Time to Act

Put Feet First
Prevent Amputations
Diabetes and Foot Care

International Diabetes Federation
International Working Group on the Diabetic Foot
Time to Act

International Diabetes Federation

INTERNATIONAL WORKING GROUP ON THE DIABETIC FOOT
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Karel Bakker (Chair) (the Netherlands)
Ali Foster (UK)
William van Houtum (the Netherlands)
Phil Riley (UK)
Zulfiqarali Gulam-Abbas (Tanzania)
Kristien van Acker (Belgium)
Marg McGill (Australia)
Hermelinda Pedrosa (Brazil)
Sharad Pendsey (India)
Lee Sanders (USA)
Vilma Urbančič-Rovan (Slovenia)
Mohamed ElMakki Ahmed; Jan Apelqvist; Morsi Arab; David Armstrong; Owen Bernard; Andrew Boulton; Neil Donohue; Khalid Edrees; Hanan M Elsetohy Gawish; Lawrence Lavery; Leonne Prompers; Margreet van Putten; Patricia Abu Rumman; Gunnel Ragnarson Tenvall; Susan Tulley; Loretta Vileikyte; Stephanie Wu.

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# Content

## 1. Introduction
- The time to act is now! 8 - 9
- Put feet first: prevent amputation 11
- How to use this publication 12 - 13
- Call to action for people with diabetes 14 - 15
- Call to action for healthcare professionals 16 - 17
- Call to action for healthcare decision-makers 18 - 19

## 2. Scope of the problem
- Diabetes: the global epidemic of the 21st Century 22 - 27
- Things that go wrong with diabetic feet 28 - 31
- Foot problems are serious and common 32 - 35
- The impact of foot ulcers upon quality of life 36 - 39
- Pay now, save later! 40 - 48

## 3. Diagnosis & treatment
- How to identify diabetic foot problems 50 - 55
- How to treat a diabetic foot ulcer 56 - 62

## 4. Prevention
- How to identify the high-risk foot 64 - 66
- Teaching people how to look after their feet 68 - 73
- The importance of relieving pressure 74 - 80

## 5. Implementation
- Guidelines are essential to good diabetes care and foot care 82 - 88

## 6. Podiatry
- A very important role in the management of the diabetic foot 90 - 96

## 7. Organization
- Optimal care: moving towards a centre of excellence 98 - 105
- Introduction to regional, national and international initiatives 106 - 107
- Working examples regional and national initiatives:
  - Starting from scratch: The small-scale model 108 - 109
  - Setting up an national foot care programme: the Belgian experience 110 - 111
  - Establishing foot clinics across a developing country: the Brazilian experience 112 - 115
  - How to develop an efficient diabetic foot-care system: the Slovenian experience 116 - 117
Working examples international initiatives:

- The Eurodiale Consortium
- Combining clinical training and cyber medicine: World Walk
- The IDF Consultative Section and International Working Group on the Diabetic Foot
- Step by Step: improving diabetic foot care in the developing countries

8. Worldwide overview

World Survey on Diabetic Foot Care

Diabetic foot care in the seven IDF regions:

- African Region (AFR)
- Eastern Mediterranean and Middle East Region (EMME)
- European Region (EUR)
- North American Region (NA)
- South and Central American Region (SACA)
- South-East Asian Region (SEA)
- Western Pacific Region (WP)

9. The future

The future

10. Practical section

- Debridement training
- Dos, don’ts and warnings
- Country representatives
- Contact details

11. Glossary

Glossary
Introduction

The time to act is now!
Put feet first: prevent amputations
How to use this publication
Call to action for people with diabetes
Call to action for healthcare professionals
Call to action for healthcare decision-makers
Time to Act

The time to act is now!

Diabetes is a serious chronic disease. All types of diabetes are potentially life-threatening and can reduce quality of life. In 2003, the global prevalence of diabetes was estimated at 194 million. It is now thought to be in excess of 200 million. This figure is predicted to reach 333 million by 2025 as a consequence of longer life-expectancy, sedentary lifestyle and changing dietary patterns. Diabetes is the global epidemic of the 21st Century and is now the fourth leading cause of death in most developed countries. At present there is no cure. This global epidemic will affect everyone, everywhere.

Healthcare financers and decision-makers will need to allocate sufficient resources effectively and will need to choose carefully how to reallocate resources efficiently in order to maximize the quality of care for their populations. This will involve investing in programmes that prevent diabetes and that facilitate the prevention of diabetes complications.

Diabetes representative organizations and others advocating for change in diabetes care will need to provide arguments to ensure that healthcare decisions are well informed and best serve the growing numbers of people with diabetes. They will need to fight hard to make sure that awareness of diabetes is prioritized and that preventing diabetes has a prominent place on the healthcare agenda.

Industry partners play an important role, not only in terms of the valuable contribution they make towards improving therapeutic care, but also in facilitating research, education and diabetes awareness programmes.

In the face of the epidemic, healthcare professionals will need to find new ways of organizing care delivery in order to absorb the fast-increasing workload. They will have to find new ways of working together to ensure that the burden of responsibility is shared across healthcare teams and that the people with diabetes in their care are welcomed and engaged as part of the team.

People with diabetes have a responsibility to themselves. They must play an active role in their own care and learn as much as they can about their condition in order to seek, recognize and act upon good advice. Many complications of diabetes can lead to death or severe disability. All of them have the potential to reduce the quality of life for people with diabetes and their families. However, with good diabetes management, the pursuit of a healthy lifestyle, and access to good healthcare, the complications of diabetes can be prevented or delayed.
The International Diabetes Federation brings together all members of the global diabetes community to work towards increasing access to and improving the quality of diabetes care, as well as raising awareness of diabetes and its complications. Our mission is to promote diabetes care, prevention and a cure worldwide. World Diabetes Day provides an excellent example of how different diabetes stakeholders can come together to promote diabetes awareness.

While the day itself is celebrated on November 14, 2005 marks the shift to year-long campaigning to highlight the need for urgent action to bring about improvements in diabetes care: 2005 is the ‘year of the foot’. The theme for World Diabetes Day is Diabetes and Foot Care.

The increasing global incidence of diabetes brings a corresponding increase in diabetes complications. Those affecting the foot are among the most serious and feared. Not only is the impact of amputation devastating on people’s lives, it is also one of the most costly diabetes complications.

This publication is the fourth in IDF’s Time to Act series. It is produced by the IDF Consultative Section and International Working Group on the Diabetic Foot (IWGDF). The aim of the publication is to inform people of the extent of diabetic foot problems worldwide, persuade them that action is both possible and affordable, and to warn them of the consequences of not taking action. It has been written by international experts in diabetic foot care to draw attention to the unacceptable number of lower-limb amputations that happen as a consequence of diabetes (up to 85% of the one million amputations per year are preventable). The publication offers solutions to those working to bring about improvements in diabetes care.

It is time for the global diabetes community to engage in a concerted effort to increase awareness among carers at all levels of healthcare services worldwide. It is time to reduce the unnecessary suffering that foot complications can bring. With relatively low investment, it is possible to advance education and prevention that will result in lower rates of amputation. The time to act is now!

Pierre Lefèvre Martin Silink
President President-Elect
International Diabetes Federation International Diabetes Federation
“Tell me and I will forget. Show me and I may remember. Involve me and I will understand.”

Confucius
Of the many serious complications that can affect individuals with diabetes, it is the complications of the foot that take the greatest toll. People with diabetes are 25 times more likely to lose a leg than people without the condition. Throughout the world, up to 70% of all leg amputations happen to people with diabetes. The economic and psychological impact of limb loss is immense. In many cases, people can no longer provide for themselves or their families, they become dependent on the care and support of others and often cannot maintain the same level of social contact.

More than one million people with diabetes lose a leg every year as a consequence of their condition. This means that every thirty seconds a lower limb is lost to diabetes somewhere in the world. The majority of these amputations are preceded by a foot ulcer. The most important factors related to the development of these ulcers are peripheral neuropathy, foot deformities, minor foot trauma, infection and peripheral vascular disease.

The spectrum of foot lesions varies in different regions of the world due to differences in socio-economic conditions, standards of foot care and quality of footwear. In developed countries, one in every six people with diabetes will have an ulcer during their lifetime. In developing countries, foot problems related to diabetes are thought to be even more common.

This situation can be changed.

It is possible to reduce amputation rates by between 49% and 85% through a care strategy that combines: prevention; the multi-disciplinary treatment of foot ulcers; appropriate organization; close monitoring, and the education of people with diabetes and healthcare professionals. Healthcare decision-makers have a key role to play in removing the barriers to implementation that still exist in many countries.

The management of the diabetic foot according to present guidelines, as set out in this publication, would result in improved survival rates and a reduced number of diabetic foot complications. In addition, implementation would be cost-effective or even cost-saving compared to standard care and would do much to reduce needless suffering.

It is the ultimate goal of reduced amputation rates and improved quality of life that should motivate the advocacy work of those fighting to make a difference for those living with diabetes around the world. It is hoped that this book will provide useful and persuasive arguments that will help achieve this goal.

Karel Bakker
Chair
IDF Consultative Section and
International Working Group on the Diabetic Foot
The aim of this book is

• to increase awareness of diabetic foot problems

• to illustrate that prevention is the first step towards solving diabetic foot problems

• to show that prevention and reduction of amputations can be achieved by identifying the high-risk foot and educating people with diabetes as well as healthcare professionals

• to state that standardized foot strategies aimed at preventing the occurrence of foot ulcers and amputations are highly cost-effective and even cost-saving

• to demonstrate that regional and national foot programmes have already been highly successful and provide models for improvements elsewhere

• to inspire key diabetes stakeholders to engage in the implementation of diabetic foot care services

• to give support to communities and individuals who want to improve foot care for people with diabetes

• to convince people with diabetes, healthcare professionals and decision-makers all over the world that the time has come to act

Put feet first prevent amputations
How to use this publication

Access the information you need

This book has been written to inform people with diabetes, healthcare professionals and healthcare decision-makers all over the world how to prevent and how best to care for diabetes-related foot problems.

While most chapters include some information that is important to all readers, some chapters are more directed towards one audience rather than written specifically for all three.

In order to facilitate the extraction of information, a colour code has been used. Almost every chapter begins with key messages for people with diabetes, healthcare professionals and healthcare decision-makers respectively.

Each group has its own colour code:

- The colour code for people with diabetes
- The colour code for healthcare professionals
- The colour code for healthcare decision-makers

The chapters that are directed more towards one group have been colour-coded for that group.

The important sections in each chapter are also indicated with the colour corresponding to the audience for which it is thought to be most useful.

The editors hope that this will help readers to access easily the information they require.

A flap at the back of the book provides a detailed guide for readers.
### Call to action: people with diabetes

**At risk of foot ulceration**
If you have diabetes, you are at risk of foot ulceration. This is particularly the case when diabetes has resulted in a loss of sensation in the feet. This often happens when someone has lived with diabetes for some time. As a consequence, it is possible to injure the foot, causing an ulcer without realising it. Foot ulcers can lead to amputation. Unfortunately, the chances of amputation are far higher for a person with diabetes than a person without the condition.

**Adequate diabetic foot care**
The risks of developing foot ulcers and therefore the possibility of amputation can be reduced if diabetic foot care is adequately managed, both by the person at risk and by those in a position to provide care. In terms of education and the consequent ability to take care of your feet, the message is simple: the more you learn about diabetes and your feet, the more likely you are to avoid foot problems in the future. However, your possibilities are greatly enhanced if the care, advice and support with which you are provided are adequate.

**Annual assessment of your feet**
The provision of adequate foot care for people with diabetes requires sufficient funding and knowledge. As a minimum, you should have an annual assessment of your feet (more if your risk of foot complications is higher). This is an essential component of your diabetes management. If you already receive regular foot care, you are fortunate. As explained in this book, many people with diabetes do not have access to the quality of diabetes care they deserve. You have a responsibility to yourself and to other people with diabetes in the community to make sure that, given local circumstances, the provision of diabetic foot care is as good as it possibly can be. One way to work towards this goal is to add your voice to the many people around the world advocating improved care for people with diabetes. The best way to start is to join your local diabetes association and support the activities in which they are engaged. National and global advocacy for people with diabetes can bring about significant changes to how diabetic healthcare is structured, managed and financed.

**Reductions in amputations**
Research into diabetic foot care has shown that reductions in amputations are possible. As the growing numbers of people living with diabetes increases pressure on limited healthcare resources, you will have to play an active role in your own healthcare. You need to know how to check and look after your feet on a daily basis. Ask the person or team who look after your diabetes to tell you whether you have or are at risk of foot problems. Ask them how best to prevent future problems. Be aware that if you have numb feet, you might not feel that there is a problem. This, however, does not mean that the problem is not serious.

**Ill-fitting shoes harm your feet**
Ill-fitting shoes can harm your feet. Make sure where possible that you make informed choices of what footwear to use by seeking good advice. If your shoes have caused a foot problem, you should wear different shoes. Ask the person or people who look after your feet to help you to find a suitable alternative.
Because diabetes is a complicated condition that can affect many parts of the body, healthcare professionals from different disciplines are likely to be involved in your healthcare team. While it is often true that any foot care is better than none and that many people are fortunate to receive any kind of foot care, you should be aware that current research in diabetic foot care strongly suggests that your feet are best cared for when teams of healthcare professionals from different disciplines (the educator, the diabetes specialist and the podiatrist, to name but a few) share information and work with you to help you care for existing foot problems and prevent future ones. It should be your role to make sure that the foot care you and other people with diabetes receive is as good as it can possibly be, or, as is often the case, better than it is at present. Be aware and make others aware that foot ulcers and amputations can be prevented with good foot care.
Call to action: healthcare professionals

All healthcare professionals working in foot care share the responsibility for bringing about improvements in the delivery of foot care for people with diabetes and for reducing amputation rates.

In some developed countries, the approach to foot care is exemplary and provides a model to inspire many working elsewhere. It has been shown that, through appropriate prevention and management of the diabetic foot, it is possible to achieve reductions in amputations and reduce the suffering of many people living with diabetes. However, in most countries, including developed countries, foot care is not yet at the level of funding, organization and professionalization that would facilitate the ready attainment of these objectives. Given, however, that the goals are both possible and affordable in many contexts, it is possible to learn from those foot-care settings where standards are being set.

Long-term cost of amputation is higher than primary healing. The core components of a successful (as measured by improved outcomes) foot clinic are described briefly below.

**Screening**
The identification of the foot at high risk of diabetes complications is key to preventing amputations. The screening of the diabetic foot does not have to be done by a doctor or a podiatrist; it can be performed by others so long as they have been carefully trained to assess the situation and react appropriately to the findings.

**Examination**
It is the responsibility of every healthcare professional involved in the care of people with diabetes to ensure that the feet and footwear of those in their care are examined at least once per year. The examination should be more frequent for those at high risk of ulceration. The results of all examinations should be carefully recorded.

**Education**
Sufficient and appropriate foot-care education must be provided in order to ensure that people with diabetes know how to take care of their feet. Education should be simple, relevant, consistent and repeated. Healthcare professionals should follow post-graduate training to improve their own understanding and enable foot-care practices to keep up with the latest developments.

**Organization**
A multidisciplinary team approach to diabetic foot care has been shown to result in fewer amputations. Healthcare professionals involved in the care of people with diabetes should strive to create a professional environment where this approach can be implemented. Podiatrists are key members of the multidisciplinary diabetic foot team. Collaboration between clinics and the standardization of diabetic foot care terminology, management, and practices will facilitate research in the field and help improve care and bring about the reductions in amputations that are needed.
It is important that healthcare professionals support and stimulate research into diabetic foot care. Data collection and study will help decision makers to allocate resources efficiently and will lead to improved outcomes for people with diabetic foot problems.

Guidelines provide an essential tool to help implement good diabetes care for all people with the condition. Guideline recommendations define standards of care and use evidence-based interventions to achieve these standards. They should be used to steer healthcare professionals, people with diabetes, policy-makers and administrators towards optimal care. The diabetes care offered will differ within countries and across national borders and therefore some components of diabetic foot care will need to be tailored to suit local circumstances. The goal posts, however, should not be moved.
Call to action: healthcare decision-makers

Diabetes is a serious, chronic disease caused by both genetic and environmental factors. Increasing age, obesity, sedentary lifestyles and changing dietary patterns are leading to year-on-year increases in the global incidence of diabetes. In 2003, the global prevalence of diabetes was estimated at 194 million. It is now thought to be in excess of 200 million. This figure is predicted to reach 333 million by 2025. At present there is no cure. All people with diabetes deserve access to the best possible care, medication and diabetes supplies that available resources will allow.

Many serious and costly complications affect individuals with diabetes. These include heart disease, kidney failure, blindness and complications of the foot. Foot problems are common, life-threatening and place an enormous financial burden on the healthcare sector, people with diabetes and their families, and society as a whole. Every year, more than one million people undergo lower-limb amputation as a consequence of diabetes. This presents a significant economic problem, particularly if amputation results in prolonged hospitalization, rehabilitation and an increased need for home care and social services. In developed countries, the long-term (3 years) costs associated with an initial amputation are estimated to be as high as approximately US$64,000. This estimate excludes the indirect costs as a consequence of loss of productivity, any costs incurred by the person with diabetes and any family member who provides care, and includes no calculation of the loss of quality of life.

The reduction of these costs and improvements in the quality of life of people with diabetes will require effective care and education to improve health outcomes. Investing in diabetic foot-care and prevention programmes can be one of the most cost-effective forms of healthcare expenditure, provided the programme is goal-focused and properly implemented.

There are many different causes of diabetic foot problems. Ideally, healthcare professionals from different specialities should be involved in the provision of care. The past 15 years have seen a growing evidence base that strongly indicates that foot care for people with diabetes is optimal when sufficient financial and human resources are employed to create diabetic foot care services that involve healthcare professionals from different disciplines. The multidisciplinary team approach to diabetic foot care has been shown to bring about a 49%-85% reduction in amputation rates. This underlines the need to provide funding and support to create new clinics along the lines described in this publication.

Of the healthcare professionals involved in the multidisciplinary diabetic foot care team, the podiatrist plays a pivotal role. In many countries, there is an urgent need for podiatry training programmes to be established. Podiatrists should be state-registered and regulated by government.
Call to action

People with diabetes should not be put at increased risk by unregulated, unqualified and poorly equipped practitioners.

People with diabetes and their representative organizations should be encouraged to help establish realistic treatment goals that recognize success in terms of metabolic control, delayed onset or prevention of complications, and sustained or improved quality of life. This involves collaborative educational initiatives to ensure that informed self-care actions are taken and appropriate lifestyle choices made.

Good equipment must be provided to diagnose foot problems in people with diabetes before the problems get worse and become more costly to treat. Well-designed promotional and educational materials should be available in sufficient quantities. As most ulcers are caused by poor footwear, adequate shoes should be provided for people with diabetes.

Wherever possible, research should be supported to collect data on diabetic foot disease and lower-extremity amputations. Using research findings to inform diabetic foot care will ensure that diabetic foot-care and prevention programmes are focussed effectively. Local and regional variations in complications of the foot, as well as varying incidence across population sub-groups suggest opportunities for targeted intervention. Identifying people with diabetes at risk of developing foot ulcers and taking the appropriate preventative measures would be cost-effective or even cost-saving. Investing resources in both would reduce total costs to society and improve quality of life.

Every 30 seconds a lower limb is lost to diabetes somewhere in the world. This need not be the case. Studies have proven that amputation rates can be reduced by more than 49% if appropriate strategies are implemented and adequate resources allocated.

The involvement of people with diabetes and diabetes representative organizations

The provision of materials and equipment

The need for research

Every 30 seconds a lower limb is lost to diabetes
Scope of the problem

Diabetes: the global epidemic of the 21st Century

Things that go wrong with diabetic feet

Foot problems are serious and common

The impact of foot ulcers upon quality of life

Pay now, save later!
Scope of the problem

**Diabetes: the global epidemic of the 21st Century**

- All types of diabetes are potentially life-threatening and can reduce your quality of life. If someone tells you that you do not have a serious type of diabetes, they are wrong.
- If someone in your family has diabetes, you may also be at risk.
- There is no such thing as 'mild' diabetes.
- The global diabetes epidemic will increase your workload.
- Diabetes is the global epidemic of the 21st Century.
- All types of diabetes, whether insulin-treated or not, are potentially serious. Doing nothing will lead to greater problems later on in life.
- At present there is no cure for diabetes.
- All people with diabetes should have access to quality care, medication and diabetes supplies.
- Every member of the public has a family member or friend with diabetes.
What is diabetes?

Diabetes is a chronic condition that arises when the pancreas does not produce enough insulin, or when the body cannot effectively use the insulin produced. Insulin is a hormone made by the pancreas that enables cells to take in glucose from the blood. Insulin works like a key to open the cells, so that the glucose can be absorbed and converted into energy. When the body produces no or insufficient insulin, or when it cannot use the insulin it produces (or both), the glucose levels in the blood rise (hyperglycaemia). It eventually spills over into the urine before leaving the body.

Raised glucose levels can damage the heart and blood vessels (cardiovascular disease and peripheral vascular disease). Hyperglycaemia can also lead to small vessel complications of the kidneys (nephropathy), eyes (retinopathy) and nerves (neuropathy). Neuropathy and peripheral vascular disease can both lead to serious foot problems.

There are two main types of diabetes:

Type 1:
People with type 1 diabetes produce very little or no insulin and require injections of insulin to survive. It is the most common type in children and young adults.

Type 2:
People with type 2 diabetes cannot use insulin effectively. They can often manage their condition with lifestyle measures alone. In many cases, oral drugs are needed, and sometimes insulin is required.

A third type of diabetes develops sometimes during pregnancy but usually disappears afterwards. Other rarer types of diabetes also exist.

Worldwide increase of diabetes

Recently released figures from the International Diabetes Federation (Diabetes Atlas) suggest that worldwide in 2003, there were 194 million people between 20 and 79 years of age with diabetes - a global prevalence among the adult population of 5.1%. These figures suggest a worldwide epidemic, with diabetes now the fourth leading cause of death in most developed countries.

Most studies of the prevalence of diabetes worldwide have been conducted over the past 20 years. During this period, there has been a sizeable increase in the prevalence of diabetes in developed, developing and newly industrialized countries. Among adults, the prevalence of diabetes is expected to reach 333 million by 2025.

Scope of the problem

Diabetes is a Greek word meaning 'to go through', mellitus is derived from the Greek word for honey. Together they describe honey-sweet urine. The body produces no or insufficient insulin and/or it cannot use the insulin it produces.

Raised glucose levels can damage:
• heart and blood vessels
• kidneys
• eyes
• nerves
Scope of the problem

Type 2 diabetes is increasing among the young

<table>
<thead>
<tr>
<th>All diabetes</th>
<th>2003</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total world population (billions)</td>
<td>6.3</td>
<td>8.0</td>
</tr>
<tr>
<td>Adult population (billions) (20 - 79 years)</td>
<td>3.8</td>
<td>5.3</td>
</tr>
<tr>
<td>Number of people with diabetes (millions) (20 - 79 years)</td>
<td>194</td>
<td>333</td>
</tr>
<tr>
<td>World diabetes prevalence (%) (20 - 79 years)</td>
<td>5.1</td>
<td>6.3</td>
</tr>
</tbody>
</table>

In addition to these figures of global diabetes prevalence among adults, there is increasing evidence that type 2 diabetes is also increasing among the young. Reports of children as young as 8 years old with type 2 diabetes, and a doubling of the prevalence of type 2 diabetes among Japanese school children between 1980 and 1995 are indicative of a fast-growing problem.

Children with type 2 diabetes now outnumber those with type 1 in Japan, with the younger age of onset increasing the risk of complications due to longer disease duration. The result is an increased burden on health budgets and society as a whole.

In addition to the increasing number of children with type 2 diabetes, there are an estimated 430,000 children under the age of 14 worldwide with type 1 diabetes. Despite being more common in children, type 1 diabetes can occur at any age.

430,000 children under the age of 14 worldwide with type 1 diabetes

Type 2 diabetes is increasing among the young

Prevalence estimates of diabetes, 2003

© International Diabetes Federation 2003
Scope of the problem

Published incidence rates of type 1 diabetes in children (0-14 age range) (cases per 100,000 population per year)

<table>
<thead>
<tr>
<th>Type 1 diabetes (0-14 years)</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total child population (billions)</td>
<td>1.8</td>
</tr>
<tr>
<td>Type 1 diabetes prevalence (%)</td>
<td>0.02</td>
</tr>
<tr>
<td>Number of children with type 1 diabetes</td>
<td>430,000</td>
</tr>
<tr>
<td>Annual increase of incidence (%)</td>
<td>3</td>
</tr>
<tr>
<td>Estimated number of newly-diagnosed cases per year</td>
<td>65,000</td>
</tr>
</tbody>
</table>

Almost 50% of people with type 2 diabetes are not aware that they have the condition. People with type 2 diabetes may have the same symptoms (as described above), but these may be less apparent. Many have no symptoms and are only diagnosed after several years.

What are the symptoms of uncontrolled diabetes?

Common symptoms of uncontrolled type 1 diabetes include:

- excessive thirst
- frequent urination
- sudden weight loss
- extreme tiredness
- blurred vision

Almost 50% of people with type 2 diabetes do not know they have diabetes.
Scope of the problem

**Risk factors for diabetes**

**Type 1**
Both genetic and environmental influences appear to be important in the development of type 1 diabetes. Potential environmental triggers include viruses, toxins in the food chain and dietary components, though to date the involvement of these factors has not been proven in the majority of cases.

**Type 2**
The risk factors for type 2 diabetes include:

- overweight and obesity
- physical inactivity
- high-fat and low-fibre diet
- ethnicity
- family history
- age
- low birth-weight

The more risk factors an individual has, the greater the likelihood of developing type 2 diabetes. People over the age of 45 are at higher risk of developing the condition. The chances of developing the condition increase further when age is accompanied by other risk factors for type 2 diabetes.

**What are the effects of diabetes?**

**Short-term effects:**

Hyperglycaemia:
- ketoacidosis
- recurrent or persistent infections

Hypoglycaemia:
- confusion
- loss of consciousness

The short-term effects of diabetes include out-of-control diabetes, which, when severe, leads to the body using stored fat for energy and a subsequent build up of acids (ketone bodies) in the blood. This is known as ketoacidosis and is associated with very high glucose levels. It requires emergency treatment as it can lead to coma and even death. Another effect of hyperglycaemia is recurrent or persistent infections.

Low blood glucose is called hypoglycaemia. If untreated, it may lead to confusion or even loss of consciousness. All people on insulin therapy should carry a sugary food supply to correct hypoglycaemia.

**Long-term effects:**
People with diabetes are at an increased risk of a number of long-term complications associated with the condition. These include:

- cardiovascular diseases
- kidney disease (diabetic nephropathy)
- eye disease (diabetic retinopathy)
- nerve disease (diabetic neuropathy)
Scope of the problem

Cardiovascular diseases (CVDs) are diseases of the circulatory system, including those affecting the heart and blood supply. The most common manifestations of CVD include angina, heart attack, heart failure and stroke. CVD is the main cause of death among people with diabetes and is the number one cause of death in industrialized countries.

Diabetic nephropathy results from increasing amounts of protein in the urine and progresses slowly, ultimately resulting in kidney failure. This usually occurs many years after the initial diagnosis of diabetes and can be delayed with tight blood pressure and good blood glucose control. Diabetes has now become the most common cause of kidney failure, requiring dialysis or kidney transplantation, in most developed countries.

Diabetic retinopathy is damage to the blood vessels servicing the retina of the eye. The small blood vessels in the retina can be damaged by high blood sugar and high blood pressure. Diabetes is the leading cause of blindness and visual impairment in adults in developed countries.

Diabetic neuropathy is damage to the nerve fibres caused by diabetes. Loss of sensation in the feet is the most common manifestation of damage to the nerves of the legs. Neuropathy can sometimes lead to severe pain, but more often goes unnoticed. Even in the absence of symptoms, diabetic neuropathy (together with vascular disease) results in a higher risk of foot ulceration and amputation.

Many complications of diabetes can lead to death or severe disability. All of them have the potential to reduce the quality of life for people with diabetes and their families. However, with good diabetes management by the person with diabetes and the healthcare professional, complications of diabetes can be prevented or delayed.

The burden of complications and early deaths that will accompany the ‘diabetes epidemic’ will stretch the resources of most countries. Much of the economic and social burden of diabetes will fall on developing countries. However, the message of this book is that, of all the complications of diabetes, foot problems are the easiest to prevent and treat if identified in time.

Ulcers and amputations are not inevitable consequences of a diagnosis of diabetes, and foot-care programmes do not have to cost a lot of money.

Further reading:


Pathophysiology

**Things that go wrong with diabetic feet**

- If you have numb feet, you might not feel a problem. This does not mean that it is not serious.
- You are at risk of developing problems with your feet. Make sure that your feet are checked regularly.
- Make sure that your diabetes team helps you to look after your feet and provides you with advice about what shoes to wear.
- The most important causes of diabetic foot ulcers are nerve damage, foot deformities, poor blood supply and injury.
- Most ulcers are caused by poor footwear. Adequate shoes should be provided for people with diabetes.
- The people at highest risk of amputation are people with neuropathy or ischaemia, and those who have not been given foot-care and footwear advice are at highest risk.
- There are many different causes of foot problems: healthcare professionals from different specialities need to be involved.

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**Key messages for people with diabetes**

- If you have numb feet, you might not feel a problem. This does not mean that it is not serious.
- You are at risk of developing problems with your feet. Make sure that your feet are checked regularly.
- Make sure that your diabetes team helps you to look after your feet and provides you with advice about what shoes to wear.

**Key messages for healthcare professionals**

- The most important causes of diabetic foot ulcers are nerve damage, foot deformities, poor blood supply and injury.
- Most ulcers are caused by poor footwear. Adequate shoes should be provided for people with diabetes.
- The people at highest risk of amputation are people with neuropathy or ischaemia, and those who have not been given foot-care and footwear advice are at highest risk.
- There are many different causes of foot problems: healthcare professionals from different specialities need to be involved.
Diabetic foot ulcers: more than one cause

The way in which an ulcer develops is often called the ‘pathway’. Common pathways to diabetic foot ulceration are shown below. Diabetic foot ulcers may have more than one cause.

The four most important causes of diabetic foot ulcers are peripheral neuropathy (nerve damage), deformity (changes in the shape of the foot that can lead to ill-fitting shoes), peripheral vascular disease (poor blood supply caused by such things as lack of exercise, a high-fat diet and smoking), and trauma (any injury to the foot such as burns or cuts).
Pathophysiology

Nerve damage

Three types of nerves can be damaged in diabetic neuropathy: sensory nerves, autonomic nerves and motor nerves. Sensory nerves are involved in feeling pain, pressure, position of the foot (proprioception) and temperature. Autonomic nerves control sweating. When they are damaged the foot becomes dry and prone to developing deep splits. Motor nerves control movement in the foot. When motor neuropathy occurs the foot can change shape.

Sensory neuropathy makes the foot susceptible to trauma (damage from an injury), as the foot can lose its normal ability to perceive pain. When someone cannot feel heat or cold, then they are easily injured from burns or freezing. If proprioception is reduced, people become unaware of the position of their foot, which places extra stresses on their bones and joints. As a result, areas of high pressure on the sole of the foot increase, and the foot responds by growing hard skin (callus), which may lead to an ulcer.

Autonomic neuropathy alters the speed of blood flow in the foot. Normally, blood flows through arteries (large blood vessels leading from the heart) into smaller vessels called arterioles, and from there into a web of tiny blood vessels called capillaries. From the capillaries, minerals and oxygen and other useful substances can pass into the tissues of the foot. Waste products pass into the capillaries and are drained by tiny vessels called venules, which lead to veins that carry the blood away from the foot. In addition, there are blood vessels called shunts that bypass the capillaries and lead directly from the arteries to the veins. In normal feet, opening and closing of the shunts controls blood flow within the foot. When a person has autonomic neuropathy, all of the shunts remain open. As a result of this, blood flow through the foot is very fast and the supply of blood to other tissues may be reduced. This ‘shunting’ may result in a warm, sometimes swollen foot with bulging veins on the top. Because the autonomic nerves also control sweating, people with autonomic neuropathy develop very dry skin that may develop splits (fissures) and cracks.

Motor neuropathy causes wasting of the muscles (atrophy) and weakness of the foot. It can lead to changes in the shape of the toes and abnormally high pressures on the foot.

Peripheral vascular disease may greatly reduce the blood supply to the foot. Arteries become narrowed or blocked (arteriosclerosis). The tissues of the foot require a good blood supply to remain strong and healthy. If the supply of blood becomes poor, the foot becomes more susceptible to injury. The delivery of essential nutrients and oxygen is also affected.

People with diabetes can develop peripheral vascular disease at a younger age than people without the condition. The progression of peripheral vascular disease in people with diabetes is more rapid than in people without the condition. In people with diabetes, many parts of the arteries develop disease. The location of peripheral vascular disease occurs further down the leg than in people without diabetes, between the knee and the ankle.
The mobility of the joints may become limited. As a result, the normal movements of the foot change during walking, and the way the foot carries the weight of the body is altered. Any variation in the normal shape of the foot (some of which may be present before the onset of diabetes), such as bunions (hallux valgus), bony lumps or scars from previous surgery, will affect the distribution of pressure on the foot.

Changes to the distribution of pressure can lead to injuries caused by repetitive pressures, formation of callus and thick skin (hyperkeratosis) and ulcers, which usually develop where pressure is highest. An area of hard and thick callus on the foot will make the pressure even higher - like walking on a stone in a shoe. Over time, the increased pressure will cause damage to the skin, eventually resulting in a foot ulcer if no preventative measures are taken. As described above, the neuropathic foot does not ‘feel’ the pressure.

Another very important cause of foot ulceration is faulty or inappropriate footwear. Such shoes can cause severe damage to a foot which is numb from neuropathy. Problems with footwear typically include protruding seams, rough places, and shoes which are not sufficiently long, broad or deep, so that they press on the foot. Tight socks can also cause problems.

**Conclusion**

In the ways described above, neuropathy, peripheral vascular disease and changes in the shape and movement of the feet during walking (biomechanical factors) can lead to foot ulcers in people with diabetes. In addition, other factors such as not looking after the feet, or lack of appropriate education in foot care and footwear, may lead to severe foot problems. In cases where the ulcerated foot becomes infected or when ischaemia has led to gangrene, it may not be possible to prevent amputation.

**Further reading:**

The Extent of the Problem

Foot problems are serious and common

Key messages for people with diabetes

- You are at risk of foot ulceration.
- Foot ulcers can lead to amputation.
- Foot ulcers and amputations can be prevented with good foot care.

Key messages for healthcare professionals

- Half of all leg amputations are performed on people with diabetes.
- People with diabetes are up to 40 times more likely to undergo lower extremity amputation than people without diabetes. Five years after a lower extremity amputation, up to 70% of people may have died.
- With good foot care, ulcers, amputations and foot-related deaths can be prevented.

Key messages for healthcare decision-makers

- Foot problems are very expensive, common, and life-threatening. In developed countries, up to 5% per cent of people with diabetes have a foot problem. They use between 12% and 15% of healthcare resources. In developing countries, the latter figure may be as high as 40%.
- Approximately 15% of all people with diabetes will have a foot ulcer at least once during their lifetime.
- Up to 85% of all amputations begin with an ulcer.
- Studies have shown that foot ulcers can be prevented and successfully treated. It is likely, therefore, that many amputations are also preventable.
The Extent of the Problem

A wide range of foot problems

People with diabetes are prone to a wide range of foot problems. These are related to nerve damage and poor blood supply, or to factors such as poor shoes and injury. Foot problems range from dry, thin skin, and fungal infections to more serious problems, including foot ulcers and bone infections.

Foot problems vary in different populations and different countries: problems which are commonly found in one country may be rare or absent in another. This makes it very difficult to gauge the extent of foot problems worldwide. Most information comes from research studies that look at numbers of foot ulcers and lower extremity amputations in certain groups of people with diabetes. In addition, some reports mention deaths associated with ulceration or amputation. More recently, researchers have focussed upon financial costs and quality of life in people with diabetic foot problems (see pages 36 - 39).

Common in people with diabetes

Foot ulcers are very common in people with diabetes. The complications associated with the condition make the foot particularly vulnerable. People with numb feet do not notice injuries that can lead to ulceration or do not consider an injury or indeed an ulcer sufficiently serious to seek medical attention.

In developed countries, research has shown that up to 5% of people with diabetes who visit their doctor have foot ulcers and that 15% of all people with diabetes will be affected by an ulcer at least once during their lifetime. One in five of all people with diabetes in hospital is there because of a foot ulcer. Figures from developing countries are scarce. However, the data we do have shows higher prevalence rates, possibly due to barefoot walking and more difficult access to appropriate foot care. The tragedy is that most foot trouble is preventable with good foot care and suitable footwear.

Up to 85% of all amputations begin with an ulcer. If ulcers can be prevented, then amputations can also be prevented. It is therefore very important to provide adequate treatment of diabetic foot ulcers. Work over the past two decades has shown that foot care can be very effective in the reduction of ulcers and amputations. New treatments have been developed to heal ulcers quickly. The impact of education on reducing the numbers of ulcers appears to be positive. Although information on this topic is limited, studies have shown that suitable educational programmes may lead to a three-fold reduction in re-ulceration. Foot-care programmes that are supported by regular podiatry have been very effective in reducing foot ulceration.
The Extent of the Problem

Amputation

Every 30 seconds a lower limb is lost to diabetes

The epidemiology of diabetes-related lower-extremity amputations has been the topic of many publications. Much more information is available on numbers of amputations than on the numbers of ulcers.

There is general agreement that half of all amputations happen to people with diabetes.

Higher amputation rates have been reported from some locations and among certain populations. The rates may vary as a result of such factors as ethnicity, age and because records may include some types of amputation that are not recorded as amputations elsewhere.

A person with diabetes is up to 40 times more likely to suffer a lower extremity amputation than one without diabetes.

A person with diabetes is up to 40 times more likely to suffer a lower extremity amputation than a person without diabetes. However, amputation rates vary tremendously. Worldwide, the reported figures range from as few as five for every 10,000 people with diabetes per year to a staggering 180 for every 10,000 people. Again, there is hardly any information from developing countries. Several studies have shown a significant reduction in amputations over time. In the Netherlands, amputations in people with diabetes decreased by over 30% over a ten-year period.

The reason for this reduction in amputations was increased availability of specialized diabetic foot care. While similar success stories have been reported in Sweden, Denmark, UK and Spain, some developed countries have not experienced similar reductions. The overall trend appears to be that, in countries with specialized diabetic foot centres, a 60% reduction in amputations can be achieved by a combination of:

- a multidisciplinary approach that includes preventative foot care
- education in foot care and footwear for people with diabetes and healthcare professionals

Mortality

Amputations are life-threatening

Leg amputations frequently lead to death in people with diabetes. By the time an amputation is necessary, people have usually had diabetes for many years and often have severe complications. Death around the time of the amputation occurs in up to 10% of cases. The rates increase over the next five years: 30% of people who have undergone amputation die within one year, 50% die within three years and 70% die within five years.

In developing countries, these figures tend to be even higher because many people only seek medical attention when their foot problem is so far advanced that their limbs and their lives are threatened.
The Extent of the Problem

The impact of diabetic foot disease on people’s lives is devastating

In many cases, an ulcer is a pivotal event that leads to a disastrous progression of events and ends in an amputation. The lives of people after an amputation are profoundly affected: many are unable to work, become dependent upon others, and cannot pursue an active social life. Studies examining the quality of life of people with diabetic foot ulcers have also shown decreased physical, emotional and social function. Recovery from foot ulcers may require several months of treatment and rehabilitation. Depression is common. Many live with the fear of recurrent ulcers, repeated bouts of infection, and potential life-long disability.

A significant economic problem

Diabetic foot complications result in huge costs for both society and people living with diabetes. While few reports on the health-economic consequences have been published, results have been consistent. In developed countries, up to 5% of people with diabetes have a foot problem. They use between 12% and 15% of healthcare resources. In developing countries, the latter figure may be as high as 40%. In Western countries, the economic cost of a diabetic foot ulcer has been estimated to be between US$7,000 and US$10,000. The direct cost of an amputation associated with the diabetic foot is estimated to be between US$30,000 and US$60,000. The estimated cost for three years of subsequent care for a person whose ulcer has healed without the need for an amputation is from just over US$16,000 to nearly US$27,000. The corresponding cost for a person who eventually needs an amputation ranges from US$43,000 to US$64,000 - mainly due to the increased need for home care and social services. Prevention of foot ulcers and amputations by various methods, including education, proper footwear, and appropriate foot care has been shown to be cost-effective or even cost-saving in people at risk. (see pages 40 - 48)

Foot disease, ulcers and amputations are still very common among people with diabetes. The destructive impact of these events on people with diabetes and on society as a whole is enormous. Fortunately, there are ways to prevent this major public health problem by organizing appropriately structured foot care. Reduction in ulceration and amputation may be accomplished by taking simple steps thus improving the lives of people with diabetes worldwide.

Further reading:

Social Factors

The impact of foot ulcers upon quality of life

- Beliefs and expectations about health and illness relating to diabetes and the diabetic foot have to be taken into account when preventing and managing diabetic foot problems.

- People with foot ulcers and amputations often suffer from depression, and have reduced quality of life.

- Social isolation, poor education and low socio-economic status place people with diabetes at higher risk of foot problems due to limited access to care.
Social Factors

A substantial impact on the quality of life and well-being of people with diabetes

Foot complications have a substantial impact on the quality of life and well-being of people with diabetes. Recent research has focused on a number of psycho-social factors, including:

- how social and economic factors influence behaviour
- how emotions can erect barriers to care
- how foot ulceration and amputation can impact upon quality of life

How social and economic factors influence behaviour

The research indicates that people with diabetes are at increased risk of amputation when they are socially isolated because they live alone, have few friends or relations, and/or are unable to go out (or choose not to go out). Risk is shown to be further increased when levels of education are low and/or when people have low socio-economic status. Support from family and social services was found to be particularly important for people with impaired vision and a reduced ability to walk. Subjective reports revealed that people with non-healing diabetic foot ulcers felt that their foot problems were putting a strain on their family relationships. The need for an understanding spouse or partner and good access to high-quality professional foot care was highlighted.

How emotions can erect barriers to care

Many people feel frustrated and angry because of uncertainty about whether their foot ulcer will ever heal. They fear amputation and are subject to feelings of depression. Many feel irritated because they do not experience symptoms. Despite their ulcer, they feel perfectly well and yet are expected to reduce their level of physical activity.

Foot complications

Risk of amputation increases when people with diabetes are socially isolated

Feelings of embarrassment

Treatment of diabetic foot ulcers often requires people to use special shoes or other off-loading devices (see pages 74 - 80). These devices make the existence of a medical problem obvious to other people. This can often lead to feelings of embarrassment in people with foot ulcers. This is particularly the case if the ulcer takes a long time to heal. Irrespective of whether or not people with diabetic foot ulcers experience pain, they feel that their quality of life is reduced.
Social Factors

It was recently reported that people with diabetes who had chronic foot ulcers or had undergone amputation were more depressed and had poorer overall quality of life than people with diabetes who had no ulcer or amputation. They also had more problems with their employment and experienced greater psychological stress. A Swedish study compared the health status of people with diabetes who had experienced foot complications. It included people with current foot ulcers, people with healed ulcers, and people who had undergone minor or major amputations. The authors showed that the health of people with foot ulcers was worse than people with healed ulcers and/or minor amputations.

How foot ulceration and amputation can impact upon quality of life

People with foot ulcers have a more ‘negative attitude’ towards the feet than people without ulcers and experience poorer quality of life than people with neuropathy who do not have ulcers. Ulcers are more likely to recur in people who have severe neuropathy and foot deformity when they are depressed and do not attend medical services regularly.

There are major differences between men and women with regard to beliefs about health, illness, and attitudes towards preventative foot care. The same is true of people from different ethnic backgrounds. Studies have shown that men use podiatric services less frequently than women. Economic considerations have also been shown to restrict access to foot care.

The loss of mobility as a result of a chronic, non-healing foot ulcer leads to severe limitations in the activities of daily living, including leisure activities and employment. Approximately half of people with diabetic foot ulcers in one study were frequently absent, had to retire early, or had lost their jobs. Career opportunities had sometimes been missed. Because of limited mobility, people with diabetic foot ulcers lost friends and were unable to keep up an active social life.

In studies where social and economic factors were ignored, it was found that people from ethnic minorities living in western countries were more likely to undergo an amputation. However, in studies where socio-economic factors were controlled, ethnic minority status alone was found be unrelated to an increased risk of amputation.
The importance of education in foot care

Education and awareness are very important. In one study, only 56% of foot problems were detected by the people who had the problems. The remaining ulcers were found by relatives or healthcare staff. Most research into the value of preventative foot care has found that following advice is an important aspect. However, many may be unaware of the potential danger of a foot ulcer because of neuropathy or poor vision.

Delays in treating foot ulcers may be attributable to the person requiring treatment or to healthcare professionals, both groups can underestimate how severe a foot problem is and fail to recognize that the blood supply to the foot is poor.

A recent study found that people with diabetes who believe that pain is a reliable symptom of foot ulceration are less likely to seek foot care or follow advice. The authors showed that foot ulcers are more likely to heal if such misunderstandings are corrected, thereby improving quality of life.

Recent investigation has gone beyond what goes wrong with the diabetic foot to consider how living with diabetic foot problems impacts upon quality of life. This has extended awareness of the profound effects of foot ulceration and amputation to reveal how they devastate people’s personal and emotional lives. In future, this may provide greater insight into behavioural patterns and may help find ways to overcome some of the psychological barriers to effective treatment.

Further reading:

**Economic Factors**

**Pay now, save later!**

- Protecting your feet with appropriate footwear and learning what you can do to look after your feet will help you to prevent foot ulcers, decrease the risk of amputation, and will help keep down the costs of your healthcare.

- Do not focus too much on unit costs for wound dressings, single products or management procedures. Establish a broader view that considers total resource use and includes quality of life as well as final outcome of the different management strategies under consideration.

- Identifying people with diabetes at risk of developing foot ulcers and taking the appropriate preventative measures would be cost-effective or even cost-saving. Investing resources in both would reduce total costs to society and improve quality of life.

- The heavy cost burden of diabetic foot complications falls on the healthcare sector, people with diabetes and their families, and society as a whole. The reduction of these costs and improvements in the quality of life of people with diabetes require investment in the prevention of ulcers and amputations.

### Key messages for people with diabetes

- Protecting your feet with appropriate footwear and learning what you can do to look after your feet will help you to prevent foot ulcers, decrease the risk of amputation, and will help keep down the costs of your healthcare.

### Key messages for healthcare professionals

- Do not focus too much on unit costs for wound dressings, single products or management procedures. Establish a broader view that considers total resource use and includes quality of life as well as final outcome of the different management strategies under consideration.

### Key messages for healthcare decision-makers

- Identifying people with diabetes at risk of developing foot ulcers and taking the appropriate preventative measures would be cost-effective or even cost-saving. Investing resources in both would reduce total costs to society and improve quality of life.

- The heavy cost burden of diabetic foot complications falls on the healthcare sector, people with diabetes and their families, and society as a whole. The reduction of these costs and improvements in the quality of life of people with diabetes require investment in the prevention of ulcers and amputations.
Health economics and cost-effectiveness

Economic evaluations have become an important tool for decision making and for the allocation of scarce resources. In order to assess the cost-effectiveness of a treatment, both health effects (outcome) and the costs associated with the treatment strategy or technology must be considered and compared with the available alternatives.

A number of treatments aimed at preventing foot ulcers and accelerating the healing of foot lesions are available. Effective strategies for preventing amputations when ulcers occur are also available. In addition, treatment related to management and care has been developed to help people in the event of amputation.

Typically, the results of cost-effectiveness analyses of interventions aimed at treating the diabetic foot are presented as cost per life year gained or cost per ulcer-free week. If quality of life is included in the analysis (which is preferable), the results could be presented as cost per quality adjusted life year (QALY) gained.

In many publications, a variety of strategies have been claimed to be cost-effective in preventing the occurrence of foot ulcers and the subsequent complications that may lead to amputation. These statements have often been based on the fact that the management of diabetic foot ulcers is costly, especially ulcers that end up in amputation. Examples from different countries of the direct costs for primary healing, healing with amputation, and long-term direct costs in a three-year period after healing are displayed in tables one to three (see pages 44 - 46). In addition to the direct costs, there are also indirect costs related to the loss of productivity that occurs when people cannot work because of foot ulcers and amputations. Many authors say that a treatment is cost effective if it prevents foot ulcers and amputations or if it reduces the time it takes for a wound to heal. The most common type of health-economic studies of the diabetic foot is the evaluation of different ulcer dressings and other materials used for local wound care.

Thus far the evidence base for cost-efficacy is small. It is difficult to conduct studies in wound healing and amputation prevention because of the long time it can take wounds to heal, the complex treatments associated with a variety of different approaches, and the financial costs associated with studies. The complexity of the management of the diabetic foot has therefore resulted in the increasing use of economic modelling during recent years.

The possibilities of evaluating strategies to manage the diabetic foot and to prove cost-effectiveness are thus limited. Some of the problems with designing health-economic studies of the diabetic foot could be solved by performing model simulations where many variables are included and considered at the same time. The modelling technique is especially useful in the absence of long-term follow-up and where new technologies have not yet been sufficiently evaluated. The method allows a longer perspective, which is important in the evaluation of diabetic foot interventions and allows extensive analysis of uncertain factors. Model simulation has attained acceptan- ce for health-economic evaluation by reimbursement authorities in various countries.
**Economic Factors**

**The cost-effectiveness of prevention**

In 2001, the results of a cost-utility analysis of the prevention of diabetes-related foot ulcers and amputations were published. In a model simulation for people with diabetes and different risk factors, optimal prevention, including patient education, foot care and appropriate footwear according to present international recommendations, was compared with actual prevention and standard care in a Swedish population. The results from the study show that providing all people at risk or high risk of diabetic foot ulcers and amputations with adequate prevention would be highly cost-effective or even cost-saving in some of the subgroups.

For people with no further risk factors except diabetes, additional preventative measures to avoid foot ulcers and amputations would not be cost-effective. The resources should therefore primarily be spent on people with sensory neuropathy, people with sensory neuropathy and peripheral vascular disease and/or unusually shaped feet and on people who previously have had a foot ulcer or have undergone amputation.

In a similar model simulation in 2004, the conclusions from the previous study were confirmed. The authors concluded that the management of the diabetic foot according to present guidelines would result in improved survival and a reduced number of diabetic foot complications. In addition, it would be cost-effective or even cost-saving compared to standard care.

A recently published study also confirms that prevention programmes are highly cost-effective for people at high risk of diabetic foot ulcers and lower extremity amputations.

A prerequisite for interventions to be cost-effective is that people with diabetes choose to follow the preventative recommendations of their healthcare team. The incentives to do so may be low when the costs for prevention have to be paid by the person with diabetes, while the cost for treatment is covered by the healthcare system.

**Interventions to increase the speed of wound healing**

Cost-effectiveness analyses of local wound treatment are more frequently reported than studies of preventative strategies, although the number of published reports is still limited. In recent years, a number of reports have indicated the cost-effectiveness of different new technologies and dressings used for the local treatment of diabetic foot ulcers. Although many of these products are more expensive than the compared standard treatment, the use of them may be cost-effective if they result in less frequent dressing changes and/or if they result in more effective and faster healing with a lower probability of amputation.
Economic Factors

It is the treatment with a specific ulcer dressing in a particular patient population that could be cost-effective and not the dressing per se. It is important to be aware that a treatment could be cost-effective in one group of people but not in another. A specific treatment may be a cost-effective alternative for one type of ulcer but not for another. Similarly, a treatment strategy with a dressing could result in different levels of cost-effectiveness in subgroups of people with diabetes, depending for example on age, risk factors, or presence of other complications. An intervention could also be cost-effective when used in one setting or country but not in another.

Conclusions

The evidence that we have indicates that providing all people with diabetes at risk or high risk of foot ulcers and amputations with adequate prevention according to present guidelines would be a cost-effective or even cost-saving strategy.

It is, however, important to note that the results from cost-effectiveness analyses of different dressings and topical treatment strategies should be interpreted carefully since the cost-effectiveness could differ a lot between subgroups of people. In order to draw more solid conclusions, further health-economic evaluations of the treatment of the diabetic foot are needed. Research in this area should be encouraged.
### Table 1. Costs of treating foot ulcers not requiring amputation

<table>
<thead>
<tr>
<th>Reference</th>
<th>Country</th>
<th>No. of patients</th>
<th>Costs (year of costing)</th>
<th>1998 US$ Equivalent</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apelqvist et al, 1994 (^{[9]})</td>
<td>Sweden</td>
<td>197</td>
<td>SEK $1,000 (1990)</td>
<td>8659</td>
<td>All ulcer types; total direct costs</td>
</tr>
<tr>
<td>Harrington et al, 2000 (^{[10]}_{b})</td>
<td>USA</td>
<td>400,000</td>
<td>US$ 3999-6278 (1996)</td>
<td>4238-6653</td>
<td>Inpatient and outpatient costs</td>
</tr>
<tr>
<td>Holzer et al, 1998 (^{[11]}_{b})</td>
<td>USA</td>
<td>1846(^{c})</td>
<td>US$ 1929 (1992)</td>
<td>2452</td>
<td>Inpatient and outpatient costs; those&gt;64 y.o. excluded</td>
</tr>
<tr>
<td>Metha et al, 1999 (^{[12]}_{b})</td>
<td>USA</td>
<td>5149</td>
<td>US$ 900-2600 (1995)</td>
<td>993-2855</td>
<td>Private insurance charges; mean age 51 years</td>
</tr>
<tr>
<td>Ragnarson Tennvall et al, 2000 (^{[13]}_{a})</td>
<td>Sweden</td>
<td>88</td>
<td>SEK 136,600 (1997)</td>
<td>17,519</td>
<td>Deep foot infection; total direct costs</td>
</tr>
<tr>
<td>Ramsey et al, 1999 (^{[14]}_{b})</td>
<td>USA</td>
<td>514(^{d})</td>
<td>US$ 27,987 (1995)</td>
<td>30,724</td>
<td>Including 2 years after diagnosis</td>
</tr>
<tr>
<td>Van Acker et al, 2000 (^{[7]})</td>
<td>Belgium</td>
<td>120</td>
<td>US$ 5227 (1993)</td>
<td>5658</td>
<td>Inpatient and outpatient costs</td>
</tr>
</tbody>
</table>

For comparison of the results, costs were first adjusted for inflation to 1998 prices with a medical care index for Sweden and USA and with the consumer price index for Belgium \(^{[15-18]}\). The Swedish currency was then transformed to US$ with the appropriate currency exchange rate for 1998 \(^{[15-18]}\).

\(^{a}\) Based on data from observational studies.

\(^{b}\) Based on data from databases and other secondary sources.

\(^{c}\) No. of episodes.

\(^{d}\) Includes 80 amputations.

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**Economic Factors**
### Table 2. Costs of lower extremity amputations (all causes) in people with diabetes

<table>
<thead>
<tr>
<th>Reference</th>
<th>Country</th>
<th>No. of patients</th>
<th>Costs (year of costing)</th>
<th>1998 US$</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apelqvist et al, 1994 a</td>
<td>Sweden</td>
<td>27</td>
<td>SEK 258,000 (1990)</td>
<td>43,800</td>
<td>All ulcer types; minor LEA; total direct costs</td>
</tr>
<tr>
<td>Apelqvist et al, 1994 a</td>
<td>Sweden</td>
<td>50</td>
<td>SEK 390,000 (1990)</td>
<td>66,215</td>
<td>All ulcer types; major LEA; total direct costs</td>
</tr>
<tr>
<td>Ashry et al, 1998 b</td>
<td>USA</td>
<td>5062</td>
<td>US$ 27,930 (1991)</td>
<td>38,257</td>
<td>Hospital charges only</td>
</tr>
<tr>
<td>Cheshire et al, 1992 a</td>
<td>UK</td>
<td>67</td>
<td>£ 10,863 (1989)</td>
<td>25,706</td>
<td>Inpatient and outpatient costs (25% pwds)</td>
</tr>
<tr>
<td>Gibbons et al, 1993 b</td>
<td>USA</td>
<td>7</td>
<td>US$ 18,341 (1990)</td>
<td>27,328</td>
<td>Inpatient care</td>
</tr>
<tr>
<td>Gupta et al, 1988 b</td>
<td>USA</td>
<td>24</td>
<td>US$ 27,225 (1978-81)</td>
<td>79,495</td>
<td>Event + 3 year charges (83% pwds)</td>
</tr>
<tr>
<td>Holzer et al, 1998 b</td>
<td>USA</td>
<td>504c</td>
<td>US$ 15,792 (1992)</td>
<td>20,047</td>
<td>Gangrene/amputation, those&gt;64 y.o. excluded</td>
</tr>
<tr>
<td>van Houtum et al, 1995 b</td>
<td>Netherlands</td>
<td>1575c</td>
<td>NLG 28,433 (1992)</td>
<td>16,488</td>
<td>Hospital costs only</td>
</tr>
<tr>
<td>Johnson et al, 1995 b</td>
<td>UK</td>
<td>23</td>
<td>£ 12,476 (1992?)</td>
<td>24,701</td>
<td>6 months inpatient and outpatient costs (66% pdws)</td>
</tr>
<tr>
<td>Panayiotopoulos et al, 1997 b</td>
<td>UK</td>
<td>20</td>
<td>£ 15,500 (1994-95)</td>
<td>28,234</td>
<td>inpatient and prostheses costs (46% pwds)</td>
</tr>
<tr>
<td>Ragnarson Tennvall et al, 2000 b</td>
<td>Sweden</td>
<td>77</td>
<td>SEK 261,000 (1997)</td>
<td>33,478</td>
<td>Deep infection; minor LEA; total direct costs</td>
</tr>
<tr>
<td>Ragnarson Tennvall et al, 2000 b</td>
<td>Sweden</td>
<td>19</td>
<td>SEK 234,500 (1997)</td>
<td>30,083</td>
<td>Deep infection; major LEA; total direct costs</td>
</tr>
<tr>
<td>Singh et al, 1996 b</td>
<td>UK</td>
<td>34</td>
<td>£ 10,162 (1996)</td>
<td>18,009</td>
<td>Event + first year costs (44% pwds)</td>
</tr>
<tr>
<td>Van Acker et al, 2000 b</td>
<td>Belgium</td>
<td>7</td>
<td>US$ 18,515 (1993)</td>
<td>19,996</td>
<td>Inpatient and outpatient costs; minor LEA</td>
</tr>
<tr>
<td>Van Acker et al, 2000 b</td>
<td>Belgium</td>
<td>9</td>
<td>US$ 41,984 (1993)</td>
<td>45,343</td>
<td>Inpatient and outpatient costs; major LEA</td>
</tr>
</tbody>
</table>

For comparison of the results, costs were first adjusted for inflation to 1998 prices with a medical care index for Sweden and USA and with the consumer price index for the other countries and then transformed to US$ with the appropriate currency exchange rate for 1998 [15-18, 29]. NA = not applicable. LEA = Lower Extremity Amputation. Minor = amputation below the ankle; major = amputation above the ankle; pwds = people with diabetes.

a Based on data from observational studies.
b Based on data from databases and other secondary sources.
c No. of episodes.
d No. of hospitalizations.

The content of Table 1 and Table 2 has previously been published in Clinical Infectious Diseases 2004:39 (Suppl 2); S132-S139 [8]. Permission to reproduce the tables has been obtained from The University of Chicago Press.
Table 3. Long-term (3 years) direct costs after primary healing or healing with amputation.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Country</th>
<th>No. of patients</th>
<th>Costs (year of costing)</th>
<th>1998 US$ Equivalent</th>
<th>Comments</th>
</tr>
</thead>
</table>

Costs were adjusted for inflation to 1998 prices with a medical care index for Sweden and then transformed to US$ with the appropriate currency exchange rate for 1998 [18]. LEA = Lower Extremity Amputation. Minor = amputation below the ankle; major = amputation above the ankle.

Economic terms explained

**Direct costs**: all the resources that are consumed to provide a particular medical or social service, including costs paid out-of-pocket by patients and costs paid by government health systems and health insurers.

**Indirect costs**: a controversial category, because of the difficulty in knowing the net ripple effects of a disease or an expenditure through the rest of the economy. Sometimes it is measured as the total sum of goods and services not produced by a person because of their illness, or because of premature death, and the lost productivity in the case that someone has to leave a job to care for the ill person.

**Utility**: The value of a duration of life that has been modified to account for the negative impacts of impairments, functional disabilities, perceptions and social opportunities that are caused by a disease or disorder and its treatments. Theoretically, this modification is usually understood to be the largest proportion of a unit of life with a given health condition that someone would be willing to ‘trade off’ in order to spend the complementary proportion of time in perfect health.

**Cost-utility analysis**: This is a type of economic analysis that measures benefits in utility-weighted life-years (see, for example, ‘QALY’, above) and compares the relative efficiency of different health-related interventions according to the ratio of intervention cost to a common measure of utility.

**Quality of life**: A term that has many meanings depending on the intention of the user and the context in which the term is used. Usually, it refers to subjective (self-reported) assessments, either by the affected individual or by others who have been asked to imagine the impact of a disease or condition. (Affected individuals typically give higher ratings than unaffected individuals.) Quality of Life can refer to perceived well-being or more narrowly to functional status (the ability to perform work and other social roles). In economic analyses, measures of quality of life are usually global and are used to modify the value of units of being alive, i.e., a Quality-Adjusted Life-Year, yielding numbers that can stand for the utilities of years of life with various health conditions.

**QALY**: Quality-Adjusted Life Year. This is a measure of utility or life expectancy that takes into account both the quantity and the quality of life - for example one year of ‘perfect’ quality of life is equivalent to 2 years of life at a quality-of-life adjusted level of 0.5.
Economic Factors

References:

Diagnosis & treatment

How to identify diabetic foot problems
How to treat a diabetic foot ulcer
Diagnosis

How to identify diabetic foot problems

• You should be examined at least once a year for potential foot problems.
• If you have nerve damage, you might not experience pain. Be aware that no pain does not mean no problems.
• Ill-fitting shoes can harm your feet. Make sure that you receive good advice from an expert.
• All people with diabetes should be examined at least once a year for potential foot problems. People at higher risk should be examined more often.
• It is important to realize that the absence of symptoms may not mean that the feet are healthy. It may indicate neuropathy.
• Screening of the diabetic foot does not have to be done by a doctor, or a podiatrist. It can be performed by others so long as they have been carefully trained to assess the situation and react appropriately to the findings.
• There is no such thing as a trivial lesion of the foot in people with diabetes.
• Shoes should be assessed to ensure that they are adequate and suitable. Look at the wear marks on the soles and check the shoes both inside and out.
• Good equipment must be provided to diagnose foot problems in people with diabetes before the problems get worse and become more costly to treat.

“For one mistake made for not knowing, ten mistakes are made for not looking.”

JA Lindsay
Diagnosis

The key to success: regular examination of the diabetic foot

Looking at diabetic feet regularly and acting rapidly to treat any problems is the key to success for people with diabetes and for healthcare practitioners. The feet of people with diabetes, in particular those at risk of developing ulcers, should be inspected during every visit to the clinic. It is important to make a careful examination and assessment of the feet before taking any decisions about treatment or referrals. However, the time of the healthcare professional and the person with diabetes is extremely valuable. It is important, therefore, not to waste time with unnecessary procedures. Nevertheless, all people with diabetes should be examined at least once a year for potential foot problems, and people with demonstrated risk factor(s) should be examined more often (every 1-6 months).

What you should know about a person with a diabetic foot problem

Before examining the feet, a careful history should be taken. It is important to realize that the absence of symptoms does not mean that the feet are healthy, since the person can have neuropathy (nerve damage and numbness), peripheral vascular disease (poor circulation) or even an ulcer (any lesion of the skin) without complaining of any pain or other problems. For this reason, the healthcare professional needs to search for signs and symptoms of foot problems.

The following items should be addressed:

- previous ulcer or amputation
- level of knowledge of foot care
- lifestyle and social circumstances
- neuropathy: tingling or loss of sensation
- vascular disease: claudication (pain during walking), rest pain, discoloration on dependency (vascular problems can be identified by a change in colour when the position of the legs is changed from horizontal to hanging down freely)
- presence of deformities
- use of footwear

Other important risk factors include kidney problems, callus (hard skin), poor vision, socio-economic problems, old age, and being male. In addition, the healthcare professional should be informed about whether there has been a recent check of HbA1c, blood pressure and blood fats (lipids).

Also, information should be obtained regarding:

- smoking history
- visits to a general practitioner or the diabetes clinic
- whether the eyes have been examined and, if so, the existence of any eye problems
- overweight
- current difficulties with diabetes control
Diagnosis

Examine the whole foot, including the heel, the nails and between the toes.

Neuropathy

Fissures and cracks

Regular foot examination

What does the diabetic foot tell us?

Screening of the diabetic foot does not have to be done by a doctor or a podiatrist. It can be performed by other people so long as they have been carefully trained to assess the situation and react appropriately to the findings.

The aims of screening are:

- to detect the presence of important problems
- to act upon the findings
- to refer the person with diabetes on to somewhere else if necessary

The feet should be examined with the patient lying down and standing up. The shoes and socks should also be inspected. Both feet and lower limbs are visually inspected and felt, not forgetting the areas between the toes, nails and the back of the heel. While examining the feet, the examiner should gain an overall impression of whether the feet are being well looked after, and ensure that the person is able to understand and undertake basic foot care.

The examination of the feet should detect the presence or absence of the following problems:

- neuropathy (nerve damage)
- ischaemia (poor blood supply)
- deformity
- non-ulcerative pathology
- ulcer or other breaks in the skin
- infection
- unsuitable footwear

When a diabetic foot has lost sensation

The presence of neuropathy is detected by careful inspection of the feet. Neuropathic feet are warm feet with bounding pulses. Swollen veins on the top of the foot may be seen, and dry skin and fissures (cracks) caused by decreased sweating. Neuropathy may affect the muscles and result in clawed toes and a raised arch.

Testing of the sensation in the feet can be done by using a ten-gram monofilament on the end of the big toe and other pre-agreed sites. A tuning fork or cotton wool can also be used. Nerve damage can be measured (quantitated) in more detail by using a neurothesiometer. This device delivers a vibratory stimulus to the foot that increases in strength as voltage to the machine is raised by turning a knob.
When the blood supply to the foot is poor

When the blood supply to the foot is poor (ischaemia), the tissues become thin and wasted. The feet are cold and there may be a bright pink colour. The temperature of the feet should be checked and the colour carefully inspected. In cases where the blood supply is very poor, dead tissue (gangrene) may be seen. Pulses should be examined by touch in the groin, knee, behind the ankle and on the top of the foot. Ischaemia can be quantitated by means of a blood pressure cuff and a small hand held ‘Doppler’ (a machine that can detect the movement of blood cells within the blood vessels and measure blood flow). Even when the foot pulses can be felt easily, it is useful to measure blood flow and record its strength so as to have a figure against which to measure future deterioration. The measurement of ankle pressure is mostly expressed as an ‘ankle brachial index’ (ABI), in which the systolic blood pressure at the level of the ankle is divided by the systolic blood pressure at the upper arm. A normal value is between 0.9 and 1.15. Any value under 0.9 denotes a compromised perfusion of the feet.

A more specialized technique to determine the vascular status is the use of transcutaneous oxygen measurements (TcPO2). This involves the use of a machine to measure the amount of oxygen in the skin. Duplex angiography can also be used. This is a test to measure blood flow in the leg. All of these tests will help to assess the blood supply to the leg and foot. However, most information can be obtained by performing angiography, where the blood vessels are made visible by injecting a contrast media into the arteries.

When a diabetic foot presents structural abnormalities

As deformities of the feet cause an increase in foot pressure, the presence of such risk factors should be carefully ascertained. Inspect the feet for claw toes, raised arch, limited joint mobility (stiffness) and bony prominences.

Some patients with neuropathy develop non-infectious destruction of bone and joint associated with neuropathy (Charcot foot) and the foot changes shape. Any previous amputation places the foot at increased risk.
Diagnosis

Non-ulcerative pathology

Never underestimate minor lesions

Other foot problems (non-ulcerative pathology) that need to be detected and treated are: fungal infections (tinea pedis), small hard benign growths on the skin caused by a virus (verucca, warts), blisters (bullae) and nail deformities such as ingrown toenails (onychocryptosis), thickening of the nails (onychauxis) and/or deformities of the nails (onychogryphosis).

Ulcer

When a diabetic foot has become ulcerated

Evaluation of the ulcerated foot should be standardized and act as a guide to further therapy. The cause of the ulcer should be determined. The type of ulcer should be classified as neuropathic or neuro-ischaemic. Size and depth should be measured. A search must be made for signs and symptoms of infection, because infection in a diabetic foot presents a direct threat of amputation. It should be taken very seriously and needs prompt and thorough treatment.

Infection

When a diabetic foot has been infected

The regular signs of infection may be lacking in people with diabetes. However, the skin should be inspected and felt to detect colour change, increased warmth, swelling, discharge, bad smell and pain. The presence of a fever should be checked. Sometimes shivering and malaise (general feeling of being weak, tired and unwell) are the only signs of a possibly life-threatening infection. Whenever infection is suspected, adequate samples should be taken. Preferably, these should be obtained from the bottom of the lesion after careful debridement. Tissue samples or swabs are then sent to the laboratory to see which germs are found (microscopy and culture).

Previous microbiology results should also be checked. If available, more advanced methods can be used to ascertain the spread of the infection or the possible presence of infected bone (osteomyelitis), which means that infection is more widespread.

In this serious condition more rigorous treatment is essential. X-ray, CT scan, MRI and nuclear imaging are sometimes used to assist with diagnosis. For more detailed information regarding these techniques the reader is referred to the International Consensus on the Diabetic Foot.

There is no such thing as a trivial lesion of the diabetic foot.

There is no such thing as a trivial lesion of the diabetic foot. Apparently minor lesions can lead to an ulcer and provide an entry point for infection to spread; they should never be underestimated. The foot should be inspected for the presence of hard skin (callus) and corns (hyperkeratosis). These may be associated with cracks, colour change and blistering. Special attention should be paid to those areas of callus formation in which some apparent bleeding may have occurred because an ulcer may be imminent or already present underneath the callus.
Diagnosis

**Ill-fitting shoes can harm your feet**

The examiner should check the shoes for size, style and state of wear. The shoes should be assessed to ensure that they are adequate and suitable. Wear marks on the soles should be checked both inside and out. The examiner should make a careful inspection for protruding seams or nails inside the shoes that might cause injury.

*Seams causing ulcer in a neurophatic feet*

Accurate diagnosis of diabetes-related foot problems is essential. People with diabetes need to have their feet checked regularly for signs of problems or for risk factors that may lead to problems. In people with a higher risk of developing foot ulcers, the frequency of inspections should be increased, depending on the level of risk. Any problems should be dealt with promptly and precisely by qualified healthcare professionals. The guidelines provided in the International Consensus on the Diabetic Foot and Practical Guidelines on the Management and the Prevention of the Diabetic Foot should be implemented and followed to ensure that people with diabetes receive the foot care they deserve.

*Further reading:*

Treatment

How to treat a diabetic foot ulcer

- The total contact cast and its variations are currently seen as the most effective devices to off-load pressure.
- About 50%-60% of serious foot infections, and perhaps 10%-20% of apparently less severe infections, are complicated by osteomyelitis (bone infection).
- While assessing a diabetic foot ulcer it is important to debride the wound adequately.
- Callus, nail and skin problems should be treated regularly in people with high-risk feet.

Key messages for healthcare professionals

- Self-care may be fundamental in treating the diabetic foot. Sufficient and appropriate education of people with diabetic foot ulcers as well as those in a position to help them should be provided.
- Once people have had a foot problem related to diabetes, they must be included in a comprehensive foot-care programme for the rest of their lives.

Key messages for healthcare decision-makers
Introduction

There are many causes of diabetic foot ulcers and many different treatments are required. The most important principles of ulcer treatment are as follows:

1. Relief of pressure
2. Restoration of good blood supply to the skin (perfusion)
3. Treatment of infection
4. Good control of diabetes and other medical problems
5. Local wound care
6. Education of people with diabetes and their relatives
7. Identification of the cause and prevention of recurrence
8. Treatment of other foot problems

Centres of excellence have achieved ulcer-healing rates of up to 85% when all the above factors have been included in the treatment strategy. It is important to recognize that the ulcer may be a sign of more widespread diabetes-related problems. For example, many people with diabetic foot ulcers have heart or kidney problems.

Even the best possible wound care available cannot compensate for continued injury, ischaemia (poor blood flow) or infection.

Deep ulcers should be taken very seriously and may need hospital admission if local resources allow. Treatment strategies will have to be adapted to local circumstances and the principles discussed below may need to be changed to fit available facilities and resources.

Principles of ulcer treatment

As continuous pressure on the foot may worsen, relieving pressure is of key importance. People with foot ulcers should be advised to limit the amount of time they spend standing and walking. For some people, crutches can be prescribed to allow some mobility. Complete immobilization is not advisable as it is associated with thrombosis, muscle wasting and the development of pressure sores.
Several techniques of mechanical off-loading have been developed to take pressure off the foot that allow the person to walk a little. Diabetic foot specialists currently believe that the total contact cast is the most effective off-loading device. Applying a cast distributes uniform pressure over the foot and eliminates areas of continued high pressure. So long as the blood supply is good and infection not present, diabetic foot ulcers will almost always heal with this technique. However, because poor application can cause new ulcers, experienced staff are needed to apply the casts. A less labour-intensive approach to casting is the prefabricated walking brace. It is easy to apply, removable, and allows regular wound inspection. In addition, a wide range of therapeutic footwear is available, including depth-inlay shoes, half-shoes, healing sandals, and the Scotch-cast boot. For additional information the reader is referred to the section of this book that discusses off-loading in more detail (see pages 74 - 80).

In addition, removal of callus is essential. Areas of the foot subjected to high pressures will develop callus (hard skin), which makes pressures on the underlying tissues even higher. Unless callus is removed, ulcers will fail to heal and new ulcers will develop. The only safe way to remove callus is with a scalpel. This should only be done by an experienced healthcare professional (see pages 184 - 185).
In people with diabetic foot ulcers, the probability of wound healing is diminished in cases where blood flow to the foot is weak. Steps should be taken to improve the blood supply (revascularization) and restore blood flow to the skin (perfusion). For arterial revascularization, an operation is required and a bypass graft is inserted into the blocked or narrowed blood vessel. An alternative approach is percutaneous transluminal angioplasty, where a special tube containing an inflatable balloon is inserted into a blocked or narrowed artery. The balloon is inflated to clear blockages, widen the artery and thus improve the blood flow. The short and long-term results from both these techniques are usually as good for people with diabetes as they are for people without the condition. The benefits of using drugs to improve the blood supply have not yet been established.

In addition to surgical and medical treatments, it is important to ensure that known risk factors for peripheral arterial disease in people with diabetes are detected and treated. Smoking should be strongly discouraged, and hyperglycaemia, hypertension and high levels of fat in the blood (dyslipidaemia) should be treated appropriately. There is compelling evidence that most people with diabetes and arterial disease will benefit from taking anti-platelet therapy (drugs such as aspirin, or, even better, clopidogrel).

Exercise is often recommended for people with diabetes and arterial disease, and has proven beneficial. However, in people with foot ulceration, weight-bearing exercise should not be advised until the ulcer has healed. People with a previous history of foot ulcers should choose forms of exercise that are less likely to overload the feet, such as swimming or cycling.

Infected diabetic foot ulcers need to be cleaned and debrided. All dead tissue and debris should be cut away in order to reveal the true dimensions of the ulcer. The healthcare professional should determine whether the infection is superficial or deep, possibly limb-threatening.

Whenever an ulcer is infected, it is important to send a sample of the infected tissue to the laboratory, so that the germ can be identified and appropriate antibiotics chosen. It is often possible to give antibiotic tablets if the infection appears to be mild or moderate. Once the laboratory results are available, the antibiotics can be changed or reduced. If the ulcer does not improve within a few days, a different antibiotic may be needed. In more severely infected ulcers, hospital admission is required and antibiotics should be given through a vein. Surgery to remove dead tissue and drain infection may also be required to control the infection and save the leg.

**Treatment of infection**

Is the infection superficial, deep or even limb-threatening?

How to choose an appropriate antibiotic
While there is no convincing evidence regarding the optimal duration of antibiotic therapy for diabetic foot infections, most experts would advise that a 1-2 week course be considered for mild to moderate infections. For more serious infections, a longer course of antibiotics should be given. People with diabetes who have infected feet should be monitored very closely.

Many diabetic foot infections are complicated by bone infection (osteomyelitis). It is commonly believed that curing chronic osteomyelitis requires surgery to remove infected bone. However, there is some evidence that it can be treated effectively with antibiotics alone. In this situation, the course of antibiotics lasts a long time - possibly for months.

Healing of diabetic foot ulcers may be prevented or delayed if the foot has oedema (swelling). There are many different causes of oedema of the feet and legs: it may be caused by heart problems, kidney problems, blood clots or nerve damage. The treatment given will vary depending on the cause of the oedema. Good control of diabetes may improve wound healing. High levels of glucose in the blood may prevent the infection-fighting white blood cells from working properly. Insulin may be needed to achieve good control in people with type 2 diabetes and infected feet. Other health problems should be treated. Pain medication may be needed, and nutrition should be good.

Diabetic foot ulcers need to be debrided in order to remove dead tissue and debris. There are several different methods. The most common and most effective method is sharp debridement, where a scalpel is used to cut away unwanted tissue. Another technique involves the use of chemicals and enzymes, but there is no strong evidence for how effective this is. Biological debridement using fly maggots is currently under investigation. This technique may be useful for ischaemic feet, or when no podiatrist or surgeon is available to debride the foot.

Debridement should leave the wound free of dead tissue and unwanted material. The wound should be inspected regularly: if it deteriorates, further debridement will be necessary.
Treatment

If the blood supply to the foot is poor, it will be difficult for the ulcer to heal and revascularization needs to be considered. In some western countries, hyperbaric oxygen (oxygen delivered under high pressure) can be used.

In order to keep the wound clean and protected, it should be covered with a dressing. Dressings should be absorbent, non-adhesive and easily lifted. Dressings containing silver, which may reduce the likelihood of infection, are popular. The use of specific types of dressings should be guided by local expertise and availability. The wound surface should be kept moist; special dressings such as hydrogels and hydrofibers may benefit drier wounds, while excessive fluid from the wound (exudates) should be removed with absorbent preparations such as alginates. Soaking the foot in a footbath should be avoided as the skin becomes soggy (macerated), which allows germs to enter.

Over the last ten years, several new treatments have been developed. These include growth factors, such as platelet-derived growth factor. These have been shown to reduce healing time. Another new development is bio-engineered skin. These new developments may be effective in promoting healing, but they are expensive. A further development is vacuum assisted closure (VAC), which applies gentle suction to a wound through a tube attached to a pump that removes exudates. Results with this device seem promising in terms of improved blood supply and faster healing.

Informed self-care may be important for people with diabetic foot problems. Education on wound care should be given to people with diabetes and their families so that they can learn how to look after the feet and how to recognize and report signs and symptoms of (worsening) infection, such as fever, changes in local wound conditions or hyperglycaemia. Often, people with diabetes may not be able to look after their feet adequately because they cannot see or reach them, it is important in such instances to teach friends or family members how to help.

Ulceration is often a recurrent disease. It is important, therefore, to recognize the cause of each ulcer. A shoe that has caused an ulcer should never be worn again. Any underlying problems that might have caused an ulcer should be identified and treated where necessary. During the treatment of an ulcer, the other foot and leg should also be protected.

People who are confined to bed will need heel protection to prevent bed sores. All people with diabetes who have ever had a foot ulcer should be included in a comprehensive foot-protection and foot-care programme with life-long observation.

In people with high-risk feet, callus, nail and skin problems such as fungal infections should be treated regularly, preferably by a trained foot-care specialist. If possible, foot deformities should be treated non-surgically.
Conclusion

In summary, diabetic foot ulcers have many different causes and therefore should be treated by a strategy that covers most of the areas described above. The implementation of such a strategy requires collaboration between healthcare professionals from different disciplines. If followed, this strategy will help many ulcers to heal and allow many people with diabetic foot ulcers to walk again. However, not all these interventions are available or affordable in every country. Local adaptation, therefore, will be needed to suit different situations.

Further reading:
Prevention

How to identify the high-risk foot
Teaching people how to look after their feet
The importance of relieving pressure
How to identify the high-risk foot

Key messages for people with diabetes

• Ask your healthcare team to tell you whether you have or are at risk of foot problems. Ask them how best to prevent future problems.
• Your healthcare team should look at your feet at least once a year if you are at low risk of diabetic foot problems. If your risk category is higher, then inspection should be more frequent.

Key messages for healthcare professionals

• Every person with diabetes should have their feet inspected at least once a year. This should be done irrespective of the type of diabetes they have, their age and how long they have had diabetes.
• Categorizing the risk-level of a diabetic foot is crucial to the development of adequate treatment and prevention strategies.
• Good record-keeping saves legs. Managing a good tracking system is indispensable. It facilitates adequate correspondence between the diabetic foot team and healthcare professionals that may be situated elsewhere.
• The risk status and applicable treatment strategies or preventative measures should be understood by everyone involved in the care of each person with diabetes.

Key messages for healthcare decision-makers

• Identifying and categorizing feet at risk, followed by adequate preventative measures and, if necessary, by appropriate treatment, will help reduce amputation rates and save costs.
Prevention

Why regular inspection of the feet is so important

One in every six of all people with diabetes will develop an ulcer. Studies have shown that once a person has experienced an ulcer, the risk of developing a second ulcer is about 70% within the following five years. Consequently, every person with diabetes should have their feet inspected at least once a year. This should be done irrespective of the type of diabetes they have, their age and how long they have had diabetes. The frequency with which a foot should be checked should be increased according to the risk status of the foot (see below).

Looking for the right strategies

The incidence of ulceration rises with the number of risk factors present. People with diabetes who have more than one risk factor have a significantly increased risk of ulceration. Therefore, it is the healthcare professionals’ task to stratify people according to their risk of foot ulceration. This will allow treatment strategies to be developed that can specifically address the increased risk for each person attending the clinic. Once the risk factors are identified, different strategies can be followed. Either the cause of the problem can be addressed to prevent the development of an ulcer, or an identified problem can be treated. Where necessary a combination of the two should be used.

Looking for risk factors

Research indicates that the majority of risk factors associated with the development of an ulcer can be identified by asking appropriate questions (history) and by thorough examination of the foot. The person taking the history and carrying out the examination should look for the following risk factors:

- neuropathy (nerve damage)
- previous ulcer
- previous amputation
- peripheral vascular disease (poor blood supply)
- limited joint mobility
- foot deformities
- inappropriate foot wear
- delay in seeking medical attention
- poor glycaemic control
- not following advice
- long duration of diabetes
- barefoot walking
- poor vision
- social isolation
- lack of education
- nephropathy (kidney disease)
- alcohol abuse
- delay in receiving treatment
Prevention

The scoring system correlates closely with ulcer incidence

Once the risk factors have been identified, a risk categorization should be performed. The International Working Group on the Diabetic Foot provides a risk categorization system that has proved readily applicable in daily clinical practice. The scoring system, as set out above, was found to correlate closely with ulcer incidence. The frequency of check-up should always be considered case-by-case, taking into account the situation and circumstances of the individual. The categorization system should serve as a template to guide the follow-up of people with certain risk factors and should be adapted where necessary to suit local context and conditions.

<table>
<thead>
<tr>
<th>Category</th>
<th>Risk profile</th>
<th>Check-up frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No sensory neuropathy</td>
<td>Once a year</td>
</tr>
<tr>
<td>1</td>
<td>Sensory neuropathy</td>
<td>Once every 6 months</td>
</tr>
<tr>
<td>2</td>
<td>Sensory neuropathy and signs of peripheral vascular disease and/or foot deformities</td>
<td>Once every 3 months</td>
</tr>
<tr>
<td>3</td>
<td>Previous ulcer</td>
<td>Once every 1-3 months</td>
</tr>
</tbody>
</table>

Managing a good record-keeping system

As well as identifying people at risk of future ulceration, it is important that every member of the foot-care team is aware of the presence of all the possible risk factors, so that the advice given by each one of them is the same or similar. It is therefore extremely valuable to manage a good record-keeping system. This will facilitate adequate correspondence between the team and other healthcare professionals that may be situated elsewhere, for example the community nurse or the person's general practitioner. The risk status and applicable treatment strategies or preventative measures should be understood by everyone involved in the care of each person with diabetes.

Further reading:


Education for people with diabetes

Teaching people how to look after their feet

- The more you learn about your feet, the more likely you are to avoid foot trouble in the future.
- An annual assessment of your feet is an essential component of your diabetes management plan.
- You need to know how to check and look after your feet on a daily basis.

Key messages for people with diabetes

- Most of the available resources for education should be dedicated to people identified as being at the highest risk of diabetic foot complications.
- Foot problems should be identified early and treated promptly by healthcare professionals who are specially trained in the diabetic foot.
- Education should be simple, relevant, consistent and repeated.

Key messages for healthcare professionals

- Effective care and education improve health outcomes for people with diabetes and reduce pressure on national health budgets.
- Education is the basis of effective self-management.
- Foot care is of the highest quality when informed self-management is supported by a multidisciplinary foot team.

Key messages for healthcare decision-makers

Doppler examination
Education for people with diabetes

Education is fundamental to foot care

For people with diabetes, learning how to look after the feet is fundamental to diabetes care and good diabetes management. It is a vital component of a comprehensive foot-care programme. Education about diabetic foot disease is not only important for people living with diabetes and their relatives, it is also important for the healthcare professionals who look after them. Members of the diabetes team should have the skills to recognize the at-risk foot and be able to differentiate between the approaches required.

Diabetes is associated with an increased risk of foot ulceration and amputation. Though the level of risk varies, people with diabetes often receive the same generalized foot-care education, irrespective of their risk status.

It is not uncommon to hear a healthcare professional tell a person in their care: “you have to look after your feet because you have diabetes.” Yet this type of comment is meaningless and results in people at low risk of foot complications receiving information that is not relevant to their current status, and in people at high risk receiving advice that is too superficial for their particular needs. Asking a person to examine their feet every day, visit a podiatrist regularly and limit their walking is good advice for someone with severe nerve damage (neuropathy) but may be inappropriate for a person without this complication.

To individualize foot-care education, the level of risk should be assessed

In education programmes for people with diabetes, ‘foot care’ invariably appears as a topic regardless of the level of risk of the people receiving the instruction. The value of this generalized approach is questionable as it is insensitive to individual needs. In order to overcome this problem, all people with diabetes should have their feet examined and their level of risk assessed. People at low risk of foot complications who have normal sensation in and normal blood flow to their feet do not need to make significant changes to their lifestyle because they are not at risk of developing serious problems. In this low-risk group, regular foot assessment is important to ensure that the risk level remains low. In settings where resources are limited, it may not be necessary to refer people from this low risk category to a podiatrist.

People with very little feeling in their feet (this is known as insensate diabetic neuropathy and is measured by an instrument called a biothesiometer or with a 10g monofilament) or poor circulation of blood to the feet and legs (detected by feeling the pulses in the feet and sometimes by measuring the blood pressure in the foot), but no signs of serious problems such as ulceration, infection or gangrene, or Charcot foot, should be regarded as high risk. They require intensive foot-care education. They should be helped to acquire practical self-care skills and advised to see a podiatrist regularly if circumstances permit.

People with serious foot problems are at very high risk and should ideally be managed in a multidisciplinary foot clinic (see pages 98 - 105). People in this category need practical and intensive education to help them avoid further damage to their feet.

Background

Education about foot problems essential for people with diabetes and healthcare professionals

Tailor-made approaches are required

Evaluating risk level

All people with diabetes should have their feet examined and their level of risk assessed

Monofilament

Hand-doppler test
Education for people with diabetes

Focus on the development of appropriate self-care behaviours

There is little point in spending valuable time teaching people the pathophysiology of neuropathy and vascular disease. No amount of information about peripheral neuropathy and the impact of loss of sensation is a substitute for nature’s alarm system of injury: pain.

People with neuropathy often feel no pain when they have a foot problem. Because of this, the education programme should focus on the development of appropriate self-care behaviours that will enable them to overcome the problem of their apparent lack of symptoms and reduce their risk of amputation.

It is important for the educator to identify, where possible, the cause of current or previous problems and to help people to avoid similar problems in future.

Common causes of diabetic foot problems include:

- ill-fitting footwear
- increased pressures on the foot
- burns or cuts
- too much walking or running when feet are at risk

<table>
<thead>
<tr>
<th>Category</th>
<th>Risk profile</th>
<th>Check-up frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No sensory neuropathy</td>
<td>Once a year</td>
</tr>
<tr>
<td>1</td>
<td>Sensory neuropathy</td>
<td>Once every 6 months</td>
</tr>
<tr>
<td>2</td>
<td>Sensory neuropathy and signs of peripheral vascular disease and/or foot deformities</td>
<td>Once every 3 months</td>
</tr>
<tr>
<td>3</td>
<td>Previous ulcer</td>
<td>Once every 1-3 months</td>
</tr>
</tbody>
</table>

Adapted from International Consensus on the Diabetic Foot, 1999
Unsuitable shoes are the most common cause of ulceration. This means that any education programme for people at high risk must focus on the careful selection of footwear from locally available alternatives and on the importance of not walking barefoot. Shoes must be worn to protect the feet of people with diabetes. However, people with a loss of sensation in their feet need expert advice on how to select appropriate footwear.

People with diabetes should be given advice on the type of footwear to buy and encouraged to bring footwear to their educator to be checked for suitability. They should be advised to buy footwear late in the day when the feet are more swollen.

It is also important that culturally relevant shoes are prescribed. The likelihood of a person who lives in the tropics wearing an enclosed lace-up shoe will be minimal. A sandal that still protects the foot but that is likely to be worn would provide a more reasonable alternative.

People with diabetes and healthcare professionals often believe that callus is protective and should not be removed. The opposite is true. Callus and corns in the high-risk foot indicate areas of increased pressure that are vulnerable to ulceration. People with diabetes need to understand that all callus and corns should be removed regularly by a podiatrist or healthcare professional skilled in the technique of sharp debridement (this technique is illustrated on page 60 and pages 184 - 185).

The numb, neuropathic foot will not feel damage from hot, cold or sharp objects. Thus people with neuropathy need to be taught how to inspect their feet every day and how to detect signs of damage. The elderly with poor vision or decreased mobility may well need help with the daily foot check from a family member or friend. This person should be invited to the education sessions along with the person they are helping.
Education for people with diabetes

People with diabetes are often encouraged to take exercise in order to improve their metabolic control. However, walking on numb feet can lead to ulceration. People with neuropathic feet should therefore be encouraged to undertake activities that will not put extra pressure on their feet such as swimming or cycling.

The education programme should include first aid and instruction on who to contact if a problem with the foot arises. Not all people at high risk can cope with intensive practical education. There is a danger of overloading some people with too much information. Many people with diabetic foot disease may find it hard to learn self-care techniques and strategies. Therefore, for many, simply knowing who to contact when they identify a foot problem may be all that is required to avoid major problems.

Evidence has shown that education is most effective when it is interactive and involves practical activities and demonstrations rather than the traditional lecture-style format. Education should always be simple, relevant, consistent and repeated often.

Written material can complement and reinforce the education programme. However, it is important that any written material is at a level that the individual can comprehend. Any illustrations should be chosen carefully to illustrate useful practical points.

All members of the diabetes healthcare team should be knowledgeable about diabetic foot disease and be able to provide guidance. They should share responsibility for foot-care education and not leave this to the podiatrist. Information should be reinforced by all team members on a regular basis. It is therefore important to educate the educator.

The quality of education should be evaluated. This is best done by focussing on behaviour changed rather than knowledge gained. Asking someone how many times in the last week they have inspected their feet is more useful than asking someone to list the symptoms of neuropathy.
Conclusion

Existing information suggests that good education can reduce foot ulceration and amputations, especially in people at high risk of foot complications. It follows that resources should be made available to ensure that appropriate education is integrated into the foot-care programme. However, no healthcare system has unlimited resources. Those that are made available for the provision of education must, therefore, be focussed carefully, tailored to the needs of the individual, and take the level of risk into consideration.

Further reading:

Prevention

The importance of relieving pressure:
Off-loading

Key messages for people with diabetes
- If your shoes have caused a foot problem, you should no longer wear them. Ask the person (or people) who look after your feet to find a suitable alternative.
- If you have a wound on your foot, it is essential to take the pressure off the wound.
- While it can be very uncomfortable to wear some off-loading devices for long periods of time, wearing the prescribed device for as long as is required will help your ulcer to heal and may prevent amputation.
- No treatment for diabetic foot ulcers will be effective unless pressure relief with good off-loading is first addressed.
- The most effective pressure-relieving devices appear to be those that are less easily removed. The benefits of non-removable devices should be carefully explained in order to encourage their use.
- It is not what one puts on a wound that tends to heal it, but what one takes off: without good off-loading, foot wounds will not heal. Pressure-relieving devices are effective and cost-saving. Investing resources in such devices will yield short and long-term benefits in preventing and healing ulceration and will help avoid expensive amputations.

Key messages for healthcare professionals

Key messages for healthcare decision-makers
The importance of off-loading

When people stand and walk, their body weight concentrates on the soles of their feet. Areas of concentrated pressure can lead to callus (hard skin) and ulcers in people with diabetes and neuropathy (nerve damage and numbness). This pressure can be reduced by suitable shoes and insoles that spread the pressure over a wider area. Healthcare professionals call this off-loading. When a person has an ulcer, they require more advanced off-loading devices.

Unrelieved pressure, friction and sliding forces (shear stress) lead to the formation of callus, tissue change and ulceration. Studies have shown off-loading to be of key importance in healing ulcers. The techniques used from country to country can vary. They can also differ between hospitals. Different doctors may apply a preferred technique or make choices as a consequence of available resources, including staff. Irrespective of the technique that is applied, it is the willingness of people to wear the prescribed device for as long as is required that has the most influence on healing.

Even low levels of pressure that are repeated frequently, when walking for example, can damage the foot. Stiff joints, bony bumps (foot deformities) and obesity can further increase pressures and cause ulcers. Losing weight and removing callus before it becomes too thick will lead to a reduction in pressure.

There are many accepted ways to reduce pressure by off-loading. Some of the most common off-loading devices are described below. Different types of footwear can help relieve pressure. They fall into two main categories: ‘therapeutic’ and ‘protective’ footwear. People with foot ulcers need therapeutic shoes. Once an ulcer has healed, they can wear protective footwear. The ulcerated foot is not stable: it may develop oedema (swelling). Ulcers may change in size and depth.
Prevention

**Therapeutic shoes**

These are needed for people with (recurrent) ulcers and for some people who have severely deformed feet. They are tailor-made for the individual. A cast is taken from the foot. A shoe last (shoemakers' mould) is then made that is the same shape as the foot. The new shoe is built onto the last in order to ensure that it fits the foot precisely. Any bony prominences, misshaped toes and vulnerable areas of previous ulceration can be accommodated in this therapeutic shoe. It is possible to incorporate special adaptations to solve problems for neuro-ischaemic feet. A rocker sole can be used to off-load pressure under the big toe, as this is a common site of ulceration in the neuropathic foot. It is time-consuming and expensive to make these type of shoes. Other off-loading devices should be used to relieve pressure when healing in a bespoke shoe is delayed.

**Half-shoes**

Because they are inexpensive and easy to apply, half-shoes have become quite popular for the treatment of foot wounds in people with diabetes. Using half shoes to treat ulcers is almost 60% more effective than using crutches alone. Half-shoes, however, are much less effective at reducing pressure than total contact casts (see below) and certain removable cast walkers.

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**Bespoke (tailor-made) shoes**

Special adaptions for neuro-ischaemic feet

Almost 60% more effective than using crutches alone
These are specially designed sandals with curved soles that reduce pressure. They are lightweight, stable, and re-usable, but require considerable time and experience to produce and modify. They do not off-load as well as removable cast walkers and other devices that are easier to obtain and take less effort to produce.

This is a recently developed device that is a cross between a healing sandal and a removable cast walker. Mabal shoes are removable but maintain more contact with the foot than standard healing sandals. They have been shown to be as effective as total contact casts (see below), but making and using them requires special expertise.

These are excellent devices to off-load the pressure on a foot. However, many people with diabetic foot ulcers may not have sufficient upper body strength to use these devices. Also, because many of these people feel no pain and experience no problems when walking, they may be unwilling to accept the need for assistance. Some off-loading devices can increase pressure on the other foot and place it at risk of ulceration. Although wheelchairs are useful, most homes are not designed for wheelchair access and many people feel there is a stigma attached to their use.
Prevention

Scotch-cast boot

This is a well-padded, ankle-high cast which is designed to protect the foot and reduce pressure while allowing the wearer to walk. The boot can be removable or non-removable and can be adapted easily. Inspection windows can be cut over ulcers as needed. The boot is worn with a cast sandal to increase mobility while protecting the ulcer from any pressure during walking. The Scotch-cast boot is light, has high integral strength and is used as an alternative to plaster of Paris.

Total contact casts

Most diabetic foot specialists consider the total contact cast to be the most effective off-loading device. It is a well-moulded, minimally padded, below-the-knee cast that maintains contact with the entire sole and lower leg. Pressures are distributed uniformly within the cast and the wearer is able to walk. This device is suitable for non-infected ulcers in feet with a good blood supply. Most ulcers will heal within around six weeks.

The safe application of a total contact cast requires experience. A poorly fitting cast can cause skin irritation and, in some cases, ulceration. Total contact casts should not be used to treat feet with soft tissue or bone infections. Total contact casts are heavy and limit mobility. They also need to be kept clean and dry. As a result, they can cause problems with bathing, showering and can make it difficult to sleep comfortably. They are, however, the quickest way to heal neuropathic ulcers and people with diabetes should be encouraged to overcome the disadvantages. Newer casting materials are being developed. It is hoped that people will experience less discomfort and be more likely to wear the cast for the required period of time.
These permit daily inspection and wound care. The Aircast contains pneumatic envelopes that are inflated to ensure a precise fit can be used. The ability to remove these devices means that in some cases people may not wear them. They may remove the cast for dressing changes, sleeping and showers, and may choose to use the walker only when they leave the house or walk excessively. For this reason, healing in removable walkers is slower than in total contact casts.

A removable cast walker can easily be converted into a device that is not so easy to remove by wrapping the cast walker with adhesive bandage or plaster of Paris. This modification is cost-saving in terms of time and materials.

**Removable cast walkers**

The ability to remove these devices means that people may not wear them.

**Instant total contact cast**

**Protective shoes**

Many people who have neuropathy or neuroischaemia but who have normally shaped feet can be accommodated in sensible shoes from shoe shops. Suitable shoes are sufficiently long, broad and deep, and should have a heel height that does not exceed two inches. The shoes should have no prominent seams or other rough places inside them. The inside of the shoe should be checked regularly to ensure that it remains suitable. The fastening should be adjustable – laces or velcro are best. Sports shoes are usually good because they are pressure-relieving and accommodate the foot generously.

These are needed for people with healed ulcers or unusually shaped feet. They are sufficiently long, broad and deep in order to accommodate the foot. For people with neuropathy, the shoes should contain a special ‘cradled’ insole that has been molded onto a plaster cast of the sole of the foot, and conforms precisely to the contours. The insole makes the area of the foot that helps to take the pressure of walking as great as possible – even the arch of the foot helps to support the weight. This is important because in people with neuroischaemic feet it is the margins of the foot that are vulnerable to pressure. Thus a suitable protective shoe will be extra deep, extra wide and will contain a cushioned insole. It is important to have adjustable fastenings because neuroischaemic feet often become swollen.
Prevention

Conclusion

Without good off-loading, it is very difficult to heal diabetic foot ulcers. Casting techniques are useful but are not widely used. Any form of off-loading is better than none. Where appropriate off-loading devices are not available, bed-rest provides the only option. However, lying in a hospital bed for months on end is not only a heavy burden for the individual, it also increases healthcare costs.

It is a good principle that people with diabetes should never walk on an ulcerated foot without protection. Local adaptations may be necessary depending on resources and local circumstances, such as geography, climate, culture and available resources, so long as the principles of good footwear are applied.

Further reading:

Implementation

Guidelines are essential to good diabetes care and good foot care
Implementation

Guidelines are essential to good diabetes care and good foot care

Key messages for healthcare professionals

- In order to implement a healthcare programme effectively, a strategy is required. Only through a well-defined and structured plan can a successful implementation project be initiated.
- To achieve success, diabetic foot care needs to be tailor-made for every situation. The goal posts, however, should not be moved.
- The main task of 'local champions' is to 'spread the word'. It is crucial to involve them in the implementation process.

Key messages for healthcare decision-makers

- Well-designed promotional and educational materials must be available in sufficient quantities in every country.
- Investing in a diabetic foot-care programme can be one of the most cost-effective forms of healthcare expenditure, provided the programme is goal-focused and properly implemented.
Implementation

Guidelines for the diabetic foot

The diabetes care offered will differ within countries and across national borders. Guidelines are an essential tool to help implement good diabetes care for all people with the condition. Guideline recommendations define standards of care and use evidence-based interventions to achieve these standards. Guidelines can help steer healthcare professionals, people affected by diabetes, policy-makers and administrators towards optimal care.

Guidelines for the diabetic foot, in the form of the International Consensus on the Management and Prevention of the Diabetic Foot, were produced in 1999. This document provides information for policy-makers and healthcare professionals. It also contains a booklet of Practical Guidelines to assist in daily clinical practice. This consensus document was updated in 2003.

World Diabetes Day 2005 campaign

In order to achieve effective implementation of a healthcare programme, a strategy is required. Only through a well-defined and structured plan can a successful implementation project be undertaken. The aim of the World Diabetes Day 2005 campaign is to raise and to sustain awareness of the impact of diabetic foot disease worldwide. This campaign aims to persuade people that action is both possible and affordable, and to warn them of the consequences of not taking action. To achieve these aims, the consensus texts provide a 'blueprint' for the delivery of excellent diabetic foot care throughout the world.

Variations in healthcare situations and medical standards

Healthcare situations and medical standards vary greatly in different countries. The goals and standards in diabetic foot care, however, should be the same in developed and in developing countries. The availability of human and economic resources may lead to adaptation in terms of different approaches to achieve these standards in different countries. However, the availability of human and economic resources may lead to a need to use different approaches, methods and therapeutic strategies to achieve these goals and standards in different countries. In order to achieve success, methods and therapeutic strategies to achieve the goals, as well as the approach to diabetic foot care should be tailor-made for every given situation. The goal posts, however, should not move.

The main targets for the implementation of diabetic foot-care programmes are healthcare professionals, healthcare decision-makers, and people with diabetes. However, other stakeholders, such as governments and industry, have an important role in promoting and facilitating guideline implementation.
Implementation

Guide for guidelines

One strategy for implementation that could be followed is described in IDF's *Guide for guidelines, a guide for clinical guideline development*. The publication suggests that several steps are crucial when considering the implementation of a healthcare programme.

<table>
<thead>
<tr>
<th>Implementation steps to be followed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Review implementation strategy with responsible parties</td>
</tr>
<tr>
<td>2. Assist in establishing local implementation groups</td>
</tr>
<tr>
<td>3. Take account of local perspectives</td>
</tr>
<tr>
<td>4. Harness the energies of other interested parties</td>
</tr>
<tr>
<td>5. Arrange local launch meetings to disseminate ideas and endorse activities</td>
</tr>
<tr>
<td>6. Integrate into local professional education</td>
</tr>
<tr>
<td>7. Integrate into patient education activities</td>
</tr>
</tbody>
</table>

Guidelines and healthcare programmes are more likely to be effective if they:

- take local circumstances into account
- are disseminated through interactive education
- are implemented through instructions that relate self-care to the activities of healthcare professionals

Local champions

It is crucial to involve 'local champions'. These are usually healthcare professionals with a great interest in the diabetic foot. They are often driven, charismatic and widely-respected. They may head local organizations involved in diabetes care or be local policy-makers who are able to create opportunities to develop improved healthcare programmes. The main task of the local champions is to 'spread the word'. They are instrumental in establishing local implementation groups, providing information regarding local adaptation strategies, and organizing meetings to publicize and launch programmes.
Promotional and educational materials

Well-designed promotional and educational materials must be available in sufficient quantities. These should be distributed among those involved in the implementation strategy. The following items are useful: quick-reference guides for healthcare professionals and patients, leaflets, and websites.

After successful initial implementation it is important to 'keep up the momentum'. Many past programmes have failed because of a lack of follow-up or reinforcement. Successful follow-up targets people with diabetes, healthcare professionals and decision-makers, all of whom need to be reminded of the importance of diabetic foot care on a regular basis by such means as outreach programmes (that should include local decision makers if possible) and continuing medical education. Sustained efforts and continuous updating and renewal of knowledge and practical skills are essential so that healthcare professionals are able to provide the best possible care and education for people with diabetes. Where limb-threatening problems are present, precise information about what action to take is needed.

Potential barriers to the implementation of guidelines

There are many potential barriers to guideline implementation (for barriers to the provision of foot care see the end of this chapter). Following a well-defined strategy does not always remove them.

<table>
<thead>
<tr>
<th>Potential barriers to implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lack of a clear, feasible and practical implementation plan</td>
</tr>
<tr>
<td>2. Lack of endorsement by and involvement of key stakeholders</td>
</tr>
<tr>
<td>3. Lack of resources (personnel, materials and funding)</td>
</tr>
</tbody>
</table>

The ultimate goal

The ultimate goal of improved diabetes care is to reduce the impact of diabetes on both the individual and society. Achievement of this goal is reflected in improved diabetes outcomes, and can be assessed in terms of diabetes-specific outcomes and improved quality of life. Which outcome measures should be assessed will depend on the scope and breadth of the guideline, but in the case of the diabetic foot might include the prevalence and incidence of ulceration and lower extremity amputation.
Implementation

Realistic time-dependent targets should be set. Several outcomes can be measured:

- amputation rates
- foot-related deaths
- numbers of ulcers
- healing times of ulcers
- prevalence (a reduction in projected increase, rather than an overall reduction may be a more realistic target)
- hospital stays related to the diabetic foot
- cost of providing diabetic foot care

A monitoring system is essential for assessing the impact of guidelines on patient outcomes.

Barriers to the provision of foot care

There is a global disparity between current and desired diabetes care and practices. In many countries, the number of diabetes healthcare professionals and the provision of specialized diabetes services still fall short of national guidelines, if guidelines even exist. Services remain far from comprehensive. Public awareness of the serious nature of diabetes and its complications remains limited, despite the fact that diabetes is one of the leading causes of death and disability around the world. More than one million people lose a leg to diabetes every year. There is an urgent need for action in the form of amputation prevention programmes to bring this figure down and ensure that people with diabetes receive the preventative care they need. Many barriers, however, exist to the delivery of and access to good diabetic foot care. The main ones are outlined here.
## Implementation

### Barriers to the provision of foot care

<table>
<thead>
<tr>
<th>Climate • Remoteness • Language</th>
<th>Geographic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of public transportation • Poor roads • Limited or no telecommunications • Limited or no internet access</td>
<td>Communication infrastructure</td>
</tr>
<tr>
<td>Unsuitable footwear (pointy-toe shoes, sandals) • Barefoot walking • Traditional healing (witch doctors, quacks, folk remedies, etc.) • Religious beliefs and rituals • Discriminatory beliefs and practices</td>
<td>Cultural</td>
</tr>
<tr>
<td>Fear of treatment and of poor outcomes • Not following advice</td>
<td>Psychological barriers</td>
</tr>
<tr>
<td>Lifestyle • Living alone</td>
<td>Behavioural</td>
</tr>
<tr>
<td>Low awareness of diabetic foot complications</td>
<td>Awareness</td>
</tr>
<tr>
<td>Illiteracy • Poverty • No or low insurance cover • Budgetary constraints</td>
<td>Socio-economic</td>
</tr>
<tr>
<td>Governmental barriers • Lack of foot-care education • Poorly trained healthcare professionals • Lack of healthcare infrastructure • Lack of foot-care services or no podiatry • Lack of facilities and materials (equipment, orthotics etc.) • Lack of medication • Lack of team work across medical staff • Variations in clinical decision-making • Poor record-keeping by healthcare professionals • No recall system to follow up patients • Patients not referred sufficiently early</td>
<td>Health service delivery</td>
</tr>
</tbody>
</table>
Implementation

Before embarking upon amputation prevention programmes, the potential barriers described above must be considered and strategies developed to overcome them. Decision-makers have a key role to play in removing many of the obstacles and in facilitating the provision of adequate diabetic foot care.

The removal of these barriers or, where not possible, finding ways around them is the challenge facing all those working to optimize diabetes care and implement national foot-care programmes.

Further reading:

Podiatry

A very important role in the management of the diabetic foot
Podiatry and podiatric education worldwide

- You should not seek treatment or advice from unregulated foot-care workers.
- Podiatrists are key members of the multi-disciplinary diabetic foot team.
- Amputations can be reduced when teams include a podiatrist.
- Podiatrists should be state-registered and regulated by government.
- In many countries, there is an urgent need for podiatry training programmes to be established.
- Mandatory minimal skills and equipment for those offering a podiatry service should be enforced to ensure that people are not put at increased risk by unregulated, unqualified and poorly equipped practitioners.

European countries with recognized podiatric education.
Podiatry is a branch of medical science concerned with the diagnosis and management of the foot. It incorporates preventative foot care, health education, as well as curing or taking care of foot problems. Podiatrists treat a wide variety of injuries and disorders of the foot; some are local to the foot, others are the result of conditions such as diabetes.

The profession of podiatry (previously also known in some countries as chiropody) is recognized in only 19 countries. In some it is restricted by law to those who are suitably qualified. In French-speaking countries, podiatrists are called ‘podologues’.

In a significant number of countries, titles such as ‘podologist’ or ‘pedicure’ are applied to practitioners who offer foot care - some of whom have minimal or no training.

Podiatrists provide care for many different people, including children, the elderly, athletes, people with a physical impairment, and people whose health status places the viability of their lower limb at high risk. This latter group includes people with diabetes. Podiatrists play a very important role in the management of the diabetic foot in terms of healing and the prevention of problems. It must be stressed that people with diabetes should receive treatment from trained podiatrists.

Worldwide there are around 100,000 podiatrists. Of these, some 50,000 from 19 countries in five continents are represented by the International Federation of Podiatrists (FIP). This international body strives to ensure access for all people to high-quality foot and ankle care through collaboration with national and international organizations of podiatrists and other healthcare professionals.

Scope of practice of podiatrists

Podiatrists are specialist practitioners capable of working independently or within a multidisciplinary team. They can diagnose and manage many foot conditions, including those affecting the diabetic foot. Recent studies have shown that multidisciplinary diabetic-foot teams that include a podiatrist playing a central role can bring about remarkable reductions in leg amputations.
The work of the podiatrist within the multidisciplinary team will include:

- assessing the risk status of the feet and delivering education about foot care
- shoe assessment and footwear education
- offering treatments to prevent and treat diabetic foot problems (nail cutting, removal of corns and hard skin, treatment of dry skin)
- debridement (removal of dead tissue) of foot ulcers, infections and gangrene (decay or death of the skin and underlying structures), usually working alongside the physician
- provision of specialist treatments such as plaster casts
- referral to other healthcare specialists

**Podiatric education**

The level of foot-care education for people taking care of diabetic feet varies tremendously around the globe. It ranges from very short courses of a few days (level 1) to a four-year, full-time course in podiatry after primary medical school that is followed by residencies of between three and five years (level 6). Details of the different levels are provided in table 1 next page.

Examination of the vessels of the foot with a doppler.
Table 1: Education at levels 1-6

<table>
<thead>
<tr>
<th>Level</th>
<th>Duration</th>
<th>Subject areas</th>
<th>Patient contact during training</th>
<th>Post-graduate teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2-4 days (part-time)</td>
<td>Only practical skills</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No theory</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2-4 weeks or months (part-time)</td>
<td>Practical skills</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some office skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3-6 months (part-time) or part of</td>
<td>Practical skills</td>
<td>Yes, a little</td>
<td>Yes: diabetic foot degree lasting 8-40 hours</td>
</tr>
<tr>
<td></td>
<td>a 1-3 year lower-level course for</td>
<td>Theoretical subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>beauty and foot care</td>
<td>Management</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Bookkeeping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>6-8 months (part-time) or part of</td>
<td>Practical skills</td>
<td>Yes, but not much</td>
<td>Yes: diabetic foot degree lasting 8-40 hours</td>
</tr>
<tr>
<td></td>
<td>a 1-3 year lower-level course for</td>
<td>Theoretical subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>beauty and foot care</td>
<td>English Evidence-based practice (very basic)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3-4 year full-time course in podiatry</td>
<td>Diagnosing Drawing up a treatment plan Carrying out the treatment plan Gait analysis with computerized systems Medical sciences Scientific research Quality care</td>
<td>Yes, about 25% of the course time is spent in podiatric settings, hospitals, rehabilitation centres</td>
<td>Yes, most countries have defined an accreditation system for life-long learning in order to keep up-to-date</td>
</tr>
<tr>
<td>6</td>
<td>4-year full-time course in podiatry after primary medical school</td>
<td>As level 5, but more scientific and more medical subjects</td>
<td>Yes. After the 4-year course the podiatrist goes into 3-5 year residencies</td>
<td>Yes, there is an accreditation system for life-long learning in order to keep up-to-date</td>
</tr>
</tbody>
</table>
Foot-care education

As well as differences attributable to the duration of the course, amount of contact, areas studied, and the detail covered by the course, a further difference between levels 1-4 and levels 5 and 6 is the use of instruments and equipment. In level 1-4, simple but not always particularly effective instruments are used to perform foot care. In level 5 and 6, greater skills are developed and modern instruments are used. For example: the nail drill in level 5-6 will be a high-speed drill, while in levels 1-4, a low-speed drill is used. Another difference is foot-print taking: in level 1-4, if anything is used, it is the blue print (a person stands on a sheet of special material to ascertain which areas of their feet experience the most pressure – the darker the colour, the greater the pressure), while in levels 5 and 6, computer technologies might be used.

The role of the FIP in education

The FIP has recently identified over 100 educational institutions that offer podiatry education programmes, successful completion of which leads to eligibility for entry to the profession. Most podiatry programmes are recognized or approved by national or federal governments and lead to the award of a diploma or first degree. The courses typically involve three-to-four years of full-time study.

Bachelor or Master level

In countries that are not yet members of the FIP, schools of podiatry are present that teach to Bachelor or Master level. Other countries send their nationals abroad to be trained. Usually, these people then return to their own country to practise.

Barriers to podiatric education

In countries where no podiatry education is offered, the government may be the most significant barrier to establishing podiatric education programmes for the following reasons:

- Lack of awareness
  - The government is not aware of the scope of practice in which podiatrists are involved.

- Less recognition
  - The government does not recognize all medical professions, with the typical exceptions of medicine, nursing and dentistry.

- Lack of financial support
  - Financial reasons – education in podiatry can be expensive because of the need to learn and develop practical skills.

Other training programmes

In many countries throughout the world, diabetic foot care is not organized. All sorts of professionals ‘fill the gap’ created by a lack of access to qualified podiatrists. In such circumstances, foot care for people with diabetes is often in the hands of pedicures (education levels 1-3), nurses or assistant-physicians. Typically, nurses and doctors are not trained in foot care, but due to their studies and experience are able to recognize and treat some of the problems.
## Foot-care education

### Countries with recognized podiatric education

<table>
<thead>
<tr>
<th>Country</th>
<th>Type of education</th>
<th>Length of education</th>
<th>Number of schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Bachelor</td>
<td>3 years</td>
<td>4</td>
</tr>
<tr>
<td>Austria</td>
<td>Level 1-3</td>
<td>1-2 years</td>
<td>10</td>
</tr>
<tr>
<td>Belgium</td>
<td>Bachelor&lt;sup&gt;+&lt;/sup&gt;</td>
<td>3 years</td>
<td>3</td>
</tr>
<tr>
<td>Canada</td>
<td>Bachelor (UK trained)&lt;br&gt;Master&lt;sup&gt;+&lt;/sup&gt; (USA trained)</td>
<td>4 years + residency</td>
<td>1</td>
</tr>
<tr>
<td>Denmark</td>
<td>Level 4</td>
<td>18 months</td>
<td>2</td>
</tr>
<tr>
<td>Finland</td>
<td>Bachelor</td>
<td>3 years</td>
<td>3</td>
</tr>
<tr>
<td>France</td>
<td>Bachelor</td>
<td>3 years</td>
<td>11</td>
</tr>
<tr>
<td>Germany</td>
<td>Level 4</td>
<td>1-3 years</td>
<td>3</td>
</tr>
<tr>
<td>Italy</td>
<td>Bachelor</td>
<td>3 years</td>
<td>12</td>
</tr>
<tr>
<td>Malta</td>
<td>Bachelor</td>
<td>3 years</td>
<td>1</td>
</tr>
<tr>
<td>the Netherlands</td>
<td>Bachelor</td>
<td>4 years</td>
<td>2</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Bachelor</td>
<td>3 years</td>
<td>1</td>
</tr>
<tr>
<td>Norway</td>
<td>Level 4</td>
<td>3 years</td>
<td>12</td>
</tr>
<tr>
<td>Peru</td>
<td>Bachelor</td>
<td>4 years + residency</td>
<td>1</td>
</tr>
<tr>
<td>South-Africa</td>
<td>Bachelor</td>
<td>3 years</td>
<td>1</td>
</tr>
<tr>
<td>Spain</td>
<td>Bachelor and Master</td>
<td>3 or 4 years</td>
<td>3</td>
</tr>
<tr>
<td>Sweden</td>
<td>Level 4</td>
<td>3 years part-time</td>
<td>10</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Level 4</td>
<td>3 years</td>
<td>2</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>Bachelor</td>
<td>3 or 4 years</td>
<td>12</td>
</tr>
<tr>
<td>United States of America</td>
<td>Master</td>
<td>4 years + residency</td>
<td>7</td>
</tr>
</tbody>
</table>

<sup>+</sup> Bachelor = level 5 education  
Master = level 6 education
Foot-care education

Survey of IWGDF:
47 of the responding countries reported that nurses had assumed the foot-care responsibilities in the absence of trained podiatrists.

People should not be put at increased risk by unregulated, unqualified and poorly equipped practitioners.

In the recent survey conducted by the International Working Group on the Diabetic Foot (IWGDF) (see pages 132 - 139), 47 of the responding countries reported that nurses had assumed the foot-care responsibilities in the absence of trained podiatrists. In the Caribbean, foot-care assistants are assuming the role (education level 1-2). They follow a two-week training programme.

Minimal education for treating the diabetic foot

Mandatory minimal skills and equipment for those offering a podiatry service should be enforced to ensure that people are not put at increased risk by unregulated, unqualified and poorly equipped practitioners. It is essential that the minimal skills outlined below are acquired and the minimal equipment provided.

Minimal skills

Minimal podiatric skills for treating people with diabetic foot problems include:

- ability to screen the diabetic foot for risk factors (see pages 64 - 66)
- ability to assess the foot
- ability to treat callus (hard skin), corns, nail problems, and to prevent and treat skin breakdown
- ability to provide sound, up-to-date advice on foot care, shoes and risk factors

Minimal equipment

Minimal equipment for podiatrists working with the diabetic foot is as follows:

- scalpel handle
- scalpel blades
- nail nippers
- nail file
- 10 gram monofilaments
- educational material appropriate to local circumstances

Podiatrists can train other healthcare professionals in the screening and assessment of the diabetic foot. The content of the International Consensus on the Diabetic Foot should be used as a framework for screening and treatment. The contact details for the International Federation of Podiatrists are provided on page 194.
Optimal care: moving towards a centre of excellence

Introduction to regional, national and international initiatives

Working examples of regional and national initiatives:
- Starting from scratch: the small-scale model
- Setting up a national foot-care programme: the Belgian experience
- Establishing foot clinics across a developing country: the Brazilian experience
- How to develop an efficient diabetic foot-care system: the Slovenian experience

Working examples of international initiatives:
- The Eurodiale Consortium
- Combining clinical training and cyber medicine: World Walk
  - The IDF Consultative Section and International Working Group on the Diabetic Foot
  - Step by Step: improving diabetic foot care in developing countries
Multidisciplinary foot team

Optimal care: moving towards a centre of excellence

- If you have a foot problem, you should obtain foot care from a multidisciplinary foot team.
- Establishing a foot clinic and working towards the final goal of creating a centre of excellence is a demanding task. The rewards, however, in terms of results and job satisfaction are extremely high.
- For healthcare professionals interested in setting up foot clinics, an established support network in the form of the International Working Group on the Diabetic Foot exists to provide advice and guidance as necessary.
- A multidisciplinary approach has been shown to bring about a 49%-85% decrease in amputations.
- The results that have been obtained by multidisciplinary teams working in dedicated foot clinics underline the need to provide funding and support to create new clinics along the lines described below.

Key messages for people with diabetes

Key messages for healthcare professionals

Key messages for healthcare decision-makers
Multidisciplinary foot team

Introduction
The gradual process is initiated by a dedicated individual.

Adaptations to local circumstances

A step-wise approach

The best-known foot clinics worldwide were created one step at a time, beginning with a basic model, as described below, and gradually developing into centres of excellence. This ‘step-by-step’ philosophy can help newcomers to the field to meet the challenge of starting up a diabetic foot clinic from almost nothing. The gradual process towards excellence is initiated by a dedicated individual working alone or with a small team. This person drives the project and assumes much of the responsibility from the start.

Typically, the project leader is able to motivate healthcare professionals and inspire people with diabetes; set up facilities and organisational structures; establish attainable goals; recruit, train and retain team members; establish contacts with administrative, governmental and healthcare bodies in order to ensure support for and the survival of the foot clinic, and is able to raise the funding required for salaries, materials and equipment.

The steps can be adapted to local circumstances. They should be considered as guidelines that interested parties can draw upon to develop diabetic foot-care centres. The distances between the different levels of foot clinic are considerable, and the optimal service may never be attained. It should, however, remain a goal that serves to encourage team leaders to strive for excellence.

STEP 1: the minimal model.

The goal of the minimal foot clinic is to prevent diabetic foot problems and stop small problems from becoming very serious.

The minimal model of foot clinic offers:

- foot examination and detection of foot problems such as callus, corns, nail problems, athletes foot, and small wounds
- treatment of foot problems
- preventative care with an emphasis on education in foot care, footwear and trauma prevention

If more serious and complicated problems are found, the person should, if possible, be referred to a centre that is equipped to deal with the problem. The setting can be in a general practitioner’s office, a community clinic or a small regional hospital.
In the minimal model, the team is made up of a doctor and a nurse and/or a podiatrist. It is desirable for one or all of these team members to visit a recognized centre of excellence to gain practical experience. The website of the International Working Group on the Diabetic Foot (www.iwgdf.org) lists its national representatives. They will be glad to mentor colleagues who are setting up new foot services.

The minimal model

<table>
<thead>
<tr>
<th>Staff</th>
<th>Doctor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nurse and/or podiatrist</td>
</tr>
</tbody>
</table>

| Aim                  | Prevention and basic curative care |

| Patients | Own population |
| Setting  | General practitioners’ office, health centre or small regional hospital |
| Facilitating elements | Close collaboration with a referral centre |

| Equipment | Scalpel handles, scalpel blades, nail nippers, nail files, 10-gram monofilaments, dressings (simple gauze), bandages, antiseptic, instrument-cleaning equipment |

STEP 2: the intermediate model

The goal in this phase must be to improve upon the groundwork in preventative and basic care and, in addition, to organize appropriate care for all types of diabetic foot problems.

The intermediate model offers:

- foot examination and detection of foot problems such as callus, corns, nail problems, athletes foot, small wounds
- treatment of foot problems
The intermediate model

<table>
<thead>
<tr>
<th>Staff</th>
<th>Diabetologist or general physician</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Surgeon</td>
</tr>
<tr>
<td></td>
<td>Nurse and/or podiatrist</td>
</tr>
<tr>
<td></td>
<td>Orthotist (shoemaker)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Aim</th>
<th>Prevention and curative care for all types of problems, more advanced assessment and diagnosis</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Patients</th>
<th>From the regional catchment area of the hospital with possibly some referrals from outside the region</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Setting</th>
<th>Hospital</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Facilitating elements</th>
<th>Motivated coordinator to inspire team. Staff meetings to discuss diabetic foot cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Active collaboration with other departments within the hospital</td>
</tr>
<tr>
<td></td>
<td>Active collaboration with extra-mural facilities (GPs, nursing homes, etc)</td>
</tr>
<tr>
<td></td>
<td>Exchanges experience with other centres</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Filaments, biothesiometer, Doppler, operating theatre, full sets of podiatry instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>including tissue nippers, probes, X-ray, lab facilities for microbiology, blood testing, etc.</td>
</tr>
</tbody>
</table>

Multidisciplinary foot team

- preventative care with an emphasis on education in foot care, footwear and trauma prevention
- treatment of all types of ulcer and infection and education on self-care of ulcers and infections

The intermediate foot clinic will accept some referrals from other practitioners. For the intermediate clinic the number of staff members increases. One member of the team fulfils the role of co-ordinator and has the responsibility of attracting new and well-motivated colleagues, including:

- diabetologist (or other doctor with special interest in diabetes)
- surgeon (general, vascular, orthopaedic and/or plastic)
- nurse and/or podiatrist
- orthotist (shoemaker)

The intermediate diabetic foot clinic is usually located in a hospital. Exchange of experience with other diabetic foot centres is important. Regular staff meetings to discuss cases and ward rounds are important aspects of the work of the diabetic foot team. Relationships with hospital administrators and with staff from other departments within the hospital should be carefully fostered. Links with aligned facilities located outside the hospital, such as the general practitioner’s office, nursing homes, and rehabilitation facilities are important. The intermediate foot clinic should provide support to community healthcare practitioners who are working with people with diabetic foot problems.
Multidisciplinary foot team

STEP 3: Centres of excellence and tertiary referral centres - The maximal model

The goal of the diabetic foot centre of excellence is not only to provide optimal diagnosis and treatment but also to play a global role by providing a working example for other healthcare professionals, and to help generate improved diabetic foot services throughout the world. Teaching is an important goal. The staff will be experts in the field. Conducting trials, writing, publishing and providing work experience opportunities for others.

People receiving treatment are not only from the local area or regional referrals. They may come from further away or even abroad to receive highly specialized diabetic foot care. More complex cases with difficult revascularization problems or even complex cases with non-infectious destruction of bone and joint associated with neuropathy (Charcot foot) can be referred and treated. Depending on the local geographical situation, the cultural context and the availability of funding, the organization and management may be more or less complex. Every team member must be aware of the central role played by the people with foot problems and their families, as well as the roles played by each member of the team.

In this advanced phase, all treatments are available on site. The team is drawn from multiple, highly specialized disciplines including those of the:

- diabetologist
- general surgeon
- vascular surgeon
- orthopaedic surgeon
- plastic surgeon
- rehabilitation specialist
- physiotherapist
- microbiologist
- dermatologist
- psychiatrist
- nurse
- educator
- podiatrist
- casting technician
- administrators, etc.

The number of team members and the composition of the team will depend upon local resources. A creative and enthusiastic coordinator who can inspire colleagues to further levels of excellence is a key asset.

The overall goal in the maximal model is to minimize amputation rates even in very advanced and complex foot problems. Also, as a specialised foot centre, perhaps there is a responsibility to set up an organization that can prevent not only diabetic foot ulcers and amputations in a local setting, but that can also play a more regional, perhaps even national or international role.
Moving from a local to a more pan-regional or even international role will require staff at the centre to be involved in the following:

- organizing local meetings
- attending and presenting at international meetings
- receiving visitors from other countries
- organizing training courses in diabetic foot care
- offering training opportunities
- forging links with diabetes representative organisations
- conducting clinical research
- forming partnerships with corporate interests to ensure a firm base for funding the service
- creating prevention and treatment programmes in collaboration with other (specialized) centres

The highly specialized centre is best equipped to teach and inform the more basic centres. Workshops or meetings should be organized in which the experience of the team is shared with other centres interested in diabetic foot care. There should also be active participation with other internationally renowned institutions. This aids clinical and pre-clinical research, development of guidelines and the organization of international meetings.
Multidisciplinary foot team

<table>
<thead>
<tr>
<th><strong>The centre of excellence</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staff</strong></td>
</tr>
<tr>
<td>- diabetologist</td>
</tr>
<tr>
<td>- surgeon (orthopaedic, and/or vascular, and/or general, and/or plastic)</td>
</tr>
<tr>
<td>- rehabilitation specialist</td>
</tr>
<tr>
<td>- physiotherapist</td>
</tr>
<tr>
<td>- microbiologist</td>
</tr>
<tr>
<td>- dermatologist</td>
</tr>
<tr>
<td>- psychiatrist</td>
</tr>
<tr>
<td>- nurse</td>
</tr>
<tr>
<td>- educator</td>
</tr>
<tr>
<td>- podiatrist</td>
</tr>
<tr>
<td>- casting technician</td>
</tr>
<tr>
<td>- administrative, reception and secretarial staff</td>
</tr>
<tr>
<td><strong>Aim</strong></td>
</tr>
<tr>
<td>- prevention and specialized curative care for complex cases</td>
</tr>
<tr>
<td>- provide training to teach other centres</td>
</tr>
<tr>
<td><strong>Catchment</strong></td>
</tr>
<tr>
<td>- national, regional or even international referral centre</td>
</tr>
<tr>
<td><strong>Setting</strong></td>
</tr>
<tr>
<td>- usually a large teaching or university hospital</td>
</tr>
<tr>
<td><strong>Facilitating elements</strong></td>
</tr>
<tr>
<td>- organize regional, national or international meetings</td>
</tr>
<tr>
<td>- share knowledge with visitors from other clinics and centres</td>
</tr>
<tr>
<td>- collaborate with other reference centres</td>
</tr>
<tr>
<td>- participate in the development of guidelines</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
</tr>
<tr>
<td>- as for intermediate centre plus: transcutaneous oxymetry, angiography, angioplasty, arterial bypass, fully equipped operating theatre, duplex scan, intensive care unit, beds, CT scans, ultrasound, laser Doppler, pedobarogram, patient and operator’s chairs, computerised records, fully equipped orthotics service, grinder, plastazote, EVA, lasts, etc. telephones, computerized record systems</td>
</tr>
</tbody>
</table>
Enthusiasm and belief in the importance of diabetic foot care are key elements in all successful foot teams.

Establishing a multidisciplinary foot clinic strategy is exciting and worthwhile. Newcomers will receive a warm welcome from established centres and from their nearest national representative of the International Working Group on the Diabetic Foot, who will be keen to offer advice and encouragement.

Enthusiasm and belief in the importance of diabetic foot care are key elements in all successful foot teams. The challenge of building, sustaining and organizing a centre of excellence for the diabetic foot is huge, but the rewards in terms of reduced amputations and improved quality of life for people with diabetes and job satisfaction for the team are very high.

Conclusion

Further reading:

**Introduction to regional, national and international initiatives**

**The gradual process towards excellence**

In the previous section, the step-wise approach that takes a foot clinic from a modest size to a centre of excellence was described. The following pages provide examples of programmes at different stages, from regional to national and include some examples of international initiatives. Taken as a whole, they illustrate the gradual process towards excellence and underscore the importance of the dedicated 'local champion' or small team in driving development. This person (or small group) provides the initial impulse (see the 'small-scale' example) that can eventually result in improved nationwide foot care for people with diabetes. This individual or team must work hard to keep up the momentum. In later stages, it is necessary to engage local partners, and from this platform establish a national network.

One way to go about this is to forge close links with existing networks, such as national diabetes representative organizations, and benefit from their experience. Another, is to develop a new national foot organization (such as in the Slovenian example). A combination of the two is common.

Official recognition will prove useful. Fledgling programmes should involve governmental officials early on (see the Belgian programme for an example). This can facilitate the process towards eventual recognition and attract useful media interest.

Financial support and developing good connections with local industry partners is very often a prerequisite to expansion and allows the clinic to move from local to regional or national level and serve a wider population.

The importance of involving different disciplines cannot be over-emphasized. This approach is at the heart of optimal foot care. Multidisciplinary teams have been shown to bring about reductions in amputation rates. Identifying and contacting the key players and organizations from different disciplines will attract useful support and increase visibility for the programme among professional colleagues.

While much weight rests upon the shoulders of the dedicated individual or 'local champion', this person is not working in a vacuum. It is important for the local champion to realize that inspiration and support can come from abroad: all the national programmes exemplified here were informed by expertise from beyond their respective national borders in their initial stages.

| The gradual process towards excellence | The importance of the ‘local champion’ | The importance of local partners and a national network | Linking with existing networks | Developing a new organization | Official recognition | Financial support and good connections with local industry | Involving different disciplines is at the heart of optimal foot care | Mentoring opportunities and support networks |
The international initiatives described below provide examples of some of the pan-regional/international activities currently underway. The list is not intended to be all-inclusive. Rather, it serves to highlight a number of high-profile international success stories. One example, the Eurodiale Consortium, describes a pan-European research project aimed at bringing about improvements in diabetic foot care. It shows how collaboration across national borders can improve research possibilities within diabetic foot care. The Consortium will analyze different models of foot-care delivery. The results of Eurodiale will help show decision-makers the impact of the diabetic foot on healthcare consumption.

Where geographic barriers make collaboration difficult, new technologies can provide potential solutions. World Walk takes advantage of new technologies including cyber-learning opportunities in order to provide clinical teaching in the management of the diabetic foot, wound care and related areas in parts of the world where resources are limited.

At the global level, initiatives are underway to provide standardized, high-quality foot care that is sensitive to local variation. Driven by the IDF Consultative Section and International Working Group on the Diabetic Foot (IWGDF), the move towards the implementation of internationally accepted guidelines is well underway.

Establishing a platform of nationally and internationally acclaimed experts in diabetic foot care has provided a springboard from which to launch the consensus movement and ensure its universal acceptance. An expanding international network of ‘local champions’ is now in place to drive the implementation process. The IWGDF is involved in a range of activities aimed at improving foot care worldwide. One such initiative is the ‘Step by Step’ programme, which aims to improve diabetes foot care in the developing world by providing educational tools for people with diabetes and healthcare professionals. This will help the prevention and treatment of diabetic foot problems in areas where there is a great need.

World Diabetes Day 2005 has not been described at length here. It is, however, worth mentioning that IDF’s ‘year of the foot’ and the World Diabetes Day 2005 campaign have brought together many players from the global diabetes community to provide a strong global voice to raise awareness of the diabetic foot and advocate improvements in diabetic foot care worldwide.

The outstanding achievements included in this chapter are intended to provide inspiration to those in a position to initiate regional, national or even international foot-care programmes.
Starting from scratch: the small-scale model

A case history

One individual with the desire to improve outcomes can work wonders. The following is a typical example of what can be achieved by someone who wants to improve local foot care.

A young physician doing research for an MD thesis uncovered many foot problems in the people with diabetes at the hospital where he was working. When he spoke with them, he found that no foot-care programme had been organized for them. Some were receiving treatment from general practitioners or community nurses, some were seeing surgeons, and some were receiving podiatry. Many, however, were not being treated by anyone at all. This situation was (and still is) widespread in many countries. The causes of the ulcers were obscure: many people had no idea why or how their ulcers had developed. As their feet were numb and their ulcers consequently painless, they showed little concern. Some were not even aware that they had a foot problem until it was pointed out to them. Diabetic foot problems were alarmingly common among the people with diabetes in the clinic.

The physician felt a strong desire to improve things. Others, however, did not think that anything could be done, and besides, no funding was available. He talked to a podiatrist, a surgeon and an orthotist (shoe fitter) at the hospital, all of whom were seeing people with diabetic foot problems in the same hospital. They agreed to meet once a week after the Thursday morning out-patient clinic, and to bring people with diabetic foot problems for examination and discussion involving the whole group. After a few weeks of this informal ‘foot clinic’, the group were able to formulate some clear ideas.

• The orthotist felt that many foot problems were being caused by unsuitable shoes or acute injuries from walking barefoot, and that special shoes would help provide a solution.
• The podiatrist felt that all people with diabetic foot problems needed nail care, debridement of callus, as well as the regular cleaning and dressing of ulcers.
• Collectively, the group realized that many foot ulcers became rapidly worse when infection developed and that many amputations occurred when infection was not controlled.
• Together, they came to the conclusion that very few of the people with problems had received education on how to prevent further problems. Nor had they been advised how to perform a daily foot check in order to detect symptoms early.
It was agreed, therefore, that all people with diabetic foot ulcers should receive footwear and antibiotics, and that they should all participate in a programme of preventative education. They were given a small printed card that carried a list of ‘dos and don’ts’.

The informal foot clinic required no extra funding. After two years, amputation data was reviewed for the five years prior to the initiation of the clinic and compared to amputation data for the two years that the foot clinic had been running. This was done by examining operating theatre lists and recording all major amputations among people with diabetes. It was found that major amputations had halved since the diabetic foot clinic had begun.

This example illustrates how many problems can be overcome by enthusiastic individuals with the vision and drive to bring people from different areas of healthcare together to form a team. Together, they can bring about improvements in the lives of people living with foot complications. It is a simple model that can result in fewer amputations.
Setting up a national foot-care programme: the Belgian experience

History

Between 4% and 5% of people in Belgium have diabetes. Until recently, little attention was paid to diabetic foot problems. Two university hospital diabetic foot clinics were established in Belgium in 1989 and the founders represented Belgium on the St. Vincent working groups. They began a diabetic-foot-care programme to implement the St. Vincent Declaration. The Declaration called for 50% reductions in lower-limb amputations.

A national symposium was held in the early 1990s. Representatives from 129 diabetes centres were invited. All participants were asked to register and document people with foot problems attending their centres over a period of three months. Some 1700 people with diabetes were included in the study. It revealed that 4% of the people attending Belgian diabetes centres had undergone amputations and around 10% had had foot ulcers.

Almost 50% of the people regularly visiting diabetic clinics were identified as being at high risk of diabetic foot ulcers.

Professionals working in primary healthcare

In 2000, the Belgian Diabetic Foot Programme aimed to involve general practitioners in the provision of diabetic foot care. Potential barriers included the fact that there are two main languages in Belgium, and that different approaches to healthcare provision exist. It was therefore necessary to accommodate different local habits and culture.

All over the country, symposia with lectures and workshops were organized and ‘departmental steering committees’ were formed. Participants were drawn from different medical disciplines. At the Flanders meeting, 700 delegates were present and the Minister of Health attended the symposium press conference. He announced increased reimbursement for diabetic foot care integrated into improved diabetes care. Suitable foot care educational materials were developed and distributed with support from a broad alliance of industry partners.

Regional implementation of the National Programme

From 2000-2003, the regional implementation of the National Programme began. Departmental steering committees were set up to organize local meetings, with an emphasis on the need for multidisciplinary teams to attend. Those who attended were encouraged to take responsibility for organizing and delivering diabetic foot care, and were trained to examine feet (using their own feet), detect problems, feel pulses to detect ischaemia (poor blood flow), use a monofilament to screen for neuropathy (nerve damage and numbness), and to examine shoes.
In these very practical sessions, participants got to know each other well and acquired much practical knowledge. In this way, a local network of diabetic foot care was created. In two years, 100 workshops were organized involving more than 4000 healthcare professionals, most of whom were community nurses and general practitioners.

Present and future

The diabetic foot in Belgium is now an integral part of diabetes care, both in hospitals and in primary care. The ‘local champions’ of the diabetic foot have received national recognition and are held in great esteem by the international diabetic foot community.

From the start, politicians were involved in the Diabetic Foot Programme as much as possible. This has helped to achieve reimbursement of special shoes for people with diabetes and official recognition of podiatry as a profession.

All people with diabetes have their category of risk of foot problems set out on a ‘diabetes pass’. This is an effective instrument for passing information between the person with diabetes and the different healthcare professionals involved in providing diabetes care. People at high risk now obtain reimbursement for the podiatric care they receive. Belgium currently has 29 multidisciplinary diabetic foot clinics.

The success of the Belgian Programme would not have been possible without mentoring and support from members of the International Working Group on the Diabetic Foot (see pages 124 - 127). Belgium is closely involved in the Eurodiale Consortium (see pages 118 - 121). Support groups can help each other by sharing experiences and problems, by visiting other countries to share knowledge and by setting up ‘twinning’ programmes. Belgium is now twinned with the diabetic centre of Senegal located in Dakar, which will start a similar programme for West Africa.

Conclusion

The Belgian experience underlines what can be achieved when individuals take responsibility and work together to build strong systems for delivering diabetic foot care in their own countries and abroad. This model includes the involvement of local and international partners from healthcare organizations, the media, industry and government. This collaboration has brought about a change in the perception and management of diabetic foot problems in Belgium. The National Programme has reached healthcare professionals throughout the country. They have responded with enthusiasm and commitment. It has received governmental recognition and has had a far-reaching impact on the provision of foot care for people with diabetes in Belgium.
Establishing foot clinics across a developing country: the Brazilian experience.

History

The prevalence of diabetes mellitus in urban Brazil is 7.6%. In 1988, a national programme of education and diabetes management was set up using teams in primary, secondary and tertiary care. However, this project did not include the diabetic foot. Instead, most of the people with diabetic foot problems were referred to surgeons (in some cases, they still are).

In the early 1990’s, a new approach to managing diabetic foot problems in Brazil was initiated, drawing on successful work by multidisciplinary diabetic foot teams in Europe and the USA. The Brazilian project is called ‘Save the diabetic foot’.

In the beginning, there were many barriers to setting up the diabetic foot project. There were no chiropodists/podiatrists, a lack of specialist foot clinics, poor provision of shoes and orthotics and other foot-care materials. Interest in diabetic foot problems was at a very low level. Diabetic feet were not regularly examined, and training in the management of foot problems was not available.

The 'Save the Diabetic Foot' project

The 'Save the Diabetic Foot' project had four main objectives:

1. To raise awareness among policy-makers of the consequences of diabetic foot problems. In order to achieve this, speakers of international repute were invited to come to Brazil and attend scientific meetings with content on the diabetic foot. This greatly influenced the staff from the Ministry of Health.

2. To make healthcare professionals more aware of diabetic foot problems and more sensitive to the needs of people with diabetes. In order to achieve this, training in foot examination, diagnosis and management at health centres and hospitals was offered. Foot workshops (see table 1) were also organized, offering both theoretical and practical activities, and including work with people with diabetes.

| Table 1 - Workshops and project demonstration in Brazil: 1992 to 2003 |
|---------------------------------|--------|
| Workshops                      | 36     |
| Workshop attendees*            | 3650   |
| National Congress - Regional Seminars | 18     |
| National Congress - Regional Seminars** | 4450   |

Average attendance: *100 per workshop; **200 per meeting; total attendance estimated: 8,100
3. To organize basic podiatry services. In order to achieve this, nurses were invited to join the project and learn how to deliver basic foot care and podiatry. This was necessary because there are no podiatrists in the country.

4. To establish a hospital-based, specialist foot clinic that could receive referrals from primary care units. A weekly foot clinic was set up in the endocrinology department of the hospital comprising an endocrinologist, a nurse and an assistant.

**Foot examination**

The recommended foot examination was simple and started with very straightforward messages:

- always remove the shoes
- identify feet ‘at risk’
- promote multidisciplinary teamwork

Inviting people with diabetes to participate was an enriching experience and improved the motivation of the healthcare professionals, who gained first-hand experience of how to deal with foot ulcers, insensitivity, limitation of joint mobility and amputations. It also clarified the economic barriers that prevented some people from obtaining access to diabetic foot care.

The Ministry of Health supported healthcare professionals attending the workshops. Teams from selected areas (each comprising one doctor and one nurse) attended the national diabetic foot workshop, and received a foot kit containing a tuning fork, a monofilament and an educational flowchart with diagrams and photographs of diabetic foot problems. These national workshops were held at the diabetic foot centre in Brasilia. Workshop participants were thus helped to set up their own outpatient foot clinics. In this way, during 1992-2004, 58 outpatient diabetic foot clinics have been set up all over Brazil.
In 1999, the foot clinic in Brasilia became a national referral centre. The team has grown (table 2), and now involves many other healthcare professionals, including people from the recently established vascular unit, which is now directly linked to the diabetic foot centre.

<table>
<thead>
<tr>
<th>Table 2 - Hospital Team: differences between 1992 and 2002</th>
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<tbody>
<tr>
<td>1992</td>
</tr>
<tr>
<td>a diabetologist</td>
</tr>
<tr>
<td>a nurse</td>
</tr>
<tr>
<td>a nursing assistant</td>
</tr>
<tr>
<td>- social worker</td>
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<tr>
<td>- infectious disease specialist</td>
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<tr>
<td>- vascular surgeon</td>
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<tr>
<td>- physiotherapist</td>
</tr>
<tr>
<td>- orthotists (shoe fitter)</td>
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<tr>
<td>- orthopaedic surgeon</td>
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<tr>
<td>- psychiatrist</td>
</tr>
<tr>
<td>- dermatologist</td>
</tr>
<tr>
<td>- plastic surgeon</td>
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</tbody>
</table>

Information gathered from this project has been useful. A pilot study examined clinical records and found that 57% of people attending the hospital clinic and 9% of people attending the health centre were at risk level 3 (high risk) according to the IWGDF classification system.

Hospital amputation rates have fallen, especially among women with diabetes. Free provision of insoles increased by more than 450% between 1999 and 2002.
The trend towards amputation reduction has had a profound impact in persuading policy-makers to fund the project.

**Conclusion**

The Brazilian model is an exemplary one for any country trying to establish a national diabetic foot-care programme. Despite numerous problems and many local difficulties, the quality of foot care in Brazil has improved greatly. This has raised the profile of the diabetic foot not only in Brazil but in surrounding countries. The Brazilian ‘Save the Diabetic Foot Project’ has shown how, with goodwill between politicians and healthcare professionals, the barriers of social deprivation that lead to inequality and inaccessibility to healthcare can be gradually overcome.
How to develop an efficient diabetic foot-care system: the Slovenian experience

Background

Slovenia is a small Central European country with less than two million inhabitants. Almost 10% of the adult population has diabetes. There are just over two physicians and six nurses per 1000 population. Historically, people with diabetes were treated at specialist diabetes clinics and not by family doctors. There were no structured foot-care programmes, no chiropodists or podiatrists and no specialized foot clinics, and foot screening was not performed. Diabetic foot problems were treated mostly by general surgeons.

Development of Diabetic foot clinics in Slovenia

In 1990, three diabetic foot clinics were established in Ljubljana, Koper and Novo mesto. There was no funding for new equipment or buildings. Diabetologists and nurses were recruited from the outpatient diabetes clinics and visited foreign clinics to receive training in diabetic foot care. From the beginning, there was an emphasis on education, and close cooperation with the department of surgery.

It was often difficult to find clinical space and personnel for the foot clinics. They were organized only once a week. There was no emergency foot service, and when staff took holidays, the clinic had to be closed. It was not possible to offer nail care and callus removal, due to lack of adequately trained personnel. In 1995, the National Diabetic Foot Working Group was established, and in the same year, the first diabetic foot training course for nurses was organized. In 1996, a national foot-screening protocol was adopted and in 1998 the first diabetic foot training course for doctors was carried out. A manual on diabetic foot care for nurses was published in 1997 and the second edition in 2003. Training courses for nurses and doctors are now organized annually. So far, about 300 nurses and 50 doctors have completed the training. Foot screening is performed routinely at most outpatient diabetes clinics in Slovenia. Unfortunately, the data are not always recorded and there is as yet no national computerized database on the diabetic foot. A network of diabetes clinics now covers the whole country. Foot care is offered both in hospitals and in primary care by specially trained nurses, although this foot care is not covered by any healthcare insurance system. People with complicated foot problems are generally referred to secondary and tertiary healthcare centres.

The system works well, though the majority of people with diabetes on diet or low-dose single oral agents are treated by general practitioners and only those on insulin or combined oral therapy receive specialist treatment from a diabetologist.

Negotiations with the Ministry of Health and the national health insurance company have resulted in increased availability of special diabetic footwear, although it is still not fully reimbursed.
The development of diabetic foot-care services in Slovenia is summarized below.

**Diabetic foot-care in Slovenia**

- **1990** First 3 outpatient foot clinics (diabetologist and nurse)
- **1995** National Diabetic Foot Working Group established
- **1995** First diabetic foot training course for nurses
- **1996** Foot-screening protocol adopted
- **1997** Handbook on diabetic foot care for nurses - first edition
- **1998** First diabetic foot training course for doctors
- **2000** Diabetic Foot Clinic Ljubljana invited to join the Eurodiale Group
- **2001** Slovenian translation of the International Consensus on the Diabetic Foot

Slovenia participated in the preparation of the International Consensus on the Diabetic Foot and has since translated the document into Slovenian. The Diabetic Foot Clinic in Ljubljana is part of the Eurodiale Consortium (see pages 118 - 121).

**Diabetic foot-care training courses**

The target audiences for the diabetic foot-care training courses are nurses and physicians in general practice, diabetology, angiology, general and vascular surgery, and rehabilitation medicine, and basic foot care providers. The courses are organized annually and consist of two parts:

- A theoretical part that consists of a two-day seminar, covering all the basic topics of diabetic complications, with special emphasis on the diabetic foot.

- A practical part takes two weeks and is organized at the diabetic foot clinics in Ljubljana, Koper and Novo mesto. The participants learn to carry out foot screening and perform podiatry and wound care. The programme is now officially recognized by the Medical Chamber of Slovenia and by the Slovenian Nurses' Association.

**Conclusion**

The Slovenian experience serves as an excellent model for other Central European countries with similar healthcare systems to Slovenia. In order to start a diabetic foot-care programme in these circumstances, a great deal of enthusiasm is needed, but no redistribution of healthcare budget is required. All activities can be carried out in the existing diabetes clinics with no additional healthcare personnel.

The Slovenian model also shows the importance of close cooperation among various specialists and confirms the importance of multidisciplinary foot-care teams. Setting up short training courses for physicians and nurses about diabetic foot care is a priority task which prepares the terrain for the establishment of a country-wide network of foot clinics and enables small clinics in primary care to learn from established centres.
The Eurodiale Consortium

Optimal organization of healthcare in diabetic foot disease

Key messages for healthcare professionals

- Participation in well-designed clinical research on the various aspects of management and treatment of the diabetic foot will result in a better understanding of the needs of people with diabetes and a better approach to their care.

Key messages for healthcare decision-makers

- Clinical research provides valuable insights into the needs of people with diabetes. Funding clinical research on the diabetic foot is likely to bring about reductions in foot ulcers and amputations.
Clinical research in the field of diabetic foot disease is an enormous challenge. In the last few decades much progress has been made. There is consensus on several approaches to management and international guidelines have been provided. However, evidence for a number of important aspects of management is still lacking and most treatment is empirical.

Diabetic foot problems have many causes, there are a number of different treatments, and wounds may not heal for a variety of reasons. This makes it difficult to conduct good research. Another problem is that most foot clinics have too few patients to enable them to conduct sufficiently large clinical trials that might help to clarify which methods of treating ulcers give the best results.

In 2000, 14 leading European diabetic foot clinics from 10 different countries agreed to embark upon a pan-European research project aimed at bringing about improvements in diabetic foot care. Collectively they are known as the Eurodiale Consortium. The principal objectives are the following:

• define relevant diagnostic and outcome criteria for diabetic foot disease
• describe differences in individual and disease-specific factors, management strategies and healthcare organizational aspects of diabetic foot care in Europe
• determine the major factors that influence outcome
• determine the impact of the diabetic foot on healthcare consumption
• analyze variations in healthcare models
• develop a protocol that can serve as a template for future clinical trials
• collaborate in multi-centre studies of the diabetic foot

The participating centres are:

<table>
<thead>
<tr>
<th>Country</th>
<th>Centre</th>
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<tbody>
<tr>
<td>Belgium</td>
<td>Bornem</td>
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<tr>
<td>Czech Republic</td>
<td>Prague</td>
</tr>
<tr>
<td>Denmark</td>
<td>Copenhagen</td>
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<td>Germany</td>
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<td>Germany</td>
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<td>The Netherlands</td>
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<td>The Netherlands</td>
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<td>Slovenia</td>
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<td>Spain</td>
<td>Barcelona</td>
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<tr>
<td>Sweden</td>
<td>Malmö/Lund</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>Ashton under Lyne</td>
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<tr>
<td>United Kingdom</td>
<td>London</td>
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</table>
Optimal organization of healthcare in diabetic foot disease

The first project to be undertaken by the Consortium is a year-long study that looks at numerous aspects of the causes of ulcers and the ways that ulcers are managed in different parts of Europe. The study, 'Optimal Organization of Healthcare in Diabetic Foot Disease', examines what happens to people with diabetes when they develop foot ulcers and records details of their management, quality of life, and the cost of their treatment.

In the project, a diabetic foot ulcer is seen as the result of a number of interacting individual and disease-specific factors. The interaction of several of these factors with management strategies and local healthcare organization determine the outcome of an ulcer, defined as clinical outcome (e.g. healing or amputation), quality of life and healthcare consumption. In the first phase of the project, a study protocol was developed that could be implemented in the busy diabetic foot clinics of each participating centre, and that could describe the different aspects relevant to each centre. Much time has been spent on the development of unambiguous terms and items in order to facilitate translation into the different languages and different treatment practices. This study protocol and the information obtained in this phase will provide the basis for future studies and randomized clinical trials.

Currently more than 1200 people receiving diabetic foot care have been included. These people will be followed every month for a year. If they heal during this period, they will be followed until six weeks after healing. All amputations will be recorded.

A further aspect of the project is the consideration of variations in healthcare models. Current literature shows that establishing multidisciplinary foot teams can have a major impact upon health outcomes for people with diabetes. The implication of organization variations across teams has not yet been studied. Site visits and structured interviews will be used to analyze the effects of these models on the main outcome parameters.

By looking at differences in aspects of treatment and outcomes, the Consortium will provide valuable insights into the needs of people with diabetic foot problems and how to best structure their care.
The Eurodiale Consortium

**EU collaboration**

The Eurodiale Consortium has obtained funding from the European Union to conduct this research. When the present study is completed, the Consortium hopes to engage in further work on different aspects of diabetic foot care. The data already obtained can serve as a template for future clinical trials. The Eurodiale Consortium will be able to initiate, coordinate and perform randomized controlled clinical trials on important aspects of diabetic foot disease, such as wound healing, peripheral vascular disease, neuropathy, infection and biomechanical offloading.

The contact details for the Eurodiale Consortium are provided on page 194.

**EU funding**

Claw toes  Signs of infection  Ischaemic 4th toe
Combining clinical training and cyber medicine:

World Walk

‘World Walk’ is a new model for foot care that:

• provides clinical teaching in the management of the diabetic foot, wound care and related areas in parts of the world where resources are limited
• increases awareness of how to care for the diabetic foot
• encourages healthcare practitioners to provide training for other practitioners in their own areas
• takes advantage of new technologies including cyber-learning opportunities

The first aim of World Walk is to create centres of excellence that can provide training for local caregivers and give opportunities for local ‘leaders’ to participate in exchange programmes. Volunteer caregivers in the programme undertake to train 100 caregivers during their careers, who in turn will train others.

The second aim is to establish ‘cyber medical’ education programmes where possible, with high-speed internet access, in order to provide both live and archived educational programmes and a consultation service manned by a team of on-call physicians around the world, thus sharing skills and knowledge.

The three core components of the programme are:

• Classroom education in basic science and clinical lectures
• Clinical education in out-patient, hospital and operating room settings
• Cyber education in basic science and clinical work, also providing reference material and consultation services

The best venue is a hospital with a medical school where medical students and staff can be involved in the programme.
The Future

World Walk has shared key concepts in foot care, including early recognition of wounds, cleansing, dressing, debridement and offloading, and has transported patients to surgeons where necessary. Programmes have been conducted in Peru, Jamaica, Cambodia and Venezuela. Live cyber conferences have brought together speakers and audiences across the United States and have linked participants from Jamaica. The next goal for the programme is to use Venezuela and Jamaica as training hubs for Latin America and the Caribbean.

By combining clinical training and cyber-medical education in wound prevention, diagnosis and care, World Walk has contributed to increasing local, regional and national self-sufficiency in managing limb and life-threatening disorders.

The contact details for World Walk are provided on page 194.
Diabetic foot disease is a major burden to people with diabetes, their families and healthcare systems.

More than 200 million people in the world have diabetes mellitus. All are at increased risk of foot ulcers and amputations. Diabetic foot disease places a heavy burden on the person with the problem and is extremely expensive to treat. Some countries have particularly high ulcer and amputation rates, which may be associated with differences in population characteristics and wound management programmes. Because many different factors can contribute to foot problems, there is a strong need for multidisciplinary teams to be set up in order to reduce the number of ulcers and amputations and thus control the associated healthcare costs.

For such an approach to be useful

• concerted action by all persons working with people with diabetic foot problems is required
• specific guidelines are needed
• awareness needs to be raised
• knowledge and skills need to be imparted to people with diabetes and to healthcare professionals

Both inadequate prevention and poor management of diabetic foot problems are alarmingly common.

Is foot care under-funded?

From the late 1970s to the mid 1990s, guidelines on prevention and management of diabetic foot problems were formulated in various parts of the world. However, because of the variety of healthcare specialists involved in foot care, different aims and target groups, as well as differences in the characteristics of the people requiring care, no document was universally accepted.

In many countries the diabetic foot was not on the agenda of the healthcare policy-makers and diabetic foot care was under funded. In countries where scientists were involved in research into the diabetic foot, problems arose because of a lack of clear definitions and consistent methods of reporting their data.

To tackle these barriers, an international consensus group was set up to formulate clear guidelines and ways of describing the diabetic foot which would be relevant across national borders.
In 1996, an international working group of experts in the field of the diabetic foot expressed the need for:

• an international set of definitions
• a consensus text
• guidelines on prevention and management of the diabetic foot

Aim

The aim of the international consensus was to provide guidelines for the prevention and treatment of diabetic foot problems in order to reduce the impact of diabetic foot disease.

This would be achieved by means of high-quality, cost-effective healthcare using evidence-based medicine backed by expert opinion. In the document, basic concepts are addressed with clear descriptions of the various diagnostic, preventative or therapeutic strategies. Ways of organizing diabetic foot care and implementing the guidelines are also described.

The proposed content was divided in several chapters, specialists were assigned as primary writers and an editorial board was established to guide the process. Texts were reviewed by the editorial panel and then presented to a group of 45 experts from all continents. The group, which became known as the International Working Group on the Diabetic Foot, included general practitioners, diabetologists, podiatrists, specialized nurses, general, vascular and orthopaedic surgeons, as well as representatives from several international organizations. The document was extensively reviewed and finally approved by all members of the International Working Group. The consensus was launched during the 3rd International Symposium on the Diabetic Foot in Noordwijkerhout, the Netherlands, in 1999.

New Consensus Projects 2003

After the successful launch and subsequent interest in the International Consensus document (the document has been translated into 25 languages and over 60,000 examples have been distributed throughout the world), new consensus projects were undertaken in order to extend the original document.

Work was undertaken on the infected diabetic foot, wound healing and on ulcer classification for research purposes, as these topics were not covered in depth by the 1999 Consensus.
Texts were produced by three working groups and sent to all members of the IWDGF for comment. These were discussed in depth and signed by all members during a Consensus/Implementation meeting of the IWDGF preceding the 4th International Symposium in 2003.

**Interactive CD-ROM**

An interactive CD-ROM containing the new supplements was produced. The Practical Guidelines on the Management and Prevention of the Diabetic Foot (in English, Spanish, French) and the original International Consensus document (1999) were included, along with a picture gallery and interactive search capabilities.

**International Survey on Diabetic Foot Care**

Another important role for the IWGDF is to pull together information and documentation relating to diabetic foot care around the world.

In 2005, the IWGDF produced its second worldwide survey on diabetic foot care (85 countries responded). The answers to the extensive list of questions offered an opportunity to acquire baseline information on the status of diabetic foot care (see pages 132 - 139).

| The International Consensus on the Diabetic Foot and/or Practical Guidelines on the Prevention and Management of the Diabetic Foot has been translated in 25 countries: |
|---------------------------------|---------------------------------|
| Azerbaijan                      | Lithuania                        |
| Brazil - Portuguese             | The Netherlands (guidelines)     |
| Bulgaria                        | Norway (guidelines)              |
| China                           | Portugal - Portuguese (guidelines)|
| Czech Republic                  | Poland                           |
| Denmark                         | Romania                          |
| France (guidelines)             | Russia                           |
| Georgia                         | Saudi Arabia                     |
| Germany                         | Slovenia                          |
| Greece                          | Spain                            |
| Israel (guidelines)             | Turkey                           |
| Italy                           | Ukraine                          |
| Japan                           |                                  |
| In preparation:                 | Serbia-Montenegro                |
| Hungary                         |                                  |
| Indonesia                       |                                  |
International initiatives

International network

The IWGDF has created a network of country representatives (‘local champions’) to focus interest on the diabetic foot and encourage healthcare professionals and policy-makers to initiate foot-care education and podiatry programmes in their countries, as well as to provide support and mentoring for newcomers to the field, especially in countries where these facilities do not exist.

Implementation Report

At the moment, the IWGDF has representatives in 82 countries, all of whom were asked to implement the aims of the consensus group.

The work towards establishing and implementing consensus is an ongoing process. The IWGDF is planning and designing new consensus items, which are expected to be ready in 2007.

Further information on the activities of the IWGDF can be found on the website (www.iwgdf.org).

Further reading:

Step by Step: improving diabetic foot care in the developing world

Step by step towards good foot care

The Step by Step Programme is a pilot project for India, Bangladesh, Sri Lanka, Nepal and Tanzania. It aims to improve diabetes foot care in the developing world by providing education for people with diabetes and healthcare professionals in the prevention and treatment of diabetic foot problems.

Lack of training, suitable shoes and orthotics, and multi-disciplinary teams

In the developing world, there is no formal training in podiatry; suitable shoes and orthotics are rarely found, and the concept of a multi-disciplinary team approach does not exist. There is a very high incidence of lower-extremity amputations, many of which are due to potentially preventable infections in neuropathic feet. Illiteracy, socio-economic factors, different cultural beliefs, barefoot walking, as well as low awareness among healthcare professionals and people with diabetes all contribute to this disastrous situation.

Practical training courses

The programme has set up practical training courses for teams of healthcare professionals and provided them with special educational materials. These are designed to overcome language barriers and teach simple ways of preventing and treating diabetic foot problems. Built into the project is a session to teach participants how to teach other healthcare professionals so that knowledge about the effective management of diabetic feet can be spread.

The pilot project received a generous financial grant from the World Diabetes Foundation (WDF) and was supported by IDF and the International Working Group on the Diabetic Foot (IWGDF).

Training courses were attended by pairs of doctors and nurses or other paramedics, with each pair representing a district or state from India, Sri Lanka, Bangladesh, Nepal, Tanzania and Zanzibar. The courses taught the principles of basic foot care, including nail cutting and callus removal, education and practical management guidelines, such as:

- how to take a history
- how to conduct a physical examination
- how to screen for neuropathy and ischaemia
- how to classify and stage the foot

Having identified feet at risk, delegates were taught how to organize appropriate foot care and education and take timely action in cases of ulceration or advanced foot problems, and when and where to refer patients in trouble, taking local circumstances into account.
Education and training also focused on teaching others. Participants are expected not only to educate people with diabetes but also cascade their acquired knowledge and skills to colleagues in their regions to create a spin-off effect and thus perpetuate and sustain the achievements of the project.

Since many languages and dialects exist in the developing world, and levels of literacy are low, a special focus on audio-visual materials and pictures, with little supporting text, was of key importance.

Small teams of young, enthusiastic healthcare professionals from remote areas were selected. In total, 100 teams from South-East Asia and 15 pairs from Tanzania were selected.

**The training sessions**

The training sessions for the basic course were designed as interactive and informal with practical workshops. The formal lecturing was kept to a minimum. The delegates for each venue in India and Tanzania were frequently divided into smaller groups for detailed sessions, but doctors and nurses worked together and were never split up. In order to make the sessions more interactive, case studies were used throughout and presented by the delegates. On the second day of the training, people with active foot problems were invited to attend so that treatment and discussion of ‘live’ cases could be included.

To enable the participants to practise the techniques for debridement and cutting out undermined edges of ulcers, the participants were provided with sweet limes as ‘guinea pigs’.

The delegates were taught some quite elaborate procedures with sweet limes - creating ulcers, probing ulcers and cutting out undermined edges using forceps (information about the technique is provided on pages 184 - 185).

All participants had been requested not to cut their nails for 1 month prior to the training, so that they could practise nail cutting on each other using equipment provided by the programme. This session worked as a great ice-breaker and helped develop a friendly and collaborative atmosphere.
International initiatives

The trainees were provided with foot clinic equipment kits at the beginning of the programme. The doctors' kits contained reference books, posters for waiting areas/clinics and educational material. The nurses' kits contained diabetes education material and an instrument kit containing podiatry tools (nail clippers, nail file, surgical blades, forceps, probe, scissors) and diagnostic instruments (10gm monofilaments and 128Hz tuning fork).

It was made clear that both kits were for use by both members of the team and that doctors should share their contents with paramedics and vice versa. In the last session, the delegates divided into smaller groups, brain-stormed ideas and plans about implementing the Step by Step Project. Then a doctor and a nurse or paramedic from each group reported back to the whole group. Delegates were thus equipped to educate and examine patients, record what they had found and what they had done, use the written material to improve their knowledge of the diabetic foot, and gradually build their own diabetic foot programme. The delegates left the training with all the equipment required to set up a basic foot clinic.

In summary, the attending delegates were trained in preventative diabetic foot care.

- primary prevention: screening of high-risk feet and proper advice on preventive footwear
- secondary prevention: management of trivial foot lesions like callus removal, treatment of nail pathologies, de-roofing blisters
- tertiary prevention: prompt referral to specialist for advanced foot lesions

Advanced course

As a prerequisite for participation, attendees agreed to follow an advanced course within one year. They will be given a specially prepared video for patient education and another for teaching other healthcare professionals in their regions, thus spreading awareness about diabetic foot disease and its prevention and management. The project will be followed by a survey on the cascading effect of improved foot care in the areas from which the participants were chosen.
Worldwide overview

World Survey on Diabetic Foot Care

Diabetic foot care in the seven IDF regions:

- African Region (AFR)
- Eastern Mediterranean and Middle East Region (EMME)
- European Region (EUR)
- North American Region (NA)
- South and Central American Region (SACA)
- South-East Asian Region (SEA)
- Western Pacific Region (WP)
Foot care worldwide

World Survey on Diabetic Foot Care

- International consensus on the diabetic foot exists. Many countries have begun implementation, the rest need to follow.
- Every country should collect data on the incidence of diabetic foot ulcers and lower-limb amputations in order to calculate the enormity of the problem and to measure the impact of prevention programmes.
- Every country should have officially recognized podiatry education. Its absence is a barrier to optimal diabetic foot care.
- The ratio of multidisciplinary foot clinics to hospitals is much too low in most countries or they do not even exist: resources must be invested now to change this. Waiting will cost more in the long term.

Key messages for healthcare professionals

- International consensus on the diabetic foot exists. Many countries have begun implementation, the rest need to follow.
- Every country should collect data on the incidence of diabetic foot ulcers and lower-limb amputations in order to calculate the enormity of the problem and to measure the impact of prevention programmes.
- Every country should have officially recognized podiatry education. Its absence is a barrier to optimal diabetic foot care.
- The ratio of multidisciplinary foot clinics to hospitals is much too low in most countries or they do not even exist: resources must be invested now to change this. Waiting will cost more in the long term.

Key messages for healthcare decision-makers
Foot care worldwide

Baseline information on the status of diabetic foot care worldwide

Little is known about diabetic foot care throughout the world. To address this, the International Working Group on the Diabetic Foot (IWGDF) has conducted a survey among its country representatives and among the member associations of the International Diabetes Federation (IDF). This survey is by no means a perfect tool to capture information on foot care. It does, however, provide the first opportunity to gain baseline information on the status of diabetic foot care worldwide. It will now be possible to monitor the progress towards improved foot care in the years to come.

Aim

The aim of the survey is to acquire information from all countries on:

- knowledge and implementation of the IWGDF International Consensus document
- the incidence of diabetic foot ulcers and lower-limb amputations attributable to diabetes
- the availability of multidisciplinary foot clinics
- the availability of professional podiatry training in each country
- the availability of specialized nurses and trained shoe fitters
- national initiatives for diabetic foot care and the prevention of amputations

The questionnaire was sent electronically to a total of 143 recipients selected from IDF member associations and the IWGDF network of country representatives in November 2004. Of these, 16 were undeliverable. A total of 85 satisfactory responses were received. What follows is a summary of the results.

Responses


In 74 out of 85 (88%) countries the answer to this question was positive. Many attributed this to a translated version of the Consensus/Practical Guidelines. (To date the International Consensus and/or the Practical Guidelines on the Management and Prevention of the Diabetic Foot have been translated into 25 languages and over 60,000 examples have been distributed worldwide.)

If the answer to the first question is positive, have the guidelines been applied and/or implemented?

All countries who have translated the document have organized meetings to implement the guidelines.
Do you have annual data for the incidence of diabetic foot ulcers and lower-limb amputations?

Detailed information on the incidence of diabetic foot ulcers is scarce. In developed countries, the incidence is known to be up to 5%. In developing countries, the number is higher. In the reports based on hospital-oriented data, incidence is as high as 20%.

The reported incidence of lower-limb amputation comes mostly from hospital data. Reports are dependent upon the structure of healthcare services, economic circumstances and on the attitudes of professionals involved. The figures are also dependent upon population selection and on the means by which the data are collected and analyzed. Significant decreases in the incidence of major amputations have been reported in Denmark, the Netherlands, Spain, Sweden, and the UK. Very few countries have nationwide figures. Such data exist in Denmark, Sweden, the Netherlands and Taiwan.

### Incidence of minor and major amputations per 1000 people with diabetes

<table>
<thead>
<tr>
<th></th>
<th>Incidence</th>
<th>Population</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mauritius</td>
<td>680</td>
<td>Hospital-oriented</td>
<td>1998-2002</td>
</tr>
<tr>
<td>Tanzania</td>
<td>400</td>
<td>Hospital-oriented</td>
<td>2002</td>
</tr>
<tr>
<td>Croatia</td>
<td>6.8</td>
<td>Hospital-oriented</td>
<td>2002</td>
</tr>
<tr>
<td>UK</td>
<td>2.6</td>
<td>Regional</td>
<td>1998</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>3.61</td>
<td>Nationwide</td>
<td>1991-2000</td>
</tr>
</tbody>
</table>

### Incidence of major amputations per 1000 people with diabetes

<table>
<thead>
<tr>
<th></th>
<th>Incidence</th>
<th>Population</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>0.056-0.12</td>
<td>Regional (hospital records)</td>
<td>1997-1999</td>
</tr>
<tr>
<td>USA</td>
<td>3.83</td>
<td>Medicare 306 health-referral regions</td>
<td>1996-1997</td>
</tr>
<tr>
<td>USA</td>
<td>18.0</td>
<td>Oklahoma Indians cohort study</td>
<td>1980s</td>
</tr>
</tbody>
</table>
Do multidisciplinary foot clinics exist in your country?

Sixty countries reported the existence of at least one specialized foot clinic (defined as two or more healthcare professionals from different disciplines working together). This number goes up in foot centres of excellence, where it is not uncommon to have representatives from as many as eight different specialties: diabetologists; general, vascular, and orthopaedic surgeons; podiatrists; specialists in rehabilitation; specialized nurses; shoe fitters and some others.

Relating the number of foot clinics to the number of hospitals in each country reveals huge differences. In China, for example, there are approximately 310,000 hospitals. Of these, only five have foot clinics (0.002%). In the USA, there are approximately 500 foot clinics for 5764 hospitals. In addition, there are 6000 foot clinics that are not tied to a hospital. Of these, some 2000 are multidisciplinary.

Not surprisingly, the highest clinic-to-hospital ratio is found in developed countries. In Sweden, this number is 54 for 95 hospitals (56%). In the Netherlands, 44 of the 122 hospitals (34%) have a foot clinic. In Denmark, the ratio is 10 clinics to 70 hospitals (14%).

### Foot Clinics

<table>
<thead>
<tr>
<th>Clinics</th>
<th>Hospitals</th>
<th>Ratio (%)</th>
<th>Population (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>5</td>
<td>0.01</td>
<td>1287.0</td>
</tr>
<tr>
<td>Kenya</td>
<td>7</td>
<td>&lt;0.01</td>
<td>31.6</td>
</tr>
<tr>
<td>Brazil</td>
<td>60</td>
<td>0.01</td>
<td>182.0</td>
</tr>
<tr>
<td>Australia</td>
<td>20</td>
<td>0.02</td>
<td>19.7</td>
</tr>
<tr>
<td>Ukraine</td>
<td>34</td>
<td>0.03</td>
<td>48.0</td>
</tr>
<tr>
<td>Denmark</td>
<td>10</td>
<td>14.0</td>
<td>5.4</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>42</td>
<td>34.0</td>
<td>16.2</td>
</tr>
<tr>
<td>Samoa</td>
<td>1</td>
<td>50.0</td>
<td>0.178</td>
</tr>
<tr>
<td>Sweden</td>
<td>54</td>
<td>56.0</td>
<td>9.0</td>
</tr>
</tbody>
</table>

\(^1\) Population figures are for 2003
Is professional podiatry training available in your country?

Only 19 of the countries that responded to the survey reported professional and officially recognized education in podiatry - only six of these countries (Australia, Canada, New Zealand, Peru, South Africa and the USA) are outside Europe. A further 12 countries reported having podiatrists who had received training in a country where recognized training exists.

European countries with recognized podiatric education. Only six countries outside Europe (Australia, Canada, New Zealand, Peru, South Africa and the USA) reported that they had officially recognized training in podiatry.
If your country lacks podiatrists, who performs the service?

Of the 85 countries, 47 reported that specialized nurses replace podiatrists. A few countries reported that either ‘foot-care assistants’ or (junior) doctors provide foot care.

Are trained shoe fitters (orthotists/pedorthist) available in your country?

Of the responding countries, 51 mentioned the availability of orthotists to provide foot wear. Not much is known, however, of their level of education.

Does your country have national initiatives for diabetic foot care and/or the prevention of amputations?

Of the responding countries, 45 indicated that they have either planned to undertake or had already launched national initiatives to prevent lower-limb amputations. A total of 56 countries declared serious interest in collecting data on the incidence of amputations.

**Conclusions**

Although a survey like this is a crude method to collect information on local foot care, it does serve to stimulate interest and create awareness of the serious problem of the diabetic foot and the distressing impact of leg amputations. It is encouraging that so much interest exists in the provision of prevention and education programmes at a national level. Very few countries report an absence or lack of interest in undertaking such programmes.

The launch of the International Consensus in 1999 (and possibly the appearance of supplements to the original document in 2003) has played an influential role. The fact that the document has been so widely translated is testament to the hard work and enthusiasm of those working to improve foot care services for people with diabetes everywhere.
It is, however, disappointing that only 19 countries in the world report professional podiatry training. This needs to be improved. The rewards that professional podiatry brings in terms of prevention and saved limbs are well documented. Podiatry is one of the cornerstones of adequate prevention and management of the diabetic foot. It merits sufficient investment. Diabetes advocates should highlight this shortfall and encourage decision-makers to take action. Good diabetes care will not only ease the heavy financial burden on healthcare budgets, it will reduce the suffering of many people who have to live with the devastating consequences of diabetes-related foot complications.

In the absence of professionally trained podiatrists, specialized nurses are taking on the responsibility of foot care in many countries (47 of the 85 surveyed). They are usually trained in 3-4 week courses abroad. Although this is positive (some foot care, after all, is better than none), and nurses are to be commended for the efforts they are making to improve foot care for people with diabetes, it is extensive and sustained training that brings the best results. Healthcare decision-makers should be made aware of this.

The high number of countries reporting a specialized foot clinic (with two or more specialists) is a promising sign that foot care is improving. Yet the ratio of clinics to hospitals in many countries remains pitifully low.

The high numbers of respondents that have indicated that they will initiate a survey of ulcer and amputation data is very encouraging. Even more encouraging is the indication that many countries are planning or have already begun nationwide amputation prevention programmes. The International Working Group on the Diabetic Foot will launch a new survey in 2007 in order to report the progress of these initiatives to the global diabetes community.
The activities of many, particularly the work of the global network of 82 ‘local champions’ of the diabetic foot and the advocacy work of diabetes representative organizations worldwide, are bringing about improvements in diabetic foot care. This is heartening. Much, however, remains to be done in order to ensure that people with diabetes receive the quality of foot care that they deserve.

IWGDF country representatives (see pages 191 - 193)
Diabetic foot care in the seven IDF regions

The ‘local’ context

All over the world, people with diabetes experience diabetic foot problems. The success with which these problems are identified and treated is tied to a range of characteristics that define local context. Of these, three defining features stand out: economic circumstances, practical limitations, and the availability of professional experience.

As a consequence of different features of ‘local’ context, advice that may be useful in one geographic location may well be inappropriate, impractical or inapplicable in another. While general standards of care should apply (see the International Guidelines) and the goals and indicators of healthcare should not differ between people with diabetes living in developed and in developing countries, it is up to local circumstance to dictate how standards and guidelines are adapted and ultimately adopted.

The seven IDF regions

In the following section of this publication, issues pertaining to diabetic foot care in the seven IDF regions are discussed. The regions are:

- Africa (AFR)
- Eastern Mediterranean and Middle East (EMME)
- Europe (EUR)
- North America (NA)
- South and Central America (SACA)
- South-East Asia (SEA)
- Western Pacific (WP)
Foot care worldwide

Local circumstances

The task of bringing myriad local contexts together to describe a regional or indeed global perspective on diabetic foot care presents an enormous challenge. Attempts to do so throw up more questions than answers. This is not surprising. Data on the prevalence and incidence of the complications of the diabetic foot are found lacking in every IDF region. Future investigation is clearly required to fill this gap in our knowledge. What is more, the geographic expanse of each region means that one cannot fully capture the influence of local culture, healthcare systems and climate on diabetic foot care, one can only hint at them. All are, of course, of importance. Some practices of traditional healing, such as the scarring of feet or packing herbal remedies into a diabetic ulcer, are of obvious detriment to foot care. The lack of a fully developed healthcare infrastructure, compounded by poor communication and remote rural populations, presents many countries of the world with serious difficulties in terms of access to healthcare. Extreme cold and heat are responsible for terrible damage to the insensitive, neuropathic foot.

Barriers need to be tackled

The intention here is not to be all inclusive. Rather to provide the reader with insight into regionally specific problems, to set out some of what is known in each region, and to provide information about the barriers that will need to be tackled in order to improve foot care for people with diabetes. Some of these barriers such as widespread poverty and the threat of communicable diseases look almost insurmountable. Others such as low awareness and a lack of professional podiatry are removable so long as the resources and intention to act are in place.

It is hoped that in every IDF Region, diabetes representative organizations and other aligned groups advocating improvements in diabetes care will continue to work towards ensuring that what we know is documented and translated into action. Everyone involved in diabetic foot care in every region should be encouraged to support these groups and add their voices to those demanding change.

Healthcare decision-makers should be encouraged to overcome the barriers that currently exist and to share information about the initiatives they fund and support. This will allow organizations like IDF and the IWGDF to share the information with the wider diabetes community. In turn, this will facilitate the development of best-practice sharing across national borders so that others can learn more about how to make optimal use of the resources at their disposal.

“Qualitatively and quantitatively the goals/guidelines and indicators of healthcare will not differ between people with diabetes living in the developed and in developing countries.”

John Ward
Foot care worldwide

African Region (AFR)

The current situation

The IDF Africa Region has more than 7.1 million people with diabetes. Out of a total of 48 countries that comprise the region do not include the countries around the Mediterranean Sea (these are included in the IDF EMME Region). The population of the region is 667 million. The IDF Africa Region is home to some 1000 ethnic groups, who between them speak more than 1000 languages, including over 900 African languages. In places, European languages such as French, English and Portuguese are also spoken. A wide range of indigenous religious beliefs are common alongside Muslim, Hindu, and Christian religions. In some countries, indigenous religions are followed by more than 40% of the population.

Sub-Saharan Africa contains 33 of the world’s 50 least developed countries as defined by the Economic and Social Council of the United Nations. Life-expectancy of less than 50 years is seen in over half the region’s countries.

The region is one of extreme conditions, including drought and flooding. The widespread hot and humid conditions contribute to a high incidence of fungal infections and provide an environment conducive to the rapid spread of infection.

The economic costs of diabetes and its complications are too high to be met by most individuals and their families in many of the region’s countries. Levels of income are too low to purchase insulin or other diabetes medication and supplies.

By the end of the twentieth century, the prevalence of diabetes had become substantial in sub-Saharan Africa, with increased morbidity and mortality rates as a consequence. Across the region, diabetes is on the rise.

Foot complications now constitute a major public health problem for people with diabetes in various African countries. Yet, despite the myriad publications on foot complications in people living with diabetes in developed countries, there is a paucity of comparable medical literature for African diabetes populations.

### Diabetes in Africa

<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total African population (millions)</td>
<td>666.6</td>
<td>1107.4</td>
</tr>
<tr>
<td>Adult population (millions) (20 - 79 years)</td>
<td>295.1</td>
<td>541.1</td>
</tr>
<tr>
<td>Number of people with diabetes (millions) (20 - 79 years)</td>
<td>7.1</td>
<td>15.0</td>
</tr>
<tr>
<td>Diabetes prevalence (%) (20 - 79 years)</td>
<td>2.4</td>
<td>2.8</td>
</tr>
</tbody>
</table>
Incidence of diabetic foot ulcers and amputation

There is a lack of data on the numbers of people affected by diabetes in Africa and very little research funding presently available to redress the balance.

One study undertaken in Tanzania established that one in every four people with diabetes attending a large clinic had symptoms of peripheral neuropathy. Other studies conducted across Africa have documented great variation in the occurrence of peripheral neuropathy, from 4% in Zimbabwe, to 46.4% in Uganda, 59% in Malawi and 68% in Nigeria.

The incidence of peripheral neuropathy in some African countries (hospital data):

<table>
<thead>
<tr>
<th>Country</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zimbabwe</td>
<td>4%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>25%</td>
</tr>
<tr>
<td>Uganda</td>
<td>46.4%</td>
</tr>
<tr>
<td>Malawi</td>
<td>59%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>68%</td>
</tr>
</tbody>
</table>

Various studies have shown that foot complications in African people are mostly caused by infection and/or neuropathy rather than peripheral vascular disease (narrowing of the arteries). However, because communities across Africa are becoming more urbanized, the epidemiology of peripheral vascular disease is changing across the continent, with corresponding increases in prevalence rates of peripheral vascular disease in diabetes populations. Published rates of peripheral vascular disease show an increasing trend in rates from 11.6% in Ethiopia, to 15% in Malawi, 21% in Tanzania and 41% in Zambia.
Peripheral neuropathy is the principal underlying risk factor for foot ulcers in people with diabetes. Observational data from Dar es Salaam record peripheral neuropathy in 100% of people with a diabetic foot ulcer. A more recent study of the clinical outcome of people with diabetic foot ulcers in Dar es Salaam found that 15% of people with diabetes admitted to Muhimbili National Hospital had foot ulcers. These were first-time occurrences in 80% of cases. Data from the same study showed that amputation is a frequent outcome (33%) and that the highest in-hospital mortality rate (50%) was observed among people with severe diabetic foot ulcers that had not previously undergone surgery with amputation. Similar findings have been recorded in other parts of Africa such as Burkina Faso (38%), Ethiopia (53%) and Kenya (55%).

Unhygienic conditions and poverty may be associated with foot ulceration. Other major factors contributing to the development of ulcers include walking barefoot or delays reporting the problem to a medical centre. Barefoot walking is common in rural Africa. It may be related to low income or the result of cultural practices. For people with diabetes living on or below the poverty line, the purchase of appropriate footwear is either not feasible or is not a high priority. The examples of ulcer-causing injury observed in rural areas include ulcers as a result of rodent bites on insensitive toes because people sleep on the floor or outside. Though less common, similar injuries caused by the common house rat or other rodents have been seen in urban areas.
Foot infections are common in people with diabetes and may have serious consequences. Although foot infections in Africa appear to be similar to those affecting people with diabetes in developed countries, there are some epidemiological differences. African people with diabetes often already have gangrene (death and decay of tissue) by the time they attend a clinic, or have an infection so advanced that it may well not respond to conventional supportive treatment with antibiotics, intravenous fluids and insulin. Delays in reaching care may result in progression to systemic infection that presents a serious threat to life.

One consequence of a delay in reaching healthcare facilities is an often erroneous assumption on the part of the treating healthcare professional that this is a sign of self-neglect. In a study of people with symptomatic peripheral neuropathy, 33% had acquired fungal infection of toenails or between the toes and 19% had cracked skin or fissure on the soles of their feet. These types of infection produce relatively slight discomfort, but are important in people with diabetes because they make it possible for bacterial microorganisms to enter the foot. Such foot infections are especially common where there is no podiatry available and unsuccessful home therapy or traditional healing has already been tried.

The term ‘Tropical Diabetic Hand Syndrome’ (TDHS) has been used to describe a progressive, fulminant (rapid-spreading) infection that affects the hand or arm following an innocuous injury. It is specific to countries with a tropical climate. People who develop TDHS often show signs of cellulitis, ulceration, or gangrene. The infection may be local or throughout the body. Delay in seeking medical attention is associated with substantial morbidity (for example the loss of hand function due to scarred tissue or amputation) and mortality. Hand sepsis is increasingly seen in coastal regions of Africa. Women tend to be particularly affected – probably as a result of manual labour. Social deprivation and poverty are recognized risk factors. Key areas for improvement include better access to care in the community.

Local barriers to foot care

As should be obvious from the situation described above, Africa faces numerous barriers to the implementation of foot care. It has been estimated that 80% of people with diabetes in Africa remain undiagnosed. Poverty is widespread. Where funding, however limited, does become available, it is exhausted in the fight against communicable diseases such as tuberculosis and malaria and, most significantly, HIV, which now affects one in five or more adults in some countries in the region (South Africa, Zambia, Botswana, Lesotho, Swaziland and Zimbabwe, for example).
A serious barrier to care is the lack of infrastructure. People may need to travel far to receive healthcare and thus may only be inclined to do so when it is already too late. People from rural areas in Ethiopia, for example, have to travel great distances to access healthcare services: 23% need to travel 100km; 13% need to travel 180 km. This can require a journey of more than 5 days to reach healthcare services.

Widespread illiteracy and common recourse to practices of traditional healing complicate the provision of diabetes care and diabetic foot care. Only a few countries in the region have national diabetes programmes. The lack of resources remains the most important barrier to implementing structured health programmes. Ghana, for example, has no separate healthcare policy. Most countries have no private or national healthcare schemes and experience shortages of specialist healthcare professionals.

The two most significant risk factors for the occurrence of foot infection and ulceration are social deprivation and limited access to healthcare. In Africa, the use of protective footwear is not widely or routinely practised.

**Conclusion**

Education remains the most powerful preventative tool in undeveloping countries, and should be an integral part of prevention programmes. It should be simple and repeated often. Perhaps the most important intervention for the prevention of diabetic foot complications in Africa is the education of people with foot problems. The two important golden rules are: ‘inspect your feet often and avoid walking barefoot’. These two simple rules, if followed, could go a long way to reducing adverse events associated with the diabetic foot in Africa. Education should target healthcare workers and people at risk. A comprehensive foot-care programme should include regular foot examination, identification of the high-risk foot, maintenance of glycaemic control, as well as educational programmes. In many parts of Africa, however, optimal foot care remains a distant objective.
Foot care worldwide

Further reading:

Foot care worldwide

Eastern Mediterranean and Middle East Region (EMME)

The current situation

The IDF EMME Region consists of 22 countries. It extends from Pakistan in the east to Morocco in the west. Its population comprises several ethnic groups. An estimated 19.2 million people in the region have diabetes. Some countries have diabetes prevalence rates that are among the world’s highest: 20% in the United Arab Emirates, 16% in Qatar, and 15% in Bahrain. Even in countries with less affluence, prevalence is high. Pakistan, for example, has a diabetes prevalence of 8.5%. One fifth of the region’s population is under 20 years of age. Life expectancy is greater than 65 years in most of the region. Some countries of the region are characterized by rapid economic development. The boom is driving the adoption of unhealthy western lifestyles, characterized by changes in diet and less physical activity (both contributing to obesity), as well as increased tobacco consumption.

Most people in the region are Muslim. Arabic is the most widely spoken language; others include Punjabi, Pashtu and Persian. In places, European languages such as French and English are also spoken. The climate varies between hot, humid summers to a moderate desert climate along the Gulf and cold winters in the eastern countries. In the south there is a heavy rainy season.

Incidence of diabetic foot ulcers and amputation

None of the countries in the region have national figures for the incidence of either diabetic foot ulcers or lower-leg amputations. The few hospital-oriented figures that are available reveal an incidence of amputation as high as 40% among people admitted for diabetic foot ulcers. One specialized centre in Sudan sees four new cases of diabetic foot ulcers every day.

Several countries have a specialized diabetes centre with an interest in the diabetic foot. These are located in the capital or other large urban areas.

<table>
<thead>
<tr>
<th>Diabetes in the EMME</th>
<th>2003</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total EMME population (millions)</td>
<td>544.6</td>
<td>839.2</td>
</tr>
<tr>
<td>Adult population (millions) (20 - 79 years)</td>
<td>276.0</td>
<td>493.6</td>
</tr>
<tr>
<td>Number of people with diabetes (millions) (20 - 79 years)</td>
<td>19.2</td>
<td>39.4</td>
</tr>
<tr>
<td>EMME diabetes prevalence (%) (20 - 79 years)</td>
<td>7.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>
Podiatric education

Unfortunately, there is no professional, government-recognized podiatry education in any of the countries of the region. There are only a handful of podiatrists active for the whole region. These have been trained elsewhere, mostly in Western Europe. However, almost all centres in countries with an interest in foot care have initiated or are considering 3-4 week courses on foot care for nurses and/or junior doctors.

The region is attracting international experts in the field of diabetic foot care to lecture or speak at symposia on the importance of adequate foot care. This is helping to engage the attention of healthcare decision-makers and raise awareness of the burden of diabetic foot problems throughout the EMME Region.

In only one country of the region is it reported that decision-makers are engaged in the development of future training programmes and the establishment of foot-care centres. One diabetic foot clinic clearly functions as a regional centre with referrals from other countries in the area. However, it is generally observed that there is no structured care for foot problems in any of the region’s countries.

Reimbursement

The reimbursement system, where it exists, varies from free medical services for the native population in the Gulf region and private insurance systems to no provision of healthcare insurance for people living in rural areas in the African countries of the region. Frequently, diabetic foot care is not covered by healthcare insurance.
Foot care worldwide

Local barriers to care and foot care

The current burden presented by the complications of the diabetic foot is high and future prospects are bleak due to a combination of:

- a high incidence of diabetes
- low or no awareness of the importance of diabetic foot care
- high illiteracy levels, especially in rural areas
- a lack of structured podiatry services and foot-care education programmes
- lack of infrastructure and communications
- a predominantly young population (many of whom are adopting a sedentary lifestyle, and many of whom are genetically predisposed to developing diabetes)

Some problems related to culture are reported. The combination of a hot, dusty environment with a culture of barefoot walking and sitting cross-legged puts the diabetic foot and lower leg at greater risk. Muslims wash their feet five times daily before prayer (ablution). This can play a positive role in terms of daily inspection of the feet. However, not drying the feet afterwards, particularly between the toes, exposes them to fungal infections and allows bacteria to enter.

Traditional healing in some countries of the region includes burning parts of the body, such as the foot, to ‘heal’ stomach problems. This can cause considerable difficulties, but is fortunately in decline among the younger generation. Herbal remedies (poultice) are still used in some places to treat the feet. This is often done without professional medical advice. Rural workers often work barefoot or wear hard plastic shoes that expose their feet to injury.

Clearly much remains to be done to bring about improvements in diabetic foot care in the EMME Region. In some places, there are promising signs that awareness is increasing. This is resulting in the provision of training opportunities and improved foot-care facilities. Moves to promote education and improve foot-care knowledge among healthcare professionals as well as programmes to foster the exchange of experience between EMME and European countries also offer hope. However, despite a number of initiatives to provide general diabetes education in most EMME countries, foot-care education programmes are not widespread. Survey data reveals a lack of awareness among healthcare professionals and that podiatrists are notably absent from the diabetes care team throughout the region.

In many countries of the EMME Region, there is not only a lack of prevention-oriented foot-care education, but also a lack of facilities to bring about the levels of reduction that have been achieved in some developed countries. Consequently, a high frequency of serious diabetic foot complications and subsequent amputations is seen across the region. Work by advocacy groups to ensure that foot care is included in national diabetes programmes is needed to further the transition to the optimal treatment and management of the diabetic foot.
“If present trends continue, economic disparities between industrial and developing nations will move from inequitable to inhuman”

James Gustave Smith

Further reading:
Foot care worldwide

European Region (EUR)

The current situation

There are 48.4 million people with diabetes in the IDF European Region (EUR). Prevalence rates show a wide variation, from 2% in Iceland to 10.2% in Germany. There is a lack of data from the former socialist republics. The region consists of 51 countries and extends from Kyrgyzstan in the east to Iceland in the northwest. There is a great diversity in populations and great differences in climate and economic circumstances.

Incidence of diabetic foot ulcers and amputation

Due to a lack of adequate record-keeping and, in some cases, a lack of interest in the diabetic foot, the impact of diabetic foot disease across the region cannot be assessed with any degree of accuracy. It is estimated that up to 5% of people with diabetes in the EUR Region have foot ulcers. The data that are available for the region indicate that the incidence of minor and major amputations varies greatly, from 0.46 for every 1000 people with diabetes in Madrid, Spain to 6.6 for every 1000 in rural Germany. Croatia gives figures of 6.8 (hospital-oriented data). Regional data from the UK and national data from the Netherlands give 2.6 and 3.61 respectively for every 1000 people with diabetes. Some limited data for major amputations are available. They reveal figures of 2.3 in Leverkusen, Germany, and 2.48 in Scotland for every thousand people with diabetes and 0.056 - 0.12 in Spain (regional records). Developed countries in the region have reported significant decreases in the incidence of major amputations and/or minor amputations (Denmark, the Netherlands, Spain, Sweden, UK).

Healthcare systems and diabetic foot care

The majority of countries in the European Region have national diabetes programmes. Many have a well-organized healthcare structure that provides most people with access to healthcare. Wealthier people are often privately insured, while the majority are provided for by the state. The provision, however, of foot care for people with diabetes varies. In many of the countries in Western Europe, diabetes care and diabetic foot care are widely available, as are sophisticated treatments. However, the availability of

<table>
<thead>
<tr>
<th>Diabetes in Europe</th>
<th>2003</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total EUR population (millions)</td>
<td>871.8</td>
<td>862.6</td>
</tr>
<tr>
<td>Adult population (millions) (20 - 79 years)</td>
<td>621.2</td>
<td>646.3</td>
</tr>
<tr>
<td>Number of people with diabetes (millions) (20 - 79 years)</td>
<td>48.4</td>
<td>58.6</td>
</tr>
<tr>
<td>Diabetes prevalence (%) (20 - 79 years)</td>
<td>7.8</td>
<td>9.1</td>
</tr>
</tbody>
</table>
Foot care worldwide

More multidisciplinary diabetic foot clinics are needed

International Consensus on the Diabetic Foot

European Diabetic Foot Study Group

Eurodiale Consortium

Foot care in Eastern Europe is improving

Improved cooperation between different healthcare professionals

specialized, multidisciplinary diabetic foot clinics remains inadequate. Provision of good diabetic foot care seems to depend on the work of ‘local champions’. Many of these individuals are driving initiatives aimed at educating other healthcare professionals, who often then go on to educate and treat the people with diabetes in their care.

Almost every country in Europe has participated in the implementation of the International Consensus on the Diabetic Foot (see pages 124 - 127). Another positive development in Europe has been the setting up of the European Diabetic Foot Study Group to promote research in the area of the diabetic foot. A new initiative that will do much to improve data collection in diabetic foot care throughout Europe is the recently formed Eurodiale Consortium (see pages 118 - 121). This is a research collaboration between diabetic foot clinics in different European countries.

The fall of the Berlin Wall in November 1989 and the subsequent collapse of the Soviet Union marked a shift in the organization of healthcare in Eastern Europe. Up to that point, the healthcare systems, and to a certain extent the education of healthcare professionals, had been organized differently to Western Europe. Slowly, the transformation is resulting in improved foot care for people with diabetes.

Today, the importance of the multidisciplinary team approach to the diabetic foot is well recognized throughout Europe, including Central and Eastern Europe, and there is improved cooperation between the different healthcare professionals involved in the care of people with diabetes. Much, however, remains to be done.

Foot screening programmes to detect people at high risk are carried out in most of the countries of the region, though there are exceptions (Albania and Georgia, for example). In many of the countries in Eastern and Central Europe, foot examination is still not an obligatory part of the follow-up examination of people with diabetes.

Prevalence estimates of diabetes, 2003 - European Region (EUR)
Foot care worldwide

Podiatric education

Professional podiatric education programmes licensed by the government are available in many countries. However, the content and duration of training varies widely, resulting in differences in standards across the region. In some areas, the crucial role of podiatrists in caring for people with diabetic foot problems is not fully recognized – neither by other healthcare professionals nor by healthcare authorities.

In Central and Eastern European countries, there are no official state-registered education programmes for podiatrists. Diabetic podiatry is delivered mostly by diabetologists and trained diabetes nurses, and only exceptionally by podiatrists. A sign of the growing awareness of the importance of proper diabetic foot care in Eastern and Central Europe is the increasing number of diabetic foot clinics, organized mostly as part of the service offered by outpatient specialist diabetes clinics. In 2000, diabetic foot care programmes were carried out in Croatia, Czech Republic, Greece, Poland, Slovakia, Serbia and Montenegro, and Slovenia. By 2004, the number of outpatient diabetes clinics offering foot care in these countries had increased, and there were also foot units in Romania. There were no specialized foot care units in Albania, Macedonia and Georgia. A questionnaire was sent to healthcare professionals from 13 countries in the Eastern and Central Europe in 2004 (see pages 156 - 157).

Local barriers to care and foot care

The education of healthcare professionals is a basic prerequisite for efficient diabetes foot care. The biggest problem in the majority of Central and Eastern European countries is the lack of properly trained healthcare professionals. State-registered education programmes will not be established in the short term. Training courses organized by professionals trained in experienced centres abroad may offer a reasonable alternative.

Although the importance of diabetic foot care is recognized, the implementation of structured foot-care programmes is limited by the availability of financial resources in many countries in Central and Eastern Europe. In order to acquire data for this part of the region, a questionnaire was sent to 13 countries, the results of which are set out in the table below.

Due to the limited availability of financial resources, the prescription of special footwear is a problem in many parts of Europe. In many of the countries of Central and Eastern Europe, there is an urgent need for further negotiations with healthcare insurance companies regarding the availability of special footwear and dressings, as well as foot-care programmes.

National amputation registers must be created throughout the region, since they can provide good feedback on achievements and problems still to be faced. The data collected in this way can also provide a persuasive argument in negotiations with healthcare policy-makers.

The availability of diabetic foot care is sometimes poor, often due to lack of funding. Although insurance is widely available in Western Europe, preventative foot care may not be included in insurance programmes. If people have to contribute financially towards their own foot care, then this may create barriers.
The total number of people with diabetes in Europe is rising rapidly, but at the same time healthcare budgets are being cut back. This combination is likely to lead to an increase in the number of amputations in the near future.

Other significant barriers in Europe result from:

- ageing population
- low awareness
- areas of great social deprivation
- people slipping through the social welfare net
- displacement and migration

Conclusion

Although many people with diabetes in Europe have access to highly specialized healthcare, amputation rates are still increasing, with a few notable exceptions. Diabetic foot care in Western Europe is at a high standard in some areas, but coverage is still not wide enough. Many barriers to optimal foot care remain. Reimbursement is not yet complete in every country. For example, special footwear and dressings are not covered in many countries in the region, particularly in those of Central and Eastern Europe. Many strategies are being employed to improve diabetic foot care and there is a growing sense of optimism as well as a move towards the increased professionalization of foot care. ‘Local champions’ of the diabetic foot have been very active in raising awareness of the diabetic foot in Europe and have been quick to highlight shortfalls where they exist.

Further reading:

# Foot care worldwide

A questionnaire was sent to healthcare professionals from 13 countries in Eastern and Central Europe in 2004. The data are shown in the table below:

<table>
<thead>
<tr>
<th>Country</th>
<th>Population (million)</th>
<th>Foot care service</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Podiatrists</td>
</tr>
<tr>
<td>Albania</td>
<td>3.5</td>
<td>No</td>
</tr>
<tr>
<td>Bulgaria (2000)</td>
<td>7.6</td>
<td>No</td>
</tr>
<tr>
<td>Bosnia and Herzegovina (2000)</td>
<td>3.9</td>
<td>No</td>
</tr>
<tr>
<td>Croatia</td>
<td>4.4</td>
<td>No</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>10.2</td>
<td>Podiatric nurses</td>
</tr>
<tr>
<td>Georgia</td>
<td>4.9</td>
<td>No</td>
</tr>
<tr>
<td>Greece</td>
<td>10.6</td>
<td>3</td>
</tr>
<tr>
<td>Macedonia</td>
<td>2.0</td>
<td>No</td>
</tr>
<tr>
<td>Poland</td>
<td>38.6</td>
<td>Yes, not specialized for pwds</td>
</tr>
<tr>
<td>Romania</td>
<td>21.7</td>
<td>No</td>
</tr>
<tr>
<td>Slovakia (2000)</td>
<td>5.4</td>
<td>No</td>
</tr>
<tr>
<td>Slovenia</td>
<td>1.9</td>
<td>No</td>
</tr>
<tr>
<td>Serbia and Montenegro (2000)</td>
<td>10.3</td>
<td>No</td>
</tr>
</tbody>
</table>

*pwds = people with diabetes*
### Foot care worldwide

<table>
<thead>
<tr>
<th>Special footwear – reimbursement</th>
<th>Wound dressings – prescription and reimbursement</th>
<th>International consensus</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No reimbursement</td>
<td>Not known</td>
<td>No</td>
</tr>
<tr>
<td>Not known</td>
<td>Not known</td>
<td>Known</td>
<td>Yes</td>
</tr>
<tr>
<td>Not known</td>
<td>Not known</td>
<td>Known</td>
<td>No</td>
</tr>
<tr>
<td>Full</td>
<td>1 prescription/month</td>
<td>Known</td>
<td>Own consensus document</td>
</tr>
<tr>
<td>Partial</td>
<td>Partial reimbursement</td>
<td>Known</td>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
<td>Not known</td>
<td>Known</td>
<td>Russian</td>
</tr>
<tr>
<td>Full</td>
<td>Provided by clinics</td>
<td>Known</td>
<td>Yes</td>
</tr>
<tr>
<td>Not known</td>
<td>Full reimbursement for classic materials</td>
<td>Known</td>
<td>In progress</td>
</tr>
<tr>
<td>Partial</td>
<td>No reimbursement</td>
<td>Known</td>
<td>Yes</td>
</tr>
<tr>
<td>Partial</td>
<td>Provided by clinics</td>
<td>Known</td>
<td>Yes</td>
</tr>
<tr>
<td>Not known</td>
<td>Not known</td>
<td>Known</td>
<td>Yes</td>
</tr>
<tr>
<td>Partial</td>
<td>Full reimbursement for classic materials</td>
<td>Known</td>
<td>Yes</td>
</tr>
<tr>
<td>Not known</td>
<td>Not known</td>
<td>Known</td>
<td>No</td>
</tr>
</tbody>
</table>

* internist – diabetologist, internist – angiologist, diabetes nurse, surgeon (general, vascular, orthopaedic, plastic), orthopaedic shoe maker, other specialists (neurologist, dermatologist, radiologist, microbiologist), family doctor
Foot care worldwide

North American Region (NA)

The current situation

There are more than **23 million people with diabetes** in the IDF North America Region. According to 2003 figures, it has the highest prevalence of diabetes among the IDF regions. In the United States alone there are more than 18.2 million people with diabetes (6.3% of the population).

There is an alarming increase in type 2 diabetes diagnosed in children and adolescents. African Americans, Hispanic/Latino Americans, and indigenous populations are at particularly high risk of type 2 diabetes and suffer disproportionately from its complications. The region is diverse with respect to culture, geography and climate.

Incidence of diabetic foot ulcers and amputation

In North America, diabetic foot disease is a major cause of morbidity and mortality and contributes significantly to increased healthcare costs. Foot complications are a major reason for admission to hospital and account for 20% of all diabetes-related admissions. More than 60% of non-traumatic lower-limb amputations occur among people with diabetes. In the USA, there are approximately 82,000 non-traumatic lower-limb amputations performed annually among people with diabetes. This figure actually under-estimates the total number of amputations, because it does not include amputations performed in military hospitals or in Veterans Health Administration hospitals.

It has been estimated that the lifetime prevalence of foot ulcers in people with diabetes is approximately 15%. More than 80% of lower-limb amputations are preceded by foot ulceration. There is a two-fold increased risk of ulcers and amputations among Hispanic/Latino Americans and African Americans, and a four-fold increased rate among Pima Indians. The 8-year cumulative incidence of lower-extremity amputation (LEA) in American Indians with diabetes is 4.4%, with marked differences in risk by sex, educational attainment, renal function and glycaemic control. The rate of LEA in men has been found to be 2.6 times higher than in woman, adjusted for age and duration of diabetes.

### Diabetes in North America

<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total NA population (millions)</td>
<td>441.7</td>
<td>533.8</td>
</tr>
<tr>
<td>Adult population (millions) (20 - 79 years)</td>
<td>289.6</td>
<td>374.5</td>
</tr>
<tr>
<td>Number of people with diabetes (millions) (20 - 79 years)</td>
<td>23.0</td>
<td>36.2</td>
</tr>
<tr>
<td>Diabetes prevalence (%) (20 - 79 years)</td>
<td>7.9</td>
<td>9.7</td>
</tr>
</tbody>
</table>
Centers for Disease Control (CDC) surveillance data on lower-extremity disease in people with diabetes reveals that foot ulcers and amputations are a common, disabling and costly consequence of diabetes that disproportionately affect the aged. In 2000, the LEA rate was highest for toe amputations (3.0), followed by below-the-knee (2.3), above-the-knee (1.4) and foot (1.0). In 2001, the LEA rate was 6.5 per 1000 people with diabetes.

**Number of amputations**

<table>
<thead>
<tr>
<th>Year</th>
<th>LEA rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>7.7 per 1000 people with diabetes</td>
</tr>
<tr>
<td>2001</td>
<td>6.5 per 1000 people with diabetes</td>
</tr>
</tbody>
</table>

In 2002, 68.2% of persons with diabetes reported receiving a foot exam in the past year, and 68.8% reported daily self-examination of their feet.

Although surveillance data indicate that LEA rates are declining and rates of preventative foot care are increasing, foot disease among persons with diabetes remains a significant problem.

A recent study of US veterans revealed regional variations in risk-adjusted major, minor and total amputation rates across Veterans Association Networks. The amputation rate was 14.1 per 1000, with 10.6 to 18.0 amputations per 1000 people across 22 networks. The investigators recommend that minor and major amputations be tracked separately for national surveillance initiatives.

In Canada, there are approximately 2 million people with diabetes. It is estimated that 4% - 10% of these individuals will develop a foot ulcer in their lifetime, and 14% - 24% of these people will require an amputation.
Foot care worldwide

The Caribbean

Caribbean countries have a high prevalence of diabetes and foot problems are a frequent complication. Hospital-based studies demonstrate that diabetic foot disease is an important and costly problem. In Trinidad and Tobago, foot problems account for 14% of hospital admissions, and 29% of bed occupancy by people with diabetes. The habit of going barefoot is common. In individuals with previous foot ulceration, 47% report that they go barefoot in the home, and 17% go barefoot outside the home. Podiatry services are generally not accessible and most people report that they would treat their own cuts and blisters.

There is a high rate of diabetes-related lower-extremity amputations reported in the Caribbean black population. In Barbados the amputation rate is 9.4 per 1000, similar to rates for African Americans (9.5 per 1000). The rate for Barbadian women is exceeded only by US Navaho Indians.

There are deficiencies in education and the provision of foot care in Caribbean communities. There is therefore a great need to increase knowledge of diabetic foot disease and to promote better foot care.

Mexico

Foot ulcers are a leading cause of hospitalizations for individuals with diabetes in Mexico. Every year 2% of all people with diabetes develop foot ulcers.

North American initiatives

The American Diabetes Association (ADA) is the leading voluntary health organization in North America that advocates for people with diabetes. ADA’s Council on Foot Care was established in 1987, and has had a significant impact on research, education and management of the diabetic foot.

Foot Council symposia have served as a forum for health professionals from around the world to meet and discuss challenging clinical issues. Foot Council members have contributed to the development of ADA’s clinical practice recommendations, position statements and consensus statements on the diabetic foot. ADA’s Clinical Practice Recommendations are published annually, and include a position statement on diabetic foot care, entitled ‘Preventive Foot Care in People with Diabetes’.

ADA has also published two consensus statements: one on Diabetic Foot Wound Care and one on Peripheral Arterial Disease in People with Diabetes.

The Canadian Diabetes Association has also published Clinical Practice Guidelines for Foot Care and Neuropathy.
Healthy People 2010

Healthy People 2010 is a national health initiative of the US Department of Health and Human Services. Essentially it is a comprehensive set of disease prevention and health promotion objectives to achieve for the first decade of the 21st century. This initiative calls for a 55% reduction in amputation rates and an increase in the proportion of adults with diabetes who have an annual foot examination.

Specialized foot care

Highly skilled medical and surgical care is widely available for treatment of the diabetic foot in the United States and Canada. Doctors of Podiatric Medicine (podiatrists) receive four years of undergraduate education, followed by four years of podiatric medical school, and 1-3 years of hospital-based residency training. Additional fellowship training in the diabetic foot is available for those with focused interests in limb salvage and research. Orthopaedic surgeons with fellowship training in the foot and ankle are also available. The importance of a multidisciplinary team approach to care is well recognized in most clinical settings and wound-care centres. The American Podiatric Medical Association, the American College of Foot and Ankle Surgeons, and the Orthopedic Foot and Ankle Society have ongoing continuing medical education programmes on the diabetic foot.

Further reading:

Foot care worldwide

South and Central American Region (SACA)

The current situation

There are nearly 40 million people with diabetes in the IDF South and Central America Region (SACA). There are 22 countries in the region, which, between them, are home to 6.7% of the world’s population. Over 80% of the population live in South America, 18% in Central America, and the remainder in the Caribbean islands. The most widely spoken language is Spanish. Portuguese is spoken in Brazil, which is home to more than 50% of the total South American population. Many Amerindian languages are also spoken: Quechuan, for example, is spoken by 8 million people, a third of whom speak little or no Spanish.

The climate across the region varies greatly from the cold of the Andes to the hot, tropical/sub-tropical climate of central Argentina, Paraguay, Uruguay and southern Brazil. There are desert areas found in the north of Chile and the northwest of Argentina.

The constitution of the region’s population is diverse. It includes peoples of many different ethnic origins such as Europeans, Africans, Arabs and Japanese as well as the indigenous populations. Paraguay is the most ethnically, culturally and socially homogeneous country: 95% of its population are Mestizos and Guarani Indians, whose language is spoken by 90% of the population. In some countries, indigenous populations constitute 40% of the inhabitants.

Incidence of ulcer and amputations

Ulcer and amputation data on prevalence and incidence are scarce in the SACA region. Data do exist from the WHO amputation study, but refer only to WHO centre data from Cuba (0.82% and 0.20% in people with type 1 and type 2 diabetes respectively). General figures for Brazil show 0.147%. In the period 1994 to 2002, foot problems accounted for 13.3% of all hospital appointments in the endocrine and diabetes section of one hospital in Brasilia. A few regional cross-sectional studies have shown ulcer prevalence of 10% in those attending primary care.

<table>
<thead>
<tr>
<th>Diabetes in SACA</th>
<th>2003</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total SACA population (millions)</td>
<td>422.8</td>
<td>244.6</td>
</tr>
<tr>
<td>Adult population (millions)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(20 - 79 years)</td>
<td>251.8</td>
<td>363.9</td>
</tr>
<tr>
<td>Number of people with diabetes (millions)</td>
<td>14.2</td>
<td>26.2</td>
</tr>
<tr>
<td>(20 - 79 years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes prevalence (%)</td>
<td>5.6</td>
<td>7.2</td>
</tr>
<tr>
<td>(20 - 79 years)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Foot care worldwide

Reimbursement

Most countries in the region do not have a proper state-run healthcare security system. In most countries in the region, healthcare is mainly provided through the public hospital system. There is very little in terms of primary-care infrastructure. Healthcare expenditure as a percentage of GDP (2002 figures) varies from as low as 1.8% in Venezuela to 8.0% in Argentina. Access to healthcare for many is a problem. In Colombia, for example, official figures estimate that 45% of the population have no healthcare cover. Private care remains well beyond the economic circumstances of the majority, while the resources available for public health are low in comparison to developed countries. In Brazil, a cooperative system of healthcare delivery is spreading.

Priority of diabetic foot complications in diabetes care

In most of the countries in the region, there are no national diabetes programmes (NDPs) although many countries report local initiatives. The ageing population and the shift from communicable to non-communicable diseases, including the high prevalence of diabetes and its complications, have been brought to the attention of governments throughout the region. Appropriate action, however, in terms of the increased investment required to provide sufficient diabetes screening, prevention and treatment has yet to be undertaken.

Diabetic foot care remains a low priority on the agenda of many decision-makers and foot problems do not yet receive the same level of attention as other diabetes complications. This is particularly true in the SACA region if the availability and quality of foot care is compared to changes that have been seen in many European countries and in the USA. Despite the discrepancies,
Foot care worldwide

Podiatric education is close to non-existent when compared with the professional standards of podiatry in the USA, UK, and the Netherlands. In some countries, however, there are courses for podology (Uruguay and Argentina, for example). These can last up to two years, but in the majority of cases last only 6 months and require no graduate-level qualification as a prerequisite of attendance.

The situation is, therefore, less than ideal, with many working in private foot clinics with no medical supervision. This is placing people with diabetic foot problems at risk of damage from inappropriate care. In Chile and in Brazil, initiatives have trained mainly nurses and some doctors to perform what could be called basic podiatry (callus removal, skin hydration, nail cutting, basic debridement, dressing changes and education).

Local barriers to foot care

While the data on foot problems are scarce, those available show a high rate of major amputations among people with diabetes, including above-the-knee amputation. In Rio de Janeiro, amputation rates reached 70% (hospital-based figures). Prevention programmes are the exception. Only Argentina, Chile, Colombia and Brazil have reported screening for diabetic foot problems.

The lack of accurate data on the numbers of people with diabetes in most countries of the region, makes it difficult to estimate the number of chronic complications, including foot problems, and take base-line measurements against which the impact of future foot-care initiatives can be evaluated. The Latin American Diabetes Association (ALAD) and the Latin American Epidemiology Study Group (GLED) are doing much to address this issue.

The SACA region is geographically complex. This contributes greatly to the difficulties in structuring and implementing optimal foot care and leads to a more difficult process of integration. Often, in the more complicated geographical areas such as the Amazonian region of Brazil, Colombia, Peru and Bolivia, the problem is further compounded by a lack of healthcare professionals and a high incidence of communicable diseases.
Lack of national diabetes programmes and little governmental support are difficult barriers to overcome at present. In the countries that do have NDPs, simple foot clinics are emerging and are being integrated into diabetes care. It is hoped that proven success will lead to an increase in this trend. The scarce number of professionals, the low interest in foot problems, the lack of materials and the high costs associated with long hospital stays are seriously impeding progress.

Conclusion

In order to overcome these barriers, the attitudes of healthcare professionals need to change. They should be made more aware of the devastating social and economic impact of diabetic foot ulcers and amputations. Professional podiatric training needs to become more widely available and ways found to motivate people to take up the cause of the diabetic foot. Policy-makers should be engaged where possible to provide support for training and the implementation of foot clinics. Self-care needs to be promoted through awareness-raising and the provision of educational materials.

A promising sign is the setting up of the Grupo Latinoamericano de Estudos de Pé Diabético (GLEPED) in September 2004. It is expected that GLEPED will provide a forum for the exchange of knowledge on foot care across the region, promote the diabetic foot at local and regional meetings and provide a platform from which to launch foot programmes throughout the SACA region.

The contact details for GLEPED can be found on page 194.
The current situation

There are nearly 40 million people with diabetes in the IDF South-East Asia Region (SEA). The seven countries comprising the region face problems of illiteracy, fast-growing populations, poverty and in many places a lack of infrastructure. Some 40% of the population is below the age of 14. The region has a multi-linguistic population, with over 1600 languages and dialects spoken. Although each country has its specific national language, English is by far the most widely-used official language.

The climate of the region is mostly tropical with temperatures ranging between 2° and 26° Celsius in winter and between 25° and 48° in summer. The average annual rainfall is 100cm, but is higher in some countries. The Maldives and Mauritius, for example, experience as much as 380cm and 500cm rainfall per year respectively. Some countries in the region (Nepal, Bhutan and Northern India) have areas that are permanently covered with snow and glaciers.

<table>
<thead>
<tr>
<th>Country</th>
<th>Religion</th>
<th>Language</th>
<th>Climate</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>Muslim</td>
<td>Bengali</td>
<td>Tropical (Monsoon)</td>
<td>131 million</td>
</tr>
<tr>
<td>Bhutan</td>
<td>Buddhism</td>
<td>Dzongkha</td>
<td>Tropical</td>
<td>1.8 million</td>
</tr>
<tr>
<td>India</td>
<td>Hindu</td>
<td>Hindi (30%)</td>
<td>Tropical</td>
<td>1097 million</td>
</tr>
<tr>
<td>Maldives</td>
<td>Muslim</td>
<td>Divehi</td>
<td>Tropical</td>
<td>0.3 million</td>
</tr>
<tr>
<td>Mauritius</td>
<td>Hindu</td>
<td>Creole, Patois</td>
<td>Tropical</td>
<td>1.2 million</td>
</tr>
<tr>
<td>Nepal</td>
<td>Hindu</td>
<td>Nepali</td>
<td>Lowlands: Sub-tropical, Mountains: severe cold</td>
<td>22 million</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Buddhism</td>
<td>Sinhalese, Tamil</td>
<td>Tropical</td>
<td>19 million</td>
</tr>
</tbody>
</table>

Diabetes in SEA

<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total SEA population</td>
<td>1251.4</td>
<td>1629.7</td>
</tr>
<tr>
<td>Adult population (millions) (20 - 79 years)</td>
<td>705.3</td>
<td>1081.0</td>
</tr>
<tr>
<td>Number of people with diabetes (millions) (20 - 79 years)</td>
<td>39.3</td>
<td>81.6</td>
</tr>
<tr>
<td>Diabetes prevalence (%) (20 - 79 years)</td>
<td>5.6</td>
<td>7.5</td>
</tr>
</tbody>
</table>
Incidence of ulcers and amputations

There is little data available and there are few scientific publications addressed to the diabetic foot. From the available data, it is evident that many of the lower-extremity amputations that are carried out on people with diabetes could have been prevented. In India, almost 40,000 legs are amputated every year as a consequence of diabetes. The most common cause is an infected neuropathic foot. This is potentially preventable. Delayed reporting, treatment with traditional medicines and economic constraints are some of the reasons for the high numbers of advanced cases of infection in neuropathic feet. The lesions are not identified in time, nor are they treated adequately by healthcare professionals working in primary care.

Injuries account for 70% of all foot ulcers in neuropathic feet. The injury may be thermal (burns), footwear related, caused by sharp objects, or mechanical.

Despite widespread use of tobacco, the prevalence of peripheral vascular disease is low, only 4%–8% as compared to 20%–40% in persons with diabetes in developed countries. Only 10% of diabetic foot ulcers in South-East Asia are ischaemic.

Only a few people with type 1 diabetes in India have diabetic foot complications. This is not only because of low prevalence but because very few children with type 1 diabetes survive long enough to fall victim to the long-term consequences of diabetes. However, in years to come, with better understanding of the management of diabetes and greater access to care, the life expectancy of people with type 1 diabetes will increase, and chronic complications such as the diabetic foot will impose a severe strain on healthcare services.
# Foot care worldwide

## Reimbursement

Different types of healthcare provision are available, including government-run dispensaries and hospitals, where medical treatment, including examination, investigation and medicine is free for low-income groups and subsidized for others. Public sector (semi-government) dispensaries and hospitals provide free medical treatment to staff and their family members. Private sector healthcare has to be paid for in its entirety by the consumer or the medical insurance company. Less than 5% of the region’s population has medical insurance.

## Priority of diabetes foot complications in diabetes care

In the SEA Region, diabetic foot care remains a low priority on the agenda of many decision-makers, and foot problems do not yet receive the same level of attention as other diabetes complications. In the absence of multidisciplinary teams, the management of the diabetic foot is fragmented, with no single healthcare discipline willing to take up the cause.

## Podiatric education

There is no formal training in podiatry and it is thus not a widely recognized profession. Awareness of foot complications and their consequences is low among people with diabetes and healthcare professionals, which compounds the problem. However, things are changing in India. Recent initiatives have been successful in drawing attention to the plight of people with diabetic foot problems.

## Local barriers to foot care

India and other countries from the SEA Region are facing the dual challenge posed by the threat of communicable and non-communicable diseases. Infectious diseases such as tuberculosis, typhoid and malaria are still not under control, while non-communicable problems like malnutrition, coronary heart disease, hypertension and type 2 diabetes are reaching epidemic proportions.

Some social, economic and cultural factors such as barefoot walking can cause problems. People are required to remove their shoes when visiting temples, exposing feet to extreme temperatures. Unsuitable footwear is commonly used. Traditional medical practices, such as the use of local applications ranging from herbs to cow-dung, are not uncommon. The hot climate with temperatures of up to 48° Celsius seriously exacerbates the situation. Over-crowding in government hospitals, long waiting lists and expensive private-sector treatment force most people to seek help from alternative sources or to attempt to treat themselves.

<table>
<thead>
<tr>
<th>Different types of healthcare provision</th>
<th>Less than 5% has medical insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low priority on the agenda of many decision-makers</td>
<td>No formal training in podiatry</td>
</tr>
<tr>
<td>Communicable diseases are still not under control Non-communicable diseases are reaching epidemic proportions</td>
<td>Long waiting lists</td>
</tr>
<tr>
<td>Traditional medical practices</td>
<td></td>
</tr>
</tbody>
</table>
To tackle and remove these barriers the SEA Region needs:

- education of people with diabetes and healthcare professionals
- formal training in podiatry
- the development of appropriate preventative footwear
- screening of the high-risk foot
- adequate follow up
- a team-based approach to foot care
- early diagnosis and aggressive management of foot lesions

Unless these steps are taken, the number of lower-extremity amputations will rise in this region over the coming years as the diabetes epidemic explodes.

A number of voluntary organizations, such as the Diabetic Foot Society of India (DFSI), Diabetes Association of Sri Lanka, Diabetes Association of Bangladesh and similar organizations are contributing to improved foot care for people with diabetes across the region by organizing short training courses in podiatry and conferences for medical personnel. Although these efforts are promising, action needs to be taken by policy-makers in order to ensure that appropriate measures are taken to reduce the suffering caused by the chronic complications of diabetes in general and of the diabetic foot in particular.

Contact details for the Diabetic Foot Society of India (DFSI) can be found on page 194.

Further reading:

Foot care worldwide

Western Pacific Region (WP)

The current situation

The IDF Western Pacific Region (WP) has more than 43 million people with diabetes. It spans a large geographic area and is characterized by great cultural, ethnic and economic diversity. It encompasses large countries such as Mongolia and China at its most northern point and includes very small Pacific island nations such as Nauru, Niu and Tokelau. The prevalence of type 2 diabetes varies widely and is increasing, particularly in areas of economic growth. Despite this, poverty in the less economically advanced countries, limited resources and, frequently, a lack of government awareness of the threat posed by the diabetes epidemic often means a limited response to the problem.

As the prevalence of type 2 diabetes increases, so too will the rate of diabetes-related foot complications and amputations. A questionnaire was distributed to the important diabetes representative organizations in each country in the region. Responses were received from Malaysia, the Philippines, Hong Kong, Taiwan, New Zealand, Thailand and Fiji. Australia did not initially respond. However, the authors based in Australia have provided the responses for the purpose of this document.

The scope of the problem

Amputation rates are perceived as a problem for most countries.

- The Philippines suggested that its main problems were aggressive amputations performed by orthopaedic surgeons, a lack of financial support and a lack of education for people with diabetes.
- Hong Kong reported foot ulcers, neuropathy and ischaemia.
- New Zealand reported that 50% of its older people with diabetes have risk factors for foot complications. Diabetes-related amputations cost their government 6 million dollars annually.

### Diabetes in WP

<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total WP population (millions)</td>
<td>2110.7</td>
<td>2445.7</td>
</tr>
<tr>
<td>Adult population (millions) (20 - 79 years)</td>
<td>1383.6</td>
<td>1750.5</td>
</tr>
<tr>
<td>Number of people with diabetes (millions) (20 - 79 years)</td>
<td>43.0</td>
<td>75.8</td>
</tr>
<tr>
<td>Diabetes prevalence (%) (20 - 79 years)</td>
<td>3.1</td>
<td>4.3</td>
</tr>
</tbody>
</table>
Foot care worldwide

- Data from Thailand indicated that, in urban areas, 2% of people surveyed had an acute or chronic foot ulcer, 3% had a healed ulcer and 1% had undergone amputation. The source of this survey was not given but the amputation rates compared to the ulcer rates suggest that amputation is the course of treatment in many cases. Interestingly, rural ulceration rates were lower (1.2%) and amputation rates similar (1.1%) to those of the urban population.
- In Taiwan and Australia, diabetes-related amputations account for about half of all amputations.
- Fiji expressed concern with its high rate of admissions and surgical procedures attributable to diabetic foot sepsis.
- Malaysia reports a lack of facilities providing assessment and management of foot problems, as well as fabrication of footwear and orthoses (in-shoe devices).
- In Australia, the data available suggests that amputation rates (estimated at about 3000 per year) are not decreasing. Foot problems in Australia cost an estimated 48 million dollars per year. The majority of foot ulcers are neuropathic in origin, although amputations for foot ulcers and infections in ischaemic feet represent a significant proportion. People in rural areas, particularly the indigenous population, suffer the worst outcomes.

Culture-related issues that impact on foot disease

In Malaysia, New Zealand, Fiji and Thailand, a culture of barefoot walking, particularly in the home, was given as one of the local cultural issues affecting diabetic foot disease. In Malaysia, an inappropriate diet based on carbohydrates and fats was also suggested. People’s preferences for traditional or herbal remedies for foot problems were thought to impact negatively on diabetic foot disease when seeking more effective contemporary management was delayed as a consequence. In Hong Kong, people with diabetic foot problems rely on traditional Chinese foot massage and pedicures, while herbal medicine in Fiji and Malaysia are popular treatments – these are thought to have a detrimental effect. Some Malaysians delay medical treatment as a consequence of beliefs that spirits or charms will protect them.
Foot care worldwide

In Australia, the indigenous population have particularly poor health status and a high rate of type 2 diabetes. This has a physiological and cultural basis. Frequently, aboriginal people fail to seek medical attention due to feelings of shame over their foot problems, mistrust of ‘white society’ and a fear that hospitals are a place to die.

Local barriers to foot care in the region

A lack of health professionals such as podiatrists and diabetes educators to provide preventative care was described by Hong Kong, the Philippines, Fiji and Thailand. Hong Kong reported having only 19 qualified podiatrists.

Poor public knowledge about foot disease was also a common theme in the responses.

• Fiji reported a lack of foot clinics. Sadly, this is despite considerable effort from local staff and specialist foot clinic staff from Australia to establish diabetic foot clinics in Fiji during the late 1990’s. A lack of recognition on the part of health and government authorities of the need for specialization in foot care may explain why local staff have not been able to continue and expand these services.

• In New Zealand and Australia, podiatry and medical services are available in most regions. However, poor co-ordination between services and healthcare professionals impacts negatively on outcomes. Delays in people receiving appropriate care are attributed to this lack of coordination, inadequate understanding of the severity of the condition (in the absence of painful symptoms) and to the absence of a clearly defined referral procedure. The ideal multidisciplinary team approach is the exception rather than the rule for the management of people with diabetic foot problems in these countries and government financial support is frequently lacking. Given that most podiatrists work in the private sector, there is a need for more affordable primary care in New Zealand.

Other barriers include social isolation and social deprivation, cultural barriers and fear of amputation (delaying access to care), and poor footwear.

The impact of climate on foot disease

Hot and humid conditions contribute to a high incidence of fungal infections and provide an environment conducive to the rapid spread of infections. In Hong Kong, dry skin fissuring occurring during the cooler, dry winter months is also a problem.
In the southern areas of Australia and New Zealand, foot injuries from cold occur during the winter months, as do burns from home heaters and fireplaces.

None of the responding countries reported that a national survey was planned.

**Annual data for the numbers of lower-limb amputations in people with diabetes**

<table>
<thead>
<tr>
<th>Country</th>
<th>Date range</th>
<th>Source of data</th>
<th>Results</th>
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</thead>
<tbody>
<tr>
<td>Australia</td>
<td>2002</td>
<td>Area health service in Sydney with a population of 500,000</td>
<td>63 amputations</td>
</tr>
<tr>
<td></td>
<td>1998</td>
<td>National Diabetes Strategy and Implementation Plan</td>
<td>2800 amputations annually</td>
</tr>
<tr>
<td>Fiji</td>
<td>1997 - 2002</td>
<td>Operations performed at CWM Hospital</td>
<td>824</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>No data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>No data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philippines</td>
<td>No data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taiwan</td>
<td>2002</td>
<td>TADE 2004</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td></td>
<td>0.8%</td>
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</tbody>
</table>
Foot care worldwide

Foot care free of charge for feet ‘at risk’

‘Community Podiatry Diabetes Project’

Publicly funded podiatry clinics

Sharing specialist expertise: ‘Telemedicine’ programme

Reimbursement or subsidy systems for the treatment of people with diabetic foot problems

In New Zealand, people with diabetes identified as being ‘at risk’ of foot complications receive foot care free of charge from hospital-based clinics. There is a movement towards access to ‘primary care’ podiatry funded by district health boards. One example is the ‘Community Podiatry Diabetes Project’, which provides screening and early intervention for people diagnosed with diabetes and foot pathology.

In Australia, publicly funded podiatry clinics provide foot care to people in the community, including those with diabetes. There is a move to prioritize access for people with diabetes and those who are assessed as being at high risk of ulceration/amputation. Some specialized services that provide free multidisciplinary management for serious diabetic foot disease have been established. These do not, however, meet the demand and existing clinics are forced to serve people from a large geographical area. In order to share specialist expertise, Sydney’s Royal Prince Alfred Hospital has pioneered a ‘Telemedicine’ programme that has been successful in improving care for people in rural Australia.

Recent changes to Medicare (the universal healthcare system for all Australians) include a rebate for a limited number of podiatry consultations per year for people with diabetes. This represents a great improvement in access to affordable care.
Provision of care for people with diabetic foot ulcers

In most countries, there are no designated foot-care professionals. Rarely, is a co-ordinated, multidisciplinary approach provided.

• In Fiji, care is provided by any doctor at the hospital/health centre or any nurse at a nurses’ station.
• In Hong Kong, care is provided by doctors, podiatrists or practitioners of traditional Chinese medicine.
• In Malaysia, people first consult a traditional healer.
• In the Philippines and Taiwan, doctors, diabetologists, plastic surgeons or orthopaedic specialists are consulted.
• In Thailand, any physician at the local hospital or clinic is consulted when self-care fails.

While Australia and New Zealand have a significant number of podiatrists, only a small percentage of foot ulcers receive podiatric care as part of their treatment. In both countries, people with diabetic foot problems may receive treatment from any number of healthcare professionals, including their local doctor. Some are referred directly to emergency departments or vascular surgeons for amputation, while others are treated by dermatologists (relatively rarely in Australia) or managed by nurses. In Australia, community nurses provide much of the wound care. Comparatively few people with diabetic foot problems are referred to the small number of multidisciplinary clinics that exist. In these countries, the majority of podiatrists work in the private sector and provide preventative foot care and management of non-diabetic foot disorders.

Examples of foot-care programmes.

New Zealand appears to have made considerable efforts to improve the identification and management of diabetic foot disease. The ‘Aotearoa Get-Checked Programme’, which was instigated by the Ministry of Health in 2000, has resulted in a growing trend towards the early detection and screening of foot pathology.
Foot care worldwide

Throughout Australia, a small number of local projects to screen for and manage diabetic foot disease have been undertaken. Typically, these projects receive little financial support. However, three programmes (aptly named ‘Priority Health Care Programs’) were recently funded in New South Wales to improve foot care services for people with diabetes. As part of this, an education document was produced, with the support of the State Health Department, to educate healthcare professionals to manage diabetic foot ulcers. Despite the improvements made by these programmes, their ongoing funding remains in doubt. Foot assessment is in the main performed as part of a general complications assessment by diabetes educators or doctors. At Australian diabetes conferences, contributions on the diabetic foot are few when compared to contributions on other diabetes complications.

In Fiji, little attention has been given to foot disease. However, in a positive break with established practice, foot care has been prioritized in the latest National Strategic Plan on Prevention and Control of Non-Communicable Diseases.

Foot clinics are run jointly by orthopaedic surgeons, podiatrists and orthotists in Hong Kong, suggesting that some attention is given to foot care for people with diabetes.

Podiatry education

In Australia, podiatrists receive undergraduate training in diabetic foot disease. Doctors receive little education in foot care and foot risk assessment. Nurses and diabetes educators receive minimal education in the assessment and identification of the high-risk diabetic foot and where to refer for treatment. As part of their wound-care training, nurses receive some education in diabetic foot wound care. Foot-care education is given as part of general diabetes education.

In Fiji, there are no qualified podiatrists. Minimal foot-care education is offered to healthcare professionals. Diabetic foot education is provided by staff from foot clinics, health centres or through printed materials.
In Hong Kong, there are 19 overseas-trained podiatrists. Diabetic foot-care education is provided by Diabetes Centres and professional associations, administered by podiatrists or diabetes educators. Awareness programmes for people with diabetes are available at hospital clinics.

In Malaysia, health professionals receive foot-care training as part of a 3-month (14 hour), diabetic-clinic-management course and people with diabetes can attend short seminars and workshops run by nurses. General awareness of foot problems is taught by nurses to people with diabetes as part of their foot-care assessment or when they attend diabetes seminars and camps.

In the Philippines, healthcare professionals receive information at conferences and twice yearly diabetes workshops provided by diabetologists and endocrinologists. Foot-care education for people with diabetes is provided annually by the Philippine Diabetes Association’s Foot Council.

Thailand has no podiatrists but foot-care education is taught to healthcare professionals. It includes direction on how to assess the risk factors for ulceration and amputation, basic daily foot care and wound care. Doctors provide education for nurses, who then educate people with diabetes. Awareness programmes exist at some hospitals.

Taiwan reports having no podiatrists.
Foot care worldwide

In New Zealand, diabetes comprises part of undergraduate training as well as post-graduate education. The foot-care education received by healthcare professionals varies widely, as does the education received by people with diabetes. In the latter case, education is provided by general practitioners, practice nurses and diabetes educators. Rarely is it provided by podiatrists, who see only a fraction of the population with diabetes. This is because podiatry is confined mainly to the private sector. Awareness is raised through local programmes. The ‘Get-Checked Programme’ provides free annual checks including foot care, and ‘foot health week’, run by the podiatrists nationally, also raises awareness of general foot care.

Further reading:
3. M McGill; V Nube; T Clingan; M Constantino; T Bolton; E Palmer; Yue D. The Diabetes Amputation Program: a structured systematic approach. The Diabetic Foot; 2003: Winter v6 i4: 172.
The future

“We drive into the future using only our rear-view mirror.”

*Marshall McLuhan*
The future

Where we are and where we are going

Where we are now

Over the last ten years, the level of diabetic foot care has progressed considerably. Each year an increasing number of articles appear in leading journals and a growing number of local, national and international meetings are held (either directly addressing or including themes related to the diabetic foot). In 2003, more than 400 articles appeared in internationally renowned journals (a four-fold increase over the last 10 years). It is particularly encouraging that there is a noticeable rise in the diversity of countries from which the articles originate. All of this drives improvements in the delivery of foot care for people with diabetes and unifies the professional community. In the field of diabetic foot care, the view that care is best delivered when healthcare professionals from different disciplines come together is now widely held.

The main achievements in recent years are:

- the publication and implementation of the International Consensus and Guidelines
- the increasing recognition of podiatry
- a growing evidence base

With the growth in professional and academic interest has come increased political interest. This provides a solid foundation on which the future can be built. It is the structural and financial support that healthcare policy and decision-makers put in place that will define the future for many people living with and at future risk of diabetes complications of the foot.

Where we may be going

As described elsewhere in this book, the future for diabetes is grave. Now described as the global epidemic of the 21st century, the increasing incidence of diabetes will put a great strain on resources and will bring suffering to many if the preventative measures promoted by IDF and other diabetes representative organizations are not put into effect. The future structural changes that will be required to cope with the growing number of people suffering the consequences of diabetic foot complications and the many educational initiatives that will be required to keep the epidemic in check are described elsewhere.
In the field of research into the diabetic foot, more pre-clinical randomized controlled trials are underway and will continue into the future. These studies will stress the importance of identifying the missing links between the outcome of diabetic foot problems and the descriptive variables found in earlier studies. This shift in direction may well indicate a more mature research community in diabetic foot care. However, future improvements are required and many areas of diabetic foot care will require further investigation. These are likely to include issues related to a given set of local circumstances and the quest for answers to recurrent questions not as yet satisfactorily resolved such as:

• how to distinguish between infection and Charcot’s osteoarthropathy
• which type of off-loading can best be used when total contact casting is not available
• whether peripheral vascular disease in diabetes is best treated by percutaneous transluminal angioplasty or by reconstructive bypass surgery

The future will no doubt see the development of new treatments and further advances in areas of diabetic foot care such as wound care stimulation. It is likely that research will lead to a better understanding of the healing process and what factors interfere with the process. This will allow treatment strategies to be more focused.

The IWGDF’s ulcer research classification scheme will assist future research by enabling a uniform, clinical classification of an ulcer and permit researchers to perform multi-centre studies that can include data from different locales. Once the classification system is validated, this instrument can be used to conduct the larger studies that will be required to answer many outstanding clinical questions. One project underway, Eurodiale (see pages 118 - 121) will return data that will likely prove of enormous importance in guiding clinical policy and future diagnosis and treatment strategies.

The future will see the further implementation and evaluation of the existing international guidelines on diabetic foot care. These will be further developed to keep in step with the advances in research and practice. They will also be expanded to include more subjects that pass the consensus process.

The IWGDF network of country representatives will continue to expand as part of the wider move towards the stimulation of local initiatives to collect data and launch prevention programmes.
The increasing interest in diabetic foot care is expected to continue. This will result in more national and international foot meetings, the further promotion of podiatric training and education worldwide, and the launch of new pilot studies to improve foot-care education in developing countries (see pages 128 - 130). It will also see the emergence of regional foot organizations and study groups to add to those already in existence:

- Diabetic Foot Study Group of the European Association for the Study of Diabetes (DFSG)
- American Diabetes Association Council on Foot Care
- Diabetic Foot Society of India (DFSI)
- Grupo Latinoamericano de Estudos de Pé Diabético (GEPED)

Much of what happens to improve diabetic foot care in the future is now in the hands of a new generation of healthcare professionals, researchers and diabetes advocates working hard to improve diabetes care and diabetic foot care in particular. Whether or not their ambitions can be realized will depend on those in a position to provide the necessary funding and make the decisions that will bring down the barriers that currently exist and erect in their place a system of care that will best serve the needs of all people with diabetes.

“I don't know what the future may hold, but I know who holds the future.”

Ralph Abernathy
Practical section
- Dos, don’ts and warnings
- Debridement training
- Country representatives
- Contact details
Practical section

Debridement training

In diabetic foot care, one of the most important activities is the debridement of callus and dead tissue in order to prevent and heal diabetic ulcers. Healthcare practitioners who have not been trained in how to debride callus and ulcers can use a simple model based on an orange. The best kind of ‘orange’ to use is the sweet lime (1), which is a citrus fruit with a hard green crusty rind with a texture and appearance very similar to callus. If these are not available, any kind of orange will do.

The trainee holds a scalpel in the dominant hand in the same way as one would hold a pen (2). With the blade parallel to the surface of the orange, the trainee removes small slices of rind (3) (4). The aim is to do this without removing any of the white pith of the orange. It is important not to try and remove all the rind in one stroke: taking many little slices is much safer.

Next, the trainee removes the pith of the orange, which has a similar texture and appearance to deeper layers of macerated (water-logged) callus (5) (6) (7). These layers can be grasped with a pair of forceps and pulled slightly. This makes the material easier to cut and provides valuable practice for performing the same procedure on a real foot.

When the pith has been debrided away, the flesh of the orange is exposed. It is similar in appearance and texture to the wound bed of an ulcer (8), (9).

Sometimes, ulcers burrow under surrounding skin that is apparently healthy. This overlying skin needs to be cut away to reveal the true size of the ulcer. A pair of forceps can be poked under the skin at the edge of the exposed flesh (10) of the orange, so that the probe passes under the skin. Using a scalpel and forceps, as shown, the trainee can practise dissecting the loose skin at the edges of the “ulcer” (11), (12).

Lastly, the trainee can draw small circles on the rind of the orange to simulate a corn (13). These are removed by inserting a small blade at an angle of 45 degrees (14) and dissecting in a circular motion until a cone-shaped piece of rind and pith (‘the corn’) has been removed (15).

These techniques can be practised at home on a piece of fruit until practitioners are familiar with the techniques and tactile sensations. More experience can be gained through practice on low-risk feet with callus, perhaps the feet of family members, until the practitioner is sufficiently confident and able to debride ulcers and remove corns and callus from the feet of people with diabetes.

This technique has been developed by UK podiatrist Ali VM Foster. It is presented here with her permission.
Practical section
Dos, don’ts & warnings

What follow are some simple instructions on what to do and what not to do to look after your feet. Included are some warning signs to look out for.

None of the information below is intended to replace the advice of your healthcare team.

Dos: Things you should always do

1. Check your feet daily for cuts, blisters, bruises or colour changes, swelling, in-grown toenails and open sores. Use a mirror to see the soles of your feet or, if this is difficult, seek help from someone else. Report any problems to your healthcare team without delay.

2. Always protect your feet. Wear suitable footwear, inside or outside your home to avoid injuring your feet.

3. Check inside your shoes for stones, sharp objects and rough places before putting them on.

4. Buy new shoes late in the day. This is because your feet become more swollen at the end of the day and you can be sure that your shoes are not too tight and fit well.

5. Wearing socks can help prevent injury. Make sure that if you have to remove your shoes and socks for cultural or religious reasons, you are careful to avoid the risk of burns from hot surfaces in hot climates.

6. Always wash your feet with soap and water. Take care to wash between your toes. Dry your feet carefully, especially between the toes. Use oil or lotion to keep your skin soft.

7. Cut toenails straight across and file any sharp edges.

8. Have your feet checked periodically by a healthcare professional.


Remember that even if foot problems are painless, they can still be serious.
Educational materials

Things you should always do

1. Wearing socks
2. Using proper shoes
3. Cleaning the shoes
4. Soaking the feet
5. Cleaning the feet
6. Trimming the nails
7. Applying a bandage
Don’ts: things you should avoid

1. Don’t walk barefoot inside or outside.
2. Don’t wear tight shoes or shoes with rough edges and uneven seams.
3. Don’t wear pointy-toe shoes, high heels, stilettos or shoes that have straps with no back support.
4. Don’t wear tight or knee-high socks.
5. Don’t use water that is too hot to wash your feet.
6. Don’t let your feet get dry and cracked.
7. Don’t use a heater or hot water bottle to warm your feet.
8. Don’t try to treat your own feet with corn medicines or razor blades. Always seek help from a healthcare professional.
9. Don’t smoke or use tobacco products. Smoking damages the blood supply to the feet.
10. Don’t wear jewellery on your feet.

Warnings: things you should look out for

1. Your foot becomes painful.
2. Your foot becomes noticeably red or discoloured.
3. A part or all of your foot becomes unusually hot.
4. There is discharge of any kind from your foot.
5. Your feet smell bad.
6. Your feet have an open sore or blister.
7. You feel generally unwell with nausea and a high temperature.
8. You have unusual difficulty keeping blood sugar levels under control.

If you observe any of these warning signs, inform the healthcare professional who looks after your feet immediately.
Educational materials

Things you should avoid
IWGDF Country Representatives

The country representatives from the International Working Group on the Diabetic Foot (IWGDF) are listed here alphabetically by IDF region. The contact details are subject to change and are thus not included. Contact e-mails can be found through the IWGDF website (www.iwgdf.org).

<table>
<thead>
<tr>
<th>Region</th>
<th>Country</th>
<th>Representative</th>
</tr>
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<tbody>
<tr>
<td>AFR</td>
<td>Cameroon</td>
<td>Prof Jean Claude Mbanya</td>
</tr>
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<td>Senegal</td>
<td>Dr Maimouna Ndour Mbaye</td>
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<td>AFR</td>
<td>South Africa</td>
<td>Podiatrist Andrew Clarke</td>
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<td>Tanzania</td>
<td>Dr Zulfiquarflai G Abbas</td>
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<tr>
<td>EUR</td>
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<td>Podiatrist Corinne Ward</td>
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# IWGDF Representatives

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<thead>
<tr>
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<tr>
<td>EUR</td>
<td>Moldova</td>
<td>Dr Eduard Bernaz</td>
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<td>Dr Karel Bakker</td>
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<td>Dr Eivind Witsø</td>
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<td>EUR</td>
<td>Poland</td>
<td>Dr Anna Korzon-Burakowska</td>
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<td>Portugal</td>
<td>Dr Rui Carvalho</td>
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<td>Dr Emilianna-Corina Mocan</td>
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<td>Russia</td>
<td>Dr Irina Gurjeva</td>
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<td>Dr Teodora Beljic</td>
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<td>Prof Boris Krahulec</td>
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<td>Spain</td>
<td>Ms Esther Gil Zorzo</td>
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<td>Dr Jan Apelqvist</td>
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<td>Prof Sena Yesil</td>
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<td>Dr Maksym B. Gorobeyko</td>
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<td>NA</td>
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<td>Ms Beth McBride</td>
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<td>Ms Els Blok</td>
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<td>Dr E Ruth Chaytor</td>
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<td>NA</td>
<td>Jamaica</td>
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<td>Dr Sharad Pendsey</td>
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<td>Dr Mrs Veenoo Devi Basant Rai</td>
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<td>Prof Humayun Kabir Chowdhury</td>
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## IWGDF Country Representatives

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<tr>
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<tr>
<td>WP</td>
<td>Australia</td>
<td>Prof Lesley Campbell</td>
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<td>Dr Sharon O’Rourke</td>
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<td>Dr Serey Seng</td>
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<td>Podiatrist Michael Yam</td>
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<td>Prof Zhangrong XU</td>
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<td>Dr Sarwono Waspadji</td>
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<td>Japan</td>
<td>Dr Kazuhiro Hosokawa</td>
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<td>Dr Maria Teresa P Que</td>
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<td>Dr Shanta C Emmanuel</td>
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<tr>
<td>WP</td>
<td>Taiwan</td>
<td>Dr Ching Fai Kwok</td>
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</tbody>
</table>
Organizations of interest

IDF Consultative Section and International Working Group on the Diabetic Foot (IWGDF)
Karel Bakker
e-mail: Karel.bakker@hetnet.nl
www.iwgdf.org

American Diabetes Association Council on Foot Care
www.diabetes.org

Diabetic Foot Society of India (DFSI)
Vijay Viswanathan
e-mail: dr_vijay@vsnl.com

Diabetic Foot Study Group of the European Association for the Study of Diabetes (DFSG)
Eve Stamm
e-mail: evestamm@aol.com
www.dfsg.org

Eurodiale Consortium
Leonne Prompers
e-mail: Leonne.prompers@intmed.maas.nl
www.eurodiale.org

Fédération Internationale des Podologues/International Federation of Podiatrists (FIP)
e-mail: Fed.nationale.podologue@wanadoo.fr
www.fipnet.org

Grupo Latinoamericano de Estudos de Pé Diabético/Latin American Diabetic Foot Study Group (GLEPED)
Hermelinda Pedrosa
e-mail: pedrosahc@aol.com

World Walk
Neil Donohue
e-mail: globalpod@aol.com

International Diabetes Federation (IDF)
Avenue Emile De Mot 19
B-1000 Brussels, Belgium
tel +32-2-5385511 | fax +32-2-5385114
e-mail: info@idf.org
www.idf.org

For information and material on World Diabetes Day, please visit: www.worlddiabetesday.org
Glossary
Glossary

Angiography  Method to visualize blood vessels

Angioplasty  Re-establishment of an arterial lumen by percutaneous transluminal instrumentation: a special tube containing an inflatable balloon is inserted into a blocked or narrowed artery. The balloon is inflated to clear blockages, widen the artery and thus improve the blood flow

Anti-platelet therapy  (Preventative) treatment with drugs such as aspirin or clopidogrel to inhibit excessive clotting of platelets in the blood

Atherosclerosis  The process of thickening of the walls of arteries due to build up of fatty material (cholesterol), which can lead to slowing or blocking of blood flow

Artery  A vessel carrying blood from the heart to the various parts of the body

Arthritis  Inflammation of a joint

Athletes foot  Fungal infection between the toes

Blood pressure  A measure in millimetres (mm Hg) of the force exerted by the blood upon the walls of arteries as it is pushed around the body by the heart

Blood vessel  An artery, vein or capillary

Bullae  Blisters

Callus  Formation of hard skin due to mechanical stress

Capillary  A very small blood vessel that joins an artery with a vein

Cardiovascular diseases  Diseases and injuries of the circulatory system: the heart, the blood vessels of the heart and the system of blood vessels throughout the body

Cellulitis  Presence of swelling, redness and heat. Indicating an inflammatory reaction, irrespective of cause

Charcot-foot  Non-infectious destruction of bone and joint associated with nerve damage: neuro-osteoarthropathy

Claudication  Pain in the foot, thigh or calf during walking, which is relieved by rest, and is combined with evidence of peripheral vascular disease

Debridement  Removal of dead tissue

Diabetic foot  Infection, ulceration and/or destruction of deep tissue associated with neurological abnormalities (nerve damage) and various degrees of peripheral vascular disease (poor blood supply) in the lower limb
A chronic condition that arises when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin produced

A machine that can detect the movement of blood cells within the blood vessel and measure blood flow

High or abnormal levels of fat (lipids) in the blood

The term given to a disease that affects a large number of people at one time

The study of a disease as it affects a group of people

Redness of the skin

Cracks, splits and small cuts of the skin

Structural abnormalities in the foot such as hammertoes, claw-toes, hallux valgus, prominent metatarsal heads, or a consequence of neuro-osteoarthropathy, amputation or other foot surgery

Blisters, erosion, minor cut or ulcer on the foot

Fast spread of disease

Decay and dead tissue: a continuous necrosis (mortification) of the skin and underlying structures (muscles, tendon, joint or bone), indicating irreversible damage where healing cannot be anticipated without loss of some part of the extremity

Deformity of the big toe

Synthesized in glands, hormones are chemical signalling molecules which have a specific regulatory effect upon the activity of body tissues

High glucose levels in the blood

Formation of hard skin

Persistently elevated blood pressure

Low glucose levels in the blood

The number of people found to have a disease, usually per year, in a given population

Invasion and multiplication of pathogenic micro-organisms in body tissues

A hormone which enables the body cells to absorb glucose from the blood and use it for energy. It is produced by the beta cells of the pancreas. It also regulates lipid and protein metabolism
## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Ischaemia</td>
<td>Poor blood supply/impaired circulation</td>
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<tr>
<td>Maceration</td>
<td>Softening of the skin</td>
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<tr>
<td>Macrovacular disease</td>
<td>Disease of the large blood vessels. It is also called macroangiopathy</td>
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<tr>
<td>Metabolism</td>
<td>The term for the way cells chemically change and use food</td>
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<tr>
<td>Morbidity</td>
<td>The condition of having a disease. The morbidity rate is the number of cases of a disease occurring within a particular number of the population</td>
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<tr>
<td>Mortality rate</td>
<td>The number of deaths in a given area or period, or from a particular cause</td>
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<tr>
<td>Necrosis</td>
<td>Devitalized tissue, either wet or dry, irrespective of tissue involved</td>
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<td>Nephropathy</td>
<td>Disease caused by small vessels of the kidneys. It results in loss of protein in the urine, high blood pressure and progressive kidney failure</td>
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<td>Neuro-ischaemic</td>
<td>The combination of diabetic neuropathy (nerve damage) and ischaemia (poor blood supply)</td>
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<tr>
<td>Neuro-osteoarthropathy</td>
<td>Non-infectious destruction of bone and joint associated with neuropathy: Charcot-foot</td>
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<tr>
<td>Neuropathy</td>
<td>Nerve damage leading to numb feet. Diabetic neuropathy refers to damage to the nerve fibres caused by diabetes. Long nerves are most affected and so the process is usually first noticed as a loss of sensation in the feet</td>
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<tr>
<td>Non-ulcerative pathology</td>
<td>Lesions other than an ulcer</td>
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<td>Oedema</td>
<td>Swelling of the foot that is sufficiently pronounced to leave a clear imprint of pressure by a finger</td>
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<tr>
<td>Onychauxis</td>
<td>Overgrowth of the nails</td>
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<tr>
<td>Onychocryptosis</td>
<td>Nail deformities such as ingrown toenails</td>
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<tr>
<td>Onychogryphosis</td>
<td>Thickening and curling of the nails</td>
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<tr>
<td>Orthosis</td>
<td>An in-shoe device that controls, corrects or accommodates a structural or functional abnormality</td>
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<tr>
<td>Osteitis</td>
<td>Infection of the bone without involvement of bone marrow</td>
</tr>
<tr>
<td>Osteomyelitis</td>
<td>Infection of the bone with involvement of bone marrow</td>
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<tr>
<td>Pancreas</td>
<td>An organ which produces insulin. The pancreas is situated behind the lower part of the stomach, close to the liver</td>
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</tbody>
</table>
Glossary

Blood flow to the skin
Disease of blood vessels in the extremities (hands and feet)
The arteries of the legs are usually the most affected

The number of all people with a disease in a given population

Footwear designed to prevent ulceration
Changes in the retina of the eye which may cause visual impairment and blindness. Diabetes can lead to damage to the small blood vessels that supply blood to the retina

Improving blood supply through vascular surgery
A bypass graft is inserted into the blocked or narrowed blood vessel

A sudden loss of function of the brain caused by interruption of blood flow or bleeding because of an obstructed artery

An infection of the skin not extending to the muscles, tendon, bone and joint

Inflammation of the tendon sheath
Footwear designed to relieve biomechanical stress on an ulcer and able to accommodate dressings

Intravascular formation of a blot clot (thrombus)
Fungal infection of the foot
Through the skin
Lesion of the skin

Disease relating to or affecting the blood vessels
A vessel carrying blood back from various parts of the body to the heart

Small hard benign growths on the skin: warts

Perfusion
Peripheral vascular disease
Prevalence
Protective footwear
Retinopathy
Revascularization
Stroke
Superficial infection
Tenosynovitis
Therapeutic footwear
Thrombosis
Tinea pedis
Transcutaneous
Ulcer
Vascular disease
Vein
Verucca