

An Integrated Health Care Approach is Needed:

The Global Burden of Diabetic Foot Disease

The world is facing an epidemic of type 2 diabetes and an increasing incidence of type 1 diabetes. Therefore, the International Diabetes Federation chose to focus on the global burden of diabetic foot disease in 2005.

REVIEWED BY PROFESSOR ANDREW JM BOULTON, MD, FRCP

Diabetic foot problems are a common occurrence throughout the world, resulting in major economic consequences for patients, their families and society, wrote Professor Andrew JM Boulton, MD, FRCP, and colleagues in a review article in *The Lancet*. The article was part of a special focus on diabetic foot disease.

Because foot ulcers are most likely to be of neuropathic origin, they are eminently preventable in the developing countries that will experience the greatest increase in the prevalence of type 2 diabetes in the next 20 years, Prof. Boulton wrote.

"People at the greatest risk of ulceration can easily be identified by careful clinical examination of the feet, education and frequent follow-up is indicated in these patients," Prof. Boulton and colleagues said.

RECURRENCE RATES HIGH

The recurrence rates of foot ulcers are >50% after 3 years, an important thing to remember when assessing the economic impact of diabetic foot disease. Costs of diabetic foot disease therefore include not only the immediate episode, but social services, home care and subsequent ulcers. "A broader view of total resources should include some estimate of quality of life and the final outcome," they wrote.

An integrated care approach with regular screening and education of patients at risk requires low expenditure and has the potential to reduce the cost of health care. In their review, Prof. Boulton and colleagues consulted with members of the International Working Group on the Diabetic Foot and identified a comprehensive review of published studies (Table 1).

Problems in foot care still exist in the former Soviet countries, although multidisciplinary foot clinics are becoming more commonplace.

EUROPE

While most European countries implement international guidelines on diabetic foot care and have multidisciplinary foot clinics, disparity remains. For example, few Eastern European countries have foot clinics or podiatry services. A large community-based study in the United Kingdom revealed that simple clinical tests predict those at risk for ulceration, which importantly has implications for screening strategies in developing countries.

Problems in care still exist in former Soviet countries, although multidisciplinary foot clinics are becoming more commonplace in large cities in a number of countries. Prof. Boulton and colleagues said Baltic states have the best foot care systems.

ASIA

Data regarding diabetic foot problems in Asia are sparse. The International Working Group reported that there are just five specialist foot-care clinics in China and no podiatry services. Amputations remain common and interest in the diabetic foot is increasing. India has more people living with diabetes than any other country, and foot problems and amputations are very

common. The investigators said that foot ulceration presents late and is most frequently associated with neuropathy and infection.

AFRICA

The region of sub-Saharan Africa contains 33 of the 50 poorest countries in the world and will experience the greatest risk in the prevalence of diabetes over the next 20 years, according to the review (Table 2). "Diabetic foot complications constitute an increasing public health problem and are a leading cause of admission, amputation and mortality in diabetic patients, and yet since neuropathy is the major cause, they should be, in many cases, preventable," they wrote. Early diagnosis, education and treatment are crucial.

AUSTRALASIA

This region has a low population density, but diabetes is common among native and island people. The amputation rates that were once common in island populations such as Fiji and Nauru have been reduced after the institution of a national foot care health education and prevention program.

A similar program has been initiated in Australia with

telemedicine to aid rural population outposts, Prof. Boulton said. Screening levels are poor and the number of podiatrists is fewer than recommended for the population.

NORTH AMERICA

Diabetic foot complications are a major cause of hospital admissions and are more common in ethnic minority groups. On many islands in the Caribbean, diabetes prevalence is approaching 20% and amputations in diabetic patients are among the highest in the world.

Diabetic foot ulceration and amputation were estimated to cost US taxpayers \$10.9 billion in 2001.

SOUTH AND CENTRAL AMERICA

The prevalence of diabetes in this region ranges from 5% to 20%. Diabetic foot care in Brazil is well organized, thanks to the excellent cooperation between health care professionals and the ministry of health, the authors said.

TABLE 1. EPIDEMIOLOGY OF FOOT ULCERATION AND AMPUTATIONS BY COUNTRY

	Year	Patients	Prevalence		Incidence	
			Ulcers	Amputations	Ulcers	Amputations
Population (community) based studies						
UK ¹	2002	9,710	1.7	1.3	2.2	..
Greece ²	2002	821	4.8	..	..	..
Netherlands ³	2002	665	..	..	2.1	0.6
Slovakia ⁴	19917	1,205	2.5	..	0.6	0.6
USA ⁵	1999	8,965	..	..	1.9	0.3
Clinic-based studies						
Algeria ⁶	1998	865	11.9	6.7	..	..
India ⁷	1998	11,300	3.6	..	..	..

1. Abbott CA, Carrington AL, Ashe H, et al. The North-West diabetes foot care study: incidence of, and risk factors for, new diabetic foot ulceration in a community-based cohort. *Diabet Med.* 2002;20:377-384.
 2. Manes C, Papazoglou N, Sassiou E, et al. Prevalence of diabetic neuropathy and foot ulceration: identification of potential risk factors—a population-based study. *Wounds.* 2002;14:11-14.
 3. Muller IS, DeGraw WJ, van Gerwen WH, et al. Foot ulceration and lower limb amputation in type 2 diabetic patients in Dutch primary care. *Diabetes Care.* 2002;25:570-574.
 4. Vozar J, Adamka J, Holeczy P, et al. Diabetics with foot lesions and amputations in the region of Horny Zitny Ostrov. 1993-1995. *Diabetologia.* 1007;40(suppl 1):A465.
 5. Ramsey SD, Newton K, Blough D, et al. Incidence, outcomes and cost of ulcers in patients with diabetes. *Diabetes Care.* 1999;22:382-387.
 6. Belhadj M. La place pu pied diabetique. *Diabetes Metab.* 1998;24 (suppl):LXVII.
 7. Pendsey S. Epidemiological aspects of the diabetic foot. *Int J Diabetes Developing Countries.* 1994;2:37-38.

More than 60 foot clinics are operational across the country and evidence is increasing that they are having an effect on amputation rates.

HEALTH ECONOMICS

Diabetic foot ulceration and amputation were estimated to cost US taxpayers \$10.9 billion in 2001. Corresponding estimates for the United Kingdom were 5% of total national health service expenditure or £3 billion that was attributable to diabetes. The total annual cost of diabetes-related foot complications was estimated to be £252 million. In addition to the direct costs of treatment, it is important to remember the indirect costs relating to loss of productivity and loss of quality of life.

A review that compiled cost data and adjusted for inflation found that the cost of diabetic foot ulcers not requiring amputation ranged from \$993 to \$17,519 (1998, USD). In a review assessing the cost of amputation, the estimates ranged from \$16,488 to \$66,215 (1998, USD).

COST-EFFECTIVENESS OF PREVENTION

According to a cost-utility analysis based on the Markov model, if intensive prevention could reduce the incidence of foot ulcers and amputations by 25%, the strategy would be cost-effective and save money in all patients with diabetes except those without specific risk factors. It was determined then, that preventive education should focus on those with risk factors. These findings were subsequently confirmed in two other studies.

CONCLUSION

Diabetic foot problems are common all over the globe and have major economic consequences to society, diabetic patients and their families. When assessing the use of resources, the researchers said, a broad view of total resource use that includes some estimate of quality of life and the final outcome should be taken.

"How can we reduce morbidity and mortality from diabetic foot disease?" The answer to this key question might not be too difficult, Dr. Boulton said. "When Paul Brand was asked to make a recommendation to a US Department of Health conference on reducing amputations in diabetes, most listeners were probably expecting an answer promoting vascular surgery or modern medications," he wrote. "They were surprised to hear that his key recommendation was a national campaign to encourage health care professionals to remove patients shoes and socks and examine the feet. Unfortunately this simple advice is ignored in many countries."

Identification of an at-risk patient may be simply

TABLE 2. THE DIABETIC FOOT IN AFRICA: A CLOSER LOOK

- Sub-Saharan Africa contains 33 of the 50 poorest countries in the world, and this region will experience the greatest rise in the prevalence of diabetes over the next 20 years.
- Diabetic foot complications are a leading cause of admission, amputation and mortality in diabetic patients. However, these complications should be preventable.
- A review of the the epidemiology of diabetic foot problems in Africa highlighted not only the frequency of neuropathy, but the increasing frequency of peripheral vascular disease, presumably a result of increasing urbanization.
- Other factors interacting to compound the condition include:
 - unhygienic conditions;
 - poverty;
 - frequent coexisting HIV infection;
 - barefoot gait;
 - low income; and
 - cultural practices.
- Tropical diabetic hand syndrome can also coexist for some unfortunate foot ulceration patients.
- Early diagnosis of foot lesions, education and treatment of sepsis are imperative in order to make an impact on these statistics.

accomplished with a tuning fork, pin, tendon hammer and a 10-g monofilament. Educational programs must be tailored to meet the specific needs of the patient, understanding their social background. An integrated approach to foot care can improve patients outcomes, even in rural areas. Societies guidelines on diabetic foot care provide valuable recommendations as well. ■

Professor Andrew JM Boulton, MD, FRCP, is in the department of medicine at the University of Manchester, Manchester, UK, and the Division of Endocrinology, Metabolism and Diabetes, University of Miami. He can be reached at aboulton@med.miami.edu.

1. Boulton AJM, Vileikyte L, Ragnarson-Tennvall G, Apelqvist J. The global burden of diabetic foot disease. *Lancet*. 366:1719-1724.