Partners reducing effects of diabetes (PREDICT): a diabetes prevention physical activity and dietary intervention through African-American churches

Zubaida Faridi, Kerem Shuval, Valentine Yanchou Njike, Julie A. Katz, Georgia Jennings, Maurice Williams, David L. Katz* and The PREDICT Project Working Group

Abstract
Type 2 diabetes is epidemic in the United States with greater incidence rates in African-American communities. Lifestyle interventions during the phase of insulin resistance mitigate cardiovascular risk and prevent diabetes. The primary aim of this study is to test the impact of a Community Health Advisor (CHA)-based diabetes prevention controlled intervention in urban African-American communities. In this controlled trial, church congregants in New Haven, CT, receiving a 1-year CHA-led diabetes prevention intervention were compared with church congregants in Bridgeport, CT, who did not receive an intervention. Outcome measures included physical activity, dietary pattern, anthropometric measure, social support, diabetes knowledge, nutrition and exercise self-efficacy. The results indicate that at the end of the 1-year intervention period, there were no significant differences observed between intervention and control groups. Possible explanations for the lack of change include difficulty in engaging the CHAs, variability in the CHA-led interventions, baseline discrepancies between the two sites which could not be fully controlled and loss to follow-up. The results indicate important obstacles which impeded the successful implementation of this intervention and lessons learned for future interventions.

Introduction
Type 2 diabetes mellitus is a worsening epidemic in the United States affecting 20.8 million people or 7.0% of the population [1–3]. In 2005, 1.5 million new cases of diabetes were diagnosed in people aged 20 years or older [4]. Diabetes was the sixth leading cause of death listed on death certificates in 2002. The burden of diabetes is disproportionately greater in minority populations, particularly in the African-American community [5]. African-Americans are 1.8 times more likely to have diabetes than Caucasians and more likely to suffer from disease complications, such as retinopathy and renal disease [6]. Recent studies examining the ethnic differences in HbA1C levels in people with impaired glucose tolerance found African-Americans had higher HbA1C levels than whites and other ethnicities even after adjusting for confounding variables [7, 8]. This has been attributed in part to differences in access and utilization of health services, miscommunication with the health care providers and diabetic self-care behaviors [9]. In a cross-sectional study of 6035 participants, Oster et al. [10] ascertained that African-Americans were significantly less likely than whites to monitor their diet (65.9% versus 73.7%, respectively), exercise (46.4% versus 52.8%) and not smoke (85.1% versus 89.3%). This might be explained by lack of culturally appropriate interventions, lack of self-efficacy for lifestyle change, insufficient knowledge and numerous environmental factors and influences [11–14]. Interventions targeted at high-risk groups and community-based lifestyle interventions have been found to be cost effective in curbing the growing incidence of diabetes [15]. Interventions during the phase of insulin...
resistance, particularly supervised weight loss combined with physical activity, have been found to mitigate cardiovascular risk and prevent diabetes [16].

The concept of training community members without formal medical training, i.e. Community Health Advisors (CHAs), also referred as Lay Health Workers or Promotoras, has gained acceptance as a means of enhancing community engagement in research particularly in minority populations [17]. CHAs have been utilized to address health disparities and health related problems such as HIV/AIDS, STD, cervical and breast cancer screening and in chronic disease prevention [17, 18]. CHA activities are often central to outreach activity or their activities underpin the foundation to the entire program. A systematic review by Lewin et al. [19] found the CHAs model to be effective in promoting immunization and improving outcomes for acute respiratory infections and malaria. However, insufficient evidence exists pertaining to the effectiveness of this model on diabetes prevention and management. Furthermore, consistently sustaining the engagement of intervening CHAs involves considerable challenges. In the present study, we assess the impact of a community-based participatory intervention dedicated to enhancing healthy lifestyle practices (i.e. physical activity and healthful diet), self-efficacy and diabetes knowledge in the New Haven and Bridgeport African-American community. Capitalizing on the competencies and capacities of the CHA model [20], we assessed the efficacy of Partners Reducing Effects of Diabetes: Initiatives through Collaboration & Teamwork (PREDICT) program through a controlled trial.

Methods

Study design and participants
The PREDICT study is a non-randomized controlled trial of a church-based intervention conducted in two urban African-American Connecticut communities: New Haven (intervention site) and Bridgeport (control site) between September 2004 (i.e. baseline) and December 2005 (i.e. post intervention). The study protocol was approved by the Yale School of Medicine Human Investigator Committee and the Griffin Hospital Institutional Review Board. The trial was designed by researchers at the Yale Prevention Research Center in collaboration with a Community Participatory Team (CPT) which consisted of local church members, community based organizations, local health department officials and academic members (see Figure 1 for study design and flow). The research team incorporated the recommendations of the CPT in the study design and methodology as well as input received from conducting focus groups with pre-diabetic and diabetic community members (our internal data), resulting in adapting materials for the intervention from the ‘Diabetes Prevention Program (DPP) Lifestyle Intervention Manual of Operations’ [21], and utilizing the CHAs as a mode of delivering the intervention in a church-based setting.

Thus, members of the research team approached churches at Christian Community Commission Council meetings in New Haven and Bridgeport. A total of 19 churches (13 churches New Haven, six Bridgeport Churches) agreed to participate in the study. Pastors were asked to nominate two to three members of their churches who were natural leaders and respected by members of their respective congregations and who would be willing to

---

Fig. 1. Study flow design, training and implementation.
commit to the intervention and be trained as CHAs. Yet due to difficulties in recruiting, CHAs were not selected based on their qualifications, past training or experience, but solely on willingness to commit. A total of 39 congregation members agreed to become CHAs: 21 from New Haven (intervention) and 18 from Bridgeport churches (control). The CHAs received monetary compensation for their training, but not for the intervention. They were trained for 10 weeks by researchers (2 h a week) and asked to recruit 10–15 members of their congregation based on the following inclusion criteria: (i) adult (aged ≥18 years) African-American residents in New Haven or Bridgeport; (ii) members of congregation of the participating churches and (iii) have diabetes or are at risk of diabetes. Diabetes risk was determined by one or more of the following criteria: body mass index (BMI) >25; have a parent with diabetes; have a sibling with diabetes and/or have had gestational diabetes. Exclusion criteria included: (i) inability to read/speak English; (ii) not at risk for diabetes; (iii) inability to participate in the intervention activities and (iv) inability to commit to participating and completing the program for any reason.

The CHAs recruited a total of 133 participants from intervention churches in New Haven and 125 participants from control churches in Bridgeport. Participating church congregation members were asked to complete several surveys to measure baseline diabetes prevention knowledge, physical activity and dietary patterns, nutrition and physical self efficacy as well as social support. In addition, anthropometric measures (i.e. height and weight) were included in the baseline and post-intervention assessments. The intervention and control group completed surveys and measurement at baseline (September 2004) and post-intervention (December 2005). All told, 121 participants from the intervention group completed baseline measurements and 83 completed post-intervention measurements. In comparison, 125 participants from the control group completed baseline measurements and only 78 post-intervention measurements. Additionally, while participants in the intervention churches participated in an intervention (September 2004–December 2005), the control group received a delayed intervention only after completing the post-intervention surveys and measurements (i.e. after December 2005).

**CHAs training and the intervention**

A 10-week training session series (2 h per session) with 21 intervention CHAs was held from June to August, 2004. CHAs in the control group were trained as well, however, only after the intervention concluded (December 2005). The sessions were led by a certified diabetes educator and facilitated by members of the research team. The CHA training curriculum was developed by the researchers in collaboration with the CPT and CHAs. The curriculum focused on diabetes prevention knowledge, awareness of diabetes-related risk factors and was based on the DPP lifestyle strategies to reduce the incidence of diabetes. Major topics included health-enhancing physical activity programs/healthful diet, reading food labels, portion control, healthful cooking; weight loss programs, social support, diabetes medications and empowering participants to communicate effectively with physicians (see Table I). The CHAs completed a survey prior to the commencement of the 10-week session followed by a training survey to measure changes in diabetes prevention knowledge. The results indicated a statistically significant increase in knowledge ($P < 0.05$).

A CHA council was formed at the conclusion of the training session to ensure ongoing CHA engagement in all aspects of the program. The council met monthly with members of the research team to review study activities, problem solving and communicate study progress to the CPT.

The CHAs were instrumental in deciding the intervention methods and tailored the frequency of contact and the teaching methods to participants’ preferences. Several CHAs elected to employ group education sessions in their churches combining them with Bible study classes while others preferred to reach out to the study participants individually. The CHAs were creative and eclectic in their teaching styles and adopted an experiential approach as opposed to a more conventional didactic method. The CHAs also organized community outreach events during this period to raise awareness of
the risk of diabetes in the community, to educate community members on the key findings of the DPP trial and to provide strategies for incorporating the DPP lifestyle intervention into their daily routine. The CHAs also engaged in diabetes-related advocacy and presented the PREDICT program to community residents to highlight their efforts and to elicit support from other community organizations and key stakeholders. However, these activities were not uniformly conducted among all CHAs; they varied considerably, and the dose and duration were hard to determine.

Sample size and power estimations
Sample size calculations were based on two primary outcome measures: physical activity as measured by the 7-Day Physical Activity Recall (PAR) [22] and dietary pattern as assessed by the healthy eating index [23]. The experiment was set at two-tailed alpha of 0.05 with 80% power, to detect a minimal difference between the control and intervention of 20% improvement in physical activity and 5.0 point improvement in the dietary pattern.

Outcomes measures
The primary outcome measures in the study include physical activity and dietary pattern. Secondary outcome measures of interest included anthropometric measures and social support, diabetes knowledge, nutrition and exercise self-efficacy.

Physical activity
Physical activity was determined by the 7-Day PAR [22]. The PAR is one of the most widely used physical activity assessments in exercise science and epidemiological research. The popularity of this measure stems largely from its versatility and relative ease of use for research applications. The PAR provides details regarding the duration, intensity and volume (energy expenditure) of physical activity and can therefore be used for a variety of applications. Because it utilizes a 1-week time frame, the data from the PAR are often considered representative of typical activity patterns.

Dietary habits
Dietary habits were assessed by the Food Frequency Questionnaire developed by the John Hopkins Weight Management Center [23].

Nutrition and exercise self-efficacy scale
Changes in nutrition self-efficacy and physical activity self-efficacy were determined by using two distinct five-item scales consisting of measures with an internal consistency of 0.87 and 0.88, respectively [24].

Medical Outcomes Social Support Survey
The emotional/informational section of the RAND Social Support Survey was used to assess social support provided by the CHAs to the study participants. [25]
In the statistical analysis, two-sample student t-tests were used to assess baseline data for all continuous variables between the two intervention sites. Chi square was used to test baseline characteristics for categorical variables between the two treatment sites. Repeated measures analyses of variance were utilized to assess differences in intraindividual responses across the intervention sites. Paired t-tests were also used to assess mean changes of all outcome measures among participants by intervention sites. Logistic regression was performed controlling for education level, household income age and gender. A two-tailed alpha of <0.05 was considered statistically significant. Data were analyzed using SAS software for Windows version 9.1. (SAS Institute Inc., 2001).

### Results

Detailed demographic characteristics and baseline social support information are presented in Table II. All participants were African-American, most were female (intervention—84.8%, control—77.8%), and approximately half were between the ages of 18 and 49 (50.5%—intervention, 52.0%—control). Slightly more than half of the intervention group had partial or full college education (52.54%) versus 71.54% in the control. Additionally, intervention participants’ mean BMI (kg/m²) was 33.8 (SD = 8.4) and 31.9 (SD = 7.1) in the control. At baseline age, body weight, body mass index, emotional/information support, diabetic knowledge, physical activity self-efficacy, nutrition self-efficacy and energy expenditure were comparable ($P > 0.05$) for...
the intervention and control sites. Higher levels of education \((P = 0.0098)\) and higher household income \((P = 0.0105)\) were observed in the control compared with the intervention (Table II). Also the mean overall social support index was higher \((P = 0.0329)\) in New Haven \((76.9 \pm 15.1)\) compared with Bridgeport \((72.4 \pm 18.0)\). The distribution for gender was comparable \((P = 0.1630)\) for the two sites.

### Changes in outcome measures

As depicted in Table III, the results of the trial indicated no statistically significant between-group improvements when comparing the intervention and control site’s body weight, BMI, overall social support, diabetic knowledge, physical activity self-efficacy, physical activity level, nutrition self-efficacy and macronutrients consumption (e.g. saturated fat, total carbohydrates). Energy expenditure \((\text{kcal/kg/week})\), however, improved significantly among the control group in comparison to the intervention group \((14.75 \text{ and } 131.31, \text{ respectively}; P = 0.0040)\).

Within-group analysis indicated a statistically significant increase in the following variables in the intervention group: diabetic knowledge \((2.4; P = 0.0496)\), total calories \((-554.0, P = 0.0086)\), total protein \((-94.5, P = 0.0051)\), transfat \((-13.3, P = 0.0363)\), mono-unsaturated fat \((-3.5, P = 0.0224)\), and poly-unsaturated fats \((-3.5, P = 0.0224)\). In comparison, within-group analysis in the control group revealed a statistically significant change in energy expenditure \((131.31, P = 0.0007)\) and nutrition self-efficacy \((0.64, P = 0.0485)\).

Controlling for education level, household income, age and gender in regression analyses did not change the direction of the findings.

### Table III. Change in outcome measures

<table>
<thead>
<tr>
<th>Variable</th>
<th>New Haven ((n = 83))</th>
<th>Bridgeport ((n = 78))</th>
<th>(P) value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight (lbs)</td>
<td>0.32 ± 25.92</td>
<td>0.82 ± 19.30</td>
<td>0.8974</td>
</tr>
<tr>
<td>Body mass index (kg/m&lt;sup&gt;2&lt;/sup&gt;)</td>
<td>-0.63 ± 6.72</td>
<td>0.13 ± 3.18</td>
<td>0.4191</td>
</tr>
<tr>
<td>Social support</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional/Information Support</td>
<td>0.99 ± 7.74</td>
<td>0.32 ± 7.48</td>
<td>0.5757</td>
</tr>
<tr>
<td>Tangible Support</td>
<td>-0.52 ± 4.49</td>
<td>0.09 ± 3.38</td>
<td>0.3312</td>
</tr>
<tr>
<td>Affectionate Support</td>
<td>-0.33 ± 3.09</td>
<td>-0.17 ± 3.55</td>
<td>0.7648</td>
</tr>
<tr>
<td>Positive Social Interaction</td>
<td>-0.33 ± 3.18</td>
<td>-0.49 ± 3.77</td>
<td>0.7743</td>
</tr>
<tr>
<td>Overall Support Index</td>
<td>0.14 ± 15.45</td>
<td>0.20 ± 16.40</td>
<td>0.9816</td>
</tr>
<tr>
<td>Diabetic Knowledge (%)</td>
<td>2.45 ± 11.22&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.76 ± 0.87</td>
<td>0.6896</td>
</tr>
<tr>
<td>Physical activity self-efficacy</td>
<td>0.23 ± 5.46</td>
<td>0.38 ± 3.49</td>
<td>0.8400</td>
</tr>
<tr>
<td>Energy expenditure (kcal/kg/week)</td>
<td>14.75 ± 117.43</td>
<td>131.31 ± 326.37&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.0040</td>
</tr>
<tr>
<td>Physical activity level, past 3 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased, (n) (%)</td>
<td>20 (25.64)</td>
<td>25 (32.05)</td>
<td>0.6652</td>
</tr>
<tr>
<td>Decreased, (n) (%)</td>
<td>14 (17.95)</td>
<td>12 (15.38)</td>
<td></td>
</tr>
<tr>
<td>About the same, (n) (%)</td>
<td>44 (56.41)</td>
<td>41 (52.56)</td>
<td></td>
</tr>
<tr>
<td>Nutrition self-efficacy</td>
<td>0.31 ± 4.66</td>
<td>0.64 ± 2.82&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.5858</td>
</tr>
<tr>
<td>Total calories</td>
<td>-554.0 ± 1863.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-319.1 ± 1595.0</td>
<td>0.3959</td>
</tr>
<tr>
<td>Total protein</td>
<td>-16.7 ± 77.2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-14.5 ± 75.9</td>
<td>0.8550</td>
</tr>
<tr>
<td>Total carbohydrates</td>
<td>-94.5 ± 297.1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-45.3 ± 227.4</td>
<td>0.2411</td>
</tr>
<tr>
<td>Transfats</td>
<td>-13.3 ± 56.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-9.9 ± 61.1</td>
<td>0.7139</td>
</tr>
<tr>
<td>Saturated fatty acid</td>
<td>-3.2 ± 16.9</td>
<td>-2.4 ± 18.0</td>
<td>0.7604</td>
</tr>
<tr>
<td>Mono-unsaturated fats</td>
<td>-5.0 ± 23.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-3.5 ± 23.7</td>
<td>0.6962</td>
</tr>
<tr>
<td>Poly-unsaturated fats</td>
<td>-3.5 ± 13.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-2.9 ± 15.9</td>
<td>0.8286</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>-24.2 ± 266.6</td>
<td>-20.3 ± 247.7</td>
<td>0.9241</td>
</tr>
</tbody>
</table>

Values are mean ± SD.

<sup>a</sup>Between-group \(P\) value.

<sup>b</sup>Within-group \(P\) value \(< 0.05\).
Discussion

The CHA model of health education and prevention has shown promising benefits in improving many health conditions including immunization uptake and improving outcomes for acute respiratory infections and malaria, when compared with usual care [19]. However, for other health issues, including diabetes prevention, the evidence is insufficient regarding the effectiveness in the African-American population [17–19]. This study, aiming to address controllable diabetes risk factors in a high-risk population, demonstrated the difficulties in implementing a community-based DPP utilizing CHAs. At the end of the 1-year intervention, there were no significant differences in the change in diabetes knowledge, body mass index, physical activity self-efficacy, energy expenditure or nutrition micronutrient intake between the New Haven participants and Bridgeport participants. Possible explanations for the lack of change include differences in baseline characteristics between the two sites which could not be fully controlled, difficulty in recruiting and retaining the CHAs, variability in the CHA interventions and loss to follow-up. The results indicate important lessons for the successful future implementation of community-based diabetes prevention interventions.

The results of this study were consistent with some but contradictory to other studies assessing the effects of lifestyle intervention among African-American church members. Wilcox et al. [26] similarly found that a faith-based intervention did not significantly increase participation in moderate intensity physical activity or meeting the Centers for Disease Control and Prevention guideline for health enhancing physical activity. Satterfield et al. [27], in a review on community-based lifestyle intervention to reduce Type 2 diabetes, found only a few studies that demonstrated positive outcomes in healthy eating and physical activity behaviors. Moreover, most studies had numerous limitations (e.g. loss to follow-up, lack of control or comparison groups), and few studies assessed the effects of the interventions on reducing glucose levels or other diabetes risk factors among the target populations [27]. In comparison, Resnicow et al. [28], in a dietary intervention in African-American churches, found that participants in the intervention group significantly decreased their calories, transfats, saturated fatty acid intake from baseline and increased their social support. Additionally, Wilcox et al. [29] in a different study found that two community-based programs significantly increased African-Americans’ physical activity levels and decreased BMI. Our study found negative results in physical activity and dietary change as well as social support due to the CHA intervention. Also, in a study that examined the feasibility of implementing the DPP in a rural African-American church, Davis-Smith [30] found a significant increase of an even greater magnitude in social support, measured by the social support index. However, notably, unlike our study which found no statistically significant change in BMI in the intervention group compared with the control group, Davis-Smith [30] found that the average decrease in BMI from the initial session to the 12-month follow-up was 1.9 kg/m². This study also showed a decrease in BMI (0.63 ± 6.72 kg/m²) from baseline in the intervention group.

In the present study, the intervention (New Haven) and control sites (Bridgeport) were selected because they are home to large African-American urban communities similar in population size, age distribution, educational attainment statistics and percentage of families and individuals below the federal poverty level [31]. However, the demographic characteristics of the sample from each site were significantly different at baseline. The control site had higher educational attainments, higher incomes and lower BMI. Moreover, the intervention site reported statistically significantly higher perceived social supports at baseline compared with the participants at the control site. The participants were sampled through individual churches in each community and it was difficult to completely control for individual demographic differences without randomization. Our results, including the lack of significant decrease in BMI in the intervention group compared with the control group, could possibly be attributed to demographic differences at baseline between the
communities, which could not be fully controlled for in the multivariable regression we conducted.

While traditional diabetes prevention and education have utilized didactic and clinically based methods, it is increasingly important to examine the effects of interventions delivered under more real-world circumstances [28]. This study aimed to evaluate the adaptation of some components of the DPP lifestyle intervention to local community needs, utilizing CHAs. Effective health education in the community relies on the community as a unique system of health-relevant resources and social relationships embedded within geographical borders [30]. As the complex social etiologies of diabetes continue to come to light, harnessing these relationships holds great promise as a powerful method for effecting health behavioral change in communities. The CHA model utilizes the natural helpers in the community: those resident individuals who are respected and knowledgeable about the culture and needs of their own community [32].

Two important lessons in utilizing CHA’s emerge from this study. First, while it is crucial for the CHAs to address the needs of their community in a culturally sensitive way, a high degree of variability in the content of the interventions impedes implementation and evaluation. These individualized approaches might have accounted for the lack of significant change in outcome measures in the intervention group versus the control group. Allowing the CHAs to maintain their discretion and creativity in creating their own interventions, while planning for more uniform intervention content, might have led to meaningful change in outcome measures due to the intervention. Second, this study raised important issues related to the CHA model including selection of and compensation to the CHAs. In our study, the church pastors were asked to nominate two to three respected church members. However, the selection process turned out to be primarily based on availability and willingness to participate. The relatively low yield of the CHA selection process might be due to the fact that the CHAs were compensated for their time in the training session, but not for their intervention work in the community. Difficulty in recruiting and a lack of compensation might have exacerbated problems in consistently engaging the CHAs throughout the intervention and in ensuring consistency. To better standardize the role of the CHAs, their compensation should be adequate and uniform throughout the study and their selection process based on social networks and roles as natural helpers [33]. A recent study by Mock et al. [20] that compensated lay health workers for their activities found a positive impact on cervical screening among Vietnamese women.

Possible explanations for the negative results might also stem from one of our study’s limitations. We experienced loss to follow-up: only 68.5% of the intervention group and 62.9% of the control completed pre- and post-surveys. Additionally, we were not able to draw blood from the participants due to the wishes of the church leadership and therefore could not take measurements of Hemoglobin A1C, blood pressure and cholesterol—important indicators of diabetes and its risk factors. This is a major limitation, and future studies should attempt to include these outcome measures, gaining the church leadership and participants’ consent. Moreover, the results of this study underscore the need for future focus on evaluating the efficacy of the CHA model in DPPs among African-Americans in church settings. Future interventions should use a standardized curriculum approach, rigorous selection criteria for the CHAs and should compensate CHAs throughout the intervention, thus enhancing engagement. In addition, participatory research methodology should attempt to use an experimental design rather than a quasi-experimental approach (i.e. non-randomized trial) when possible.

**Funding**

Financial support was provided by the Connecticut Health Foundation and the Centers for Disease Control and Prevention (Grant #U48-CCU115802).

**Acknowledgements**

We wish to thank the study participants, churches, pastors, and the following CHAs: Shirley Washington, Brenda Hammett, Julie Harding, Audrey Tinsley,

The PREDICT working group consists of the following contributors: Dr. Gail Melkus & Pam Galasso (Yale School of Nursing), Dr. Kari Hartwig (Yale School of Public Health), Dr. Douglas Shenson (SPARC), Morris Moreland (Community Action of New Haven), Dawn and Ruby Slade (Varick Memorial AME Zion Church), Nancy Humiston (VNA of South Central), Cindy Kozak (CT Department of Public Health Diabetes Control and Prevention Program), Sharon Bradford (New Haven Family Alliance), Dr. Derrick Gordon (Yale School of Medicine), Onya Harris (James Hillhouse High School), Celia Cordero (Hill Health Center), Umekia Taylor (UCONN N.H. Expanded Food & Nutrition Program), William P. Quinn & Marry Ann Zavorskas (New-Haven Health Department), and Connie Green (Center for Holistic Nursing Dietary Management Services).

Conflict of interest statement

None declared.

References

Reducing diabetes in urban communities


Received on February 28, 2008; accepted on January 27, 2009