:2469–2475, 2002

[33]Bodenheimer T, Laing B: The teamlet model of primary care. *Ann Fam Med* 5:457–461, 2007

[34]Bodenheimer T, Grumbach K: *Improving Primary Care: Strategies and Tools for a Better Practice*. New York, McGraw-Hill Medical, 2006

[35]American Diabetes Association: Standards of medical care in diabetes—2012. *Diabetes Care* 35 (Suppl. 1):S11–S63, 2012

[36]Walker EA, Shmukler C, Ullman R, Blanco E, Scollan-Koliopoulus M, Cohen HW: Results of a successful telephonic intervention to improve diabetes control in urban adults: a randomized trial. *Diabetes Care* 34:2–7, 2011

[37]Lee K, Palacio C, Alexandraki I, Stewart E, Mooradian AD: Increasing access to health care providers through medical home model may abolish racial disparity in diabetes care: evidence from a cross-sectional study. *J Natl Med Assoc* 103:251–256, 2011

[38]Gary TL, Batts-Turner M, Yeh HC, Hill-Briggs F, Bone LR, Wang NY, Levine DM, Powe NR, Saudek CD, Hill MN: The effects of a nurse case manager and a community health worker team on diabetic control, emergency department visits, and hospitalizations among urban African Americans with type 2 diabetes mellitus: a randomized controlled trial. *Arch Intern Med* 169:1788–1794, 2009

[39]Association of Asian Pacific Community Health Organizations: The role of enabling services in patient-centered medical homes [article online]. Available from http://www.aapcho.org/resources_db/the-role-of-enabling-services-in-patient-centered-medical-homes. Accessed 5 December 2011

[40] National Committee for Quality Assurance: *NCQA's Patient-Centered Medical Home*. Washington, D.C., National Committee for Quality Assurance, 2011

[41]National Association of Community Health Centers: Serving patients with limited English proficiency: results of a community health center survey [article online]. Available from http://www.nachc.com/Health Center Services.cfm. Accessed 12 December 2011

[42]Association of Asian Pacific Community Health Organizations, National Association of Community Health Centers: Highlighting the role of enabling services at community health centers: collecting data to support service expansion & enhanced funding [article online]. Available from http://www.nachc.com/Health Center Services.cfm. Accessed 13 December 2011

[43]Ford JG, Howerton MW, Lai GY, Gary TL, Bolen S, Gibbons MC, Tilburt J, Baffi C, Tanpitukpongse TP, Wilson RF: Barriers to recruiting underrepresented populations to cancer clinical trials: a systematic review. *Cancer* 112:228–242, 2008

[44]Robinson JM, Trochim WMK: An examination of community members', researchers' and health professionals' perceptions of barriers to minority participation in medical research: an application of concept mapping. *Ethn Health* 12:521–539, 2007

[45]Keyzer JF, Melnikow J, Kuppermann M, Birch S, Kuenneth C, Nuovo J, Azari R, Oto-Kent D, Rooney M: Recruitment strategies for minority participation: challenges and cost lessons from the POWER interview. *Ethn Dis* 15:395–406, 2005

[46]Swanson GM, Ward AJ: Recruiting minorities into clinical trials toward a participant-friendly system. *J Natl Cancer Inst* 87:1747–1759, 1995

Susan L. Ivey, MD, MHSA, is a physician, an associate adjunct professor at the UC Berkeley School of Public Health, Division of Community Health and Human Development, and the director of research at UC Berkeley's Health Research for Action Center. Winston Tseng, PhD, is a research sociologist in the UC Berkeley School of Public Health, Division of Community Health and Human Development and Health Research for Action Center. Elaine Kurtovich, MPH, PT, is a staff research associate at the UC Berkeley Health Research for Action Center. Ben Lui, MD, MPH, is an internist and site director at the Asian Medical Center, AHS, in Oakland, Calif. Rosy Chang Weir, PhD, is the director of research at the Association of Asian Pacific Community Health Organizations in Oakland, Calif. Jing Liu, MS, RD, is a dietitian and diabetes self-management education program coordinator at AHS. Hui Song, MS, MPH, is the research manager at the Association of Asian Pacific Community Health Organizations. May Wang, DrPH, is an associate professor in the Department of Community Health Sciences at the UC Los Angeles School of Public Health. Alan Hubbard, PhD, is an associate professor at the UC Berkeley School of Public Health, Division of Biostatistics.