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Abstract: The purpose of this review is to present an evaluation of the available literature on rates of postoperative infections in podiatric surgery, both in Australia and internationally. It is not the intention of this review to evaluate treatments or interventions associated with infections. Of the literature that does exist, it appears that podiatric surgery carries no greater risk of infection to the patient than other surgical disciplines. Recent studies have shown infection rates to be well within accepted industry standards of 2-13% as stated in a report by the National Strategy to Address Healthcare Associated Infections. However, in Australia, a paucity of literature indicates there is a need for the podiatric surgical community to evaluate and publish audit results. This will help establish the true risks associated with podiatric surgery to the patient in relation to complications, including postoperative infections

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An innovative multi-disciplinary diabetes’ complications screening programme in a rural community: A description and some preliminary results of the screening

Abstract

This paper describes an innovative multi-disciplinary pilot research project, which is a ‘one-stop diabetes complications assessment programme’, for people living in rural north-east Victoria and southern New South Wales. A total of 91 participants were screened, 14 of whom already had a diagnosis of diabetes. Twenty-six participants were referred to the general practitioner with cardiovascular anomalies for further assessment, 8 had retinal vasculature changes that were indicative of diabetes, and 26 had foot problems that warranted further investigation by a podiatrist. The pilot project was able to provide participants with information about their health status, and also to recommend health management strategies that participants could take. Feedback from participants, general practitioners and community health services indicated that the university's initiative provides an additional health screening opportunity that should be integrated successfully into existing services.
Introduction

Diabetes is a significant health problem in Australia, and is one of the seven National Health Priority Areas identified as causing the most significant burden of disease and illness across Australia (Engelgau, Colagiuri, Ramachandran, Borch-Johnsen, & Venkat Narayan, 2004). Diabetes is a chronic health condition for which there is currently no known cure. At best diabetes is managed such that the effects of the condition impacts minimally upon the person who is affected by the disease. However, uncontrolled diabetes can result in devastating ill-health consequences, such as cardiovascular, eye, and foot disease. Mathers, Vos and Stevenson (1999) noted that early detection of undiagnosed diabetes or latent diabetes is a key intervention point in reducing the associated personal and community burden that living with diabetes imposes. It is therefore vital that health management strategies include regular testing for the presence of disease and abnormality. If ill-health can be detected early there is considerable benefit to patients and to effective provision of health services. The benefit to patients includes better prognosis of the disease as symptoms can be detected and treated before irreparable and serious damage occurs. The benefit to the health services includes the cost benefits that are derived through prevention of illness and treatment of early-stage illness, as opposed to the high costs associated with the care of chronic and complicated medical conditions. However, it is difficult to determine exactly the real cost benefit of any multi-system disease in a multi-discipline health care system.

An additional issue for people living in rural areas is that despite there being a significant proportion of people with diabetes, there are not enough primary health care providers who are available to assess and treat diabetes and its complications. As yet only a few health programs directly address diabetes and its management from a multi-discipline health care team approach.
Retinopathy associated with diabetes

Twenty percent of people with non-insulin dependent diabetes mellitus have developed retinopathy at the time of first diagnosis (Harris, Klein, Welborn, & Knuiman, 1992). Retinopathy is a serious potential consequence of unmanaged diabetes but if detected early, possibly at a prediabetes stage, treatment to prevent blindness is very effective (Lee, Sicari, Harper, Taylor, & Keeffe, 2001). Assessment of the retina is therefore a useful screening tool for the early detection of the presence of diabetes in a sample population.

Cardiovascular Disease

People with diabetes are two to four times more likely to develop cardiovascular disease and their prognosis is not as good as persons without diabetes. Early recognition of abnormal cardiac function allows more effective intervention and reduces the number of cardiovascular deaths (Pagani, 2000).

Foot complications

Foot problems are the most common complication of diabetes, including peripheral neuropathy and peripheral vascular disease that lead to foot ulcers and loss of a limb (Campbell, 2001). Regular monitoring of the feet for early signs of neuropathy, peripheral vascular disease and foot deformities reduces the risk of serious foot ulcers and amputation (Mani, Krentz, & Shearmann, 2003).

Barriers to effective screening and treatment

In regional areas regular effective screening is difficult because of health care barriers (Heazlewood, Smallhorn, Geraghty, & Buckmaster, 2003). Health barriers include a lack of specialists in rural communities, frequently the cost of equipment required for assessment is
prohibitively high, and rural and remote areas experience relative deficits in supply of allied health professionals and medical practitioners (AIHW, 2003). Further barriers include geographical separation of health care providers from the community they seek to serve, impairments to communication and collaboration of providers, and patient passivity and low compliance. General practitioners (GP) carry a much greater case load in many rural areas where there are chronic shortages of GP services, This high case load will naturally lead to a reduction in the overall number of consultations per patient and the time available with the patient (AIHW, 2003).

**Diabetes Centres**

Diabetes centres provide a varying range of services such as diabetes education, nutrition advice and clinical assessment. In 2001, there were an estimated 80 centres throughout Australia of which 16 were located in rural NSW and Victoria, according to registrations with the Australian Diabetes Educators Association. Discussion with several diabetes centres in NSW revealed that the organisation of screening services depends on site-specific factors such as the availability of expertise, services, and funding. None of the centres contacted check for cardiac anomalies. For example, the Broken Hill Diabetes Centre is one of the few independent centres where diabetes educators are multi-skilled to include podiatric assessment; however, eye screening is now referred to the local optometrist. The diabetes clinic at the Tallangatta Health Centre, servicing a town of 4000 people, also has a multi-disciplinary approach, and includes two general practitioners as part of the clinic as well as a general practitioner who deals with complicated cases, whilst a visiting podiatrist assesses foot problems. Here heart assessment was provided annually but aging of equipment and lack of funds to replace the equipment has now stopped this service.
In the rural city of Albury, eye assessment is carried out through the Albury Eye Clinic (AEC). Community Health at Albury have limited diabetes education, dietetic and podiatric services. The Allied Health Clinic at CSU provides a reduced fee for service additional podiatric care to the Albury community. Albury Community Health also conducts health promotion throughout the region, but few patients attend specialist services for eye and heart checks, occupational therapy and physiotherapy.

These examples illustrate that rural services established to manage complications of diabetes are ‘fractured’, in that there is no one place which a patient can visit to receive all the services and advice that they need. Therefore, the patient may be forced to spend considerable time and money obtaining the necessary services, since the patient must travel to many different services in order to receive the care they need.

*The university as a diabetes complications screening service*

Australia is in the fortunate position of having a number of rural universities and the majority of these have health programmes that include allied health, aboriginal health, and nursing, and some offer medicine. These rural universities employ highly regarded professionals who have the health expertise needed by rural communities. Another interesting effect of rural universities is that these institutions are required to provide clinical/fieldwork experience for their students, and it makes sense at many of this experience could be obtained in rural settings. Given that many primary health care services appear to experience lack of appropriate personnel and lack of funding to assist all the people in their catchment areas, a rural university may be well placed to assist in the provision of primary health care. By working collaboratively, the aims of both institutions can be more effectively achieved. Through becoming involved in primary health care
provision, a university is able to provide rich learning placements for its students, and research opportunities for its staff, while primary health care services are enabled to provide high quality health care services.

Initiatives in establishing partnerships in primary care are not novel (Simons, 2004). However a model involving expertise and resources that a university can provide has not been considered in the literature.

To summarise, there are a number of key issues that led researchers at CSU to consider developing an innovative form of latent/diabetes and complications of diabetes screening that is described in this paper. These issues include:

- the need for cost-effective screening to reduce the development of chronic and complicated ill-health that can arise as a result of poorly managed diabetes.
- the barrier faced by rural people of ‘fractured’ health delivery services. This barrier could be overcome by the strategy of co-locating and synchronising services.
- that the existence of rural universities means there is a ready supply of health experts who are motivated to engage in health service provision in order to meet research needs and the requirement of providing learning opportunities for students.

This paper describes an initiative by a research group at CSU to improve access to multi-disciplinary primary health care in a rural setting by co-locating screening services into a ‘one-stop diabetes complications assessment unit’. The service aims to identify people who may be at risk of developing Type 2 diabetes and to identify early signs of foot, eye and heart disease, that can arise as complications of diabetes. The programme aims to integrate
with existing primary care services by including written feedback for participants that are passed on to their general practitioner and other primary health care providers.

At this stage of its development, the assessment unit particularly focuses on eye, heart and foot complications since health professionals who have the skills to manage these conditions are the ones currently involved in the study. Further development of the programme is planned, including exploring ways in which people can be proactive in increasing their health through lifestyle choices. It is anticipated that occupational therapists, physiotherapists, nurses and leisure and health professionals will contribute to an increased understanding of this area of diabetes management.

**Method**

Participants were recruited via a newspaper article in the *Border Mail* and also a WIN Television news story. These media reports highlighted early detection of diabetes and potential complications. Everyone over 45 years was welcomed to attend, be they diabetic or not and regardless of how ‘healthy’ they felt. This ensured that a broad spectrum of the community attended and reduced bias. People who were interested in participating contacted the University and made an appointment to attend the clinic, which was physically located on the CSU, Albury campus.

The assessment clinic screened 89 participants. On arrival at the clinic, participants were welcomed, provided with an information sheet and required to sign a consent form to participate in the study as well as complete a basic questionnaire, which asked about age, gender, diabetes status, years of having diabetes, current medications, and previous and current illnesses as well as family history of diabetes or Cardio Vascular Disease (CVD).
Blood glucose levels using a glucometer (Roche Diagnostics), cholesterol using basic blood screening (BioRad P/L), blood pressure and the participant’s Body Mass Index (BMI) were determined. Combined technical assistant staff, third year Podiatry and Nursing students completed these assessments, under supervision of the primary researchers.

Next, participants’ had a cardio-vascular assessment using 12-lead electrocardiograph (ECG) recording obtained with a CardioControl recorder (Welsh Allyn P/L). A 5-minute rhythm strip and lying to standing blood pressure were recorded, in order to check for heart disease and autonomic nervous system dysfunction. Technical staff and nursing students administered these tests, under the supervision of a specialist cardiac care nurse. Eye assessment was carried out using a standard retinal camera system used by the local AEC (Canon CR5 camera) a standardised Polaroid image was used to capture the retinal image (of the posterior pole). Assessment of this image was carried out by the retinal specialist at the AEC. Podiatric assessment included the ankle-brachial pulse index (ABPI), a monofilament test, range of motion and ankle and knee reflex tests. Podiatry students completed these assessments for peripheral vascular disease and neuropathy, under the supervision of experienced podiatrists.

All assessments were completed within 2-3 hours, and all were completed within the one-clinic site. A number of participants declined certain assessments since at the time of their visit to the clinic they had completed recent similar assessments elsewhere or had a medical condition that contraindicated the assessment. The final part of the process was a consultation with the research coordinator, who provided feedback about the test results, and made recommendations for follow-up where required, in accordance with guidelines produced by the Australian Diabetes Association and Australian Heart Foundation. Ethical
approval for the research was obtained from CSU and the Greater Murray Area Health Service Ethics Committees.

**Results**

The total number of participants in this pilot study was 91, 14 of whom reported already having a diagnosis of diabetes. Participants’ gender, age and presence/absence of diabetes are shown in Table 1. The least represented group of participants were people of indigenous origin. This population represent a significant “At risk” group since diabetes is 3 times more prevalent (AIHW, 2003) than in the general population.

PUT TABLE 1 HERE

**Eye Assessment**

Seventy-nine (79 (97%)) people chose to have their eyes assessed. Within the diabetes group, five people (36%), with no previously reported eye anomalies had a retinal fundus abnormality that required further investigation by an ophthalmologist. The types of abnormality included glaucoma (n = 2), diabetic retinopathy (n = 2), and venous nipping (n = 1).

In the non-diabetes group, 12 people had anomalies that required follow-up by an ophthalmologist. Of these, six had signs of diabetic retinopathy and two of glaucoma.
**Cardiac Assessment**

Seventy-two (72 (79%)) participants, of whom 14 had diabetes, chose to have cardiovascular assessment. Ten people of 14 (66%) with diabetes were identified with a cardiac abnormality, while 34 of 57 (60%) in the non-diabetes group also had cardiac abnormalities and referred to their general practitioner. Severe (as defined by the testing equipment) cardiac anomalies were found in 29 people (22%) and where sent for further testing by specialists. This group was made up of seven of 10 (70%) people who had diabetes, and 19 of 34 (56%) in the non-diabetes group. In the non-diabetes cohort, of those identified with serious ECG anomalies, two were immediately referred to the local hospital and admitted for by-pass surgery, one person received a pace-maker and one commenced on prophylactic anti-arrhythmia medication.

**Foot Assessment**

Eighty-eight (88) people were assessed for sensory-neuronal loss in their feet. In this instance a higher number of people with diabetes presented with foot pathology. Specifically, four of 14 (28%) in the diabetes group had anomalies such as absence of patella reflex or sensory loss using monofilament testing. Within the non-diabetes group, 12 of 74 (16%) participants had similar pathology.

**Discussion**

Access to health services (eg doctors, allied health professionals) for remote area and rural populations is generally poorer than for metropolitan residents (AIHW, 2003). Thus, the one-stop assessment project at CSU was created, with its central objective being to identify people with early signs of, or ‘at risk’ of developing diabetes and to provide timely referral to their general practitioner. As such, it aimed to be part of the local primary health care
provision and refer to appropriate services when necessary. To obtain the best compliance from the community, recruitment is important and how to advertise our service. Initially recruitment was through television, radio and newspaper articles. These media still represents the best type of advertisement for general population access. However, the lack of indigenous subjects in the pilot study shows that this “at risk” group were not accessing this study. Clearly there is a need to emphasise different aspects of this work to create interest in diverse sections of the community. In addition, the results of this study have been presented at the local Lions and Rotary Clubs as well as the Australian Diabetes Society. The community health centre nurses and diabetic educators associated with general practice also refer people that would benefit by this screening service.

Providing a “one-stop” diabetes screening clinic by the local university has several advantages for both the community and university. The impact on the community is obvious, with easy access to a free service that offers a range of assessments that have significant benefit to the participants well being. The university benefits by giving the students a “real life” clinical experience and the data collected from the screening offers a number of possible research questions to be answered (Austin, Jelinek, & Cole, 2003; Flynn, Jelinek, & Smith, 2005; Leandro, Soares, Cesar, & Jelinek, 2003; Nwose, Jelinek, & Richards, 2004; Wilding, Whiteford, & Jelinek, 2004). The results from this pilot study also demonstrate that a proportion of participants had eye, heart and/or foot problems serious enough to warrant further medical investigation/intervention for both people who already had a diagnosis of diabetes and also for those without diabetes. This finding is significant in that it shows the benefit of this type of community screening. It has identified serious health issues in 31% of the study population. These findings would have otherwise
remained hidden and may have lead to significant health problems for these particular people

**Retinopathy associated with diabetes**

The findings in this pilot study are of interest as the percentage of newly detected retinopathy was similar to that reported in earlier research based on targeted screening (Lee et al 2001???????). Specifically, ophthalmic review confirmed a significant portion of people identified with retinopathy who were unaware of their diabetes status at the time of screening.

**Cardiovascular Disease**

People with diabetes are two to four times more likely to develop cardiovascular disease and if they do develop cardiovascular illness their prognosis is not as good as persons without diabetes (AIHW, 2002). This current screening research showed similar findings with diabetic retinopathy, a significant proportion of the participants were found to have serious cardiovascular disease that required referral and in some instances immediate action.

**Foot complications**

Foot problems are the most common complication of diabetes. Regular monitoring of the feet for early signs of neuropathy, peripheral vascular disease and foot deformities reduces the risk of serious foot ulcers and amputation within the diabetic population. The non diabetes group showed no significant presence of foot problems indicating the limited value in using foot screening techniques in this general population screening study. However the participants with diabetes complications were screened for significant changes and identified a number of participants to their general practitioner for review.
Economic considerations

Opportunistic diabetes screening would seem to have limitations since there is generally a low number of positive identifications obtained with respect to the number of people screened, thus resulting in low cost efficiency. However, complications screening undertaken at university organised clinics that are a part of the clinical research and student placement requirements may hold the key to a much more cost efficient and effective use of health care resources. The type of assessment unit described in this paper is not only able to identify persons at high risk of developing diabetes, it also has the capacity to identify a range of pathologies that may be unrelated to diabetes, but that nevertheless require immediate attention. In the process of providing a useful community service, research can be incorporated and health students have the opportunity to practice assessment skills under supervision by experienced practitioners.

Systematic identification of early signs of diabetic complications associated with good sensitivity of the test and specificity for referral for further treatment are essential for cost effectiveness (Colagiuri, Colagiuri, Conway, Grainger, & Davey, 2003; Engelgau et al., 2004). Thus, treatment initiated in the asymptomatic phase can prevent progression of complications of micro and macrovascular origin (ADA, 2003; DCCT, 1993; UKPDSG, 1998).

A British cost analysis model has suggested that better management including early detection can save the health service over $400 million per year (Begg, 2003). The costs of running the opportunistic diabetes screening are listed in Table 2 per 1000 participants. The per patient cost was $83 but this screening included cardiovascular, eye and foot
complications as well as extensive biochemistry, BMI and hypertension and a general feedback with specific recommendations provided by a diabetic educator, podiatrist and cardiovascular nurse specialist when required. Still the cost per patient is low if compared to the study by (Lee, McCarty, Taylor, & Keeffe, 2001) who reported a cost of $40 per patient for patients who received only diabetic retinopathy screening in rural Victoria.

PUT TABLE 2 HERE

Cost-benefit to the Commonwealth government is also apparent if one considers cost of the general practice referral, the ophthalmic and specialist cardiologist service. This cost is approximately $150 to the Government, through Medicare. If the screening process is able to improve access to these services and targets particular “at risk” individuals then the overall costs to government maybe reduced overall. Early detection is still a significant factor in chronic disease management.

The impetus to establish a one-stop assessment unit for checking complications of diabetes stemmed from reported barriers to effective health care for people with diabetes (Heazlewood et al., 2003), and that community-screening programs are an effective way of identifying problems that could benefit from early intervention (Lee, McCarty et al., 2001). The United Kingdom National Service Framework for diabetes has also clearly indicated that the modes of managing diabetes by offering regular easy-to-access diabetes care and assessment improves health outcomes (Mani et al., 2003). The findings of this study argue for a role for a community diabetes-screening centre that specialises in identification of early signs of complications. Earlier identification of diabetes complications can lead to better treatment prognosis and reduction in number of hospital admissions. As such, this
one-stop assessment centre provides a comprehensive adjunct to current services. The clinic can also be incorporated into the existing Practice Incentive Payments (PIP) and Service Incentive Payments (SIP) programme these need further description established by the Commonwealth Government, to provide earlier diagnosis and improve management of people with diabetes through general practice.

**Conclusion**

In this paper, a “one stop” multi-disciplinary assessment shop has been described for people living in rural north-east Victoria and southern NSW. In additions the preliminary results of this screening have been presented. This programme aims to reduce time and financial burdens for patients by providing access to a range of health monitoring services within one location. This one-stop screening for diabetes associated complications within people living in rural areas has the potential to reduce serious health outcomes, improve quality of life and reduce cost to individuals and the community.
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References

AIHW. (2002). Diabetes: Australian facts (Cat. No. CVD 20, Diabetes Series No 3). Canberra: AIHW.


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<th>Diabetes Group</th>
<th>Non Diabetes Group</th>
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<tr>
<td></td>
<td>Females</td>
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<tr>
<td>Number of participants</td>
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<tr>
<td>Mean age ± standard deviation</td>
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<td>61.6 ± 14.3</td>
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Table 1: Participant demographics
Table 2: Costs for a one-stop diabetes screening at CSU per 1000 participants

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<td></td>
<td>5,959 on costs</td>
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<tr>
<td>Technical assistants</td>
<td>26,990</td>
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<td></td>
<td>7,017 on costs</td>
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