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Chapter 1

The Origins and Dangers of Prediabetes

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Prediabetes is a condition in which blood sugar (in the form of glucose) levels are higher than normal but not yet high enough to be diagnosed as Type 2 diabetes. It signals that the body is starting to have trouble managing blood glucose effectively.

While prediabetes itself may not cause noticeable symptoms, high blood glucose increases the risk of developing Type 2 diabetes, heart disease, and other medical problems if left unaddressed. Even if blood glucose levels don't rise progressively to a diagnosis of Type 2 diabetes, having higher than normal average blood glucose levels does increase the risk of some of the same health complications that are associated with Type 2 diabetes including heart disease and strokes, kidney and eyes diseases as well as in increased risk of neurological problems including dementia.

REMEMBER

Although the prefix "pre" may suggest that prediabetes inevitably leads to diabetes, this is certainly not the case and there are many people who would not be predestined to develop Type 2 diabetes.

Diagnosing prediabetes is crucial because it may be the critical step before developing diabetes. As you find out in this book, diabetes is associated with complications that may cause considerable physical and mental discomfort at best and be life-threatening at worst. So you don't want to go there.

Even if you go on to develop diabetes, all is not lost. You can use the suggestions found here to avoid further complications. You can't get rid of the diagnosis, but you can get rid of the problems.

In this chapter, you discover how to differentiate among three physical states: normal health, prediabetes, and diabetes. We explain that prediabetes is a recent phenomenon, which parallels the epidemic of obesity and lack of exercise in countries around the world.

Next, you discover who is affected by prediabetes and which groups of people are at the highest risk. We also touch on special considerations for children and the elderly at risk for prediabetes.

Finally, we focus on the costs of prediabetes, which are not only monetary. We explain that even though prediabetes is often considered a benign condition and not a disease, changes occur in the body of a person with prediabetes that may not be benign after all.

Recognizing a Global Problem

Prediabetes is increasingly recognized as a major public health concern in the United States, Europe, and around the world. What makes prediabetes particularly worrying is its silent nature and a vast majority of those who have it are unaware. In the United States, for example, the Centers for Disease Control and Prevention (CDC) estimates that about 96 million adults, or nearly 38 percent of the adult population, have prediabetes. Yet over 80 percent of these people don't know they're affected. The situation is similarly concerning in Europe. According to the International Diabetes Federation, over 36 million people in Europe are thought to have prediabetes. In the UK, National Health Service figures suggest that around 5 million people may be living with prediabetes, sometimes referred to as "non-diabetic hyperglycemia."

Globally, the International Diabetes Federation estimates that more than 540 million adults may be affected by prediabetes. While high-income countries still bear much of the burden, the problem is accelerating in low- and middle-income nations due to rapid urbanization, changes in diet, and increasingly sedentary lifestyles. What is especially concerning is the strong association between

prediabetes and the eventual development of Type 2 diabetes. Without intervention, as many as 70 percent of people with prediabetes will go on to develop diabetes, often within five to ten years.

Taking control of prediabetes

The good news is that prediabetes is being identified more frequently with increased screening and can often be reversed or managed through the lifestyle changes described throughout this book. In this chapter, you discover some of the basics about prediabetes and its impact on health.

Here are some encouraging facts about managing prediabetes:

- Without intervention, about 15–30 percent of people with prediabetes will develop Type 2 diabetes within five years. This means that while a substantial proportion do progress, it is not inevitable. Many do not develop diabetes, especially with lifestyle changes.
- Up to 50 percent of Type 2 diabetes cases can be prevented or delayed with appropriate lifestyle modifications, such as weight loss, healthy eating, and increased physical activity.
- A substantial number of people with prediabetes can reverse the condition through lifestyle changes such as losing a modest amount of weight, eating more healthfully, and becoming more physically active.
- With the right changes, many people are able to bring their blood glucose levels back into the normal range, often avoiding the progression to Type 2 diabetes altogether.
- Even if blood glucose doesn't return fully to normal, lifestyle improvements can still make a big difference — slowing or stopping the progression to diabetes and lowering the risk of serious complications.
- While not everyone may fully reverse prediabetes, the majority of people who make and sustain these changes can significantly improve how their body handles glucose and reduce their long-term health risks.

Embodying the Spectrum

Every cell in the human body needs energy to function, and one of the body's primary sources of this energy is *glucose* — a simple sugar derived from the food we eat. When we consume carbohydrates such as bread, fruit, rice, or pasta, our

digestive system breaks them down into glucose, which is then absorbed into the bloodstream. Protein and fat can also be converted into glucose by the body, particularly when carbohydrate intake is low. This blood glucose is then transported around the body and taken up by cells, where it's either used immediately for energy or stored for later use.

To ensure that blood glucose levels remain within a healthy range, our bodies rely on a carefully balanced system of regulation. A key player in this process is the hormone insulin, which is produced by the pancreas. When glucose enters the bloodstream after a meal, insulin is released to help move the glucose from the blood into the cells. This keeps blood glucose levels from rising too high. Between meals or during periods of physical activity, the body taps into its glucose stores to keep energy levels stable.

However, this finely tuned system can be disrupted by various aspects of lifestyle. Dietary habits, portion sizes, levels of physical activity, the presence of excess body fat, and the quality of sleep can all influence how efficiently the body regulates blood glucose. Genetic factors also play an important role. When the balance tips, either because the body doesn't respond properly to insulin or because insulin production declines, glucose can start to build up in the bloodstream. Over time, chronically elevated blood glucose levels can damage blood vessels and organs, contributing to serious complications such as heart disease, kidney problems, and vision loss.

This risk doesn't appear overnight; it increases gradually. There is a spectrum of blood glucose regulation that ranges from healthy and optimal, through intermediate stages where glucose levels are mildly elevated in prediabetes, to persistently high levels that meet the criteria for diabetes. Everyone, whether they are aware of it or not, is somewhere on this spectrum. Some people manage their blood glucose levels very efficiently, while others may struggle due to lifestyle factors, genetics, or a combination of both.

Understanding where you fall on this spectrum is important, and fortunately there are reliable ways to measure how well your body is handling glucose over time. These measurements — such as fasting glucose, HbA1c, or glucose tolerance tests — are explored in more detail later in this chapter. For now, it's worth remembering that blood glucose regulation is something that affects everyone, and that the way each of us live our daily lives has a powerful influence on how well our bodies manage this essential energy source.

Going from normal to prediabetes

The diagnosis of prediabetes is made the same way that a diagnosis of diabetes is made: by doing a blood glucose test in the laboratory.

Many countries, including the United States, report blood glucose levels in milligrams per deciliter (mg/dL), while many other regions such as Europe and the UK use millimoles per liter (mmol/L). Both units measure the same thing, but the values differ due to the conversion factor between the two systems.

The critical *values* (numbers) in the test results are as follows:

- A normal fasting blood glucose result is less than 100 mg/dL (5.6 mmol/L).
- Prediabetes is diagnosed when the fasting blood glucose is between 100 and 125 mg/dL (5.6–6.9 mmol/L) on more than one occasion.
- Diabetes is diagnosed when the fasting blood glucose is 126 mg/dL (7 mmol/L) or greater on more than one occasion.
- A normal blood glucose level two hours after eating 75 grams of glucose is less than 140 mg/dL (7.8 mmol/L).
- Prediabetes is diagnosed when the glucose two hours after eating 75 grams of glucose is between 140 and 199 mg/dL (7.8–11.1 mmol/L) on more than one occasion.
- Diabetes is diagnosed when the glucose two hours after eating 75 grams of glucose is 200 mg/dL (11.1 mmol/L) or greater on more than one occasion.

Table 1-1 is a summary of these values using mg/dL units.

TABLE 1-1 **Normal, Prediabetic, and Diabetic Glucose Values**

Type of Test	Normal	Prediabetes	Diabetes
Fasting blood glucose	Less than 100 mg/dL	100–125 mg/dL	126 mg/dL or greater
Blood glucose two hours after eating 75 grams of glucose	Less than 140 mg/dL	140–199 mg/dL	200 mg/dL or greater

In recent years, another laboratory test called HbA1c has become a widely used way of diagnosing and monitoring both prediabetes and diabetes. HbA1c stands for glycated hemoglobin, which refers to the percentage of red blood cells that have glucose attached to them. Because red blood cells live for, and are replaced in, a cycle of around three months, this test reflects a person's average blood glucose level over the previous two to three months — rather than just at the moment of testing, such as a fasting glucose or glucose tolerance test does.

The use of HbA1c in diagnosing diabetes became more common after it was endorsed by major organizations such as the American Diabetes Association (ADA) and the World Health Organization (WHO) around 2009–2011. One of the main reasons for its popularity is practicality. Unlike glucose tests, HbA1c doesn't require fasting, and it isn't affected by short-term factors such as recent meals, stress, or illness. That makes it more convenient for both patients and healthcare providers.

According to current guidelines:

- An HbA1c below 5.7 percent (which is below 39 mmol/mol) is considered normal.
- A level between 5.7 percent and 6.4 percent (39–47 mmol/mol) indicates prediabetes.
- A level of 6.5 percent or higher (48 mmol/mol or above), confirmed by a repeat test, signals diabetes.

While HbA1c is now frequently used to diagnose prediabetes because of its reliability and convenience, with a single blood test without the need for fasting, it is also useful for monitoring how well prediabetes is managed over time. However, it's worth noting that HbA1c results can be less reliable in certain individuals, for example, those with anemia, certain blood disorders, or recent blood loss, so healthcare professionals may choose alternative tests when needed.

REMEMBER

These definitions are arbitrary. They have changed in the past, and they may do so again depending on scientific studies. For example, a fasting glucose result of greater than 140 mg/dL (7.8 mmol/L) used to be the cutoff point for a diagnosis of diabetes. Then doctors discovered that people who had fasting glucose levels below 140 mg/dL suffered from the complications of diabetes without having a diagnosis of diabetes. So, they lowered the level for the diagnosis to 126 mg/dL (7 mmol/L). Unfortunately, even some people with fasting blood glucose levels below 126 have shown up with complications of diabetes.

You should be familiar with some other terms for these levels of blood glucose, because you likely can read or hear about them:

- *Impaired fasting glucose* (IFG) is another name for the condition where the fasting blood glucose is between 100 and 125 mg/dL (5.6–6.9 mmol/L) after an overnight fast.
- *Impaired glucose tolerance* (IGT) is another name for the condition where the blood glucose is between 140 and 199 mg/dL (7.8–11.1 mmol/L) two hours after eating 75 grams of glucose.

Some people have impaired fasting glucose, while others have impaired glucose tolerance. Still others have both conditions combined, so the total number of people with prediabetes is *not* the sum of the people with IFG plus the people with IGT.

REMEMBER

Other terms that you may hear should be disregarded because they have no clear meaning and are no longer used scientifically. These include:

- Borderline diabetes
- Touch of sugar

Understanding diabetes

Two major types of diabetes are called *Type 1 diabetes mellitus* (T1DM) and *Type 2 diabetes mellitus* (T2DM). (If you want to find out exactly what distinguishes them, pick up our book *Diabetes For Dummies*, which is also published by Wiley.) Here's a grossly oversimplified overview:

- Type 1 is an autoimmune disease that usually occurs in children.
- Type 2 may occur in either children or adults and is often associated with risk factors such as being overweight and having high blood pressure.

When diabetes develops in Type 2, the body still has plenty of insulin but not enough to keep the blood glucose in the normal range because the body resists the action of insulin.

REMEMBER

The word *prediabetes* in this book refers to the period between normal blood glucose control and Type 2 diabetes.

Knowing the Recent History of Prediabetes

In this section, we discuss the reason for the development of the term *prediabetes*, as well as the fact that prediabetes is not an entirely benign condition.

Needing new language

The term *prediabetes* hasn't been around long. In fact, it was first used in 2002. It was introduced by the American Diabetes Association (ADA) and by Tommy G. Thompson, the health and human services secretary at the time.

A number of reasons for the introduction of this term were:

- The terms *impaired fasting glucose* and *impaired glucose tolerance* were meaningless to patients and required a lot of explaining.
- Other terms, such as *touch of sugar* and *borderline diabetes,* were generally meaningless.
- Studies such as the Diabetes Prevention Program showed that diet and exercise resulting in a weight loss as little as 5 to 7 percent of someone's initial weight would lower the incidence of Type 2 diabetes by up to 58 percent.
- A broadly understandable term was needed so that patients could know where they were and where they had to go with respect to diabetes. These people stood to benefit from lifestyle modification and other treatments.

Studies at the time showed that most people with prediabetes would go on to develop diabetes within ten years unless they made relatively modest changes in diet and exercise. Therefore, the ADA and Thompson put together an expert panel of doctors and other diabetes experts. The panel report stated that intervention in prediabetes is critical for three reasons:

- Just having glucose levels in the prediabetic range puts a person at a 50 percent greater risk of a heart attack or stroke.
- The development of Type 2 diabetes can be delayed or prevented by modest lifestyle change.
- For many people, modest changes in lifestyle can turn back the clock and return elevated blood glucose levels to normal.

Along with the new term, the ADA recommended that physicians begin to screen their patients for prediabetes at age 45. Screening was especially important for people who answered yes to these questions:

- Do you have a relative with Type 2 diabetes or heart disease?
- Are you overweight or obese?
- Do you have high blood pressure?
- Do you have a sedentary lifestyle?
- Do you have high levels of triglycerides and/or low levels of HDL cholesterol (both being types of fats measured in a blood test)?

- Do you belong to a higher-risk ethnic group, such as African American, Latino, or Asian American/Pacific Islander?
- Do you have apple-shaped rather than pear-shaped weight distribution? This means your excess weight is around your stomach rather than your hips.
- For women who have had children, did you develop diabetes during the pregnancy or have a baby who weighed more than 9 pounds at birth?
- For women, is there a history of *polycystic ovarian syndrome,* a condition that may include lack of periods, infertility, and increased hair on the body?

Understanding the Risks

Prediabetes may not be associated with all the problems of diabetes, but your body may be developing some reversible damage if you have this condition. We discuss the most important issues here.

Heart attacks and strokes

People with blood sugar levels above the healthy range in the prediabetes zone face a significantly increased risk of heart disease and stroke. Research shows the relative risk of these cardiovascular events can be up to twice as high compared to those with consistently healthy blood sugar. If blood sugar rises further into the diabetes range, the risk increases even more. These relationships are strongly supported by large, long-term studies, though it is important to note that other factors such as blood pressure, cholesterol, and lifestyle habits also play a role.

Eye health: Retinopathy

Damage to the small blood vessels in the eye, known as *retinopathy*, is a well-known complication of diabetes, but it can also occur when blood sugar is only moderately elevated. Studies have shown that the risk of developing eye problems rises steadily as glucose levels increase, even before reaching the diabetes threshold. There is no clear cut-off below which risk disappears, but the closer blood sugar is to the normal range, the lower the risk of vision-related complications.

Brain health and dementia

Higher blood sugar levels are associated with an increased risk of cognitive decline and dementia, including Alzheimer's disease. Research indicates that individuals with elevated blood glucose in the prediabetes range tend to perform worse on memory and thinking tests than those with lower, healthier glucose levels. The risk of developing Alzheimer's disease is about twice as high for people with diabetes, and those with prediabetes also show measurable declines in brain function. While these findings show strong associations, it is not yet clear if high blood sugar directly causes dementia or if shared risk factors are involved.

Quality of life and daily function

Living with prediabetes can impact daily life. Studies have found that people with elevated glucose levels report lower quality of life, including more fatigue, reduced work productivity, and increased absenteeism. On average, individuals in this group lose several weeks of productive time each year compared to those with healthy blood sugar.

Chronic kidney disease

Growing evidence shows that people with moderately elevated blood sugar have a higher risk of developing chronic kidney disease (CKD). A large meta-analysis found that those with higher-than-normal glucose had about a 12 percent increased risk of CKD compared to those with normal blood sugar, after accounting for other risk factors. Recent studies have found that the prevalence of CKD in this group can be as high as 16.5 percent, compared to 15.3 percent in the general population and nearly 30 percent in those with diabetes. Other research has shown that more than one third of people with elevated glucose show early signs of kidney damage, such as protein in the urine or reduced kidney function. While these studies demonstrate a clear association, it is not yet certain that higher blood sugar directly causes kidney disease, as other factors such as high blood pressure and cholesterol often coexist.

Overall mortality

Elevated blood sugar, even if not in the diabetes range, has been linked to a higher risk of premature death from all causes. Large population studies find that people with higher-than-normal glucose have an increased risk of dying from heart disease, stroke, kidney failure, and some cancers compared to those with normal

blood sugar. While these associations are consistent, it is important to recognize that other lifestyle factors, such as obesity, smoking, and lack of physical activity, may also contribute to the increased risk.

Risk of cancer

Recent research suggests that people with moderately elevated blood sugar may have a higher risk of developing certain cancers, including pancreatic, liver, endometrial, stomach, colorectal, breast, and gallbladder cancers. For example, a 2024 meta-analysis found a 42 percent higher risk of pancreatic cancer among people with elevated glucose compared to those with normal levels. However, the relationship between blood sugar and cancer is complex and may be influenced by other factors such as excess weight, poor diet, and physical inactivity, which often accompany higher glucose levels. Therefore, while there is a clear association, it is not certain that elevated blood sugar directly causes cancer.

REMEMBER

Even though prediabetes is not as serious as diabetes, it does involve medical deterioration. The longer you allow yourself to have prediabetes, the greater the damage. Start to reverse it now!

Realizing Who Is Affected

Some groups of people are affected by prediabetes more than others, and they may even be affected when their blood glucose levels are lower than the levels that currently define prediabetes. (In the earlier section "Going from normal to prediabetes," We spell out those levels.)

Prediabetes rates of about 38 percent in the adult US population are now considered similar across major racial and ethnic groups when age-adjusted. While earlier studies suggested some differences, current research shows that non-Hispanic White, non-Hispanic Black, Hispanic or Latino, Asian American, and American Indian and Alaska Native adults all experience prediabetes at comparable rates. This means that elevated blood sugar before the onset of diabetes is a shared challenge for many Americans, regardless of background.

However, disparities remain in the progression from prediabetes to diabetes. Adults from non-Hispanic Black, Hispanic or Latino, Asian American, and American Indian and Alaska Native backgrounds are more likely to develop diabetes compared to non-Hispanic White adults. For example, the CDC reports that the

age-adjusted prevalence of diagnosed diabetes is 12.1 percent in non-Hispanic Black adults, 11.7 percent in Hispanic or Latino adults, 13.6 percent in American Indian and Alaska Native adults, and 9.1 percent in non-Hispanic Asian adults, compared to 6.9 percent in non-Hispanic White adults. These differences are influenced by a variety of factors, including genetics, access to healthcare, socioeconomic status, and the impact of social determinants of health.

Approaching these statistics with respect and sensitivity is important. Differences in health outcomes among racial and ethnic groups are shaped by a complex mix of factors, including historical and ongoing inequities in healthcare access, neighborhood resources, and opportunities for healthy living.

WARNING

These numbers reflect patterns seen in large populations and should never be used to make assumptions about individuals or communities. Addressing these disparities and inequalities is a moral imperative and requires culturally sensitive prevention and care, as well as efforts to improve access to healthy food, safe places to be active, and high-quality health care for everyone.

Ensuring that proper education on healthful diets, lifestyle, and the strategies for being able to implement them is available to all communities (especially those which are underserved) is integral to transform the historical patterns that evidence suggests. Whether it's teaching nutrition classes, offering educational programming on fitness, cooking classes, or giving people tips to fit the lifestyle habits into their daily life with ease, every amount of time and money spent on education offers enormous benefit.

Considering children and adolescents

By 2023, the Centers for Disease Control and Prevention (CDC) estimated that 8.4 million US adolescents aged 12 to 17, about 32.7 percent, have prediabetes, a dramatic increase from earlier years. This rise in prediabetes among young people is closely linked to the ongoing epidemic of childhood obesity which is closely associated with the development of prediabetes.

REMEMBER

The prevalence of obesity among children ages 6 to 11 in the United States has remained a serious concern. According to the CDC, as of 2017–2020, approximately 20.7 percent of children ages 6 to 11 were classified as having obesity. Among adolescents aged 12 to 19, the rate was even higher, with 22.2 percent affected by obesity. These figures reflect a continued rise from previous decades and underscore how high rates of childhood and adolescent obesity are contributing to the increasing prevalence of prediabetes in young people.

Not only are children with obesity at greater risk for prediabetes and diabetes, but they may suffer bone and joint problems, *sleep apnea* (periods of stopping breathing during sleep that lead to extreme fatigue during the day), and social and psychological problems. In Chapter 11, we offer specific advice about prediabetes and obesity in children and adolescents.

Prediabetes and diabetes in older adults

Older adults, those aged 65 and above, are at the highest risk for developing elevated blood sugar and diabetes. According to the latest CDC data in the US about 29 percent of people aged 65 and older have diabetes, and an additional 48.8 percent have prediabetes. This data means that nearly four out of five older adults in the United States are affected by one of these conditions, and only about one in five have neither.

When prediabetes and diabetes are combined with other common health challenges in older age such as heart disease, reduced kidney function, and cognitive decline, the result can be significant illness, the need for multiple medications, and a higher risk of complications that require ongoing medical care. Managing blood sugar is therefore an important part of maintaining health and independence for many older adults.

REMEMBER

Prediabetes in the elderly is reversible just as it is in children, adolescents, and adults. Reversing the condition may be more difficult because of the reduced ability to exercise and the tendency to eat a less healthful diet, but it's never too late to prevent and reverse prediabetes.

Considering the Costs

The health and economic burden of elevated blood sugar is enormous and continues to grow. In 2022, the total annual cost of diabetes in the US reached $412.9 billion, including $306.6 billion in direct medical costs and $106.3 billion in indirect costs such as lost productivity. About one in every four healthcare dollars in the US is now spent on caring for people with diabetes. Beyond these financial figures, there are also significant personal costs: individuals and families often face ongoing physical challenges, emotional stress, and disruptions to daily life as they manage the complications and demands of living with diabetes and prediabetes.

Actual health costs

Most of the costs of diabetes and prediabetes are for treating the complications which include:

- Eye disease possibly leading to blindness
- Kidney disease possibly leading to kidney failure
- Nerve disease possibly leading to severe pain or amputation
- Heart disease and arterial disease possibly leading to heart attacks, strokes, or severe leg pain

REMEMBER

The fact is that the top three complications will *never occur* if prediabetes is reversed or never allowed to occur in the first place. Stopping prediabetes in its tracks is preventive medicine. Unfortunately, health insurance companies are willing to spend the thousands needed for treating the end results of disease but won't spend the much smaller sums needed to prevent the complications in the first place.

The Diabetes Prevention Program shows that preventive methods such as diet and exercise delay the development of Type 2 diabetes by an average of eleven years and reduces the number of new cases of diabetes by 20 percent.

According to recent estimates in the US, people with diabetes have medical expenditures 2.6 times higher than those without the condition. Among Medicare beneficiaries aged 65 or older with Type 2 diabetes, the median cost associated with diabetes complications is nearly $5,900 per person each year. Up to 64 percent of a person's lifetime medical costs with diabetes are spent on managing these complications.

Other economic costs

The indirect costs of diabetes and prediabetes are also substantial. These include lost productivity, higher disability rates, and increased taxes to cover public health expenditures. For example, indirect costs — such as missed work and reduced ability to work — add more than $90 billion to the national burden in the US each year. The societal cost savings from effective prevention programs are estimated to be as high as $8,800 per person.

Industries across the economy, from manufacturing to services, are affected by these costs. The high price of diabetes-related care is a significant challenge for employers, health insurers, and public programs such as Medicare and Medicaid.

Social costs

People who suffer blindness or kidney failure can't work at the level of people without these conditions, so much of their productivity is lost. Sometimes these complications — and the heart disease that is so much worse with diabetes — lead to an early death, so the losses from diabetes also affect entire families.

Because prediabetes and Type 2 diabetes are now being seen so often in children and adolescents, we can expect that people will develop complications at much younger ages. People who should be in the prime of their lives will instead be suffering illness and premature death.

The goal of this book is to show you that such a path isn't inevitable and that these costs can be avoided. By reading this book you can begin finding out how to walk the road back to health.