



# Step by Step, improving diabetic foot care in the developing world

## A pilot study for India, Bangladesh, Sri Lanka and Tanzania

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### Introduction Epidemiology: foot care and diabetes

Diabetes mellitus is a serious chronic disease. The global prevalence of diabetes is estimated at over 200 million. This figure has been predicted to reach 333 million by 2025 because of longer life expectancy, sedentary lifestyles and changing dietary patterns. In India, Tanzania and the surrounding countries, the estimated incidence of diabetes for the urban areas is between 12–14% and in rural areas about 1–2%. This means that India has approximately 40 million and Tanzania one million people with diabetes.

Although many serious complications, such as kidney failure or blindness, can affect individuals with diabetes, it is the complications of the foot that take the greatest toll. Foot problems are a threat to every person with diabetes. Worldwide, more than a million lower leg amputations are performed each year as a consequence of diabetes, which means that in every 30 seconds a lower limb is lost to diabetes somewhere in the world.<sup>1</sup> This figure is unacceptably high. The treatment and subsequent care of people with diabetic foot problems have a significant impact on health care budgets and a potentially devastating effect on the lives of affected individuals and their family members, particularly in developing countries.

Of all lower extremity amputations, 40–70% is related to diabetes.

### SUMMARY

The increase in the prevalence of diabetes and its complications is alarming. The incidence of diabetic foot disease, which leads to foot amputations far too often, is unacceptably high. This is particularly true for developing countries.

Worldwide, every 30 seconds a lower limb is lost as a consequence of diabetes.

The International Diabetes Federation (IDF) Consultative Section and the International Working Group on the Diabetic Foot (IWGDF), together with the Diabetic Foot Society of India (DFSI) and the Muhimbili University College of Health Sciences Dar es Salaam, Tanzania (MUCHS), have initiated a foot care project called 'Step by Step, improving diabetic foot care in the developing world'. Participating countries were India, Bangladesh, Sri Lanka and Tanzania. Teams, consisting of a doctor and a nurse or paramedic, were invited to attend a basic and an advanced course. The goal was to improve educational skills and the management of diabetic foot problems. An experienced national and international faculty was responsible for teaching and the practical sessions.

This article describes the design and the execution of the project. The outcome looks very positive. It is expected that the acquired knowledge and skills of the teams will sustain and that the effect of the courses will cascade from the teams to the local community. We expect that the setup of the project can ultimately help reduce the number of lower extremity amputations. The authors feel that this project is ready to be carried out in other developing countries.

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### KEY WORDS

diabetic foot; Step by Step, pilot study for improving diabetic foot care in the developing world; foot care education and prevention; lower extremity amputations

In most studies, the incidence of lower leg amputation is estimated to be 5–25/100 000 inhabitants/year; among people with diabetes the number is 6–8/1000.

Lower extremity amputations are usually preceded by a foot ulcer in people with diabetes. The most important factors related to the development of these ulcers are peripheral neuropathy, foot deformities, minor foot trauma and peripheral vascular disease. The spectrum of foot lesions varies in dif-

ferent regions of the world due to differences in socio-economic conditions, standards of foot care and quality of footwear.

### Reduction of amputations

Foot complications are one of the most serious and costly complications of diabetes. However, through a care strategy – that combines prevention, the multidisciplinary treatment of foot ulcers, appropriate organisation, close monitoring, and the education of people with dia-

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## A multicentred project

betes and health care professionals – it is possible to reduce amputation rates by 49% to 85%. Most of the foot ulcers in Asia and Africa are of neuropathic origin. Such neuropathic ulcers are usually curable. This perspective should motivate those fighting to make a difference for people living with diabetes around the world.<sup>2–4</sup>

### Guidelines

Qualitatively and quantitatively, the goals and indicators of health care will not differ between people with diabetes living in developed and in developing countries. However, the difference is the availability of resources (human and economic). This unfortunate fact conditions the need to use different approaches, methods and therapeutic strategies to achieve these goals.<sup>5</sup>

### Socio-economics

The diabetic foot is a significant economic problem, particularly if amputation results in prolonged hospitalisation, rehabilitation, and an increased need for home care and social services. Approximately 3–4% of all people with diabetes have a foot problem and use 12–15% of the health care resources for diabetes. In some developing countries, foot problems may account for up to 40% of available resources.<sup>1</sup>

### An initiative to improve foot care

Recently, initiatives and programmes have been developed to direct and improve diabetic foot care. Furthermore, these initiatives address the lack of awareness of the diabetic foot among both health care professionals and those with or at risk of diabetes.

In the developing world, there is no formal training in podiatry; suitable shoes and orthotics are rarely found, and the concept of a multidisciplinary 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 health care professionals

Opening by the Tanzanian Minister of Health, Dr Hussein Mwinyi, of the first Step by Step course in Dar es Salaam; Karel Bakker (l), Zulfikarali G Abbas (r). (© Stephan Morbach)



and people with diabetes all contribute to this disastrous situation.<sup>6</sup>

In 2003 it was the International Diabetes Federation (IDF) Consultative Section and the International Working Group on the Diabetic Foot (IWGDF), together with the Diabetic Foot Society of India (DFSI) and the Muhimbili University College of Health Sciences Dar es Salaam, Tanzania (MUCHS), that took the initiative to design a pilot study to improve diabetic foot care in the developing world called 'Step by Step'.

In 2003 the faculty was invited to Mumbai, India, to set up, design and write the project to apply for funding through the World Diabetes Federation (WDF). In September 2003 the pilot project received a generous financial grant from the WDF.

### The project: Step by Step, improving diabetic foot care in the developing world

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 health care professionals in the prevention and treatment of diabetic foot problems. A national and international faculty of experienced educators in the field was responsible for teaching and chaired the

practical sessions. The first courses started in the autumn of 2004.

### Goals and objectives

- To create more awareness of diabetic foot problems in India and Tanzania (and possibly other developing countries).
- To provide sustainable training of health care professionals in the management of the diabetic foot.
- To facilitate the cascade of information from health care professionals who have undergone training to other health care professionals and thus to export expertise.
- To reduce the risk of lower limb complications in people with diabetes.
- To empower people with diabetes to care for their feet better, detect problems earlier and seek help timely when problems arise.

### Methods

- Preparation of special foot care education materials designed specifically for people with diabetes in developing countries.
- Preparation of foot care education materials for physicians working with people with diabetes in developing countries.
- Preparation of foot care education materials for nurses/paramedics working with people with diabetes in developing countries.
- Preparation of kits of diagnostic



instruments and foot care instruments for participants.

- Preparation of foot care education models to cascade directly from participants to other health care professionals working with people with diabetes in developing countries.
- To use the experience gained from this project in other developing countries.

### The courses

Pairs of doctors and nurses or other paramedics attended the training courses. Both courses were free of costs for all participants.

For India it was decided to invite physicians from remote places along with their paramedics (to develop a concept of the team approach) and offer them a basic and an advanced course after one year. From 600 applications, 100 teams were selected: 94 pairs from India, three from Bangladesh, two from Sri Lanka and one from Nepal. The selected participants were offered a basic course of two and half days in four metros of India (New Delhi, Kolkata, Mumbai and Chennai) in the months of September/October 2004 and an advanced course in August 2005 in India, again of two and half days. The Chair of the project was Dr Sharad Pendsey.

From the 112 applicants from 22 regions in Tanzania, three pairs from Zanzibar, one pair from Pemba and 11 pairs from Tanzania were selected to participate in the basic course in December 2004 and advanced

course in December 2005 in Dar es Salaam – both of two and a half days under the chair of Dr ZG Abbas.

The programme has set up practical training courses for teams of health care professionals and provided them with special educational materials. These have been 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 health care professionals so that knowledge about the effective management of diabetic feet can be spread.

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.
- Conduct a physical examination.
- Screen for neuropathy and ischaemia.
- Classify and stage the foot.

Having identified feet at risk, delegates were taught how to organise 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 to cascade their acquired knowledge and skills to colleagues in their regions.

Teaching colleagues can create a spin-off effect and can thus help to perpetuate and to 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.

### 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. The delegates presented these cases themselves. 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 practise the techniques for debridement and cutting undermined edges of ulcers, the participants were provided with sweet limes as 'guinea pigs' for diabetic feet. The delegates were taught some quite elaborate procedures with the help of these sweet limes – creating ulcers, probing ulcers and cutting out undermined edges using a forceps.<sup>7</sup> All participants had been requested not to cut their nails for one 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 icebreaker and helped develop a friendly and collaborative atmosphere.

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.<sup>8,9</sup> The nurses' kits contained diabetes education material and an instrument kit containing podiatry tools (nail clippers, nail file, surgical diagnostic blades, forceps, probe and scissors) and diagnostic instruments (10g monofilaments and 128Hz tuning



Better footwear is needed. (© Karel Bakker)



A multcentred project

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, and 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, to record what they find and what they do, to use the written material to improve their knowledge of the diabetic foot, and to gradually build their own diabetic foot programme. The delegates left the training with all the equipment required to set up a basic foot clinic.

**The advanced courses**

As a prerequisite for participation, attendees agreed to follow an advanced course within one year. At the course, they have been given a specially prepared video for patient education and another for teaching other health care professionals in their regions, thus spreading awareness about diabetic foot disease and its prevention and management.

Advanced subjects – such as the management of vascular disease, biomechanics and offloading, neuropathic osteoarthropathy, imaging modalities of the diabetic foot, indications for amputations, newer treatments and effective techniques of education – were taught. An important part of the advanced course was also reporting of the achievements in the first year (see below) and the interactive case report session delivered by and commented on by the delegates.

The project will be followed by a survey on the cascading effect of improved foot care in the areas from which the participants have been chosen. The delegates will continue to register the achievements in the second year.

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.

Practice of the technique for debridement of undermined edges of ulcers. The participants were provided with sweet limes as ‘guinea pigs’ for diabetic feet. (© Karel Bakker)



Table 1. Advanced courses: first year results\*

India	
<b>Reports from all delegates from the participating regions after the first year at the advanced courses in 2005</b>	
• Registered patients at diabetic clinics, screened in first year after basic course and who received foot care education	45 000
• Registered patients with high risk feet	15 000
• Registered patients with trivial foot lesions (and treated)	4 500
• Registered patients referred to tertiary centre	350
Tanzania	
<b>Reports from all delegates from the participating regions after the first year at the advanced course in December 2005</b>	
• Registered patients at diabetic clinics	11 583
• Patients with high risks	4 322 (37%)
• Patients with foot ulcers	465 (11%)
• Reported patients ended up with amputations	42 (9%)
• Reported patients died	17 (4%)
*These self-reporting data are incomplete as they are not from the full year but were reported during the second course in 2005 by the delegates.	

- *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.

The delegates and the faculty left full of enthusiasm and excitement. They all felt that they had attended

high quality courses. The delegates scored significantly higher on a questionnaire on foot care knowledge at the end of each course than they had done at the beginning.

**Participation**  
**India**

- Basic course: 97 teams; drop out 3%.
- Advanced course: 87 teams; drop out 10.3%.



### Tanzania

- Basic course: 15 teams; drop out 0%.
- Advanced course: 14 teams; drop out 6%.

All reasons for absence were known. They varied from being ill, disqualification, not being allowed to leave the hospital, getting a PhD degree and getting married.

### First year results

First year results are shown in Table 1.

### Future

#### Expected impact of the project

- Implementation of regular screening programmes.
- Patient education.
- Management of basic foot lesions.
- Reduction of amputations.
- Cascading effect.
- Sustainability.
- Extending the project to other parts of the developing world.

The project will be followed by a survey on the cascading effect of improved foot care in the areas from which the participants have been chosen. This is a pilot project and, if it succeeds in achieving its goals, it can then be extended to other parts of the developing world. The project committee strongly believes that our patients with high-risk feet are presently walking on the road to amputation. By implementing this project, we wish to guide them step-by-step to the road of safety.

### Press coverage

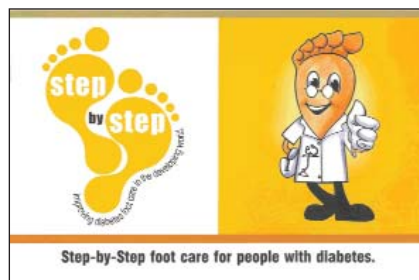
Press coverage is very important in raising awareness of the serious implication of diabetic foot disease. Fortunately, newspapers and radio did cover the Step by Step foot project extensively in both countries. Several leading newspapers reported the event and showed pictures of the delegates and faculty. TV interviews were taken in both English as well as in the national language. In Tanzania the Minister of Health, Dr Hussein Mwinyi, personally opened the first course in Dar es Salaam which led to much exposure.

### Discussion

This carefully designed and executed project to improve diabetic

Step by Step education leaflet to instruct people with diabetes.

(© Karel Bakker)



foot care in the developing world turned out to be a major success. The strength of the Step by Step programme is that the project consist of a two-year set up: a basic and an advanced course to be attended by the same delegates. The prerequisite to participate in the first course was to agree to follow the second course. The drop out rate was very low, particularly if one takes into account the long travelling hours for most of the delegates. The attendees were supplied with a free full set of clinic equipment. Combined with the education and teaching materials, and the acquired knowledge, the participants could immediately start to improve the local foot care management. The lively and interactive exchange of thoughts through the presentation of case reports by the delegates made them more alert to common pitfalls. The delegates realised the possibility of improving management by means of rather simple and affordable care, including education of both colleagues and patients. Another strength of the project is the interaction of both doctors and nurses or paramedics in the teams. This enhances the cooperation and makes the deliverance of care easier at home. The real test will be a significant reduction of the lower extremity amputation rate. Therefore, the project will be followed by a survey on the cascade of effects of improved foot care in the areas from which the participants have been chosen. The faculty (see Box) felt that attending both courses had helped the delegates' awareness of the gaps in their knowledge. As has already been proven in several districts, it provides a firm foundation on which to build a foot care programme. Finally, the display of

### Faculty

#### For India:

- Sharad Pendsey, India
- Arun Bal, India
- Vijay Viswanathan, India
- Ali Foster, UK

#### For Tanzania:

- Zulficarali G Abbas, Tanzania
- Janet K Lutale, Tanzania
- Neil Baker, UK
- Karel Bakker, The Netherlands
- Ali Foster, UK
- Stephan Morbach, Germany

interest of TV, newspapers and radio helps to raise the indispensable awareness of the serious problems of diabetic foot disease. The authors feel that this project is ready to be carried on to other developing countries.

### References

1. Boulton AJM, Vileikyte L, Ragnarson-Tennvall G, *et al*. The global burden of diabetic foot disease. *Lancet* 2005; **366**: 1719–1724.
2. Abbas ZG, Lutale JK, Morbach S, *et al*. Clinical outcome of diabetes patients hospitalized with foot ulcers, Dar es Salaam, Tanzania. *Diabetic Med* 2002; **19**: 575–579.
3. Pendsey S. Peripheral Vascular Disease and the Diabetic Foot Syndrome. In *RSSDI Textbook of Diabetes Mellitus*. Ahuja MMS, Tripathy BB, Modes S, *et al* (eds). Hyderabad: RSSDI, 2002; 559–570.
4. Abbas ZG, Gill GV, Archibald LK. The epidemiology of diabetic limb sepsis: an African perspective. *Diabetic Med* 2002; **19**: 895–899.
5. Apelqvist J, Bakker K, Van Houtum WH, *et al*. International consensus and practical guidelines on the management and the prevention of the diabetic foot. International working Group on the Diabetic Foot. *Diabetes Metab Res Rev* 2000; **16**(Suppl 1): S84–S92.
6. Van Houtum WH. Barriers to the delivery of diabetic foot care. *Lancet* 2005; **366**: 1678–1679.
7. Bakker K, Foster AVM, Van Houtum WH, *et al*. *Diabetes and Foot Care, Time to Act*. IDF, 2005.
8. Edmonds ME, Foster AVM. *Managing the Diabetic Foot*. Oxford, UK: Blackwell Science, 1999.
9. Pendsey S. *Diabetic Foot: A Clinical Atlas*. London, UK: Martin Dunitz (Taylor & Francis Group), 2004.

