ORIGINAL ARTICLE

An opportunistic pre-diabetes screening program offered with existing hypertension screening

M.T. IQBAL
State University of New York (SUNY) Upstate Medical University, Syracuse University, Central New York Masters of Public Health (CNYMPH), USA

Key words

Diabetes mellitus • Hyperglycemia • Screening • Prevention

Summary

Diabetes mellitus refers to a group of metabolic diseases that share the hallmark characteristic of hyperglycemia. Generally, Diabetes is categorized as type I, or type II. Type I results from the body's failure to synthesize insulin, and requires insulin injections. Type II, also known as adult-onset or non-insulin dependent diabetes mellitus (NIDDM), occurs when the body's cells fail to use insulin properly due to a defective insulin receptor, and may also be combined with a relatively reduced insulin secretion. Type II can be managed with healthy lifestyle habits and early detection of high sugar levels. Most local health departments across New York State offer hypertension screening but no pre-diabetes screening programs. The US preventive Services Task Force recommends that asymptomatic adults with sustained blood pressure greater than 135/80 mm Hg should be screened for type II diabetes. Since high blood sugar levels can be controlled, and in some cases reduced, there exist strong benefits in offering pre-diabetic screening for individuals who are hypertensive.

Introduction

60 million adults in United States have been diagnosed with diabetes, are currently undiagnosed with this disease, or have pre-diabetes [1]. Pre-diabetes is a condition in which blood glucose levels are higher than normal, but not high enough for a diagnosis of diabetes. Clinically the range for a fasted blood glucose tests indicating pre-diabetes ranges from 100 mg/dL to 125 mg/dL, and may also be referred to as impaired glucose tolerance (IGT). Type II is the most common form affecting nearly 95% of the U.S. diabetic population [2]. This translates to an alarming 9% prevalence of this disease among the adult population. Diabetes has long been recognized as the leading cause of blindness, renal abnormalities, and non-traumatic amputations [3]. Furthermore, the risk for death is twice as much for an individual with diabetes, than one without diabetes. Diabetes is the sixth leading cause of death and diabetes is often underreported as a cause of death [4]. Diabetes cost $132 billion, of which $40 billion were due to indirect causes such as disability, absenteeism, and premature mortality.

Although genetics play a role in the development of type II diabetes, the environment, and one's lifestyle contribute to this process. The Center for Disease Control (CDC's) Diabetes Program [5] says that as Americans, "we are eating ourselves into a diabetes epidemic". Almost half of all that have been diagnosed with type II have also been diagnosed as obese [6]. In the state of New York, 5.7% and 17.4% of the population had diabetes and were obese respectively. In 2009, the prevalence increased to 8.9% and 24.6%, for diabetes and obesity respectively [7].

There exists a public health opportunity to promote initiatives that aim to modify eating habits, physical activity, and offer pre-diabetes screening programs to those who have one or more risk factors for diabetes. First and foremost, our aim should be to encourage healthy behavior as this is the most cost effective and sustainable method to reduce the diabetic crisis. The landmark results of the Diabetes Prevention Program, a 27 center randomized clinical trial across the United States [8], has shown that lifestyle changes have been shown to be more effective than medication [9] and extreme lifestyle interventions may reduce the risk of developing diabetes type 2 by 50% [10].

How do we change the behavior of the population as a whole? It is our duty to inform the public about the relationships between obesity, poor physical activity, smoking, hypertension, and all other risk factors that may predispose one to developing type II diabetes. Unlike other chronic diseases, type II diabetes can be managed, and nearly eliminated with proper diet, exercise, treatment, and early detection. To that end, we must include screening programs that range from targeted to opportunistic for our local population. Screening allows us to identify those who may be at risk (pre-diabetic), and those that have been living with undiagnosed diabetes, in turn providing opportunity for early interventions. The residual effect of decreasing the incidence of diabetes is astronomical. Not only would it reduce health care costs, it would dramatically reduce the prevalence of other chronic diseases. Cardiovascular disease is the leading cause of death in this country and 75% of cases have also been diagnosed with type II diabetes [11].

Opportunistic screening

Several county health departments in New York currently provide free blood pressure screenings at numerous locations throughout the county. The US preventive Services Task Force [12] recommends that asymptomatic adults with sustained blood pressure greater than 135/80 mm Hg should be screened for type II diabetes. The American Diabetic Association has set forth guidelines for screening procedures; however these parameters can be adjusted for a local population and available resources within a specific health network. Medicaid and Medicare cover diabetic testing, and by 2014, all insurance plans are mandated to cover preventive services, of which diabetic screening would be included [13, 14]. The test of choice is the Fasting Plasma Glucose Test, it is inexpensive, and produces quick and reproducible results. Clinical practice recommendations by the American Diabetic Association's (ADA) Standards for Medical Care [15] deem fasted sugar levels greater than or equal to 126 mg/dL as diabetic, and anything between 100 to 125 mg/dL as pre-diabetic. Given the uncontrolled nature of health department visits and that at the time of visit an individual will most likely not be in a fasted state; the value of concern for a random blood glucose test is anything greater than 126 mg/dL.

An individual that has a random blood glucose test result greater than 126 mg/dL should be scheduled for a fasted test, and proper action will be taken depending on the results of the second test. If the individual is found to be pre-diabetic upon subsequent testing they will be assigned to counseling to reduce their risk of developing diabetes. In addition, the ADA [15] recommends follow up periods every three years for those who are pre-diabetic and over the age of 45. The time of onset of type II diabetes is not confirmed, but studies show that it is around ten years [16]. Therefore an individual who is pre-diabetic should be followed up, at minimum, for three to four screening periods (9-12 years). In most cases, those who are concerned enough about their livelihoods will learn to test their blood sugar a few times a month on their own. Medicaid and Medicare will cover the cost for home testing kits. Kits should also be available for purchase from the local health department at a subsidized cost for those who are uninsured or financially troubled. In the case that someone that is at risk has a negative result; an attempt should be made to re-screen them within six months.

The assumption is that if one is warned of their risk of developing a disease that can be extremely debilitating the longer one has it; one will make changes in their lifestyle and behavior to avoid progression toward a clinically diagnosed state. Numerous programs and campaigns exist to promote these changes, such as Healthy New York, Healthy People 2020, and various programs at local YMCA's. The first step, however, is to identify those who are at risk of having diabetes, those who are pre-diabetic. Since it is not feasible to screen the entire population, the ADA recommends opportunistic screening to those who have one or more risk factors (Tab. I) [17]. In addition, a diabetes questionnaire should be completed by those who will be screened, with the assistance of a health care provider if needed, to supplement the test results [18].

To date, no trail has been done to determine if systematic screening and early treatment of pre-diabetics leads to improved health outcomes compared with clinical diagnosis. To conduct a randomized cohort clinical study would provide useful evidence to evaluate this proposal for diabetes screening. However, major hurdles exist. To provide diabetes screening to one group continuously for up to twelve years, and not to another, brings up ethical concerns that cannot be avoided [17]. In the case that many in the screened group are found to have diabetes, or pre-diabetes, these individuals may seek proper treatment or change lifestyle behaviors to prevent or extend their onset of clinical type II diabetes. Those in the non-screened group may continue to live with undiagnosed treatment, or would not be informed of their pre-diabetic state, and might continue to practice lifestyle habits which are detrimental to the avoidance of type II diabetes.

Several state pilot projects that provide diabetes screening are underway across the country; and the results of a few studies have been published with remarkable results. The Diabetes Prevention Program that provides screening for people covered by Medicaid and Medicare in Minnesota showed an overall reduction of 58% from pre-diabetes to diabetes type II. The state of Minnesota reported that they were able to deliver the Diabetes Prevention Program curriculum, for less than $300 per participant. This included screening, and 16 lifestyle and health structured education sessions to those who were pre-diabetic [19]. The Medicare Diabetes Screening Project [20] in Georgia and New Hampshire has also reported great success by implementation of their own Diabetes Prevention Programs. Outside of the United States, the ADDITION (Anglo-Danish-Dutch Study of Intensive Treatment in People with Screened Detected Diabetes in Primary Care), was a population based study that managed to achieve high levels of participant retention and follow up for over 200,000 people between the ages of 40-69. The find-

Tab. I. Risk factors for type 2 diabetes [16].

- ❑ Age ≥ 45 years
- ❑ Overweight (BMI ≥ kg/m^2 *)
- ❑ Family history of diabetes (i.e., parents or siblings with diabetes)
- ❑ Habitual physical inactivity
- ❑ Race/ethnicity (e.g., African-Americans, Hispanic-Americans, Native Americans, Asian-Americans, and Pacific Islanders)
- ❑ Previously identified IFT or IGT
- ❑ History of GDM or delivery of a baby weighing > 9 lbs
- ❑ Hypertension (≥ 140/90 mmHg in adults)
- ❑ HDL cholesterol ≤ 35 mg/dl (0.90 mmol/l) and/or a triglyceride level ≥ 250mg/dl (2.82 mmol/l)
- ❑ Polycystic ovary syndrome
- ❑ History of vascular disease

* May not correct for all ethinic groups. BMI- Body mass index; GDM-Gestational diabetes mellitus;

ings of the study were that "stepwise screening for type 2 diabetes in primary care is feasible and acceptable [and] identifies individuals with high levels of modifiable risk factors [21].

Conclusions

The aim of this screening program is to identify those with undiagnosed diabetes and those who show signs of a pre-diabetic state. This will allow the health department to refer for early treatment or prevention to delay the onset of diabetes and the various other long-term complications that are related with it. It is obvious that the economic costs of high blood sugar and its consequences are substantial. Although no real world studies have been done on the cost savings of screening versus no screening, several simulations have been run to determine if screening would be economically efficient. It has been shown that screening appears to be cost-saving and cost-neutral from a societal perspective [22]. Providing this service from the health department will promote and spread awareness of services and habits that will reduce the frequency of obesity, lack of physical activity, and poor diet. Overall, this program will provide a service that increases the general health and awareness of the community itself. Although the American Diabetic Association recommends screening with fasted blood glucose tests, it is not commonly performed in everyday clinical practice, even to individuals who shows many risk factors [23]. Thus, in the interest of the community, the public health service, namely the Department of Health, should take initiative in a screening program.

Providing screening for at risk individuals does not require any changes in the health infrastructure, and glucose test kits are readily available at most health care facilities. It is highly likely that the incidence of type II will decrease through systematic screening. Since the screening will be opportunistic, and only offered to people who fulfill one or more of the risk factors, resources will be well spent in this effort.

References

[1] Bang H, Edwards AM, Bomback AS, et al. *Development and validation of a patient self-assessment score for diabetes risk*. Ann Intern Med 2009;151:775-83.

[2] Wild S, Roglic G, Green A, et al. *Global prevalence of diabetes: estimate for 2000 and projections for 2030.* Diabetes Care 2004;27:1047-53.

[3] Calgone N, Petitti DB. *Members of the U.S. Preventative Services Task Force. Screening for Type 2 Diabetes Mellitus in Adults: U.S. Preventive Services Task Force Recommendation Statem*ent. Ann Intern Med 2008;148:846-54.

[4] Moss SE, Klein R, Klien BE. *Cause-specific mortality in a population-based study of diabetes*. Am J Public Health 1991;81:1158-62.

[5] Centers for Disease Control and Prevention. 2000. *CDC's Diabetes Program.*

[6] Anderson JW, Kendall CW, Jenkins DJ. *Importance of weight management in type 2 diabetes: review with meta-analysis of clinical studies.* J Am Coll Nutr 2003;2:331-9.

[7] New York State Behavioral Risk Factor Surveillance System, 1999-2009 (2010).

[8] Centers for Disease Control and Prevention. 2011. *CDC Statement on Results of Diabetes Prevention Program.*

[9] Raina EC, Kenealy T. *Lifestyle interventions reduced the long-term risk of diabetes in adults with impaired glucose tolerance*. Evid Based Med 2008;13:173.

[10] Ripsin CM, Kang H, Urban RJ. *Management of blood glucose in type 2 diabetes mellitus*. Am Fam Physician 2009;79:29-36.

[11] Bloomgarden ZT. *Cardiovascular disease and diabetes*. Diabetes Care 2003;26:230-7.

[12] U.S. Preventative Services Task Force (2008.) *U.S. Preventative Services Task Force recommendations on screening for type 2 diabetes mellitus in adults*.

[13] New York State Department of Health (2010). *Insurance Coverage for diabetes-related goods and services in New York State, Medicaid coverage and diabetes fact sheet for clinicians*.

[14] Centers of Medicare and Medicaid Services (2004). *Medicare Coverage of Diabetes Supplies and Services*.

[15] *American Diabetes Association Standards of Medical Care in Diabetes*. Diabetes Care 2010;33:11-61.

[16] O'Connor PJ, Gregg E, Rush WA, et al. *Diabetes: how are we diagnosing and initially managing it?* Ann Fam Med 2006;4:15-22.

[17] American Diabetic Association. *Screening for type 2 diabetes*. Diabetes Care 2004;27:11-4.

[18] Herman WH, Smith PJ, Thompson TJ, et al. *A new and simple questionnaire to identify people at increased risk for undiagnosed diabetes*. Diabetes Care 1995;18:382-7.

[19] Bergenstal RM, McGowan J. *Diabetes-Initiatives for diagnosis and prevention*. Minnesota Healthcare News 2010;8.

[20] Medicare Diabetes Screening Project, http://www.screenfordiabetes.org/.

[21] Dalsgaard EM, Christensen JO, Skriver MV, et al. *Comparison of different stepwise screening strategies for type 2 diabetes: Finding from Dutch general practice, Addition-DK*. Prim Care Diabetes 2010;4:223-9.

[22] Chatterjee R, Narayan KM, Lipscomb J, et al. *Screening adults for pre-diabetes and diabetes may be cost saving*. Diabetes Care 2010;33:1484-90.

[23] Ealoverga MW, Tabaei BP, Brandle M, et al. *Opportunistic screening for diabetes in routine clinical practice*. Diabetes Care 2004;27:9-12.

■ Received on March 13, 2012. Accepted on November 12, 2012.

■ Correspondence: Mohammad T. Iqbal, SUNY Upstate Medical University**,** 750 Adams Street, Syracuse, NY 13210**,** USA - E-mail: iqbal569@hotmail.com; iqbalmoh@upstate.edu