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Peer Coaching to Improve Diabetes Self-Management: Which Patients Benefit Most?

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BACKGROUND: Peer health coaching is an effective method of enhancing self-management support in patients with diabetes. It is unclear whether peer health coaching is equally beneficial to all patients with poor glycemic control, or is most effective for subgroups of patients.

OBJECTIVE: To examine whether the effect of peer health coaching on hemoglobin A1c (A1c) is modified by characteristics that are known to be associated with diabetes control.

DESIGN: Sub-group analyses of randomized control trial.

PARTICIPANTS: Two hundred and ninety nine patients with diabetes receiving care in public health clinics who participated in a randomized controlled trial of peer health coaches.

MAIN MEASURES: We examined whether the association between study group and change in A1c was modified by differences in patients' demographic, behavioral or psychosocial characteristics. Analyses were adjusted for co-variables associated with change in A1c.

KEY RESULTS: The effect of coaching on patient A1c was modified by patients' level of self-management and degree of medication adherence as baseline (p=.02, and p=.03 respectively in adjusted models). For participants with "low" self-management (one standard deviation below the mean score), the usual care group experienced a slight increase in A1c (0.3 %), while the health coaching group experienced a decrease (−0.9 %). For participants with "high" self-management (one standard deviation above the mean score), both groups experienced a similar decrease in A1c (usual care group: -1.0 %; health coaching group: −1.1 %). Participants with "low" medication adherence in the usual care group experienced an increase in A1c (0.5 %), while the health coaching group experienced a decrease (−0.8 %). Participants with "high" medication adherence experienced similar decreases (usual care group: −1.1 %; health coaching group: −1.3 %).

CONCLUSION: Peer health coaching had a larger effect on lowering A1c in patients with low levels of medication adherence and self-management support than in patients with higher levels. Peer health coaching interventions may be most effective if targeted to high-risk patients with diabetes with poor glycemic control and with poor self-management and medication adherence.

KEY WORDS: peer health coach; self-management support; diabetes; primary care; medication adherence; interaction.
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INTRODUCTION

Diabetes self-management support—defined as the provision of ongoing support to assist patients in developing the skills and confidence to care for their diabetes[1]—is a critical component of diabetes care.[2,3] As such, it has been incorporated into a number of innovations that use the health care team to augment the work of the physician.[4,5] A further refinement of this general approach includes training laypeople to serve as members of the primary care team: The peer health coach model for diabetes uses volunteer patients with diabetes to provide self-management support for other patients with diabetes.[6,7] Peer health coaches have been successful at enhancing self-management and in lowering hemoglobin A1c in diabetic patients.[8–12]

Patients' success at controlling their diabetes is not uniform. Both individuals from low socioeconomic status and from non-white racial/ethnic groups have poorer control[13] and higher diabetes related morbidity.[14,15] Individuals with poorer health literacy, lower levels of social support and more severe depression also have worse diabetes outcomes.[16–19] Additionally, the degree of diabetes control is positively associated with the better medication adherence and self-management.[2,20]

Ideally, a peer health coach intervention would be delivered to patients who would derive the greatest benefit. However, it is unknown whether peer health coaches are equally effective for all patients with poorly controlled diabetes, or whether coaching interventions could be more effective if targeted to subgroups. We conducted a secondary analysis of a randomized control trial that found a

significant improvement in diabetes control in patients receiving peer coaching compared to usual care,[12] to investigate whether the effect of a peer health coaching intervention was modified by patient characteristics associated with glycemic control.

METHODS

Settings and Participants

Details of the study design and randomized controlled trial have been published elsewhere and are summarized here.[12,21] Patients receiving care at one of six public clinics in San Francisco were eligible for randomization if they spoke English or Spanish, had a hemoglobin A1c≥8.0 % within the 6 months prior to enrollment, and were not identified as inappropriate for the intervention by their primary care provider.

Peer health coaches were recruited from the same clinics. Patients were eligible to become health coaches if they spoke English or Spanish, had a hemoglobin A1c<8.5 % within the 6 months prior to training, and were recommended by their primary care provider or a member of the clinic staff. Health coaches completed 36 hours of training on methods for improving patients' self-management of diabetes through developing action plans (e.g., to improve diet and exercise, monitoring and other self-care activities, and medication adherence.) Further details of the standardized training program for health coaches is available at: http://familymedicine.medschool.ucsf.edu/cepc/pdf/HealthCoachTrainingCurriculumJune12.pdf Those that successfully completed the training and passed both oral and written examinations met in person and talked by phone with assigned patients randomized to the intervention study group throughout the 6-month study period, developing action plans and assisting patients in reaching goals related to diabetes self-management. Peer health coaches did not typically interact directly with physicians and group visits were not part of the intervention.

Participants in both the health coaching and usual care groups completed detailed surveys at the time of enrollment and 6 months later, at completion of the study. These surveys were administered by research assistants who also recorded participants' height, weight and blood pressure. Hemoglobin A1c was measured at a central laboratory at San Francisco General Hospital.

Dependent Variable

For our analyses, we used change in hemoglobin A1c as the dependent variable. This was calculated by subtracting the baseline value from that at the end of the 6-month study period, where negative difference scores indicated a decrease in Hemoglobin A1c.

Independent Variables

We selected variables a priori that have been shown to be robustly associated with the degree of diabetes control. We grouped these into three domains: demographic, psychosocial and behavioral. We treated all psychosocial and behavioral variables as continuous.

Demographic variables included race/ethnicity, and socioeconomic status. To ascertain race/ethnicity, participants selected one of the following categories: "White, Non-Latino," "African American," "Latino," "Asian," "Native American," and "other/mixed." Because of small numbers, we collapsed "Native American" and "other/mixed." We used educational attainment as a measure of socioeconomic status. Participants indicated the highest grade completed as: "none", "1st through 5th", "6th through 8th", "some high school", "high school graduate or GED", "some college" or "college graduate". We collapsed none, "none", "1st through 5th", "6th through 8th" and "some high school" into "less than high school".

Psychosocial variables, measured at baseline, included depression, health literacy and social support. We measured depression with the PHQ-8.[22,23] We used the continuous measure rather than a dichotomous representation of depression, as only 10 % of the study population had scores that would be classified as major depressive disorder. We used the Diabetes Support Scale to measure the availability and satisfaction with diabetes-specific social support.[24] We measured health literacy via a scale developed and validated by Chew and colleagues.[25,26]

Behavioral variables, measured at baseline, included self-management and medication adherence. We measured self-management with the 4-item Perceived Diabetes Self-Management Scale, with higher values indicating better self-management.[27] We measured self-reported medication adherence with the 4-item Morisky Medication Adherence scale.[28,29] As higher raw values of this scale indicate poorer adherence, we inverted it for our analyses in order to present variables in a conceptually consistent manner. Thus, larger scores on all psychological and behavioral scales indicated higher amounts of the construct being measured. To aid the interpretation of regressions for continuous predictors derived from different scales, we centered on the mean and standardized the coefficients after confirming normal distribution.

Analysis

We compared characteristics of participants in the two study groups, using Student's *t*-test and Fischer's exact test as

appropriate. Next, we modeled change in hemoglobin A1c in a series of adjusted linear regression models. Each model included the patient characteristic being evaluated as a possible effect modifier, the study group (health coach vs. usual care), a product interaction term (study group x patient characteristic), as well as characteristics that differed between study groups at a p value of≤0.20 as covariates. For categorical variables, we used F-tests to calculate the joint statistical significance of interaction terms. For models that showed interaction terms significant at the 0.05 level, we calculated changes in hemoglobin A1c at "low" "medium" and "high" levels of the patient characteristic, stratified by study group. We defined "low" as −1 standard deviation, "medium" as the mean and "high" as +1 standard deviation; these levels represent discrete "slices" at the specified levels. This is a well established method for exploring interactions.[30]

RESULTS

Two hundred and ninety nine patients were enrolled, with 151 randomized to usual care and 148 to health coaching. Descriptive data are presented in Table 1. The mean age was 56 years in the health coaching group and 54 years in the usual care group. Approximately half of the participants were female and half were Spanish-speaking. Just less than half were Latino, with African-Americans constituting approximately 30 %. About one-third had less than a high school education. While patients in the usual care and coaching groups were similar for most characteristics at baseline, they were significantly different on mean body mass index (BMI) and proportion with hypertension, and borderline significantly different for the proportion using insulin, and mean scores on depression and social support scales.

Table 1. Patient Characteristics at Baseline

	Usual care (n=151)	Intervention (n=148)	p value
Age (mean, sd)	54.1 (10.4)	56.3 (10.3)	0.07
Female (n, %)	80 (53.0)	76 (51.4)	0.43
Education (n, %)			0.99
≤ high school	56 (37.1)	52 (35.6)	
High school graduate	37 (24.5)	38 (26.0)	
Some college	40 (26.5)	40 (26.7)	
College graduate	18 (11.9)	18 (11.6)	
Race/Ethnicity (n, %)			0.94
White, non-Latino	73 (48.7)	66 (44.6)	
African American	46 (30.7)	47 (31.8)	
Latino	15 (10.0)	17 (11.5)	
Asian/Pacific Islander	11 (7.3)	11 (7.4)	
Other	5 (3.3)	7 (4.7)	
Primary language other than English (n, %)	74 (49.0)	68 (45.9)	0.89
Born outside of United States (n, %)	81 (53.6)	70 (46.4)	0.30
Married/living as married (n, %)	66 (59.5)	45 (40.1)	0.02
Smoking in past 30 days (n, %)	40 (26.5)	38 (25.7)	0.89
Hemoglobin A1c (mean, sd)	9.8 (2.0)	10.1 (2.0)	0.20
Body mass index (mean, sd)	32.5 (8.48)	35.0 (8.30)	< 0.01
Hypertension (n, %)	117 (77.5)	131 (88.5)	0.02
Hyperlipidemia (n, %)	103 (68.2)	103 (69.6)	0.78
Using insulin (n, %)	75 (49.7)	89 (60.1)	0.05
Depression (mean, sd)	6.83 (5.30)	8.07 (5.43)	0.05
Health literacy (mean, sd)	3.57 (1.20)	3.66 (1.12)	0.48
Social support (mean, sd)	4.09 (0.99)	3.87 (1.01)	0.05
Self-management (mean, sd)	2.58 (0.44)	2.59 (0.47)	0.89
Medication adherence (mean, sd)	6.83 (0.09)	6.78 (0.10)	0.70

Table 2 presents p values for the unadjusted and adjusted linear regression models' interaction terms. Two of the seven adjusted models had interaction terms that were statistically significant (self-management [p=0.02], medication adherence [p=0.03]).

The model examining self-management showed a significant association between increased self-management and improved HbA1C in the usual care group. It showed no association between self-management and HbA1C in the health coaching group. The model examining medication adherence showed the same pattern.

As a result, the benefit of health coaching compared to usual care was greatest for patients with lower self-management and poorer medication adherence scores at baseline, as illustrated in Figures 1 and 2. Figure 1 shows that for participants with "low" self-management, those in the usual care group experienced a slight increase in HbA1c (0.3 %), in contrast to those in the health coaching group who experienced a decrease in HbA1c (−0.9 %). For participants with a high level of self-management, both those in the usual care and health coaching group, experienced a similar decrease in HbA1C (−1.0 and −1.1 %, respectively). The greatest decrease in HbA1C was seen in patients in the health coaching group with high baseline self-management. However, there was minimal difference in HbA1C between this group and the usual care group with high baseline self-management.

Table 2. Interaction Between Study Group and Patient Characteristics on Change in Hemoglobin A1c (p Value for Interaction Term)

	Unadjusted	Adjusted*
Demographic		
Education	0.09	0.13
Race/ethnicity	0.79	0.83
Psychosocial		
Depression	0.61	0.95
Health literacy	0.46	0.52
Social support	0.57	0.42
Behavioral		
Self-management	0.17	0.02
Medication Adherence	0.08	0.03

Adjusted for age, marital status, hypertension, initial HbA1c, insulin use, body mass index

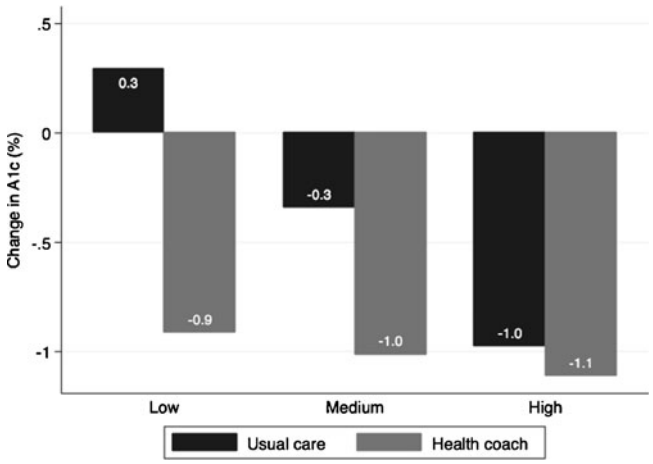

Figure 1. Change in hemoglobin A1c at low, medium and high levels of self-management, stratified by study group. Adjusted for age, marital status, hypertension, initial HbA1c, insulin use, body mass index.

Figure 2 shows a similar pattern for medication adherence, as observed for self-management. Participants with "low" medication adherence in the usual care group experienced an increase in HbA1c (0.5 %), in contrast to those in the health coaching group experienced a decrease (−0.8 %). Likewise, while participants with "high" medication adherence experienced the greatest decreases in HbA1c, the magnitude of the decreases was similar for both the usual care and the health coaching group (−1.1 % and −1.3 %, respectively).

DISCUSSION

In a cohort of patients diagnosed with type 2 diabetes with poor glycemic control, we found that peer health coaches were more effective in lowering hemoglobin A1C for patients with low medication adherence and self-management. This association persisted after adjusting for initial hemoglobin A1c as well as other covariates.

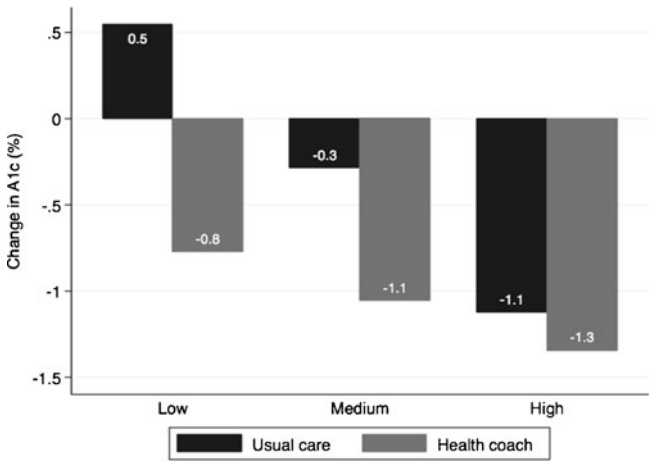

Figure 2. Change in hemoglobin A1c at low, medium and high levels of medication adherence, stratified by study group. Adjusted for age, marital status, hypertension, initial HbA1c, insulin use, body mass index.

Our findings are consistent with the model used to train peer coaches, which emphasizes helping patients to better manage their disease by developing action plans that often involve improving medication adherence and self-management.[31] Patients who reported high levels of self-management and medication adherence at baseline have already ostensibly developed such strategies, and therefore benefit less from peer coaching to improve self-management and medication adherence.

The patients enrolled in this study had poor glycemic control. One might wonder why patients with good reported medication adherence and self-management would have high HgA1c levels. While HbA1c and management are associated with one another, there is not a perfect correlation, so many patients who do take their medications and self-manage appropriately will still have elevated HbA1c at a given point in time. One explanation might be that medication adherence and self-management were ascertained by self-report: patients with high levels of these characteristics may in fact have poorer skills than they report. Another explanation for high HbA1c in the setting of good adherence and self-management might be that patients were not receiving optimal medications at enrollment. Alternatively, the fact that a study intervention was ongoing in the clinics might have resulted in an intensification of provider management behavior in the usual care group.

We found no effect modification by demographic or psychological factors. This suggests that patients from a variety of backgrounds were able to experience benefits of peer coaching including high-risk groups (e.g. non-white race/ethnicity, low educational attainment, poor health literacy, symptoms of depression and poor social support). The absence of an effect of patient race/ethnicity may be explained though the linguistic concordance of coaches and patients as well as the fact that patients were allowed to choose their coach, potentially further matching by race/ethnicity.

Our study has limitations. Participants were recruited from under-resourced community health centers and all had poorly controlled diabetes. This may affect the generalizability of our findings to other clinical settings and populations in which patients diabetes is better controlled, or in populations with different levels of health literacy or social support. Second, follow-up was at 6 months: thus we do not know if the differences we found would be sustained over a longer time period. Despite our attempt to adjust for covariates that differed between study groups, there is the potential for residual confounding. We examined several variables as potential effect modifiers. While the probability

of any given variable showing significant effect modification by chance is < 0.05, the probability that at least one of the seven variables will be significant is approximately 30 %. Finally, the peer health coach is a complex intervention: We did not assess potential differences in how coaching was delivered. Health coaches may have used a qualitatively different approach with participants they perceived as having poorer self-management or medication adherence.

Within the setting of a randomized control trial of health coaches, we identified subgroups of poorly controlled diabetic patients that differentially benefited from the intervention. In an era of cost containment, innovations in the management of chronic diseases should be directed toward the patients most likely to benefit. Future work should be directed at identifying subgroups from routine clinical data and in replicating our findings in other populations.

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Conflict of Interest: *The authors declare that they do not have a conflict of interest.*

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