National Institutes of Health

Fact Sheet — *Type 1 Diabetes*

Thirty Years Ago

- Twenty percent of people born in the 1950s died within 20 years of a type 1 diabetes diagnosis. Over 30 percent died within 25 years.
- About one in four people developed kidney failure within 25 years of a type 1 diabetes diagnosis. Doctors could not detect early kidney disease and had no tools for slowing the progression to kidney failure.
- About 90 percent of people with type 1 diabetes developed diabetic retinopathy within 25 years of diagnosis. Blindness from diabetic retinopathy was responsible for about 20 percent of new cases of blindness between the ages of 45 and 74.
- Major birth defects in the offspring of mothers with type 1 diabetes were three times higher than the rate in the general population.
- Patients relied on injections of animal-derived insulin. The insulin pump would soon be introduced but would not become widely used for years.
- Researchers did not yet recognize the need for intensive glucose control to delay or prevent the debilitating eye, nerve, kidney, heart, and blood vessel complications of diabetes. Also, the importance of blood pressure control in preventing complications was not established yet.
- Patients monitored their glucose levels with urine tests, which recognized high but not dangerously low glucose levels and reflected past, not current, glucose levels. More reliable methods for testing blood glucose levels were not developed yet.
- Researchers had just discovered autoimmunity as the underlying cause of type 1 diabetes. However, they couldn't assess an individual's level of risk for developing the disease, and they didn't know enough to even consider ways to prevent it.

Today

- For people born between 1975 and 1980, about 3.5 percent died within 20 years of diagnosis, and 7 percent died within 25 years of diagnosis. These death rates were much lower than those of patients born in the 1950s but still significantly increased compared to the general population.
- After 20 years of annual increases from 5 to 10 percent, rates for new kidney failure cases have leveled off. The most encouraging trend is in diabetes, where rates for new cases in whites under age 40 are the lowest in 20 years. Improved control of glucose and blood pressure and the use of specific antihypertensive drugs called ACE inhibitors and ARBs prevent or delay the progression of kidney disease to kidney failure. With good care, fewer than 10 percent of people with diabetes develop kidney failure.
- With timely laser surgery and appropriate follow-up care, people with advanced diabetic retinopathy can reduce their risk of blindness by 90 percent.
- For expectant mothers with type 1 diabetes, tight control of glucose that begins before conception lowers the risk of birth defects, miscarriage, and newborn death to a range that is close to that of the general population.
- Patients now use a variety of insulin formulations, e.g., rapid-acting, intermediate acting, and long-acting insulin, to control their blood glucose. Insulin pumps are widely used, and inhaled insulin is available. Components of an artificial pancreas are being tested in clinical studies.
- A major clinical trial, the Diabetes Control and Complications Trial, showed that intensive glucose control dramatically delays or prevents the eye, nerve, kidney, and heart complications of type 1 diabetes. This finding caused a paradigm shift in the way type 1 diabetes is controlled.

- Patients monitor their blood glucose with precise, less painful methods. The widely used hemoglobin A1c test (HbA1c) shows average blood glucose over the past 3 months.

- Scientists found a region of the human genome that accounts for half the increased risk of developing autoimmune diabetes. This key region houses genes that encode proteins involved in the immune response. Changes in other genes, such as the insulin gene and genes that regulate T cell activation also increase susceptibility.

- Researchers have learned a great deal about the underlying biology of autoimmune diabetes and can now predict who is at high, moderate, and low risk for developing type 1 diabetes. Exploiting this knowledge and advances in immunology, researchers seek to prevent type 1 diabetes and preserve insulin-producing cells in newly diagnosed patients. This new understanding allows diagnosis and treatment of type 1 diabetes before the development of life-threatening complications.

- Many people who received islet transplants for poorly controlled type 1 diabetes are free of the need for insulin administration a year later, and episodes of dangerously low blood glucose are greatly reduced for as long as 5 years after transplant, according to studies at 19 medical centers in the U.S. and Canada. However, transplanted islets' function is lost over time, and patients have side effects from immunosuppressive drugs.

Tomorrow

- By finding all the genes and environmental factors (e.g., viruses, toxins, dietary factors) that contribute to type 1 diabetes, researchers will develop ways to safely prevent or reverse the autoimmune destruction of insulin-producing cells.

- Methods for safely imaging the insulin-producing beta cells will help scientists better understand the disease process and assess the benefits of treatments and preventions that are under study.

- Toxic suppression of the immune system to prevent rejection of transplanted organs and tissues will be replaced with safer, more targeted methods of immune modulation.

- New technologies, such as a closed loop system that automatically senses blood glucose and adjusts insulin dosage precisely, will become available. Patients will more easily control their blood glucose levels and develop fewer complications.

- Increased understanding of the molecular pathways by which blood glucose causes cell injury will allow scientists to develop novel therapies that prevent and repair the damage.

- Some of the most important progress in type 1 diabetes has been gained from clinical studies in patients with diabetes and those at risk for the disease. To maintain the rapid pace of discovery, it is critical for individuals to take part in well designed clinical studies. As one leading researcher put it, "The patient is the most important member of the research team."