AdvaMed
Advanced Medical Technology Association

THE VALUE OF MEDICAL TECHNOLOGY IN CONTROLLING AND TREATING DIABETES

MEDICAL TECHNOLOGY
life changing
innovation

the disease

Diabetes is a group of diseases characterized by high blood glucose, or blood sugar, caused when the body either does not produce enough insulin or is unable to use insulin in an effective way. When not controlled, the high level of glucose can lead to serious health complications, including death.[1]

Diabetes is broken up into three primary common forms:

Type 1 diabetes, Type 2 diabetes, and gestational diabetes. **Type 1 diabetes** is an autoimmune disease associated with the failure of the body to produce insulin and accounts for about five percent of diagnosed cases. It is usually first diagnosed in children or young adults.[2] The vast majority of adult-diagnosed diabetes cases, about 95 percent, are **Type 2 diabetes,** and are often an outcome of environment and lifestyle. Increased obesity rates in America have led to a recent rise in cases of Type 2 diabetes, particularly among children and young adults.[3] Pregnant women who have high blood glucose levels during pregnancy but no history of diabetes are said to have **gestational diabetes.** This form of diabetes occurs in two to 10 percent of pregnant women.[4]

Nearly 26 million Americans are thought to have diabetes, although only roughly 19 million of them have been diagnosed, leaving millions more untreated.[5]

The Centers for Disease Control and Prevention (CDC) estimates that **one in three** U.S. adults could have diabetes by 2050, if recent trends continue at the same rate.[6]

health risks

Diabetes is known to cause serious complications for patients, some of which are life threatening. In fact, according to the American Diabetes Association (ADA), diabetes kills more Americans every year than AIDS and breast cancer combined.[7] Complications can include heart and kidney disease, and patients with diabetes are more likely to face vision loss and limb amputation.[8]

Additional health risks include:

Death from heart disease and stroke risk among adults with diabetes are about **two to four times** higher than for adults without diabetes.[9]

Diabetes is the leading cause of kidney failure, accounting for **44 percent** of all new cases of kidney failure.[10]

More than **60 percent** of non-traumatic lower-limb amputations are in patients with diabetes.[11]

Diabetes is the leading cause of new cases of **blindness** among adults ages **20 to 74.**[12]

701 PENNSYLVANIA AVE NW, STE 800, WASHINGTON, DC 20004 | P 202-783-8700 | F 202-783-8750 | WWW.ADVAMED.ORG

the costs

Diabetes imposes a substantial economic burden on society and is one of the costliest chronic diseases, accounting for $245 billion in economic costs in 2012 alone for diagnosed cases, including $176 billion in direct medical costs and $69 billion in reduced productivity.[13] What's more, these costs represent a 41 percent increase over just five years, from 2007 to 2012.[14] It is important to note that these costs do not take into account the estimated 6.3 million-plus cases of undiagnosed diabetes in the U.S. as of 2007, and the corresponding $18 billion burden that places on society.[15]

According to the ADA's *Economic Costs of Diabetes in the U.S. in 2012*:

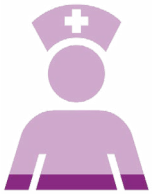
"People with diagnosed diabetes incur average medical expenditures of about $13,700 per year, of which about $7,900 is attributed to diabetes. People with diagnosed diabetes, on average, have medical expenditures that are approximately 2.3 times higher than they would be in the absence of diabetes."[16]

Proportionally, medical expenditures for patients with diabetes include:

Hospital inpatient care **(43%)**;

Prescription medications to treat complications of diabetes **(18%)**;

Physician office visits **(9%)**;



Nursing/residential facility stays **(8%)**.[17]

Among the indirect costs associated with diabetes are:

Absenteeism **($5B)**;

Reduced productivity at work **($20.8 billion)**;

Inability to work as a result of disability **($21.6B)**.[18]

Importantly, according to the ADA, complications are a driving cost of diabetes care, with 25 percent of diabetes-attributed emergency room costs and 45 percent of diabetes-attributed hospital inpatient costs associated with treating complications.[19] Further, diabetes is the leading cause of chronic kidney disease (CKD) and kidney failure in the U.S.[20], and in 2005 care for patients with kidney failure cost the economy nearly $32 billion.[21]

Similar findings have shown that treatment of patients with uncontrolled diabetes and diabetes complications can cost two to eight times more than patients with controlled diabetes.[22] In other words, improved treatment and maintenance of diabetes can help avoid complications, saving health care dollars and improving quality of life for patients and caregivers.

701 PENNSYLVANIA AVE NW, STE 800, WASHINGTON, DC 20004 | P 202-783-8700 | F 202-783-8750 | WWW.ADVAMED.ORG

medtech & diagnostic solutions

Patient benefits

In recent years, medical technology has revolutionized the ways in which people are screened for and live with diabetes, providing diagnostic and treatment options that contribute to improved health outcomes, helping to maintain a better quality of life and reducing complications associated with the disease.

The HbA1c test is a common blood test used to diagnose pre-diabetes, Type 1 and 2 diabetes and then to gauge how well a person is managing the disease so that physicians can appropriately tailor treatments. Clinical studies show that in-office HbA1c results improve decision making,[23] patient compliance [24] and outcomes. Further, when diabetes is detected early and a person starts treatment, small changes can have a significant impact: a 1% reduction in HbA1c levels can translate into a 30% reduction in complications such as eye disease and nerve damage, and a 16% drop in complications such as heart disease.[25]

The evolution of glucose monitoring over the past few decades has revolutionized diabetes management. By being able to test glucose levels frequently— either with a **portable glucose meter and test strips** or with more recent continuous glucose monitoring technology—patients have been able to improve self-management of the disease, gain greater freedom and flexibility in their daily activities, and make more informed decisions about food, physical activity and medications.

Recent advancements in blood glucose monitoring devices have resulted in improved accuracy, smaller required blood volumes, and the ability to transfer data between the meter and insulin delivery devices.[26]

Continuous glucose monitoring technology is a newer tool that allows patients with Type 1 diabetes to check their glucose levels on a continuous basis, as opposed to three to four times per day,[27] and without a blood draw. Such devices comprise three components: a glucose sensor placed just under the skin of the abdomen; a transmitter that connects to the sensor and sends results to a receiver; and the receiver which displays glucose results,[28] with some devices providing nearly 300 measurements in a 24-hour period.[29]

As more and more patients and health care providers recognize the benefits of continuous monitoring, such technology has been more widely adopted by insulin-dependent diabetes patients, both Type 1 and Type 2, to help them maintain consistent glucose levels and avoid complications.[30] Continued advancements—including smaller devices and predictive, customizable alerts that offer early warning of high or low glucose levels—are helping to improve accuracy and performance, making these monitors even more effective tools for maintaining glucose control.[31]

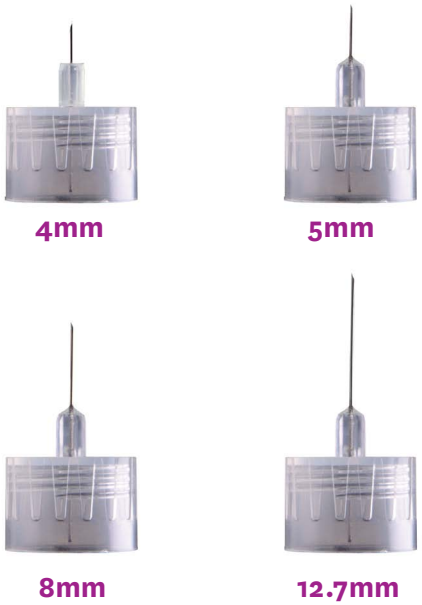
701 PENNSYLVANIA AVE NW, STE 800, WASHINGTON, DC 20004 | P 202-783-8700 | F 202-783-8750 | WWW.ADVAMED.ORG

For patients who inject insulin, advancements in **needle technology**—including shorter needles with finer gauge—have been shown to improve the patient experience through reduced pain, and greater ease and convenience, all of which may help patients overcome barriers to injection and support better adherence to prescribed therapies.[32 33 34]

Four-millimeter needles have been demonstrated to lower the risk of intramuscular injection that can lead to hypoglycemia, and use of shorter needles also improves access to more injection sites, supporting healthy site rotation[35] that can reduce the risk of developing lipohypertrophy (rubbery-feeling lumps that appear under the skin). These lumps may increase variability in insulin action and contribute to fluctuations in blood glucose control and excess insulin use.[36 37]

Also for treatment of the disease, particularly Type 1, **insulin pumps** can provide patients with the insulin they need to stabilize their glucose levels, either on a continuous basis or as needed, such as around mealtime. The pump imitates the insulin secretion patterns from the pancreas of a person without diabetes, enabling the patient to maintain blood glucose levels that are closer to normal than often can be achieved through injection treatment.[38]

Both the continuous glucose monitor and insulin pump allow for more flexibility and greater control of diabetes, which in turn reduces long-term complications such as eye, heart and kidney disease, and nerve damage.[39]



Evolution of pen needle length over the last 20 years

In fact, improvements in blood glucose management reduce a patients' risk of:

Eye disease by **76 percent** [40 41]

Kidney disease by **54 percent** [40 41]

Heart attacks by **40 percent** [40 41]

According to CDC, among adults with diabetes, death rates from hyperglycemic events have declined since the mid-1980s, and rates of lower-limb amputation and kidney failure have dropped since the mid-1990s.[42] Among the reasons cited for these declines are:

- Improvements in blood glucose control,[43]
- Early detection and management of diabetes complications, and
- Improvements in preventive care, treatment, and diabetes care management.[44]

701 PENNSYLVANIA AVE NW, STE 800, WASHINGTON, DC 20004 | P 202-783-8700 | F 202-783-8750 | WWW.ADVAMED.ORG

cost savings

Importantly, these advanced diabetes technologies don't just improve quality of life, but they can help to cut overall health care costs. Many of the costly complications associated with diabetes — high blood pressure, kidney failure or dialysis, heart attacks and hospitalization requirements to name a few — can be prevented or delayed with regular diagnostic testing and better management of glucose control.

One study found that, over time, early detection of diabetes leads to great savings for health care systems as fewer, less severe complications arise, especially in older age groups and those at high-risk of developing the disease.[46] ***According to the American Clinical Laboratory Association, the average cost of the HbA1c test – used for early detection of diabetes – is roughly $13.***[47]

Another study estimated that with appropriate primary care for diabetes complications, nearly $2.5 billion of the $3.8 billion spent in 2001 for related hospital in-patient costs could have been averted, with significant potential savings obtained in Medicare ($1.3 billion of total costs) and Medicaid ($386 million of total costs).[48]

In addition, evidence suggests that between $34,000 and $57,000 is saved each year for every 100 patients who use insulin pumps, largely by reducing the risk of complications through improved blood glucose control.[49]

The future of medical technology for the treatment and care of people with diabetes promises to bring even more value. Research is ongoing toward development of a fully functioning artificial pancreas — a technology that links an insulin pump with a continuous glucose monitor to provide automatic, real-time monitoring of glucose levels and delivery of insulin. A study carried out on behalf of the Juvenile Diabetes Research Foundation (JDRF) estimates the potential savings to Medicare of artificial pancreas technology at $1.9 billion over 25 years.[50]

Advances in medical technology are revolutionizing the ways in which millions of Americans live with diabetes, and in so doing, they are improving lives, allowing patients to avoid hospitalizations and costly complications, and saving health care dollars.

701 PENNSYLVANIA AVE NW, STE 800, WASHINGTON, DC 20004 | P 202-783-8700 | F 202-783-8750 | WWW.ADVAMED.ORG

references

1 Centers for Disease Control and Prevention. Diabetes Report Card 2012. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services; 2012.
2 Ibid
3 Ibid
4 Ibid
5 Centers for Disease Control and Prevention. National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011.
6 Ibid
7 American Diabetes Association. Fast Facts: Data and Statistics about Diabetes. Retrieved March 3, 2014, from: http://professional.diabetes.org/admin/UserFiles/0%20-%20Sean/FastFacts%20March%202013.pdf
8 Ibid
9 Ibid
10 Ibid
11 Ibid
12 Ibid
13 American Diabetes Association. Economic Cost of Diabetes in the US in 2012. [published online ahead of print March 6, 2013] Diabetes Care. DOI:10.2337/dc12-2625.
14 Ibid
15 Zhang, Y et al. The Economic Costs of Undiagnosed Diabetes. Population Health Management. April 2009, 12(2): 95-101. doi:10.1089/pop.2009.12202.
16 American Diabetes Association. Economic Cost of Diabetes in the US in 2012. [published online ahead of print March 6, 2013] Diabetes Care. DOI:10.2337/dc12-2625.
17 Ibid
18 Ibid
19 Ibid
20 National Kidney and Urologic Diseases Information Clearinghouse (NKUDIC). Retrieved March 3, 2014, from: http://kidney.niddk.nih.gov/KUDiseases/pubs/kdd/index.aspx#1
21 United States Renal Data System. USRDS 2007 Annual Data Report. Bethesda, MD: National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, U.S. Department of Health and Human Services; 2007.
22 Kim, S. Burden of hospitalizations primarily due to uncontrolled diabetes: implications of inadequate primary health care in the United States. Diabetes Care 2007; 30: 1281-1282.
23 Thaler, LM, Ziemer, DC, Gallina, DL et al. Diabetes in urban African-Americans. XVII. Availability of rapid HbA1c measurements enhances clinical decision-making. Diabetes Care. 1999;22:1415-1421.
24 Miller CD, Barnes CS, Phillips LS, et al. Rapid A1c availability improves clinical decision-making in an urban primary care clinic. Diabetes Care. 2003;26:1158-1163.
25 Why screening for diabetes makes good sense – for people and society. Novo Nordisk. Retrieved March 5, 2014, from: http://www.novonordisk.com/images/about_us/changing-diabetes/PDF/Screening_book_FINAL.pdf
26 Ramchandani N., Rubina H. New technologies for diabetes: a review of the present and the future. Int J Pediatr Endocrinol. 2012 Oct 26;2012(1):28.
27 Facchinetti A, et al. Real-Time Improvement of Continuous Glucose Monitoring Accuracy. Diabetes Care 2013; 36(4): 793-800.
28 Warshaw H. Continuous Glucose Monitoring: Advancements & Uses for People with Diabetes. Diabetic Living. Retrieved March 5, 2014, from: http://www.diabeticlivingonline.com/monitoring/blood-sugar/continuous-glucose-monitoring-advancements-uses-people-diabetes?page=0%2C0
29 Philis-Tsimikas A. To your health: Advances in self-testing for diabetes. Del Mar Times. Retrieved March 5, 2014, from: http://www.delmartimes.net/2013/11/29/to-your-health-advances-in-self-testing-for-diabetes/
30 Christiansen M, et al. A New-Generation Continuous Glucose Monitoring System: Improved Accuracy and Reliability Compared with a Previous-Generation System. Diabetes Technol Ther. Oct 2013; 15(10): 881–888.
31 Ibid
32 Hirsch LJ, et al. Impact of a Modified Needle Tip Geometry on Penetration Force as well as Acceptability, Preference, and Perceived Pain in Subjects with Diabetes. J Diabetes Sci Technol 2012;6(2):328-35.
33 Aronson R, et al. Insulin pen needles: Effects of extra thin-wall needle technology on preference, confidence, and other patient ratings. Clin Ther 2013;35(7):923-933.
34 Aronson R. The role of comfort and discomfort in insulin therapy. Diabetes Technol The 2012;14(8):1-7.
35 Hirsch LJ, et al. Impact of a Modified Needle Tip Geometry on Penetration Force as well as Acceptability, Preference, and Perceived Pain in Subjects with Diabetes. J Diabetes Sci Technol 2012;6(2):328-35.
36 Chowdhury TA, Escudier V. Poor glycaemic control caused by insulin induced lipohypertrophy. BMJ 2003;327(7411):383-4.
37 Blanco M, et al. Prevalence and risk factors of lipohypertrophy in insulin-injecting patients with diabetes. Diabetes Metab 2013;39(5):445-53.
38 NICE. (2008). Continuous subcutaneous insulin infusion for the treatment of diabetes mellitus. Review of technology appraisal guidance 57. NICE technology appraisal guidance 151.
39 Doyle EA, Weinzimer SA, Steffen AT, Ahern JAH, Vincent M, Tamborlane WV. A randomized prospective trial comparing the efficacy of insulin pump therapy with multiple daily injections using insulin glargine. Diabetes Care. 2004;27(7):1554-1558.
40 Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. New Engl J Med. 1993;329:977-986.
41 Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications Study Research Group. Intensive diabetes treatment and cardiovascular disease in patients with type 1 diabetes. New Engl J Med. 2005;353:2634-2653.
42 Centers for Disease Control and Prevention. Diabetes Report Card 2012. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services; 2012.
43 Hoerger TJ, Gregg EW, Segal JE, Saadine JB. Is glycemic control improving in U.S. adults? Diabetes Care. 2008; 31(1):81-86.
44 Geiss LS, Engelgau M, Pogach L, et al. A national progress report on diabetes: successes and challenges. Diabetes Technol Ther. 2005:7(1):198-203.
45 Saadine JB, Cadwell BL, Gregg EW. Improvements in diabetes processes of care and intermediate outcomes: United States, 1988–2002. Ann Intern Med. 2006; 144:465-474.
46 Waugh N, et al. Screening for type 2 diabetes: literature review and economic modelling. Health Technol Assess. 2007 May; 11(17).
47 Mertz A. (2014, February 14). Lab testing a Medicare cost saver. The Hill. Retrieved March 4, 2014, from: http://thehill.com/opinion/op-ed/198640-alan-mertz-lab-testing-a-medicare-cost-saver
48 Agency for Healthcare Research and Quality. Economic and Health Costs of Diabetes. Retrieved March 3, 2014, from: http://archive.ahrq.gov/data/hcup/highlight1/high1.htm
49 S. Bevan, K. Zheltoukhova and R. McGee. Adding Value: The Economic and Societal Benefits of Medical Technology. The Work Foundation – part of Lancaster University, November 2011.
50 Juvenile Diabetes Research Foundation. Retrieved March 3, 2014, from: https://www.jdrf.org.uk/news/latest-news/19-billion-potential-healthcare-saving-for-usa-with-artificial-pancreas

The Value of Medical Technology: Controlling & Treating Diabetes

Diabetes is a group of diseases characterized by high blood glucose, or blood sugar, caused when the body either does not produce enough insulin or is unable to use insulin in an effective way. When not controlled, the high level of glucose can lead to serious health complications, including death.[1]

26 MILLION

Americans are thought to have diabetes.[2]

1 in 3 ADULTS

Could have diabetes by 2050 if recent trends continue at the same rate.[3]

According to the American Diabetes Association (ADA), diabetes kills more Americans every year than AIDS and breast cancer combined.[4] Complications can include heart and kidney disease, vision loss and limb amputation.[5]

KIDNEY FAILURE

Diabetes accounts for 44% of all new cases of kidney failure.[6]

STROKE & HEART DISEASE

Death from heart disease and stroke risk among adults with diabetes are two to four times greater than among adults without diabetes.[7]

LOWER-LIMB AMPUTATION

More than 60% of non-traumatic lower-limb amputations are in patients with diabetes.[8]

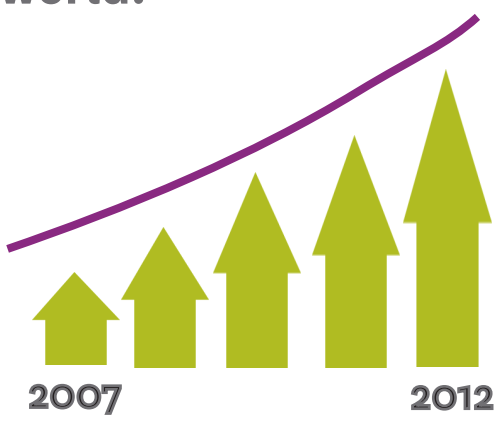
Diabetes imposes a substaintial economic burden on society and is one of the costliest chronic diseases in the world.

$245 BILLION

Economic costs of diagnosed cases of diabetes in 2012 included $176B in direct medical costs and $69B in reduced productivity.[9]

$18 BILLION

Burden placed on society due to undiagnosed cases of diabetes.[10]



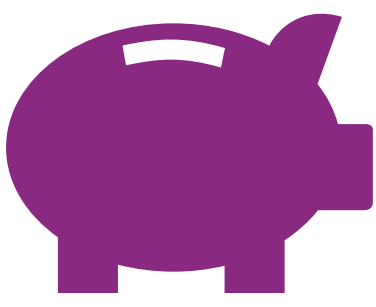
41% INCREASE

Economic costs of diabetes increased 41% over just five years, from 2007 to 2012.[11]

Medical technology has revolutionized the ways in which people are screened for and live with diabetes, providing diagnostic and treatment options that contribute to improved health outcomes, helping to maintain a better quality of life and reducing overall health system costs.

COMPLICATIONS REDUCED

Eye disease reduced by 76%, kidney disease by 54% and heart attacks by 40%, due to better blood glucose management.[12 13]



DOLLARS SAVED

Between $34,000 and $57,000 is saved each year for every 100 patients who use insulin pumps.[14]

THE FUTURE OF MEDTECH

An estimated $1.9B over 25 years could be saved through development and utilization of artificial pancreas technology.[15]

LifeChangingInnovation.org

1 Centers for Disease Control and Prevention. Diabetes Report Card 2012. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services; 2012.

2 Centers for Disease Control and Prevention. National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011.

3 Ibid

4 American Diabetes Association. Fast Facts: Data and Statistics about Diabetes. Retrieved March 3, 2014, from: http://professional.diabetes.org/admin/UserFiles/0%20-%20Sean/FastFacts%20March%202013.pdf

5 Ibid

6 Ibid

7 Ibid

8 Ibid

9 American Diabetes Association. Economic Cost of Diabetes in the US in 2012. [published online ahead of print March 6, 2013] Diabetes Care. DOI:10.2337/dc12-2625.

10 Zhang, Y et al. The Economic Costs of Undiagnosed Diabetes. Population Health Management. April 2009, 12(2): 95-101. doi:10.1089/pop.2009.12202.

11 American Diabetes Association. Economic Cost of Diabetes in the US in 2012. [published online ahead of print March 6, 2013] Diabetes Care. DOI:10.2337/dc12-2625.

12 Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. New Engl J Med. 1993;329:977-986.

13 Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications Study Research Group. Intensive diabetes treatment and cardiovascular disease in patients with type 1 diabetes. New Engl J Med. 2005;353:2634-2653.

14 S. Bevan, K. Zheltoukhova and R. McGee, "Adding Value: The Economic and Societal Benefits of Medical Technology", The Work Foundation – part of Lancaster University, November 2011.

15 Juvenile Diabetes Research Foundation. Retrieved March 3, 2014, from: https://www.jdrf.org.uk/news/latest-news/19-billion-potential-healthcare-saving-for-usa-with-artificial-pancreas

AdvaMed
Advanced Medical Technology Association