

Making Strides in Type 2 Diabetes Prevention

Ann L. Albright, Guest Editor

The prevalence of diagnosed diabetes in adults in the United States, currently at 23.1 million people, has tripled in the past two decades (1). In addition, an estimated 84 million adults have prediabetes, putting them at increased risk of type 2 diabetes, heart attack, and stroke; only 1 in 10 know they have it (2). If interventions to slow the increase in and ultimately reduce the number of new cases of diabetes are not widely implemented, projections estimate that one in three adults in the United States could have diabetes by 2050 (3).

Diabetes remains a leading cause of blindness, kidney failure, and lower-limb amputation, increasing these risks to 6–10 times that of people without diabetes (2). It also increases risks of macrovascular conditions such as heart attack and stroke by 60–80% (2). Fortunately, rates of heart attack, stroke, and cardiovascular disease (CVD) death have recently declined for many people with diabetes, but this has led to an exposure to and diversification of other outcomes, including increasingly diverse causes of death (4). Although CVD remains the leading cause of death for people with diabetes, its proportion has declined from half of all such deaths ~20 years ago to one-third of all deaths today. As a result, other causes, including influenza, pneumonia, septicemia, and chronic liver disease, now make up a greater proportion of the deaths of people with diabetes (4). Furthermore, diabetes doubles the risk of physical disability; adults with

diabetes who are ≥ 50 years of age lose independence 6–7 years before their peers without diabetes (5).

Diabetes is the costliest of the 155 most common diseases in the country, at \$327 billion in 2017, including \$237 billion in direct medical costs and \$90 billion in indirect costs (e.g., reduced productivity and absenteeism)—an increase of 60% from 2007 (6,7). Care for people with diabetes was responsible for one in every four U.S. health care dollars spent, and annual medical expenditures were \$16,750 per person with diagnosed diabetes—2.3 times as much as for those without diabetes (7).

The data are clear: diabetes poses a considerable burden to individuals, families, communities, and society. Fortunately, there is a substantial body of evidence supporting the prevention or delay of type 2 diabetes. Much of the evidence—more than a dozen randomized controlled trials—focuses on intensive, structured lifestyle change programs (LCPs) for individuals with prediabetes or otherwise at high risk for type 2 diabetes. These studies from the United States, China, Finland, Japan, India, and elsewhere all conclude that the development of type 2 diabetes can be reduced successfully through LCPs (8–12). Long-term trials that have followed participants for at least a decade show a continued, though reduced, statistically significant impact on type 2 diabetes onset (13,14).

In addition to research trials, there is a rich body of evidence that pro-

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vides critical information for moving these research results into implementation in settings where people spend most of their time—communities (e.g., community organizations, faith-based organizations, and senior centers), worksites, and health care facilities—and via digital modes (e.g., online, telehealth, and distance learning programs) (15–17). These translation studies have been instrumental in helping to reduce the expense of delivering the LCPs, which have been shown to be cost-effective and even cost-saving (18,19).

To capitalize on this wealth of evidence, the Centers for Disease Control and Prevention (CDC) established the National Diabetes Prevention Program (National DPP), a partnership of public and private organizations working together to build the infrastructure for nationwide delivery of the lifestyle intervention developed in the Diabetes Prevention Program (DPP) research trial (8,20). CDC, state and local health departments, community-based organizations, faith-based organizations, employers, insurers, health care organizations, and many others are working together to increase access to LCPs delivering this intervention, increase coverage among people at risk, implement systems to facilitate identification and referral to CDC-recognized organizations that have demonstrated the ability to deliver a quality program, and raise awareness of prediabetes.

The National DPP is growing rapidly, but much work remains, and it is with that in mind that we developed this *Diabetes Spectrum* From Research to Practice section. The need to engage millions of people who would benefit from lifestyle change intervention requires maximizing various modes of delivery and personnel trained to deliver the DPP-based intervention. Toward that end Kate Kirley and Neha Sachdev begin our discussion by reviewing evidence for digital delivery of the National DPP intervention, which is necessary to ensure access and to reach program scale (p. 303).

They also describe the use of digital tools such as trackers and reminders that support program delivery. These authors discuss research findings and highlight gaps in the literature, particularly in populations that are underserved relative to their diabetes burden. Their article also touches on insights that digital tools can provide about participant engagement.

Participant retention is one of the primary challenges and is necessary to achieve program goals and ultimately show a reduction in incidence of type 2 diabetes. Robin E. Soler and her colleagues address the journey that people at risk for type 2 diabetes take to become—and stay—engaged in a diabetes prevention program (p. 310). They draw from literature on behavioral economics to better understand key decision points along this journey. Because there can be multiple barriers and decision points, examining engagement and dropout in a comprehensive way is more likely to lead to effective solutions for improving program uptake and retention.

Evidence shows that the National DPP lifestyle change intervention can be delivered by both health professionals and paraprofessionals (21). A variety of health professions are well positioned to support the National DPP, either by delivering the intervention or by engaging in activities that increase program availability, uptake, visibility, and coverage. The article by Brooke D. Hudspeth (p. 320) provides evidence for the role of pharmacists in delivering services beyond those directly related to medication management, including contributions to the National DPP.

Although most evidence for type 2 diabetes prevention is among adults at high risk using lifestyle modification or medication, it is equally important to address whole-population strategies that focus on improving risk factors for everyone, because both individual and population-attributable risk contribute to type 2 diabetes incidence (22). Lack of phys-

ical activity and poor nutrition—the primary modifiable risk factors for type 2 diabetes—are important targets for both individual-level and whole-population interventions. Whole-population approaches under consideration include restrictions on marketing of less healthy foods on television or within stores, taxes on less healthy foods and subsidies for healthier foods, reformulations of commercially produced food to reduce less healthful ingredients, reductions of portion sizes for commercially packaged foods, and increased availability of walking/bike paths (23,24).

Studying whole-population strategies before their implementation is challenging. As a result, these policy, system, and environmental interventions are increasingly being evaluated once they are in place, using experimental and quasi-experimental designs that are often referred to as “natural experiments” (25).

Obesity and type 2 diabetes risk are intergenerational. As such, their prevention must address the life span, including prenatal, postnatal, and early-childhood periods (26). Women with a history of gestational diabetes mellitus (GDM) have a 40–60% chance of eventually developing type 2 diabetes and are thus an important target audience for prevention (27). The DPP research trial included women with a history of GDM and demonstrated that structured lifestyle intervention and metformin were similarly effective in preventing or delaying type 2 diabetes in these women (8). As part of our research section, Maria L. Gómez and her colleagues present the results of a small pilot study that examined the delivery of the National DPP lifestyle intervention to women with children ≤ 5 years of age (p. 324). This article describes the challenges faced by researchers in recruiting and retaining these women, provides insights from lifestyle coaches, and offers suggestions for program delivery to women with very young children. More

research is needed to determine effective ways to serve this population.

Obesity is a primary risk factor for type 2 diabetes and affects more than 18 million children; thus, prevention and treatment of childhood obesity is key to any comprehensive type 2 diabetes prevention plan (28). Deborah A. Galuska and her colleagues describe the burden of and contributors to childhood obesity (p. 330). The authors present evidence-based interventions for preventing unhealthy weight gain and for obesity management in children, including both individual-level and whole-population interventions.

Finally, although intensive lifestyle intervention is considered the foundation of type 2 diabetes prevention, some studies have also tested the use of medications (8,12,29). Metformin showed a 31% reduction in the development of type 2 diabetes in the DPP research study, with an 18% reduction when extended to 15 years. In our last article (p. 336), Vanita R. Aroda and Robert E. Ratner present research evidence for supporting the use of metformin in preventing type 2 diabetes and consider insights from research trials to answer questions such as whether metformin prevents microvascular complications or alters the underlying pathophysiology of prediabetes. The authors offer clinical practice recommendations for the use of metformin in prevention and identify existing gaps in evidence.

Preventing type 2 diabetes is a necessity. The toll diabetes takes is felt by every sector of society. In this From Research to Practice section, the contributing authors share valuable information and insights on some of the many areas of work and research currently underway in type 2 diabetes prevention. We have made great strides over the past two decades in gathering evidence for what works, laying the foundation for type 2 diabetes prevention strategies, and building a system for delivery of interventions nationwide. But much remains to be done to ensure that

people who are at risk get the support they need to live a healthier life and reduce their risk for type 2 diabetes.

This research section, along with the work that has come before, provides a wealth of knowledge for evidence-based decision-making to ensure better patient care and public health outcomes. Please use this information to further your work or to spur you to action in type 2 diabetes prevention. All of us working together can achieve this crucial goal.

Disclaimer

The findings and conclusions in this report are those of the author and do not necessarily represent the official position of the U.S. Centers for Disease Control and Prevention.

Duality of Interest

No potential conflicts of interest relevant to this article were reported.

Author Contributions

A.L.A. is the sole author and guarantor of this work and, as such, had full access to all of the references cited and takes responsibility for the accuracy of the content.

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