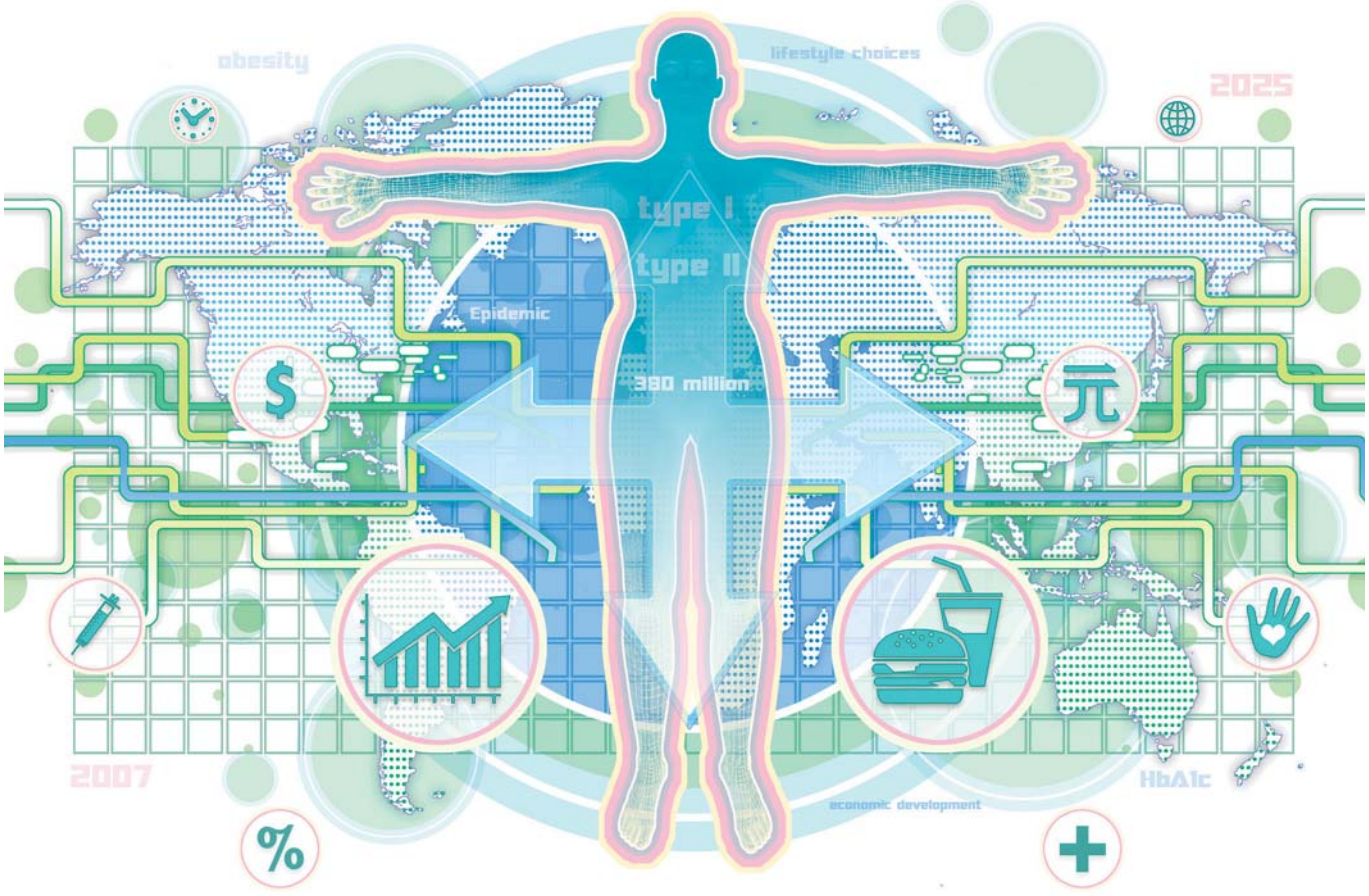
Economist Intelligence Unit

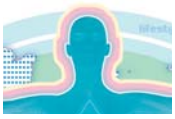
The Economist

The silent epidemic

An economic study of diabetes in developed and developing countries

A report from the Economist Intelligence Unit
Sponsored by Novo Nordisk





Preface

The silent epidemic: An economic study of diabetes in developed and developing countries countries is a report published by the Economist Intelligence Unit and sponsored by Novo Nordisk. It examines the economic cost to the developed and developing world of a condition that is rapidly becoming one of the world's most serious health problems.

Research undertaken for this report breaks down into two main areas. First, the Economist Intelligence Unit calculated the economic cost of diabetes to five countries: China[1], Denmark, India, the United Kingdom and United States. This was compiled using published data from a range of sources (see page 26). The five countries examined were chosen on the basis that they represent economies of differing sizes, at various stages of their development and with a range of healthcare and social systems.

The components of the economic cost were based on two main categories: direct healthcare costs (including the cost of treating complications of diabetes) and cost associated with lost productivity. The latter consists of foregone earnings related to mortality, morbidity and disability. Due to a lack of data, we did not calculate the costs related to informal care, such as care by relatives or in nursing homes.

The second strand of research was a programme of in-depth interviews with leading figures from the diabetes community, including government officials, healthcare policy advisers, academics and senior figures from non-profit organisations. The Economist Intelligence Unit would like to thank the interviewees for their time and insight.

The Economist Intelligence Unit bears sole, unrestricted responsibility for the content of this report. The Economist Intelligence Unit's editorial team carried out the research, conducted the interviews and wrote the report. The findings and views expressed in this report do not necessarily reflect the views of the sponsor.

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1. In the case of China, only the costs of lost productivity were calculated as data were not available for direct healthcare costs.

Introduction

There was a time when diabetes was seen as a problem of the elderly and often dismissed as "a touch of sugar". It was perceived as a condition that mainly affected more affluent societies, and was rarely a priority for developing countries, especially in the context of more pressing healthcare concerns, such as malaria or HIV/Aids.

But in recent years, diabetes has evolved to become one of the most serious health concerns in both the developed and developing world. The global increase in prevalence of diabetes has been rapid and alarming. In the 1990s, various studies put the number of people with the condition worldwide at between 100m and 135m. By 2007, according to the *Diabetes Atlas*, a study of global prevalence published by the International Diabetes Federation, the number of people aged 20-79 with a form of the condition had reached about 246m, or 5.9% of the global total within that age range. By 2025, this figure is predicted to rise to 380m—or 7.1% of the total population—if action is not taken.

Moreover, the biggest increases in prevalence are no longer being seen in affluent countries, but in the developing world, where it is estimated that 80% of cases can now be found. Between 2007 and 2025, the *Diabetes Atlas* predicts that India and China will see a staggering increase of an additional 48.5m people with diabetes. Over the same period, South and Central America will see 102% growth in the diabetes population, while Africa will witness an 80% increase.

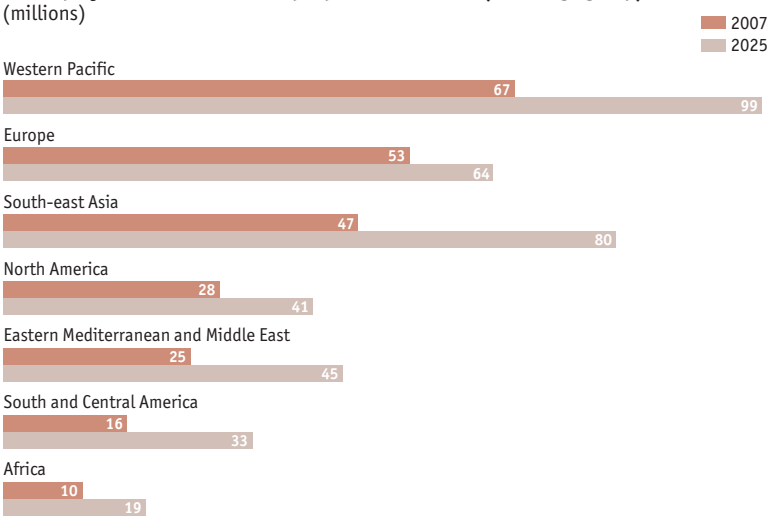
This white paper, sponsored by Novo Nordisk, sets out to examine the economic cost of diabetes in the developed and developing world. It is based on original research conducted by the Economist Intelligence Unit that utilises existing data from a variety of published sources. This has then been supplemented by a programme of in-depth interviews with diabetes experts.

Any calculation of the economic cost of diabetes is constrained by limitations of data, and we examine these in detail in the report. Despite these constraints, research of this nature has an important role to play in increasing awareness of diabetes and its costs. By gradually piecing together a picture of the true cost of the condition to healthcare systems and society, over time it is hoped that policy makers from a variety of backgrounds will be able make more informed recommendations on which to base the efficient allocation of resources.

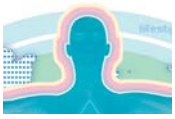
The key findings from the research include the following:

Diabetes prevalence is increasing rapidly in the developed and developing world. A wide range of factors are contributing to this growth: diet and lifestyle are the biggest culprits, at least in the case of type II diabetes, but genetics also have a role to play. One irony of the condition is that positive economic developments, such as increased wealth,

Global projections for number of people with diabetes (20-79 age group), 2007-2025
(millions)



Source: Diabetes Atlas.



What is diabetes?

Diabetes has two main forms: type I and type II. In the former, the body does not produce enough, or often any, insulin because the immune system has destroyed the necessary cells. In the latter, the body loses the ability to use the insulin it makes. Despite having different causes, type I and type II diabetes have many complications in common, and some therapies, such as insulin injections, work for both.

Type I diabetes is an auto-immune disease which typically becomes apparent in childhood. Like other such conditions, its precise cause is unclear—anything from genetics and viral factors to growing up in overly clean houses could be involved. The prevalence of type I is increasing by about 3% each year, slightly higher than the *Atlas*' predicted overall annual growth rate for both types of diabetes of 2.44%. Type I diabetes, however, is a small part of the overall story: in developed countries, it accounts for around 5% to 15% of all cases, whereas in developing ones it is typically less common, partly because it is often fatal if left untreated.

Unlike type I, the far more prevalent type II diabetes is largely preventable by adhering to a healthy diet and lifestyle. It is initially less urgent than type I, and can be controlled in the early stages by diet and exercise, along with oral drugs to control blood glucose. As the disease progresses, however, people with type II diabetes will usually need insulin. There is also evidence that earlier prescription of insulin to type II patients can reduce the likelihood of complications, such as cardiovascular disease or kidney problems, occurring at a later stage.

better healthcare, ageing populations and a reduction in subsistence farming, are leading to greater rates of diabetes. For these reasons, the biggest rises in prevalence over the coming decades are forecast to affect developing countries.

A number of powerful barriers are preventing change. The more common type II diabetes is both preventable and treatable, but a number of powerful factors are conspiring to prevent the problem being effectively addressed. Key constraints include cultural resistance to healthier diet and lifestyle among the population, a lack of attention devoted to chronic disease by national and international health organisations, a focus on short-term costs rather than long-term implications, and a lack of universal healthcare coverage in many countries (including the US). Success in overcoming these barriers requires systemic change and collaboration between a wide range of important stakeholders.

Lost productivity and healthcare costs exact a heavy burden. Based on available data, this report has calculated the economic cost of diabetes for four countries: Denmark, India, the United Kingdom and United States. This includes direct healthcare costs (including the cost of treating complications) and lost productivity as a result of mortality, morbidity and disability associated with the condition. It does not, however, include the costs of informal care, such as care at home by relatives. We have also estimated lost productivity costs for China. Expressed as a percentage of GDP, India currently bears the heaviest cost of approximately 2.1% of GDP. Among the developed countries, the US faces the biggest burden, with an estimated cost equivalent to 1.2% of GDP in 2007. The UK faces costs in the region of 0.4% of GDP, while Denmark incurs costs equivalent to 0.6% of GDP. Lost productivity costs alone for China are equivalent to 0.6% of GDP.

The cost of treatment is high but the cost of doing nothing is far greater. The five countries studied for this report spend significant sums of money every year on treating diabetes and its complications. For example, the United States spends US$134.8bn annually, or 6% of its healthcare expenditure. Cutting back on treatment, however, is not an option. If countries do not invest in prevention, early diagnosis and treatment, the costs in future will escalate dramatically. Individuals who were not diagnosed and treated in the early stage are far more likely to suffer

from serious complications, such as heart disease, and these are far more expensive to treat than early-stage diabetes.

A complex problem requires innovative solutions. While there is currently no "magic bullet" solution to the problem of diabetes, a number of innovative approaches in both the developed and developing world are helping to address the issue more effectively. In the developed world, programmes that measure performance based on health outcomes, such as the success of treatment, rather than process, such as the number of tests given, are having impressive results. Meanwhile, in the developing world, innovative collaborations between diverse stakeholders, and the use of social enterprise principles, are helping to ensure that treatment is more accessible and affordable to both the urban and rural poor.

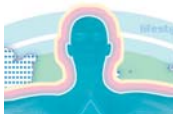
Reasons for the epidemic

A variety of factors are responsible for growth of prevalence in diabetes worldwide. In the case of type II, there is one obvious cause: obesity. Excess weight is a well-known risk factor and growing levels of obesity in many countries are being matched by increasing diabetes prevalence. In this sense, there is general agreement that type II is a largely avoidable "lifestyle" disease. Dr Francine Kaufman, a leading US paediatric endocrinologist, uses the term "diabesity" to describe the joint epidemic which, she notes, is now even affecting children. Indeed, type II diabetes is now more common among Japanese children than type I.

"It is vitally important to focus on obesity," says Guy Barnett, Liberal Senator for Tasmania, Australia, and an executive member of the Australian parliamentary diabetes support group. "We have to adopt public health measures to make the environment less obesogenic, including everything from nutrition education to making it easier to walk in cities."

Professor Stig Pramming, director of the Oxford Health Alliance, a non-profit set up to confront the epidemic of chronic disease, makes the point that diabetes is just one of several chronic diseases that are largely caused by lifestyle decisions. "Three risk factors (poor diet, tobacco use and lack of physical activity) cause four chronic diseases (diabetes, many cancers, chronic lung disease and heart disease) that kill over 50% of the people in the world," he explains. "This epidemic is responsible for many more deaths than HIV/AIDS, tuberculosis and malaria combined. The tragedy is that this crisis is largely avoidable."

Although obesity is an important factor in the diabetes epidemic, it does not alone explain the vast increase in prevalence, especially in the developing world. Dr Viswanathan Mohan, a leading Indian diabetologist and Chairman of Dr. Mohan's Diabetes Specialities Centre at Chennai, points out that if



adoption of western eating and exercise habits were solely responsible, one would expect prevalence rates in developing countries to be approaching European and American levels. Instead, they are far exceeding them.

While the lifestyle shifts accompanying economic development in the developing world are an important factor, genetics also play a crucial role. Certain phenotypes are more affected by changes to diet and lifestyle: in the US, for example, the overall diabetes prevalence is 9.2%, whereas the Pima Indians who live in the country have one reaching 50%.

The first generation to experience rapid change

High-tech efforts in rural India

Among India's 40m individuals with diabetes, the most severely affected are the rural poor. Although prevalence in cities is much higher than in rural areas, the absolute numbers of rural sufferers is higher because 70% of the country still lives outside cities. Moreover, unlike the urban poor, who may sometimes be able to obtain publicly funded care, there is no such option for those outside the cities. "For the rural poor," explains Dr Mohan, "diabetes healthcare is currently neither affordable, accessible, nor available."

The logistical and economic challenges of providing and paying for the necessary care to treat diabetes in India are huge. While no single solution exists, one project suggests that high quality care and treatment is possible by leveraging skills and resources rather than relying on the public sector to provide.

In Tamil Nadu, the state where Dr Mohan works, successful diabetes "camps" to bring the opportunity for diagnosis and treatment to rural areas led to consideration of how to extend these facilities to more remote places. The result is a Mobile Screening Unit, which consists of a vehicle carrying highly advanced medical equipment and communications technology. With a small team of medical professionals on board, the unit travels to remote towns and villages, where it provides general screening for diabetes and retinopathy examinations. In addition to the medical professionals on site, the van can send images back to experts at the Aravind eye hospital, one of India's leading facilities, for diagnosis and consultation on more complex cases. In the early stages, the units themselves were able to provide care for over 80% of cases, with the rest referred to the Aravind hospital in Madurai. Given the costs of travel for the rural poor, in particular in foregone income, many of these cases would simply not have seen a doctor until their diabetes was much more advanced.

Treatment at the Aravind eye hospital

World Diabetes Foundation/Jesper Westley

As interesting as the technology being used by the Mobile Screening Units is the combination of stakeholders that has helped to develop the project. The World Diabetes Foundation financed the initial equipment, and the Lions Club International and the government of India have also been involved—with the India Space Research Organisation, the country's national space agency, providing free satellite communication.

The ongoing running costs, and operation of the units, are the responsibility of the Aravind Eye Care System. This private group of five hospitals describes itself as the largest eye care facility in the world. It treats some 1.7m people per year, and has an extensive research and training programme.

What makes the Aravind Eye Care System unique, however, is its fee structure. In addition to researching ways to provide inexpensive, high-quality care, it treats two-thirds of its patients for free, largely paid for by the fees charged to the other one-third. In this way, international assistance, local groups, government departments and market mechanisms—as tapped into by a huge social enterprise—can come together to provide India's poorest rural citizens with its very best medical care.

may face particular risk. Anil Kapur, Managing Director of the World Diabetes Foundation, points to research suggesting that if mothers are malnourished during pregnancy—a common result of poverty—then babies are programmed in the womb to survive on less. When these individuals get older and end up being able to afford more than their parents, what is normal for others is excessive for them. In India, for example, people with body mass indices of between 18 and 21 are developing impaired glucose tolerance, and between 22 and 24 are getting diabetes, when 20 to 25 are the normal limits by international standards.

As globalisation has brought increased wealth to developing nations, it has become apparent that ethnic Indian, Chinese and Arab individuals have a greater susceptibility to diabetes than Europeans. "It is ironic that a lot of the challenges in diabetes derive from positive developments, in particular economic growth and better care for chronic diseases," says Dr Julio Frenk, the former Health Minister of Mexico.

Another positive feature of economic development and improved healthcare that impacts on diabetes prevalence is an ageing population. Type II diabetes rates increase with age, and as the demographic profile of developing countries begins to resemble the older populations of countries in North America or Europe, prevalence will inevitably increase.

In addition, development tends to bring with it, for good or ill, greater levels of urbanisation. Urban populations in developing countries, with the exception of Eastern Europe, show much higher rates of diabetes. The difficult lifestyle choices available in the vast slums and favelas attached to many of these cities all contribute to heightening the prevalence of the disease.

A dose of politics

Individuals with diabetes look to doctors and nurses for treatment and researchers for medical advances, but increasingly those concerned about the condition are turning to politics as well. The most notable example is the Unite for Diabetes campaign, which successfully lobbied the United Nations for a resolution to recognise the serious threat that the condition posed for world development and to institute November 14 as World Diabetes Day.

"It is a huge conceptual leap to recognise that this burden must be addressed not only at World Health Organisation level but by governments," says Professor Martin Silink, President of the International Diabetes Federation. Dr Frenk adds that, at the national level, it requires a similarly big mental leap for the condition "to be addressed not only by ministries of health but by other parts of government as well." He says that one of the most important aspects of the UN resolution was that it "moves diabetes out of the specialised agencies and into the broader political arena."

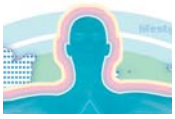
According to activists, the greater accomplishment of the campaign was not the resolution, but the creation of what Prof Silink calls "a self-aware diabetes world"—including both persons with diabetes and those working on the condition—that has found the power of a united voice in pursuing these goals.

This is undoubtedly a positive move, but how much real benefit is there from the UN, or other political actors, simply stating the obvious in a formal way? The answer is a surprising amount. Health systems arise out of political processes. "Enlightened politics looking for the greater good is not only unavoidable but highly desirable," says Dr Frenk. "Although one needs good evidence to advance a cause, also necessary is a certain activism to push that evidence onto the agenda and mobilise the political actors."

Senator Guy Barnett believes that the political dimension is critically important. "I don't think that we can solve [the growing diabetes epidemic] without the political motivation of the key decision makers of each country," he explains. "You can't fix a problem unless it is acknowledged."

Political action will be crucial in bringing about several essential changes, which will in turn affect the very political question of what level of public resources to devote to diabetes. Also being considered is the question of how far governments, in their search to combat obesity and diabetes, regulate everything from the built environment, through to physical education in schools, and food contents in the interests of public health.

Karen Jochelson of the UK-based health think tank, the King's Fund, has studied similar debates in the past and thinks that this discussion will soon be underway. "We are right at the beginning of a political process," she says. "Over a period of time, there will be debate over where to draw the line between government and individual responsibility before we reach the final decision on how to intervene."



Barriers to change

Despite diabetes reaching epidemic proportions in many countries, there are still a number of barriers that impede action against it. Lars Rebien Sørenson, chief executive officer of Novo Nordisk, a Danish healthcare company, believes that awareness and knowledge are the biggest challenges in addressing the condition. "Even in Europe and America, people are only now starting to discuss the impact of obesity, while in poorer countries, understanding of the condition, even among medical professionals, is sometimes sadly lacking," he says. This problem is exacerbated because, in many parts of the world, obesity is seen as a sign of affluence, and sometimes of health.

Even in societies where there is widespread recognition of the health problems associated with obesity, there is still considerable resistance among some individuals to improve their diet and lifestyle. Although there may be constraints preventing change, such as a lack of shops in the community selling fresh food, to some extent people are still pursuing unhealthy lifestyles out of choice. They choose fatty food because it tastes good and decline to exercise because they consider it difficult.

A change in attitudes is necessary but requires a lot of work. Dr Jonathan Betz Brown, Chair of the International Diabetes Federation's Task Force on Health Economics, says that attitude change will take generations. Even those actively campaigning in this area, like Senator Barnett, believe it will take decades for cultural resistance to be overcome.

David Matthews, Professor of Diabetic Medicine at Oxford University, believes that a solution will depend on complex, wide-ranging, multi-stakeholder intervention. "This means that we need to address everything from food labelling, environmental and building planning, and education to modify cultural norms," he says.

Among individuals with diabetes, poor understanding and knowledge about their condition remains a problem. "Lack of awareness among patients about how to treat their condition is a fairly common situation," says Dr Frenk. Even if individuals do have access to the right kind of treatment, the extent to which they monitor and control their condition varies widely. "Highly motivated people [manage diabetes] well, but they are in the minority," says Viggo Birch, Vice President Europe North for Novo Nordisk. Engaged patients are essential to good diabetic control, and finding treatments and technologies with which they are comfortable is crucial to success.

Diabetes does not need to overcome cultural taboos to the same extent as certain other conditions, notably HIV/AIDS, but they do exist. Dr Kapur points out that, in some countries, young women do not reveal their diabetes, and sometimes do not take insulin, because the cost of the condition makes it harder for them to find spouses.

Also worrying is the potential backlash against a condition that is characterised as a lifestyle disease. "A lot of children with type I diabetes are upset at the implication that it is their fault," says Karen Addington, chief executive of the Juvenile Diabetes Research Foundation UK, "because they are wrongly told by those around them that their condition is the result of over-eating." More generally, there is a risk that sufferers may face discrimination because of their condition—perhaps being excluded from certain jobs or turned down for insurance or mortgage products.

From the perspective of healthcare, many national and international health systems tend to focus on communicable diseases rather than chronic ones, such as diabetes. All too often, diabetes is simply ignored. Dr Kapur points out that, in 2002, just 0.01% of all health aid went to all non-communicable conditions—such as diabetes, hypertension, heart

disease, cancer, and mental illness—put together. At the international level, Prof Silink points out that the World Health Organisation, despite recognising that 60% of the world's disease burden comes from chronic diseases, spends only a few percentage points of its budget on them. The entire WHO Diabetes Unit consists of just four people, including the Secretarial Assistant. National health systems often mirror this emphasis, because, with limited budgets, it is easier to ignore chronic conditions than infectious ones.

Another problem is that diabetes often does not receive the attention it warrants in medical school. This means that many general practitioners do not have the requisite knowledge of diabetes, and rely on a small number of specialists to provide effective treatment for patients. With knowledge concentrated

Measuring success: A virtuous circle in Minnesota

As the economic impact of diabetes becomes more acute, the importance of focusing on the right treatment strategies seems obvious. But selecting the best approaches can be challenging, not least because there is often no straightforward way of measuring the effectiveness of a particular treatment. "Health systems are very, very fractured," explains Dr Elizabeth Teisberg, co-author with Michael Porter of *Redefining Health Care*, "and this makes it difficult to look at the costs and benefits of innovation in their entirety."

Performance metrics used in healthcare tend to focus on process—whether a particular treatment was used, or whether counselling to stop smoking occurred, for example. According to Dr Teisberg, a better way of measuring the effectiveness of healthcare would be to focus instead on health outcomes—in other words extent of disability, time until return to work, or, for a diabetic, HbA1C level. "As long as we are not really measuring results (health outcomes and costs)," she explains, "we won't give the right kind of attention to what really works."

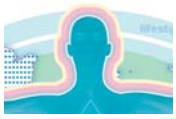
One pioneering effort to use outcomes measurement for diabetes care is in Minnesota. The project consists of a partnership between two non-profits, MN Community Measurement and the Institute for Clinical Systems Improvement. The former explores ways of measuring and reporting on health information, while the latter focuses on improving the quality of healthcare.

The goal of the project, according to Dr Sanne Magnan, President of the Institute for Clinical Systems Improvement and a board member of MN Community Measurement, was to move away from measuring tests to measuring outcomes, because what matters is not how many tests a patient receives, but the results. The problem with chronic diseases, like diabetes, is that there are few true outcomes to measure. In addition, it is difficult to extract reliable data from the relatively small population that is treated by a single medical provider. To get around this problem, MN Community Measurement aggregates across a number of healthcare providers a selection of measures that are all closely correlated with long-term risk of diabetes complications. The measures used are: Hemoglobin A1c of less than or equal to 7.0%; blood pressure under 130/80 mmHg; LDL-C below 100 mg/dl; daily aspirin use for those aged 41-75; and no tobacco use. The measure is all-or-nothing, so failure to meet any one of these goals means the patient is not included in the provider's score.

After two years the results are already positive. Between 2004 and 2006, the number of patients at the 48 participating healthcare providers who met these challenging targets rose from 4% to 10%, with the best practices reaching over 20%. Although there are no data on expected cost savings, the likely reduction in complications is obvious.

The improvements arise partly from the rewards and incentives that the two organisations have built into the system, but Dr Magnan believes that the most important factor is the transparency associated with publishing the information. "Physicians are a competitive group of individuals," she explains. "There is a lot of friendly competition to improve, and a lot of collaboration." By making the information publicly available, it is also easier to share best practice revealed by the statistics. In time, Dr Magnan hopes that patients may use the data to choose between providers, although as yet, there is not much evidence of this.

Such efforts are not necessarily the best use of funds everywhere. Dr Magnan advises, for example, that developing countries should direct their scarce resources towards public health matters, such as reducing smoking or discouraging obesogenic environments. That said, she hopes that MN Community Measurement and ICSI will not just be able to improve clinical practice but also focus on areas where they can "make quantum leaps in healthcare" such as changing its design and underlying structure, or addressing public health issues.



in the hands of too few individuals, patients may not see specialists quickly enough, meaning that timely diagnosis and treatment is difficult to achieve.

Dr Frenk adds that there needs to be a change in emphasis in terms of treatment of diabetes. "In addition to diagnosing and treating those already affected, we need to direct our energy towards predicting and preventing," he explains. This will be costly in the short term, because more widespread screening programmes will need to be undertaken, but in the long run, costs will fall because there will be fewer patients and fewer complications.

The surprising thing about addressing the diabetes epidemic is that cost is potentially such a small issue. Many effective medicines, including metaformin, a drug used to lower blood glucose levels, are off-patent. Moreover, according to Dr Brown, there are a handful of interventions, such as aspirin, which have the potential to save large sums of money because they reduce the likelihood of complications associated with diabetes, such as heart disease, and are very inexpensive.

Some commentators believe that more attention needs to be paid to the cost of treating conditions at medical school. If doctors were instilled with a better understanding of the economics of treatment, and were more aware of the long-term savings that would accrue from some short-term expenditure, then more resources might be directed towards diagnosis and early-stage treatment. "The notion that treating diabetes is expensive is the biggest myth around," says Dr Kapur. "It's not treating diabetes that is expensive."

The economic costs of diabetes

Diabetes exacts three broad categories of economic cost:

- **Direct healthcare costs**: These include such items as medication and devices, visits to healthcare professionals, both general and specialist, as well as hospitalisation both for the condition itself and for its complications;

- **Indirect healthcare costs**: This includes care in nursing homes and informal care by relatives or carers. Although difficult to calculate this expense—and our model does not—some studies suggest that this constitutes up to half of the cost of diabetes. Societal expectations about the appropriate place of professional and informal care certainly have important economic consequences. Even within Europe, there are considerable differences in approach often due to differences in labour market participation by women. In Denmark, for example, professionals typically provide home care, whereas in Germany relatives more commonly do. Although the latter may cost the state less, foregone income by carers adds to the national cost of diabetes, and can be deeply significant at a household level—for example for relatively poor families in developing countries;

- **Productivity costs**: This includes the loss of earnings from mortality, morbidity (i.e. time taken by otherwise economically individuals with diabetes to treat their condition), and disability associated with diabetes and its complications.

Achieving goals in Tanzania

A diabetes clinic in Tanzania

World Diabetes Foundation/Jesper Westley

In developing countries with scarce resources, it is still possible to put in place effective programmes to combat diabetes. Tanzania is an economically poor country: its GDP per capita (PPP) was about US$800 in 2006, among the world's lowest. It is also seeing rising levels of diabetes. In the 1980s, prevalence rates in the cities and rural areas were comfortably below 1% but, by 2000, the rural figure was 1.3% and the urban figure 4.0%.

Until recently, these individuals faced many of the problems associated with the disease in underdeveloped states. First, medication, if it is available at all, is expensive. A 2003 study found that a patient's average annual insulin cost was equivalent to three-quarters of his or her per capita share of GDP.

Second, patients had to travel great distances to medical care facilities, which meant that greater earnings needed to be sacrificed in order to attend. This discouraged individuals from seeking an early diagnosis. In 2003, only a handful of diabetic clinics and four diabetologists served the entire country.

Third, there was a general lack of awareness of diabetes generally, even among the well-off. A screening session in 2004 of Tanzanian Members of Parliament, held as a media exercise to raise awareness, found 2% of the group to be previously undiagnosed persons with diabetes.

Finally, there was widespread ignorance within the medical profession and among individuals with diabetes. A 2004 study found that only about one-third of healthcare staff at regional hospitals properly understood the key aspects of diabetes diagnosis, treatment and complications. Little wonder that only two-thirds of diagnosed, hospitalised diabetes patients realised that their problems related to high or low blood glucose.

But in the past few years, the Tanzania Diabetes Association set itself the apparently Olympian goal of providing affordable treatment for all throughout the country. Since 2003, with funding from the World Diabetes Foundation, the Vienna Diabetes Association and other sources, it has achieved some remarkable successes.

Across 25 of the country's 26 regions, 38 diabetic clinics have been established, ensuring that well over one-third of the country's likely diabetes patients now have access to care. These clinics, which are run out of existing hospitals and medical facilities, provide free consultations and, depending on the patient's economic situation, highly subsidised or free medication.

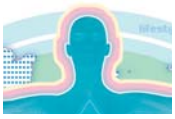
The TDA has instituted programmes that have greatly increased the number of healthcare professionals who can properly treat the disease. And in the country's capital, Dar es Salaam,

Muhimbili National Hospital has developed a national centre of excellence for diabetes care, including specialist clinics for people with diabetes from around the country and a training centre for doctors and nurses.

The numbers speak for themselves. By December 2006, after only a few years of operation, clinic doctors had seen nearly 18,000 patients, including 3,242 new cases of diabetes, and the clinics had held 360 patient education sessions. Although nowhere near addressing the entire problem, the results are a welcome contrast with nearby Mozambique, with twice the GDP per capita, where the average life expectancy of someone needing insulin is one year.

More importantly, in such a poor country, the work is not overly expensive. The WDF's contribution, which covered establishment of 60% of the clinics and much of the training, was just over US$100,000 over four years. Now, with the infrastructure established, the Tanzanian government provides the clinics with doctors and nurses. It also helps, along with other donors, to subsidise the medicine.

Diabetes will be a huge challenge to the world's poorest countries, but as this case shows, it is still possible to do a great deal with limited resources. The benefits of a relatively small investment are potentially huge: a World Bank report estimated that the combined growth loss to the country between 2005 and 2015 resulting from deaths due to diabetes and heart disease would reach US$2.5bn.



Data issues

Since the 1960s, numerous national cost of illness studies have examined diabetes in individual countries. These focus, however, on a handful of states, almost all developed, and include different elements in figuring the overall cost or use varying methodologies even when looking at the same thing. There is simply a dearth of comparable, international data. Information on some expenses, such as indirect care costs, are almost non-existent—hence our inability to estimate this element of diabetes' impact in our model. Estimates for developing countries represent a particular challenge: for example, much of what we know of the costs facing some 40m individuals with diabetes across China is derived from recent IDF-sponsored work in one city—Shanghai.

In many ways, however, complaining about poor economic data puts the cart before the horse. For many countries, information on the extent of diabetes itself is problematic. The *Diabetes Atlas*, for example, needs to rely on studies from five countries to try to estimate national prevalence numbers for all of sub-Saharan Africa. Although problematic, the approach is probably better than relying on local guesses. "Every country that looks into [diabetes numbers] finds more than they were expecting," explains Dr Frenk.

Particularly difficult is estimating the number of undiagnosed cases, which can frequently be very high: one Tanzanian study found these made up 80% of the total and even a developed country like the UK only recently tried to create a model to estimate the number of undiagnosed cases.

A significant proportion of the costs of treating diabetes, and of its broader economic impact on society, comes from attendant complications, including heart disease, kidney disease, amputations, cerebral conditions and blindness. For example, Dr Brown points out that more than half of deaths from heart disease occur in people with diabetes, pre-diabetes, or the closely-related metabolic syndrome. Frequently, however, diabetes—particularly when it has not yet been diagnosed—is not recorded as the underlying cause of these incidents. The condition's true cost is therefore almost certainly underestimated.

Such difficulties point to an additional problem for any study relying on diverse economic and epidemiological work: variance between models and estimates. For example, differing treatment of the undiagnosed in prevalence figures used can have a profound effect on the final estimate of economic cost.

It is clear that a better understanding of the scale of the challenge that diabetes represents requires further consistent, clearly defined research. "One excuse given for inaction in countering the epidemic has been the lack of globally comparable data around the diseases and risk factors," says Prof Pramming. "This knowledge gap makes it particularly challenging to prioritise limited resources for healthcare and health promotion, and more research is urgently needed."

Obtaining better data on diabetes costs and prevalence means that healthcare professionals must be encouraged and, if appropriate, incentivised to diagnose diabetes and make correlations between complications of the condition and their underlying cause. Research organisations must then collect and share this data at a national and international level, and then contextualise it for key policy-makers in government, healthcare and business.

Prof Pramming adds, however, that a lack of data should not hold up the urgent action that is required to address diabetes and other chronic diseases. "We already know what to do to counter obesity and smoking," he says. "Stakeholders must all work together to make the small changes needed to create societies in which the healthy choices are the easy choices."

A variegated problem: The developed and developing worlds

The five countries examined in this study are China, Denmark, India, the United Kingdom and the United States. They have greatly differing populations, are at different stages of their economic development, and possess different healthcare and social systems.

The underlying causes of the diabetes epidemic in each, and therefore the appropriate response, may vary markedly. As noted above, the kind of rapid economic growth that is currently being experienced in China and India will exacerbate prevalence figures considerably. What even a concerted public health campaign could do in the face of such change is unclear.

The fact that the epidemic is being most acutely felt in the developing world has huge implications for the healthcare systems of those countries. Many are already being overwhelmed by the need to treat diabetes and its complications, and only those individuals who can afford to pay will be able to expect reasonable care. No wonder, then, that a recent United Nations resolution on diabetes recognises that the condition poses serious challenges to the achievement of the Millennium Development Goals.

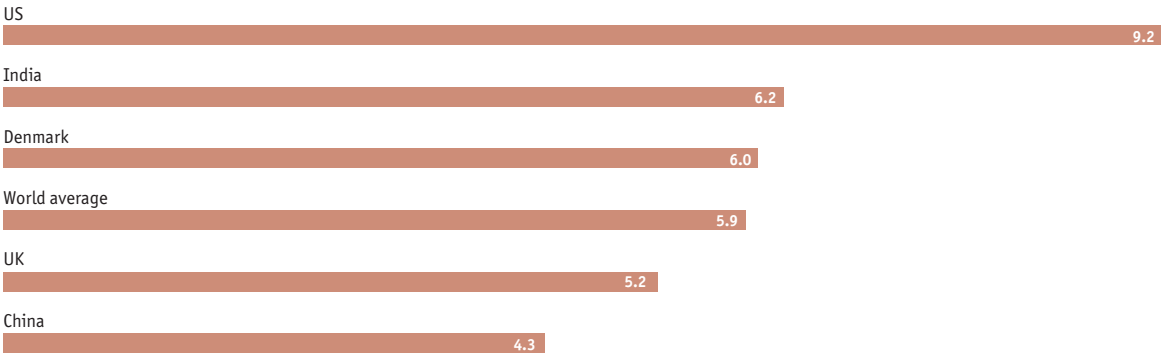
Differing levels of development also greatly affect the available treatment options. The United States can spend half of all money going toward diabetes care in the entire world, and see it take up just 6% of its overall healthcare budget. This study's model, however, indicates that India would use up one-quarter of its healthcare budget on diabetes alone were all individuals with diabetes to get treatment. This is an ultimately unsustainable figure and, in reality, because probably only around 10% of persons with diabetes receive treatment, the figure is more like 4.5% of the healthcare budget.

In the absence of universal healthcare coverage in developing countries, more attention needs to be paid to developing insurance products in those countries that provide coverage against chronic disease. These are currently rare, but would do much to encourage earlier diagnosis and treatment.

Even if developing states found the money they need to treat diabetes, spending on health infrastructure might not lead to treatment of their own citizens, but to those of wealthier states instead. In 2000, according to the OECD, more than 20% of doctors in New Zealand, the UK, US and Canada were not trained in the country where they were practising. A 2006 study for *Health Affairs* reported that some 60,000 Indian physicians work in these countries and Australia, equivalent to 10% of those in India itself.

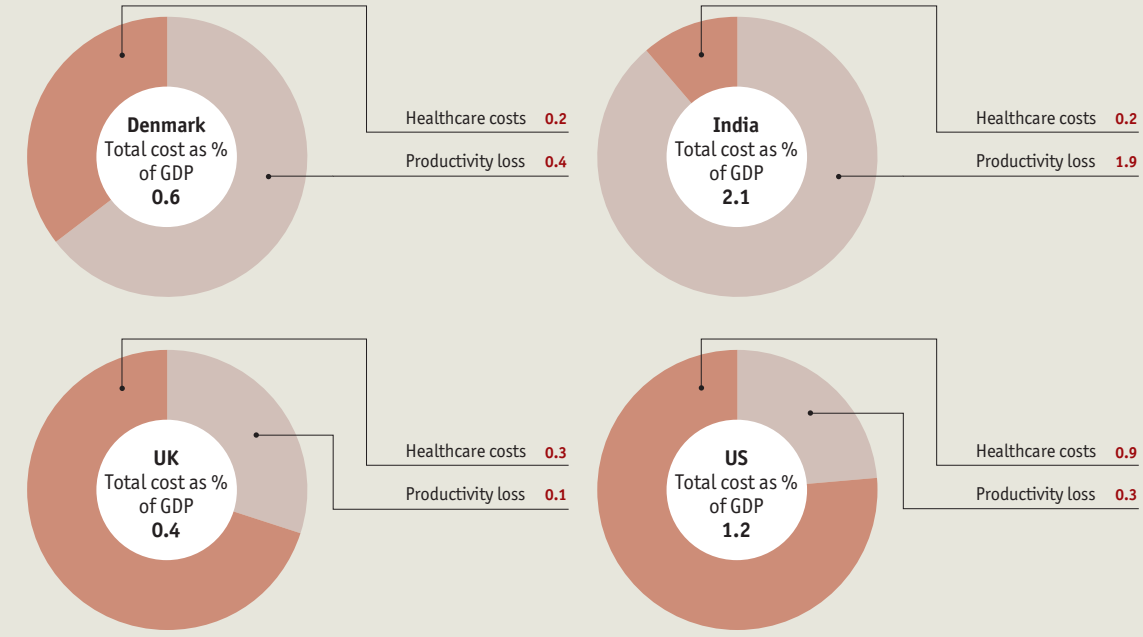
Country studies

Prevalence rates for 2007 as a % of the population



Source: Diabetes Atlas.

Productivity and healthcare as a % of GDP



Source: Economist Intelligence Unit, 2007.

People's Republic of China

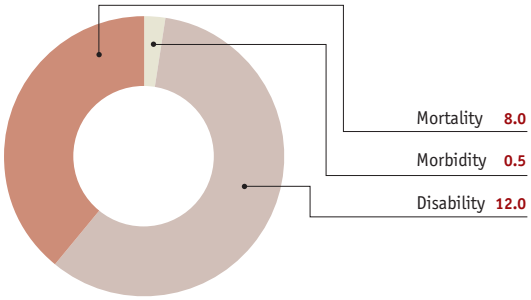
US$bn, unless stated	2004	2005	2006	2007
Nominal GDP at market prices	1,936	2,278	2,689	3,209
GDP per capita (US$)	1,490	1,742	2,045	2,425
Nominal GDP (at PPP)	7,642	8,692	9,901	11,178
Population (million)	1,300	1,308	1,314	1,323
Population age 20-79 (million)	868	889	909	929
Diabetes prevalence (age 20-79, millions)	29	32	36	40
Prevalence rate	*3.3%*	*3.6%*	*4.0%*	*4.3%*
Total cost of diabetes	**12.4**	**14.4**	**17.0**	**20.5**
National healthcare expenditure	91.7	104.6	121.4	144.4
(% total healthcare expenditure)	*13.5%*	*13.8%*	*14.0%*	*14.2%*
Per patient (US$)	430	444	471	516
Productivity loss*	**12.4**	**14.4**	**17.0**	**20.5**
(% of GDP at market prices)	*0.6%*	*0.6%*	*0.6%*	*0.6%*
Cost per patient (US$)	430	444	471	516
Mortality	4.8	5.6	6.6	8.0
Average lifetime earnings loss (US$)	8,454	9,835	11,618	14,033
Morbidity	0.3	0.3	0.4	0.5
Disability	7.2	8.4	10.0	12.0

*The year of refence for productivity losses is 2004 and figures for 2005 to 2007 have been uprated using growth in average nominal wages.

Any figures on diabetes in China are sketchy at best. Despite the country's rapid industrialisation, more people still live in rural areas than in cities, from which most of the existing data come. Overall estimated prevalence rates are currently low, albeit growing—4.3% in 2007 according to the *Diabetes Atlas* and 5.6% in 2025. The increase may be greater still if the country's urbanisation accelerates: genetically Chinese populations in Hong Kong and Singapore have about twice this prevalence. The sheer size of China's population means that the country has just under 40m persons with diabetes, and will likely have more than 59m in 18 years' time, putting it second in absolute terms to India.

There is little reliable evidence on medical spending on diabetes in the country. As with India, more than 60% of healthcare expenditure is financed out of pocket, and therefore is likely to be cost-sensitive. In addition, diabetes is an expensive disease in China. An as yet unpublished IDF-sponsored study in Shanghai suggests that individuals with diabetes need to spend 2.5 times the average per capita amount on medical care—a higher ratio than in developed countries, where it has now dropped below 2.0, according to Dr Brown.

Productivity loss in China for 2007: costs attributed to mortality, morbidity and disability.
(US$bn)



Source: Economist Intelligence Unit, 2007.

In 2007, our model suggests that the country is likely to suffer a fall in productivity equivalent to US$20.5bn, or 0.6% of GDP, due to diabetes. Diluted across the general population, the figure is not massive, but it represents over 20% of GDP per capita. China may not face a challenge on the same scale as India's, but ignoring diabetes will prove costly especially if, as has been the case in most countries, further investigation reveals a higher prevalence than initially suspected.

Denmark

US$bn, unless stated	2004	2005	2006	2007
Nominal GDP at market prices	243.6	258.8	275.3	307.1
GDP per capita (US$)	45,127	47,827	50,719	56,458
Nominal GDP (at PPP)	173.5	186.4	191.6	200.0
Population (million)	5.398	5.411	5.427	5.44
Population age 20-79 (million)	3.862	3.871	3.88	3.889
Diabetes prevalence (age 20-79, millions)	0.20	0.21	0.22	0.23
Prevalence rate	*5.05%*	*5.32%*	*5.67%*	*6.04%*
Total cost of diabetes	**1.71**	**1.79**	**1.87**	**1.96**
National healthcare expenditure	21.8	22.9	24.8	26.1
(% GDP at market prices)	*0.7%*	*0.7%*	*0.7%*	*0.6%*
Per patient (US$)	8,793	8,693	8,504	8,324
Healthcare costs	**0.5**	**0.6**	**0.6**	**0.7**
% total healthcare expenditure	*2.4%*	*2.5%*	*2.4%*	*2.5%*
Per patient (US$)	2,668	2,723	2,749	2,776
Hospitalisation	0.30	0.32	0.35	0.41
Ambulatory care	0.12	0.13	0.14	0.15
Treatment	0.10	0.11	0.12	0.13
Oral anti-diabetics and insulin	0.01	0.01	0.01	0.01
Other drugs	0.10	0.11	0.11	0.12
Productivity loss*	**1.2**	**1.2**	**1.3**	**1.3**
(% of GDP at market prices)	*0.5%*	*0.5%*	*0.5%*	*0.4%*
Cost per patient (US$)	6,125	5,970	5,755	5,548
Mortality	0.3	0.3	0.3	0.3
Average lifetime earnings loss (US$)	104,554	107,644	110,825	114,101
Morbidity	0.1	0.1	0.1	0.1
Disability	0.8	0.8	0.9	0.9

*The year of refence for productivity losses is 2004 and figures for 2005 to 2007 have been uprated using growth in average nominal wages.

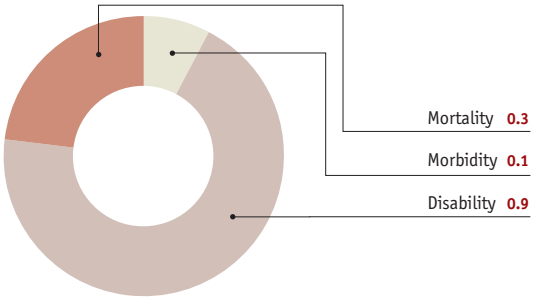
Our estimate for Denmark's current actual prevalence (6.04%) is roughly equivalent to the world average of 5.9%. The *Diabetes Atlas*, however, predicts a relatively rapid rise so that by 2025, these figures (11.4%) will exceed the European and global ones.

Despite the average prevalence, diabetes still constitutes a notable cost for the healthcare system. Our model indicates that it takes up about US$700,000 of health spending annually, some 2.5% of the total, and 0.22% of GDP. This comes to around US$2,776 per patient, most of which is borne by the state health system.

The surprising finding about Denmark is that the total level of productivity loss is far higher than the healthcare spend—figures that are consistent with developing but not other developed countries in this study. The model puts this loss for 2007 alone at over US$1.3bn, or 0.4% of GDP, making the total cost of diabetes to the economy 0.6% of GDP.

On the surface, this implies that diabetes care in Denmark is relatively expensive and inefficient. A closer look, however, suggests otherwise. Most of the lost productivity—about US$900m—is work not carried out by those reported to suffer from a diabetes-related disability. The latter constitute roughly 12% of working-age persons with diabetes, a far higher proportion of the total than in the US (under 2%) or the UK (4.5%), and consistent with the best available data for India (14.7%).

Productivity loss in Denmark for 2007: costs attributed to mortality, morbidity and disability.
(US$bn)



Source: Economist Intelligence Unit, 2007.

The OECD reported in 2005, however, that about 12% of the entire Danish working-age population received some form of disability pension or sickness benefit, well above the OECD average. The Danish government has begun to toughen up its disability pension and job subsidy arrangements, but still has some way to go. As this occurs, it would be surprising if the number of individuals with diabetes too disabled to work did not also decline. Reaching the UK figure of 4.5% would benefit the economy by over half a billion dollars annually and put productivity costs below that of direct healthcare.

India

US$bn, unless stated	2004	2005	2006	2007
Nominal GDP at market prices	693	806	910	1,080
GDP per capita (US$)	621	710	790	925
Nominal GDP (at PPP)	3,390	3,815	4,287	4,753
Population (million)	1,116	1,134	1,151	1,168
Population age 20-79 (million)	617	631	645	660
Diabetes prevalence (age 20-79, millions)	37	38	40	41
Prevalence rate	*6.0%*	*6.0%*	*6.1%*	*6.2%*
Total cost of diabetes	**18.2**	**20.0**	**21.1**	**23.0**
National healthcare expenditure	34.1	39.8	46.7	56.9
(% GDP at market prices)	*2.6%*	*2.5%*	*2.3%*	*2.1%*
Per patient (US$)	494	523	535	563
Healthcare costs	**2.1**	**2.3**	**2.3**	**2.6**
(% total healthcare expenditure)	*6.2%*	*5.7%*	*5.0%*	*4.5%*
Cost per patient (US$)	211	227	234	256
Hospitalisation	0.21	0.22	0.23	0.25
Ambulatory care	1.68	1.80	1.86	2.04
Treatment	0.23	0.24	0.25	0.27
Oral anti-diabetics and insulin	n/a	n/a	n/a	n/a
Other drugs	n/a	n/a	n/a	n/a
Productivity loss*	**16.1**	**17.7**	**18.8**	**20.4**
(% of GDP at market prices)	*2.3%*	*2.2%*	*2.1%*	*1.9%*
Cost per patient (US$)	436	463	476	500
Mortality	7.9	8.6	9.2	10.0
Average lifetime earnings loss (US$)	8,643	9,513	10,111	10,980
Morbidity	0.3	0.4	0.4	0.4
Disability	7.9	8.7	9.2	10.0

*The year of refence for productivity losses is 2004 and figures for 2005 to 2007 have been uprated using growth in average nominal wages.

India is, in the words of Dr Mohan, "the diabetes capital of the world". Although the overall prevalence figures in the *Diabetes Atlas* are not particularly remarkable (6.2% now growing to 7.6% in 2025), the absolute figures are huge: 41m individuals with diabetes—a conservative estimate—look set to grow to about 70m in the next 18 years. Dr Mohan notes that a combination of high genetic susceptibility of the Asian-Indian phenotype to the condition, mixed with the effects of economic

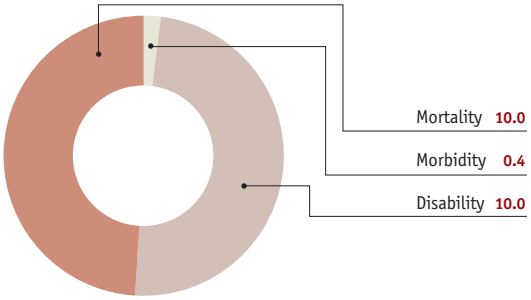
growth, give diabetes in India some unique features. First, Indians tend to develop type II diabetes earlier—making complications more likely—and at a far higher rate in cities. He puts the current urban prevalence at around 15%. Worse still, Indians are also more prone than average to suffer from heart disease.

The economic costs of diabetes to India are worrying. Our model calculated that, were everyone with the condition being treated, even with the country's relatively low-cost medicine, it would use up US$13.8bn, or nearly one-quarter of all health spending.

The fact is that huge numbers of individuals with diabetes in India are not being treated, in a system where out-of-pocket payments cover over 60% of expenses and the average cost of diabetes care is over one-third of per capita GDP. It is more likely that urban dwellers, who account for 30% of the population, will receive treatment, but even then a large proportion may not have access or may only receive occasional treatment. Figures vary, but it is estimated that around 10m people will be receiving some form of sporadic treatment for diabetes. Based on this figure, healthcare costs for a single year would amount to US$2.6bn, or 4.5% of the total expenditure on healthcare.

According to Dr Mohan, the well-off can afford care, the middle classes can just about make ends meet, but the poor simply cannot afford treatment and have to rely on whatever public medicine is available. Even the better off, however, face challenges. Ambujam, an upper middle class Indian with diabetes who can meet the expenditure with less difficulty than others, reported in an interview for this report that the medical test from an annual consultation for the disease came to about US$100, when per capita GDP is just US$925. She notes that diabetes, like other chronic diseases, is not covered by medical insurance in India—there is only one company that offers very restrictive cover. Thus, if any complication does set in, the patient has to pay the cost in its entirety. A reasonably priced foot amputation, for example, would cost more than US$10,000.

Productivity loss in India for 2007: costs attributed to mortality, morbidity and disability.
(US$bn)



Source: Economist Intelligence Unit, 2007.

The results are predictable: people die and become disabled—the best data put the percentage of individuals with diabetes in the latter category at 14.7%. Indeed, our model shows that not treating people is at least as expensive as treating them. Productivity losses took the equivalent of US$20.4bn from India's economy, or 1.9% of GDP, when total diabetes prevalence is only a little over 6%. Put another way, this amounts to a productivity loss of US$497 per individual with diabetes, which is equivalent to around half of per capita GDP. The loss is in fact probably greater, because the calculation uses an average wage for all of India, and does not take into account the higher earning potential in urban areas, where prevalence is greater.

India may find it hard to treat diabetes, but it needs to find a way, as not doing so is already growing extremely costly in both human and economic terms.

United Kingdom

US$bn, unless stated	2004	2005	2006	2007
Nominal GDP at market prices	2,154.10	2,229.06	2,373.54	2,643.26
GDP per capita (US$)	36,028	37,139	39,395	43,705
Nominal GDP (at PPP)	1,864.54	1,955.31	2,083.99	2,186.30
Population (million)	59.8	60.0	60.3	60.5
Population age 20-79 (million)	41.9	42.2	42.5	42.8
Diabetes prevalence (age 20-79, millions)	2.0	2.1	2.1	2.2
Prevalence rate	*4.71%*	*4.87%*	*5.02%*	*5.17%*
Total cost of diabetes	**8.93**	**9.51**	**9.94**	**10.60**
National healthcare expenditure	172.3	184.6	196.8	209.1
(% of GDP at market prices)	*0.4%*	*0.4%*	*0.4%*	*0.4%*
Per patient (US$)	4,522	4,631	4,662	4,794
Healthcare costs	**6.3**	**6.8**	**7.0**	**7.3**
(% total healthcare expenditure)	*3.7%*	*3.7%*	*3.6%*	*3.5%*
Cost per patient (US$)	3,185	3,302	3,306	3,316
Hospitalisation	2.3	2.5	2.6	2.7
Ambulatory care	2.5	2.7	2.8	2.9
Treatment	1.4	1.5	1.6	1.7
Oral anti-diabetics and insulin	0.3	0.3	0.4	0.4
Other drugs	1.1	1.2	1.2	1.3
Productivity loss*	**2.6**	**2.7**	**2.9**	**3.3**
(% of GDP at market prices)	*0.1%*	*0.1%*	*0.1%*	*0.1%*
Cost per patient (US$)	1,336.9	1,329.0	1,355.6	1,478.6
Mortality	1.2	1.2	1.3	1.4
Average lifetime earnings loss (US$)	59,171	61,156	64,764	73,243
Morbidity	0.3	0.3	0.3	0.3
Disability	1.2	1.3	1.3	1.5

*The year of refence for productivity losses is 2004 and figures for 2005 to 2007 have been uprated using growth in average nominal wages.

Diabetes is less of a problem for the UK than for many other countries, with a current overall prevalence of 5.17%. As noted earlier, however, these forecasts do not take into account the impact of rising levels of obesity over the past few decades, and here the country faces a serious health threat. According to the OECD, 63% of the population was overweight in 2004—the latest year for which figures are available—and about one-third of these was obese. By contrast, in 1980 just 36% was overweight or

obese. Among developed countries, these obesity numbers are surpassed, but only slightly, by the US. The UK government is certainly concerned about the resultant health implications, including an increase in type II diabetes.

For the moment, however, the lower prevalence has kept UK spending on diabetes down. Our model shows a total of just over US$7bn per year or around US$3,300 per patient. This takes up about 3.5% of total health care spending, but translates into just 0.28% of GDP. Through this spending, the country benefits from the lowest rate of productivity loss in the study, 0.1% of GDP, or US$3.3bn.

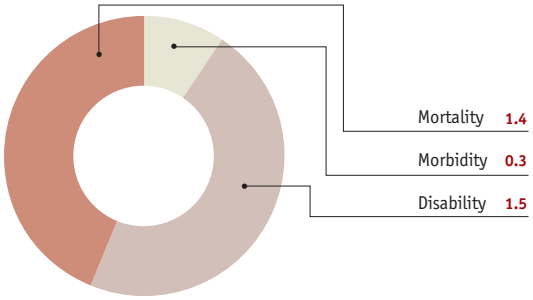
The broad coverage of diabetes costs by the UK's state-run National Health Service, including drugs and testing supplies, also provides a great psychological benefit to those with the condition. Keith, a type II diabetic interviewed for this study, could think of no real economic impact on him personally from the disease except some minor increased difficulty in obtaining travel insurance.

Clouds, however, are appearing on the horizon. Just as the healthcare system in the US suffers from its purchasing structure, the NHS also has weaknesses. Efforts to cut costs, and in some cases a bureaucratic mindset, can impede high-quality care. Decisions regarding which medications and devices to pay for are a particular minefield, even where the medical benefit should be obvious. For example, Karen Addington of the JDRF notes that getting insulin pumps prescribed and fitted on the NHS is a real issue, despite the clear benefits.

In addition, after having had to campaign to get coverage of diabetic testing supplies, patients are facing new limitations on their provision. This is ostensibly because a person with type II diabetes who has not been prescribed insulin cannot do anything immediate when faced with a high reading, but the restriction is, in some cases, also being applied to type I patients who will have been prescribed insulin and therefore can respond. More broadly, Professor Matthews complains that the government is starting to move diabetes to primary care providers. "The government is disinvesting in the secondary care necessary to treat chronic disease in a big way," he says. The results will not be apparent immediately, but in the long term, standards of care will drop and complications will therefore increase.

The comparatively low cost of diabetes in the UK—which still comes to 0.4% of GDP—is not a given: it arises from a relatively low prevalence and a relatively high standard of medical care. A probable increase in obesity-related disease, combined with attempts to reduce spending on diabetes, means that the country may well lose in productivity what it seeks to gain through decreased health spending.

Productivity loss in the UK for 2007: costs attributed to mortality, morbidity and disability.
(US$bn)



Source: Economist Intelligence Unit, 2007.

United States

US$bn, unless stated	2004	2005	2006	2007
Nominal GDP at market prices	11,712	12,456	13,247	13,858
GDP per capita (US$)	39,885	42,022	44,244	45,873
Nominal GDP (at PPP)	11,712	12,456	13,247	13,858
Population (million)	294	296	299	302
Population age 20-79 (million)	195	199	204	209
Diabetes prevalence (age 20-79, millions)	16	17	18	19
Prevalence rate (20-79)	*8.3%*	*8.6%*	*8.9%*	*9.2%*
Total cost of diabetes	**143.2**	**154.2**	**165.5**	**176.3**
National healthcare expenditure	1791.9	1987.7	2122.5	2262.3
(% GDP at market prices)	*1.2%*	*1.2%*	*1.2%*	*1.2%*
Per patient (US$)	8,813	8,957	9,100	9,201
Healthcare costs	**105.5**	**115.5**	**125.4**	**134.8**
(% total healthcare expenditure)	*5.9%*	*5.8%*	*5.9%*	*6.0%*
Cost per patient (US$)	6,492.2	6,706.1	6,892.2	7,038.3
Hospitalisation	62.34	68.23	74.07	79.67
Ambulatory care	23.13	25.32	27.49	29.56
Treatment	20.03	21.92	23.80	25.59
Oral anti-diabetics and insulin	13.71	15.00	16.29	17.52
Other drugs	6.32	6.92	7.51	8.08
Productivity loss*	**37.7**	**38.8**	**40.1**	**41.4**
(% of GDP at market prices)	*0.3%*	*0.3%*	*0.3%*	*0.3%*
Cost per patient (US$)	2,320.9	2,250.9	2,207.5	2,162.5
Mortality	27.0	27.7	28.7	29.6
Average lifetime earnings loss (US$)	169,842	174,545	180,816	186,565
Morbidity	3.9	4.0	4.1	4.3
Disability	6.9	7.1	7.3	7.6

*The year of refence for productivity losses is 2004 and figures for 2005 to 2007 have been uprated using growth in average nominal wages.

Diabetes is a serious problem in the US, largely due to obesity-inducing lifestyle choices: some 66% of the country is overweight or obese. Even after adjusting for an ageing population, prevalence nearly doubled between 1980 and 2005, according to the Centre for Disease Control. That said, according to the *Diabetes Atlas*, the overall prevalence figures of 9.2%, while above the world average of 5.9%, are not exceptionally high. The Atlas does not predict this will change by 2025, but its calculations do not factor in the obesity issue.

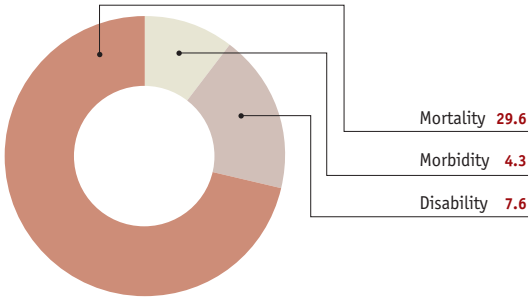
What sets the US apart is its spending on diabetes, which as noted above comprises about half the global total. Our model puts total direct outlay on the condition at about US$135bn in 2007, or over US$7,000 per individual with diabetes. This accounts for some 6% of the country's overall healthcare spending, and almost 1% of its entire GDP.

Along with many others, Dr Brown believes that the "broken and inefficient nature" of US healthcare means that the country does not get what it could out of such spending. On a purely macro-economic level, the results are reasonable, if expensive. The country will lose US$41.4bn in productivity from the condition in 2007, bringing the total cost, including healthcare and productivity, to 1.3% of GDP. This translates to US$2,162 per individual with diabetes, more than the UK's US$1,478 even though the latter spends much less per patient.

Where the US system is particularly wanting is at the individual level. Nearly 16% of citizens do not have health insurance and, as a result, face very high costs. If these individuals then cannot afford basic care, the quality of the overall system becomes irrelevant. As Dr Elizabeth Teisberg points out: "Universal coverage is not just more equitable, it is more efficient."

Dr Kaufman points out that, even if patients wanted to obtain insurance, they may be prevented from doing so. "Every patient that I deal with will at some point be uninsured," she says, "and getting cover with a pre-existing condition is remarkably difficult." This situation can cause very high levels of anxiety. In a study with which Dr Kaufman was involved of the parents of type I patients, some respondents scored anxiety levels that noticeably exceeded those of parents in other countries.

Productivity loss in the US for 2007: costs attributed to mortality, morbidity and disability.
(US$bn)



Source: Economist Intelligence Unit, 2007.

Conclusion

Success in addressing the fast-growing problem of diabetes depends on the interaction and participation of a wide range of stakeholders. Healthcare providers, governments, the education system, food manufacturers and retailers, pharmaceuticals companies, the media and patients themselves must all work together in order to effect the systemic change that is required to address the diabetes epidemic. Each player has the potential to put one piece of the puzzle in place, but each can also serve as a barrier that prevents the overall problem from being addressed.

At a national government level, there needs to be better co-ordination between different departments, as the costs of diabetes and the benefits of addressing the problem span a variety of different ministries. Finance ministers, health ministers, employment ministers and those responsible for social programmes all have a stake and should therefore collaborate closely in their efforts to minimise the impact of diabetes.

The health spending and productivity loss arising from diabetes is already taking a noticeable share of GDP from various countries examined in this study, including over 1% from the world's largest economy. As rates of prevalence increase, these costs can only escalate. Moreover, due to poor rates of diagnosis and the tendency for complications caused by diabetes not to be attributed to the underlying condition, these figures are likely to underestimate the true cost.

While the cost of diabetes in the current environment is certainly significant, solutions to the problem need not be expensive. The least costly solution of all is prevention, but it may take decades to enact the social and cultural changes required to reverse the bad habits of diet and lifestyle that can have such a damaging effect on overall health. In the meantime, increased awareness, among patients and healthcare professionals, better rates of diagnosis and earlier intervention, and innovative approaches—both in business and healthcare terms—must be encouraged in both developed and developing countries.

One area not dealt with directly in the report, because it is difficult to foresee what impact it may have, is medical research. This of course has the potential to overturn completely the whole structure of treatment and attendant costs. Dr Robert Goldstein, Chief Scientific Officer for the Juvenile Diabetes Research Foundation International, says that he "cannot overemphasise the point that a real investment in research has a really large payoff for society." JDRF focuses on type I diabetes, but a similar argument applies for type II, as well. New treatments might initially be expensive, but they will, like metaformin, still work when they come off-patent.

Despite the alarming statistics, diabetes is a condition whose physical and economic damage can be controlled. It can largely be prevented (at least in the case of type II) and it can be effectively treated. With the right financing, treatment, research and education in place, it is even possible that a large part of the problem might just be solved.

Appendix: Methodology

Direct healthcare costs

Healthcare costs were calculated by multiplying the estimated number of diabetes patients (as given by the prevalence figures) by an estimate of the average annual unit cost per patient for the following resource categories: (i) hospitalisation; (ii) ambulatory (outpatient) care; (iii) oral anti-diabetics and insulin, and; (iv) other drugs[1]. Per patient costs were retrieved from academic papers that have made estimates based on surveys and, in some cases, patient medical records (full references are supplied in the next section). Costs were inflated using an appropriate medical price index.

Productivity costs

Mortality

The calculations estimate the earnings—present and future—that are foregone by all those who die of a diabetes-related condition in a given year (2004). In essence, we pretend that the deaths did not occur and estimate the labour income these people may have earned given projections for future wages, labour participation and general (non disease-specific) mortality[2].

Estimates of the level of mortality attributable to diabetes mellitus in 2007 are sourced from the *Diabetes Atlas* (3rd edition, Tables 4.7 to 4.10). To estimate the distribution of these deaths across the various age groups, national statistics data on total deaths by one year age band were used. Thus, if at national level, 10% of all deaths in the 20-29 age group were at age 29, it was assumed that 10% of diabetes deaths in the same age range occurred at age 29.

It was initially assumed that, had they not died from diabetes-related conditions, all men and women actively participating in the labour market would have gone on to work until the age of 65 and 60, respectively. This assumption was modified by using official actuarial life tables which, for each age, provide a general probability of death (from all causes)[3].

As with the population at large, not all of those that die from diabetes are active members of the labour market. In the absence of data specific to diabetes sufferers, we assume that, had they not died from the condition, their rate of labour market participation would have been identical to that for all men and women in the same age-sex cohort. (This assumption could be modified given better information on the tendency of diabetes suffers to be from certain socio-economic backgrounds). Projections of labour market participation rates by different age groups were collected for the US (from the Bureau of Labor Statistics) and the UK (from the Office for National Statistics) and applied to the pool of deceased diabetes sufferers at each age. In the remaining countries, where a forecast was not readily available, we assumed that the current participation rate remains constant over time.

The Economist Intelligence Unit forecasts average monthly wages per worker in nominal US dollars. In the base year (2004), this figure was multiplied by 12 to attain the average earnings foregone in that year. In the subsequent seven or eight years the average earnings figure grows in line with the real wage index, which the EIU currently projects to 2011. Beyond this date, we exploit the EIU's long-term forecasting model and assume that all increases in labour productivity result in a proportional increase in labour wages (or associated income taxes).

Lost earnings are calculated by multiplying the number of remaining survivors from diabetes-related deaths in each age/gender group by the average real earnings in each working year and the appropriate age-specific labour market participation rate (male or female).

Finally, in order to account for the time preference of money, future earnings are discounted at a rate of 4 per cent per annum (as advocated in Her Majesty's Treasury Green Book for public sector cost-benefit analyses).

Morbidity

The calculations attempt to estimate the cost of lost work days caused by diabetes-related conditions during a given year.

Figures on the prevalence of diabetes were obtained from the Diabetes Atlas (3rd edition, Tables 1.19 and 1.22). These were for the age groups 20-39, 40-59 and 60-79 and by gender.

To ascertain the total numbers of lost working days for the 20-39 and 40-59 age groups, the population of these groups is multiplied by the labour market participation rate (male or female) and the average number of *additional* certified days off work taken by individuals with diabetes.

1. In India we assumed, on the basis of conversations with experts, that only 10m (approx one quarter) of all India's diabetes population has access to medical care. Only 10 per cent of these patients were assumed to receive hospital care.

2. Household work (which does not attract a pecuniary market wage) is not accounted for. This could form a substantial part of lost earnings.

3. Current life tables, which tend to be estimated using data for the past two or three years, are used to predict mortality probabilities in the future. It is likely that there will be an improvement in the chances of people living beyond retirement in 20 or 30 years' time, which would serve to increase the productivity loss.

Data on the amount of time taken off work because of diabetes is scarce. As a result we have used estimates by the American Diabetes Association (2003). These indicate that in 2002, controlling for age, men with diabetes have 3.1 more lost workdays and 7.9 more bed days per year, on average, than men without diabetes. Women with diabetes had 0.6 more lost workdays and 8.1 more bed days, on average, than women without diabetes. As explained in the ADA report, lost workdays are subtracted from bed days to avoid "double counting".

The economic cost was estimated by multiplying the average number of lost working days (bed days minus lost work days) by daily wage rate (computed as annual earnings divided by the result of 365 minus the number of weekends in a year).

Disability

Surveys and national statistics concerning the number of people claiming incapacity benefits relating to diabetes (where available) were used to estimate the number of persons unable to work for a whole year due to the condition. Once established we multiplied the number of disabled persons of working age by the average annual wage.

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General

Methodology

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