A Report From

The Diabetes Summit for South-East Asia, Chennai, India

November 28th – 30th, 2008

A supplement to

Practical Diabetes International
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Diabetes and other chronic non-communicable diseases (NCDs) are significant public health challenges in the 21st century. It is estimated that 3.8 million deaths were attributable to diabetes in 2007, equivalent to 6% of all deaths globally. In India, which has the largest population of diabetes patients of any country, diabetes accounts for 9.7% of these deaths.

This imposes a huge burden on the health and economies of the developing world but too little is being done to help. The World Diabetes Foundation (WDF) is dedicated to tackling this problem by improving the prevention and treatment of diabetes in developing countries. Its projects raise awareness, and support the education and training of patients and healthcare professionals, as well as helping to improve the prevention, detection, treatment and monitoring of diabetes. Further, the WDF acts as a catalyst to build relations among different stakeholders such as governments, diabetes organisations, hospitals and authorities so that local communities are empowered to achieve sustainable solutions. Diabetes is a global problem and the WDF is working to raise diabetes higher on the world’s agenda and to collaborate with recognised institutions in promoting health and development aid.

Each of these aspects of the WDF’s work was evident in the presentations at this Diabetes Summit in Chennai, India, fulfilling its aim of creating a forum for local and international stakeholders, policy makers, opinion leaders and WDF partner organisations to share their knowledge and experience of developing services for people with diabetes. The Summit was hosted by the WDF in collaboration with the World Health Organization Regional Office for South-East Asia, the International Diabetes Federation (IDF) and the World Bank. It was addressed by senior representatives of the Indian national and state governments and Sri Lanka, and brought together specialists, academics and primary care workers to debate their invaluable efforts to improve the care of diabetes.

The Summit unanimously agreed a resolution, which may become known as the Declaration of Chennai, calling on health authorities and policy makers worldwide to act now to stem the tide of NCDs threatening the health and economies of developing countries. It is essential that the UN includes NCDs in its Millennium Development Goals and creates a global fund for health. With their support, participants at the Summit have strengthened the WDF in its resolve to work towards this goal.

Professor Pierre Lefèbvre.
Chairman, World Diabetes Foundation
In his short welcome, Dr Anil Kapur (Managing Director of the WDF), thanked the partners for their constructive support for the Summit. Referring to the tragic events in Mumbai, he said: ‘The fact that so many of you chose to travel from far and wide to attend the meeting, even considering the security situation, speaks volumes of your commitment to the cause.’ He asked the assembled guests to rise and observe a minute of silence as a mark of respect to the many innocent victims of the contemptible violence.

Welcoming the delegates, Professor Pierre Lefèbvre (Chairman of WDF and former President of IDF) stated that: ‘The Summit brings together one of the largest assemblies of the most influential people capable of changing the course of diabetes in the region. The fact that so many people have come together on this platform is not merely a coincidence. The fact that this Summit has speakers and participants ranging from political leaders to policy planners, researchers, academics, health professionals, funding agencies, economists, teachers, representatives from the industry, non-governmental organisations and distinguished members of the media shows that the problem will have to be addressed at multiple fronts, and that there is a need for collaboration.’

Tackling the prevention and care of diabetes is an essential component of the WHO NCD programme, because no other condition is so closely implicated in the pathogenesis of these disorders. The Summit had brought together some of the people – politicians, academicians, clinicians – with the greatest power to change the course of diabetes in India. The WDF has played a small role in bringing the fight against diabetes close to the tipping point. It funds initiatives all over the world, helping local champions with their work, and acts as a catalyst by helping to create partnerships and networks.

Access to care is important in the fight against diabetes, but so too is awareness of the disorder and its cardiovascular and renal complications. All, including type 2 diabetes itself, are eminently preventable.

Globally, diabetes accounts for 3.4 million deaths annually, or 6% of all deaths. In India, diabetes accounts for 10% of all deaths and up to 15% of deaths among women. The complications of diabetes cost people their future but it needn’t be so – there is a clear economic case for prevention. It costs only $3 to provide education about foot care, compared with an estimated $850 for a limb amputation and another $824 for a limb prosthesis. Such expense puts people living on less than $1 a day in life-long indebtedness and the disability associated with diabetes complications means they can’t work or support their family. Diabetes is now affecting people at a younger age, with serious implications for economic productivity.

Professor Martin Silink (President of IDF), said the IDF was proud and honoured to be part of the Summit. The IDF is now a federation of 203 national associations from 162 countries in 7 regions. As a non-governmental organisation (NGO) represented at the United Nations and WHO, it is one of the largest consumer advocacy organisations in the world. The IDF’s World Diabetes Day 2008 delivered awareness messages to more than 1 billion people, illuminating over 1,000 monuments in blue, organising thousands of community events and promoting the message that children develop diabetes too.

In 2007, UN Resolution 61/225 officially recognised World Diabetes Day with the acknowledgement that diabetes poses risks to families, member states and the entire world. This was the first time that a NCD was recognised as a global threat. However, projections of the risk posed by diabetes have always underestimated the scale of the problem: it is now a global health catastrophe, affecting over 380 million people within a generation.

The key question is, why is the political voice not stronger? A total of 6% of adults in the world have diabetes and for each person another 2 or 3 family members are affected. Diabetes is more than a risk factor for cardiovascular disease (CVD): it causes high morbidity and mortality, it is associated with 10% of cases of tuberculosis in developing countries, and its economic impact is high.

The work of the WDF is much appreciated, Professor Silink said, and we now face some important geopolitical battles. He reminded the delegates that the UN Resolution on diabetes provides the diabetes community with a huge opportunity to press policymakers to address the diabetes burden. Professor Silink expressed extreme concern that: ‘Even 85 years after the discovery of insulin, children are dying in many developing countries because insulin is either not available or inaccessible, and adequate knowledge on how to diagnose and treat these children is lacking. This can no longer be tolerated.’ In a passionate address, he asked the delegates to support a call for a special session of the UN General Assembly to discuss and include chronic NCDs into the United Nations Millennium Development Goals and the creation of a global fund for health to include both communicable and NCDs. We must have sustainable, affordable and accessible essential medicines for everyone with diabetes. It is vital that more countries become champions for diabetes; Bangladesh has shown leadership and we need others – India, China and Sri Lanka, and middle-income countries such as Mexico and Brazil.

Delivering his address at the opening ceremony, Dr Samlee Plianbangchang (Regional Director, WHO Regional Office for South-East Asia), said: ‘If appropriate public health action is not taken, disability and premature deaths from heart disease, cancer, diabetes and chronic respiratory diseases will increase by more than 21% over the next 10 years in the South-East Asian region. Almost half of the 89 million NCD-related deaths projected in the region during the next 10 years will happen prematurely, thus hindering social and economic development of member countries.’
The increase in diabetes poses a challenge to societies and their economies and, unless there is appropriate action, the impact on morbidity and mortality will be great. In South-East Asia there are currently 54 million people with diabetes, with 41 million in India alone, and this is expected to increase by 71% by 2025.

These statistics may underestimate the threat posed by diabetes as many diabetes-related deaths are not correctly attributed to the underlying cause. A total of 80% of cases are in low-income countries, but only 20% of global expenditure on diabetes care is spent there. Application of comprehensive, population-based interventions to tackle prevalent risk factors could prevent at least 80% of diabetes, heart disease and stroke cases. Primary prevention is therefore critically important and should be integrated into public health programmes; even a modest investment in this approach will be highly effective.

Much of the burden of diabetes and other NCDs is attributable to unhealthy behaviour and lifestyle that stems from specific socioeconomic, physical, cultural and political environments. Strategies to prevent and control diabetes should therefore be multidisciplinary and multistructural. Over the last 6 years, the WDF has been an influential advocate for action against diabetes and other NCDs. The WHO South-East Asia Regional Office is very proud to be a co-sponsor of this Summit.

In his opening statement, the Minister of Healthcare and Nutrition, Leader of the house in the Sri Lankan Parliament and Chairman of the WHO’s Executive Board, Sri Nimal Siripala De Silva, addressed the magnitude of the problem: “The problem of diabetes is big enough for the United Nations to recognise it as a significant global health challenge and for the member states to pass a unanimous vote recognising 14 November as World Diabetes Day. By doing so, they also accepted the responsibility of taking appropriate actions to address the issue. The global diabetes community must be congratulated for coming together and advocating this to happen. South-East Asia is particularly affected by the diabetes epidemic, which kills more people each year than the tragic tsunami of 2004,” he said. Accompanied by loud applause, he declared the Summit open and wished the organisers success. The Minister of Health for Sri Lanka, offered warm greetings from the President and people of Sri Lanka. He also said that the Summit is a timely event.

The countries of South-East Asia are facing an unavoidable socioeconomic transition. WHO predicts that NCDs will account for two-thirds of all deaths within the next 25 years and half of these will occur in people of working age. Diabetes is a major contributor to this burden and lack of awareness of this risk is a serious concern. No country, rich or poor, can cope with the burden of diabetes. Providing funding is a daunting challenge for economically developing countries. Primary prevention is therefore critically important and offers the most cost-effective strategy. The pharmaceutical industry has an obligation to make drugs available at an affordable price.

We need to demonstrate leadership and commitment, Mr De Silva continued. All countries should now make the prevention of diabetes a priority in their health agenda. The healthcare system should be strengthened to provide acute care, to detect diabetes at an early stage and to deliver better care to prevent complications. He expressed thanks to the WHO South-East Asia office for its work in promoting primary prevention of NCDs. The World Health Assembly has adopted a plan, focussed especially on low-income countries, to control NCDs through lifestyle change. If successful, this will significantly reduce the incidence of diabetes and other chronic diseases. He also thanked the World Bank and others for their support for developing countries.

In Sri Lanka, the prevalence of diabetes is 6–8%; this is increasing due to urbanisation, reduced physical activity and dietary change. Many more cases are undiagnosed. A national plan to tackle diabetes through awareness, health promotion and screening has now been developed. Public-private partnerships mean that more new clinics are being built, improving quality of care and access to services. The corporate sector has a social responsibility and should follow this example.

The Minister thanked the WDF, IDF and WHO for their efforts in organising the Summit which, he predicted, would be a landmark event in tackling diabetes in the region.
**Health impact of diabetes**

One of the core functions of the WHO is monitoring and assessing health trends in individual countries, storing its data in Global InfoBase which can be accessed at www.who.int/ncd_surveillance/infobase. Most countries have conducted surveys using the WHO’s STEPS methodology to ensure a standard approach, or have published population-based data to provide a comprehensive knowledge base on diabetes. The IDF also periodically produces estimates of the diabetes burden, using data from population-based surveys.

Dr Gojka Roglic (Medical Officer of the Diabetes Programme, Department of Chronic Diseases and Health Promotion, WHO), said these surveys show that approximately 84 million people aged 20–79 in South-East Asia had diabetes in 2007. It is predicted that this figure will almost double by 2025, although this estimate is based on expectations of growth in urbanisation and population aging and takes no account of the increasing prevalence of obesity. Nor does it include people under 20, many of whom have type 1 diabetes and an increasing number have type 2 diabetes.

Surveys in Myanmar and India show that prevalence is particularly high among 40–60 year-olds. This group is economically productive and relatively young, and likely to live long enough to develop complications. Prevalence is higher in urban than rural populations: over the period 1989–2004, the prevalence in Chennai increased by 72% to 14.3%. However, where the rural population is larger, as in India, the absolute number of cases is greater in rural areas. Indonesia is one of the few success stories in the fight against diabetes. Its public campaigns to promote healthy lifestyle and diet have reduced prevalence over the last 3 years, especially in men under 55 years old.

Population aging, younger age at onset and decreasing mortality account for only 25% of the observed increase in diabetes prevalence. The remainder is due to an increase in risk factors associated with lifestyle change and growing prosperity.

Estimates of diabetes mortality based on death registration data are likely to underestimate the true figure. More realistic figures can be achieved by modelling mortality according to prevalence, relative risk of death and population statistics. WHO estimates that 2.3 million people died in 2000 as a result of diabetes, equivalent to 5.2% of global mortality. This compares with 3 million deaths attributed to HIV/AIDS. Using similar methodology, the IDF estimated that in 2007 diabetes accounted for 1 in 7 deaths among 50–59 year-olds in the South-East Asia region and almost 1 in 4 deaths in this age group in India.

Diabetes has an extended impact. Gestational diabetes adversely affects pregnancy outcomes and the risk of diabetes for the mother and child. Reliable statistics are difficult to find, but recent data show the prevalence of gestational diabetes in South India is 17.8% in urban areas, 13.8% in semi-urban areas and 9.9% in rural areas. The association between diabetes and tuberculosis is now becoming recognised. In adults in India, the proportion of pulmonary tuberculosis attributable to diabetes is 12.5% among 25–39 year-olds and 23.9% among 30–38 year-olds. Overall, it is estimated that diabetes is likely to be responsible for 15% of all new tuberculosis cases in India – compared with 3–4% for HIV/AIDS.

Dr Roglic concluded that the prevalence of diabetes in South-East Asia is increasing, with a shift in the age of onset to younger people, it is a significant cause of death. Although it is more prevalent in urban areas, it is by no means rare in rural areas. It is not rare among the poor and its complications are more prevalent in lower socioeconomic groups. Diabetes could therefore be a significant obstacle to achieving the Millennium Development Goals.

**Economic impact of diabetes**

As countries acquire increasing wealth they invest in infrastructure development which facilitate economic activity. These changes are associated with lifestyle change in the population, which may result in risk factors for NCDs becoming more prevalent (Figure 1). Dr Michael Engelgau (Senior Public Health Specialist, South Asia Human Development Unit, The World Bank), explained that some studies have found that NCDs can be anti-economic growth through reducing the productivity of the workforce and diverting spending from investment to healthcare. For example, a WHO study found that the national income foregone due to heart disease, diabetes and stroke over the period 2005–2015 is predicted to be $237 billion for India and $30 billion for Pakistan.

The population growth rate and age distribution are interlinked and have an important influence on health. For example in Sri Lanka, 10% of the population is aged over 60, an age where NCDs are more common, and the country has a reduced growth rate (0.8% annually). Other countries in South-East Asia will soon have similar age profiles: the proportion of people aged over 60 in India, Pakistan and Bangladesh is 8%, 6% and 8% respectively, with all having declining growth rates of 1.5%, 1.8% and 1.8%. Sri Lanka also has a population bulge in the number of people aged 20–30 years; this group will age to produce a bulge of middle-aged and eventually elderly people. In Sri Lanka, a common reason for withdrawal from the workforce is disability and studies have noted the rate of disability among the older population has doubled in 2001 compared with 1981. As the population ages it is also developing more disabilities.

Compared with wealthy countries, a greater proportion of total...
healthcare expenditure in low-income countries comes from out of pocket spending by patients (Figure 2). Paradoxically, the proportion of healthcare spending from out-of-pocket expenditure increases as you move from high-income countries which have developed financing schemes, to low-income countries that have no such schemes. One means of assessing vulnerability to health costs is to look at catastrophic spending, which can be defined as when the proportion of annual income spent on healthcare exceeds 30%. Preliminary findings from a recent study found that the level of catastrophic spending has increased in people with CVD and was 5 times greater for low-income than high-income groups.

Double burden of diabetes and tuberculosis

Diabetes and tuberculosis place a huge burden on global resources, said Professor Anthony David Harries (International Union Against Tuberculosis and Lung Diseases). In 2007, it was estimated that 246 million people were living with diabetes, with 6 million new cases and 3.5 million deaths; 14.4 million were living with tuberculosis, with 9.2 million new cases and 1.7 million deaths. A total of 70% of cases of diabetes occur in developing countries, including 20% in South-East Asia, 23% in the Western Pacific and 8% in Africa. Developing countries have 95% of tuberculosis cases, with 36% in South-East Asia, 28% in the Western Pacific and 23% in Africa.

Approximately 2 billion people carry the tuberculosis bacterium and their lifetime risk of active disease is 5–18%. Risk factors include HIV/AIDS, other causes of immunosuppression (such as corticosteroids), silicosis, malnutrition, smoke from tobacco and domestic fires, and diabetes mellitus.

The link between diabetes and tuberculosis has been known since Roman times. Epidemiological studies show that diabetes is associated with a 3-fold increased risk of tuberculosis overall, with the highest risk among young people, communities with a high background incidence of tuberculosis, and in Asia, Central America and Europe. Modelling using data from India suggests that diabetes accounts for 15% of new clinical cases of pulmonary tuberculosis, and 20% of smear-positive cases; urban areas are more affected than rural areas. A study in Africa suggests that diabetes is 4 times more common among people with tuberculosis than in others.

Diabetes probably increases the risk of tuberculosis by impairing innate and immune responses; diabetes is also associated with pulmonary microangiopathy, renal failure and micronutrient deficiency, all of which increase the risk of infection. It is not known whether tuberculosis increases the risk of developing diabetes, but it may complicate management; rifampicin may cause high blood sugar levels, and some antiretroviral drugs may also cause high blood sugar levels in HIV-infected patients with tuberculosis.

Clinically, diabetes is underdiagnosed in people with tuberculosis (data from Africa suggest it may be missed in as many as half of patients) and the presentation of tuberculosis may be different in people with diabetes. Diabetes may be difficult to manage initially but this should improve when tuberculosis is controlled. Research in India suggests that diabetes does not worsen the outcome of tuberculosis, but this is contradicted by evidence from South America suggesting higher fatality rates and an increased risk of treatment failure.

The strong association between diabetes and tuberculosis means that screening patients is an effective means of identifying cases. The DOTS approach (directly-observed therapy, short-course) for tuberculosis control can be adapted for...
Patients with tuberculosis are identified by passive case finding and the diagnosis is confirmed by sputum smear examination, chest X-ray and circumstantial evidence. These patients should then be screened with a simple test for diabetes (ideally fasting blood glucose although oral glucose tolerance test or HbA1c are alternatives if resources allow) before registration and beginning treatment. Integrating this process into the procedures for tuberculosis management and documenting the investigations and their results ensures that screening is systematically carried out. Similarly, patients with diabetes should be screened for tuberculosis: by asking if they have a chronic cough, and if so by testing their sputum for tuberculosis organisms.

Patients with diabetes can be screened for tuberculosis by asking about signs and symptoms (fever, weight loss, chest pain, night sweats) when they visit the clinic. Patients who report a cough of more than 2 weeks’ duration should have a sputum smear; negative smears should be confirmed by chest X-ray. It is important to remember other causes of cough – in particular, ACE inhibitors, which may be prescribed to reduce the risk of microalbuminuria progression for patients with diabetes, may cause persistent dry cough.

There is no evidence to guide practice if screening is negative. One option is tuberculin testing; if this is strongly positive isoniazid preventive therapy may be indicated but, again, there is no evidence to support or refute this strategy.

Monitoring and evaluation of diabetes screening can be conducted in a similar way to DOTS. The use of standardised outcomes for death, treatment status and care (for example, alive and on treatment, dead, defaulted, stopped treatment, transferred out) simplifies data collection and the development of a patient register. In turn, this allows health workers to carry out regular outcome analyses to quantify the disease burden and plan resources.

The Millennium Development Goals include the elimination of tuberculosis as a public health problem by 2050. Professor Harries told the Summit that this will not be achieved with the DOTS approach alone because of the increased risk associated with HIV/AIDS in Africa, multiply-resistant tuberculosis in Eastern Europe, China and India, and diabetes in Asia. The global plan to stop tuberculosis should therefore include strategies to tackle diabetes.
RESPONDING TO THE CHALLENGE: PRIMARY PREVENTION

This session was chaired by Mr V K Subburaj IAS (Secretary of Health, Government of Tamil Nadu) and Dr Palitha Abeykoon (Acting Director Non-Communicable Diseases and Mental Health, WHO Regional Office for South-East Asia).

Introducing the session, Dr Abeykoon said that the WHO has passed several resolutions in relation to NCDs and diabetes over the last 20 years. These have had several features in common: they specifically mention the need to adopt a lifestyle approach; most emphasise the role of health promotion and disease prevention as the main focus of the strategy; and all stress the need for interventions at both the levels of the community and the individual.

Primary prevention is possible

Economic growth in India has been associated with a substantial increase in the prevalence of diabetes in urban and rural populations, said Professor Ambady Ramachandran (India Diabetes Research Foundation). There is strong evidence that primary prevention is effective, with trials in Europe and the United States reporting risk reductions of approximately 60% with lifestyle change and 30% with metformin therapy. However, there are important differences between the participants in these trials and the population in India.

In 2006, the Indian Diabetes Prevention Programme (IDPP) showed that the 3-year incidence of diabetes in 531 participants with impaired glucose tolerance was reduced from 55% among controls, to approximately 40% with lifestyle modification and/or metformin. By contrast with other trial, participants in IDPP were younger and less obese; they underwent less intensive lifestyle change and they did not significantly lose weight. In IDPP, lifestyle modification was associated with a reduction in LDL-cholesterol levels but no change in HDL-cholesterol.

The cost of primary prevention in India is relatively low. Standard care received by the control group in IDPP cost $61 over 3 years; the costs for lifestyle modification and metformin were $225 and $220, and together they cost $270. With numbers needed to treat (NNT) to prevent one case of diabetes of 6–7, the costs of prevention were $1052 for lifestyle change alone, $1095 for metformin alone and $1359 for the combination. For a similar NNT, the corresponding cost of lifestyle change in the US Diabetes Prevention Study was $15 700. In this study, the NNT for metformin monotherapy was higher than in IDPP (14), giving a cost of $31 000 for drug treatment.

Professor Ramachandran concluded that this evidence demonstrated the cost effectiveness of primary prevention in India. The optimal strategy would be to use a low-technology, non-invasive test to identify individuals at high risk who are eligible for a simple, cost-effective treatment. Evaluation should also be simple and easy to carry out.

Public health response to diabetes

Rapid growth of diabetes in developing countries of the region may be seen as a public health outcome of adoption of unhealthy behaviours by large segments of populations, explained Dr Jerzy Leowski, (Regional Advisor for Non-Communicable Diseases [NCD], Regional Office for South-East Asia [SEA], WHO). Along with heart diseases, chronic respiratory diseases and cancer, diabetes is linked to a cluster of common risk factors such as tobacco use, harmful alcohol use, unhealthy diet and physical inactivity. In South-East Asia there is already evidence of a growing prevalence of major risk factors among the poor and the peak prevalence of NCDs has not been reached in most countries. In 2005, 54% of deaths in the SEA Region were due to NCDs, of which half involved people under 70 years old. It is estimated that deaths from NCDs will increase by 21% by 2025 whereas the mortality of infectious diseases will decrease by 16%.

Individual countries cannot tackle the growing epidemic of NCDs alone and there is a strong need for collaborative action. In close consultation with Member States, the WHO Regional Office for SEA Region has developed a regional framework for prevention and control of NCDs with focus on epidemiological assessment and co-ordinated public health intervention targeting major risk factors for NCDs and their socioeconomic, cultural, political and physical determinants. As part of this response, NCD surveillance using the STEPS methodology has revealed a high prevalence of risk factors in the Region (Table 1). There is a need to support public health messages with intervention at policy, health system, community and individual level. A programme for capacity strengthening of policy makers and NCD programme managers is under way in the region.

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Prevalence (%)</th>
</tr>
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<tbody>
<tr>
<td>Current smokers</td>
<td>16–32</td>
</tr>
<tr>
<td>Current consumers of alcohol</td>
<td>3–41</td>
</tr>
<tr>
<td>Eating &lt;5 portions/day of fruit and veg</td>
<td>81–99</td>
</tr>
<tr>
<td>Physically inactive</td>
<td>4–24</td>
</tr>
<tr>
<td>Overweight or obese (BMI &gt;25)</td>
<td>9–44</td>
</tr>
<tr>
<td>Raised blood pressure (&gt;140/90 mmHg)</td>
<td>8–42</td>
</tr>
<tr>
<td>Raised fasting blood glucose (&gt;7 mmol/l)</td>
<td>4–9</td>
</tr>
<tr>
<td>Raised blood cholesterol (&gt;5.2 mmol/l)</td>
<td>13–54</td>
</tr>
</tbody>
</table>

Table 1. NCD risk factors in STEPS surveys in SEA Region 2003–2005 (25–64 years, both sexes)
KEY NOTE LECTURES

This session was chaired by Professor Pierre Lefèbvre, Professor Martin Silink and the Hon Sri Nimal Siripala De Silva.

Key note lecture given by Hon Dr Anbumani Ramadoss, Union Minister of Health and Family Welfare, Government of India

One of the most distinguished and important key note lectures was delivered by the Indian Union Minister of Health and Family Welfare, Dr Anbumani Ramadoss. During his half-hour lecture, he addressed and emphasised the importance of policy actions and preventive measures required to halt the epidemic of diabetes and other chronic NCDs. He pointed out the measures taken by the Indian government on tobacco control and announced that new regulations with regard to food labelling and advertising food products to children will soon be implemented.

‘India is experiencing a rapid health transition, with a large and growing burden of chronic diseases, accounting for 53% of all deaths and 44% of disability-adjusted life years in 2005. The close link between diabetes, hypertension, obesity, cardiovascular disease and stroke is well-known,’ he said. He added that ‘the leading causes of non-communicable diseases, and diabetes in particular, are harmful consumption of alcohol, lack of exercise and intake of unhealthy processed food. The Indian Health Ministry wants to remove junk food. It should not be available in school canteens, and labelling rules should be amended under the proposed food standards. Also, Indian health authorities want to make arrangements to introduce yoga in all schools and screen students for risk factors for non-communicable diseases.’

Deaths from NCDs are expected to increase from 3.8 million in 1990 to 7.8 million by 2025. The major health challenges today are no longer HIV/AIDS, tuberculosis and malaria, but diabetes, CVD, stroke, mental health disorders and cancer. India suffers a greater loss in economically productive life expectancy is still increasing and the proportion of the population aged over 35 is expected to rise from 28% in 1981 to 30% by 2030, this will be equivalent to 17.9 million years lost among 35–64 year-olds.

The epidemic of chronic disease is propelled by demographic, economic and social factors, the main determinants being urbanisation, industrialisation and globalisation. Life expectancy is still increasing and the proportion of the population aged over 35 is expected to rise from 28% in 1981 to 42% in 2021. The proportion of the population living in urban areas is now 30% but will increase to 43% by 2021. Urbanisation and industrialisation are changing the pattern of living in ways that raise the level of behavioural and biological risk factors in the population.

India has the largest number of people with diabetes in the world and the prevalence of diabetes increasing - why? It is a complex problem with no simple answer. Diabetes was once viewed as a rich man’s disease but this idea is wrong. Lifestyle is changing radically, resulting in an increase in sedentary occupations. In villages where people used to walk to their fields and work the land by hand, they now use machines and in the evenings they watch TV. There is also a problem with misuse of alcohol. There have been corresponding changes in semi-urban environments so it is not surprising that morbidity and mortality from NCDs are increasing.

People living with NCDs face increased healthcare costs, and the out-of-pocket expenses for someone with diabetes can be high. In a poor Indian family, the entire household is affected when the family breadwinner develops diabetes. The cost of treatment for the complications of diabetes is exorbitant and beyond the means of most families. Essential drugs for the treatment of diabetes and CVD are available in India at below global prices but this still represents a high cost for the poor. There should be a more rational use of drugs: prescribing of newer agents is increasing even though they offer little advantage over older, less expensive alternatives.

Prevention is therefore the best strategy. Primary prevention of diabetes may seem optimistic but it is a realistic option. Policies should promote responsibility and behaviours that favour health. However, India is a huge country. Spreading awareness about diabetes among poor and illiterate communities is a daunting challenge and it is difficult to deliver health messages to a population with multiple languages and dialects living in remote areas.

The escalating epidemic of chronic diseases requires a comprehensive policy response. Healthcare has prioritised communicable disease and maternal and child care and the development of services for NCDs has been hampered by a lack of data on the burden of disease. The cost of tertiary care for the treatment of tobacco-related diseases has only recently been recognised and health budgets have not been sufficient to include NCDs. Measures to control tobacco use have been introduced against strong opposition but a policy framework for implementing the WHO Global Strategy on Diet, Physical Activity and Health is still evolving.

The Health Ministry has launched an integrated national programme for the prevention and control of diabetes, CVD and stroke. This is now being piloted in 7 states and will focus on surveillance to determine the prevalence of risk factors, health awareness and screening, diagnosis and management for high-risk sectors. When the pilot phase is completed, we will expand the programme to include cost-effective treatment for type 1 diabetes (including free insulin for patients below the poverty line).

The steps taken to prevent diabetes include a requirement for food labelling to state the ingredients and nutritional value of products. The National School Health Programme includes annual screening for anaemia, CVD, skin disorders and diabetes. Children receive mandatory instruction in yoga and teaching about public health issues such as healthy lifestyle and sensible alcohol use.
Health education alone will be insufficient unless supported by lifestyle change and structural change. Health messages to combat NCDs have to compete with many others such as communicable disease, sanitation and hygiene, and family planning. In this context, policy interventions related to tobacco use (banning smoking in public places), urban planning (walkways and cycle tracks) and food supply are likely to have a greater and more rapid effect on NCD prevention.

There is increasingly strong evidence that diabetes and tuberculosis are linked, and there is a higher risk of diabetes and metabolic syndrome associated with antiretroviral drugs in people with HIV/AIDS. This emphasises the need for even greater attention to the control and prevention of diabetes and to integrate services in primary care to maximise efficiency.

The need to provide an effective public health response to the growing challenge of chronic diseases in India can no longer be ignored without endangering India’s development. India is committed to addressing these issues but commitment needs to be backed by resources. While the current Government has significantly increased spending on healthcare, and for the first time introduced the rural health mission programme, there are not enough healthcare resources to address these dual and triple health burdens simultaneously for a large population. Additional funding will have to be found and we will have to focus on community-based primary healthcare, as recommended by the World Health Assembly in 2008.

The Minister concluded his address by acknowledging the WDF’s work in India and welcomed its contribution to building capacity to supplement the public health system.

Key note lecture: Tackling diabetes and other NCDs in South-East Asia

This lecture was delivered by Dr Jerzy Leowski on behalf of Dr Ala Alwan (Assistant Director General, WHO).

Dr Leowski listed 8 key messages for participants at the Summit. Firstly, the prevalence of diabetes in South-East Asian countries is changing at ‘an astonishingly fast rate’ and this has serious implications for economic growth and poverty reduction. Of the 12 leading causes of death in the world, 8 are NCDs and these account for 85% of total mortality. Over the next 10 years, WHO expects a 17% increase in deaths due to NCDs globally, but a 21% increase in South-East Asia; deaths related to diabetes will increase by 36%. Diabetes has important and troubling implications for economic growth: India could lose $237 billion over the next 10 years due to premature deaths associated with CVD, diabetes and stroke.

The second message is that diabetes, heart disease, stroke and cancers are largely preventable by cost-effective interventions that tackle 4 shared risk factors – physical inactivity, unhealthy diet, smoking and harmful use of alcohol – and the obesity, high cholesterol and high blood pressure associated with them. Countries need to establish integrated policies for the prevention and control of NCDs and there are encouraging signs that this problem is now being addressed, with 50% of member states now having specific plans to tackle diabetes.

Thirdly, the World Health Assembly endorsed a 6-year Global NCD Action Plan in May 2008 to address diabetes, CVD, cancer and respiratory disease over the years 2008–2015. Based on lessons learned in recent years, it has 6 objectives:

• To integrate NCD prevention into the development agenda
• To establish and strengthen national policies and programmes
• To reduce and prevent risk factors
• To prioritise research on prevention and healthcare
• To strengthen partnerships
• To monitor NCD trends and assess progress at country level.

In turn, countries have 6 objectives:

• They need to develop poverty reduction strategies; utilise the UN Development Assistant Framework and work with planning, finance and social affairs ministries
• Establish multisectoral frameworks integrated into health development plans and reorient their health systems
• Implement cost-effective risk-reduction strategies
• Invest in research and establish national reference centres and networks
• Strengthen surveillance systems and monitor progress on implementation.

Fourthly, primary healthcare reforms in South-East Asia lead to workable solutions to integrate essential NCD interventions into primary healthcare. The issues to be addressed include access to care, organisation and finance, prevention and health promotion, healthy workforce and the role of individuals and self-care. Governments should recognise their role as leaders in developing inclusive policy and dialogue. Spending on healthcare is growing and this needs to be matched by massive reinvestment in capacity. The determinants of NCDs are outside the health sector; public policy reform therefore needs to have cross-government support.

The 2008 World Health Report identified three levels of public policies to strengthen primary healthcare. Health systems policies to achieve universal coverage – for example, access to essential drugs and basic technologies and providing human resources; public health policies to address risk factors, such as primary and secondary prevention, health promotion and surveillance; and policies for other sectors to promote integration and health urbanisation.

Three examples of interventions that have proved effective in reducing risk factors are tobacco control, promoting healthy diet and obesity prevention, and the assessment and management of cardiovascular risk.

The last message is a call from WHO for international partners to support and work jointly to implement the Global Strategy Action Plan. Measures to prevent and control NCDs have been adopted by a number of intergovernmental organisations, development agencies such as the World Bank and private bodies such as the Gates Foundation.
This session was chaired by Professor Ib Christian Bygbjerg (University of Copenhagen).

Preventing foetal programming – the Pune experience

Foetal programming – a permanent change in structure or function in response to a stimulus (such as maternal nutrition) during a critical period of development – appears to be important for the risk of developing diabetes. Low birth weight is a risk factor for diabetes and metabolic syndrome, and foetal exposure to famine during the first half of pregnancy predisposes an individual to diabetes.

Professor Chittaranjan Sakerlal Yajnik (King Edward Memorial Hospital), said that the 1992–94 Pune Children’s Study showed that, in 4 year-old children, those with a lower birth weight had evidence of impaired glucose tolerance after a glucose challenge regardless of their current size. When these children were 8 years old, the association between birth weight and impaired glucose tolerance persisted, but glucose homeostasis was most impaired in children who had grown tall even though their parents were short. This implies that foetal undernourishment may increase the risk of glucose intolerance and this may be worse after rapid growth in childhood.

The Pune Maternal Nutrition Study assessed the relationship between maternal nutrition and children’s development from preconception to age 12. The mothers were characteristically small (mean BMI 18 kg/m²), implying the possibility of undernourishment, but physically fit and active; their diet included a high proportion of carbohydrates (accounting for 73% of calories). The infants had low birth weights (mean 2.65 kg). Despite this, MRI scans revealed a higher level of internal abdominal fat compared with babies in the West (Figure 3). There was no correlation between maternal dietary calories or fat but there was a strong link between higher birth weight and intake of vegetables, fruit and milk. Adiposity and insulin resistance were greatest in children whose mothers had low levels of vitamin B12, but high levels of homocysteine. This maternal metabolic profile appears to be associated with vegetarianism; B12 deficiency was most prevalent among the urban middle class, possibly associated with the national programme to promote folate supplementation during pregnancy.

It is also true that ‘over-nutrition’ alters foetal programming: children whose mothers developed gestational diabetes are at increased risk of impaired glucose tolerance and increased adiposity.

These findings, together with other research data, strongly suggest that nutritional programming can modify the foetal genome in a way that predisposes an individual to develop diabetes. The changes in lifestyle associated with urbanisation provide a link between under-nutrition and over-nutrition as factors contributing to the development of diabetes (Figure 4). This relationship between maternal nutrition, foetal programming, child health and adult lifestyle underpins the Life Circle approach to the prevention and control of diabetes. Only by ensuring women’s health can the circle be broken.

Promoting healthy living in schools in North India

The prevalence of obesity and metabolic syndrome is high among school children in India and has been increasing over the past 5 years. In children in classes 10 and 12 (private schools), 29.5% and 25.3% respectively are now obese. This trend, which is primarily due to the consumption of energy-dense food and declining physical activity, has been noted in both public and private schools – that is, in both low- and high-income groups. Professor Anoop Misra (Director of the Department of Diabetes and Metabolism, Fortis Hospitals, New Delhi), outlined how the MARG project is tackling the problem.

MARG (Medical education for children/Adolescents for Realistic prevention of obesity and diabetes and for healthy...
aGing) means ‘The Path’. The project, which is funded by
the WDF, aims to change children’s behaviour and their
environments by promoting healthy behaviours at school and
at home. Interventions include training teachers and student
volunteers and raising awareness among parents and children
about diabetes, obesity and other cardiovascular risk. The
strategies for children include lectures and group discussions
about nutrition and lifestyle, cookery and awareness-raising
events. Prizes and certificates are awarded to encourage par-
ticipation and attainment. Schools are encouraged to create
healthy environments, offering a choice of healthy foods and
food labelling in their canteens, and to increase the provision
of physical activities. A walk to school to publicise the risks of
obesity, diabetes and heart disease involved 2500 partici-
pants. Families are encouraged to limit the time they spend
watching television and to have weighing scales at home so
they can monitor their weight. These messages have been
supported by public lectures and an information campaign
using posters and booklets. The project is being formally
monitored in 27 schools but the interventions have now been
extended to a further 50.

Gestational diabetes: the Tamil Nadu, India experience
Women diagnosed with gestational diabetes mellitus (GDM),
are at increased risk of developing diabetes (predominantly
(type 2 DM) in the future, as are their children. In our country,
the concern is that, the prevalence of GDM has increased from
2% to 13.9% over the past 30 years. Thus, addressing maternal
health both during the ante and the post partum periods has
become an important public health priority.

Professor Veerasamy Seshiah described how the Diabetes
In Pregnancy – Awareness and Prevention Project (DIPAP)
conducted by the Dr V Seshiah Diabetes Care and Research
Institute in Chennai and the WDF, had addressed the problem
in Tamil Nadu. The project aims to raise awareness among
women and build capacity to empower the healthcare system
to diagnose and control GDM. Interventions include training
health workers and educators, incorporating diabetes screen-
ing into standard healthcare for pregnant women; treating
affected women and teaching them and others at risk of GDM
how to prevent diabetes in themselves and their families.
DIPAP raised awareness of GDM among women by 85.2%
(from 13% to 28%) in 3 years.

In this project 12 056 women were screened for diabetes dur-
ing pregnancy. They all underwent 75 g OGTT recommended
by WHO and GDM was diagnosed if 2 hour plasma glucose
PG ≥140 mg/dl. The prevalence was 17.8% in the urban,
13.8% in the semi-urban and 9.9% in the rural (overall mean
13.9%) population respectively. Risk factors for GDM were
age ≥25, BMI ≥25 kg/m² and a family history of diabetes. In
an offshoot study of this project, of 741 women diagnosed with
GDM, 121 (16.3%) were within 16 weeks’ gestation, 166
(22.4%) were between 17 and 23 weeks, and 454 (61.3%)
were more than 24 weeks. These data show that GDM
occurs in the early weeks of pregnancy in a large proportion
of antenatal women. The chances are that a few of them may
be pre-GDM women. Women who have normal glucose
tolerance in the first clinic visit require repeat OGTT in sub-
sequent trimesters as there are chances that they may develop
diabetes later as the pregnancy advances.

Pregnancy outcomes are available for 8731 women who
participated in the DIPAP project. The proportion of infants with
low birth weight (<2.5 kg) was 10.5% and those with high birth
weight (>3.5 kg) was 7.3%. National Family Health surveys
have previously reported the prevalence of low birth weight as
17% and high birth weight as 19% in Tamil Nadu. Thus in this
project the reduction of low birth weight was 41.2% (from 17%
to 10.8%) and similarly the reduction of high birth weight was
63.2% (from 19 % to 7.3%). This single initiative of achieving
birth weight appropriate for gestational age in neonates, would
have a significant positive effect on the overall health of the
family and the community as both low and high birth weight
infants are prone to develop diabetes in the future.

The success of the DIPAP project is strong evidence for
screening pregnant women for diabetes. Free screening
during pregnancy is now mandatory in Tamil Nadu and a
maternity welfare scheme is providing Rs 6000 ($150) to
poorer women to enable them to supplement their diet. The
State Health Society has made insulin aspart pens available
for women who need drug treatment. DIPAP has now been
extended to train more healthcare providers, enable
primary healthcare centres to offer screening, and to ensure
that counselling and treatment is available to all women in
Tamil Nadu with GDM.

Mobilising the community
An observational study of the prevalence of diabetes in
Chennai revealed a diabetes prevalence of 18% in 2000. Only
one-third were aware of their condition and, of these, 86%
were receiving treatment. Diabetes control was satisfactory in
only 28% – equivalent to fewer than 6% of the total population
with diabetes.

The need to raise awareness was obvious, said Dr Viswanathan
Mohan (Madras Diabetes Research Foundation). The PACE
(Prevention, Awareness, Counselling and Evaluation) project
put research into practice by offering 774 free diabetes aware-
cess camps for nearly 2 million people, free blood glucose
tests for 78 645 people, training for 232 doctors and primary
prevention in the community through lifestyle change aimed
at 2000 people.

Comparison of the periods before and after the PACE project
showed that awareness of diabetes increased significantly,
although it remained low for some risk factors (Figure 5). This raised the question of whether the community was ready to respond to further intervention. The Chennai Urban Population Study (CUPS) aimed to prevent obesity and diabetes by empowering an urban community to take more exercise.

CUPS compared 824 middle-income residents of the Asiad Colony in Chennai with a control group of 875 low-income individuals living in T. Nagar. In 2001, the baseline prevalence of diabetes was significantly higher in Chennai residents (12.4% vs. 6.5%). In 2007, after CUPS, the proportion of Chennai residents who exercised increased from 14% to 52% and the prevalence of diabetes was 15% compared with 18% among controls in the T. Nagar slum. This suggests that CUPS had substantially mitigated the increase in diabetes prevalence evident among the rural population.

Dr Mohan noted that providing diabetes care in rural communities is challenging due to low literacy rates, lack of awareness, transport difficulties, poverty and lack of specialised facilities. He emphasised the urgent need to implement the ‘4 A Test’ – to make diabetes care Available, Accessible, Affordable and Acceptable in rural areas. To demonstrate how this can be achieved, his colleague Dr S Ravikumar described their experience of empowering people in Chunampet in another presentation to the Summit.

Promoting a healthy workplace
On behalf of the Confederation of Indian Industry, Ms Yashaashree Gurjar (Avantha Group), described how companies promote the health of their employees.

Avantha is among India’s largest transnational companies, with 20 000 employees in over 15 countries. The company utilises the WHO definition of health – a state of complete physical, social and mental well-being, not merely the absence of disease or infirmity and agrees that a healthy workplace is one whose culture, climate and organisational practices create an environment which promotes mental and physical health as well as productivity and organisational effectiveness.

The main factors that influence health at the workplace are: health and safety (the physical environment), the culture and social environment, and the lifestyle of employees. Avantha’s guiding principle is that healthy employees and a health organisation make for healthy workplaces; it therefore takes an holistic approach to the health and wellbeing of its workforce that includes community development, HIV/AIDS prevention, addiction programmes and corporate support for NGOs.

This is achieved by support through leadership, appropriate policies and ongoing programmes. Leadership issues include a commitment to employee health at group level and providing doctors and counsellors at each unit. Written policies are in place for the environment, health and safety, diversity, sexual harassment, HIV/AIDS and volunteerism.

Ongoing workforce programmes address awareness of safety and first aid, prevention of chronic disease (hypertension, diabetes, cancer, HIV) and personal issues such as stress management, marriage counselling and parenting. Facilities for prevention and cure include hospitals and health centres at each location and multidiagnostic camps for early detection of illness involving employees and their communities. Social facilities aim to promote a healthy work-life balance and include celebrating festivals, sports services, family participation, a residential colony and school at each location.

The health programmes extend to the communities that live around the sites. There are community health workers in 270 villages and a mobile health facility reaches over 60 villages. Special clinics are offered to truckers and migrant workers and two antiretroviral centres are provided for the care and treatment of people who are HIV-positive.

This provision for employee health and wellbeing is supported by a strong business case. The company is perceived as the employer of choice. A healthy workforce has lower absenteeism due to illness and loses fewer working days. Accident claims are minimal. There has been no employee unrest for decades; workers are more motivated and stay with the company longer.


**PANEL DISCUSSION**

**Preventing diabetes: can it be done and what does it take?**

BBC presenter Mr Quentin Cooper co-ordinated questions from the floor to a panel of the morning’s speakers – Professor Ambady Ramachandran, (India Diabetes Research Foundation), Professor Chittaranjan Sakerlal Yajnik (King Edward Memorial Hospital), Professor Veerasamy Seshiah (Dr V Sehiah Diabetes Care and Research Institute), Professor Anoop Misra (Fortis Hospitals), Dr Viswanathan Mohan (Madras Diabetes Research Foundation) and Ms Yashashree Gurjar (Avantha Group) – who were joined by Mr Narasimhan Ram, (Editor-in-Chief of The Hindu newspaper).

Discussions centred on how to prioritise diabetes in the media. Mr Ram acknowledged that it was difficult to maintain a high profile for diabetes. What’s needed, he suggested, is a core of up to 20 key players who could educate and work with journalists. He described the process of ‘agenda building’, in which an issue takes off in the media when a credible number of people and agencies are behind it. Professor Misra agreed that experts should help journalists to ensure accuracy and focus. Dr Mohan said that diabetes needs media champions. Perhaps, he added, specialists could list 10 items the public should know about diabetes and monitor awareness. Stakeholders such as industry associations and trade unions can also be called on to influence communities, Ms Gurjar said. Manufacturers should exercise corporate responsibility when promoting products which may adversely affect health and consider the interests of the community.

The success of a media campaign depends on having a structured programme. Do one thing at a time, one participant commented, not everything at once. Dr Mohan suggested two approaches: one aimed at families with a focussed message, another aimed at the population as a whole. There should be more focus on NCDs and public health, Professor Misra said. Manufacturers should exercise corporate responsibility when promoting products which may adversely affect health and consider the interests of the community.

It was pointed out to the panel that the media depend on advertising and that health messages may conflict with influential adverts from the food industry, many of which involve celebrities. Mr Ram said this is a problem for large and small newspapers alike. It is hard to censor advertising: journalists have no say on what advertising is carried and a newspaper can only act within the law to control adverts. Another complication is that journalists can get caught between the conflicting opinions of medical experts and are targeted by quacks. Even qualified people can make tall claims, he said, and it’s hard to monitor the output of all journalists. Peer endorsement of experts could be one solution but there is a risk of conflict between experts. It’s difficult to find a middle way, Mr Ram said. Dr Mohan suggested that newspapers should ask where information to support claims has been published; if it’s in a peer-reviewed journal, it will have been endorsed by the international community.

It was astutely pointed out that knowledge alone is not enough: doctors themselves are among the least healthy people. How can readers and viewers be involved in health messages rather than be talked at? Professor Misra said that all media should be used to deliver health messages, targeting schools in particular. Professor Yajnik said his work in Pune had focussed on communication between parents and children and teaching children about nutrition and sexual health. Mr Ram described how the Chennai Cancer Institute uses volunteers to tackle smoking; its CanStop campaign is targeted at schools, he added. Could religious leaders have a role? It makes a huge difference if they can be won over, agreed Mr Ram, especially in a country with multiple religions like India. Several participants considered how health messages should be presented. We need to talk about responsibility, not charity, said one. Prohibition doesn’t work, said a second. We should raise awareness of the available alternatives and offer people practical options. People will behave differently if they are given options – there is plenty of evidence to show which behaviours increase risk. Perhaps too much, said one participant, but it was pointed out that surveys have revealed a low level of public awareness. Ms Gurjar said messages should be clear and simple. Perhaps the problem should be socialised, she suggested, but Mr Ram warned against taking an anti-intellectual stance. Mr Cooper pointed out that the media report what people want to hear. Surely there is plenty to report about diabetes?

Mr Cooper concluded by saying the morning’s proceedings have highlighted how we can get closer to effective prevention of diabetes. We should strike early with measures pre- and post-conception, better care for women and health education in schools. A media group should be formed to promote public health, he said, and industry needs a package of health messages and measures it can easily use.
DELIVERING HEALTHCARE TO PREVENT COMPLICATIONS

This session was chaired by Professor Sidartawan Soegondo (PERSADIA, Jakarta).

Training needs in primary care
Each year approximately 31,000 doctors graduate from Indian universities but they are poorly equipped to manage NCDs. The undergraduate medical curriculum includes only a few hours on the management of chronic disease, noted Professor Meer Mustafa Hussain (Tamil Nadu Dr MGR Medical University). To address this, every medical resident should be allotted a rotation for at least 2 weeks in clinics for diabetes and hypertension during their internship, and medical officers in primary care health centres should attend monthly continuing medical education programmes, backed up by certification.

In clinical practice, healthcare workers should be supported by management guidelines to encourage the provision of comprehensive care. Those who already have expertise in diabetes care should be trained to adapt their skills to educate others. Education should include the fundamentals of diabetes epidemiology and management with practical sessions to teach monitoring, nutrition and lifestyle interventions. This should be provided to all, including those not directly involved in diabetes care. Staff should ensure that their skills meet agreed competency standards.

It is important to remember that health professionals see patients with chronic disease for only a few hours each year – the rest of the time, people care for themselves. The most effective model of care will therefore help self-management by patients through education and personal care plans that specify the patient’s expectations about management and their responsibilities. Education programmes must be relevant to patients’ needs so that people will want to attend. Care should be integrated across primary, secondary and tertiary services and any practice offering diabetes care should be obliged to work with the community diabetes team.

Guidelines and quality assessment
Management guidelines can improve the quality of clinical decision-making by promoting the use of evidence-based care, removing uncertainty about choice of treatment and improving consistency of care between different locations, said Professor Ashok Kumar Das (Additional Director, General Health Services, Ministry of Health). They also offer a common point of reference for auditing the provision of care at clinical and institutional levels. From the perspective of the healthcare system, implementing guidelines and quality assessment promotes cost-effective practice. This, in turn, reassures funders that the service offers value.

Performance indicators for measuring the quality of diabetes care can assess the process of care (proportion of patients who have annual tests), proximal outcomes (quality of glycaemic control or lipid-lowering) and distal outcomes (amputation rates, renal disease, cardiovascular mortality). Table 2 lists the core indicators most widely used to assess quality of care. The choice of which indicator to measure depends on the priorities of the service and what time scale is feasible. For example, glycaemic control, blood pressure and lipid levels are widely used because they have a direct impact on the risk of complications; amputation rates may be the most meaningful endpoints but they take a long time to accrue. Structural measures (staffing levels, facilities, education of staff) are used to evaluate the characteristics of the care provider to ensure that a service meets minimum standards. Continuing adherence can be checked by certification but this may not correlate with the quality of clinical care.

Preventing blindness
Loss of vision due to proliferative diabetic retinopathy and macular oedema (Figure 6) often affects people with diabetes during working age and is frequently detected too late for effective laser surgery. But, explained Professor Perumalsamy Namperumalsamy (Aravind Eye Care System), vision loss is avoidable.

The majority of people with type 1 or type 2 diabetes show evidence of retinopathy within 15 years of their diagnosis. Risk factors for retinopathy related to diabetes include the duration of disease, hyperglycaemia, hypertension, hyperlipidaemia, proteinuria and nephropathy. Others include cigarette smoking, alcohol use, anaemia, pregnancy and cataract surgery.

Management involves screening, management of risk factors, laser surgery and vitreous surgery. In India, 23–38% of people with diabetes have diabetic retinopathy; of these, about one-third need active ophthalmological intervention and the remainder need regular eye examinations to monitor progression. But in order to identify those with diabetes who require ophthalmological intervention, it is necessary to screen the whole diabetic population. Screening frequency depends on the severity of retinopathy and ranges from annual for patients with no or few microaneurysms to every 2–3 months for those with proliferative retinopathy. However, many patients with diabetes – even in economically developed countries – have never had an eye examination. The risk of developing retinopathy can be reduced by intensive glycaemic control and controlling blood pressure; reducing blood lipids may delay...
progression. However, this level of care may not be available widely in developing countries.

The WDF and the Aravind Eye Hospitals have collaborated on three projects in Southern India to provide training for health workers and promote awareness of retinopathy, screening and treatment. Diabetic retinopathy patients do not exhibit/present any symptoms during the stages when they are treatable and hence it is necessary to screen all those with diabetes. A mobile unit sends retinal scans via the internet or satellite link for screening by ophthalmic technicians, who are able to call on expert advice. Between 2004 and 2008, 176 screening camps were held and the unit screened 51 578 people; 6389 were diabetic, of whom 1286 had retinopathy. Diabetologists and internists get access to all diabetes patients who attend their clinics. Screening for diabetic retinopathy is carried out in these clinics and digital fundus photographs are sent over the internet to ophthalmic centres for confirmation. Diagnosis of 906 eye scans referred for diabetology opinion found no retinopathy in 739 cases and mild disease in 118; non-proliferative retinopathy was moderately severe in 39 cases and severe in 1 case. A total of 9 cases of proliferative retinopathy were diagnosed.

In summary, Professor Namperumalsamy emphasised that people with diabetes should be aware of the risk of retinopathy and should undergo regular eye (fundus) examinations. Eye screening should be as much a part of diabetes management as monitoring blood sugar, he said.

**Preventing amputations**

Dr Vijay Viswanathan (MV Hospital for Diabetes), began his presentation with some stark statistics. The foot accounts for 39% of diabetes complications. People with diabetes are up to 40 times more likely to undergo a lower leg amputation than non-diabetics and, somewhere in the world, a leg is lost every 40 seconds due to the complications of diabetes. The impact of amputation can be profound, affecting employment prospects and burdening the family with the cost of surgery. The total cost of diabetes care in India increases from Rs 7895 ($158) in patients without complications to Rs 61 981 ($1240) in those with amputation. Mortality after amputation in India is 16%.

A survey by Dr Viswanathan and colleagues of 31 centres in India identified a total of 1200 amputations. Minor amputations (e.g. a toe) accounted for 88%, below knee amputations for 6.6% and above knee amputations for 4.9%. The reasons for amputation were infection (78%), trauma (22%) and burns (2%). Comparison of outcomes for patients in Tanzania, India and Germany revealed that, although Germany had the highest rate of peripheral vascular disease its amputation rate was about 60% lower. This difference was due to higher rates of progressive infection in India and Tanzania. Research also shows that outcomes are worse in rural compared to urban areas in India due to a higher prevalence of bare foot walking and smoking.

The prevalence of diabetic foot ulcers and amputations can be reduced by multidisciplinary specialised foot clinics and services. In 2005, the Diabetes Amputation Prevention Initiative in the Community (DAPIC) began screening and monitoring in 20 villages around Chennai with the aim of developing a model programme of preventive foot care. A multidisciplinary team provided education, screening and treatment, and local volunteers were trained to provide follow-up. Initial evaluation showed that intensive intervention reduced the prevalence of foot ulcer from 4.1% to 1.9% compared with an increase from 5.5% to 28.5% in a control population. The DAPIC model could be replicated in other

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**Figure 6. Stages of diabetic retinopathy**

Mild non-proliferative retinopathy  
Moderate non-proliferative retinopathy  
Severe non-proliferative retinopathy  
Clinically significant macular oedema  
Proliferative diabetic retinopathy
Nevertheless, he noted, catastrophic spending and poverty philanthropy-supported systems filling some of the gaps. Employer-based insurance, government-based systems, and in the United States as a patchwork of several entities: developed countries. Dr Engelgau described medical coverage shortcomings of healthcare provision in economically developed

The discussion began with brief summaries of some of the Novo Nordisk).

Lars Rebien Sorensen (President and Chief Executive Officer, Kerala), Professor Ida Nicolaisen (WDF, Copenhagen) and Mr Vishwas Mehta (Secretary of Health and Family Welfare, (Chairman, WDF), Dr Michael Engelgau (World Bank), Mr Vishwas Mehta (Secretary of Health and Family Welfare, Kerala), Professor Ida Nicolaisen (WDF, Copenhagen) and Mr Lars Rebien Sorensen (President and Chief Executive Officer, Novo Nordisk).

Panellists 

This session was chaired by Dr Michael Engelgau and Professor Ida Nicolaisen (Nordic Institute of Asian Studies, Copenhagen University).

Economic implications of chronic disease

This was presented by Dr Engelgau on behalf of Professor Indrani Gupta (Institute of Economic Growth).

There have been few studies of the economic burden associated with NCDs in India. Dr Engelgau summarised two studies undertaken by Indrani Gupta, which suggest that the economic burden of NCD is high, and likely to worsen health and income inequalities, resulting in worse outcomes for poorer communities.

A 2005 study – funded IC Health – estimated the economic impact of CVD in Kerala, using a survey of 838 individuals at one industrial site. The study showed significant economic burden of CVD emanating from high treatment costs and foregone earnings due to morbidity and premature mortality.

A more recent analysis using the 60th round of the National Sample Survey in 2004 found that, CVD accounted for 8.3% of the states.

Out-of-pocket spending on hospital admissions for CVD and diabetes was greater than that for other illnesses in both the public and private sectors.

Poorer individuals were affected disproportionately by the costs of care. Fewer than 4% of respondents in rural areas and 13% in urban areas had health insurance. Almost half of those reporting illness associated with CVD and diabetes were from rural India.

These data suggest that the increasing prevalence of NCDs will worsen the incidence of poverty and increase the inequalities between rich and poor. Those who have health insurance, access to health services and higher income will continue to obtain more resources for treatment.

**FINANCING PREVENTION AND CURE**

Mr Cooper was again master of ceremonies as a panel convened to debate issues raised by the day’s presentations. Panel members were Professor Abdul Kalam Azad Khan (Diabetes Association of Bangladesh [DAB]), Professor Martin Silink (President, IDF), Professor Pierre Lefèbvre (Chairman, WDF), Dr Michael Engelgau (World Bank), Mr Vishwas Mehta (Secretary of Health and Family Welfare, Kerala), Professor Ida Nicolaisen (WDF, Copenhagen) and Mr Lars Rebien Sorensen (President and Chief Executive Officer, Novo Nordisk).

The discussion began with brief summaries of some of the shortcomings of healthcare provision in economically developed countries. Dr Engelgau described medical coverage in the United States as a patchwork of several entities: employer-based insurance, government-based systems, and philanthropy-supported systems filling some of the gaps. Nevertheless, he noted, catastrophic spending and poverty induction does not occur to the same extent as in low-income countries. Professor Nicolaisen pointed out that, despite universal coverage in Denmark, the consequences of urbanisation among the indigenous people in Greenland had not been fully addressed. Bhutan was previously blessed with a low incidence of diabetes but a recent shift to urbanisation is now introducing the same problems other countries are facing; the prevalence of diabetes is now 6.5%.

Public health tends to receive a smaller proportion of health funding than curative care. In spite of this, recent studies in high-income countries have shown that half of the reduction in cardiovascular deaths over the past decades have been achieved by population-level changes in risk factors that are not necessarily attributed to the health delivery system and, in some cases, more directly related to public health measures such as smoking cessation. Professor Silink pointed out that we are only just coming to understand the social determinants of health. For example, he said, satisfaction at work has been
shown to have an important impact on health outcomes and we need to look at improving it.

One participant asked whether an essential drugs list for diabetes would improve care. Mr Sorensen said it might but treatment wouldn’t be free, even with generic drugs, and there would still be problems with capacity and distribution. Professor Lefèvre noted that many guidelines included metformin as the drug of first choice. It’s very cheap, he said, but the problem is whether to progress to treatment with newer, more expensive drugs offering only incremental benefits. It’s not rocket science, commented Professor Silink, it just needs political will. An essential drugs list has been done for HIV, tuberculosis and malaria. The experts are available, they just need to be brought together. We are very close to achieving this, he added. The Indian Government should be encouraged to raise this at the UN: there will be a special session on metabolic diseases and diabetes where this would be appropriate.

Dr Engelgau was asked about linking funding to development – did this not indirectly increase impoverishment and dependence on external funding? He noted that a standardised safeguard policy is reviewed for each World Bank project. Mr Mehta said that Kerala had been able to forgo external assistance with its schemes because it had begun investment many years ago, and it had already achieved its health targets. He agreed that a proportion of allocated money may not be spent because too many conditions were imposed on funding, making projects inflexible.

The panel agreed there is a need for strong governance to ensure that projects are managed rationally, particularly if they are managed at a national level and decisions about allocation are made locally. There is a disconnection when governments make policy but don’t fully understand local needs, one participant noted, and local services may lack the capacity to implement national policy. Mr Sorensen said that WDF criteria for funding include support from governments and official agencies to avoid building parallel structures. An effective project can act as a catalyst to show potential donors what can be achieved.

Finally, the panel was asked to consider whether it would be helpful to label children with type 1 diabetes as ‘metabolically handicapped’. If this served to attract more funding for healthcare, surely it would be worthwhile? Professor Lefèvre expressed sympathy for the concept but balked at the label, although he acknowledged this was probably a cultural issue. Professor Silink agreed that the idea was a good one if an appropriate term could be found. However, he said it is excusable, 70–80 years after the discovery of insulin, for a child to die because of lack of access and affordability to insulin.

TRAINING AND BUILDING CAPACITY

This session was chaired by Professor Ariachery Chinnamma Ammini (AIIMS).

The WDF does not provide grants for buildings, basic laboratory research, travel grants or training grants. Instead it believes in supporting realistic and sustainable or long-term projects that will continue when its funding ends. Building capacity in human resources is essential to the success of any strategy to tackle NCDs. The WDF has supported many projects in South-East Asia with the primary aim of training health workers in diabetes management. Dr Narayanasamy Murugesan (Indian Diabetes Research Foundation), described how WDF projects had helped to build capacity to support India’s National Programme to prevent CVD, diabetes and stroke.

The first project, implemented during 2004/07 and involving 7 states largely in the south and east of India, aimed to train 3000 doctors, 1080 paramedical staff, 120 health educators and 60 dieticians. Medical training was provided in a series of 5-day workshops and was shown to improve knowledge of diabetes management significantly. Training for paramedics focused on increasing knowledge and changing attitudes, beliefs and behaviours. This project demonstrated the value of paramedical staff who are in direct contact with communities and therefore able to influence lifestyle change more directly.

A second project, with greater emphasis on training paramedics, was initiated in June 2007 and will run until 2011 in 10 states in Southern and North-West India. With the support of the Union Ministry of Health and Family Welfare and the state health systems, its implementation has been smooth. The aim

| Table 3. The Ibrahim model for diabetes care in a resource-poor society |
|-----------------|-----------------|
| • Comprehensive care |
| • Community participation |
| • Decentralisation of initiatives |
| • Emphasis on qualified and trained manpower |
| • Priority to academic and research activities |
| • Democratic management policy |
| • Public-private partnership |
| • Self-reliant financial management with safety net for vulnerable groups |

is to provide sufficient 3-day courses to train 4000 paramedics in addition to a further 960 doctors and 600 health educators/dieticians. To help meet these targets, Dr Murugesan said 100 trainers are being trained to provide diabetes education to paramedics. The training methodology includes lectures from local experts, skills development sessions (including use of slogans and songs) and practical exercises including organising awareness programmes and camps.

Indonesia has a population of 220 million and a prevalence of known diabetes of 8.7%. In 2005, its 51 000 doctors included only 47 endocrinologists and 1377 specialists in internal medicine. Capacity building is therefore a priority and Dr Pradana Soewondo (Indonesian Society of Endocrinology), described a 2-year project supported by the WDF to improve diabetes management in hospitals and primary care and establish support systems in the community.
Working with the Ministry of Health, the Indonesian Society of Endocrinology, the Indonesian Diabetes Association and the Indonesian Diabetes Educators Association, the project included revising training materials, providing courses on diabetes management for internists and primary care physicians, training for diabetes educators, and disseminating management guidelines and education kits. A total of 1237 health professionals underwent training and the proportion of health providers who provided diabetes education increased by 28% in hospitals and 46% in primary care. A total of 3 hospitals and 14 primary care centres offered new clinics for diabetes care. Meetings to discuss referral linkage revealed a lack of resources to diagnose diabetes complications, obstructive bureaucracy and problems with medication supply.

Feedback from participants identified a lack of resources for some and problems with access to some training centres. The training courses were considered too long and were subsequently provided in shorter blocks.

Capacity is still insufficient to meet growing demand, even in the most developed area of Indonesia. The project has raised awareness about diabetes prevalence and improved communications between primary care and the hospital sector (there is a plan for internists to visit primary care centres) and officials have promised to discuss reducing bureaucracy. Overall, the project has improved diabetes management and efforts continue.

Bangladesh has developed its diabetes services from a small primary care clinic serving only 39 patients in 1956 to the new 600-bed BIRDEM hospital, a tertiary care centre that is part of a highly structured healthcare system. Professor Hajera Mahtab (WHO Collaborating Centre for Prevention and Control of Diabetes), described how applying the Ibrahim model for organising care in a resource-poor society (Table 3) had proved so successful.

Professor Mahtab summarised the key components of diabetes care as public awareness, primary prevention, early detection and healthcare. Comprehensive diabetes care includes education about diabetes and nutrition, social welfare (the poor receive free care), clinical care, follow-up, record-keeping and evaluation and monitoring. The DAB is based in BIRDEM but has a countrywide network including 56 affiliated but autonomous local associations. Capacity building began in the 1960s with training about diabetes and its detection for village social workers in primary care. The WHO and the IDF assisted with training of trainers with the result that 2760 doctors and 233 educators (primarily nurses and dieticians but also science graduates) were trained by 2008. Structured training in endocrinology and metabolism began at BIRDEM Academy in 1986 and the range of specialties taught has increased ever since. A distance learning project was developed in 2003, supported by a tutor-based regional training system organised by DAB. A total of 10 prospective training centres have been identified and each will offer up to 10 students 2 half-day sessions twice monthly. DAB is now implementing a healthcare development project that will increase capacity in primary, secondary and tertiary care centres covering approximately one-quarter of the country.

**PREVENTION OF BLINDNESS RELATED TO DIABETES**

This session was chaired by Professor Veerasamy Seshiah (Dr V Seshiah Diabetes Care and Research Institute).

The management of diabetic retinopathy (DR) in India faces several significant challenges. There is a large unidentified population with diabetes and many known to have diabetes have undiagnosed retinopathy; there is a low level of awareness of the risk. The population is widely dispersed and it is difficult to deliver care; treatment is unaffordable for many.

Dr Kim Ramasamy (Aravind Eye Hospital and Postgraduate Institute of Ophthalmology), described how the Aravind Eye Hospitals have collaborated with WDF on 3 projects between 2003 and 2009 to promote awareness and offer screening and treatment to remote rural areas.

Problems of remoteness and under-diagnosis were tackled with outreach activities such as retinopathy camps and networking to involve local clinicians, laboratory facilities and voluntary organisations. Awareness was raised through health education targeted at communities, groups such as laboratory personnel, pharmacy shop owners, sedentary workers, and individuals by media campaigns, meetings, discussions, videos and literature.

IT solutions were found to tackle obstacles such as a dispersed population and difficult access. These included a mobile screening unit which visited remote areas and took fundus images (Figure 7) which were transmitted to a reading centre for grading using standardised data analysis. The turnaround time for reporting on images received from diabetes clinics is 1 hour and the software automatically generates a report that includes treatment alternatives. Between April 2004 and October 2008, this unit screened 53 000 people, of whom 12.5% were identified.
Aravind is now proposing a new model for screening and diagnosis in which it acts as an expert resource to develop DR management at various places by supporting local diabetologist/physician for identifying DR and training the local ophthalmologist to manage DR. Patients diagnosed with retinopathy can then be referred locally and managed within the system. This approach will develop local skills and improve the quality of care, increase revenue for local clinicians and help to ensure that patients are followed-up.

Complex interventions such as vitreous surgery can be referred to a tertiary centre where available. The introduction of user fees will ensure this model is sustainable.

Karnataka is a state in Southern India with a population of 63 million. There were facilities for the investigation and treatment of diabetic retinopathy in only 7 urban centres, and local ophthalmologists offered unsatisfactory treatment for DR due to lack of training, the cost of equipment, the fees to patients and perceived lack of need.

This presented significant difficulties in achieving early diagnosis and access to laser surgery. Working with the WDF and the National Association for the Blind, Dr Praveen Ramachandra Murthy (Prabha Eye Clinic and Vittal International Institute of Ophthalmology), described how local resources were included in a project to reduce costs, take diagnosis and treatment closer to patients, and raise clinical standards.

Local ophthalmologists were offered shared use of equipment (a fundus camera, a diode and YAG laser, B-scan and visual fields machine) and a mobile screening van. Patients paid if they were able to (although at a rate one-third of the norm for Bangalore), and the fees were shared with the local ophthalmologist providing an economic incentive for the doctor. Individual training was provided on the van by a specialist.

The equipment in the van was at risk from vibration due to poor quality roads and had to be disassembled, carefully packed into cushioned containers and stored in a shock-absorbing cage. The van was equipped with its own generator to avoid the high voltage fluctuations in local power, a dehumidifier and an air-conditioning unit. Its satellite dish was collapsible to avoid damage from overhanging trees. Contamination from dust was minimised by prohibiting footwear in the van, restricting entry during treatment and rigorous cleaning. Every month the van covers 4500 km and visits 23 locations, seeing 33 patients per visit. Training has been provided for 229 GPs, 107 ophthalmologists and 114 paramedical staff.

The project was expected to break even by the end of 2008. Local ophthalmologists have earned an average of Rs 47 493 for 12 days’ work annually. Patients have received the equivalent of Rs 17.3 million in concessions, excluding the value of free procedures. No procedure cost more than $10 and no patient was refused treatment for lack of money.

The challenges ahead include transferring ownership of the project to local ophthalmologists, funding revenue and capital costs such as replacing the van and equipment periodically, and replicating this model elsewhere.

Dr K V R Krishnaji (RR Lions Eye Hospital), described a comprehensive 5-year joint project with the WDF to raise awareness about diabetes, increase screening and treatment, and train thousands of health workers in diabetes management.

The public campaign included a media strategy of road shows, television and radio to reach 2–3 million people and camps for awareness and screening. Booklets, pamphlets, posters and stickers were distributed to teachers, village elders, schools and colleges, hospitals and clinics. Training seminars were held for health workers and community groups.

By the end of the project, the objective is to screen 300 000 people and train 1000 doctors, 2000 nurses and 4000 health professionals. To date, after 46 months, 998 screening camps have been held and 174 254 people have been screened. Of these, 18 003 had diabetes, of whom 1359 were previously undiagnosed, giving a prevalence of 11%. The prevalence of DR was 8.8%. Patients diagnosed with retinopathy were offered counselling about laser treatment and referred to the base hospital in Palakol.

**PREVENTIVE FOOT CARE**

This session was chaired by Professor Abraham Joseph (Institute of Public Health).

The diabetic foot is the Cinderella of diabetes complications – there is confusion about who should treat it and a lack of training programmes for health workers. So the success of India’s Step-by-Step project is all the more welcome.

Dr Sharad Pendsey (Step-by-Step Project, and Dream Trust), described how, with WDF support, the project had begun with a basic course for 100 pairs of doctors and paramedics at 4 centres in 2004, followed by an advanced course one year later. This was the first project of its kind to offer participants hands-on experience and in which nurses were afforded equal status to doctors. The emphasis was on treating trivial injuries (which precede 85% of leg amputations) such as shoe bite, cuts and bruises. In its first year, Step-by-Step screened 46 000 people and salvaged 900 limbs; in the second year, 82 000 people were screened and 1943 limbs were salvaged.

Step-by-Step is now part of the IDF/UN Resolution Implementation Programme for developing countries and has been implemented in Pakistan and Egypt; future sites include the Caribbean, African countries and other parts of South-East Asia. An Indo-German exchange has provided further training for 14 doctors in Germany. It has now become a national movement in India and an international contact committee has now been formed and
held its first meeting in September 2008. A new Step-by-Step 2-day workshop for 100 trainees was held in Nagpur in 2007 and there is now strong demand for more workshops every year.

In India, complications from diabetic foot ulcers often affect the household’s sole breadwinner. Limb loss therefore has a huge impact on the family and, with poor prosthetic support, most people are unlikely to be rehabilitated into the workforce. Dr Kalkunte Rangaswamy Suresh (Jain Institute of Vascular Sciences), explained how a well-equipped, basic outreach service for diabetic foot care could prevent many complications.

The JIVAS approach included 3 components. First, a study to determine the impact of education and counselling found that most patients adhered to advice, though there was a high drop-out rate. The second component (Padasamrakshane), with WDF support, offered training to healthcare workers in rural areas, established 10 centres for diabetic foot care with the support of the local medical community, and a mobile ‘diabetic foot and vascular evaluation’ clinic provided care to under-served areas within 100 miles of Bangalore.

The mobile clinic was a customised bus containing a podiatry chair, an examination couch, a comprehensive range of equipment for neuropathic and vascular evaluation, a foot scanner, an area for making and modifying footwear, and an area for minor podiatry procedures. The bus also carried educational and counselling materials, laptops for recording data and, for the staff, air conditioning, a fridge and a microwave. The staff included two specialists in diabetic foot care, a technician, a secretary, two drivers, two cobblers, two ward boys and one cleaner.

In the 18 months up to October 2008, the mobile clinic made 477 visits in 11 rural locations (including 36 camps), screening 19 500 people.

The third part of the JIVAS approach is an outreach project (Anveshani) in which 40 local volunteers, trained in basic foot care and diabetes care and monitoring, visit about 200 villages within 100 km from Bangalore. These volunteers are highly effective, delivering their health messages via songs and street plays. They communicate well with the villagers because they are local and it is hoped this approach will reduce the drop-out rate. The volunteers’ services are currently free to patients thanks to generous funding but the project needs to become self-sustaining. To date, they have screened 192 000 people and identified 4350 cases of diabetes, one-fifth of which were previously undiagnosed. They have found that the prevalence of neuropathy is 40% and that of peripheral arterial disease is 15%.

India has huge resources of healthcare infrastructure and manpower that can be redeployed to build an integrated diabetes care service. Professor Nihal Thomas (Christian Medical College), and Dr Mannam Ebenezer (Schieffelin Institute of Health – Research and Leprosy), described a nationwide project to redeployservices for leprosy foot care to diabetes management in rural and semi-urban areas.

Professor Thomas said the objective is to help 100 hospitals (Figure 8) develop a sustainable infrastructure of diabetes clinics, enhance their foot care and laboratory facilities and improve essential pharmacy services. Using video conferencing to deliver distance education programmes, the Christian Medical College trained diabetes nurse educators and doctors, and enrolled laboratories into a quality control programme. The Schieffelin Institute trained podiatric technicians and orthopaedic cobblers. Evaluation and monitoring of each site was provided within 2 years.

The obstacles identified so far include poor laboratory facilities in 30% of hospitals, a trainee discontinuation rate of 15%, lack of administrative support and teamwork, and a lack of egalitarianism in the team.

Professor Joseph congratulated Dr Thomas on his work, adding that this project was an example of how to make good use of the existing facilities and expertise of a leprosy program. This was the WDF’s first attempt to reach hospitals and communities in rural areas, and indeed the north east of India, through a team approach.

Professor Lefèvre, agreed that the project was a good example of how facilities established for priority health problems of the last century, which have now been controlled to a large extent, can be redeployed to address newer problems such as NCDs. This is an important message for other funding agencies to take from the WDF’s experience.

Dr Ebenezer explained why leprosy services provided a good resource for developing diabetes care. The two conditions have some features in common – notably, they are both chronic disorders in which foot care is critical. Leprosy services have built an effective community-based programme integrated with the appropriate educational, diagnostic and support services. The Schieffelin Institute has considerable expertise in the management of foot ulcers.
A groundbreaking partnership between the WDF and social marketing specialists Jagran-Pehel has delivered messages to raise diabetes awareness to a potential audience of 40 million.

Mr Anand Madhab (Jagran-Pehel), described a campaign founded in a strong visual brand identity across print, radio and mobile media. The objectives were to sensitise and inform policy makers and health professionals about the need for prevention and care; to encourage the target audience to adopt a healthy lifestyle; and to offer local screening, especially to young people, to reduce the risk of complications.

Speaking from his position as Chair of the session, Professor Joseph commented that this project provided a good example of how a health system can use its current resources to tackle diabetes. Leprosy is now considered to have been eliminated in India, although patients diagnosed 30–40 years ago still have foot complications. A speaker from the floor added that this model has worked elsewhere for different patient groups who share common problems of chronic disease.

AWARENESS AND ADVOCACY FOR PREVENTION

This session was chaired by Mr V K Subburaj IAS (Principle Secretary for Health and Family Welfare, Ministry of Health) and Mr Vishwas Mehta (Secretary of Health and Family Welfare).

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The campaign achieved massive participation of public representatives and other stakeholders and was widely covered by other media agencies. The slogan ‘Screening saves lives’ was featured in articles syndicated in the press and featured on major radio stations (listeners and readers were able to respond by SMS text). The campaign also included 661 awareness camps and 410 screening camps. Out of a total of 114,027 people screened, 13.8% were found to have diabetes. There is now the need to support the people who, as a result of the campaign, know they have diabetes. The media

Visit to Chunampet Rural Diabetes Project

This project was launched in March 2006 in rural Chunampet – 100 km south of Chennai. It aimed to involve villagers in delivering diabetes care to their remote communities. Principal investigator Dr Viswanathan Mohan welcomed representatives of the WDF and the press to Chunampet to see the project in action.

The 4-year project serves 43 villages with a total population of about 50,000. It is being run by the Madras Diabetes Research Foundation under the Project Director, Dr V Ravikumar, with the assistance of specialists in Chennai, including co-principal investigator and ophthalmologist, Dr M Rema. It has been made possible by funding from the WDF, a donation of land from a local owner, satellite technology from the Indian Space Research Organisation and support from the National Agro Foundation. Primary and tertiary care for 4000 registered patients is provided by the Sai Rural Diabetes Specialities Centre, a unit of Dr Mohan’s Diabetes Specialities Centre with facilities including a clinical laboratory and pharmacy.

The goal of the project is to encourage local people to participate in promoting a healthy lifestyle by helping women and young people to become village health workers and act as catalysts in the community. Local workers raise awareness about diabetes and its complications through lectures, street plays, puppet shows (see inset picture) and nutrition workshops. The visitors were invited to a demonstration nutrition workshop to see and taste the wide variety of appetising – and healthy – meals that can be prepared from locally available foods. Some of the dishes on offer were specially prepared to be visually appealing to children, including a vegetable man complete with a carrot tongue! So far, over 40 health education campaigns have been carried out.

The project also includes a telemedicine van which provides screening for diabetes and its complications. Almost 90% of eligible people have already been screened for diabetes and 1114 new cases have been diagnosed. The van is equipped with a satellite link that makes it possible to provide retinal screening and an online consultation with an ophthalmologist based in Chennai without people having to leave their village. People with sight-threatening diabetic retinopathy are offered treatment at the main centre, free of charge.

A visit to the Sai Rural Diabetes Centre showed how quality diabetes care is being provided in Chunampet. Since its inception, the average HbA1c in the community has fallen by almost 2% – this translates into a substantial reduction in the risk of future complications and potential economic savings for the community. Dr Mohan commented that it has not been possible to achieve such results in Chennai, where follow-up is difficult; in a small community like Chunampet, it’s easier to identify people and encourage them to visit the clinic. He emphasised that the factors key to this success were providing structured care and promoting adherence through local ownership of the project.

It is hoped that the Chunampet project will become fully self-sustaining in the next 2–3 years. It has already shown that it is feasible to deliver a standard of diabetes care to a remote rural community that matches that of a city clinic, Dr Mohan said. It serves as a model for developing services elsewhere in India and fits well with the National Programme. In the future, he added, the project could be extended throughout the Kancheepuram District to serve a population of 2 million.
campaign ran for 193 campaign days and covered 96 districts spread over 14 states in India. Over 500 doctors took part in the campaign. The total population reached with awareness activities during the roadshows exceeded 350 000 people. Media coverage: the editorial coverage amounted to approximately 30 pages of a broadsheet newspaper while advertisements amounted to 14.5 pages. An estimated 431 870 seconds of airtime was dedicated to the campaign by Radio Mantra – this equates to almost 5 whole days. The whole media coverage of the campaign was estimated to have reached more than 40 million people. The mobile helpline number 57272 received over 58 871 messages in response.

The campaign has paved the way for future interventions and could now be more intensively implemented in selected districts using mobile clinics. Targeting in schools will be a particular focus, using innovative means of communication that will engage children and adolescents.

Professor Abdul Kalam Azad Khan, explained how a professional organisation can help to empower local health leaders. The DAB respects the autonomy of its 58 affiliate associations. These independent organisations generate their own funds locally; they are run democratically and posts are awarded on merit. Constitutionally, these affiliates are similar in principle and in spirit to the DAB. The DAB provides support through training and technical assistance. In turn, representatives from the affiliates are elected to the DAB governing body.

The DAB oversees a decentralised care programme funded by private-public partnership and grant aid, in which running costs are generated locally. This is now being extended throughout Bangladesh under a Health Care Development Programme that will ultimately provide a country-wide network of self-sustaining general healthcare centres. Its guiding principles include decentralisation, local ownership, democratic management and a safety net for the poor.

The Chunampet Rural Diabetes Project is an example of how to encourage community participation in a service that delivers primary, secondary and tertiary level services, said diabeticologist Dr S Ravikumar, the Project Director. This 4-year project, with multi-agency funding, offers diabetes prevention and treatment to a population of about 80 000 in a cluster of 43 villages in Tamil Nadu and Dr Viswanathan Mohan and Dr M Rema oversee this project. The key to its success is encouraging community participation and empowering local people – particularly women and young people – to become junior health workers who can educate others and be catalysts for change. Prevention initiatives include written material, mass education programmes (including street plays and films) (Figure 9), school initiatives, dietary education for farmers and nutrition workshops for women. An air-conditioned telemedicine van equipped with a retinal camera, a satellite connection to a base hospital (Dr Mohan's Diabetes Specialities Centre, Chennai) and a video conferencing facility travels to the villages to offer screening. This allows specialists at the base hospital to conduct a teleconsultation with villagers and provide rapid assessment of retinal photographs.

To date, 23 449 people (88% of those eligible) have been screened as part of the Chunampet project. Of these, 970 had previously diagnosed diabetes and 1114 were newly diagnosed. Screening for complications has so far been carried out in 1060 people. In 2007, Dr Mohan's Diabetes Specialities Centre opened the Sai Rural Diabetes Specialities Centre in Chunampet to provide primary and tertiary care, supported by a pharmacy and clinical laboratory. This has already achieved a substantial improvement in the quality of glycaemic control: in the first 1000 patients, HbA1C fell from 9.8% at baseline to 8.0% at first follow-up.

The Chunampet project could serve as a model for diabetes prevention and care in other rural parts of India, Dr Ravikumar concluded, and it fits well with the National Programme for Prevention and Control of Diabetes, Cardiovascular Disease and Stroke.

**POLICY ACTIONS AND PROGRAMMES**

This session was chaired by Dr Vijayakumar Sankaran (Special Secretary for Health and Family Welfare, Tamil Nadu) and Mr Vishwas Mehta, (Secretary of Health and Family Welfare, Ministry of Health, Kerala).

Mr Mehta opened the session with a summary of the population changes that will challenge the delivery of public health goals in Kerala in future years. Older teenagers and young adults are currently the largest age groups in Kerala. In 2021 it is predicted that the number of people aged over-60 will exceed that of 0–14 year-olds and, by 2061, the over-60s will form the largest age group. This has profound implications for morbidity and mortality. Kerala already has a higher prevalence than India of hypertension, diabetes, heart disease and mental health disorders and the prevalence of diabetes among 18–50 year-olds may already be as high as 40%.

Dr Cherian Varghese (Technical Officer NCD, WHO Regional Office for the Western Pacific, Manila), reviewed the public health strategies that can be used to keep people healthy. He pointed out that the idea of changing behaviour appears simple, but is a major challenge as the determinants of such behaviours are largely outside the health sector. Rapid urbanisation is leading to changes in dietary patterns and physical activity leading to increasing risk levels in the population. Disparities in income and living standards of the population add to these challenges.

Health promotion is defined as ‘the process of enabling people to increase control over and to improve their health’. The Health promotion approaches used are: healthy public policy, creating supportive environments, strengthening community action, developing personal skills and reorienting health services.

Diet and physical activity are key issues for health promotion. Dietary habits are established at an early age and strongly influenced by highly effective marketing and promotion.
strategies. In May 2004, the WHO adopted the ‘Global Strategy on Diet, Physical Activity and Health’. The objectives are to:

- Reduce risk factors for chronic diseases that stem from unhealthy diets and physical inactivity through public health actions
- Increase awareness and understanding of the influences of diet and physical activity on health and the positive impact of preventive interventions
- Develop, strengthening and implementing global, regional, national policies and action plans to improve diets and increase physical activity that are sustainable, comprehensive and actively engage all sectors
- Monitor science and promoting research on diet and physical activity.

An example of a policy intervention can be seen in control of tobacco consumption by taxation and limiting promotion. In the area of diet there are indications that comprehensive approaches including policy measures can be effective. In Mauritius, regulatory change to reduce the saturated fat content of cooking oil was associated with a marked fall in serum levels of cholesterol and triglycerides. In England and Wales, mortality due to coronary heart disease declined by 54% between 1981 and 2000; 58% of this change was attributable to a reduction in risk factors (smoking, blood pressure and cholesterol). In Finland, the proportion of people using butter on bread fell from 60% to almost 0 between 1978 and 2007, with increases in vegetable intake and low-fat milk over the same period.

Strong regulatory responses are now being introduced to control unhealthy foods. In New York transfats are being banned from restaurant foods; in the UK, the Food Standards Agency has introduced a traffic lights system for food labelling that warns of high fat, sugar and salt content.

Health promotion can be delivered effectively using a settings-based approach which includes a defined population, usually under a single administrative structure, which facilitates policy change, availability of resources, sustainability and the ease of demonstrating results (for example, workplaces and schools). An enabling policy environment with stakeholder participation can control the promotion of and access to unhealthy foods, promoting physical activity and making healthy choices readily available. An adequately equipped health system can complement this setting-based approach. To be effective, Dr Varghese concluded, health promotion should be early, easy, exciting and everywhere.

At the time of being diagnosed with type 2 diabetes, more than 15% of patients in India have neuropathy, 7% have retinopathy and 1–2% have nephropathy. In addition, 4–5% have ischaemic heart disease and there is a high prevalence of cardiovascular risk factors. The clock is ticking, said Dr Shaukat Sadikot (Vice President, IDF), but how can it be stopped?

Reviewing the efforts of the IDF in India, Dr Sadikot described four core activities: education, including diabetes in health planning, controlling costs and prevention. Regarding education, he said the IDF has published good guidelines on various aspects of diabetes care but, although they have been well received, he was uncertain whether they had actually changed clinical practice. Guidelines succeed when they are inclusive: only when people participate in their formulation will they implement the recommendations effectively. However, continuing education is not compulsory for family doctors and other health professionals, and practitioners of traditional medicine (who may prescribe allopathic drugs) do not receive any ongoing education in scientific medicine.

India spends only 0.9% of its GDP on healthcare. Most people pay 80–90% of their health expenses out of their own pockets, yet around 40% of India’s population live in poverty. Regardless of what’s being claimed, Dr Sadikot said, diabetes and other NCDs are not on the Government’s health radar. The IDF has done excellent work in increasing access to medicines but should work with WHO to prepare a list of essential medicines for diabetes and work with governments to make them affordable.

We also need to consider where to spend resources. Many people with diabetes, especially in rural areas, are undiagnosed. How should resources be allocated between preventive strategies and early diagnosis? Dr Sadikot concluded that the IDF is doing excellent work but it is now up to local associations to take things further.

Dr Thangamani Sathish Kumar (CVD Project), described a pilot project for prevention of CVD which formed one part of the state’s larger health systems project. Comprising opportunistic screening of hypertension in hospitals and primary care centres, and health promotion in the workplace, schools and the community, the project is being implemented in two districts and compared with two controls over a 2-year period.

The project is still underway but early data suggest it is highly effective. For example, the rate of diagnosing hypertension is 8–12 times greater than during a similar period in the preceding year. The major challenges identified so far include human resources, continuity of supply of medicines and reagents, and adherence to treatment guidelines. The State now plans to integrate CVD prevention into primary and secondary care institutions. His colleague, Dr Balaiah Bharathi (Cancer Cervix Tamil Nadu Health Systems Project), described the successful implementation of a second component of the project, a cervical cancer screening programme.
This session was chaired by Professor Pierre Lefèbvre and Professor Martin Silink.

Professor Silink began the closing session by welcoming the presence of so many distinguished politicians and dignitaries to the WDF Summit, where it had been a privilege to hear the voice of so many local champions who had been empowered to do extraordinary things. He said the solution to the diabetes epidemic will come from the health workers, researchers, industry and the individuals affected by it. He complimented the WDF for supporting the meeting, and congratulated the WDF Board and their supporting team on their achievements.

The WDF Report – global, regional and local projects

Dr Anil Kapur, reported on the various projects that the WDF is involved in.

About half a billion people worldwide have diabetes and for each of them, the disease impacts on 3 or 4 family members. This is equivalent to about one-third of the world’s population and is a huge problem – one that is borne largely by developing countries, which account for 7 of the top 10 countries with the highest numbers of people with diabetes. It is predicted that diabetes prevalence will increase by half by 2025, presenting resource-constrained countries with a major challenge.

In 2002, overseas aid to the health sector amounted to $2.2 billion. Most of this was directed towards HIV/AIDS, with only 0.1% for chronic disease (including mental health).

Diabetes is central to the NCD programme. It is a bridge between NCDs and communicable diseases and presents a unique opportunity to bring together different aspects of healthcare. Diabetes and other NCDs share many risk factors, and diabetes is itself a risk factor for NCDs (Figure 9) such as tuberculosis.

The WDF was set up in March 2002 with a funding commitment from Novo Nordisk of Kr 650 million over 10 years; this was increased by Kr 575 million in March 2008 and its duration was increased to 15 years. Over the years WDF has received funding from other sources including the Danish Government and individual donors. In addition, WDF funding has a multiplier effect by attracting more funds from other donors; the $54.7 million donated by the WDF so far has resulted in a project portfolio of $170.6 million. Thus for every dollar contributed by the foundation the projects are able to attract two more in cash or kind.

The role of the WDF is to create partnerships and act as a catalyst, linking people and resources to deliver care locally and to act as global advocates. It works only in developing countries to help the poorest of the poor, striving for solutions that are sustainable. The WDF recognised that losing vision or a limb due to diabetes has health and economic consequences. The complications of diabetes can force children of affected families to leave school prematurely, driving poverty. The WDF has therefore prioritised ‘orphan’ aspects of diabetes care for support. These include foot care, eye screening, children with diabetes, mothers and primary prevention. Over the next 3–4 years, WDF projects could directly influence diabetes management for 64.8 million people.

To date, the WDF has funded 164 projects in 80 developing countries, with a further 18 supported by fundraising initiatives (often by Novo Nordisk employees). The South-East Asia Region carries 66% of the burden of diabetes in the developing world and receives 74% of WDF funding. The WDF has granted $14.2 million in project funding; this has been matched by additional funding of $14.7 million. Amounting to 49 projects in total, these include all the priority areas for support (Table 4).

Globally, WDF-funded projects have trained 13 839 doctors, 11 926 nurses and 26 754 paramedics, many of whom had little or no prior expertise in diabetes. These healthcare professionals have provided diabetes care to an estimated 15 million people. Many projects have used the clinic model very successfully; 606 clinics have been established or strengthened, providing care for 228 245 documented cases of diabetes. Over 169 600 high-risk feet have been screened by 1129 newly trained health workers; this has probably saved over 18 000 amputations. Advanced diabetes eye care is now available to 175 million people in India, either through screening and awareness camps supported by specialist centres or mobile diagnostic and treatment units. So far, 4 884 330 people have participated in 4654 camps and 2 628 551 have been screened for diabetes. Sight-saving laser surgery has been provided for 21 453 people with diabetic retinopathy.

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Figure 9. Diseases for which diabetes is a risk factor
The WDF supports 5 projects on gestational diabetes globally. Its collaboration with the State Government in Tamil Nadu – one of the most successful projects in terms of its impact on public health policy – has resulted in a major policy decision on diabetes prevention and maternal and child health. The WDF has collaborated with other agencies, including the WHO and the UN, in an expert meeting on women’s issues associated with diabetes.

Other projects include a programme of behaviour modifications among employees in Thailand; school-based programmes to raise awareness of obesity and diabetes in China, India, South Africa and the Caribbean; improved diabetes management for children in Sudan, Tanzania, Bangladesh, Cameroon and Kenya; and diabetes training for paediatricians in Kenya.

Another example of our efforts to place diabetes on the global agenda is the annual Global Diabetes Walk, which is promoted by the WDF. This awareness initiative attracts the attention of the media and mobilises the global diabetes community in collaboration with multiple stakeholders. At its inception in 2004, 68 582 people took part in mass walks; in 2008, the number was 282 375.

Concluding remarks from the WDF Board of Directors
To conclude the Summit, Professor Lefèbvre invited the WDF Board of Directors to the dais and asked each to describe their vision for the next few years. Professor Ida Nicolaisen said the focus should remain on marginalised populations, health promotion and building bridges between medical specialties. There is a growing gap between the haves and have-nots, between those who are educated and can change, and those not educated and unable to change. She identified the WHO Millennium Goals as a barrier to tackling NCDs.

Professor Ib Bygbjerg said that tackling diabetes will be a catalyst for finding solutions to many chronic health problems. Within the next 2 years, we should aim to reach 80% of people with diabetes, raise awareness in 80% of the public, and educate 80% of school children so that they can guide their parents.

The presentations at the Summit have shown that success depends on human resources, Dr Kaushik Ramaiya (Vice President, IDF) said. The projects have succeeded thanks to the efforts of committed people who are willing to work for little financial gain. At the moment, it is difficult to deliver rural outreach programmes in parts of Africa because those involved in the projects are already multitasking and there is no more capacity. It will be particularly important to train and empower paramedical workers because they are likely to remain where they are needed. We need to overcome the misconceptions that some professions have a higher status than others.

Mr Lars Sorensen said he had been enlightened by the presentations: he had not fully understood the importance of tackling diabetes during pregnancy until now. He said it remained important to stress the role of governments – only they can provide full healthcare and education for their populations and he would continue to raise these issues at the UN and national level. Mr Sorensen promised that Novo Nordisk would do its part to ensure that no child would die for lack of insulin. On December 3rd, World Human Rights Day, the company announced that it will provide diabetes care, including free insulin, to 10 000 children in some of the world’s poorest countries. The 5-year programme, called ‘Changing the Future for Children with Diabetes’, will begin in 2009 with an initial roll-out in Uganda, Tanzania, Guinea-Conakry and the Democratic Republic of Congo.

### Table 4. Overview of WDF projects in South-East Asia Region

<table>
<thead>
<tr>
<th>Country</th>
<th>Projects</th>
<th>Prevention</th>
<th>Capacity</th>
<th>Awareness</th>
<th>Eye Care</th>
<th>Foot Care</th>
<th>GDM</th>
<th>Type 1 diabetes</th>
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<tr>
<td>India</td>
<td>31</td>
<td>31</td>
<td>30</td>
<td>27</td>
<td>17</td>
<td>6</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Indonesia</td>
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<td>7</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
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<td>Bangladesh</td>
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<td>1</td>
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<td></td>
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<tr>
<td>Nepal</td>
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<td>3</td>
<td>3</td>
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<td><strong>49</strong></td>
<td><strong>47</strong></td>
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<td><strong>18</strong></td>
<td><strong>8</strong></td>
<td><strong>2</strong></td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>
Professor Lefèbvre proposed that the Summit should publish a declaration entitled: ‘Addressing the urgent need for prevention and control of diabetes and related non-communicable disorders’ that reflected the views of the Regional Office of the WHO, the IDF, the World Bank (South Asia) and the WDF; representatives of governments, NGOs and other organisations present at the meeting; and the participants. After recalling the relevant resolutions from the UN, WHO Assembly and WHO SEAR Committee, the text would state:

Participants recognise that
1. Diabetes and several related chronic non-communicable diseases (NCDs) are major public health challenges in the region
2. If appropriate public health action is not initiated, disability and deaths from heart disease, cancer, diabetes and chronic respiratory diseases will continue to grow as well as occur prematurely
3. This poses a threat to the social and economic development of already resource constrained member countries.

Participants called for urgent actions to address and mitigate this threat through the following measures:
• Strengthen and adjust health systems to address the prevention and care of chronic non-communicable diseases at the primary healthcare level. Participants recommend that prevention and control of diabetes and arterial hypertension offer a model for initiating such activities
• Develop and implement culturally appropriate programs for education and awareness raising to the common risk factors for non-communicable diseases; as well as programmes to reduce these risks through healthy diet, increased physical activity, smoking cessation and avoidance of harmful use of alcohol
• Promote ‘life cycle’ as well as ‘life style’ approach for prevention of diabetes and related non-communicable diseases to accrue multigenerational benefits of the interventions
• Strengthen surveillance systems to track and monitor the health and economic burden of non-communicable diseases and their risk factors
• Recognise that survival and optimal development of children with type 1 diabetes is dependent on daily injection(s) of insulin; creating access to uninterrupted supply of insulin is therefore not merely a matter of making a treatment available, but tantamount to the child’s basic human right to live
• Facilitate the creation of an essential drug list for rational and optimal care of common non-communicable diseases at the primary healthcare level, as well as ensuring the availability and distribution of these medications at all times
• Endorse and support a call for a UN General Assembly special session to discuss and include chronic non-communicable diseases into the United Nations Millennium Development Goals and the creation of a Global Fund for Health including both communicable and non-communicable diseases.

Professor Lefèbvre invited the audience to vote on what may come to be known as the Declaration of Chennai.

The proposal was unanimously approved and the Declaration will now go to all stakeholders for approval.

Professor Lefèbvre thanked all the organisations who had helped the WDF to make the Summit a success, including the IDF, WHO, the World Bank, the representatives of governments and ministries, all speakers and participants in the proceedings, and the team responsible for the logistics and organisation behind the meeting.

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During the Summit, the World Diabetes Foundation showcased six major projects for the media across India in the area of capacity building of healthcare professionals, public awareness in rural areas, gestational diabetes, primary prevention interventions in schools and innovative diabetic foot and eye care projects to demonstrate how interventions funded by the WDF work at a practical level.

Within one week of the event, over 80 newspaper articles, online articles, radio interviews, television coverage and pod-casts had been published and broadcasted. By attending the event and seeing the projects in action at grass root level, journalists were not only better informed about the growing burden of diabetes, but they could also not help but be moved by the impact of this disease on the people in India and other developing countries, thus helping to create awareness of the problem.

Headlines from the event included:

- **SHOW CASING TO THE MEDIA AND RAISING AWARENESS**

- India battles diabetes 'epidemic'
- WHO asks India to wake up to 'diabetic tsunami'
- Diabetes seen linked with TB
- National Policy to fight diabetes- Health Minister
- Obesity fuels fears of faster diabetes rise
- Mobile diabetes clinic a hit
- Obesity fuels fears of faster diabetes rise
- SILENT KILLERS
- Diabetes causes more amputations than landmines
- Mobile clinic a runaway success
- Mobile diabetes clinic a hit
- Pregnant Indians risk passing diabetes to babies
- Diabetes prevention targets schoolchildren
- Diabetic clinic a hit
- Obesity fuels fears of faster diabetes rise
- WDF Transforming Health Policy
- India fights uphill problem with diabetes
- Obesity fuels fears of faster diabetes rise
- Plea to devise strategy to combat diabetes
- Diabetes responsible for amputations