

# THE IMPACT OF DIABETES IN MICHIGAN



**The Diabetes Burden Report  
and the  
Michigan Diabetes Action Plan  
2011-2014**

*Diabetes has changed from a public health concern to a widespread epidemic. One in three children born in 2000 is at risk of developing diabetes during their lifetime.*

*Ann Albright, PhD, RD*

*CDC Congressional Testimony July 1, 2010<sup>1</sup>*

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Dear Michigan Citizens,

It is my pleasure to support the *Michigan Diabetes Action Plan 2011 – 2014* and the *Diabetes Burden Report*. The plan was developed by the Michigan Department of Community Health's Diabetes Prevention and Control Program (DPCP) in conjunction with the Diabetes Partners in Action Coalition (DPAC) and other partners across the state to provide direction for diabetes prevention and control efforts in Michigan. The importance of this plan is underscored by the fact that diabetes continues to be a major public health challenge in the United States and Michigan.

The *Diabetes Burden Report* was developed by the DPCP using the latest diabetes data in Michigan which shows that:

- Diabetes affects 25.8 million Americans (8.3% of the population) and an estimated 1.65 million Michigan citizens.
- Prediabetes, a condition in which individuals have blood glucose levels higher than normal but not high enough to be classified as diabetes, affects 79 million Americans, including 2 million citizens in Michigan.
- Diabetes costs the United States \$174 billion annually and over \$9 billion per year in Michigan.
- Diabetes disproportionately affects some groups of people more than others, such as certain racial/ethnic groups, physically inactive people, overweight people and those who have a familial predisposition to the disease.

To address the burden of diabetes with a unified course, the DPCP is pleased to release an updated Action Plan to reduce the increasing prevalence of diabetes through prevention of the progression from prediabetes to diabetes, and to reduce the preventable complications from diabetes.

I would like to extend my thanks to all who developed this Action Plan and ask that others see this plan as "a call to action" to get involved and become a partner of the DPCP. Partners include health care professionals and service providers in businesses, schools and education programs who may have clients or constituents who have diabetes or are at risk of diabetes. Together, we can work to improve the lives of people with diabetes in Michigan and decrease the burden of the disease.

Sincerely,



Jean Chabut, Deputy Director  
Public Health Administration  
Michigan Department of Community Health

# Executive Summary

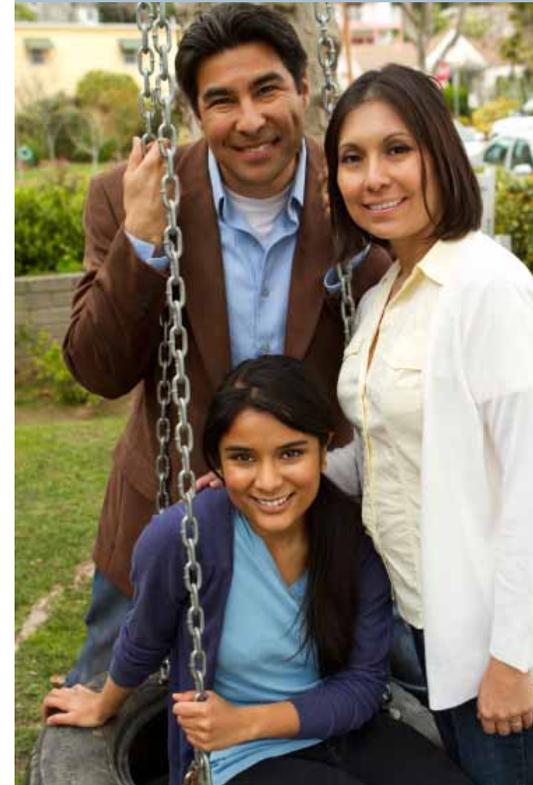
Diabetes is common, serious, costly — and controllable. The number of Americans with diabetes has more than tripled between 1980 and 2008. Diabetes is one of the leading causes of death and disability. Health care costs associated with diagnosed diabetes increased 32 percent from 2002 to 2007; however, there are promising evidence-based programs that reduce the severity of medical complications associated with diabetes and prevent or delay diabetes from developing in the first place.

One in 12 U.S. adults has been diagnosed with diabetes (closer to one in 11 in Michigan). At the current rate of growth, one in four U.S. adults will be diagnosed with diabetes by 2050. As much as 80 percent of the growth in diabetes can be attributed to the rise in obesity. Obesity, in turn, is influenced by factors such as increased consumption of calories and decreased opportunities for physical activity. Some races and ethnicities are disproportionately affected by diabetes. African Americans, Hispanics, American Indians, Asian and Pacific Islanders, and Arab Americans all have higher prevalence of type 2 diabetes compared to White, non-Hispanics.

Diabetes is the leading cause of kidney failure, blindness and lower-limb amputation. Diabetes is also a major cause of heart disease and stroke. Nationally, 6 in 10 people with diabetes have one or more diabetes-related medical complications. Overall, persons with diabetes are twice as likely to die as their peers of similar age who do not have the disease. The national economic burden of prediabetes and diabetes reached \$218 billion in 2007 (including an estimated \$9 billion in Michigan). If diabetes prevalence continues to grow at the same pace, the economic burden of diagnosed diabetes alone will double in size to \$336 billion by 2034. Half of the increased spending will come from Medicare.

Evidence-based programs are the key to reversing the growing trends seen in diabetes prevalence. The Diabetes Prevention Program, a landmark clinical trial, showed modest lifestyle changes (such as losing 5–7 percent of one's body weight and 150 minutes of physical activity per week) were significantly more effective in preventing the onset of type 2 diabetes as compared to oral diabetes medication. For those already diagnosed with diabetes, disease management through coordinated provider care has shown improvement in glycemic control and screening rates for complications. People who receive diabetes self-management education are more likely to do their daily care activities and to get all of their recommended medical care (A1C tests, eye exam, and foot exam).

The Michigan Diabetes Action Plan provides direction to diabetes prevention and control efforts in Michigan and utilizes the DPCP staff, resources, and partnerships effectively. This Action Plan is aligned with the mission of the DPCP: **to establish and implement prevention strategies to reduce the morbidity and mortality due to diabetes and its complications among Michigan residents. We seek to achieve this through capacity-building projects that ensure persons at risk for diabetes and diabetes-related complications are identified, entered into the health care system, and receive ongoing preventive care and education.**



The prevalence of diabetes in Michigan underscores the need for this Action Plan. An aging population and increase in races and ethnicities disproportionately affected by diabetes also are factors contributing to the growing trend in diabetes prevalence.

Three critical factors drive the development of this Action Plan: 1) a growing national and statewide diabetes epidemic, 2) evidence-based programs shown to improve health and 3) a challenging funding and economic climate.

How can this Action Plan impact diabetes in Michigan? By using data and input from key partners, it can focus priorities and program outcomes. Also, by having key stakeholders and partners reach consensus on three catalytic goals for Michigan, it can clearly indicate the direction for the DPCP for the next three years. These goals are:

- **Strategic Collaboration:** Strengthen the capacity of new partners to work together with DPAC toward common goals
- **Unified Message:** Develop and promote a simple, captivating message specific to diabetes in Michigan that can attract board interest addressing the issue.
- **Evidence-Based Programs:** Expand and promote successful self-management programs and prevention programs and support innovation to improve these programs' efficacy with more culturally diverse populations.

The Action Plan has broad goals and objectives for preventing, managing and monitoring diabetes in Michigan. Therefore, evaluation will be based on the objectives, outcomes and data sources identified within the plan. An ongoing evaluation process will measure the progress of this plan in addressing the three catalytic goals and how they impact the burden of diabetes in Michigan.



# What Is Diabetes?<sup>2</sup>

Diabetes is a disorder of metabolism — how the body uses digested food for growth and energy. Most of the food people eat is broken down into glucose, a form of sugar. Glucose is the main source of fuel for the body.

During digestion, the pancreas (a large gland behind the stomach) produces a hormone called insulin. Glucose passes from the digestive tract into the bloodstream, where it can be used by cells for growth and energy. However, insulin must be present for glucose to get into the cells.

When people eat, the pancreas automatically produces the right amount of insulin to move glucose from blood into the cells. In people with diabetes, however, the pancreas either produces little or no insulin, or the cells do not respond appropriately to the insulin that is produced. Glucose builds up in the blood, overflows into the urine, and passes out of the body in the urine. Thus, the body loses its main source of fuel through the kidneys even though the blood contains large amounts of glucose.

Over time, if the extra glucose is allowed to remain in the blood, it can harm nerves and blood vessels and lead to organ damage or other long-term complications. For this reason, diabetes is the primary cause of new cases of adult blindness, kidney failure, and non-traumatic lower-limb amputation. Diabetes is known to contribute to nerve damage, heart disease, stroke, high blood pressure, dental disease, pregnancy complications, and other life-threatening conditions.

## Types of Diabetes<sup>2,3</sup>

Three major types of diabetes have been identified: type 1 diabetes, type 2 diabetes and gestational diabetes.

**Type 1 diabetes**, which was previously known as insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes, is an autoimmune disease in which the immune system destroys the insulin-producing beta cells in the pancreas and, therefore, the ability of the pancreas to produce the insulin necessary for blood glucose regulation and use. Since their bodies cannot produce adequate insulin, individuals with type 1 diabetes must take replacement insulin by either injection or pump every day of their lives to survive.

Type 1 diabetes accounts for about 5–10 percent of all diagnosed diabetes cases in the United States. Although type 1 diabetes is most likely to develop in children and young adults, it can appear in individuals at any age. Risk factors for type 1 diabetes may include autoimmune, genetic and environmental factors (such as viruses). These factors are not easily modified, which means primary prevention efforts are non-beneficial.

**Type 2 diabetes**, which was previously known as non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes, occurs when the body fails to make enough insulin or cannot properly use insulin.

\* In addition to the three major types of diabetes, a small number of cases result from specific genetic conditions (e.g., maturity-onset diabetes of youth), surgery, medications, infections, pancreatic disease, and other illnesses.

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*Type 2 is the most common form of diabetes, accounting for about 90 - 95 percent of all diagnosed diabetes cases in the United States.*

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*Women with gestational diabetes have a 35 - 60 percent chance of developing type 2 diabetes within the next 10 - 20 years, although they may be able to reduce their risk of developing the disease by maintaining a healthy body weight and being physically active.*

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The onset of type 2 diabetes is usually gradual, with little or no initial symptoms. Many people with the disease are unaware they have it and are not receiving needed treatment and education. Type 2 diabetes usually begins as insulin resistance, a disorder in which the pancreas produces enough insulin, but the body's cells are not using the insulin properly. After several years, as the need for insulin rises, the pancreas gradually loses its ability to produce insulin.

Type 2 is the most common form of diabetes, accounting for about 90–95 percent of all diagnosed diabetes cases in the United States. Risk factors for type 2 diabetes include older age, obesity, family history of diabetes, personal history of gestational diabetes, impaired glucose metabolism, physical inactivity, some other health problems (such as high blood pressure), and certain racial or ethnic heritages. African Americans, Hispanic/Latino Americans, American Indians, and some Asian Americans and Native Hawaiians or other Pacific Islanders are at particularly high risk for type 2 diabetes.

Nearly 80 percent of people with type 2 diabetes are overweight, and most cases of type 2 diabetes are diagnosed in people older than 40. However, the number of young people diagnosed with type 2 diabetes is increasing. Although nationally representative data do not currently exist, anecdotal data based on clinical reports and regional studies indicate type 2 diabetes is now being diagnosed more frequently in children and adolescents, particularly among American Indians, African Americans, Hispanic/Latino Americans and Asians/Pacific Islanders. Prevention or delay of type 2 diabetes with either lifestyle or metformin intervention has been effective in all racial and ethnic groups and has shown to persist for at least 10 years.

**Gestational diabetes** is a form of glucose intolerance diagnosed in some women during pregnancy, even though they have no known history of diabetes. Gestational diabetes is caused by the hormones of pregnancy or a shortage of insulin. If not controlled, gestational diabetes can cause the baby to grow especially large and could lead to problems with delivery for the mother and the baby.

Gestational diabetes often can be controlled through diet changes and regular physical activity, but some women with gestational diabetes also must take insulin shots. In general, gestational diabetes requires treatment only during pregnancy. Treatment helps normalize the mother's blood glucose levels and also prevents complications in the infant.

About 3–8 percent of pregnant women in the United States develop gestational diabetes, and some women may develop it late in their pregnancy. Gestational diabetes occurs more frequently among African Americans, Hispanic/Latino Americans, and American Indians, and it is also more common among obese women and women with a family history of diabetes.

Although this form of diabetes usually disappears after the birth of the baby, 5–10 percent of women with gestational diabetes are diagnosed

with type 2 diabetes after pregnancy. Women with gestational diabetes have a 35–60 percent chance of developing type 2 diabetes within the next 10–20 years, although they may be able to reduce their risk of developing the disease by maintaining a healthy body weight and being physically active.

## Prediabetes

**Prediabetes**, a condition in which a person's blood glucose levels are higher than normal, but not yet high enough to be diagnosed as diabetes, has received increasing attention in recent years because the condition raises the risk of developing type 2 diabetes, heart disease and stroke.<sup>2</sup>

The U.S. Centers for Disease Control and Prevention estimates 35 percent of the U.S. adult population aged 20 years and older — an estimated 79 million American adults — were living with prediabetes in 2010, but only 7 percent of those people were aware they had prediabetes.<sup>3,4</sup> In Michigan, it is estimated\* in 2006, approximately two million adults aged 18 to 85 had prediabetes. Three-quarters of the two million adults were 40 years old or older.<sup>5</sup>

Prediabetes is considered an increasingly serious problem that must be addressed. Between 33–65 percent of those with prediabetes may go on to develop type 2 diabetes within 6 years, compared to less than 5 percent of those with normal blood glucose.<sup>6</sup> Although people with prediabetes often do not show symptoms, their impaired glucose status places them at greater risk for complications. Prediabetes, like type 2 diabetes, may lead to long-term damage to the body, particularly to the heart and circulatory system, as well as to the eyes.<sup>7,8</sup>

The risk factors for prediabetes are similar to those for type 2 diabetes (i.e., overweight, age, family history of diabetes, racial or ethnic background, personal history of gestational diabetes or high birth weight, and high blood pressure). However, adults with prediabetes were more likely to be male, older, and have lower educational attainment. Some risk factors can, in many cases, be modified successfully through the adoption of healthy lifestyle changes. Only about half of U.S. adults reported attempting to lose weight in the past year, eat more nutritious food, or increase their physical activity.<sup>4</sup>

Results of one landmark clinical trial, the Diabetes Prevention Program, showed that modest lifestyle changes, such as losing 7 percent body weight, and being physically active (defined as exercising moderately 150 minutes per week) was nearly twice as effective as oral diabetes medication in preventing the onset of type 2 diabetes (58 percent relative reduction versus 31 percent relative reduction, respectively). Indeed, follow-up Diabetes Prevention Program research indicates lifestyle changes continue to reduce cumulative diabetes incidence by 34 percent ten years after the initial intervention. Therefore, lifestyle modification should be the first choice for those hoping to prevent or delay the onset of diabetes.<sup>9</sup>

\* To derive this prediabetes prevalence rate for Michigan adults, the national prediabetes prevalence rate was applied to Michigan's population.

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# Diabetes Prevalence

Currently, 1 in 12 U.S. adults has been diagnosed with diabetes.<sup>10</sup> National survey data shows the number of Americans with diabetes more than tripled between 1980 and 2008, rising from 5.6 million to 18.1 million.<sup>11</sup> The growth in U.S. diabetes prevalence began to accelerate noticeably in 1990 and more than doubled in the 15 years between 1993 and 2008. If diabetes continues to grow at the current rate with low mortality, projected diagnosed diabetes rates will increase from 21 million adults in 2010 to 87 million adults in 2050 — which translates to 1 in 4 U.S. adults in 2050.<sup>12</sup>

Michigan's growth in diabetes prevalence parallels national trends (Table 1):<sup>13,14</sup>

- Males have higher diabetes prevalence rates than females;
- Older age groups have higher prevalence rates than younger age groups (although prevalence peaks among 65 to 74 year olds);
- Among racial/ethnic groups, non-Hispanic whites have the lowest prevalence.

However, diabetes prevalence in Michigan has consistently been higher than the nation as a whole. **It is estimated 701,000 Michigan adults have been diagnosed with diabetes, and another 364,400 have undiagnosed diabetes.**<sup>15</sup> **This means over 1 million adults in Michigan have diabetes.**

While diabetes in children is still relatively rare, there are growing concerns in recent years that type 2 diabetes in youth is increasing. One in every 1,000 children aged 0-9 has diabetes, and three in every 1,000 children aged 10-19. Eight-five percent of diabetes cases in youth are type 1, and non-Hispanic Whites carry the highest burden. However, there is a forty-fold increase in the number of type 2 diabetes cases from young children (aged 0-9) to adolescents (10-19); compared to a three-fold increase in type 1 diabetes between the same age groups. Native American and African American adolescents carry the highest burden of type 2 diabetes.<sup>16</sup>

Table 1. Prevalence of Diagnosed Diabetes by Demographic Characteristics – Michigan, 2007-2009.

| Demographic Characteristics |                     | Prevalence (%) | 95% Confidence Interval* |
|-----------------------------|---------------------|----------------|--------------------------|
| <b>Overall</b>              |                     | 9.2            | (8.8 - 9.6)              |
| Age                         | 18-44               | 2.8            | (2.4 - 3.3)              |
|                             | 45-54               | 8.5            | (7.7 - 9.4)              |
|                             | 55-64               | 17.0           | (15.9 - 18.2)            |
|                             | 65-74               | 22.3           | (20.8 - 23.8)            |
|                             | 75+                 | 19.1           | (17.7 - 20.5)            |
| Gender                      | Male                | 9.8            | (9.2 - 10.4)             |
|                             | Female              | 8.6            | (8.2 - 9.1)              |
| Race/<br>Ethnicity          | White, non-Hispanic | 8.2            | (7.8 - 8.6)              |
|                             | Black, non-Hispanic | 13.3           | (12.0 - 14.7)            |
|                             | Other, non-Hispanic | 12.1           | (10.1 - 14.4)            |
|                             | Hispanic            | 10.1           | (7.3 - 13.7)             |
| Household<br>Income         | < \$20,000          | 15.0           | (13.7 - 16.3)            |
|                             | \$20,000 - \$34,999 | 12.7           | (11.7 - 13.8)            |
|                             | \$35,000 - \$49,999 | 8.4            | (7.5 - 9.4)              |
|                             | \$50,000 - \$74,999 | 8.0            | (7.1 - 9.0)              |
|                             | \$75,000+           | 5.0            | (4.4 - 5.7)              |

\* While the best estimate is listed under prevalence, confidence intervals are the statistical range where the true population value may fall.

## Contributing Factors

The spiraling growth in diabetes prevalence is due to a number of contributing factors, most notably rising rates of obesity,\* physical inactivity and the population's increasingly poor diet and nutrition. Additional factors include the aging of the nation's population and growth in the racial and ethnic populations at highest risk for diabetes.<sup>12</sup> The growth in diabetes prevalence is not the result of more people with diabetes living longer, but rather is directly attributable to a rise in the number of new cases of diabetes diagnosed each year.<sup>17</sup>

**Obesity, Physical Inactivity, and Poor Dietary Choices:** A direct correlation can be drawn between the national rise in obesity and the nation's increasing rate of diabetes prevalence. In 1986, obesity in the U.S. population began to increase at a faster pace; four years later, the nation's diabetes rate also began to increase significantly.<sup>18</sup> Between 1976 and 2004, U.S. diabetes prevalence increased by 73 percent (from 5.1 percent to 8.8 percent). As much as four-fifths of the increase can be attributed to obesity prevalence which more than doubled (from 14 percent to 31 percent) during the same time.<sup>19</sup>

Nationally, more than two-thirds of adults and nearly one third of children and teens are either overweight or obese. Since 1980, the number of obese adults has doubled, and the rates of obesity among children ages 2–19 have more than tripled.<sup>20</sup> Whereas it was previously thought most overweight children would “grow into” their weight during puberty, there is now increasing evidence overweight children become overweight adults. Obese children already demonstrate markers for cardiovascular disease, such as insulin resistance, hypertension, hypercholesterolemia and metabolic syndrome.<sup>21</sup>

Except for Michigan, the 10 states with the highest adult obesity rates are in the South. Currently, Michigan is ranked as the tenth highest adult obesity rate in the nation (tied with North Carolina).<sup>20</sup> Thirty-six percent of Michigan adults are overweight and 31 percent of Michigan adults are obese.<sup>22</sup> Therefore, 67 percent of Michigan adults are either overweight or obese, and some counties are more heavily burdened than others (Figure 1).<sup>23</sup> Physical inactivity is another contributor to type 2 diabetes, independent of obesity.<sup>24</sup> The Centers for Disease Control and Prevention (CDC) recommend 30 minutes of moderate physical activity 5 or more days per week, or 20 minutes of vigorous physical activity 3 or more days per week. In 2009, roughly 50 percent of U.S. and Michigan adults met this recommendation for physical activity.<sup>10</sup> The good news is these numbers are growing. Michigan adults increased their physical activity levels from 46 percent in 2001 to 51 percent in 2009.<sup>22,25</sup>

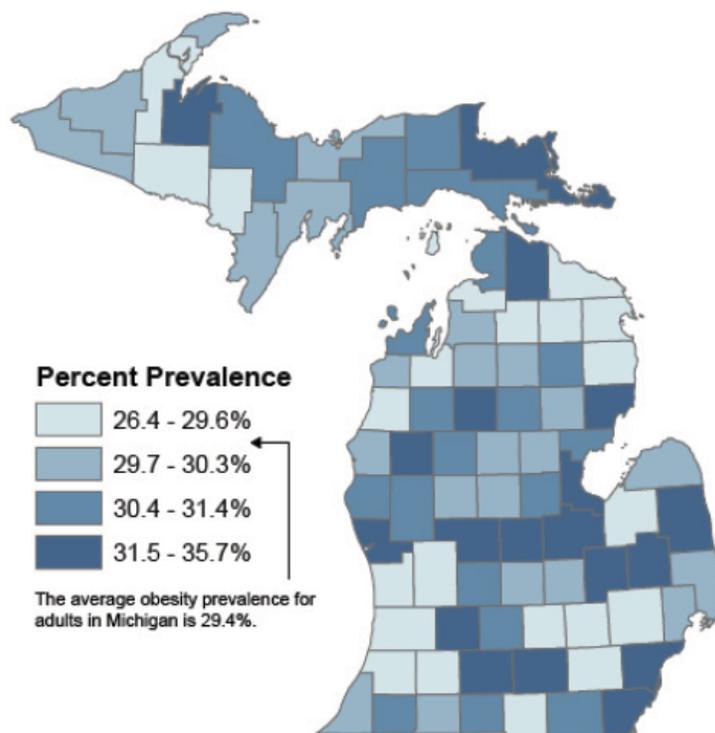
\* Obesity and overweight in adults are determined by using weight and height values to calculate a “body mass index” (BMI), which for most people correlates with the amount of body fat. An adult who has a BMI of 30 or more is considered obese, an adult with a BMI of 25–29.9 is considered overweight, and an adult with a BMI of 20–24.9 is considered normal weight.

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*Thirty-six percent of Michigan adults are overweight and 31 percent of Michigan adults are obese.*

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Figure 1. County-Level Estimates of Obesity Among Michigan Adults, 2008.



Nutrition also has a role in the development of type 2 diabetes, although that role is less clear. Poor diet can contribute to obesity; however, it is believed the essential vitamins, minerals and fiber in fruits and vegetables help to reduce the risk of many chronic diseases. The 2010 Dietary Guidelines recommend increasing your vegetable and fruit intake and eating a variety of vegetables, especially dark green, red, and orange vegetables and beans and peas. The suggested intake is about five cups of fruits and vegetables per day, which is consistent with past guidelines. In 2009, the diets of 24 percent of U.S. adults and 22 percent of Michigan adults met these recommendations.<sup>10</sup> In Michigan, consumption of fruits and vegetables actually declined from 24 percent in 1996 to 22 percent in 2009.<sup>22,25</sup>

**Environmental Factors:**<sup>20</sup> While it is clear people need to make healthy lifestyle choices, it is also clear people do not make choices in a vacuum. The prevalence of obesity, a key risk factor for diabetes, is influenced by environmental factors. In the United States, foods are inexpensive and widely available. In the past few decades, Americans have begun consuming more calories (including more foods high in sugar, fat and carbohydrates); drinking more soda and fruit juice and less milk; eating fewer fruits, vegetables and whole grains; and increasing both their portion sizes and the number of meals eaten out. At the same time, opportunities for physical activity may have decreased. For some minority Americans, poverty, lack of access to health care, differences in disease education and cultural attitudes present barriers to diabetes prevention and management.<sup>26</sup>

**Genomics:**<sup>27</sup> Diabetes can “run in families,” meaning heredity often makes someone more likely to develop diabetes. Researchers believe certain genes affecting immune response can play a role in the development of type 1 diabetes, while genes affecting insulin function can contribute to the development of type 2 diabetes. Populations at higher risk for type 2 diabetes are African Americans, Hispanic/Latino Americans, American Indians, Asian Americans and Pacific Islander Americans.

**Aging of the Overall Population:** The risk for diabetes increases as people age. The effect of an aging population on diabetes prevalence can be seen by comparing prevalence rates from both the crude and the age-adjusted data.\* For the past 20 years, the crude and age-adjusted prevalence of diagnosed diabetes have been similar.

\* Crude data are raw data that are not adjusted for age or another factor. Age-adjusted data are an artificial estimate that has been adjusted to minimize the effects of different age distributions and allow comparisons between different population groups. Age-adjusted data represent what the crude data would have been in the study population if that population had the same age distribution as the standard population.

This indicates changes in age distribution (e.g. the aging Baby Boomer population) play a less influential role in rising diabetes prevalence trends than do other factors, such as decreasing physical activity and increasing obesity.

## Health Disparities

In the past 20 years, Michigan's population has become more diverse, with a slight increase in non-White populations. As previously mentioned, non-White populations tend to have a higher risk for developing type 2 diabetes. However, the changing demographics in Michigan play a minor role in the diabetes burden in Michigan. The major causes for the increasing trend in diabetes prevalence can be attributed to risk factors cutting across both ethnic and racial categorizations.

It is important to build cultural competency among providers to help ensure people from all racial and ethnic groups can access providers who understand their language, as well as their cultural attitudes and preferences. Community health workers may be used to increase the availability of culturally appropriate education and support groups. Persons with disabilities may experience additional challenges, and special programs will be needed to address barriers to high-quality care (e.g., physical access, programs tailored to individuals with hearing or vision disabilities).

**Racial and Ethnic Populations:** While African Americans, Hispanic/Latino Americans, American Indians, Asian Americans, and Pacific Islander Americans have a slightly lower rate of type 1 diabetes, they are at a higher risk for type 2 diabetes than the rest of the population. In addition, gestational diabetes occurs more frequently in African Americans, Hispanic/Latino Americans, and American Indians than in other groups:<sup>27,28</sup>

- The prevalence of diabetes among American Indians is 2.8 times the rate for all races.
- Different studies found African Americans are from 1.4 to 2.2 times more likely to have diabetes than White persons.
- Hispanic Americans have a higher prevalence of diabetes than non-Hispanic people, with the highest rates for type 2 diabetes among Puerto Rican Americans (1.8 times) and Hispanic people living in the Southwest (1.7 times) and the lowest rate among Cuban Americans.
- Major groups within the Asian and Pacific Islander communities (Japanese Americans, Chinese Americans, Filipino Americans, Korean Americans, and Indian Americans) all have higher prevalence than those of Whites.

Although diabetes in children and adolescents is still relatively rare (<1%), reports of increasing frequency of both type 1 and type 2 diabetes in youth are among the most concerning aspects of the evolving diabetes epidemic. Type 1 diabetes is the most common form of diabetes in all racial/ethnic groups except in American Indian youth, where 71% of their youth diabetes burden is type 2 diabetes. Among adolescents and young adults (age 10–19 years):<sup>16</sup>

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*While African Americans, Hispanic/Latino Americans, American Indians, Asian Americans, and Pacific Islander Americans have a slightly lower rate of type 1 diabetes, they are at a higher risk for type 2 diabetes than the rest of the population.*

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- American Indians are 9.2 times more likely to have type 2 diabetes than Whites.
- African Americans have 5.5 times the rate of type 2 diabetes compared to Whites.
- Hispanic and Asian and Pacific Islanders have type 2 diabetes at 2.5 times the rate of Whites.

Michigan mirrors national trends in diabetes prevalence among racial/ethnic groups. African Americans, Hispanics and other races have significantly higher diabetes prevalence than White, non-Hispanics (Table 2).<sup>29</sup> Of particular note in the Michigan data is that while men tend to higher diabetes prevalence than women, African American and Hispanic women appear to carry a higher diabetes burden than their male counterparts.<sup>30</sup>

Michigan is the home of the largest Arab geographic concentration outside the Middle East, and the Arab American population represents the third largest minority group in Michigan. Self-reported diagnosed diabetes among Arab Americans appears to be similar to the prevalence seen in Whites.<sup>31</sup> However, the Arab American population has as much as 50 percent of their diabetes population with undiagnosed diabetes, compared to 33 percent of the general diabetes population.<sup>32</sup>

The Bemidji Area (which includes Michigan, Minnesota and Wisconsin) had the second highest death rate from diabetes for all American Indian and Alaskan Native Indian Health Services (IHS) administrative regions or service areas (1999–2001), and one of the highest diabetes prevalence rates compared to other IHS areas (2006).<sup>33</sup> Self-reported diagnosed diabetes among Michigan tribes range from 5 percent to 19 percent.<sup>34</sup> A majority of American Indians are no longer living on reservations but in metropolitan areas, and Southeast Michigan has the 10th largest American Indian population in the country with an estimated diabetes prevalence of 16 percent.<sup>35</sup>

Table 2. Prevalence of Diagnosed Diabetes by Race/Ethnicity – Michigan, 2009.

| Demographic Characteristics |                      | White, non-Hispanic |               | Black, non-Hispanic |               |
|-----------------------------|----------------------|---------------------|---------------|---------------------|---------------|
|                             |                      | %                   | (95% CI)      | %                   | (95% CI)      |
| Age                         | 18-49                | 3.0                 | (2.4 - 3.9)   | 4.5                 | (3.0 - 6.6)   |
|                             | 50+                  | 15.1                | (14.0- 16.3)  | 27.0                | (23.3 - 31.0) |
| Gender                      | Male                 | 9.0                 | (8.0 - 10.1)  | 12.0                | (9.1 - 15.7)  |
|                             | Female               | 8.2                 | (7.3 - 9.1)   | 13.0                | (10.8 - 15.6) |
| Education                   | High school or less  | 11.2                | (9.9 - 12.6)  | 15.9                | (12.8 - 19.7) |
|                             | Some college or more | 7.1                 | (6.3 - 7.9)   | 10.0                | (7.9 - 12.7)  |
| Household Income            | < \$35,000           | 13.4                | (12.0 - 15.1) | 17.0                | (13.9 - 20.5) |
|                             | \$35,000+            | 5.9                 | (5.1 - 6.7)   | 7.9                 | (5.6 - 11.1)  |
| Demographic Characteristics |                      | Other, non-Hispanic |               | Hispanic            |               |
|                             |                      | %                   | (95% CI)      | %                   | (95% CI)      |
| Age                         | 18-49                | 4.0                 | (1.9 - 8.1)   | 8.4                 | (3.9 - 17.3)  |
|                             | 50+                  | 24.7                | (18.5 - 32.2) | 26.7                | (16.1 - 40.9) |
| Gender                      | Male                 | 13.3                | (8.7 - 19.8)  | 9.6                 | (4.3 - 20.2)  |
|                             | Female               | 9.0                 | (5.8 - 13.8)  | 15.9                | (8.9 - 27.0)  |
| Education                   | High school or less  | 15.6                | (9.6 - 24.2)  | 17.0                | (9.1 - 29.5)  |
|                             | Some college or more | 8.6                 | (5.6 - 12.9)  | 8.3                 | (3.5 - 18.2)  |
| Household Income            | < \$35,000           | 13.6                | (8.4 - 21.5)  | 10.4                | (4.5 - 21.9)  |
|                             | \$35,000+            | 9.8                 | (6.0 - 15.4)  | 11.6                | (5.5 - 22.9)  |

**People with Disabilities:** While diabetes is not automatically considered a disability, accommodations should be made for the activities people with diabetes must do to manage blood glucose. The definition of disability used in the Michigan Behavioral Risk Factor Survey is a “limitation of activities due to physical, mental or emotional conditions and/or required use of special equipment due to a health condition.” Most people with diabetes do not feel disabled and would rather avoid the stigma that comes with such a label.

There is evidence diabetes is associated with markedly increased risks of disability. The associated factors include co-morbid chronic diseases common with diabetes complications, depressive symptoms, obesity, lack of regular exercise, and taking insulin.<sup>36</sup> Conversely, the impact of disability on the diabetes population is extensive. People with diabetes and disability have higher rates of unemployment, absenteeism, and use of health care services. The prevalence of impairments increases steadily with age, and is more common in women and minority ethnic groups.<sup>37</sup> In Michigan, 44 percent of people with diabetes reported at least one disability — twice that of the general population.<sup>13</sup>

**Urban versus Rural:**<sup>38</sup> Across the nation, diabetes is more prevalent in rural counties than in urban areas, and Michigan is no exception to this pattern (Figure 2).<sup>23</sup> Nationally, the prevalence of self-reported diabetes in adults is 17 percent higher in rural counties than in metropolitan areas, seen across all race/ethnicity groups except Hispanics.

Adults with diabetes in rural areas are slightly less likely to receive recommended eye exams and foot exams, or to have had diabetes self-management education compared to those in urban areas. In general, rural adults are more likely to lack health insurance, and more likely to report deferring care due to cost than urban adults. Additionally, rural residents tend to travel further to receive care.

**Access to Care and Insurance:** In recent decades, increasing numbers of Americans face the realities of living without health care insurance coverage\* in a society where medical care is increasingly more expensive.<sup>39</sup> In 2009, 40 million persons aged 18–64 had no health insurance.<sup>40</sup> In general, adults who lack health care coverage are both less likely to access health care services and more likely to delay getting care when needed; and contrary to popular belief, the uninsured do not use emergency room services any more than the insured.<sup>41,42</sup> While lack of health care coverage would be a major concern for nearly all adults, lack of coverage poses more immediate and substantial risks to the health of people with diabetes — individuals for whom accessing routinely scheduled, appropriate health care services is a critical key to controlling the onset of life-threatening complications.

Michigan had an estimated 1.15 million uninsured residents in 2008, and the likelihood of being uninsured appears to be higher in the more northern

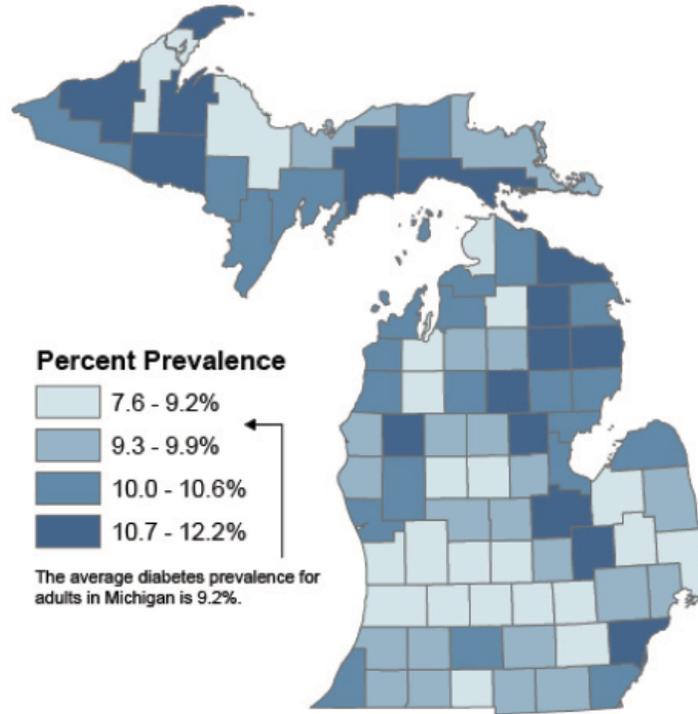
\* Health care insurance coverage is defined as including health insurance; prepaid plans, such as HMOs; or governmental plans, such as Medicare.

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Figure 2. County-Level Estimates of Diagnosed Diabetes Among Michigan Adults, 2008.



counties (Figure 3).<sup>44</sup> Michigan was ranked 14th lowest in non-elderly uninsured rates (those 65 and older are typically insured by Medicare and other options).<sup>44</sup> Michigan's poor and working poor are disproportionately uninsured. Black and Hispanic residents in Michigan are almost twice as likely to be uninsured. Fortunately, non-elderly adults with diabetes in Michigan are more likely to have insurance than the general population (Figure 4).<sup>13</sup> However, over the past decade, the rate of uninsured among people with diabetes has increased faster than the general population.

Figure 3. County-Level Estimates of the Uninsured Among Michigan Adults Aged 18-64, 2007.

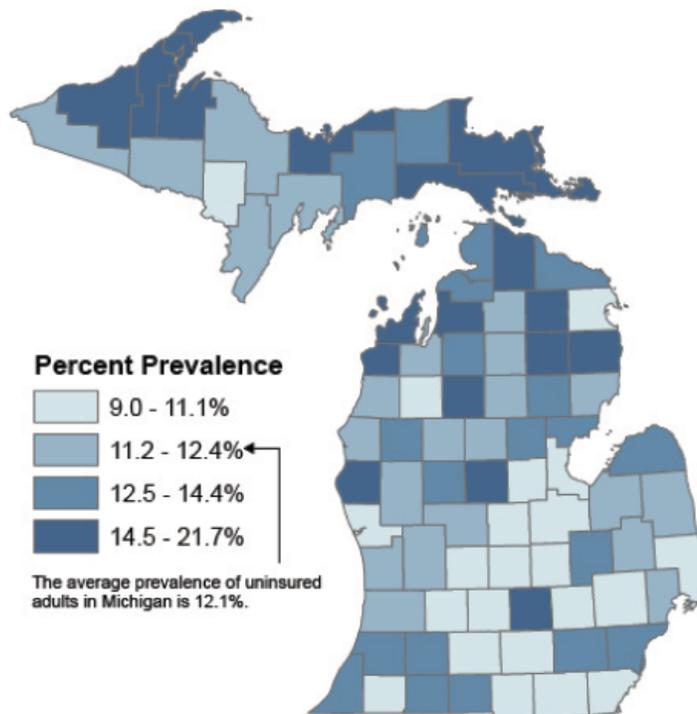
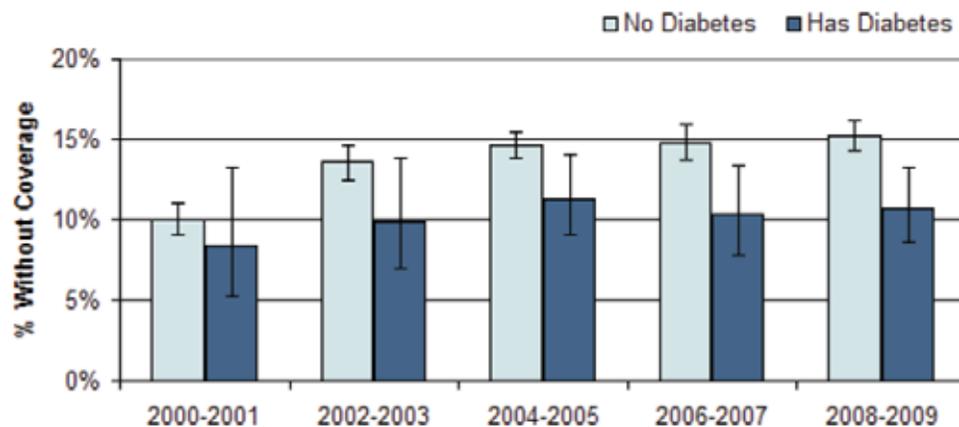


Figure 4. Adults Aged 18-64 Living without Health Care Coverage by Diabetes Status, Michigan 2002-2009.



Growing numbers of Michigan residents are *underinsured*, meaning their health care insurance coverage is not sufficient to meet their needs or they cannot afford the cost-sharing associated with covered benefits. Nationally, 38 percent of insured people report experiencing problems accessing medical services.<sup>45</sup> Underinsured adults are nearly as likely as uninsured adults to go without needed medical care and to incur medical debt.<sup>46</sup> Lower-income and sicker adults are most at risk of having inadequate health care insurance coverage.

**Health Care Reform:**<sup>47</sup> The Patient Protection and Affordable Care Act, the federal health care reform legislation, became law in March 2010. According to the American Diabetes Association, many important provisions of the law will impact people with diabetes, including rules about exclusions for pre-existing conditions, lifetime limits on benefits, and out-of-pocket expenses (i.e. medications and testing supplies). The law prohibits insurers from excluding children under age 19 with diabetes from being covered under their parents' insurance plans simply because of their diabetes. Also, young adults with diabetes will be able to stay on their parents' insurance plans until age 26.

When the law fully takes effect in 2014, insurance companies will no longer be allowed to deny coverage due to a pre-existing condition such as diabetes. Nor will insurance companies be able to charge higher premium rates because a person has diabetes.

The new law also addresses the prevention of diabetes. The National Diabetes Prevention Program will be established to expand the reach of community-based programs with a proven track record of preventing type 2 diabetes. Additionally, restaurants with over 20 locations will be required to display nutritional information on their menus.

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*Diabetes is recognized as one of the leading causes of death in the United States (7th), as well as within Michigan (6th).*

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*About two-thirds of deaths among those with diabetes are attributed to heart disease or stroke.*

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*Diabetes often causes vision-related complications, heart and blood vessel disease, stroke, high blood pressure, kidney disease, nerve damage, amputations, dental disease, and other complications.*

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Diabetes is recognized as one of the leading causes of death in the United States (7th), as well as within Michigan (6th). However, this is likely an underestimate of the impact since diabetes is not listed on death certificates over 90 percent of the time for adults with known diabetes.<sup>48</sup>

Overall, persons with diabetes are twice as likely to die as their peers of similar age who do not have the disease. On average, a person with diabetes in Michigan will die 12 years sooner (Table 3).<sup>49</sup> The mortality disparity in Michigan is even greater in African Americans with diabetes, who may die 13–15 years sooner. About two-thirds of deaths among those with diabetes are attributed to heart disease or stroke.

Diabetes is the leading cause of kidney failure, blindness and lower-limb amputation. Diabetes is also a major cause of heart disease and stroke. Nationally, 6 in 10 people with diabetes have one or more diabetes-related medical complications.<sup>50</sup>

## Medical Complications

Diabetes is associated with long-term complications, which affect almost every part of the body. Diabetes often causes vision-related complications, heart and blood vessel disease, stroke, high blood pressure, kidney disease, nerve damage, amputations, dental disease, and other complications. Uncontrolled diabetes can complicate pregnancy, and birth defects are more common in babies born to women with poorly controlled diabetes, especially in the first trimester.

### Cardiovascular Complications<sup>51,52</sup>

- Approximately 35 percent of U.S. adults with diabetes aged 35 or older reported having a cardiovascular disease condition.
- In Michigan, 28 percent of people with diabetes aged 18 and older reported having cardiovascular disease.

### High Blood Pressure<sup>3,52</sup>

- Sixty-seven percent of U.S. adults with diabetes had blood pressure greater than or equal to 140/90mmHg, or used medications for hypertension.
- In Michigan, 68 percent of people with diabetes aged 18 and older reported having been told they have high blood pressure.

### Vision-Related Complications<sup>3,52</sup>

- 4.2 million U.S. adults with diabetes (29 percent) had diabetic retinopathy; including 655,000 cases that could lead to vision loss.
- In Michigan, 21 percent of people with diabetes aged 18 and older reported having been diagnosed with retinopathy.

### Kidney Disease<sup>53,54,55</sup>

- More than 35 percent of U.S. adults with diabetes aged 20 years or older have chronic kidney disease – a condition in which the kidneys are damaged and cannot filter waste from blood well, and can lead to kidney failure over time if not treated.

Table 3. Average Years of Potential Life Lost Due to Diabetes – Michigan, 2008.

| Demographic Characteristics |        | Average Years of Potential Life Lost (YPLL)* |
|-----------------------------|--------|--|
| <b>Overall</b>              |        | 12.3   |
| White, non-Hispanic         | Male   | 12.1   |
|                             | Female | 11.4   |
| Black, non-Hispanic         | Male   | 15.0   |
|                             | Female | 13.2   |
| Other, non-Hispanic         | Male   | 10.0   |
|                             | Female | 12.7   |
| Hispanic                    | Male   | 13.3   |
|                             | Female | 11.1   |

\* A higher average YPLL indicates that individuals are dying at younger ages.

- Diabetes is the cause for 44 percent of the 112,097 new U.S. cases of kidney failure.
- In Michigan, diabetes is the cause for 41 percent of the 3,901 new cases of kidney failure.

### Nervous System Disease<sup>3</sup>

- Approximately 60 to 70 percent of people with diabetes have mild to severe forms of nervous system damage that could result in impaired sensation or pain in the feet or hands, slowed digestion of food in the stomach, carpal tunnel syndrome, erectile dysfunction and/or other nerve problems.
- Severe forms of diabetic nerve disease are a major contributing cause of lower-extremity amputations.

### Amputations<sup>3,49</sup>

- Nationally, more than 60 percent of non-traumatic lower-limb amputations occur in individuals with diabetes.
- In Michigan, more than 70 percent (2,730 individuals) of non-traumatic lower-limb amputations were diabetes related.

### Oral Health<sup>3</sup>

- Among young U.S. adults, those with diabetes have about twice the risk of periodontal (gum) disease as those without diabetes.
- U.S. adults aged 45 or older with poorly controlled diabetes (A1C > 9%) were nearly three times more likely to have severe periodontitis than those without diabetes.

### Complications of Pregnancy<sup>3</sup>

- Poorly controlled diabetes before conception and during the first trimester of pregnancy can cause major birth defects in 5 percent to 10 percent of pregnancies and spontaneous abortions in 15 percent to 20 percent of pregnancies.
- Poorly controlled diabetes during the second and third trimesters of pregnancy can lead to excessively large babies, posing a risk to both mother and child.

### Sexual Dysfunction<sup>56</sup>

- Estimates of prevalence of erectile dysfunction in U.S. men with diabetes vary widely, ranging from 20 to 75 percent. Men who have diabetes are two to three times more likely to have erectile dysfunction than men who do not have diabetes.

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*Roughly one in every ten health care dollars in the United States is spent on diabetes.*

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*Investments in community-based disease prevention programs aimed to increase physical activity, improve nutrition and prevent tobacco use could yield significant savings.*

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- In U.S. women, 18 to 27 percent with type 1 diabetes and 42 percent with type 2 diabetes experience sexual dysfunction.

### **Mobility<sup>3</sup>**

- U.S. adults aged 60 or older are 2–3 times more likely to report an inability to walk one-quarter of a mile, climb stairs, or do housework compared with people without diabetes in the same age group.

### **Other Complications<sup>3</sup>**

- Uncontrolled diabetes often leads to biochemical imbalances that can cause acute life-threatening events, such as diabetic ketoacidosis and hyperosmolar (nonketotic) coma.
  - In Michigan, 6,542 diabetes-related admissions were the result of uncontrolled diabetes.<sup>49</sup>
- People with diabetes are more susceptible to many other serious illnesses. Once they acquire these illnesses, they often have worse prognoses than their peers without diabetes.

**Emotional Health:** Diabetes can also affect the overall emotional well being of an individual. To be successful at managing diabetes, individuals with diabetes must develop the necessary skills for managing stress, coping, and problem solving as they work to modify their lifestyle, monitor their blood glucose levels, and adapt their treatment regimen.

### **Depression<sup>3,57</sup>**

- U.S. adults with diabetes are twice as likely to have depression.
- Depression is associated with a 60 percent increased risk of developing type 2 diabetes.
- Among people with diabetes, depression is a stronger predictor of hospitalization and death than are physical and metabolic factors (e.g. medical complications, body mass index, or A1C level).

While poorly controlled diabetes can cause symptoms that look like depression, diabetes and depression do have a bidirectional relationship. People who have symptoms of depression are more apt to be overweight, eat more, exercise less, and smoke — all factors that can increase risk for type 2 diabetes. Conversely, depression in individuals with diabetes is associated with increases in diabetes symptoms and greater impairment of functioning, as well as poor adherence to medication regimens and diet, exercise, and smoking treatment plans. Research suggests there may be biochemical reasons for the bidirectional relationship as antidepressant medication appears to increase incidence of diabetes and insulin use appears to increase risk of depression when the other factors mentioned above are controlled for.<sup>58</sup>

## **Economic Costs**

Roughly one in every ten health care dollars in the United States is spent on diabetes. The burden of diabetes falls most heavily on people with diabetes and their families, who have higher out-of-pocket medical expenses and reduced earnings from indirect issues, such as lost work days. On average, a person with diagnosed diabetes has medical expenditures

approximately 2.3 times more than their non-diabetic peers. For most Americans, the diabetes burden represents a hidden “tax” in the form of higher health insurance premiums, and the reduced overall quality of life for their families and friends with diabetes.<sup>59</sup>

Comprehensive estimates of the societal cost of diabetes suggest the U.S. national economic burden of prediabetes and diabetes reached \$218 billion in 2007. This figure includes the higher medical costs and reduced productivity related to diagnosed diabetes (\$174 billion), as well as the higher medical costs related to undiagnosed diabetes (\$18 billion), prediabetes (\$25 billion) and gestational diabetes (\$636 million).<sup>60</sup> For each American, regardless of diabetes status, this represents a cost burden of \$700 annually in the “hidden tax.” Using this information, it is estimated prediabetes and diabetes cost Michigan residents \$9 billion in 2009 (Table 4).

However, this is just a snapshot of the economic burden in 2007. Cost continues to rise as diabetes prevalence continues to rise. If diabetes prevalence continues to grow at the same pace, the overall economic burden of diagnosed diabetes alone will double in size to \$336 billion by 2034. Half of this spending (\$171 billion) will come from Medicare.<sup>61</sup>

Investments in community-based disease prevention programs aimed to increase physical activity, improve nutrition and prevent tobacco use could yield significant savings. The nation could, in theory, save up to \$250 billion in health care costs (about 7.5 percent of estimated spending on diabetes and prediabetes services) over the next 10 years if an intensive intervention strategy was implemented for all at-risk individuals.<sup>62</sup> It is estimated Michigan could save \$545 million across all chronic diseases by investing just \$10 per person per year.<sup>63</sup>

Table 4. Estimated Costs of Diabetes in Michigan, 2009.

| Type of Diabetes     | Cost per Person | Cost to Michigan | Cost to Nation | Projected Cost to Nation (2014) |
|----------------------|-----------------|------------------|----------------|---------------------------------|
| Diagnosed Diabetes   | \$9,963         | \$7 billion      | \$174 billion  | \$311 billion                   |
| Undiagnosed Diabetes | \$2,864         | \$1 billion      | \$18 billion   | \$21 billion                    |
| Prediabetes          | \$443           | \$976 million    | \$25 billion   | \$49 billion                    |
| Gestational Diabetes | \$3,305         | \$32 million     | \$636 million  | n/a                             |

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*Data indicate as much as one-third of all people with diabetes may be undiagnosed.*

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Although diabetes can begin with few or no warning signs, as the disease progresses individuals may begin to experience one or more symptoms, including frequent urination, excessive thirst, unexplained weight loss, extreme hunger, sudden vision changes, tingling or numbness in hands or feet, feeling very tired much of the time, very dry skin, sores that are slow to heal and more infections than usual. In addition, individuals who undergo an abrupt onset of insulin-dependent diabetes (type 1 diabetes) also may feel nauseous, vomit, or have stomach pains.

Appropriate diabetes care and treatment depend upon timely and accurate diagnosis. However, diabetes frequently is not diagnosed until complications appear which, for the average person with diabetes, can be as much as 12 years after the disease begins. Data indicate as much as one-third of all people with diabetes may be undiagnosed.<sup>64</sup>

## Testing and Diagnosis<sup>65,66</sup>

The 2011 American Diabetes Association Clinical Practice Recommendations state testing should be considered in adults of any age who are overweight or obese and have one or more of the known risk factors for diabetes. Because age is a major risk factor for diabetes, testing of those without other risk factors should begin no later than age 45. If results are normal, testing should be repeated at least every 3 years.

Results that are above the normal levels can diagnose a person with pre-diabetes, diabetes, or gestational diabetes (Table 5). When test results indicate a person has diabetes, the diagnosis should be confirmed with a second test on a different day — preferably using the same testing method.

Descriptions of the diagnostic tests follow, with advantages and disadvantages of each:

The **Fasting Blood Glucose (FBG)** test measures blood sugar levels after a fasting period of eight hours or more, and is most reliable when done in the morning. This test can be used to diagnose prediabetes or diabetes. However, it will miss some cases that could be found with an Oral Glucose Tolerance Test.

The **Oral Glucose Tolerance Test (OGTT)** also requires a fasting period of eight hours or more. The person then drinks a precise amount of glucose dissolved in water. Blood sugar levels are measured before and two hours after drinking the solution. This test can be used to diagnose prediabetes or diabetes. Research has shown the OGTT is more sensitive than the FBG in detecting prediabetes. However, the drawback is that it is considered less convenient to administer.

The OGTT is also the primary test used to diagnose gestational diabetes. In pregnant women not already diagnosed with diabetes, screening for gestational diabetes should be done at 24–28 weeks of gestation. Blood sugar levels are measured three times over the course of two hours, and the cutoff limits for the test results are different than those for diabetes (Table 5).

If glucose levels are above normal at least twice during the test, the woman is diagnosed with gestational diabetes. Since it is possible for undiagnosed diabetes to be present when testing for gestational diabetes, it is recommended to screen for diabetes at the first prenatal for those with risk factors.

Table 5. Diagnostic Test Criteria for Prediabetes and Diabetes.

| Type of Diagnostic Test            | Test Result |                      |             |
|------------------------------------|-------------|----------------------|-------------|
|                                    | Normal      | Prediabetes          | Diabetes    |
| Hemoglobin A1C (A1C)               | < 5.7%      | 5.7% - 6.4%          | > 6.4%      |
| Fasting Blood Glucose (FBG)        | < 100 mg/dL | 100 - 125 mg/dL      | > 125 mg/dL |
| Oral Glucose Tolerance Test (OGTT) | < 140 mg/dL | 140 - 199 mg/dL      | > 199 mg/dL |
|                                    | Normal      | Gestational Diabetes |             |
| OGTT - at fasting                  | < 92 mg/dL  | ≥ 92 mg/dL           |             |
| OGTT - at 1 hour                   | < 180 mg/dL | ≥ 180 mg/dL          |             |
| OGTT - at 2 hours                  | < 153 mg/dL | ≥ 153 mg/dL          |             |

In 2010, the **Hemoglobin A1C test** was approved by an International Expert Committee and the American Diabetes Association to diagnose prediabetes and diabetes. The A1C blood test provides an average blood sugar for the previous two to three months. Unlike the other two testing methods, the A1C does not require a fasting period. Another advantage of A1C is lower variability of test results since A1C levels are less influenced by day to day stress and illness.

Hemoglobin A1C does have some potential weaknesses. The A1C test tends to cost more to administer than an FBG. Blood samples need to be analyzed at a diagnostic lab where instruments have been appropriately calibrated. The A1C test is also more somewhat likely than the FBG test to miss identifying undiagnosed diabetes. Additionally, some racial populations have naturally higher hemoglobin A1C levels when at normal glucose tolerance levels.<sup>67</sup> This could potentially lead to some misdiagnosis of diabetes where none exists.

## Care and Treatment<sup>68</sup>

Diabetes management can be complex for both the provider and the patient. For the provider, it can be difficult to track patients with a disease in order to conduct the recommended clinical care practices. For patients, healthy behaviors are difficult to maintain over long periods, and daily medication requirements and glucose monitoring can be complex and time consuming.

Recently, there has been considerable focus on evidence-based practices – or practices with documented effectiveness. The Task Force on Community Preventive Services has systematically reviewed the evidence related to the benefits and potential harms of diabetes care services. As a result, the Task Force strongly recommends the following effective interventions for people with diabetes:

1. Disease and case management in health care systems
2. Diabetes self-management education in the community

**Disease and Case Management:** Disease management is an organized and proactive approach to healthcare. The focus is on integrating care for the disease and preventing complications and co-morbid conditions across multiple aspects of healthcare delivery. In addition to their primary care physician, the patient may also benefit from the care provided by an endocrinologist (specialized diabetes management and monitoring), a certified diabetes educator (daily diabetes management skills), a podiatrist (foot health), an ophthalmologist or an optometrist (eye health), and a dentist. Coordinating services and sharing outcomes across providers may be improved through the use of case management.

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*In addition to their primary care physician, the patient may also benefit from the care provided by an endocrinologist (specialized diabetes management and monitoring), a certified diabetes educator (daily diabetes management skills), a podiatrist (foot health), an ophthalmologist or an optometrist (eye health), and a dentist.*

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Case management identifies patients at risk for excessive resource usage, suboptimal outcomes, or suboptimal coordination of services. One assigned professional, the case manager, works to improve the coordination and provision of care for a patient. Recent advances in electronic medical records (EMR) have improved comprehensive case management through provider monitoring of patient testing and referrals. In fact, having an EMR system and on-site lab services in the provider office are better predictors of positive outcomes for patients with diabetes than race/ethnicity or insurance status.<sup>69</sup>

Recommended diabetes management and preventive practices have proven effective in reducing risk of complications:

#### **Glucose Control<sup>3</sup>**

- Improved glycemic control benefits people with either type 1 or type 2 diabetes. In general, each percentage point drop in A1C blood test results (e.g. from 8 percent to 7 percent) can reduce the risk of microvascular complications (eye, kidney, and nerve disease) by 40 percent.
- In persons with type 1 diabetes, intensive insulin therapy has long-term beneficial effects on the risk of cardiovascular disease.

#### **Blood Pressure Control<sup>3</sup>**

- Blood pressure control reduces the risk of cardiovascular disease (heart disease or stroke) among persons with diabetes by 33–50 percent and the risk of microvascular complications (eye, kidney, and nerve disease) by 33 percent.
- For every 10 mmHg drop in systolic blood pressure, the risk for diabetes-related complications is reduced by 12 percent.

#### **Control of Blood Lipids<sup>3</sup>**

- Improved control of LDL cholesterol reduces cardiovascular complications by 20–50 percent.

#### **Preventive Care Practices<sup>3,70</sup>**

- Regular eye exams and timely treatment may prevent as much as 90 percent of diabetes-related blindness.
- Detecting and treating diabetic eye disease with laser therapy can reduce the development of severe vision loss by an estimated 50–60 percent.
- Comprehensive foot care programs can reduce amputation rates by 45–85 percent.
- Detecting and treating early diabetic kidney disease by lowering blood pressure can reduce kidney function decline by 30–70 percent.

#### **Smoking Cessation**

- Smoking has been shown to impair insulin sensitivity and glucose tolerance. An estimated 12 percent of all type 2 diabetes in the U.S. may be attributable to smoking.<sup>71</sup>
- The risk for cardiovascular disease among smokers with diabetes is up to 14 times higher than either smoking or diabetes alone.<sup>72</sup>

- Since either smoking or diabetes can narrow the blood vessels, both can further increase risk of complications such as eye disease, kidney disease and amputation.<sup>73</sup>
- Scientifically proven smoking cessation treatments, including counseling and medications, or a combination of both, can double a person's chances of quitting smoking.<sup>74</sup>
- Over 95 percent of Michigan smokers with diabetes have been told by their doctor they should quit; however, only 38 percent were referred to a smoking cessation program.<sup>13</sup>

#### Immunizations<sup>52,75</sup>

- People with diabetes are about three times more likely to die with flu or pneumonia.
- In Michigan, 45 percent of adults with diabetes 18–64 had a pneumococcal vaccination and 75 percent of adults 65 and older. One shot is usually enough to protect for a lifetime, but for adults over the age of 64 who received a shot over 5 years ago, revaccination is recommended.
- In Michigan, 54 percent of adults with diabetes 18–64 had a flu shot and 73 percent of adults 65 and older. It is recommended people with diabetes receive a flu vaccine annually.

**Diabetes Self-Management Education:**<sup>76</sup> Diabetes self-management education (DSME) assists people in management techniques to care for their diabetes, and is key to a person's success. At the center of the diabetes management team is the person with diabetes. A person with diabetes, or their caregiver, performs 99 percent of the tasks required for successful diabetes management. Empowering and educating the diabetes patient and caregiver on self-management is essential.<sup>77</sup>

DSME focuses on behavior change, particularly related to self-monitoring, healthy eating and leading an active life. Behavior change and goal setting by people with diabetes are necessary to improving blood glucose levels, quality of life and diabetes outcomes. Due to the importance of beneficial daily behaviors and self-management skills, health care providers should be diligent in assuring their patients with diabetes receive DSME.

Diabetes management guidelines from the American Diabetes Association (ADA) and the Michigan Quality Improvement Consortium (MQIC)\* recommend individualized, comprehensive DSME as a critical component of a successful diabetes care management program.<sup>78</sup> Diabetes education is associated with increased use of primary and preventive care, and decreased use of emergency and hospital care. DSME leads to appropriate care (Figure 5),<sup>13</sup> which leads to a reduction in complications. People who have diabetes education are more than twice as likely to get all recommended medical care (A1C tests, eye exam, and foot exam) in a single year.<sup>79</sup>

\* MQIC is a collaborative effort whose participants include physicians and other personnel representing the Michigan HMOs, as well as the Michigan State Medical Society, the Michigan Osteopathic Association, the Michigan Association of Health Plans, the Michigan Peer Review Organization, and Blue Cross Blue Shield of Michigan.

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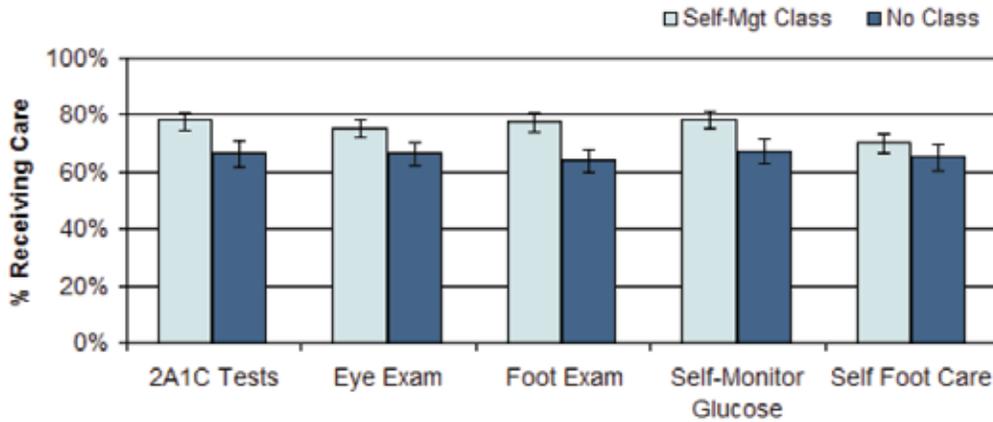


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*People who have diabetes education are more than twice as likely to get all of their recommended medical care (A1C tests, eye exam, and foot exam) in a single year.*

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Figure 5. Diabetes Care Rates Comparing People with Diabetes who Receive Diabetes Education to Those Who Have No Diabetes Education – Michigan, 2008-2009.



For successful management, persons with diabetes need adequate education and social support. Diabetes is an ever-changing disease that requires daily attention for a lifetime. People with diabetes require on-going information and support to continue the efforts needed to maintain control of the disease; hence the need for diabetes self-management support (DSMS) as one standard of care for DSME.<sup>80</sup> Evidence-based programs such as the Stanford Chronic Disease Self-Management Program, which is named Personal Action Toward Health (PATH) in Michigan, can guide people to develop a long-term focus on self-management, behavior changes and goal setting. Additionally, support groups may be effective as a source of emotional assistance. Support groups are often a means for people with diabetes to obtain new information, or to reinforce skills already learned, on properly managing the disease. Health care providers should encourage their clients with diabetes to seek out the type of on-going support each person finds most helpful.

## Summary

This report has demonstrated that diabetes is a common, serious and costly chronic disease that is a leading cause of death and disability in the United States. Yet, diabetes is both a *controllable* and *preventable* chronic disease. Although one in twelve U.S. adults has been diagnosed with diabetes, largely because of the rise in obesity, this trend can be reversed through the spread of evidence-based programs to prevent and manage the disease. These evidence-based programs empower individuals to take an active role in their health and include prevention programs that address lifestyle change, disease management through coordinated provider care and diabetes self-management education programs. By working as a team, people with diabetes, their health care providers, and their support system can lessen and perhaps even avoid diabetes complications by making positive lifestyle changes and following preventive care practices in a timely manner.

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*It is estimated 701,000 Michigan adults have been diagnosed with diabetes, and another 364,400 have undiagnosed diabetes. This means over 1 million adults in Michigan have diabetes. Diabetes is recognized as one of the leading causes of death in the United States.*



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