Diabetic foot examination: findings of a screening survey performed in Jordan

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Summary

Despite the alarming prevalence of diabetes in Jordan, there is insufficient information on foot manifestations of diabetes. Periodic screening is recommended for the prevention of diabetes-related foot complications so that foot changes can be identified in the initial stages and appropriate treatment provided in a timely manner.

The purpose of the current study was two-fold: first, to report the findings of an opportunistic foot screening survey for 1072 people with diabetes recruited from nine health care facilities in Jordan; and, second, to identify whether or not they undergo periodic screening.

Descriptive statistics were used to analyse data collected by trained research assistants using an ethically approved standardised protocol covering three main aspects of foot examination (dermatological inspection, and vascular and neurological assessment) with demographic data plus information on diabetic foot care. The protocol also guided the research assistant to appraise height, weight, blood pressure and blood glucose levels.

The study participants were almost equally distributed in terms of gender (males: 50.9%). More than half of participants were aged between 41 and 60 years; 58.1% of the study population had diabetes of more than five years' duration, and most of them had type 2 diabetes. Poor protective sensation was found in the feet of one-fifth of the study population, and a similar proportion was documented for foot deformities. The participants were sorted into four categories of risk for foot ulceration, ranging from risk category 0 to risk category 3. A quarter of the study population were located within risk category 3, and nearly 66% were classified into risk category 0.

In conclusion, Jordanians with diabetes possess several risk factors for diabetic foot ulceration. These risk factors coexist with a lack of adherence to periodic foot screening. Efforts should be made to incorporate periodic foot screening within the context of routine care provided to individuals with diabetes.

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Key words

diabetic foot; screening; Jordan; risk factors; ulceration

Background

Jordan is one of the developing countries that faces an alarming prevalence of type 2 diabetes and poor glycaemic control.[1,2] In two identical cohorts conducted 10 years apart (1994 and 2004), the prevalence of diabetes increased from 13% to 17.1%,[2] leading to a conclusion that Jordan has one of the highest prevalence of diabetes in the world.[1] Such a prevalence places a heavy financial burden on the health care system: the annual direct cost of diabetes management has been estimated to be as much as 654 million Jordanian dinars.[3]

Indeed, the excessive cost of diabetes care is due to complications of the disease including ulcers developed in the foot, which consume the main bulk of the budget.[4]

The recommended preventive activities have been directed towards manipulating factors contributing to the development of foot ulcers. Examples of such factors, which are mainly complications arising from diabetes, include: peripheral neuropathy, structural changes of the foot, peripheral vascular disease, and oedema.[5,6] Therefore, the basic principles of prevention and care of the diabetic foot suggest helping those suffering from diabetes to maintain their blood glucose levels close to the normal range throughout their life. In so doing, the incidence of the risk factors (complications of diabetes) for foot ulcers would be reduced.

Experts also stress the importance of frequent foot screening to reduce the incidence and/or consequences of diabetic foot disease. It is assumed that people at risk would be identified in the initial stages, and thereby early and effective treatment can be provided before too much damage occurs.[6,7] Specifically, periodic screening will enable timely detection of poor protective sensation, and so special precautions will be taken to avoid possible sources of injury that may not be perceived because of peripheral neuropathies. Screening will also reveal foot deformities that increase the chance of skin breakdown, when bony prominences repeatedly compromise soft tissues against the hard surface of shoes.

A literature search showed a lack of information from Jordan on foot changes contributing to the development of diabetic foot ulcers. In view of this dearth in the literature, the present study was conducted in the southern part of Jordan to discover local patterns of diabetic foot changes. In so doing, the evidence necessary to make modifications in the current model of diabetic foot care would be generated. Specifically, this study aimed to

report the findings of diabetic foot examination in a cohort of Jordanians with diabetes. It also sought to elucidate whether or not foot screening is provided as part of lifelong diabetes management.

Methods

This study was part of descriptive cross-sectional research that aimed to examine the status of foot care services in Jordan. The research comprised two studies: one was an interview-based survey of knowledge and practice of diabetic foot self-care; the other was a screening survey of the feet of a Jordanian cohort with diabetes.

This article reports on the screening survey. Details of the study design have been described in a previous publication.[8] Granted ethics approval was reported along with a description of the study setting; namely, nine health care facilities throughout the south of Jordan, with one hospital being in Amman, the capital of Jordan.[8] Strategies employed to recruit eligible participants were also outlined in addition to the training provided for research assistants (registered nurses were working in the participating sites) in terms of collecting data and preparing the data for analysis.[8]

Data collection: the instrument. The data were collected using a protocol for foot examination that was developed from the literature on foot care.[9–11] The protocol guided the research assistants to conduct three main aspects of foot screening: i.e. dermatological inspection, vascular assessment and neurological assessment. Dermatological assessment included inspection of the interdigital foot space/toenails area for evidence of fungal infection. Other areas of the foot were also inspected for corns, callus, oedema, foot deformities and any evidence of ulcers. The vascular assessment included palpating the foot for hotness and pulse (dorsalis pedis pulse and posterior tibial pulse). The neurological assessment sought information on touch pressure sensation using a 10g monofilament. The designed protocol contained a diagram showing areas for monofilament application: five areas in each foot (the pulp of the hallux, the 2nd digit, and the 1st, 3rd and 5th metatarsal phalangeal joints). For the purpose of this research, loss of protective sensation was defined as inability to feel the 10g monofilament in three locations or more on both feet. The research assistants were trained on how to perform the neurological assessment using the monofilament instruments. These instruments were not available within the Jordanian pharmaceutical and medical equipment market, and so were ordered online from a foot care company in the United Kingdom.

The protocol was examined to establish its face and content validity. Content and face validity was established firstly through reviews by nurses specialising in diabetic foot care. A review for face validity was sought from the Research Committee of the Faculty of Nursing, Mu'tah University, and as a result modifications were made.

The reliability of the examination protocol was established in two stages. Firstly, expert reviewers established the accuracy of the protocol. Secondly, the peer review process ensured, as far as possible, the stability of the protocol. This assurance stemmed from the fact that the peer reviewers were knowledgeable of research practices as well as being diabetic foot care clinicians. Such multi-perspective reviews helped in establishing consistency in the protocol. Before starting the process of data collection, the protocol was piloted on a sample of the target population in Al-Karak governorate, and modifications were made as necessary.

The procedure. Before examining each participant, the trained research assistants obtained written informed consent after providing written and verbal information about the study. On agreement to take part in the study, demographic data and information on participants' health history were collected. After that, the research assistants measured the participants' weight, height, blood pressure (BP) and blood glucose level using standardised equipment provided by the researcher. In addition to the training undertaken, the research assistants were provided with a set of procedures for unifying the way of measuring each parameter in different sites of the study. Each participant was instructed to remove their shoes and heavy clothes, and then their body weight was measured using a mechanical scale (ADE Model 707). Blood pressure was measured on the participant's right arm using a mercury sphygmomanometer with appropriate cuff size and stethoscope. Blood glucose level was measured using a portable glucometer (OneTouch Select). Finally, foot examination was done using the protocol described in the previous section.

Data analysis. SPSS version 16 was used to manage the data obtained using the examination protocol. Descriptive statistics were used to summarise the participants' demographic characteristics and describe their clinical profile as well as report on the findings of the examination.

Body mass index (BMI) was calculated (kg/m^2) and classified into four groups: underweight (BMI <18.5), normal (BMI ≥18.5 and <24.9), overweight (BMI ≥25 and <29.9), and obese (BMI ≥30).

Systolic and diastolic BP results were classified into two groups: ≥130/80mmHg and <130/80mmHg. Conventionally, a patient with diabetes is considered to have

Variable		No.	%
History of numbness and tingling	Yes No Missing values	642 429 1	59.9 40 0.1
History of foot ulceration	Yes No Missing values	144 924 4	13.4 86.2 0.4
Foot pain	Present Absent	377 695	35.2 64.8
Numbness and/or tingling	Present Absent	668 404	62.3 37.7
Feet examined by your doctor	Yes No Missing values	173 898 1	16.1 83.8 0.1
Heard about foot specialist	Yes No Missing values	207 864 1	19.3 80.6 0.1
Visit foot specialist	Yes No Missing values	76 993 3	7.1 92.6 0.3
Regular foot examination	Yes No Missing values	52 1016 4	4.9 94.8 0.4

Table 1. Foot examination profile of study participants

hypertension if the average of two independent BP readings, one month apart, is ≥130/80mmHg.[12]

Measured blood glucose levels were classified into the following groups: <140mg/dL (7.7mmol/L), 140–199mg/dL (7.7–11.05mmol/L), and ≥200mg/dL (11.1mmol/L). It was postulated that classification into three groups would provide a clearer picture of the participants' glycaemic control.

Findings of the foot examination were used to classify participants into four risk categories ranging from 0 to 3; risk category 0 means no loss of protective sensation in the foot.[13] If protective sensation was lost, participants who had no foot deformities were placed into category 1. Those with the coexistence of poor protective sensation and foot deformities and/or absence of pulsation (dorsalis pedis or posterior tibial) were placed in risk category 2.[13] Those who had a history of foot ulceration were assigned to risk category 3.[13]

Results

Out of 1101 completed sheets of the examination protocol, 29 people did not meet the inclusion criteria for the study. As a result, this analysis included 1072 participants.

Demographic profile. Out of the 1072 participants, 50.9% were males. Participants' age ranged from 17–90 years with a mean of 53.4 years (SD=13.2 years). More than half of the participants (54.2%, n=581) were within the age group of 41–60 years; around 30% (n=313) of the participants were aged above 60 years. The analysis showed that the majority of participants were either obese (47.3%, n=507) or overweight (35.4%, n=379). More than half (57.9%, n=621) of the participants were non-smokers, and the majority (81.5%, n=874) were married. The majority (75.9%, n=814) of participants were literate, and the proportion of those educated to high school level or above was the highest one (44.6%, n=478). More than one-third (38.2%, n=410) of the participants were housewives, and nearly a quarter (24.3%, n=261) of them were retired.

Clinical profile. The majority (69.7%, n=747) of participants had type 2 diabetes. The analysis showed that the duration of diabetes was from less than one year to 45 years, with a mean of 9.22 years (SD=7.54 years). The duration of diabetes of 35.2% (n=377) of the participants was within the bracket of 1–5 years. More than half (58.1%, n=624) of the participants had had diabetes for more than five years. Around half (48.5%, n=520) had a blood glucose level of ≥200mg/dL. The mean blood glucose level of the study population was 216mg/dL and the range was very broad from 53–850mg/dL (SD=101mg/dL). The most common (65.8%, n=705) form of diabetes treatment was oral hypoglycaemic agents, followed by insulin (31.2%, n=335) either alone or with oral hypoglycaemic agents. Most (62.4%, n=669) participants had a history of other illness. The analysis showed that 48.6% (n=521) of the participants were reported to have a history of hypertension. On examination, measured values of BP showed that more than half (55.2%, n=592) of the participants had a systolic/diastolic BP of ≥130/80mmHg. Systolic BP ranged from 90–200mmHg with an average of 133.20mmHg (SD=19.83mmHg). Diastolic BP was between 50mmHg and 160mmHg with an average of 82.36mmHg (SD=12.22mmHg).

The foot: profile. A history of foot numbness and tingling was reported by nearly 60% of participants, and most (62.3%) of the study population had numbness and tingling at the time of foot examination (Table 1). More than one-third (35.2%) of the participants had current foot pain. The vast majority (83.8%) of the participants reported that their feet had never been examined by health care providers (Table 1). Nearly one-fifth (19.3%) of participants reported that they had heard about the presence of professionals specialising in the field of foot care. A small proportion (7.1%) of participants sought care from foot specialists, and a smaller (4.9%) proportion mentioned that they undergo regular foot examination (Table 1). The analysis showed that 13.4% of participants had a history of previous foot ulceration.

The foot: examination. Inspecting the participants' feet showed the presence of foot dryness among 56.7% (n=608) of the study population. Foot deformities were reported to be present among nearly one-fifth (19.9%, n=213) of the study population. Corns were noticed on the feet of more than a quarter (25.7%, n=275) of the participants. Oedema was documented in 23.8% (n=255) of participants. Fungal infection was present between the toenails of 29% (n=311) of the study cohort. Toenail disorders were documented to be inspected among 34.6% (n=371) of the participants. Active foot ulcers were found among 15.2% (n=163) of the study population. Foot amputation was reported to be present among 17 (1.6%) participants.

Palpating the participants' feet revealed the presence of foot hotness among 17.9% (n=189) of the cohort. Assessment of foot pulse showed that dorsalis pedis pulse and posterior tibial pulse were not palpable in either foot of 6.1% (n=65) and 8.1% (n=87) of the study population, respectively.

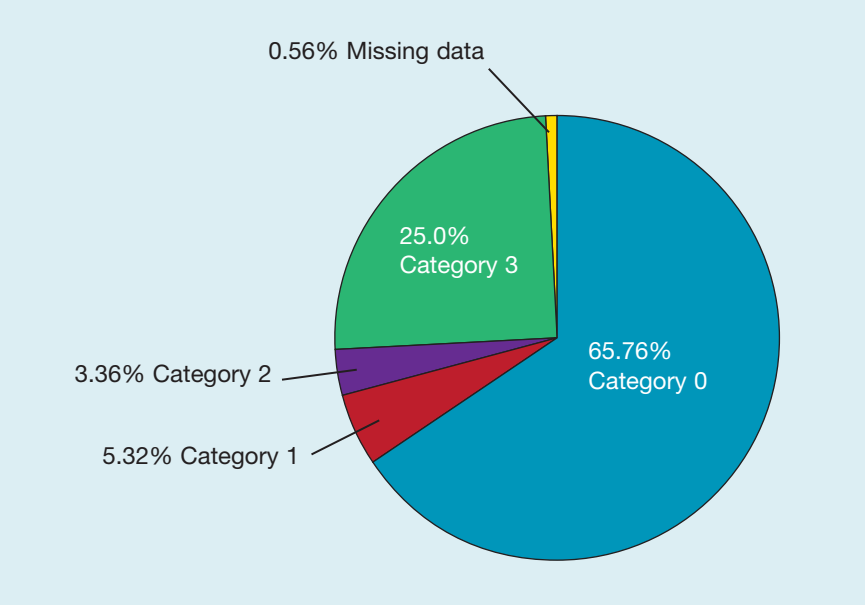

Figure 1. Foot risk categorisation of study participants

The use of a 10g monofilament showed that 20.6% (n=221) of participants had poor protective sensation.

Findings obtained from foot examination showed that most (705) participants fell into risk category 0, while 268 participants were placed into risk category 3; 36 and 57 participants were in risk categories 2 and 1, respectively. (Figure 1.)

Discussion

To our knowledge, this study is the first to document foot examination in a cohort with diabetes from Jordan, including those from the southern part. Our results showed that nearly 66% of the study population had a risk category 0, and 25% had a risk category 3. These categories are part of a stratification scheme aiming to identify patients at risk of diabetic foot-related complications, and then allocate the patients to the appropriate level of care. The foot risk stratification scheme suggests that the frequency of foot screening should be greater when the category of risk increases. Accordingly, patients within risk category 3 require foot examination every one to three months depending on the patient's condition, whereas those in risk category 0 can be examined on an annual basis.

The increase in the frequency is necessary because risk category 3 includes patients with a history of foot ulceration or amputation,[13] people at greater risk of recurrence of foot ulcers.[14] Our screening found that 15.2% (n=163) and 13.4% (n=144) of the study population had active ulcers at the time of examination and history of previous foot ulceration, respectively. Our analysis did not examine the percentage of those who had both a previous history and current foot ulcers. Studies from Jordan have reported a diabetic foot ulcer prevalence of 4% (n=1142),[15] and 19% (n=95).[16] The reported prevalence in Arabian countries varies from 1–12%.[17] Such wide variations could be explained by differences between studies in terms of the research design used and the sampling approach, making comparisons difficult. Determining the prevalence of diabetic foot ulceration is beyond the scope of this study. Accordingly, additional research is required to examine the prevalence of diabetic foot in Jordan. A considerable proportion of Jordanians with

diabetes experience foot ulcers in their lifetime, placing them at higher risk of ulcer recurrence. Therefore, risk category 3 is the recommended class for such patients because intensive follow up can be provided, thus reducing the incidence of ulcer recurrence.

In the light of the discussion above, it is necessary to prevent people from reaching risk category 3, and to stay within the categories of relatively low risk. A substantial proportion of our participants were within risk category 0. The feet of such patients require an annual examination as recommended by the International Working Group on the Diabetic Foot who developed the stratification scheme mentioned above.[13] In other words, diabetic foot care should be started once the diagnosis of diabetes is made, even if there is no evidence of foot irregularities. This was not the case for the vast majority of the study participants whose feet had never been examined by health care providers. It is recognised that foot examination is the most neglected part of diabetes care.[18] Accordingly, diabetic foot care programmes have been established, and so an increase was reported in the percentages of people who have their feet screened annually.[19–21] However, it must be emphasised that most programmes have been established in developed countries.[22] In developing countries, preventive diabetic foot care programmes are either not available,[22] or they are in their infancy and not accessible to people outside major cities.[22,23]

Qualitative evidence from Jordan argues that, similar to other countries, reasons for a lack of adherence to periodic diabetic foot examination include the culture of practice within the health care systems.[24] Negative attitudes and beliefs of both patients and health care professionals towards preventive care are also real barriers to optimal diabetic foot care.[24] Accordingly, it is of no surprise that the percentage of participants whose feet were screened periodically was <5%. It is a matter of concern that the 10g monofilament was not available within the Jordanian pharmaceutical market, as it is considered a convenient, simple and inexpensive tool for detecting loss of protective sensation.[25] Indeed, the lack of availability of such a simple screening tool suggests that the concept of diabetic foot screening is not established within the context of the Jordanian health care system, despite the availability of a national diabetes centre offering educational programmes in the field of foot care. Moreover, Jordan has not yet adopted local guidelines for the management of the diabetic foot. Consequently, it is unsurprising that >80% of the study participants had not heard about professionals specialising in the field of foot care. Accordingly, we add our voice to the qualitative argument that launching the concept of periodic diabetic foot screening within the Jordanian health care system requires decisions at national level plus efforts to increase public awareness of the importance of lifelong diabetic foot care.[24] Circulating the findings of the present study to policy-makers and professional organisations will foster the adoption of a policy of annual foot assessment. Raising public awareness should also encourage the avoidance of behaviours, e.g. barefoot walking, that increase the likelihood of ulceration.

The main benefit of lifelong management is detecting foot changes in their early stages. Loss of protective sensation is considered the primary contributing factor in the occurrence of diabetic foot ulceration.[26,27] For this reason, people with sensory peripheral neuropathy are classified within risk category 1.[13] In the present study, the 10g monofilament examination revealed that one-fifth of the study participants had diminished protective sensation, yet only 5.3% of the participants were within risk category 1. This can be explained by the fact that participants had, in addition to loss of protective sensations, other factors according to which they were classified into higher categories of risk. Examples of other risk factors include foot deformities and peripheral vascular disease; such factors increase the risk when any of them coexists with peripheral sensory neuropathy. As a result, risk category 2 becomes the appropriate class for those with diabetes, and so it is recommended that their feet be examined every three months.[13] Our findings showed that one-fifth of the participants had deformities in their feet with 6.1% and 8.1% having impalpable dorsalis pedis and posterior tibial pulses, respectively.

In addition to the risk factors discussed above, our screening exercise found other factors that increase the likelihood for ulcer formation. Examples include: foot dryness, corns, oedema, toenail disorders and foot hotness. Although these factors may be deemed minor skin changes, they are considered serious issues if they coexist with diabetes because such minor problems may progress into serious ulcers. Accordingly, the role of patients and their families should be considered in performing daily foot inspection to detect minor skin changes, and so appropriate care will be sought. Patients should be encouraged to report evidence of pain, tingling and numbness in their feet which are early indicators of peripheral neuropathy. Our findings showed that numbness and tingling in the foot was a common complaint among the study participants. Furthermore, the blood glucose readings obtained suggest that participants had poor glycaemic control, a primary contributory factor for diabetic neuropathy.[28] This supposition was made despite the fact that a single blood glucose reading may not be

representative of an individual's glycaemic state. However, the reading was obtained on random bases that most likely reflect the reality of the participant's daily glycaemic control. It is claimed that glycaemic control is still far from satisfactory among the majority of Jordanians with diabetes.[2,29] Accordingly, patients should be encouraged to maintain their blood glucose levels within the normal range in that well-controlled blood glucose is the initial step towards reducing the incidence of foot ulcerations.

Limitations. As our study results were obtained from a relatively large cohort with diabetes recruited from nine health care facilities, the findings reflect a realistic depiction of diabetic foot risk factors among Jordanians. However, the study had certain limitations that need to be taken into account. These include the multi-site nature of the study, suggesting that differences among participating sites may have affected the results in some way. Despite the training undertaken, variations between research assistants in performing the foot examination were possible because of different experiences. Additionally, data obtained through examination were not confirmed by in-depth clinical assessment.

Conclusion

In this screening survey study, trained research assistants examined the feet of 1072 people who sought diabetes treatment from health care facilities located in the capital, and the south of Jordan. Findings from the screening not only confirmed the impression that Jordan has a high prevalence of risk factors for diabetic foot ulceration, but also highlighted limitations in care provided to Jordanians with diabetes. Specifically, periodic foot screening is not part of basic diabetes care, yet postgraduate degrees in diabetic foot care are offered. Efforts should be made to legitimise the concept of standardised periodic foot examination within the context of care provided to Jordanians with diabetes. In the meantime, national campaigns are recommended to promote foot screening as an integral component of lifelong diabetes management. The campaign needs to be targeted to reach the public as well as providers of diabetes care.

Declaration of interests

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References

1. Ajlouni K, *et al.* Diabetes and impaired glucose tolerance in Jordan: prevalence and associated risk factors. *J Intern Med* 1998;244:317–23.
2. Ajlouni K, *et al.* An increase in prevalence of diabetes mellitus in Jordan over 10 years. *J Diabetes Complications* 2007;3:1–8.
3. Ford G. The Jordanian Diabetes Crisis: International Economic Development Program 2008, University of Michigan, School of Public Policy, Michigan, 2008.
4. Matricali G, *et al.* Economic aspects of diabetic foot care in a multidisciplinary setting: A review. *Diabetes Metab Res Rev* 2007;23:339–47.
5. Boulton AJ. The diabetic foot: from art to science. The 18th Camillo Golgi lecture. *Diabetologia* 2004;47:1343–53.
6. Singh N, *et al.* Preventing foot ulcers in patients with diabetes. *JAMA* 2005; 293:217–28.
7. Mayfield J, *et al.* Do foot examinations reduce the risk of diabetic amputation? *J Fam Pract* 2000;49:499–504.
8. Abu-Qamar M, Wilson A. Qualitative content analysis of complementary topical therapies used to manage diabetic foot in Jordan. *African J Traditional, Complementary & Alternative Med* 2012;9:440–50.
9. Boulton AJM, *et al.* Comprehensive foot examination and risk assessment: a report of the Task Force of the Foot Care Interest Group of the American Diabetes Association, with endorsement by the American Association of Clinical Endocrinologists. *Diabetes Care* 2008;31:1679–85.
10. Burrow JG, McLarnon NA. Foot assessment: recognizing potential problems. *Nursing & Residential Care* 2004;6:68–71.
11. Kravitz S, *et al.* Physical assessment of the diabetic foot. *Adv Skin Wound Care* 2003;16:68–77.
12. Stults B, Jones RE. Management of hypertension in diabetes. *Diabetes Spectr* 2006;19:25–31.
13. Frykberg RG, *et al.* Diabetic foot disorders: a clinical practice guideline (2006 revision). *J Foot Ankle Surg* 2006;45(5 Suppl):1–66.
14. Matriacali G, *et al.* Outcome and recurrence rate of diabetic foot ulcers treated by a total contact cast: a short-term follow-up. *Foot Ankle Int* 2003;24:680–4.
15. Jbour A, *et al.* Prevalence and predictors of diabetic foot syndrome in type 2 diabetes mellitus in Jordan. *Saudi Med J* 2003; 24:761–4.
16. Salayta W, Al-Ghzawi S. The prevalence of diabetic foot and its risk factors among Jordanian diabetics. *Middle East J Age Ageing* 2010;7(4):19–21.
17. Ahmed AA, *et al.* The diabetic foot in the Arab world. *J Diabetic Foot Complications* 2011;3:55–61.
18. Jeffcoate W, Bakker K. World Diabetes Day: footing the bill. *Lancet* 2005;365:1527.
19. Centers for Disease Control and Prevention. Data & Trends. Age-Adjusted Percentage of Adults Aged 18 Years or Older with Diagnosed Diabetes Receiving a Foot Exam in the Last Year, United States, 1994–2010. www.cdc.gov/diabetes/statistics/preventive/fX_foot.htm [accessed 21 March 2012].
20. Colagiuri S, *et al. National diabetes strategy and implementation plan.* Diabetes Australia, Canberra, 1998.
21. Tapp RJ, *et al.* Diabetes care in an Australian population: frequency of screening examinations for eye and foot complications of diabetes. *Diabetes Care* 2004;27:688–93.
22. Boulton A, *et al.* The global burden of diabetic foot disease. *Lancet* 2005;366:1719–24.
23. Ramachandran A. Specific problems of the diabetic foot in developing countries. *Diabetes Metab Res Rev* 2004; 20(Suppl 1):19–22.
24. Abu-Qamar M, Wilson A. Foot care within the Jordanian healthcare system: a qualitative inquiry of patients' perspectives. *Aust J Adv Nurs* 2011;29:28–36.
25. Armstrong D. The 10-g monofilament: the diagnostic divining rod for the diabetic foot? *Diabetes Care* 2000;23:887.
26. Reiber G, *et al.* Causal pathways for incident lower-extremity ulcers in patients with diabetes from two settings. *Diabetes Care* 1999;22:157–62.
27. Lavery L, *et al.* Practical criteria for screening patients at high risk for diabetic foot ulceration. *Arch Intern Med* 1998; 158:157–62.
28. Smith A, Singleton J. Impaired glucose tolerance and neuropathy. *Neurologist* 2008;14:23–9.
29. Centers for Disease Control and Prevention. Assessing Risk Factors for Chronic Disease — Jordan, 2004. *MMWR Weekly* June 16, 2006;55:653–655. www.cdc.gov/mmwr/preview/mmwrhtml/mm5523a3.htm [accessed 20 March 2011].