

The Management of Type II Diabetes Mellitus in the Face of the Healthcare System and Social Determinants

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Abstract

Type II Diabetes Mellitus (T2D) is one of the most prevalent chronic diseases in the United States healthcare system. Many of the known risk factors, such as obesity, hypertension, a family history of diabetes, a prior history of gestational diabetes, high cholesterol levels, or physical inactivity, have implications on the healthcare system and could in many cases have been prevented through a change in the delivery of care (CDC, 2013). Managing T2D brings up one of the major issues that inherently plague the United States healthcare system, which is addressing acute, episodic care, instead of practicing comprehensive and preventative care. The current system of payment does not address the root causes of T2D, which perpetuates the development of diabetes, significantly increasing the health expenditures in the U.S. healthcare system as it continues to pay for the management of T2D. A key player moving forward in the management of T2D would be the Accountable Care Organizations (ACOs), who primarily focus on comprehensively maintaining the health of the patient. Care coordination and education between providers and patients, as well as an overall restructuring of care delivery in the healthcare system, may improve the health status of the population and reduce health expenditures in the long run.

Keywords: Chronic disease, Type II Diabetes Mellitus, Accountable Care Organizations, Social determinants, Care management

Introduction of Chronic Diseases

According to the Center for Medicare and Medicaid Services (CMS), the United States spent \$2.7 trillion dollars on healthcare in 2011, which made up 17.9% of the GDP (Squires, 2012). One of the most pressing issues affecting a high amount of Americans while contributing a significant amount to health expenditures are chronic conditions, which account for more than 75% of healthcare expenditures at approximately \$2.025 trillion. Chronic conditions are prolonged in duration, do not resolve spontaneously, and are rarely cured completely (CDC, 2013). All chronic illnesses have the potential to limit the functional status, productivity, and quality of life of those affected (IOM, 2012). According to The Center for Disease Control and Prevention (CDC), 133 million Americans suffer from chronic conditions, which cause 7 out of 10 deaths each year in the United States (CDC, 2013). Chronic disease accounts for more than 75% of healthcare expenditures, which is approximately \$2.025 trillion. The Institute of

Medicine (IOM) asserts, “All chronic illnesses hold the potential to worsen the overall health of our nation by limiting an individual’s capacity to live well,” and has defined a list of nine chronic conditions that affect the most people and dominate health expenditures in the United States (IOM, 2012).

The chronic condition from which the fourth-most Americans suffer, Type II Diabetes Mellitus (T2D), could in many cases have been prevented through a change in the delivery of care (Table 1). T2D is the sixth leading cause of death in the United States (2010 National, 2010). Many of the known risk factors have implications on the healthcare system. For example, as of 2007, the U.S. has spent approximately \$174 billion on care related to T2D (AHRQ, 2012).

An Overview of Type II Diabetes Mellitus

Approximately 8.3% of the United States population is affected by diabetes. There are

25.8 million people in the United States with diabetes, 18.8 million of which who have been diagnosed with diabetes, and an estimated 7.0 million people who have diabetes but have not been diagnosed (National Diabetes, 2011). Diabetes is a chronic disease caused by the body's inability to make or process insulin,

which is required to convert glucose into energy (Mayo Clinic, 2003). Diabetes Mellitus Type I, occurs when the pancreas is unable to produce insulin. This is typically a congenital disease, and it can be managed through insulin injections (Mayo Clinic, 2003).

Table 1: IOM's Nine Most Common" Chronic Conditions (IOM, 2012)

Condition	# of United States millions of adults affected
Arthritis	50
Cancer survivorship	12
Chronic pain	116
Dementia	5.4
Depression	20.3
Type 2 Diabetes	25.6
Schizophrenia	2
Hearing and vision loss	34 & 25
Post-Traumatic Disability	Data not available

Insulin-resistant diabetes mellitus, commonly referred to as T2D, is the most common form of diabetes, affecting 95% of people with diabetes (American Diabetes Association, 2014). In T2D, the fat, liver, and muscles of the body are unable to properly respond to insulin, which allows high levels of sugar to build up in the blood, resulting in hyperglycemia (NIH, 2013). Early symptoms of T2D are fatigue, hunger, increased thirst, increased urination, and bladder, kidney, skin, or other infections that are more frequent or take longer to heal (NIH, 2013). There is currently no cure for T2D. However, treatments include blood sugar monitoring, healthy eating, regular exercise, and some forms of diabetes medication or insulin therapy (Mayo Clinic, 2013).

There are many risk factors associated with T2D, some of which include: obesity, hypertension, a family history of diabetes, a

prior history of gestational diabetes, high cholesterol levels, or physical inactivity (CDC, 2013). These risk factors are more commonly found in older populations as one's health status continues to decline with age, leading to a higher rate of risk factors of T2D. Figure 1A demonstrates the positive correlation between T2D incidence and age, demonstrating that older age categories had higher rates of incidence of T2D. Due to the current declining health of the population of a whole in the United States, including higher rates of obesity and related comorbidities, general incidence of T2D has also increased (Fig 1B). The risk factors mentioned above, such as being overweight or obese, having high blood pressure, and abnormal cholesterol levels are three factors that are most prevalent in African American, American Indian, Asian American, Pacific Islander, and Hispanic American/Latino communities. Thus, many diagnosed with T2D in the United States

fall into the aforementioned ethnic communities, which highlights the possible issue of health disparities. Figure 1C demonstrates the higher rate of diagnosed diabetes in groups of African Americans and Asians than in groups of Caucasians. Moreover, studies have shown that minorities for the most part have high complication rates when it comes to T2D,

indicating possible discrepancies in treatment and management (Fig 3). Furthermore, the rate of diabetic end stage renal disease (ESRD) is 2.6 times higher among African Americans than Caucasians, which may be attributed to the interaction between hypertension and T2D (AHRQ, 2013).

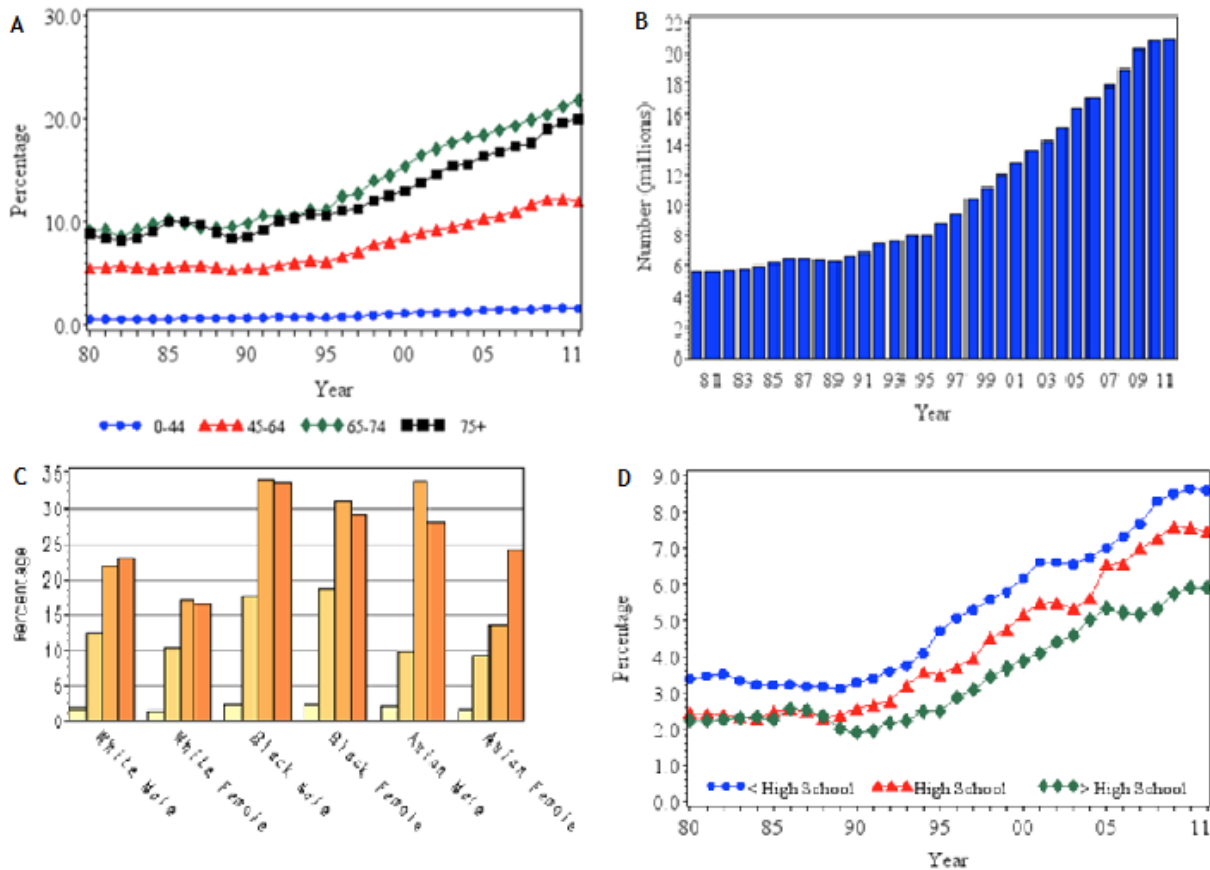


Figure 1: Statistics of Noninstitutionalized Population with Diagnosed Diabetes, United States, 1980-2011. A. Percentage of civilians affected by age: increased incidence of diagnosis of T2D over a 30 year span in all age groups, with a significant increase in the 65-74 and 75+ age groups. **B.** Number (in millions) of civilians affected by age: increased incidence and steadily increasing prevalence of T2D in the United States population over a 30 year span, possibly demonstrating changes in the health of the population. **C.** Age-specific percentage of civilians by age, race and sex: higher prevalence of T2D among African Americans and Asian Americans in comparison to Caucasian Americans and increased prevalence of T2D with increased age for all represented groups. **D.** Age-adjusted percentage of civilians affected by education: those who did not graduate high school consistently had a higher incidence of T2D between 1980 and 2011 while those who finished high school or completed education at a higher level than high school maintained a similar incidence between 1980 and 1988; but those who had only completed high school had a higher incidence of T2D starting in 1988 (CDC, 2013).

The Challenges of Managing Type II Diabetes in the Current Environment

There are many challenges associated with managing T2D because of the difficulty in addressing the root issues. Changing the root problems would revolve around a lifestyle change of factors that are often beyond the scope of control of the person affected by diabetes. The risk factors associated with T2D are highly associated with the social determinants of health, which can be defined as the circumstances in which people are born, grow up, live, work, and age, and the systems put in place to deal with illness, which are in turn shaped by a wider set of forces: economics, social policies, and politics (Social determinants, 2013). Being unable to afford or have access to healthy foods, which help to prevent obesity, hypertension, and high cholesterol, may affect the intake of proper nutrients and increase the intake of unhealthy foods. Additionally, safety and community issues may play a role in the amount of physical activity one can get. Health disparities influenced by these social determinants perpetuate risky health behaviors that can increase the chances of developing T2D. The differences in prevalence between different levels of education have increased between 1980 and 2011 (Fig 1D). This may be due to the same socioeconomic factors that affect various ethnic/racial groups that contribute to risky health behaviors. This, again, could possibly be linked to health disparities and the impact of the social determinants of health.

Social determinants are difficult to overcome, especially if one is in a socioeconomic position in which he or she cannot address certain recommendations for lifestyle changes. This leads to poor health behaviors that lead to negative health outcomes later in life, such as T2D. Poor health behaviors, such as unhealthy diet and lack of exercise, are perpetuated throughout the lives of the individuals and by individuals in the community, which may lead to obesity, hypertension, and high cholesterol levels, all of which can lead to T2D. Once an individual is diagnosed with T2D, it is just as difficult to manage because the same social determinants that helped perpetuate the

development of T2D are in place. The individual may still not have access to healthy foods, may still not be able to pursue an increase in physical activity, and may still not be able to take control of their own health.

Managing T2D brings up one of the major issues that inherently plague the United States healthcare system, which is addressing acute, episodic care, instead of practicing comprehensive and preventative care. Currently, the reimbursement system pays more for procedures and acute episodes of care, such as heart attack and stroke, the rates of which are increased by the same risk factors that lead to T2D. Instead of receiving consistent, preventative treatment, people continue to practice bad health behaviors until they develop T2D. Although treatment for diagnosed T2D can be covered by insurance, actions taken to prevent T2D are not covered or addressed by the system. The current system of payment does not address the root causes of diabetes, which tend to be the social determinants of health. This perpetuates the development of diabetes, significantly increasing the health expenditures in the U.S. healthcare system as it continues to pay for the management of T2D. Currently, the Affordable Care Act (ACA) is expanding coverage through the health insurance exchange and Medicaid expansion. While this will be beneficial to those who previously could not afford insurance, this still does not address the problems associated with T2D, but is simply enabling more people to receive care for T2D. Although this is beneficial for the population, it does little to reverse the current pattern, and simply perpetuates the increase in prevalence.

Another issue that makes T2D difficult to manage is the actual clinical management. It requires constant monitoring of blood sugar levels, as well as consistent adherence to prescribed medication. The National Diabetes Education Program has developed a four-step approach to managing T2D: Learn about diabetes, know your diabetes ABCs, learn how to live with diabetes, and get routine care to stay healthy (4 Steps, 2012).

It is often up to the patient to seek out information to fully understand diabetes. Although the physician may explain diabetes, they can feel rushed and may not be able to fully explain management of T2D in a way that the patient understands due to health literacy barriers or language barriers (Marvel, 1999). While the Internet may be filled with information to adequately address diabetes concerns, many people are not able to access the correct information to learn about their diabetes. This brings up issues in the delivery of care and reimbursement system as well. Because reimbursements are higher for more complicated, acute procedures, physicians get reimbursed very little to explain diabetes management to a patient (Green, 2013). Additionally, the hospitals make more money over time by treating diabetes, whether through the actual management, or through critical acute issues that may arise from the same risk factors of T2D, such as heart attacks and strokes. Overall, the current healthcare reimbursement system simply makes not preventing diabetes and not educating about diabetes more economically favorable (Green, 2013).

The National Diabetes Program asserts that the patient must know their “Diabetes ABCs,” which are different health indicators that must be managed to lower the chances of having heart attacks, strokes, or other diabetes-related problems. “A” stands for the A1C test, which measures the average blood level over the past three months. If the blood level is too elevated, the heart, blood vessels, kidneys, and feet could be negatively affected. “B” stands for blood pressure, which must be measured to prevent the heart from overworking, which could result in heart attack or stroke. “C” stands for cholesterol. Low density lipoprotein (LDL) cholesterol buildup can result in heart attack or stroke, whereas HDL helps remove LDL cholesterol from blood vessels. Although the three ABC tests can monitor the chance of heart attack and stroke, studies have shown that there is still discrepancy in the delivery of these tests. The National Health Disparities report demonstrated that there were disparities between different races/ethnicities that had their hemoglobin (Hb) A1c levels, their total cholesterol, and blood

pressure under control. (2010 National, 2010). The Agency for Healthcare Research and Quality (AHRQ) found a low rate of adults age 40 and over with diagnosed diabetes who had reported receiving the four recommended services. The highest percentage that received all four recommended services was the 60 and up age range at 30% (Fig 2). The four recommended services for diabetes include two or more HbA1c tests, a foot exam, a dilated eye exam, and a flu shot (AHRQ, 2012).

Learning to live with diabetes and getting into a routine is highly influenced by the social determinants of health, especially in regards to economic resources. While the actual medications and tests may be paid for by insurance, the lifestyle change required for a diabetic may still be out of financial reach. Keeping track of blood sugar and checking blood pressure may also be difficult for many patients and many might not adhere to the medical recommendations. The National Diabetes Education Program also suggests seeing a healthcare provider at least twice a year for a blood pressure, foot, and weight exam, in addition to an A1C Test. It is recommended that once a year patients have a cholesterol test, a triglyceride test, a complete foot exam, a dental exam, a dilated eye exam, a flu shot, and a urine test (NDEP, 2013). It is clear from the study above that not all people with diabetes are receiving this process of care. The current healthcare system lacks a consistent primary care provider gatekeeper who would help facilitate to make sure these tests were performed in order to maintain the health of the patient. The lack of primary care provider (PCP) also brings up an issue in diagnoses. As mentioned above, it is estimated that approximately 7.0 million people do not know that they have diabetes (National Diabetes, 2011). Without consistent check-ups with a PCP, it is very difficult to determine whether or not one is suffering from diabetes, since the symptoms are not extremely obvious and become more evident over time.

The Institute of Healthcare Improvement (IHI) has introduced the triple aim of healthcare would require developing three dimensions: improving

the patient experience of care, improving the health of populations, and reducing the per capita cost of healthcare (IHI, 2013). Currently, the healthcare system is not achieving these aims for diabetes. Overall, the main issues in dealing

with T2D are that the current delivery system is not focused on coordinated care or preventative care, the current reimbursement system is not focused on patient-centeredness, and the root causes of T2D are difficult to address.

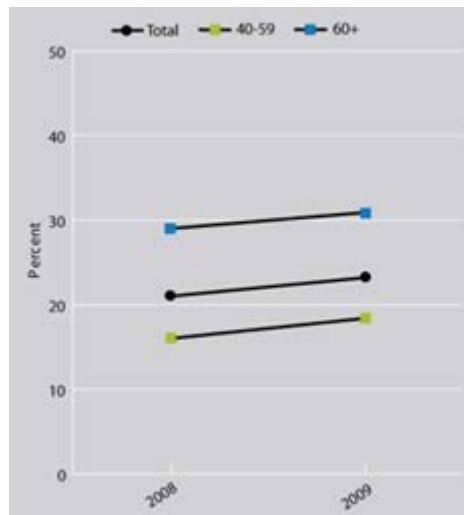


Figure 2: Adults age 40 and over with diagnosed diabetes who reported receiving four recommended services for diabetes in the calendar year (2+ hemoglobin A1c tests, foot exam, dilated eye exam, and flu shot), by age and residence location, 2008-2009 (AHRQ, 2012).

Best Practices for Management of Type II Diabetes

In order to facilitate optimal outcomes in diabetes management, several guidelines have been established outlining best practices. These best practices, once fully explored, can eventually be implemented as a standard process of managing chronic disease in an effort to increase the standardized, evidence-based practice that can lead to better health outcomes overall. The following are best practices in the clinical aspect of T2D care and the standards of self-management of diabetes.

The American Diabetes Association has created a framework of clinical T2D management. The first aspect of clinical care is classifying the types of diabetes and standardizing the measures of diabetes diagnosis and pre-diabetes diagnosis. In 2009, the International Expert Committee recommended the use of the A1C test to diagnose diabetes, with the threshold at greater than 6.5% (National Diabetes, 2011). This would also be used to determine the individuals

who are between a healthy glucose level percentage and 6.5%, who would be defined as having impaired glucose intolerance. The next aspect of diabetes management would be testing for diabetes in asymptomatic patients. As previously mentioned, a lack of testing in a preventative capacity of testing to treat in the early stages can be hindered by a lack of PCP usage. Best practices suggest testing the A1C levels of adults of any age who are overweight, obese, or have other risk factors for diabetes, and repeating the tests every three years. The same A1C test that is used for diagnosis should be used for screening. Due to the long presymptomatic phase of T2D, as well as the increasing prevalence among populations, screening is recommended for adults with the risk factors of diabetes and children and adolescents who are overweight so that efforts can be taken to delay and prevent the formation of T2D. Best practices in preventing and delaying diabetes include losing 7% of body weight, increasing physical activity, and annual monitoring (National Diabetes, 2011).

Diabetes care must first begin with the initial evaluation of the type of diabetes as well as the risk factors that could lead to complications. A comprehensive, patient-centered plan must be established for the individual patient based on their medical condition to facilitate the disease management. This management would be assisted by a variety of health providers who would ideally work with this individualized plan. The next aspect of diabetes management would be glycemic control, which would require the assessment of glycemic control through regular glucose monitoring, and A1C tests that are administered consistently over the individually recommended intervals. Lowering the A1C below 7% has been shown to reduce complications associated with diabetes. However, the healthcare provider may recommend different levels for different patients. Metformin is the recommended pharmacological agent for T2D, while insulin therapy is usually used. Individualized medical

nutrition therapy (MNT) should also be developed, with the mix of carbohydrate, protein, and fat contents adjusted to meet the metabolic goals and individual needs of the patient.

It is recommended that individuals with diabetes receive standardized diabetes self-management support (DSMS) as well as diabetes self-management education (DSME), which are ongoing processes of facilitating the knowledge, skill, and ability necessary for diabetes self-care (National Diabetes, 2011). There are ten national standards for DSME (Table 2). Additionally, it is recommended that the individuals receive psychosocial assessment and care to determine the root cause of unhealthy behaviors, and that the patient increase physical activity. The American Diabetes Association has also developed standards for preventing further complications from diabetes.

Table 2: DSME National Standards. These standards demonstrate the need for consistent care necessary to maintain health when diagnosed with a chronic disease. (Haas, 2013)

<i>Internal structure</i>	The healthcare providers who administer DSME must have an organizational structure, mission statement, and goals;
<i>External Input</i>	The providers of DSME must seek the ongoing input from external stakeholders and experts to promote program equality;
<i>Access</i>	The DSME provider must determine how to deliver the best diabetes education to a population considering what resources and support are available for that population;
<i>Program Coordination</i>	A coordinator will oversee the DSME program and be responsibility for the planning, implementation, and evaluation of the services provided;
<i>Instructional staff</i>	At least one of the instructors should be a registered nurse, registered dietician, or pharmacists trained to provide DSME, or other diabetes care certified professionals;
<i>Curriculum</i>	A written curriculum be used to establish the framework for the DSME. The curriculum contains the most current evidence and practice guidelines with outcome evaluation criteria;
<i>Individualization</i>	An individualized education and support plan focused on behavior change must be made;
<i>Ongoing Support</i>	A personalized follow-up plan must be established as part of the DSMS. Communication of self-management should be communicated with the healthcare team;
<i>Patient progress</i>	The evaluation of progress in achieving personal diabetes self management goals must be measured to assess the success of the DSME;
<i>Quality improvement</i>	A systematic review of process and outcome data should be used to determine effectiveness of the program.

This system would be beneficial to chronic disease management, especially in managing T2D. Because T2D requires constant coordinated care, the transparency of information and coordination of the ACO could address these needs to ensure that the proper tests are being done at the proper time. Furthermore, because ACOs are incentivized to keep the patient population healthy, they would be incentivized to follow the recommended process of performing the tests to maintain better health and manage T2D. Additionally, because many of these ACOs will be formed through the MSSP, many people suffering with T2D who are in the 65 and up high-risk category would be able to use these ACO models to help manage their diabetes through Medicare. The ACO model would address the issues of delivery of coordinated and preventative care through information transparency and data sharing among providers, thus also increasing patient centeredness. It is to the advantage of the ACO to maintain the health of the patient, so they are incentivized to carefully explain to their patients how to manage diabetes and to follow up on their patients regularly.

The current ACO model does not address the root causes of T2D. However, if the ACO models are successfully integrated into the healthcare system and are able to revolutionize care coordination, other healthcare providers will form similar organizations that might be able to serve all ages throughout the continuum of care. The consistent and preventative care from these visits may help people become more aware of the causes of diabetes, so they can attempt to make better, more informed health decisions in an effort of avoiding chronic disease in the future. While the social determinants of health will still be barriers, the consistent reminders and monitoring of the ACO might decrease the incidence rates of T2D in the future.

Measuring the Effectiveness of the ACOs on Type II Diabetes Management

The effect of the ACOs on T2D management can be measured in many ways. Figure 3 demonstrates improvement in the short term

because it measures the percentage of people in each ethnic/racial group that received the entire defined process of recommended tests. Those specific tests are recommended to reduce the likelihood of poor outcomes, such as heart attack or stroke, so measuring the percentage of patients in the ACO that receive all of the recommended tests would be a good indicator of improved quality in diabetes management. While simply the number of adults who received all tests could show the effectiveness of the ACOs on diabetes management, comparing the different ethnicities/races, education level, and age level who received all tests could further evaluate if and how much the ACO is standardizing care by consistently administering the tests to all patients, regardless of race, education level, and age. These numbers could then all be compared to the most recent quality benchmark measurement as described by the National Healthcare Quality Report.

An example of an ACO model developed to manage chronic disease that could be especially applied to management of T2D is the Quality Blue Model developed by Blue Cross Blue Shield of Louisiana (BCBSLA). BCBSLA partners with various patient centered medical homes to monitor the health maintenance of at risk patients. Through a setup using health information technology and a structured care team, physicians are able to more closely and consistently monitor high risk patients, while receiving monthly reimbursement management fees based on meeting certain quality benchmarks (BCBSLA, 2013). This model incentivizes primary care teams to maintain the health of at-risk patients, performing the standardized tests and best practices to manage chronic disease, such as T2D.

In the long term, the trend of the amount of diabetic patients who have had severe heart attacks or strokes can be evaluated. If the diabetes management has been effective, the likelihood of severe heart attacks or strokes, although not eliminated, can be reduced. A significant reduction would indicate progress in diabetes management. The development of T2D as a whole can be evaluated in the long term if two different groups of kids from the same area

and socioeconomic status could be evaluated through their lifetime, with one group using an ACO, and one group using the current system of care. If the group who used an ACO had significantly better health outcomes, and other variables had been standardized, it would be evident that preventative care had an influence on the long-term health outcomes. An analysis

of various ACOs created through the MSSP program found that ACOs reduced spending by 2.5%, reduced inpatient admissions 2.5%, reduced readmissions 9.7%, and reduced potentially preventable initial admissions by 13.2%, while increasing outpatient services by 7.4% (Early ACOs, 2014).



Figure 3: Composite measure: Adults age 40 and over with diagnosed diabetes who received three recommended services for diabetes in the calendar year (hemoglobin A1C test, dilated eye examination, and foot examination), by race, ethnicity, family income, and education, 2002): Measuring the process of the amount of adults ages 40 and over who were diagnosed with diabetes who received the three recommended services for diabetes in the calendar year, which are the hemoglobin A1c test, dilated eye examination, and foot examination as compared to the 2008 Achievable Benchmark established by the Behavioral Risk Factor Surveillance System (BRFSS) (National, 2011).

Conclusion

T2D is one of the most prevalent diseases in the United States despite the numerous preventative measures. The disparity in prevalence between different minority communities, education levels, and age are indicators of the current health delivery system, which focuses on episodic, acute care, rather than preventative care over time. Additionally, the incentives in the current reimbursement system do not encourage optimal management of T2D as a goal in comparison to performing more lucrative procedures. With the best practices factors assessed, a step going forward in the management of T2D may be the use of ACOs whose focus would be on maintaining the health of the patient, which may help prevent negative complications that may result in diabetes.

The IOM released its six quality aims that are necessary to improve healthcare: patient safety, patient centeredness, efficiency, effectiveness, equity, and timeliness (AHA, 2013). If every one of these aims is addressed, there could potentially be a significant decrease in incidence of T2D, as more established processes of prevention and management are developed. This could lead to better outcomes of the United States population overall, by not only reducing the prevalence of T2D and its associated health risks, such as heart attack and stroke, but also by reducing risk factors associated with T2D, such as hypertension, obesity, and high cholesterol levels. This can lead to both a healthier nation and a decrease in health expenditures in the future.

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