



Applying national survey results for strategic planning and program improvement: The National Diabetes Education Program



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ABSTRACT

Since the 1970s, the federal government has spearheaded major national education programs to reduce the burden of chronic diseases in the United States. These prevention and disease management programs communicate critical information to the public, those affected by the disease, and health care providers. The National Diabetes Education Program (NDEP), the leading federal program on diabetes sponsored by the National Institutes of Health (NIH) and the Centers for Disease Control and Prevention (CDC), uses primary and secondary quantitative data and qualitative audience research to guide program planning and evaluation. Since 2006, the NDEP has filled the gaps in existing quantitative data sources by conducting its own population-based survey, the NDEP National Diabetes Survey (NNDS). The NNDS is conducted every 2–3 years and tracks changes in knowledge, attitudes and practice indicators in key target audiences. This article describes how the NDEP has used the NNDS as a key component of its evaluation framework and how it applies the survey results for strategic planning and program improvement. The NDEP's use of the NNDS illustrates how a program evaluation framework that includes periodic population-based surveys can serve as an evaluation model for similar national health education programs.

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1. Introduction

Since the early 1970s, the federal government has spearheaded several large-scale national education programs to reach the public and health care providers with critical information on preventing and managing the leading chronic diseases affecting the U.S. population. Guided by the latest scientific research, these national health education programs have addressed conditions such as diabetes, asthma, cholesterol, eye diseases, blood pressure, and kidney disease.

Abbreviations: CATI, computer-assisted telephone interviews; CDC, Centers for Disease Control and Prevention; CI, confidence interval; DPP, Diabetes Prevention Program; NDEP, National Diabetes Education Program; NIDDK, National Institute of Diabetes and Digestive and Kidney Diseases; NIH, National Institutes of Health; NNDS, NDEP National Diabetes Survey; OR, odds ratio; RDD, random-digit dial.

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As shown in In*line Supplementary Table S1, these education programs¹ share common characteristics:

- They are federally sponsored and have a national agenda to reduce the disease burden in the United States.
- The programs are designed to reach a variety of audiences: the general public, those at high risk for the disease, those who have the disease or condition, and health care professionals.
- They employ a wide range of outreach methods and channels, including traditional media, social media, web-based resource portals, educational materials, and awareness-building campaigns.
- They develop partnerships with state and local health departments, key professional and voluntary organizations, and community stakeholder groups to enlist their support and help with disseminating and promoting program messages and materials to their constituents.

¹ Program characteristics developed from website information, current as of December 19, 2013.

In*line Supplementary Table S1 can be found online at <http://dx.doi.org/10.1016/j.evalprogplan.2014.10.002>.

2. Challenges of evaluating the impact of National Health Education Programs

Evaluating the impact of national health education programs presents a number of challenges. The requirements of “gold standard” evaluation designs (e.g., comparison groups, holding an intervention constant) do not align with the way these education programs work (e.g., no comparison group, multiple and frequently-updated implementation strategies). Federally sponsored education programs do not operate in isolation. Many other non-profit and commercial entities conduct their own education programs and advertising campaigns at the same time, distributing consistent or possibly conflicting messages. As a result, evaluations of the programs generally cannot provide evidence for causation.

National health education programs are inherently “messy,” and the path from intervention to effect can be indirect (Hornik, 2002) and difficult to detect or isolate. For example, programs often have little or no control over placement of public service announcements in media channels. Furthermore, partner organizations may not be able to schedule their activities at the same time as the national program, diminishing the frequency and intensity of message delivery. In addition, federally sponsored education programs with the mandate to address public health priorities often must target their activities to multiple audiences who have the greatest risk or greatest disease burden such as racial and ethnic minority audiences or seniors. As a result, program resources are spread across efforts to reach multiple audiences with tailored messages instead of intensively targeting just a few audience segments over a long period of time. Large-scale national programs do not always publish their evaluation methodology or program results; thus, there is scant literature on relevant evaluation efforts. For example, the programs shown in In*line Supplementary Table S1 all conduct evaluation activities; however, they do not always report their evaluation framework or results in peer-reviewed journal articles.

One relatively recent article reviewed communication campaigns that employed a range of program and evaluation designs to target health behaviors (Wakefield, Loken, & Hornik, 2010). The authors noted that such campaigns were delivered in experimental settings or as regional or national interventions that are not operationally constrained to meet the needs of outcomes assessment. Evaluation designs for the latter include time series analyses, natural experiments, and analysis of associations in population-based studies. The authors concluded that, although isolating independent effects of mass media campaigns is difficult, “substantial evidence has, however, been garnered from study designs that, in isolation, are less than classically excellent, but in aggregate yield a substantial body of support for the conclusion that mass media campaigns can change population health behaviors” (p. 1268). Evaluators such as Davidson, Nakazona, Afifi, and Gutierrez (2009), Helitzer, Peterson, Thompson, and Fluder (2008), and Wutzke et al. (2007) have included baseline, process, and outcome measures collected from a single source or triangulated from multiple sources as part of a one-time or longitudinal evaluation study.

This article describes the ongoing evaluation activities of the U.S. Department of Health and Human Services’ National Diabetes Education Program (NDEP). The article details how the NDEP conducts periodic surveys and uses the results to inform strategic planning and program improvement.

3. Overview of the National Diabetes Education Program

The NDEP was launched in 1997 to improve diabetes management and to reduce the morbidity and mortality from

diabetes and its complications. The program is sponsored by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) of the NIH and the Division of Diabetes Translation of the Centers for Disease Control and Prevention (CDC). As shown in In*line Supplementary Table S1, the program is a multi-faceted information and education program that works closely with more than 200 public and private-sector organizations.

The program’s goals are to improve diabetes management and outcomes, promote early diagnoses, and prevent or delay the onset of type 2 diabetes in the United States and its territories. Since its inception in 1997, the NDEP has become a leader in the development and implementation of diabetes information, education, and outreach activities.

Due to the NDEP’s multi-faceted nature of the program, its theoretical underpinnings span multiple theories and models of communication, learning, and behavior of individuals, social groups, and communities. The overall Program is guided by a logic model (presented in Section 4.2), with relevant theories used to develop specific interventions. To further ensure cohesion among interventions, planners use a framework that focuses on eight variables important to behavior change across five commonly used theories. Three of these variables are necessary and sufficient for behavior change: whether the environment provides opportunity for the behavior or at least does not constrain it, whether the individuals have adequate motivation or positive intent to engage in the behavior, and whether they have adequate skills or ability to do so (Fishbein et al., 2001; Lotenberg, 2010).

For example, in recent years as NDEP has focused more on helping people change their behavior, the program has turned to the transtheoretical model of stages of change (Prochaska & DiClemente, 2005) for guidance. The temporal aspects of the transtheoretical model provide guidance on who is likely to be ready to change and what they need – costs reduced or benefits increased – to move to the next stage. (See Fig. 1 below showing the temporal relationship.) NDEP used this model to identify individuals’ stage of change in the revised NNDS instrument for the forthcoming survey as well as in designing the instrumentation for an evaluation of Diabetes HealthSense (<http://ndep.nih.gov/resources/diabetes-healthsense/>), NDEP’s web-based behavior change resource compendium.

With guidance from leading experts in diabetes, the program develops its strategic plans and its messages and materials to be consistent with the latest scientific research on effective approaches to diabetes prevention and management. As a public health program, the NDEP bases its priorities on an understanding of the epidemiology of diabetes and the disproportionate disease burden among different population subgroups. To reach these target subgroups, the NDEP uses a wide array of outreach and education strategies. These include Diabetes HealthSense (a comprehensive website containing resources for people at risk for or with diabetes, their family members, and health care professionals), training and technical assistance for organizations addressing various audience groups, outreach through mass media and social media, and educational materials that can be obtained free of charge from the NIDDK National Diabetes Information Clearinghouse. The NDEP’s partners supplement national distribution of the program’s messages through their own communications channels.

4. The NDEP evaluation framework

4.1. NDEP’s evaluation history

The NDEP has conducted ongoing evaluation research activities on diabetes since the program was created. The program’s initial and subsequent strategic plans have been based on periodic review

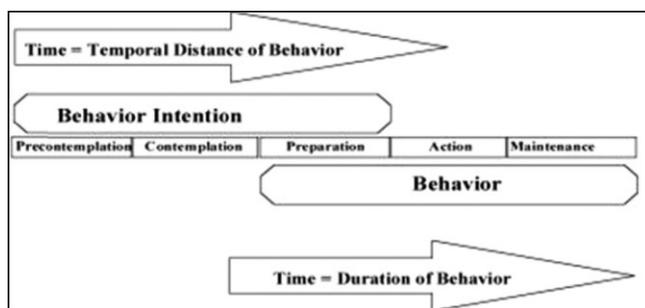


Fig. 1. The temporal dimension as the basis for the stages of change.

Source: Fig. 1 in the detailed overview of the transtheoretical model. Cancer Prevention Research Center, University of Rhode Island [Material adapted and updated for this Website from: Velicer, W. F., Prochaska, J. O., Fava, J. L., Norman, G. J., & Redding, C. A. (1998) Smoking cessation and stress management: Applications of the transtheoretical model of behavior change. *Homeostasis*, 38, 216–233] <http://www.uri.edu/research/cprc/TTM/detailedoverview.htm>.

and monitoring of the health behavior literature and existing national health survey data available from the Federal government and program partners.

Reviews of secondary research enable the program to track trends in diabetes epidemiology and available, but limited, data on target audience knowledge, attitudes and practices. Program planners typically examine data from these sources: current population trends, the nature and extent of the burden of diabetes, and disparities in the disease's impact on various population subgroups. To gain further insights about its target audiences, the program has used formative qualitative research methods, such as focus group interviews, to guide message development and has pretested messages with individuals in its target audiences.

Two major limitations of other existing national health surveys are that they do not focus on diabetes nor do they assess knowledge, attitudes and practices about diabetes. As the NDEP matured, became more complex, and expanded its focus to include type 2 diabetes prevention as well as diabetes management, the limitations of existing survey data to inform program development became more apparent. The NDEP also found that the time between data collection and publication of study results was too long for its purposes.

4.2. Development of NDEP's evaluation framework

In 2005, with consultation from experts in diabetes and national health education program evaluation, the NDEP took stock of its past evaluation activities and formulated an evaluation framework that has guided its more recent efforts (Gallivan, Greenberg, & Brown, 2008). Similar to the work of MacDonald et al. (2006), the framework and plan are based on the CDC's *Framework for Program Evaluation in Public Health* (1999).

The current NDEP Evaluation Framework has three components:

- A logic model of program inputs, outputs, and outcomes that guides the direction of program evaluation efforts. (See In*line Supplementary Figure S1.) NDEP uses the different constructs of the logic model to identify specific theoretical approaches that can guide intervention development to maximize achievement of outcome(s).
- A set of program outcome measures that is used to monitor diabetes-related changes over time in the program's target audiences. Data for the measures are gathered using the evaluation methods below.

- Quantitative and qualitative evaluation methods that provide NDEP with results to close information gaps and allow timely evidence for planning and decision-making. Semi-annual reviews of quantitative data from published national health surveys² are augmented with qualitative and quantitative primary data from a periodic national survey, the NDEP National Diabetes Survey (NNDS). The NNDS survey provides additional diabetes-related information that is not available from existing national health surveys.

In*line Supplementary Figure S1 can be found online at <http://dx.doi.org/10.1016/j.evalprogplan.2014.10.002>.

5. The NDEP National Diabetes Survey (NNDS): a key tool for program evaluation

To fill gaps in the data needed to assess program progress, the NDEP applied for and received NIH Evaluation Set-Aside program funding to conduct a population-based telephone survey – the NNDS-focused exclusively on diabetes-related knowledge, attitudes, and practices.

Population-based surveys are a well-established evaluation method used by national education programs (Dillman, Smyth, & Christian, 2009; Newcomer & Triplett, 2004). At baseline, they provide timely and representative national data to inform program planning; when conducted in the post-intervention period, they can be used to assess program outcomes. The NDEP tailored the use of this evaluation method to meet its needs, designing a survey that could be implemented frequently enough on a national scale to provide timely data without being too burdensome to the public for the program to conduct regularly.

Conducted every two to three years, the NNDS has become a key component of NDEP's ongoing evaluation efforts. The NDEP conducted the first NNDS in 2006 to measure public knowledge, attitudes and practices related to diabetes prevention and diabetes self-management. Since then, the NDEP has conducted the survey in 2008 and 2011, and plans to conduct another in late 2014.

5.1. NNDS survey design

Each NNDS survey was conducted using a random-digit-dial (RDD) national probability sample of the U.S. civilian, non-institutionalized adult population living in households that had landline telephones. All survey rounds used consistent methodology and question wording to allow examination of trends over time. The computer-assisted telephone interviews (CATI) were conducted in English or Spanish, depending on the survey respondent's preference.

In 2006, the 1763 respondents who completed the survey were adults ages 45 years and older. In 2008 ($n = 2078$) and 2011 ($n = 2234$), the age criterion was expanded to include adults ages 35- to 44-years-old since research showed that the rate of type 2 diabetes was growing fastest among adults in this age group. Data reported in this article are restricted to the survey populations 45 years and older so that the sample parameters are consistent across all three surveys.

Each time the NDEP conducted the survey, African Americans and Hispanics were oversampled to ensure adequate representation of these groups. Survey response rates ranged from 30% to 54% for the three survey rounds, typical for RDD surveys of this

² Surveys such as the National Health Interview Survey, the National Health and Nutrition Examination Survey, the Behavioral Risk Factor Surveillance System, and other private sources (e.g., American Diabetes Association-commissioned surveys, Porter Novelli Health Styles).

Table 1
Definitions of respondents' diabetes status.

Type of respondent	Operational definition
People with diabetes	• Said they had been told by a doctor or other health professional that they had diabetes or sugar diabetes
People with prediabetes	• Said they had been told by a doctor or other health professional that they had prediabetes, impaired fasting glucose, impaired glucose tolerance, borderline diabetes, or high blood sugar
People at risk	• Self-reported height and weight that gave them a body mass index of 25 or greater, or • Said they had been told by a doctor or other health care professional that they were at risk for diabetes, or • Said they had been told by a doctor or other health care professional that they had gestational diabetes or high blood sugar during pregnancy
All others	• Met none of the above criteria

kind.³ Each survey data set was weighted to reflect unequal selection probabilities and the race/ethnicity, gender, age, education, and marital status of the U.S. population. The data were analyzed for the sample as a whole and for subgroups of particular interest to the NDEP. These include people with diabetes, people with prediabetes, people at risk for diabetes or prediabetes (see definitions for the post hoc coding⁴ in Table 1), and African Americans and Hispanics.

5.2. Limitations of the NNDS

Although it is a key component of the overall NDEP evaluation strategy, the NNDS has its limitations. The survey excludes people who live in nonresidential settings or in households without landline telephones and also those who do not speak English or Spanish well enough to participate in an interview. Data are self-reported and may or may not accurately reflect an individual's knowledge, attitudes, practices, and demographic or anthropometric characteristics. In addition, NDEP activities are implemented nationally rather than in a constrained experimental setting; therefore, the NNDS trends reported here do not necessarily reflect changes that are due solely to the NDEP's education activities.

6. How the NDEP has used NNDS results

The NNDS results have been important for NDEP strategic planning and for identifying program improvements. As discussed in several examples below, the survey results are used to document audience trends and have guided NDEP in the development of new messages and campaigns, in refining previous messages, and in making needed changes in promotion, dissemination and partnership strategies.⁵

6.1. Tracking trends in public awareness and knowledge about diabetes

When the NDEP was established in 1997, public awareness of diabetes as a serious disease was very low – only 8% of Americans

³ According to survey experts at the Department of Education (Federal Register/Vol. 75, No. 177/Tuesday, September 14, 2010/Notices, p. 55779), random digit dial (RDD) survey response rates declined from above 80% in early 1990s to 53% in 2007, and they have continued to decline. The decline in the percentage of households without landline telephones (from 93% in early 2004 to about 75% in 2009 mostly due to conversion to cellular-only coverage) has contributed to that decline.

⁴ Some people categorized as having prediabetes or being at risk for type 2 diabetes or prediabetes may not have identified themselves as such at the time of data collection. For example, someone told by a doctor that s/he had impaired glucose tolerance would not necessarily know that the term meant prediabetes. Similarly, those categorized into the people-at-risk group based on their self-reported height and weight may not have known they were at risk for diabetes. This lack of awareness could explain inconsistencies between diabetes status and expected behaviors.

⁵ An article with NNDS trend results for 2006, 2008, and 2011, "Recent trends in diabetes knowledge, perception, and behaviors: implications for national diabetes education," currently is under review.

considered it serious (NDEP/NIH, 2007). As a result, throughout the first 10 years of the program, NDEP and its partners focused on disseminating and reinforcing the message that "diabetes is a serious, common, costly, yet controllable disease" to the public, people with diabetes, health care professionals and the media. By 2006, the NNDS data showed that over 90% of people surveyed considered diabetes to be "very serious."

In 2002, the NDEP was charged with disseminating the results of a landmark NIH-led clinical trial, the Diabetes Prevention Program (DPP), to the public and health care providers. The trial showed that onset of type 2 diabetes can be prevented or delayed in people at high risk for diabetes who had a newly named condition, called "prediabetes," that can be a precursor to diabetes. Beginning in 2003, the NDEP launched several waves of a multi-faceted media campaign, developed prevention messages and materials, and devoted a section of its website to prevention. The NNDS has shown significant knowledge gains:

- In 2006, 65% of adults ages 45 and older knew that type 2 diabetes can be prevented; by 2011, this proportion rose significantly to 77%.
- Awareness of the term "prediabetes" increased from 45% in 2006 to 57% in 2011.

6.2. Identifying improvements in program messages: perceived risk of diabetes

A key objective in the campaign to promote the results of the Diabetes Prevention Program (DPP) trial was to inform the public about who is at high risk for diabetes and how they can take action to prevent onset of the disease. The 2006 NNDS provided the NDEP with the first measure of public perceptions of diabetes risk. The 2006 results revealed that only 26% of the population at high risk for type 2 diabetes reported actually feeling they were at risk for the disease. These proportions remained the same in the 2008 and 2011 surveys. Furthermore, multivariate analyses of the 2006 NNDS data (after adjusting for multiple risk factors) revealed that two high-risk population groups, African Americans (OR [odds ratio] 0.53; 95% CI [confidence interval] 0.29–0.96) and older adults (OR not available), were significantly less likely than non-white Hispanics and younger adults, respectively, to report that they felt at risk for developing diabetes (Gallivan, Brown, Greenberg, & Clark, 2009). Younger adults were more than twice as likely as older adults to feel at risk for diabetes (OR 2.50; 95% CI 1.56–4.01).

Diabetes risk increases with a number of factors: having prediabetes, being a member of a racial or ethnic minority group, being over age 45, being obese or sedentary, and having a family history of diabetes. The NNDS showed that among those not diagnosed with diabetes, the most common reason given for feeling at risk for the disease was having a family history of diabetes (61% in 2006, 62% in 2008 and 51% in 2011, not significant for either the 2006–2011 or 2008–2011 comparisons). Being

overweight was the reason mentioned next most often, although the percentages did not change significantly from 2008 to 2011 (23% in 2006 and 2008, to 31% in 2011, not significant; the standard errors were large, relative to the size of the estimates).

Initially, NDEP's materials emphasized risk factors such as age, being a member of a racial/ethnic minority, being overweight, or having a sedentary lifestyle. Drawing on the NNDS findings, NDEP revised its diabetes risk messages and materials and launched the *Family Health History* campaign in 2008. The campaign was designed to increase awareness of the family history risk message and was targeted to populations with the lowest levels of self-perceived risk of diabetes.

In 2011, the NNDS results on perceived risk of diabetes demonstrated no significant increases in the percentage of people who thought a family history of diabetes was a reason they could be at risk. The fact that the *Family Health History* campaign had been in progress fewer than three years by 2011 may partly explain the lack of significant change. The survey results continue to confirm that improving awareness of critical diabetes risk factors is challenging, particularly where most people at risk in the general population are not aware of their risk status.⁶ NDEP has responded to these latest findings by refining, focusing, and enhancing the *Family Health History* campaign. The program has identified improvements in conveying messages to the public around diabetes risk-patient counseling messages, educational materials, and behavior change strategies targeted to these audiences to increase perceived personal risk for diabetes and to empower people at risk to take action.

6.3. Providing direction for strategic planning

NNDS results have been an important factor in the NDEP's strategic planning process. When the NDEP was developing its 2011–2013 strategic plan, examination of NNDS results showed that while there was a high level of awareness of diabetes as a serious disease, that awareness had not been translated into high levels of behavioral changes by people with diabetes and those at risk. As a result, as we describe below, the current strategic plan (2014–2019) includes a focus on activities to support target audiences as they move toward behavioral changes; it also addresses areas of stagnation.

6.3.1. Moving from awareness to action: facilitating behavior change

Preventing or managing diabetes requires significant self-care that typically involves making and sustaining lifestyle changes such as losing or maintaining weight, changing dietary practices, and increasing physical activity. NNDS data show that knowledge that diabetes is serious and can be prevented or managed is not enough – people need to know *what* to do and they need ongoing support with *how* to do it.⁷

To support people at risk and people with diabetes in their efforts to adopt effective self-management behaviors and to help them understand how to take action, the NDEP worked with a team

of behavioral science experts to develop the Diabetes HealthSense website (www.YourDiabetesInfo.org/HealthSense). This online library of diabetes resources includes a series of behavior change videos with people talking about how they are working to prevent or manage diabetes, the struggles they face, and how they overcome these challenges. The website provides users with a searchable database of over 160 resources from more than 80 organizations that support people with diabetes, people at risk for the disease, and their caregivers. The resources address the wide array of psychosocial and lifestyle change challenges that can prevent people from achieving their goals.

6.3.2. Addressing areas of stagnation

The 2011 NNDS results and trend comparisons identified stagnant areas where there has been little or no change in target audience knowledge, attitudes or practices. The NDEP has examined three areas (detailed below) in developing the newly begun 5-year strategic plan as these appear to require additional attention and resources going forward:

- Understanding of diabetes self-management
- Understanding the link between diabetes and cardiovascular disease
- Perceptions of health care provider counseling

6.3.2.1. Understanding of Diabetes Self-Management. The NNDS assesses whether people with diabetes have received education on nine key aspects of self-management and how they rate their understanding of each topic. Trends from the NNDS 2006–2011 showed an early increase in the proportion of people with diabetes rating as excellent their understanding of how to use the results of blood sugar monitoring (41% in 2006, 48% in 2008 to 49% in 2011). Understanding of how to manage low blood sugar continued to lag behind understanding of other topics such as prevention of complications, prevention and treatment of high blood sugar, and using blood sugar monitoring results. The percentage of people who rated their understanding as poor was twice as high for managing low blood sugar (12%) as it was for the other topics (5–6% each).

Diabetes self-management education has proven to be one of the most effective strategies for helping patients manage their diabetes (Haas, Maryniuk, & Beck, 2014). As a result, Medicare and other major health care plans offer this education to people with diabetes. Yet, the NNDS results for 2011 show that only about half (49%) of people with diabetes reported attending diabetes self-management education classes or receiving counseling. The NDEP developed its *Managing Diabetes. It's Not Easy, But It's Worth It* campaign in 2009 to reinforce diabetes self-care knowledge and self-efficacy behaviors to support improved diabetes outcomes. Results from the most recent NNDS, however, show there is still room for improvement in self-management efforts for the disease, with no significant changes since 2006 in the proportion reporting they check their own blood sugar, keeping records of their results, or using insulin or taking oral medications.

6.3.2.2. Understanding the link between diabetes and cardiovascular disease. Cardiovascular disease is the leading cause of death and disability in people with diabetes (National Diabetes Fact Sheet, CDC, 2011). The 2011 NNDS showed that fewer than 10% of people surveyed in 2011 thought heart attacks, cardiovascular disease, stroke, or hypertension were linked to diabetes – and there have not been any significant changes in knowledge from 2006 to 2011. The NNDS findings indicate the need to re-energize efforts to communicate the link between diabetes and cardiovascular disease, the actions people can take to reduce their risk for heart

⁶ Only about 7% (2005–2006 NHANES) of people with prediabetes were aware they had it (Geiss et al., 2010). In 2009–2010, CDC reported this increased to 11% (NHANES data, as cited in MMWR March 22, 2013).

⁷ Since 2006, almost all people surveyed considered diabetes to be “somewhat serious” or “very serious” condition (99% in 2006 to 98% in 2011). In the same period, only about one-fourth (26% in 2006 to 25% in 2011) of people with risk factors said they felt at risk of developing diabetes or prediabetes. Only about three fourths (81% in 2006 to 77% in 2011) of people with diabetes said they checked their own blood sugar, and their understanding of other important factors in diabetes management and control (e.g., hypo- and hyperglycemia) showed no significant improvements from 2006 to 2011. This is an area where health professionals might help by providing support and encouraging referrals for diabetes education and self-management.

disease and stroke, and the critical importance of comprehensive management of diabetes.⁸

6.3.2.3. Perceptions of health care provider counseling. The NNDS data also provide information about people's perceptions of the involvement of their health care providers in helping them to prevent or manage diabetes. NNDS results suggest that health care providers play an important role in helping their patients take action to lower diabetes risk and to manage the disease. As in previous years, the majority of respondents (over 70% in 2011) said they followed their health care providers' advice on taking steps to reduce disease risk, yet the proportions of people who reported being told by a health care provider to exercise (51%), lose weight (47%) or reduce calories or fat (42%) in 2011 has not changed significantly since 2006. The NDEP is focusing on strategies to encourage health care providers to close this gap by referring their patients to diabetes prevention and education resources produced by the NDEP and other organizations. This activity has been designed to increase the number of people who receive ongoing support with lifestyle changes to prevent and manage diabetes by providing them with both the *what* and the *how*.

A key NDEP focus for addressing the stagnating areas has been the development of Diabetes HealthSense. The web-based HealthSense (<http://ndep.nih.gov/resources/diabetes-health-sense/>) provides a range of resources – general and focused (such as for specific audiences or healthcare providers) – that promote how to take action.

7. Lessons learned

The use of the NNDS, a tailored periodic national survey designed to meet the NDEP's specific strategic program planning needs, has been critical for evaluating the program's progress and achievements. The NNDS has informed the NDEP's strategic planning efforts, providing valuable results about public knowledge, attitudes and practices related to diabetes and identifying specific opportunities where new information, education, and messaging interventions are needed.

Evidence from the three rounds of the NNDS confirms substantial increases in awareness and knowledge about diabetes prevention and management. The survey results have pinpointed information needs such as altering messaging and materials to better connect with people at risk and to help them perceive their personal risk. The NNDS also provided the evidence needed to make a change in the program's strategic focus – from *what* to do to manage diabetes and change lifestyle behaviors to *how* to do this.

The NDEP's evaluation framework, which comprises a logic model, a set of outcome measures, and evaluation methods that include the periodic NNDS, have served the program well. Moving forward, the NNDS will continue to help the NDEP clarify and personalize its messages as well as to identify times when strategic shifts are advisable, such as moving along the continuum from raising awareness to supporting behavior change.

To sustain the survey's useful role in program evaluation, the NDEP periodically updates the NNDS to incorporate new and evolving research design approaches, sampling strategies, and data collection technologies. For example, the methodology for the next NNDS has been updated to engage better the U.S. cellphone-only and cellphone-mostly households.

The survey instrument has been updated to reflect changes in the language used to communicate about diabetes to more accurately measure progress. This required retaining or rephrasing

survey questions while preserving the ability to track key trend information. In particular, modifications to the survey questions are now focused on more thoroughly capturing individuals' readiness to change and their attempts at change, using behavioral models such as the transtheoretical model of stages of change (Prochaska & DiClemente, 2005).

8. Conclusion

The NNDS has given the NDEP valuable information for targeting and focusing the work that the program and its partners carry out across the United States. Conducting the survey more frequently than every five years, the traditional project or funding period, has reinforced the value of the survey information for program improvement and strategic planning – and it argues for a continued prominent role of periodic surveys in the evaluation framework utilized by the NDEP. This model of applying frequent, population-based, disease-focused survey results helps the NDEP move its program forward while NNDS findings also contribute to the body of knowledge on prevention and management of diabetes. This is an evaluation approach that similar programs can replicate – an activity that is feasible to conduct frequently and that provides regular programmatic results about a specific disease or condition of interest. In NDEP's present five-year strategic plan, periodic NNDS results – triangulated with other NDEP evaluation activities such as the semi-annual secondary data review of national survey results (described in Section 4.2) – will help the NDEP set directions and focus and will provide baseline results for measuring progress during this strategic plan period. The periodic NNDS findings provide valuable results that contribute to the body of knowledge on diabetes.

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⁸ Comprehensive management includes the ABCs of diabetes (A1C – a measure of average blood glucose, blood pressure, and cholesterol), as well as smoking cessation.

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