

# Opportunities and Challenges for Diabetes Prevention at Two Community Health Centers

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**OBJECTIVE**— Translating evidence-based diabetes prevention interventions to disadvantaged groups is a public health priority that poses unique challenges. Community health centers (CHCs) provide unequalled opportunities to prevent diabetes among poor and minority high-risk groups. This formative study sought to assess structural, processes-of-care (health care quality domains), and patient factors that need to be considered for diabetes prevention at CHCs.

**RESEARCH DESIGN AND METHODS**— A multimethod approach was implemented to assess system-, provider-, and patient-level factors at two large CHCs serving diverse urban communities.

**RESULTS**— Medical chart audits ( $n = 303$ ) showed limited documentation of risks. Provider surveys ( $n = 74$ ) evidenced knowledge gaps regarding factors associated with increased diabetes risk, efficacy of pharmacological interventions, and low perceived efficacy in promoting patient behavior change. Patient focus groups (two groups) with at-risk Hispanics and African Americans suggested mixed knowledge regarding whether diabetes can be prevented, some knowledge gaps regarding factors related to risk, and multiple challenges for lifestyle change.

**CONCLUSIONS**— Multiple and multilevel challenges to translating diabetes prevention interventions for the benefit of at-risk populations who seek care at CHCs were observed.

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**T**ranslating evidence-based diabetes prevention interventions (1–3) to disadvantaged groups is a challenging public health priority. This study sought to identify patient-, provider-, and system-level opportunities and challenges to delivering diabetes prevention services in community health centers (CHCs). This manuscript adds to current literature on structural, processes-of-care (health care quality domains) (4), and patient factors (5) that need to be considered

in the design and implementation of diabetes prevention efforts for the high-risk populations who seek health care at CHCs.

## RESEARCH DESIGN AND METHODS

— An ecological framework (6), which recognizes the multiple levels of influence on patients' outcomes within health care settings, including factors associated with the health care system, providers and pa-

tients, guided this study. Within this framework, we assessed quality-of-care domains from Donabedian's Structure-Process-Outcome model (4) at the system level (system structure, including health care resources) and at the provider level (processes related to technical expertise and interpersonal relationships with patients). At the patient level, social cognitive theory (5) constructs (knowledge, attitudes, behaviors, and environmental influences) were assessed. Institutional review board approval was obtained before study implementation.

## Setting

Two large CHCs that were affiliated with a tertiary referral academic medical center in Massachusetts and served urban African Americans (40%) and Hispanics (40%) participated in this study. Both CHCs used a resident-faculty practice model, with each patient being assigned a primary care physician (80% of visits are with the assigned primary care physician). Nutrition counseling and interpreter services were available at both CHCs.

## Data sources

This study involved three data sources: medical record audits, provider surveys, and patient focus groups. Data collection methods for each are described below.

**Medical records audit.** A medical record audit form was systematically designed and implemented to assess factors related to diabetes prevention, including documentation of factors related to diabetes risk (7) (family history of diabetes, hypertension, hyperlipidemia, history of gestational diabetes, and obesity). A problem checklist, lab values, text notes, and documentation of height and weight were searched.

We obtained administrative records of all clinic visits of patients aged 25–60 years for the prior year at each of the clinics. Patients with a diagnosis code indicating diabetes care were removed from the file. Retaining one record per subject, we selected a simple random sample from each of four strata defined by clinic and sex. Administrative records did not dis-

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**Abbreviations:** CHC, community health center.

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Table 1—Summary of medical records audit\*

Chart audit data	
Medical record eligibility (n)	
Total number of records registered	450
Total records available and eligible	303
Patient characteristics	
Age (years)	42.6 ± 10.0
Female sex (%)	50
Ethnicity (%)	
Hispanic	41
African American	29
White	27
Marital status (not married) (n)	73
Weight (lb)	186.2 ± 46.5 (n = 262)
Height (in)	67.7 ± 5.3 (n = 38)
Type of primary care provider (%)	
Resident	75
Attending	22
Nurse practitioner/physician assistant	4
Documented factors related to diabetes risk (%)	
Family history	17
Hypertension	17
Hyperlipidemia	13
History of gestational diabetes	0.3
Obesity	11
Screening tests recommendations (%)	
Lipids (ever)	46
Fasting blood glucose (ever)	1.3
Oral glucose tolerance test (ever)	0.3
Random blood glucose (ever)	40
A1C (ever)	3
Behavior change recommendations (%)	
Weight loss	
Ever	7.3
Past 3 years	0
Exercise	
Ever	13
Past 3 years	74
Diet	
Ever	11
Past 3 years	0
Referrals to a nutritionist	2
Pharmacological prescriptions for reduction of a known diabetes risk factor	5

Data are means ± SD unless otherwise indicated. \*Measurement tool is available from the corresponding author.

tinguish between registered clinic patients and one-time walk-in patients. Thus, we deliberately sampled a larger number of records, taking into consideration that only records of established patients were of interest. A stratified random sample of 450 patient records was selected for auditing. Records not located in the clinic were requested on three occasions, at least 2 weeks apart, before being designated as missing.

**Provider survey.** A survey to assess providers' knowledge, attitudes, and self-

reported practices related to diabetes prevention was designed, pretested for relevance and understandability, and then mailed to providers with an introductory letter that explained the purpose of the study and assured the confidentiality of their responses. An additional mailing and a follow-up e-mail were sent to nonrespondents 2 weeks later to enhance the response rate.

**Patient focus groups.** Focus groups were conducted with at-risk patients. Eligibility included 1) African-American or

Hispanic race/ethnicity, 2) age ≥25 years, 3) English or Spanish speaking, 4) no known diagnosis of diabetes, and 5) classified as at high risk for developing type 2 diabetes based on either of the following criteria: 1) had at least three of five metabolic syndrome criteria (e.g., BMI ≥25 kg/m<sup>2</sup>, triglycerides ≥150 mg/dl, low sex-specific HDL cholesterol, blood pressure >130/>85 mmHg, and fasting glucose >110 but <126 mg/dl) or 2) had a history of gestational diabetes or a first-degree relative with diagnosed diabetes plus met at least one of the criteria for metabolic syndrome (listed above).

Convenience samples of patients were recruited from both CHCs. Over a 1-week period, providers screened eligible patients at the time of their clinic visit and obtained verbal consent from eligible patients to be contacted by a study coordinator. Two groups were facilitated by two experienced qualitative researchers: an African-American facilitator (assisted by a Caucasian researcher) led a group composed of African-American patients, and a Hispanic facilitator (assisted by another Hispanic researcher) led a group of Hispanic patients. This group was conducted in Spanish.

A semistructured interview guided the discussions. Topics included knowledge about diabetes and diabetes prevention, attitudes toward diabetes prevention, and previous efforts to modify dietary and physical activity habits and to lose weight. Patients' preferences for program development were also assessed.

Patients provided written consent and completed a brief survey (demographics and health care history). The 90-min discussions were audiotaped and transcribed. Participants received a \$25 incentive.

## Analyses

Quantitative (provider survey and medical record audit) analysis included frequencies, proportions with 95% CIs, and cross-tabulations. Focus group transcripts were analyzed using the constant comparative method (8). Results were then triangulated to facilitate a multilevel understanding of opportunities and challenges for diabetes prevention.

## RESULTS

### Medical record audit results

In all, 303 records were available and eligible for review (Table 1). Age and sex

distributions were similar in both clinics. However, CHC 1 had more Hispanics (45%) and most patients were seen by residents (91%), whereas CHC 2 had more African Americans (47%) and patients were equally seen by attending physicians (46%) and residents (44%).

More than half of medical records reviewed had no documentation of factors associated with diabetes risk. Weight and height were documented in 86 and 13% of charts, respectively, making it impossible to calculate BMI for the majority of patients. Chronic conditions (depression 22%, asthma 13%, gastroesophageal reflux disease/gastrointestinal 12%, arthritis 7%, and others) were relatively common. Referral for lipids or glucose screening tests was relatively limited, with less than half of patients having documented referrals. Documented behavioral recommendations for weight loss, exercise, and dietary change were uncommon. Only 5 patients had a documented nutrition referral, and 14 had been prescribed a lipid-lowering agent.

We attempted to determine the percentage of patients who might have a higher diabetes risk using an algorithm to obtain a risk factor score (7,9). We used measures of overweight (defined by documentation in clinical notes, calculated BMI >24.9 kg/m<sup>2</sup>, or weight >180 lb if female or 220 lb if male), elevated lipids (defined by serum cholesterol levels >240 mg/dl or documentation in clinical notes), hypertension (defined as documented in medical chart or clinical notes), and impaired fasting glucose (defined by a value  $\geq$ 110 mg/dl in fasting blood glucose) to estimate diabetes risk. A patient was defined as at high risk for diabetes if he/she met at least two of the above criteria or at least one of the above criteria plus either a personal history of gestational diabetes or a first-degree relative who has a diagnosis of diabetes.

Among 69 (23%) patients classified as at elevated diabetes risk, provider advice for lifestyle behavior change was documented as follows: 17% of patients had received weight loss advice (none received this advice in the past 3 years), 32% had received exercise advice (the majority of them in the past 3 years), and 30% had received dietary advice (none in the past 3 years). Only four patients had ever been referred to dietary counseling with a nutritionist, and three had been referred to a weight loss clinic/obesity clinic. Seventy percent of

patients were at low or unclear risk due to incomplete information.

### Provider survey results

Seventy-four (56%) providers completed and returned the survey (Table 2). Respondents were 55% female. Fifty-nine percent were residents, and 30% were attending physicians. Two-thirds of respondents worked at their CHC only 1 or 2 half-day sessions per week.

Most providers were aware of an association between excess weight and diabetes, although the role of inactivity, abdominal fat, and type of diet was less commonly understood. Most did not identify hypertension and elevated LDL as risk factors for diabetes. Few providers (9%) appropriately identified obesity, physical inactivity, glucose abnormalities, hypertension, and elevated LDL as associated with diabetes risk.

Most providers endorsed weight loss and lifestyle changes as effective diabetes prevention interventions. However, almost half incorrectly endorsed reduction in sugar intake as an evidence-based diabetes prevention strategy (data not shown). Less than one-third of providers endorsed biguanides and some endorsed thiazolidinediones as evidence-based prevention strategies (data not shown).

Overall, providers believed that their lifestyle recommendations were unlikely to be adopted by patients (Table 2), and more than two-thirds (69%) (data not shown) endorsed counseling by a nutritionist as more likely to be adopted. Most providers believed that patients were adherent to lipid-lowering agents. Use of pharmacotherapy for obesity or diabetes prevention was uncommon. Providers' perceived barriers (from a list of possible barriers) and strategies for diabetes prevention were also assessed (See Table 2).

### Focus groups results

Participants were stratified into two groups: one African-American and the other Spanish-speaking Hispanic patients. The African-American group included three female and four male subjects (age range 46–68 years); five of seven patients had at least a high school education or passed a general education development test, and two patients were employed. The Hispanic group consisted of eight female and four male subjects (age range 36–77 years); 10 of 12 patients had less than a high school education (three had <4th

grade). All patients reported to be unable to work for health reasons. Findings (Table 3) were organized by thematic categories based on most salient topics discussed by participants.

Similarities existed between the two groups. Most patients had family history of diabetes and were aware of diabetes symptoms and complications. However, knowledge that diabetes can be prevented or delayed was mixed, with some reporting awareness and others appearing less sure. Risk perception was greater among Hispanics compared with African Americans, and more Hispanic patients had made previous efforts to lose weight compared with African Americans. More similarities than differences existed among the groups with regard to cited barriers to weight loss and lifestyle behavior change, having regular sources of health information, and preferences for health information, sources. The groups differed slightly with regard to the importance of provider recommendations, although both groups appeared to rely on CHC initiatives for information and assistance. Differences also were noted in terms of preferences for intervention strategies and logistical needs (e.g., language needs, transportation).

### Triangulated results

Table 4 summarizes challenges to diabetes prevention related to system structure, technical process, interpersonal process, and patient factors and proposes strategies to facilitate prevention.

**CONCLUSIONS**— Translation of evidence-based diabetes prevention care into routine health care settings is a public health priority and can decrease morbidity, mortality, and health care costs (1–3). However, we observed suboptimal quality of care with respect to diabetes prevention efforts at the two urban CHCs in this study. Risk factor assessment was poor, screening tests were underutilized, and documentation of counseling and referral interventions for risk factors was limited and lower than previously reported (10,11). Consistent with previous studies (12), multiple and multilevel challenges for translation were observed. Study results suggest opportunities for quality improvement and for intervening for diabetes prevention at CHCs, related to structural factors, processes of care (both technical and interpersonal) (4), and patient factors (5).

Table 2—Summary of provider survey results\*

	Attendings	Residents	Total
<i>n</i>	32	42	74
Health care system/structure			
Items endorsed by >50% of providers as moderate or major provider/system barriers for diabetes prevention			
Time pressures	28 (88)	35 (83)	63 (85)
Inadequate resources for physical activity counseling	28 (88)	31 (74)	59 (80)
Limited reimbursement by third-party payers	27 (84)	27 (64)	54 (73)
Limited provider counseling effectiveness	23 (72)	26 (62)	49 (66)
Inadequate resources for diet counseling	20 (63)	23 (55)	43 (58)
Process: provider technical expertise			
Knowledge items endorsed by providers			
Identified risk factors			
Obesity (BMI >30 kg/m <sup>2</sup> )	32 (100)	41 (98)	73 (99)
Abdominal fat distribution	24 (75)	28 (67)	52 (70)
Physical inactivity	23 (72)	28 (67)	51 (69)
Insulin resistance, impaired glucose tolerance, or impaired fasting glucose	32 (100)	42(100)	74 (100)
Hypertension	10 (31)	4 (10)	14 (19)
Elevated LDL cholesterol	8 (11)	5 (12)	13 (18)
Unbalanced diet (high carbohydrate, high fat, or low fiber)	15 (47)	17 (40)	32 (43)
Identified obesity, inactivity, glucose abnormalities, hypertension, and LDL as diabetes risk factors	6 (19)	1 (2)	7 (9)
Diabetes prevention strategies endorsed			
Weight reduction	31 (97)	42(100)	73 (99)
Decrease in dietary fat and total caloric intake	23 (72)	27 (64)	50 (68)
Moderate physical activity	27 (84)	40 (95)	67 (91)
Biguanides	9 (28)	14 (33)	23 (31)
Process: interpersonal relationships with patients			
Provider-perceived efficacy for influencing patient behavior			
Perceived influence on dietary change			
>50% of the time	3 (10)	3 (2)	6 (8)
<25% of the time	17 (59)	25 (51)	42 (57)
Perceived influence on physical activity			
>50% of the time	2 (7)	3 (7)	5 (7)
<25% of the time	16 (55)	28 (68)	44 (59)
Perceived influence on lipid-lowering medication use			
>50% of the time	19 (66)	35 (86)	54 (73)
<25% of the time	1 (3)	2 (5)	3 (4)
Perceived influence on obesity medication use†			
>50% of the time	5 (17)	7 (17)	12 (16)
<25% of the time	5 (17)	5 (12)	10 (14)
Perceived influence on medication compliance for diabetes prevention‡			
>50% of the time	8 (28)	15 (37)	23 (31)
<25% of the time	5 (17)	6 (12)	11(15)
Items endorsed by at least two-thirds of providers as moderate or major perceived patient barriers for diabetes prevention			
Limited patient motivation	32 (100)	42 (100)	74 (100)
Patients' attitude toward dietary change	30 (94)	37 (88)	67 (91)
Cultural differences toward prevention	23 (72)	32 (76)	55 (74)
Reluctance to treat risk factor (compared with treatment of disease)	23 (72)	27 (64)	50 (68)
Patients' attitude toward ideal body size	23 (72)	27 (64)	50 (68)
Possible solutions			
Strategies rated by at least two-thirds of providers as very important			
Onsite registered dietitian§	29 (91)	40 (95)	69 (93)
Culturally appropriate interventions and services	28 (88)	31(74)	59 (80)
Case management	26 (81)	32 (76)	58 (78)
Interventions tailored to patient ethnicity	27 (84)	29 (71)	56 (76)
Incentive programs for diet and physical activity changes	21 (66)	32 (76)	53 (72)
Onsite exercise counselor	20 (63)	32 (76)	52 (71)
Community-based wellness center	19 (59)	29 (69)	48 (65)
Provider training in preventive counseling§	21 (66)	29 (69)	50 (68)

Data are *n* (%). \*Measurement tool is available from the corresponding author; †52% of providers endorsed "not applicable/not usually recommend;" ‡32% of providers endorsed "not applicable/not usually recommend;" §perceived as feasible in their practice by >50% of providers.

Table 3—Summary of patient focus group findings with Hispanic (n = 12) and African-American (n = 7) participants

Constructs explored	Findings
Health care history*	<ul style="list-style-type: none"> <li>• Almost all reported seeing their health care provider at least once a year.</li> <li>• Most reported having been screened for diabetes in the past.</li> <li>• Compared with African Americans, more Latinos reported 1) being told by their health care provider that they had an increased risk for developing diabetes and 2) being in fair or poor health.</li> </ul>
Experience with/exposure to diabetes	<ul style="list-style-type: none"> <li>• Almost all indicated that a family member had diabetes.</li> <li>• Most had knowledge of symptoms and complications.</li> <li>• Most were aware of the elevated prevalence of diabetes in the general population.</li> </ul>
Knowledge of diabetes risk factors and attitudes toward diabetes prevention	<ul style="list-style-type: none"> <li>• Both groups endorsed family history, overweight, dietary factors, and lack of exercise as risk factors.</li> <li>• Both were aware of the elevated diabetes risk in their minority group. However, although most Hispanic patients expected to develop diabetes at some point, few African Americans articulated an understanding of higher individual risk.</li> </ul>
Attitudes toward and experiences regarding weight loss	<ul style="list-style-type: none"> <li>• Both groups had strong perceptions that motivation (Hispanics) and discipline (African Americans) are important in making lifestyle changes.</li> <li>• Most Hispanics (and few African Americans) reported a history of weight loss efforts.</li> <li>• Hispanics' weight loss efforts included following a diet and exercise regimen, changing cooking habits, meeting with a dietitian, taking medications, drinking "teas," and "willpower."</li> <li>• Hispanics' weight loss motivations included health reasons, being overweight/obese, and fatigue.</li> <li>• Facilitators of exercise for Hispanics included motivation, will power, not wanting to gain weight, social support for exercise (groups), and free access to an exercise facility.</li> <li>• Walking appeared to be an acceptable form of exercise for both groups.</li> </ul>
Barriers to weight loss and lifestyle change	<ul style="list-style-type: none"> <li>• Both groups identified lack of willpower (Hispanics) or discipline (African Americans) as the main barriers to weight loss (low self-efficacy).</li> <li>• Other commonly discussed barriers include 1) limited financial resources to buy healthy foods; 2) preferences for culturally based, less healthy foods; and 3) comorbid conditions perceived to limit physical activity (asthma, bone aches, leg swelling, and back and neck pain).</li> <li>• Hispanics also reported stress, lack of family support, and lack of professional help to address psychological aspects of weight control as barriers to weight loss.</li> <li>• African Americans also reported fatigue, laziness, and lack of social support as additional barriers to physical activity.</li> </ul>
Usual health information sources	<ul style="list-style-type: none"> <li>• Common information sources for both groups are family members and print media (brochures, pamphlets, and magazines).</li> <li>• Hispanics also reported obtaining health information from the television, classes at a health center, and doctors and dietitians. Providers' role was perceived primarily as the source of referral for screenings.</li> <li>• Although African Americans portrayed a mistrust of the medical care system in general, there were strong opinions in favor of their own providers as credible sources of health information.</li> </ul>
Preferences for health information	<ul style="list-style-type: none"> <li>• Both groups favored group interventions for education and exercise groups at the CHC.</li> <li>• In addition, Hispanics referred to 1) the use of "promotores de salud" to do outreach work and 2) the use of radio programs to disseminate information. They pointed out their need for transportation to attend programs.</li> <li>• African Americans referred to 1) opportunities for participation of family members and 2) written information in public places and schools (for children).</li> </ul>

\*Health care history data were obtained.

Deficits in CHC structure were apparent. The level of difficulty locating patient charts is likely to be a barrier to appropriate documentation of patients' risk factors and timely counseling for risk factor reduction. Limited reimbursement is an added challenge. A recent review summarized important roles that health systems could play in diabetes prevention (e.g., electronic

records, computerized reminders and provider feedback, multidisciplinary teams providing patient education and follow-up, self-management education in community settings, and case managers coordinating care) and highlighted the lack of data on system-based approaches to diabetes prevention (13). Systems changes could facilitate identification and documentation of diabetes

risk factors, implementation of hands-off referrals, and care continuity in CHCs with multiple part-time providers. While electronic records have potential to aid prevention efforts, many CHCs do not count on resources to take advantage of electronic tools. Other office system redesign options with demonstrated efficacy for improving quality of care and outcomes in CHCs, such as

Table 4—Summary of challenges for diabetes prevention interventions at two CHCs and proposed strategies to facilitate translation

Challenges for diabetes prevention interventions	Strategies to facilitate translation
<p>Health care system/structure</p> <ul style="list-style-type: none"> <li>Inadequate time to counsel patients on lifestyle modification.</li> <li>Limited resources for dietary and physical activity counseling.</li> <li>Limited insurance coverage for lifestyle-related interventions.</li> <li>Limited documentation of diabetes-related risk factors.</li> <li>Limited availability of medical records.</li> </ul>	<ul style="list-style-type: none"> <li>• Resources to support providers' prevention interventions (print or other materials, skilled support staff, cost-efficient intervention formats, office systems, community partnerships) (29).</li> <li>• Training support staff to facilitate or conduct screening (14). Identifying skilled support staff to facilitate delivery of preventive interventions/referrals (14,29).</li> <li>• Expanding CHC interventions to community settings and use of community resources (30).</li> <li>• Implementing quality improvement efforts to standardize height and weight and vital sign ascertainment at all routine visits (31). Developing office systems that prompt providers and other health center staff to assess and document risk factors (16,32,33).</li> <li>• Adopting electronic medical records or improved medical record systems that includes patient registries with basic demographic, lab, and risk factors tracked over time (34).</li> </ul>
<p>Process: provider technical expertise</p> <ul style="list-style-type: none"> <li>Knowledge gaps (diabetes risk factors and evidence-based interventions)</li> <li>Infrequent assessment of diabetes risk factors.</li> <li>Infrequent delivery of diabetes prevention strategies (dietary, physical activity and weight loss counseling as well as pharmacological interventions).</li> </ul> <p>Process: provider interpersonal relationships with patients</p> <ul style="list-style-type: none"> <li>Limited provider self-efficacy for dietary and physical activity counseling.</li> <li>Providers perceived patients as not motivated to change.</li> <li>Cultural and language tailoring needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Implementing programs to disseminate evidence-based interventions to increase provider awareness of risk factors and evidence-based interventions (15).</li> <li>• Implementing office systems interventions that prompt providers to assess risk factors (e.g., routine height and weight assessments) (14,15).</li> <li>• Implementing office systems interventions (linked to risk factor assessments) that facilitate implementation of counseling (e.g., prompts to providers, hands-off referrals to support staff) and pharmacological protocols (14,15). Adapting brief intervention protocols (14,15).</li> <li>• Training providers in behavioral counseling skills (14,15).</li> <li>• Training providers to promote effective communication and improvement of attitudes toward patient behavior change (15).</li> <li>• Promoting culturally sensitive interventions; culturally competent providers; skilled interpreters (35).</li> </ul>
<p>Patient</p> <ul style="list-style-type: none"> <li>Limited knowledge of diabetes prevention.</li> <li>Limited patient self-efficacy to prevent diabetes</li> <li>Limited behavioral self-management skills (absence of successful past experiences with lifestyle behavior change).</li> <li>Numerous barriers (financial, stress, lack of support, and comorbidities) to lifestyle change.</li> <li>Cultural and language tailoring needs.</li> </ul>	<ul style="list-style-type: none"> <li>• Developing educational materials and strategies appropriate for various literacy levels (35).</li> <li>• Using evidence-based interventions (such as the Diabetes Prevention Program) (3) that address attitudes and motivations among patients and providers.</li> <li>• Providing hands-on learning opportunities for enhancing patient self-management skills (goal setting, self-monitoring, and problem solving) (35).</li> <li>• Collaborating with community organizations to meet patients' needs and support long-term maintenance of behavior changes (30).</li> <li>• Taking into consideration cultural preferences for interventions; delivering information in the patients' primary language (35).</li> </ul>

manual clinician reminder systems, brief intervention algorithms, and use of trained office staff, among others (14–16), may be more feasible.

Although nutritionists were available at both CHCs and providers stated a preference for referring patients for counseling to ancillary staff who they believed to be more efficacious in counseling patients, limited referrals were made to nu-

tritionists. A possible contributing factor to this discrepancy was lack of adequate reimbursement, which may have precluded recommendations by providers and acceptance of recommendations by patients. Of note, when describing preferences for diabetes prevention and weight loss, most patients discussed CHC-based groups and community outreach as a preferred method for interven-

tion. Group interventions that target behavior change among patients may be cost-effective (17,18) and potentially be delivered through collaborations between health delivery systems and community agencies and resources (e.g., YMCA) and alleviate pressures to deliver in-depth counseling during time-pressured clinic visits.

Factors related to processes of care,

including provider knowledge deficits and lack of confidence for behavioral counseling, were evidenced and may have contributed to limited screening and intervention efforts. Successful models for training health care providers in behavioral counseling skills exist (19), along with evidence that training improves patient and provider satisfaction and patient outcomes (20). Our data suggest that providers would welcome training in behavioral counseling. Thus, opportunities for provider training related to diabetes prevention through formal continuing education courses or in-service trainings are important and likely to enhance prevention counseling.

The impact of interpersonal processes between providers and patients also was observed, with discrepancies between provider perceptions of patients and what patients reported. Particularly striking was the contrast between providers' views of patients' attitudes toward prevention compared with patients' views of prevention. Providers perceived patients' cultural traditions, attitudes, and low motivation for prevention as important challenges, whereas patients expressed interest and were concerned about their diabetes risk, despite expressing challenges regarding their ability to initiate and maintain lifestyle changes. Interventions that address this chasm may be important to improving diabetes prevention efforts.

Patient influences observed included limited mixed knowledge regarding diabetes risk and prevention, low self-efficacy, and limited behavior change skills as evidenced by many reporting a history of failed weight loss attempts. Multiple external barriers to lifestyle change also were identified. Future diabetes prevention interventions need to address these constructs, all of which are associated with behavior change outcomes (21–24).

Study strengths include its multi-method, multilevel approach to assessing challenges to the translation of evidence-based diabetes prevention interventions; its attention to minorities; and its focus on CHCs where many at-risk minorities receive care. Generalizability of findings is limited in that only two CHCs were included, there was difficulty locating records to be audited, not all providers responded to the survey, and there are potential biases in using a convenience sample for focus groups. In addition, because we relied on chart audits to assess

provider practice, counseling efforts may have been underestimated if documentation did not match practice. The sizable number of missing medical charts is of concern; however, the consistency of our results across health centers suggests that it is unlikely that the review of those charts (had they been available) would have resulted in a more optimistic perspective of the situation. On the contrary, if providers do not have their patients' records readily available at the time of appointments, missing charts may have revealed poorer documentation. The providers' survey response rate was slightly lower than in other studies (25), possibly due to the number of part-time providers. A more important study limitation is the lack of input from Caucasians and English-speaking Hispanics. Another study limitation relates to the strategies we had to use to identify diabetes risk factors. It is possible that these limitations could have underestimated the nature of the problems observed.

Evidence-based lifestyle interventions are recommended for first-line use in diabetes prevention (26). Translation efforts are needed to effectively implement these interventions in real-world CHC settings to prevent diabetes among at-risk underserved and minority patients. Quality improvements will be needed to facilitate diabetes prevention at CHCs. Despite its limitations, this study identified numerous and multilevel challenges to these efforts. The authors have proposed strategies whose effectiveness will require further research. Given that most Americans seek primary care services every year (27), intervening for diabetes prevention at health care settings has tremendous potential for moving forward the public health agenda of fighting obesity and preventing diabetes. Failure to counsel patient populations seen at CHCs to reduce weight to prevent diabetes represents a missed opportunity (28).

## References

- Eriksson J, Lindstrom J, Valle T, Aunola S, Hamalainen H, Ilanne-Parikka P, Keinanen-Kiukaanniemi S, Laakso M, Lauhkonen M, Lehto P, Lehtonen A, Louheranta A, Mannelin M, Martikkala V, Rastas M, Sundvall J, Turpeinen A, Viljanen T, Uusitupa M, Tuomilehto J: Prevention of type II diabetes in subjects with impaired glucose tolerance: the Diabetes Prevention Study (DPS) in Finland. Study design and 1-year interim report on the feasibility of the lifestyle intervention programme. *Diabetologia* 42:793–801, 1999
- Tuomilehto J, Lindstrom J, Eriksson JG, Valle TT, Hamalainen H, Ilanne-Parikka P, Keinanen-Kiukaanniemi S, Laakso M, Louheranta A, Rastas M, Salminen V, Uusitupa M: Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med* 344:1343–1350, 2001
- Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, Nathan DM: Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 346:393–403, 2002
- Donabedian A: Basic approaches to assessment: structure, process and outcome. In *Explorations in Quality Assessment and Monitoring: The Definition of Quality and Approaches to Its Assessment*. Griffith JR, Filerman GL, Dixon M, Dornblaser BL, Riedel DC, Stevens R, Eds. Ann Arbor, MI, Health Administration Press, 1980, p. 77–128
- Bandura A: *Self-Efficacy: The Exercise of Control*. New York, WH Freeman and Company, 1997
- Elder JP, Lytle L, Sallis JF, Young DR, Steckler A, Simons-Morton D, Stone E, Jobe JB, Stevens J, Lohman T, Webber L, Pate R, Saksvig BI, Ribisl K: A description of the social-ecological framework used in the trial of activity for adolescent girls (TAAG). *Health Educ Res* 22:155–165, 2007
- Stern MP, Williams K, Haffner SM: Identification of persons at high risk for type 2 diabetes mellitus: do we need the oral glucose tolerance test? *Ann Intern Med* 136: 575–581, 2002
- Knodel J: The design and analysis of focus group studies: a practical approach. In *Successful Focus Groups: Advancing the State of the Art*. Morgan DL, Ed. Newbury Park, CA, Sage Publications, 1993, p. 35–50
- Meigs JB, Williams K, Sullivan LM, Hunt KJ, Haffner SM, Stern MP, Gonzalez Vilalpando C, Perhanidis JS, Nathan DM, D'Agostino RB Jr, D'Agostino RB Sr, Wilson PW: Using metabolic syndrome traits for efficient detection of impaired glucose tolerance. *Diabetes Care* 27:1417–1426, 2004
- Guo JL, Gottlieb NH, Smith MM, Huang PP, Huang CM: Nutrition and physical activity counseling practices of family practice residents. *J Cancer Educ* 17:128–137, 2002
- Stafford RS, Farhat JH, Misra B, Schoenfeld DA: National patterns of physician activities related to obesity management. *Arch Fam Med* 9:631–638, 2000
- Astin JA, Soeken K, Sierpina VS, Clarridge BR: Barriers to the integration of psychosocial factors in medicine: results of a national survey of physicians. *J Am Board Fam Med* 19:557–565, 2006

13. Burnet DL, Elliott LD, Quinn MT, Plaut AJ, Schwartz MA, Chin MH: Preventing diabetes in the clinical setting. *J Gen Intern Med* 21:84–93, 2006
14. Kennedy C, Finkelstein N, Hutchins E, Mahoney J: Improving screening for alcohol use during pregnancy: the Massachusetts ASAP program. *Matern Child Health J* 8:137–147, 2004
15. Pbert L, Ockene JK, Zapka J, Ma Y, Goins KV, Oncken C, Stoddard AM: A community health center smoking-cessation intervention for pregnant and postpartum women. *Am J Prev Med* 26:377–385, 2004
16. Kohatsu ND, Cramer E, Bohnstedt M: Use of a clinician reminder system for screening mammography in a public health clinic. *Am J Prev Med* 10:348–352, 1994
17. Weinger K: Group interventions: emerging application for diabetes care: preface. *Diabetes Spectrum* 16:86–87, 2003
18. Rickheim PL, Weaver TW, Flader JL, Kendall DM: Assessment of group versus individual diabetes education: a randomized study. *Diabetes Care* 25:269–274, 2002
19. Adams A, Ockene JK, Wheeler EV, Hurley TG: Alcohol counseling: physicians will do it. *J Gen Intern Med* 13:692–698, 1998
20. Reiff-Hekking S, Ockene JK, Hurley TG, Reed GW: Brief physician and nurse practitioner-delivered counseling for high-risk drinking: results at 12-month follow-up. *J Gen Intern Med* 20:7–13, 2005
21. Clarke KK, Freeland-Graves J, Klohe-Lehman DM, Bohman TM: Predictors of weight loss in low-income mothers of young children. *J Am Diet Assoc* 107:1146–1154, 2007
22. D'Angelo MS, Reid RD: A model for exercise behavior change regulation in patients with heart disease. *J Sport Exerc Psychol* 29:208–224, 2007
23. McEwen MM, Baird M, Pasvogel A, Gallegos G: Health-illness transition experiences among Mexican immigrant women with diabetes. *Fam Community Health* 30:201–212, 2007
24. Blalock SJ: Predictors of calcium intake patterns: a longitudinal analysis. *Health Psychol* 26:251–258, 2007
25. Ang DC, Thomas K, Kroenke K: An exploratory study of primary care physician decision making regarding total joint arthroplasty. *J Gen Intern Med* 22:74–79, 2007
26. American Diabetes Association, the National Institute of Diabetes and Digestive and Kidney Diseases: The prevention or delay of type 2 diabetes. *Diabetes Care* 25:742–749, 2002
27. Cherry DK, Burt CW, Woodwell DA: National Ambulatory Medical Care Survey: 2001 summary. *Adv Data* 337:1–44, 2003
28. Wee CC, McCarthy EP, Davis RB, Phillips RS: Physician counseling about exercise. *JAMA* 282:1583–1588, 1999
29. Mangione CM, Gerzoff RB, Williamson DF, Steers WN, Kerr EA, Brown AF, Waitzfelder BE, Marrero DG, Dudley RA, Kim C, Herman W, Thompson TJ, Safford MM, Selby JV: The association between quality of care and the intensity of diabetes disease management programs. *Ann Intern Med* 145:107–116, 2006
30. Ackermann RT, Marrero DG: Adapting the Diabetes Prevention Program lifestyle intervention for delivery in the community: the YMCA model. *Diabetes Educ* 33:69, 74–75, 77–78, 2007
31. Orzano AJ, Scott JG: Diagnosis and treatment of obesity in adults: an applied evidence-based review. *J Am Board Fam Pract* 17:359–369, 2004
32. Fox CH, Mahoney MC: Improving diabetes preventive care in a family practice residency program: a case study in continuous quality improvement. *Fam Med* 30:441–445, 1998
33. O'Connor PJ, Rush WA, Peterson J, Morben P, Cherney L, Keogh C, Lasch S: Continuous quality improvement can improve glycemic control for HMO patients with diabetes. *Arch Fam Med* 5:502–506, 1996
34. Zgibor JC, Orchard TJ, Saul M, Piatt G, Ruppert K, Stewart A, Siminerio LM: Developing and validating a diabetes database in a large health system. *Diabetes Res Clin Pract* 75:313–319, 2007
35. Rosal MC, Olendzki B, Reed GW, Gumieniak O, Scavron J, Ockene IS: Diabetes self-management among low-income Spanish speaking patients: a pilot study. *Ann Behav Med* 29:225–235, 2005