

Footwear requirements of patients with diabetes mellitus

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ARTICLE POINTS

1 Nearly a fifth of patients with diabetes mellitus require specialist footwear.

2 Deformity is the primary factor necessitating specialist footwear.

3 The demand for specialist footwear is greater in patients with established disease than in newly diagnosed patients.

4 When planning a footwear service, future requirements of newly diagnosed patients need to be considered.

5 Sessional employment of an orthotist or other healthcare professional for specialist footwear fitting offers potential savings.

KEY WORDS

- Specialist footwear
- Podiatric surgery
- Foot pathology
- Cost savings

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Introduction

An audit was conducted to assess patients with diabetes regarding their footwear requirements and previous podiatry contact. Of 304 patients, 22.4% required a footwear change. Specialist footwear was required by 19.1% of the patients (mainly due to foot deformity). By extrapolation, the annual cost of providing this footwear (one pair of shoes per patient) to the estimated 3700 patients with diabetes in City and Hackney would be £122,100. Potential areas of savings are highlighted, including provision of a podiatric surgical service and shoe fitting on a sessional basis. This paper highlights the need for a strategic plan for footcare services for patients with diabetes.

The incidence of foot pathology as the result of diabetes mellitus and the importance of management are well documented. It is imperative to ensure the patient has the most appropriate footwear in order to minimise pressure and friction, two factors that predispose to foot ulceration (Edmonds et al 1986; Chantelau and Haage, 1994). Footwear requirements range from good, commercially available shoes, through 'off-the-shelf' semi-orthopaedic shoes to bespoke, made-to-measure surgical shoes.

When planning the provision of such a service, it is necessary to estimate the requirements and thus the financial implications. A study was therefore undertaken to estimate the needs of the diabetes population being treated within the City and Hackney district.

Materials and methods

A prospective study was undertaken to screen patients with diabetes at the time of appointment. The duration of diabetes, type of control, footwear requirements and previous podiatry contact and advice were elicited on interview.

In order to achieve an even representation, the patients were divided into four categories:

- Newly diagnosed (duration <6 months)
- New to the diabetes department (duration >6 months but previously seen elsewhere)
- Existing patients (currently attending the diabetes department)
- Podiatry (patients with diabetes attending

the podiatry department only).

Owing to the lack of existing data, the representative sample was estimated at 13% newly diagnosed patients, 10% new patients and 77% existing and podiatry patients. Patients were randomly selected at both diabetes and podiatry outpatient clinics and all the patients were assessed by one experienced practitioner.

Results

A total of 304 patients were assessed over a one-year period. There were 159 (52.3%) men and 145 (47.7%) women, with the majority of the patients in the 40-49 (15.8%), 50-59 (26%) and 60-69 (35.2%) age groups.

There were 80 (26.3%) newly diagnosed patients, 171 (56.3%) existing, 24 (7.9%) new and 29 (9.5%) podiatry patients. Ninety patients (29.6%) were controlled by diet, 125 (41.1%) by tablet and 89 (29.3%) by insulin.

Only 68 patients (22.4%) required a footwear change; the split by patient category is shown in Table 1. A footwear change was deemed necessary if the shoes currently worn by the patient were too tight, provided inappropriate support, or commercially available shoes were not able to accommodate the foot size and shape.

Table 2 shows that the majority of patients either had suitable shoes or required commercially available shoes. Only 58 (19.1%) patients required specialist footwear (semi-orthopaedic or surgical); there were various reasons for this (Table 3). Some patients had

more than one contributory factor; however, deformity was the single most common factor (present in 77.6% of patients who required specialist footwear).

Footwear requirements were also correlated to the patient category. These findings are shown in Table 4 (specialist footwear) and Table 5 (current and commercially available footwear). Table 4 shows that 12.5% of patients with established diabetes (i.e. existing category) require specialist footwear; the figures for podiatry and new patients are much lower, with little to choose between them (3% and 2.3%, respectively). Newly diagnosed patients had the lowest requirement for specialist footwear. Table 5 shows that 246 patients were suited to either their current or commercially available shoes.

The majority of patients, 195 (64.1%), had received some form of podiatry services, while only 138 (45.4%) had received previous footwear advice, 65 of whom still required a change of footwear (Table 6).

Discussion

The St Vincent's declaration, to which the UK DoH is committed, aims to reduce amputations in patients with diabetes by 50%. This can be achieved by good preventive measures, of which careful choice of footwear is a vital component. The use of specialist footwear has been demonstrated to significantly reduce the recurrence of ulceration in the diabetic foot (Edmonds et al, 1986; Chantelau and Haage, 1994). It is therefore important to estimate the potential need, and thus the cost of providing such a service.

Results show that the percentage of newly-diagnosed patients recruited was higher than had been estimated, because more patients were recruited via new patient clinics. However, this will underestimate rather than overestimate demand, as newly diagnosed patients were shown to have fewer requirements for specialist footwear than patients with established diabetes.

Results showed that 19.1% of patients attending diabetic clinics require specialist footwear. The larger percentage of patients requiring a change of footwear (22.4%) is explained by:

- Patients requiring commercially available shoes who are wearing an inappropriate style shoe.

- Patients who had already received specialist shoes, and thus did not require a change of footwear.
- The 65 patients (21.4%) who had previously received advice and still required a footwear change; this probably includes patients requiring specialist footwear who have yet to receive such shoes, and patients failing to heed advice.

The traditional association of non-prescription (commercially available) shoes and foot lesions is not prospectively predictive of these lesions (Litzelman et al, 1997). In this study, patients with diabetes mellitus who had received a recommendation for specialist shoes were reviewed at baseline and one year; both shoe length and shoe width were indicative of wounds at follow-up. The authors deduced that if the severity of the foot status was sufficient for specific footwear advice, then these patients were more likely to develop wounds. However, wounds were more likely to be present if the shoes were felt to be of appropriate width and length. The authors acknowledged that

PAGE POINTS

1 Specialist footwear was required by 19% of patients.

2 Newly diagnosed diabetes patients have less requirement for specialist footwear.

3 Specialist footwear reduces the recurrence of ulceration.

Table 1. Patients requiring footwear change by patient category

Category	No. of patients (% study group)
Newly diagnosed with diabetes	4 (1.3)
Existing patients in diabetes department	48 (15.8)
New to diabetes department	5 (1.6)
Attending podiatry department	11 (3.6)
Total	68 (22.4)

Table 2. Footwear requirements of the study group

Footwear requirement	No. of patients (%)
Current shoes suitable	119 (39.1)
Commercially available	127 (41.8)
Semi-orthopaedic	41 (13.5)
Surgical	17 (5.6)
Total	304 (100)

Table 3. Reasons for requiring specialist footwear

Reason	No. of patients by requirement (%study group)		
	Semi-orthopaedic	Surgical	Total
Deformity	32 (10.5)	13 (4.3)	45 (14.8)
Ulceration	10 (3.3)	10 (3.3)	20 (6.6)
Swelling	8 (2.6)	5 (1.6)	13 (4.3)
Miscellaneous	8 (2.6)	0	8 (2.6)

this is counter to popular theory and, while recognising that their definition of appropriate may have been incorrect, further investigation is needed. Overall, the style and material of the shoes were not significantly associated with wounds at follow-up, and there was no significant relationship between neuropathy and footwear in the aetiology of wounds at follow-up. The authors did not assess cushioned shoes such as running shoes because there were too few patients wearing them. A simple running shoe has been shown to reduce plantar pressures by 30% compared with little improvement with an Oxford style shoe (Cavanagh and Ulbrecht, 1994).

Litzelman et al (1997) conclude that their results challenge the concept that patients with neuropathy and inappropriate footwear are at higher risk of wounds than patients with normal sensation and improper footwear. While this study is well structured and statistically robust, the presence of wounds in the intervening period (i.e. the year between baseline and review) does not appear to

have been considered; furthermore, the study involved commercially available shoes, not specialist footwear. In a prospective study, Uccioli et al (1995) found that the relapse rate of ulceration was lower in patients wearing therapeutic footwear than in those wearing their own shoes.

Litzelman et al (1997) question the lack of scientific evidence surrounding footwear issues for patients with diabetes mellitus, and the lack of specific prescription protocols. The current study did not detail specific prescription criteria for the decision as to whether specialist footwear was required. The decision was based on a clinical assessment by the podiatrist. Further studies may wish to be more prescriptive. Recommendations for footwear by risk category have been suggested (Sims et al, 1988; Coleman, 1991) but these do not appear to have been validated scientifically.

Table 6 indicates that patients with established diabetes (current patients) are more likely to have received a podiatry contact than patients

Table 4. Specialist footwear requirements by patient category

Category	Semi-orthopaedic (%study group)	Surgical (%study group)	Total (%study group)
Newly diagnosed with diabetes	4 (1.3)	0	4 (1.3)
Existing patients in diabetes department	23 (7.6)	15 (4.9)	38 (12.5)
New to diabetes department	5 (1.6)	2 (0.7)	7 (2.3)
Attending podiatry department	9 (3.0)	0	9 (3.0)
Total	41 (13.5)	17 (5.6)	58 (19.1)

Table 5. Nonspecialist (current and commercially available shoe requirements) by patient category

Category	Current (%study group)	Commercially available (%study group)	Total (%study group)
Newly diagnosed with diabetes	35 (11.5)	41 (13.5)	76 (25)
Existing patients in diabetes department	65 (21.4)	68 (22.4)	133 (43.8)
New to diabetes department	7 (2.3)	10 (3.3)	17 (5.6)
Attending podiatry department	12 (3.9)	8 (2.6)	20 (6.6)
Total	119 (39.1)	127 (41.8)	246 (80.9)

Table 6. Number of patients that have received podiatry service and footwear advice, by patient category

Category	Previous podiatry (%patient category)	Previous advice (%patient category)
Newly diagnosed with diabetes	22 (27.5)	12 (15)
Existing patients in diabetes department	135 (78.9)	101 (58.7)
New to diabetes department	12 (50)	8 (33.3)
Attending podiatry department	26 (89.7)	17 (58.6)

newly referred to the diabetes team (new patients) or newly diagnosed patients. This is to be expected as all patients under the care of the diabetes team are referred for podiatry assessment and advice. The development of diabetes would warrant a referral even if there were no current or previous foot pathology. The lack of previous podiatry contact in the podiatry category indicates new patients seen at clinic. Footwear advice is not given to all patients in each category, probably because of suitable footwear being worn by a number of patients, as well as a failure to provide advice. The need for footwear advice for all patients with diabetes should be stressed and the use of appropriate patient information as reinforcement may help.

Using the ethnic census data, and knowing the prevalence of diabetes in each ethnic group, it was estimated that there were 3700 people with diabetes in City and Hackney district. The study data enable an estimation of the specialist footwear requirements of the district. Table 7 shows the outcome of extrapolating the figures of 13.5% and 5.6% for semi-orthopaedic and surgical footwear, respectively, to the district caseload. The table includes the study group figures and the cost of provision of specialist footwear (calculated on local figures: £120 for semi-orthopaedic footwear and £300 for surgical shoes, both with fitting). The annual cost of providing appropriate footwear to patients attending diabetes clinics is potentially £122 100. This figure is based on each patient receiving one pair of shoes per year, a renewal rate derived from Chantelau and Haage (1994)

However, there will be a yearly increase in the estimated footwear budget when newly diagnosed patients are considered, as the specialist footwear requirement increases with the duration of diabetes. Thus the number of patients requiring specialist footwear will increase with time, even if the number of patients with diabetes within the district remains static.

While £122 100 represents a significant initial outlay, the use of specialist footwear for 707 patients with diabetes would only have to prevent two below-knee amputations per year to prove cost-effective as the total cost of such a procedure is £60 000. In addition, there are ways in which the cost of providing specialist shoes can be reduced.

Firstly, many surgical shoe fitters are

remunerated according to the work provided. Employment on a sessional basis provides a potential saving. For semi-orthopaedic shoes, many centres use appropriately trained healthcare professionals on a sessional basis.

Secondly, the primary indication for specialist footwear was deformity, which has the potential for surgical correction. Correction of an underlying deformity may obviate the need for specialist shoes or alter a patient's requirement from a surgical to a semi-orthopaedic shoe. Giacalone et al (1994) performed a retrospective study of 64 patients who underwent 182 prophylactic surgical procedures. Their findings clearly indicate an improvement and demonstrate the potential of surgical correction.

The potential savings from surgical correction of the 45 patients in the study group with deformity and requiring specialist footwear are shown in Table 8. Daycare surgery and the increased use of local anaesthetics have allowed the provision of a cost-effective, efficient service and reduced the risk to the patient from general anaesthesia. The surgery expenses are based on the current extracontractual referral costs of the local podiatric surgical service (£495 per patient). Clearly, not all patients will benefit from or be appropriate for foot surgery. However, there is a potential saving of £55 125 if 45 patients undergo successful surgery, which is almost

PAGE POINTS

1 The cost of footwear provision to the study group was £10 000. Extrapolation to the local population yields £122 100.

2 Even with a static diabetes population, there will be a yearly increase in the estimated footwear budget because the specialist footwear requirement increases with duration of diabetes.

3 To be cost-effective, the provision of specialist footwear to the district diabetes population would only need to prevent two below-knee amputations.

Table 7. The cost of specialist footwear for the study group (n=304) and the City and Hackney diabetes population (n=3700)

	Study group	Cost (£)	City and Hackney	Cost (£)
Semi-orthopaedic	41	4920	500	60 000
Surgical	17	5100	207	62 100
Total	58	10 020	707	122 100

Table 8. Potential savings (£) from performing surgery on study patients with foot deformity requiring specialist footwear

	Semi-orthopaedic (n=32)	Surgical (n=13)	Total
Cost/saving			
Cost per shoe	120	300	-
10-year costs (1 pair/year)	1200	3000	-
Surgery costs	495	495	-
Saving per patient	705	2505	-
Saving on study group	22 560	32 565	55 125

PAGE POINTS

1 Podiatric surgery has the potential to reduce footwear requirements.

2 To provide an adequate footwear service, the potential demand and resource funding must be assessed.

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half of one year's required budget for specialist footwear. Extrapolation to district level gives 547 patients potentially requiring footwear due to deformity. Thus, the potential saving at district level is likely to be greater than £55 125.

Conclusions

Specialist footwear is extremely important in the conservative management and prevention of foot pathology in the diabetic foot. In order to provide an adequate service, the potential demand and resource funding must be estimated. This study has estimated the costs of providing such a service for patients with diabetes mellitus within the City and Hackney district. Allowances must be made for future demands, as the requirements of newly diagnosed patients are likely to change with the duration of the condition. The employment of a surgical shoe fitter or appropriately trained healthcare professional on a sessional basis and the use of prophylactic podiatric surgery have been identified as potential areas of cost savings. There has been no estimate of the socio-economic costs of

diabetic foot disease both to the patient and to the community.

A prospective randomised study is required to evaluate the true outcome of such a strategy. ■

Cavanagh PR, Ulbrecht JS (1994) Biomechanical aspects of foot problems in diabetes. In: Boulton JM, Conner H, Cavanagh PR (eds) *The Foot in Diabetes*. Wiley, Chichester: 25-35

Chantelau E, Haage P (1994) An audit of cushioned diabetic footwear: relation to patient compliance. *Diabetic Medicine* **11**: 114-6

Coleman WC (1991) Footwear considerations. In: Frykberg RG (ed) *The High Risk Foot in Diabetes Mellitus*. Churchill Livingstone, New York: 487-96

Edmonds ME, Blundell MP, Morris HE, et al (1986) The diabetic foot: impact of a foot clinic. *Quarterly Journal of Medicine* **232**: 763-71

Giacalone VF, Krych SM, Harkless LB (1994) The university of Texas Health Science Center at San Antonio: experience with foot surgery in diabetics. *Journal of Foot & Ankle Surgery* **33**(6): 590-7

Litzelman DK, Marriott DJ, Vinicor F (1997) The role of footwear in the prevention of foot lesions in patients with NIDDM: conventional wisdom or evidenced based practice? *Diabetes Care* **20**(2): 156-62

Sims DS, Cavanagh PR, Ulbrecht JS (1988) Risk factors in the diabetic foot: recognition and management. *Physical Therapy* **68**: 1887-902

Uccioli L, Faglia E, Montcone G et al (1995) Manufactured shoes in the prevention of diabetic foot ulcers. *Diabetes Care* **18**: 1376-8