

## Looking at diabetes

Hand-in-hand with the worldwide epidemic of obesity is a huge increase in the number of people developing type 2 diabetes.

“Almost half of all people with type 2 diabetes are not aware that they have this life-threatening condition”

- In 2002 the World Health Organization (WHO) estimated that 150 million people worldwide had diabetes.<sup>1</sup> In 2006 it is estimated that this number has risen to 180 million.<sup>2</sup>
- The increase in type 2 diabetes is largely due to an unhealthy diet, obesity and sedentary lifestyles.

- In the US it is estimated that nearly 10% of all people aged over 20 years have type 2 diabetes and that one in five people over the age of 60 has type 2 diabetes.<sup>3</sup>
- Patients who have had diabetes for more than 15 years have a 2% chance of becoming blind, with 10% developing severe visual impairment.<sup>2</sup>
- Damage to the nerves as a result of diabetes can lead to ulceration, especially on the lower limbs, and may even require amputation.<sup>2</sup>
- In people aged 35–64 years the rate of death worldwide from diabetes ranges from 6–27%.<sup>4</sup>
- WHO estimates that 1.1 million people died from diabetes in 2005.<sup>2</sup>
- Half of all deaths arising from diabetes are due to the effects that the disease has on the heart and blood vessels.<sup>2</sup>

Almost 80% of deaths due to diabetes occur in low and middle-income countries.<sup>2</sup>

In most developing countries, almost one in 10 of the deaths of people aged 35–64 is related to diabetes.

These people are in their most productive years, and their loss has an enormous impact on society.<sup>4</sup> For people with type 1 diabetes, and many with type 2, insulin is a necessary part of treatment. International health agencies are concerned that insulin is unavailable and unaffordable in many poor countries, even though WHO lists it as an essential drug.

### Symptoms of diabetes

Symptoms of **type 1** diabetes appear suddenly. They include: excessive thirst and urination; increased hunger; unexplained weight loss; rapid, hard breathing; changes in vision; sleepiness or exhaustion.

By comparison **type 2** diabetes develops over years—the result mainly of poor lifestyle choices. Thus, while the symptoms for type 2 diabetes may be similar to type 1 they are less obvious. Unexplained weight loss is not usual. Many patients have no symptoms and are only diagnosed after having the disease for many years, by which time significant problems may have developed. Almost half of all people with type 2 diabetes are not aware that they have this life-threatening condition.



## From the Editor



Diabetes is a serious global health problem, and its incidence is rapidly increasing. It can lead to nerve damage, kidney

failure, blindness, heart disease and stroke.

In many countries, the complications of diabetes are the leading causes of death.

We are dedicating this edition of Snooze Newz to an investigation of diabetes. We've asked Professor Paul Zimmet, an acknowledged world expert and leading researcher in the world of diabetes, to describe the problem, and Ms Martha Funnell, a diabetes educator, to help us understand what it is like living with the disease.

In her interview, Martha Funnell makes the point that today "there are better therapies and more tools for patients to use so they can make informed decisions as they manage their diabetes." As well as continuing improvements in medication, research has shown that lifestyle changes can delay the onset and reduce the severity of type 2 diabetes. This reduces the enormous demands on our healthcare systems and families.

Some exciting new research examines the link between sleep-disordered breathing (SDB) and diabetes. To date, prevalence studies have indicated that up to 58% of people with type 2 diabetes also have SDB. We have an interview with Christina Philippa who recently volunteered to be a participant in such a study. As a result of her involvement, it was found that Christina had obstructive sleep apnea (OSA) (a particular type of SDB). When her OSA was treated she noticed an enormous improvement in her quality of life and her physician was able to better manage her diabetes.

Indeed, there is more and more research emerging that shows that while nutrition and exercise are important in the control of type 2 diabetes, the quality of sleep is also fundamental.

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Fay Everett  
Editor

# What is diabetes?

People who have diabetes (diabetes mellitus) have high levels of glucose in their blood (hyperglycemia). This can develop because of the body's failure to produce insulin, or because the insulin is not performing its proper role. Insulin allows the body to absorb glucose, so any problems with insulin production will lead to an imbalance in glucose levels. Diabetes can result in damage to virtually every body organ, especially the heart and blood vessels, eyes, kidneys and nerves.

## Types of diabetes

There are three major types of diabetes:

- Type 1 diabetes: the body's immune system destroys the cells that produce insulin in the pancreas. Approximately 10–15% of all cases of diabetes are type 1. It is usually diagnosed in young, non-obese people. Type 1 diabetes patients must inject themselves with insulin several times a day and carefully control their diet and exercise.
- Type 2 diabetes: the most common form, affecting 85–90% of all patients. It usually begins as insulin resistance, where the cells do not use insulin properly. The need for insulin rises, exhausting the cells that produce insulin in the pancreas until they gradually lose their ability to produce it. Age and obesity are the two main reasons for the development of type 2 diabetes. However, it is becoming increasingly common in young adults, adolescents and even children. A sedentary lifestyle increases the risk. Type 2 diabetes may be manageable with exercise and dietary changes. Some oral medication is usually required, and sometimes insulin injections are needed.

“Diabetes can result in damage to virtually every body organ, especially the heart and blood vessels, eyes, kidneys and nerves”

- Gestational diabetes mellitus (GDM): a form of glucose intolerance seen during pregnancy. It occurs in about 5% of pregnancies in Australia. If GDM is not treated, it can lead to malformations in the foetus and increased birth weight. There is also an increased risk of miscarriage. Women who have had GDM have a 20–50% chance of developing type 2 diabetes within 5–10 years.<sup>3</sup> Very recent Australian research<sup>10</sup> indicates that, in addition to genetic factors, the high levels of blood glucose in women with GDM can place their daughters at increased risk of developing GDM.

# Preventing type 2 diabetes

The good news is that many cases of type 2 diabetes are preventable. People in the early stages of diabetes (prediabetes) may be able to delay its full development through commonsense healthy lifestyle choices.



## The triumvirate of health proposed by Dr. William C. Dement.

Director, Stanford Sleep Disorders Clinic and Research Center, Stanford University, USA

The 'triumvirate of health' (integrating three aspects of health) was first proposed by Professor William Dement, a pioneer in the world of sleep medicine. While the importance of exercise and diet had been recognized for many years, he suggested that healthy sleep was also fundamental to the maintenance of health. By following his advice—good nutrition, physical fitness, healthy sleep—you can prevent many diseases, including type 2 diabetes.

### Good nutrition

Obesity is one of the major risk factors for type 2 diabetes: one study showed that for people with a Body Mass Index (BMI) of 30–35 the risk of developing diabetes was 20 times greater than for people with a BMI below 23.<sup>5</sup>

A study in China with people showing an early sign of diabetes—impaired glucose tolerance (IGT)—had encouraging results. By reducing their weight through improved diet and increased physical activity, the progression to type 2 diabetes was nearly halved over a six-year period.<sup>6</sup> These people were part of a program that provided continual education throughout the period of the study—the question now is whether people are willing to improve their own health without this level of support.

### Physical fitness

Many overweight people with mild glucose intolerance go on to develop diabetes. Large studies in China, Finland and USA have demonstrated that it is possible for diabetes to be prevented, or at least delayed, by even a moderate reduction in weight and as little as half an hour of walking every day.<sup>1</sup>

### Healthy sleep

Sleep has a marked effect on the body's use of glucose, and interactions between sleeping and eating have been well documented. It is now recognized that poor quality sleep can put you at risk of developing obesity and diabetes. A large multi-center study found that having SDB increased your risk of weight gain and development of insulin resistance and type 2 diabetes.<sup>7</sup> Importantly, other studies show that treatment of SDB with CPAP (continuous positive airway pressure) "can be an important therapeutic approach for diabetic patients with SDB."<sup>8</sup>

“What might be considered remarkable was that ... only modest weight loss was required by lifestyle intervention to achieve dramatic results”<sup>9</sup>

### Do you know your BMI?

BMI = weight in kg / height in m<sup>2</sup>

≤ 18.5	Underweight
18.5-24.9	Normal
25.0-29.9	Overweight
30.0-34.9	Obese
≥ 35.0	Morbidly Obese

#### Example:

Weight 115 kg  
 Height 178 cm = 1.78 metres  
 $1.78 \times 1.78 = 3.1684$   
 $115 / 3.1684 = 36.295922$

This person has a BMI of 36, and is classified as morbidly obese (obesity which may cause the onset of health complications).

# OSA Diagnosis: A True Awakening

## More good news!

As better therapies are developed and more tools become available, patients can make informed decisions as they manage their diabetes.

If lifestyle changes—good nutrition, physical fitness, healthy sleep—aren't sufficient, new drug treatments are now emerging. The thiazolidinediones (or glitazones) reduce hyperglycemia in type 2 diabetes when given alone or in combination with other therapies. Importantly, thiazolidinediones not only control hyperglycemia but also reduce insulin resistance.<sup>14,15</sup>

Since insulin resistance has been directly linked with the risk of damage to the heart and blood vessels, tackling it may help to address some of the complications of type 2 diabetes. In addition, if taken soon enough, they may reduce the progress of the disease from insulin resistance to full diabetes.<sup>15</sup>

Christina Philippa lives at Speers Point on Lake Macquarie, north of Sydney. Over the past 20 years she had become used to being lethargic, stopping for frequent rest breaks and falling asleep in odd places. She thought it was just part of life with diabetes. But in 2005, a friend told her about a program that changed her life.

The program offered testing for obstructive sleep apnea (OSA) to Diabetes Australia–NSW members in the Newcastle area. “My friend said, ‘I think you might have OSA,’” Christina recalls. “So I took the test kit home to see if I did. They said it would measure every time I stopped breathing while I was sleeping.”

The screening program, developed by Diabetes Australia–NSW and ResMed Asia Pacific, was a pilot study set up to investigate the association between OSA and diabetes. Of the 144 people with type 2 diabetes screened, 81 were found to have severe or moderate OSA.

Christina’s results showed that she was one of the group with OSA—she was having irregular breathing every three minutes. “I realized that for the last 20 years, I haven’t had a good night’s sleep!”

“After a month on the new machine ...it showed that I had not had any irregular breathing at all and it was much more comfortable! I was excited, I thought wow! This is great!”

She was given a two-week trial on a continuous positive airway pressure (CPAP) machine to use while she slept. Christina says she didn’t realize what a difference it made—until she had to give it back. “Because I also have asthma, and the machine pushes air at you, I had a little trouble with it due to the asthma. But it did help improve my sleep. After I gave it back, my body had to readjust to not getting good sleep again.”

So Christina consulted her medical team and decided to trial an S8 AutoScore™ CPAP machine. Although the S8 AutoScore was more expensive, Christina says it has been worth every dollar. “My lung capacity has increased dramatically, which has helped my asthma.” Christina’s blood glucose levels have dropped and she no longer takes the two tablets she previously needed every day for her diabetes. “I have higher energy levels and I can concentrate. Yesterday I worked in the garden without getting tired, which I have not done in a long time. To do work around the house I would have had to break it up into small amounts over a few days. Now I can do it all in one day. My friends say I’m looking better, my skin has color and the dark circles under my eyes are going. They can have a conversation with me now, without me dozing off on them!”

Eight of Christina’s brothers and sisters also have diabetes, and she will encourage them to get a test done. “I want to say thankyou very much to the trial organizers. My quality of life has improved enormously.”

ResMed’s Medical Director Dr Glenn Richards said the levels of OSA revealed in the pilot program were similar to those found at diabetes clinics in the US and the UK recently. “We’re starting to see a pattern—about a third of people with type 2 diabetes have moderate or severe OSA, a third have mild OSA and a third have no OSA.”

Dr Richards says that as Australian health care services become more aware of the association between OSA and type 2 diabetes, testing for OSA will become more common. “These trials are the first step towards that. Health professionals are increasingly recommending that their patients be assessed for OSA and perhaps they will make it a routine part of their diabetes assessments.”

This interview with Christina Philippa was first published in the Summer 2005 edition of Issues, a newsletter of Diabetes Australia – NSW. Reprinted with permission.



# An Interview with Professor Paul Zimmet



Professor Paul Zimmet AO MD PhD  
FRACP FRCP FTSE

**Professor Paul Zimmet is regarded as one of the world's leading diabetes researchers. He founded the International Diabetes Institute in 1985, was the original CEO and later Professor-Director and CEO. He is also head of the World Health Organization's Collaborating Center for the Epidemiology of Diabetes, Professor of Diabetes at Monash University and a Professor at Deakin University, the Graduate School of Public Health at the University of Pittsburgh in the United States, and Victoria University.**

Professor Zimmet has served on the Australian government's Strategic Taskforce on Diabetes, published more than 600 scientific papers, chapters and reviews in peer-reviewed journals and books, and was co-editor of the "International Textbook of Diabetes Mellitus" and "The Epidemiology of Diabetes".

#### How widespread is diabetes?

Diabetes is a serious and rapidly escalating global health problem. Worldwide, the number of people with diabetes is estimated at 200 million. More than 5% of the global adult population has diabetes and another 8% has impaired glucose tolerance, a condition that typically precedes diabetes. In some countries, diabetes is one of the leading causes of death.

A year-long investigation conducted recently by *The New York Times* identified diabetes as the largest health crisis facing New York and the only major disease that is escalating. Despite intensive research, medical scientists have so far been unable to find the cause of the two major forms of diabetes, types 1 and 2. Nor have they yet found a cure for type 1 diabetes or a safe means of preventing it.

“Type 2 diabetes is positioned to be one of the largest epidemics in human history and it is certainly one of the major threats to human health in the 21st century”

However, there is now evidence that weight reduction and exercise can reduce the burden of type 2 diabetes by about 50%. There are also drug therapies that can prevent progression to type 2 diabetes in people at high risk. Regrettably, many of the world's governments and public health planners are still largely unaware of how widespread the disease is and the speed at which it is escalating out of control.

#### Who is at risk of developing type 2 diabetes?

Two main environmental factors that increase the risk of developing type 2 diabetes are age and obesity, with many people having the classic 'apple shape', ie, a high waist-to-hip ratio. Typically, the condition is diagnosed in individuals over the age of 40, with the risk of developing type 2 diabetes rising as people get older.

However, it is becoming increasingly common in young adults, adolescents and even children. The problem of obesity has been exacerbated by increased urbanization in some countries, leading to the rise in popularity of an unhealthy, westernized diet coupled with reduced physical activity. There is also some evidence that type 2 diabetes runs in families, suggesting that genetics may also play a role. In developed countries, more women than men appear to be affected, possibly because they tend to have a higher Body Mass Index (BMI) and often live longer. Type 2 diabetes is positioned to be one of the largest epidemics in human history and it is certainly one of the major threats to human health in the 21<sup>st</sup> century.

### **What serious complications are associated with type 2 diabetes?**

Type 2 diabetes is commonly associated with a number of serious 'microvascular' and 'macrovascular' complications. Microvascular complications include blindness, kidney failure and foot ulceration, while macrovascular complications include atherosclerosis, heart attacks and strokes.

Diabetes can shorten life expectancy by as much as 15 years.

### **What is the metabolic syndrome?**

A person is said to have the 'metabolic syndrome' when they have a particular collection of metabolic abnormalities including centrally distributed obesity, decreased high-density lipoprotein cholesterol (HDL-C), elevated triglycerides, elevated blood pressure and high blood sugar. The metabolic syndrome has become a major public health challenge around the world.

### **What is its association with type 2 diabetes?**

There is a very close association between type 2 diabetes and the metabolic syndrome—up to 70% of people with type 2 diabetes also have the metabolic syndrome. It is associated with a two-fold increase in type 2 diabetes and a three-fold increase in cardiovascular disease (CVD), and is thought to be a driver of the modern day epidemic of type 2 diabetes and CVD.

### **What is the role of central obesity in the metabolic syndrome?**

There is strong evidence linking waist circumference, as an indicator of central obesity, with cardiovascular disease and other metabolic syndrome markers. Central obesity is also thought to be one of the earliest steps contributing to the development of metabolic syndrome.

“Man may be the captain of his fate, but he is also the victim of his blood sugar.”

Dr Wilfred Oakley, Transactions of the Medical Society of London 78:16, 1962

# An Interview with Martha Funnell



Martha Funnell, MS, RN, CDE, is a clinical nurse specialist, diabetes educator, adjunct lecturer in the University of Michigan School of Nursing, and co-director for the Behavioral, Clinical, and Health Systems (BCHS) Intervention Research Core at the Michigan Diabetes Research and Training Center.

Ms Funnell has published more than 100 journal articles, books, book chapters, and curricula for the American Diabetes Association (ADA). She has served on the National Boards of AADE and ADA and was the President for Health Care and Education for the ADA in 2002–2003.

## **What is the biggest challenge you face in helping patients manage their diabetes?**

As a diabetes educator, there are two issues that always surface and present the greatest challenge. The first is the psychological impact of diabetes diagnosis on the person with diabetes and his or her family members. Feelings of disbelief, fear, anger, guilt and depression are common, but often not recognized or assessed by health professionals. Friends and family members may not be sensitive to this side of diabetes, so patients may feel isolated or that these feelings are a sign of weakness. As time goes on, feelings of frustration, guilt and of being overwhelmed often occur, and again are seldom recognized or addressed.

The other challenge is helping patients take on the huge responsibility for self-management that a chronic illness like diabetes entails. Diabetes is a 24/7 disease and the number of decisions that patients need to make each day, and the consequences of those decisions, can become overwhelming.

There are no easy answers to these challenges. Each person with diabetes needs to develop their own solutions and ways of dealing with these issues. We need to work with each person and provide the emotional and behavioral support they need. While education is the essential first step, most patients also need ongoing self-management support.

“Our goal is empowerment, by helping patients discover their own innate ability to manage their diabetes”

## **Where does sleep apnea awareness fit into your education?**

Like other health professionals who specialize in diabetes, we are just becoming aware of this problem as it relates to glycemic control. While the importance of sleep and general good health habits have always been part of our discussions with patients, the impact of sleep disorders on blood glucose levels is a new topic. It is now being incorporated into educational programs and curricula.

## **How do people with diabetes benefit from knowing about sleep apnea?**

The research in this area is very important for patients with diabetes. When I teach, I find that the participants are always interested in new research, no matter what their own educational background may be. Because of the emphasis in recent years on reaching target glucose levels, being able to offer people a very real way to affect their glucose level is exciting for them and rewarding for me.

# The cost of diabetes

## What trends do you see in diabetes self-management?

Diabetes self-management is clearly a good news / bad news situation. The good news is that there are better therapies and more tools for patients to use so they can make informed decisions as they manage their diabetes. Diabetes self-management education is more likely to be reimbursed [in the US] than ever before, so there is greater access. Research is highlighting the problems caused by diabetes and putting more emphasis on patient-centered care and education. Our goal is empowerment, by helping patients discover their own innate ability to manage their diabetes.

The bad news is that the majority of patients with diabetes are never referred to a diabetes education program or to a dietitian, in spite of data showing that education helps patients improve their metabolic control and quality of life.

Because diabetes is a chronic disease and its complications are severe, it is a costly disease. The affected person and his/her family bear many financial and emotional costs, while health authorities and governments have to deal with the increased demand for their services.<sup>11</sup>

- Diabetes, its complications and associated premature mortality, account for at least 10% of total healthcare expenditure in some countries.
- The increasing number of children developing type 2 diabetes could face 40–50 years of treatment, representing a major burden on healthcare systems.<sup>12</sup>
- WHO estimates that over the next 10 years China will lose \$558 billion in national income due to heart disease, stroke and diabetes alone.
- The estimated economic cost of diabetes in the US in 2002 was \$132 billion. Of this amount, \$92 billion was due to direct medical costs and \$40 billion due to indirect costs such as lost work days, restricted activity, and disability due to diabetes. The average medical expenditure for a person with diabetes was \$13,243, which is 5.2 times greater than the cost for a person without diabetes. Diabetes care accounted for 11% of national healthcare expenditures.<sup>13</sup>
- In WHO's Western Pacific region a recent analysis has shown that 16% of hospital expenditure was on people with diabetes.

“The average medical expenditure for a person [in the US] with diabetes ...is 5.2 times greater than the cost for a person without diabetes”

- Intangible costs (pain, anxiety, inconvenience and generally lower quality of life) also have an enormous impact on the lives of patients and their families, and are the most difficult to quantify.
- For most countries, the largest single item of diabetes expenditure is hospital admissions and outpatient treatment of long-term complications, such as diabetic retinopathy, heart disease and stroke, kidney failure and foot problems that may result in amputation. Many of these complications can be prevented if they are promptly diagnosed and treated. This requires education for patients and professionals, and support for long-term care. Appropriate action taken at the right time improves quality of life and is cost-effective.

# The AusDiab report

In 1999, Professors Paul Zimmet and Tim Welborn and the International Diabetes Institute assembled a team from across Australia to conduct a nationwide survey of diabetes.<sup>16</sup> This was the first national study to investigate the spread of diabetes, its complications such as heart disease and kidney disease, and its risk factors such as obesity and hypertension. The size and thoroughness of the study has given the researchers a comprehensive view of the impact of all levels of abnormal glucose metabolism on the development of diabetes, and heart and kidney disease.

The original Australian Diabetes Obesity and Lifestyle (AusDiab) study was followed up five years later to assess how the disease had developed in the original participants. The report from the five-year data showed that every day there are 275 new cases of diabetes, and 100,000 annually. This, together with the increasing number of people with prediabetes, obesity, the metabolic

syndrome and kidney disease, has demonstrated that abnormal glucose metabolism is having a major impact on the health of Australians. It has also exposed the mortality risk associated with diabetes, as people with previously diagnosed diabetes at the beginning of the study were twice as likely to die compared to those with normal glucose tolerance. A further 10 year study is planned.

Some findings from the five-year study:

- Every year eight out of every 1000 people in Australia developed diabetes, with slightly more males than females.
- Compared to those with a normal BMI, people classified as overweight had almost twice the incidence of diabetes; those classified as obese had an almost four-fold increase.
- People who reported that their activity levels were 'sedentary' were nearly twice as likely to contract diabetes than as those who did at least 150 minutes of physical activity a week.

“Every year eight out of every 1000 people in Australia develop diabetes, with slightly more males than females”

- The annual incidence of diabetes was three times greater in those with hypertension compared to those with normal blood pressure. The incidence of hypertension was higher in those who were overweight or obese, and higher for males in smokers than in non-smokers.
- Women with the metabolic syndrome had a four-fold increase in annual incidence; men had a three-fold increase.





## Which is the best mask?

Do you remember the first time you used a CPAP machine? You probably weren't aware that your clinician was watching and listening to work out the best mask for your needs. Jenny Petersen, RN, is one of those clinicians, and as the manager of the ResMed Centre for Healthy Sleep at Gosford, north of Sydney, she does a lot of work to assess what's best for each person.

Jenny's experience tells her what to look for. "When someone comes in for a CPAP treatment trial, I need to find out what their individual needs are. What are their habits when they go to bed? If they just turn out the light and go to sleep they'll be happy with a number of masks—if they wear glasses and like to sit up and read or watch television in bed, they'll want a mask that accommodates that, like the Mirage Vista<sup>1</sup> or the Mirage Swift<sup>2</sup>."

Her favourite mask for people who are new to CPAP treatment is the

Mirage Activa<sup>3</sup>. "The Activa is soft and gentle. It virtually floats over your face. The mask doesn't have to be tight or restrictive as the cushion maintains contact with your face even when you move around in bed. The cushion's design prevents leaks, so therapy is more effective. People can get used to the treatment without having to worry about the mask. After their two-week trial, I'll see how they're going. If they're happy with it they stay with that. If they want something different we consider their other priorities."

What's good for a young, active person is going to be different to what's good for someone with a chronic illness. "Someone robust who feels comfortable with the pressure going directly into their nostrils can stand the pressure of the air in their nose and will be happy with a Swift.<sup>2</sup> It's a nasal pillows system so it's the least obtrusive and has very little skin contact, and for a lot of people that's very important. But I wouldn't advise a frail person to use it—they won't like the pressure. They'll prefer something softer, gentler—back to the Mirage

“We're lucky these days with the range of masks available”

Activa!<sup>3</sup> And someone who breathes through their mouth will need a full - face mask, so I'll suggest an Ultra Mirage Full Face Mask.<sup>4</sup>

“We're lucky these days with the range of masks available,” Jenny says. “I can fit each person according to their needs. That means therapy is easier, and then you get all the benefits of regular sleep—more energy, improved health and a better quality of life.”

#### Notes:

- 1 Mirage Vista™ Nasal Mask
- 2 Mirage Swift™ Nasal Pillows System
- 3 Mirage Activa™ Nasal Mask
- 4 Ultra Mirage™ Full Face Mask

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# Sleep moment

When you stop breathing during sleep because your upper airway closes (called an apnea), your brain wakes you to open your airway and start breathing again. In cases of severe sleep apnea your brain can return to a state of arousal around 500 times a night.

## The next day is not your best day!

This condition—obstructive sleep apnea (OSA)—is a form of sleep-disordered breathing (SDB) and can be treated with the use of a

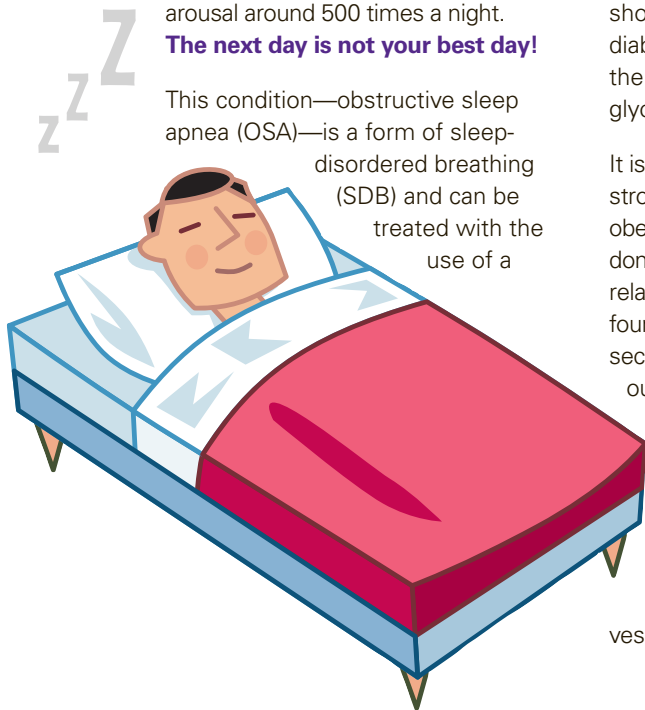
continuous positive airway pressure (CPAP) machine, which uses air pressure to keep your upper airway open during sleep. This improves both the quantity and the quality of your sleep. Moreover, studies have shown that if you have type 2 diabetes and OSA, treatment of the OSA with CPAP can improve glycemic control within 48 hours.<sup>8</sup>

It is now recognized that there are strong relationships between SDB, obesity and diabetes, although we don't yet know exactly how those relationships work. Researchers have found sleep deprivation affects the secretion of hormones that affect our appetite. This is associated with increased hunger, and "may lead to overeating and weight gain."<sup>7</sup>

Dr Naresh Punjabi is one of a number of people working to determine the effects that sleep apnea has on the heart and blood vessels. He is one of the field site

Principal Investigators for the multi-center Sleep Heart Health Study, and Associate Professor of Medicine and Epidemiology, Division of Pulmonary and Critical Care Medicine and Department of Epidemiology, at Johns Hopkins University in Baltimore, Maryland, USA.

Dr Punjabi tells us that "sleep restriction in humans for a few days can lead to abnormalities in glucose metabolism—these abnormalities are important as they can predispose to central obesity and set up a vicious cascade (sleep restriction → glucose abnormalities → obesity → sleep apnea → glucose abnormalities → diabetes and so forth)." Working out the causes and the effects of these conditions is the work of Dr Punjabi and many like him around the world.



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