Daily Self-Blood Glucose Monitoring in Diabetics

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Healthy People 2020 outlines a wide range of objectives intended to promote a healthier population in the United States. This paper will focus on the thirteenth objective for diabetes, which is to “increase the proportion of adults with diabetes who perform self-blood glucose monitoring at least once a day,” (Healthy People 2020). In 2008, only 64.0 percent of adults diagnosed with diabetes did this (BRFSS, CDC 2014). The target goal is an increase to 70.4 percent of adult diabetics following this protocol (Healthy People 2020).

According to the National Diabetes Statistics Report released in 2014, diabetes was prevalent in 29.1 million people in the United States in 2012, which is about 9.3% of the population (CDC, 2014). Of these cases, only 21 million were diagnosed (CDC, 2014). Therefore, 27.8% of people living with diabetes are undiagnosed (CDC, 2014). A CDC study predicted that one-third of Americans could have diabetes by 2050 (Boyle, Thompson, Gregg, Barker & Williamson, 2010). In individuals 20-44 years old, 4.1% have diabetes (CDC, 2014); for ages 45-60, 16.2% have diabetes (CDC, 2014); and for ages 65 years and older, 25.9% have diabetes (CDC, 2014). Minor differences exist in prevalence between men and women currently, with rates of 13.6% in men and 11.2% in women (CDC, 2014). Type 2 Diabetes account for approximately 95% of all cases (CDC, 2014).

Among individuals age 20 years and older variations occur between ethnic groups (CDC, 2014). In 2012, prevalence was 7.6% in non-Hispanic whites, 9.0% in Asian Americans, 12.8% in Hispanics, 13.2% in non-Hispanic blacks, and 15.9% in American Indians/Alaska Natives (CDC, 2014). Among American Indians, prevalence was highest in southern Arizona at 24.1% (CDC, 2014). Although the high prevalence rates are concerning, so too is the rate of increase. In 2012, the incidence rate in adults ages 20 years and older was 7.8% (CDC, 2014). The rate was
highest for adults age 45-64 at 12%, compared to 11.5% for individuals age 65 and older, and only 3.6% for individuals age 20-44 years (CDC, 2014).

Given these statistics, the long-term effects associated with diabetes raise concern. Diabetic nephropathy, caused largely by poor blood glucose control, is the leading cause of renal failure among patients known to have diabetes (Currie, McKay & Delles, 2014). Poor blood glucose control from extended periods of hyperglycemia is associated with diabetic retinopathy, a significant factor in vision impairment (Safi, Qvist, Kumar, Batymalaie & Ismail, 2014). From 2005-2008, 28.5% of adults age 40 and older with diabetes, experienced diabetic retinopathy (CDC, 2014). Diabetic neuropathy is also linked with recurring hyperglycemia (Tracy & Dyck, 2009). Certain cases can be painful, result in loss of function, or are associated with a decline in feeling (Tracy & Dyck, 2009). Neuropathy can mask the pain caused from a wound on the extremities, leading to infection, even amputation (Alvarsson, Sandgren, Wendel, Alvarsson & Brismar, 2012). In 2010, approximately 60% of lower limb amputations were from individuals 20 years and older with diabetes (CDC, 2014). In 2010, diabetes was recognized as the seventh leading cause of death, however diabetes may be underreported as a cause of death (CDC, 2014).

In 2012, the total cost of diabetes in the United States was $245 billion (CDC, 2014). Medical costs accounted for $176 billion, and indirect costs accounted for $69 billion (CDC, 2014).

Frequent self-monitoring of blood glucose (SMBG) is one of the primary strategies in preventing complications and improving metabolic control (Schutt, Kern, Kruasse, Busch, Dapp, Grizwotz, Mayer, Rosenbauer, Wagner, Zimmerman, Kerner & Holl, 2006). A study involving U.S. veterans with Type 2 diabetes found that strict SMBG regimens helped improve glycemic
control (Murata, Shah, Hoffman, Wendel, Adam, Solvas, Bokhari & Duckworth, 2003). Another study found that the more frequently a patient self-monitors blood glucose levels, the more likely they were to take other precautious measures such as adhering to medications and performing foot inspections (Piette, Aikens, Rosland & Sussman, 2014). One study found significantly lower HbA1c levels (an indicator of glycemic control and frequency of hyperglycemia) in patients with SMBG compared to the non-SMBG group (Alleman, Houriet, Diem & Stettler, 2009).

In 2010, rates of daily SMBG between age groups varied little with a range of 62.2% to 65.7% from lowest to highest (BRFSS, 2012). However, in a 2010 age-adjusted comparison by sex, daily SMBG rates were higher in females at 67.8% compared to males at 59.6% (BRFSS, 2012). In another age-adjusted comparison done by race in 2010, slight variations do occur. Among whites, the daily SMBG rate was 63.5%, among blacks the daily SMBG rate was 69.8%, and among Hispanics the daily SMBG rate was 56.9% (BRFSS, 2012). When comparing the rate of daily SMBG to education level in 2010, no trend was established (BRFSS, 2012). A study of rural, older adults with type 2 diabetes found that 77% performed SMBG checks at least once per day (Kirk, Arcury, Ip, Bell, Saldana, Nguyen & Quandt, 2015).

A variety of strategies are being considered to increase the proportion of adults who perform daily SMBG. Guidelines called BRIGHT (Better Recommendations, Implementation and Guideline development for Health care providers and their Training) are based on which type of diabetes and how frequently the individual should perform SMBG checks (Basit, Khan & Khan, 2014). One study found a difference in frequency of SMBG based on what type of blood glucose meter was being used, with a 77% increase in frequency using the Accu-Chek meter (Overland, Abousleiman, Chronopoulos, Leader, Molyneaux & Gilfillan, 2014). Self-monitoring
education has been shown to improve glycemic control and the frequency of SMBG, however rates of participation are low in these programs (Li, Shrestha, Lipman, Burrows, Kolb & Rutledge, 2014). A study using pain-free lancets and financial incentives to increase SMBG found no significant difference, indicating that other factors have more effect (Huntsman, Olivares, Tran, Billimek & Hui, 2014). A review on the effectiveness of tech applications found little improvement in SMBG, however, users found the apps helpful (Hunt, Sanderson & Ellison, 2014). Researchers speculated that little improvement was seen in part because the mean frequency of SMBG was already high (Hunt et al., 2014).

With review of current prevalence, incidence, and the available research, it is apparent that there is particular need for intervention among type 2 diabetics. There is a large difference between the frequency of SMBG testing between men and women, with lower rates in men, indicating a need for focus on men. Between races, the highest prevalence of diabetes was among native groups in Arizona, which presses the need for intervention there.
References


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