The Diabetes Primary Prevention Initiative Interventions Focus Area
A Case Study and Recommendations

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Background: In 2005, CDC began the Diabetes Primary Prevention Initiative Interventions Focus Area (DPPI-IFA), which funded five state Diabetes Prevention and Control Programs (DPCPs) to translate diabetes primary prevention trials into real-world settings by developing and implementing a framework for state-level diabetes primary prevention.

Purpose: The purpose of this case study, conducted in 2007, was to describe DPPI-IFA implementation, including facilitators and challenges to the initiative.

Methods: Case studies of the five DPCPs in the DPPI-IFA involving site visits with key informant interviews of state staff and partners and archival record collection.

Results: Partners recruited for DPPI-IFA activities included local or state public health agencies (three of five DPCPs); regional or state nonprofit organizations (five DPCPs); businesses or employers (three DPCPs); and healthcare organizations (four DPCPs). The DPCPs implemented a variety of interventions in three main domains: diabetes primary prevention and prediabetes awareness, screening activities and lifestyle interventions, and prediabetes-related health policy efforts. Preliminary outcomes are described at the individual and organization/partnership levels. Results suggest the importance of utilizing preexisting partnerships to extend work into diabetes prevention, providing even small amounts of funding to partners, and prior program planning for diabetes prevention. Challenges for the DPPI-IFA included recruiting participants, establishing links with providers to obtain diagnostic testing for people screened for prediabetes, and offering a lifestyle intervention.

Conclusions: The DPPI-IFA represents a unique effort by state public health programs in the translation of diabetes primary prevention trials into real-world settings. The experiences of the DPPI-IFA programs offer valuable lessons for future community-based diabetes prevention initiatives, especially regarding the need to strengthen clinical–community partnerships for referral of people with prediabetes to evidence-based lifestyle programs.

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Introduction

In the U.S., nearly 30% of adults have prediabetes (defined as impaired fasting glucose [IFG] or impaired glucose tolerance [IGT]).[1] People with these conditions have a five to 15 times greater risk of developing diabetes than people with normal blood glucose.[2] Importantly, there is firm consensus that intensive lifestyle interventions can delay or prevent the onset of diabetes in people with prediabetes[3–7] and that screening and lifestyle interventions are cost effective.[6–9]

Preventing the burden of diabetes by detecting and intervening in people with prediabetes, however, requires translation of clinical trials into real-world settings.[10–12] Public health agencies play an important role in the translation of diabetes prevention trials through a variety of mechanisms, including promoting the adoption of screening guidelines in healthcare settings,[13] developing community-based interventions, and linking providers to existing interventions. Yet "many public health areas relevant to diabetes have been relatively underexplored and understudied."[10]

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In 2005, the CDC's Division of Diabetes Translation began the Diabetes Primary Prevention Initiative (DPPI), which built on previous public health diabetes prevention projects.[14,15] The Interventions Focus Area (IFA) component of the DPPI funded five state Diabetes and Prevention Control Programs (DPCPs) in California, Massachusetts, Michigan, Minnesota, and Washington to develop, implement, and disseminate a framework for state-level primary prevention programs targeting people with prediabetes. States were given maximum flexibility to identify and implement interventions across the broad spectrum of activities normally conducted by DPCPs (health communications, health systems interventions, and community interventions and policy initiatives). At the same time that DPCPs piloted their own state-based initiatives, they also worked together in an ongoing fashion to develop a framework and other materials that would guide other DPCPs in future efforts.

In 2007, the CDC and the Agency for Healthcare Research and Quality (AHRQ) contracted with RTI International to develop a descriptive case study of the five states participating in DPPI-IFA. The purpose of the present study was to describe the implementation of diabetes primary prevention programs in the five states, with an explicit intent to identify and disseminate lessons learned, resources, and tools to inform future efforts of CDC, the additional 54 DPCPs in all states and territories, and other public health and clinical stakeholders. This manuscript describes the key findings of the case study, provides recommendations to CDC and DPCPs for further efforts, and provides recommendations to other clinical or public health organizations attempting to translate the diabetes prevention clinical trials into real-world settings.

Methods

The case study design was influenced by CDC's "Framework for Program Evaluation in Public Health"[16] and key qualitative research authors.[17,18] The work was also guided by a Steering Group of representatives from CDC, AHRQ, and state DPCPs who focused the case study; gave extensive input to the design of case study questions (Table 1) and methods; and reviewed the final case study report. RTI's IRB reviewed the proposed work and determined it to be exempt from review.

RTI reviewed program documents from each state, developed and completed state-specific Program Summary Forms (PSF), and conducted face-to-face and telephone interviews. From July through September 2007, RTI conducted five 2-day site visits, with a total of 29 interviews involving 57 people (14 DPCP staff, 6 other state health department staff, and 37 partners). These site visits included key informant interviews and additional archival record collection. The interview guides were developed based on the case study questions and consisted of open-ended, semistructured questions. A combined purposive and snowball sampling strategy was used to identify key informants beyond program staff with a maximum of 12 interviews per site visit, in groups no larger than three people. State DPCPs were given two opportunities to provide updated information to capture work conducted since the original data collection in summer 2007, including 5 additional interviews with DPCP staff in April and May of 2008.

Table 1. DPPI-IFA case study questions

Level	Overarching questions
Structure	What are the intervention designs?
	Are interventions consistent with best practices and available evidence?
	What types of support were most helpful to the pilot states in facilitating implementation of this program?
	What have been the resources needed for planning and implementing the program?
	What are the states doing to institutionalize/sustain the programs?
Process	How do the programs recruit and retain partners?
	What are partners doing to meet the DPPI objectives?
	How do the programs involve partners once they are on board?
	What tools have been developed or used by states?
Outcome	What are the programs accomplishing?
	What are accomplishments at the participant level?
	What are the accomplishments at the community/organizational level?

DPPI-IFA, Diabetes Primary Prevention Initiative Interventions Focus Area

Two separate analyses—individual case studies and a cross-site case study—were conducted. Because the case study was largely descriptive in nature, extensive a priori coding structure was not used; rather, data were analyzed around case study questions. Where appropriate, common themes were identified and used as loosely defined codes both within and across states. The analyses included an in-depth review of the PSF, annual budgets, program documents, and notes and recordings of each interview. After analyses were completed and a site summary was drafted, each case study team member reviewed the summary for accuracy. For the cross-site case study, results are organized around five major areas: partnerships, interventions, outcomes, facilitators, and challenges.

Results

Description of the Partners and Partnerships

Central to DPPI–IFA activities was identification of capable partners and establishment and maintenance of strong partnerships (Table 2). Three of five DPCPs partnered with local or state public health agencies, all five

Table 2. Primary and secondary DPPI-IFA partners, by funded state

DPPI-IFA state	Intervention description	Partners
California	Worksite screening and lifestyle interventions with a primary partner (a healthcare system and its associated foundation) and two additional employers	Healthcare system and its associated foundation Employers: Newspaper Bank Healthcare system
	Clinic-based screening in a healthcare system	Healthcare system and its associated foundation
Massachusetts	Worksite screening and lifestyle intervention for staff employed at a local manufacturing facility in conjunction with a community-based diabetes nonprofit organization	Community-based diabetes nonprofit organization Employer: lighting manufacturer Hospital
	Trainings for employers on worksite health improvement	A regional worksite health improvement initiative, including employers and other state agencies
Michigan	Pilot program in a local health department WISEWOMAN program implementing diabetes and prediabetes screening and lifestyle intervention	Michigan WISEWOMAN program A local health department WISEWOMAN program
	Pilot screening and lifestyle intervention program involving one local health department WISEWOMAN program and a local YMCA	A local health department WISEWOMAN program A local YMCA
	A training for WIC providers on gestational diabetes and development of nutrition care plans for these clients	Michigan WIC program
	Support for a regional diabetes initiative	Regional diabetes initiative (led by a health plan and a healthcare system)
	A screening program in community locations led by a regional diabetes outreach network	TIPDON
Minnesota	Support for the development and release of statewide prediabetes screening and treatment guidelines	Statewide diabetes steering committee Statewide clinical guideline development organization
	Newspaper and TV media to increase prediabetes awareness	Minnesota Diabetes Collaborative Statewide diabetes steering committee State public health genomics program American Diabetes Association (Minnesota)
	A multisite screening and lifestyle intervention (I CAN Prevent Diabetes) involving local Steps programs, clinics, and YMCAs	Steps to a Healthier Minnesota (and local Steps programs in Rochester, St. Paul, Willmar, and Minneapolis) Four clinics Two YMCAs and one parks and recreation center
Washington	A screening program in a rural hospital district for prediabetes incorporated into an existing health risk assessment for county employees	A rural hospital district
	A collaboration with REACH organizations in Seattle to conduct screenings in three community-based health clinics or organizations, all of which serve racial and ethnic minorities	REACH Seattle Three community-based clinical/health organizations

DPCPs, Diabetes Prevention and Control Programs; DPPI-IFA, Diabetes Primary Prevention Initiative Interventions Focus Area; I CAN Prevent Diabetes, Individuals and Communities Acting Now to Prevent Diabetes; REACH, racial and ethnic approaches to community health; TIPDON, Northern Michigan's Diabetes Outreach Network; WIC, U.S. Department of Agriculture's Special Supplemental Nutrition Program for Women, Infants, and Children; WISEWOMAN, Well-Integrated Screening and Evaluation for Women Across the Nation

DPCPs partnered with regional or state nonprofit organizations, three partnered with businesses or employers, and four partnered with healthcare organizations. Primary partners worked directly with DPCPs on design or implementation of interventions, whereas secondary partners worked closely with primary partners but had little direct interaction with DPCPs. For example, in one state, the health department partnered with a local community-based diabetes organization, which in turn partnered with a hospital and a business to conduct a worksite screening.

Across all five states, three key themes emerged regarding reasons state DPCPs recruited partners for this work: previous experience or work with DPCP or DPCP staff, access to target audience, and previous experience in the area of intervention. Almost all DPPI-IFA states utilized existing organizational or personal relationships to identify potential partners for implementation of their DPPI-IFA interventions. In many cases, DPCPs were able to capitalize on their relationships with other state health department programs to integrate diabetes primary prevention and prediabetes screening into other areas of work. Many partners were selected because they provided access to high-risk target groups; for example, Well-Integrated Screening and Evaluation of Women Across the Nation (WISEWOMAN); Women, Infants, and Children (WIC); and Racial and Ethnic Approaches to Community Health (REACH).

Partners' reasons for participating included that the DPPI-IFA interventions were in line with their organizational priorities and were a natural fit with their organizations' existing work. Having even relatively modest resources available was enough for several DPCPs and organizations to initiate a partnership.

Description of the Interventions

The DPCPs implemented a variety of interventions in three main domains: diabetes primary prevention and prediabetes awareness, screening activities and lifestyle interventions, and prediabetes-related health policy.

Diabetes primary prevention and prediabetes awareness interventions. Educating and raising awareness of prediabetes was a priority for many programs; the five DPCPs implemented five interventions in provider awareness and three in public awareness. Educational activities were conducted for providers as part of some screening programs to prepare them to diagnose and treat individuals with prediabetes identified by the community-based screening, and in one state a statewide educational training on gestational diabetes and nutrition care plan materials were developed for WIC providers. For the general population, another state conducted several awareness-raising campaigns around family history of diabetes as a risk factor for diabetes and diabetes primary prevention.

Screening activities and lifestyle interventions. All five DPCPs implemented some type of screening component for their DPPI-IFA intervention, with three worksite interventions, three health system interventions, two interventions in health departments, and four in other settings. One feature of the DPPI-IFA was that screening programs generally took place in a community or nonclinical setting, diagnosis took place in a provider's office or another clinical setting, and interventions were placed once again in the community. This necessitated linkages and information flow between the public health/community organizations and clinical providers. Community-based screenings took place in health fairs and other community settings, such as Laundromats, food pantries, and free clinics. Another state implemented two screening pilots in local health department settings through their existing WISEWOMAN program. Finally, two states implemented screening in providers' offices, either in a network of clinical sites in partnership with local Steps to a HealthierUS programs or within a healthcare system.

The linkages between screening activities outside clinical settings and a formal diagnosis of prediabetes in a clinical setting varied significantly across interventions. Importantly, DPCPs were almost universally aware that having a referral source for people was critical before implementing a community-based screening intervention. Resources and strategies to accomplish this varied greatly across locations; screened participants in one community-based program were told to visit their primary care provider for diagnosis, whereas participants in a worksite intervention had access to a clinical team and "in-house" oral glucose tolerance testing (OGTT). Other interventions relied on existing referral networks, which at times were strengthened by activities of the DPCP or partner staff.

In the majority of screening interventions, OGTT, conducted in a provider's office, was recommended as the diagnostic test of choice. However, screening programs used a variety of tests to identify people at high risk for prediabetes and requiring in-office, OGTT diagnosis. These included the ADA paper risk test, a paper screen or computer algorithm using National Diabetes Education Program (NDEP) criteria for prediabetes screening, random capillary glucose tests, and fasting capillary glucose tests. Three of the five states had developed a formalized, documented screening algorithm. Most states acknowledged the importance of tracking and follow-up of individuals screened; two states tracked people screened and

conducted follow-up, one using a paper system and one a computer database.

Most of the screening activities were paired with lifestyle interventions for those identified as high risk for or having prediabetes. Interventions were offered at worksites; in community settings; at YMCAs; and, for one healthcare system initiative, as part of their weight management program. Almost all the interventions were described as being adapted from the Diabetes Primary Prevention (DPP) curriculum.[3,4] This tailoring of the DPP curriculum resulted in a shorter (hours and sessions) treatment intervention. In addition to health education in a group setting, features of the interventions included one-on-one sessions with a lifestyle coach, weekly weigh-ins, or a free 4-month membership to a local gym. The number of contact hours per participant ranged from one visit to 16 hours. Most interventions were free for the participants. Although designed for people with prediabetes, the lifestyle interventions in the three states that had results at the time of data collection each included participants either whose status was not known or who were known to not have prediabetes.

Prediabetes-related health policy. Across the five DPCPs, there were three health policy interventions in health systems, two in health departments, and three in other settings. One state worked extensively in diabetes-related health policy, by partnering with a state-based clinical guideline–making body of medical groups, hospitals, and health plans to strengthen references to prediabetes within the context of two existing guidelines and to contribute to a new primary prevention of chronic disease guideline. In another state, policy-level work included institutionalizing diabetes and prediabetes screening into the WISEWOMAN program and working to have prediabetes detection activities included in a regional diabetes initiative led by a health plan and healthcare system.

Preliminary Outcomes of the Interventions

The purpose of the present case study was descriptive, not evaluative, and a description of results relies on the evaluations conducted by the DPCPs as well as information collected in the case study interviews. Several states collected process and impact measures, whereas others were less engaged in evaluation activities. In general, relatively little data were available on the implementation or outcomes of activities other than the screenings for prediabetes.

Organizational and community level. Across the state DPCPs, there is evidence that some interventions have been institutionalized and will continue after funding ends. These include screening and lifestyle interventions incorporated in one state's WISEWOMAN program after a successful pilot in one county, the WIC nutrition care plan incorporated into one state's manual and standard protocols, and the prediabetes screening that was incorporated into a countywide health promotion campaign. The clinical guidelines in one state, expanded to incorporate prediabetes, also represent a major potential policy force.

Some evidence suggests that prediabetes programming has become institutionalized within the DPCPs and will continue even without future dedicated funding. An additional outcome of note is the enhanced expertise or capacity of DPCPs and partners to work in prediabetes or conduct specific interventions.

Individual level. Summarizing individual-level outcome results of the DPPI-IFA is challenging because data were unavailable or incomplete at the time of data collection and because different screening and diagnosis strategies were used across sites. This paper summarizes available data from three worksite interventions in two states, the WISEWOMAN screening pilot in a third state, and community-based screening initiatives in a fourth.

Reach. The worksite interventions had potential to reach large numbers of people (from 600 to 6,000); the interventions did reach from 1% to 18% of employees. The WISEWOMAN pilot had a potential reach of 250 participants. The community-based screenings had an unknown number of potential participants.

Yield. In one state with two different worksite screenings, more than 80% of people were classified as at risk and recommended for OGTT testing based on NDEP criteria. In the second of these screenings, approximately 15% of people referred to OGTT were ultimately diagnosed with prediabetes. In two other states, which used capillary fasting tests, approximately one quarter to one third of people screened had a blood glucose level over the cutoff of 100 mg/dL. Unfortunately, no additional data are available on the diagnoses (yield) of prediabetes from these groups.

Enrollment in interventions. It is not possible to assess whether enrollment of people with prediabetes into the interventions was successful, because interventions were generally open to people who signed up for screening, regardless of their risk status or screening results, and because of the limitations of the tracking systems employed. In one state, 80% of those referred for the intervention did enroll.

Intervention completion. Two states reported data on intervention completion, reporting high levels (87% and 95%).

Outcomes of the interventions. The screening programs that included a lifestyle intervention resulted in modest, but potentially meaningful, weight loss. One intervention reported an average weight loss of 3.6% ($n=14$ people); the second reported an average weight loss of 4.3% ($n=14$); and the third reported an average weight loss of 0.1% ($n=33$).

Facilitators of Success

Several respondents commented that utilizing existing partnerships was integral to the implementation of interventions. Often DPCPs developed strong working relationships with new partners; elements that made these new relationships effective include identifying capable lead people within the partner organization and having a common organizational goal to address prediabetes.

An additional facilitator of success reported by several DPCPs was the ability to provide even minimal funding to partners to implement activities. Finally, three states had participated in previous diabetes prevention planning work,[14,15] which helped them develop ideas for diabetes primary prevention projects as part of the DPPI-IFA.

Challenges

Although all DPPI-IFA DPCPs and partners described their work with DPPI-IFA as a success, they also acknowledged many challenges. Challenges specific to the DPPI-IFA were the level of DPPI-IFA funding to DPCPs; the nature of the funding (uncertain levels of funding year-to-year); and the tight timeline within which interventions were to be implemented.

Other challenges are generalizable to community-based diabetes prevention programs. In the screening phase of interventions, the variety of screening tests available and slightly varying published algorithms[13,19] presented a challenge for DPCPs and partners. States reported spending a substantial amount of time investigating various tests and designing screening protocols, which decreased the time available to identify or develop lifestyle intervention programs. Also, recruitment of participants was a challenge for several states, and worksites presented unique implementation challenges. Both states with worksite interventions needed to develop strategies that would allow for inclusion of participants working different shifts, while not disrupting productivity. Finally, establishing strong links between the public health or community organizations and primary care providers, ensuring that referral appointments were kept, and obtaining diagnostic test results were notable challenges for several states. Intervention staff received diagnostic information for between 3% and 100% of patients. This indicates suboptimal integration in some cases between the primary care delivery system and public health.

In the intervention phase, implementing the DPP curriculum as designed was too burdensome, but two states noted that adapting the DPP curriculum was also a challenge in terms of time and resources required. Programs also found it challenging to identify enough people with a diagnosis of prediabetes to fill capacity in the lifestyle interventions because of the tight timeline, low numbers of people recruited, and delays in getting reports back from providers. As a result, people with an unknown status or who were known to not have prediabetes were enrolled in the classes.

A final challenge related to the technical aspects of tracking participants and the need for data systems. All programs did follow lifestyle intervention participants, although not all programs tracked screened participants. Programs commented that some partner staff lacked experience with data collection or computer skills necessary to maintain the data.

Discussion

For the past 3 years, the DPPI-IFA has challenged state DPCPs to develop novel interventions in diabetes primary prevention in order to translate research findings of clinical trials into real-world settings. The current case study was designed to provide a midcourse snapshot of these pilot interventions, their implementation, and early outcomes, and to inform CDC and future diabetes primary prevention efforts by other DPCPs.

The major limitation of the present case study is that it was conducted while DPCPs were still in the implementation phase of their interventions. Thus, it cannot be considered a final description of their work. In addition, the current case study was not intended as an evaluation. Any findings or recommendations that extend beyond a description of the five state interventions deserve further exploration.

Although each DPCP in the DPPI-IFA tackled only one of a few interventions, together the five DPCPs contributed to policy, organizational, and individual change. In addition to the individual successes of each state, as a pilot initiative, the DPPI-IFA met its goal of furthering the translation of clinical trials in diabetes primary prevention to community-based health and public health settings. The present case study complements other reports emerging from community-based projects[20–22]; the DPPI-IFA is unique, however, in terms of having state public health entities in the role of disseminators or facilitators of such projects.

Table 3. Recommendations for funders, public health programs, and other stakeholders

CDC or other funders	Provide sustained and sufficient funding. Provide sufficient time for planning and implementation. Provide appropriate technical assistance on screening protocols and tests for identifying people at risk for prediabetes and diabetes in a community-based screening. Conduct a comprehensive evaluation at the end of the DPPI-IFA, including a cost-effectiveness analysis of clinical interventions and an evaluation of the health policy and awareness interventions. Reconsider the feasibility of screening programs taking place in community settings.
DPCPs or other public health programs	Maximize existing relationships when identifying primary prevention partners. For screening and lifestyle interventions: Consider a prolonged awareness phase prior to recruitment. Evaluate and adopt existing algorithms or protocols. Allocate sufficient staff and resources for tracking and follow-up of participants. Ensure clinical referrals and a mechanism to get diagnostic information in a timely fashion. Consider offering an educational intervention for referral physicians. Adopt existing intervention curriculum if possible. Track people recruited and screened; adopt existing data systems for tracking and evaluation. Strengthen evaluation by involving appropriate staff (for DPCPs, an epidemiologist or evaluator). Recognize that partners may need assistance with developing or using data collection systems. Look for potential policy or health system interventions that can complement or facilitate clinical interventions.
Other partners/stakeholders	Recognize the important contribution of local networks of organizations and access to secondary partners that will aid diabetes primary prevention initiatives. Seek necessary technical assistance regarding data systems, tracking, and evaluation.

DPCPs, Diabetes Prevention and Control Programs; DPPI-IFA, Diabetes Primary Prevention Initiative Interventions Focus Area

The DPPI-IFA illustrates many of the challenges previously described in translating diabetes prevention science into public health practice. These include deciding on the target population for intervention and the screening tests to be used to identify them; integrating healthcare and public health systems; designing the lifestyle interventions, including who should deliver them and where they should occur; understanding the need for interventions to be intensive and sustained in nature; and determining who should pay.[11,15,23,24] The DPPI-IFA also demonstrates the challenges of establishing effective linkages between public health or community organizations and primary care.[25,26]

The specific challenges of the DPPI-IFA programs offer valuable lessons in terms of recommendations for CDC or other funders, DPCPs or other public health programs attempting to translate clinical trials into real-world settings, and other partners or stakeholders (Table 3). For funders such as CDC, it is critical to provide sufficient and sustained funding and to provide sufficient technical assistance, in the case of the DPPI-IFA to help grantees to understand and translate technical aspects of community-based screening (which tests to use, how to track participants) and lifestyle interventions (how to adapt the DPP curriculum).

For DPCPs and other public health programs, there are numerous lessons learned from the variety of clinical interventions of the DPPI-IFA, which address increasing reach of the interventions (e.g., implementing prolonged educational phases prior to recruitment); increasing quality of the screening (e.g., adopting existing protocols); increasing the yield of screening (e.g., ensuring linkages to providers for diagnostic screening, tracking participants); and strengthening evaluation. Finally, an important lesson learned from this initiative is that although utilizing partners and networks of organizations to implement the varied components of these interventions is necessary, one must recognize and address that partners may have varying levels of knowledge about prediabetes, screening and lifestyle interventions, and systems necessary to conduct evaluation. The overall lack of outcome data available at the time of this case study highlights an important and potential gap; future efforts must prioritize measurement of effectiveness and ideally cost effectiveness if a case is to be made to disseminate diabetes prevention programs widely.

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