

Diabetes care: When is (specialist) referral needed?

Diabetes requires complex and lifelong care, but not always at specialist level.

W F MOLLENTZE, MD, MMed (Int), FCP (SA), FACE

Chief Specialist and Head, Department of Internal Medicine, University of the Free State and Universitas Academic Health Complex, Bloemfontein

Professor Willie Mollentze is an endocrinologist with an interest in diabetes care and general medicine.

Diabetes mellitus, regardless of type, is a chronic condition requiring complex and lifelong care. Comprehensive diabetes care calls for a team approach (Fig. 1) and even endocrinologists have to rely on colleagues from other disciplines to provide optimum care. Diabetes care in a resource-constrained environment like South Africa calls for creative ways to make optimal use of scarce resources. The main aim of this article is to elaborate on the role of the primary caregiver and other members of the diabetes care team, to highlight minimum standards of care, and to focus on some common pitfalls in the management of the diabetic patient.

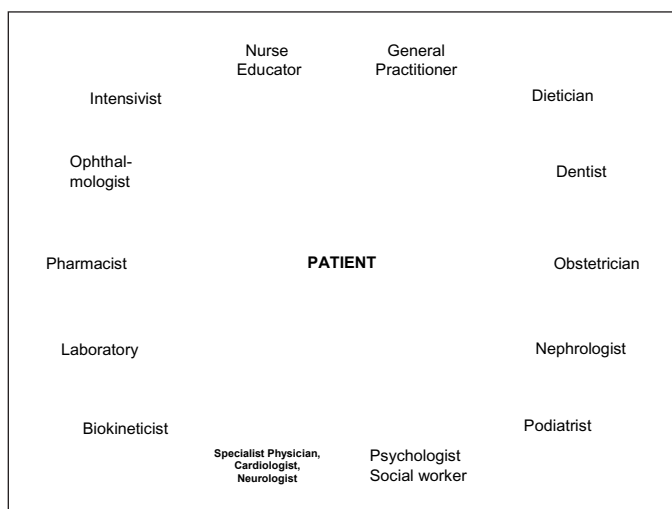


Fig. 1. The diabetes health care team.

Primary caregiver (medical practitioner or primary health care nurse)

Newly diagnosed patient

The majority of diabetics in South Africa rely on a medical practitioner (in private practice) or a professional nurse (in the public service) for basic diabetes care including diagnosis, routine follow-up and referral, depending on the caregiver's level of knowledge, skills, experience and time constraints. Diabetes care at primary health care (PHC) clinic level is currently confined to weighing the patient, measuring his/her height, waist circumference, blood pressure, and finger prick glucose concentration, and performing a dipstick urinalysis.¹ Unfortunately, most newly diagnosed patients in this setting currently need to be referred to the next level of care for confirmation of diagnosis and initiation of treatment.

The mainstay of the initial and successful long-term management of the diabetic patient is dietary intervention and lifestyle modification.

Primary care physicians, on the other hand, will obtain a more detailed history, perform a thorough clinical examination and request additional investigations. Although they would be comfortable to initiate management of the patient described in Appendix 1, most would (or should) prefer to refer the patient described in Appendix 2 to a facility with experienced caregivers after stabilising him/her with short-acting insulin and intravenous fluids if necessary. It needs to be emphasised that if the basic clinical evaluation in Table I can, for whatever reason, not be done at PHC level, the patient must rather be referred. At the time of diagnosis the comparative clinical features outlined in Table II may be of benefit to determine the type of diabetes at presentation.

Follow-up visit

Continuous diabetes care, at whatever level, needs to be delivered in a structured way and many examples of how this can be done successfully are freely available² and beyond the scope of this article. The main focus at follow-up visits is on:³

- glucose control (including reducing the risk of hypoglycaemia)
- detecting microvascular complications (retinopathy, nephropathy, and neuropathy) and intervening or referring before significant disability develops
- screening for cardiovascular risk factors and macrovascular disease and intervening or referring before disability develops
- providing information and establishing or renewing communication channels.

Dietician

The mainstay of the initial and successful long-term management of the diabetic patient is dietary intervention and lifestyle modification.⁴ These aspects of diabetes care are possibly the most neglected in the day-to-day practice at all levels of care. Although most caregivers are able to provide diabetics with basic nutritional advice, all patients should ideally be counselled by a dietician as soon as possible. Due to the scarcity of dieticians at PHC level and

Table I. Clinical examination of the patient with diabetes*

General observation	Head
Weight loss in insulin deficiency	Xanthelasma
Obesity in type 2 diabetes	Cranial nerve palsy
Mucosal candidiasis	Eye movements/ptosis
Dehydration – dry mouth, decrease in tissue turgor	Eyes
Air hunger – Kussmaul breathing in ketoacidosis	Visual acuity
Hands	Arcus cornealis
Dupuytren's contracture	Cataract/lens opacity
Carpal tunnel syndrome	Funduscopy
Trigger finger/thumb	Abdomen
Limited joint mobility	Tenderness (ketoacidosis)
Wasting of small muscles	Hepatomegaly (fatty infiltration)
Sensory abnormality	Legs
Skin	Muscle wasting
Insulin injection sites	Hair loss
Bullosis	Sensory abnormality
Pigmentation	Tendon reflexes
Acanthosis nigricans	Feet
Necrobiosis lipoidica diabetorum	Inspection (callus, ulcers, deformities, infection)
Granuloma annulare	Palpation (pulses, temperature, dryness)
Vitiligo	Achilles tendon – pain and xanthomata
Blood pressure (supine, standing)	Sensation
Neck	Light touch – monofilament
Carotid pulses	Vibration – 128 Hz tuning fork
Bruits	Pin-prick
Thyroid enlargement	Proprioception – test position of big toe
	Ankle reflexes

* Adapted from Frier and Fisher.³¹

long distances that patients need to travel this service needs careful planning. The training of more professional nurses to provide basic dietary advice may alleviate these obstacles to some extent. Every effort should be made to involve a dietician on a regular basis in the management of all patients with type 1 diabetes, especially when an intensive insulin regimen is considered.

Diabetes nurse educator

Diabetes educators have established themselves as indispensable members of the diabetes care team since the development of this category of health care worker more than two decades ago.⁵ Although most diabetes educators come from the ranks of professional nurses, dieticians

Table II. Comparative clinical features of type 1 and type 2 diabetes³²

	Type 1	Type 2
Typical age at onset	<40 years	>50 years
Duration of symptoms	Weeks	Months to years
Body weight	Normal or low	Obese
Ketonuria	Yes	No
Rapid death without insulin treatment	Yes	No
Autoantibodies	Yes	No
Diabetic complications at diagnosis	No	No
Family history of diabetes	Uncommon	Common
Other autoimmune disease	Common	Uncommon

Diabetes remains the most common cause of blindness in the age group 30 - 69 years.

and pharmacists also contribute to their numbers. The diabetes nurse educator spends time with the patient and family and has specific responsibilities including but not limited to:

- providing information about the patient's condition according to his/her individual needs
- teaching patients (or caregivers) the principles and techniques of self-monitoring of blood glucose and how to fine-tune therapy accordingly
- teaching insulin injection techniques to patients or caregivers
- teaching patients basic survival skills, e.g. sick-day rules, how to recognise and manage hypoglycaemia and how to prevent diabetic ketoacidosis
- teaching (and often assisting) patients with foot care
- identifying patients in need of psychological support
- providing patients with telephonic advice.

The diabetes educator also has the responsibility and capability to assess the effectiveness of this teaching and learning.⁴ Most level 2, level 3 and private hospitals employ diabetes nurse educators. Because of the shortage of these educators, especially in the public service, education often takes place in groups during or in between official clinic hours. The education of patients using insulin takes precedence for obvious reasons.

Pharmacist

Although the role of the pharmacist as a member of the diabetes health care team in South Africa is not well defined, pharmacists are in a unique position to contribute to and advance diabetes care. The pharmacist can make a positive contribution by, e.g.:⁶

- identifying and referring patients at high risk of diabetes
- encouraging patients to comply with treatment and adhere to regular follow-up visits
- educating patients regarding the proper use of oral hypoglycaemic agents, insulin

Diabetes

- administration and home blood glucose monitoring
- controlling blood pressure.

Metabolic emergencies

Diabetic ketoacidosis (DKA) and hyperglycaemic hyperosmolar states (HHS) remain the most important and serious causes of morbidity and mortality in patients with type 1 or type 2 diabetes. Almost 30% of patients with DKA in an African population died within 48 hours of admission.⁷ Type 2 diabetes is increasingly recognised as a cause of DKA, especially in newly diagnosed patients.⁸ Common precipitating causes for these metabolic emergencies include:

- infections, especially respiratory and genito-urinary tract infections and septicæmia
- missed injections of insulin
- new-onset diabetes
- drugs, e.g. diuretics and glucocorticoids.

Early warning signs of DKA and HHS include:

- dehydration
- acidosis (as indicated by Kussmaul breathing)
- ketonuria
- blunted levels of consciousness.

When any of these metabolic emergencies are considered, patients should be resuscitated with intravenous 0.9% saline (when serum sodium is below 155 mmol/l) or 0.45% saline (when serum sodium is above 155 mmol/l) and 10 units of short-acting insulin, administered either IV or IM, and transported by ambulance to the nearest facility (preferably with an ICU) equipped to handle these emergencies.

Life-threatening infections

Some acute infections are notorious for their predilection to occur in diabetics and are characterised by high mortality rates. A high index of suspicion and early referral may be life saving. Examples of these infections include:⁹

- rhinocerebral mucormycosis (suspected when sinusitis in a diabetic is accompanied by a bloody nasal discharge) or gastric mucormycosis
- necrotising fasciitis
- malignant otitis externa
- perinephric abscess
- pyogenic liver abscess

- emphysematous cholecystitis, pyelonephritis and cystitis
- deep neck infections (parapharyngeal).

Diabetes during pregnancy

Strict glycaemic control before and after conception in patients with type 1 or type 2 diabetes is essential to reduce the likelihood of congenital malformations, fetal loss and high perinatal mortality rates.¹⁰ In patients with type 1 diabetes pregnancy may worsen renal function and accelerate preproliferative and proliferative retinopathy. Diabetes first diagnosed during pregnancy is called gestational diabetes. All diabetic patients planning a pregnancy or those already pregnant should be referred immediately for specialised care. Clinical risk factors for the development of gestational diabetes include:

- overweight and obesity
- family history of diabetes (especially in a first-degree relative)
- diabetes during a previous pregnancy
- previous macrosomic infant, unexplained stillbirth or neonatal death during a previous pregnancy
- glycosuria on two or more occasions during current pregnancy.

Eye care

Diabetes remains the most common cause of blindness in the age group 30 - 69 years.¹¹ At the time of diagnosis 10 - 20% of patients with type 2 diabetes already have evidence of diabetic retinopathy¹² and after 15 years almost all patients with type 1 diabetes¹³ and 78% of patients with type 2 diabetes will have some degree of retinopathy.¹⁴ Regular screening for retinopathy in patients with diabetes should ideally be performed by an ophthalmologist. This is not attainable in the public service where direct funduscopy through a dilated pupil in a dark room is still the responsibility of the primary care physician. Regular screening for diabetic retinopathy in patients with type 1 diabetes should start not later than 5 years after diagnosis and for patients with type 2 diabetes immediately after diagnosis.¹¹ Indications for immediate referral to an ophthalmologist include:

- reduced visual acuity from any cause
- proliferative or preproliferative changes
- clinically significant macular oedema
- hard exudates near the macula

- any form of progressing or extensive diabetic retinopathy, especially if the lesions are near the macula.

In the USA diabetic patients most commonly visit optometrists (along with ophthalmologists), accounting for 29 - 60% of specialist visits per year.¹⁵ The feasibility of involving optometrists in official screening programmes to detect diabetic retinopathy in South Africa should also be investigated.

Renal care

Diabetic nephropathy is a progressive condition that passes through well-defined stages and culminates in end-stage renal disease. Good glucose and blood pressure control is essential to prevent the development and progression of diabetic nephropathy in susceptible individuals.⁴ Eventually up to 35% of patients with type 1 or type 2 diabetes will develop diabetic nephropathy.¹⁶ Serum creatinine and urinary albumin excretion should be measured regularly, starting at the time of diagnosis in patients with type 2 diabetes and 5 years after diagnosis in patients with type 1 diabetes.⁴ Consider referral to a specialist experienced in the care of patients with diabetic renal disease when:

- the estimated glomerular filtration rate has decreased to <60 ml/min/1.73 m²
- difficulties occur in the management of blood pressure and hyperkalaemia
- different aetiologies for the renal disease seem likely
- there is severe hypertension (SBP >180 mmHg or DBP >110 mmHg).¹⁷

Troublesome neuropathies

Diabetic symmetrical polyneuropathy will affect about 50% of patients after approximately 20 years, regardless of the type of diabetes.¹⁸ These neuropathies are clinically characterised by insidious onset and, once established, tend to be irreversible. Patients should be screened regularly (at least annually) for distal, symmetrical sensory deficits that may lead to trauma and diabetic foot disease. Palsies of single nerves, e.g. femoral or cranial nerves (mostly the IIIrd or VIIth cranial nerves), may develop acutely, posing a diagnostic challenge.¹⁹ Symptomatic autonomic neuropathy is associated with a poor prognosis possibly due to coexisting macrovascular disease.¹⁹ Indications for referral include:

- Patients with established neuropathy. These patients are at risk of the development of foot ulceration, Charcot's arthropathy and eventually amputation.

Periodontal disease is more common, more severe and more extensive in patients with diabetes than in non-diabetic subjects.

- Painful neuropathy. Patients may complain of severe painful neuropathy with few abnormalities on routine clinical examination. Symptoms may be incapacitating and management difficult.
- When the aetiology of neuropathy is in doubt:
 - in older patients with type 2 diabetes presenting with pure sensory neuropathies with large fibre involvement (consider vitamin B₁₂ deficiency and paraneoplastic neuropathy)
 - neuropathies with prominent motor involvement (consider chronic inflammatory demyelinating polyneuropathy (CIDP) or paraproteinaemic neuropathy in older patients)
 - proximal motor neuropathy (diabetic amyotrophy – unilateral or asymmetrical bilateral weakness of the thigh sometimes accompanied by pain) (distinguish from neoplastic or other lesions of the cauda equina and lumbar sacral plexus)
 - truncal mononeuropathies or radiculopathies (girdle-like pain similar to that experienced in shingles involving the anterior abdominal wall) (spinal cord compression must be excluded).
- Acute painful diabetic polyneuropathy characterised by acute onset, severe neuropathic pain, contact sensitivity (allodynia), weight loss and poor diabetes control.
- When entrapment neuropathy is considered, e.g. carpal tunnel syndrome, ulnar nerve compression at the elbow, and peroneal nerve compression at the neck of the fibula.
- Symptomatic autonomic neuropathy presenting with abnormal sweating, postural hypotension (a decrease in SBP on standing exceeding 20 mmHg), diabetic gastroparesis, diarrhoea, constipation, neuropathic bladder and erectile dysfunction.

Foot care

About 30% of patients are at risk of foot ulceration because of peripheral neuropathy and vascular disease and 17% will develop foot ulceration.²⁰ The annual incidence of major amputations in industrialised countries is $\leq 4/10$ diabetics at risk.²¹ A comprehensive foot examination should be performed and foot self-care education should be provided annually.⁴ Essential elements of foot examination include proper inspection, palpation, measuring of the ankle-brachial index and use of a monofilament, tuning fork and reflex hammer. Referral should be considered when such an evaluation cannot be performed, and when the following risk factors for amputation are present:

- peripheral neuropathy with loss of protective sensation
- altered biomechanics (in the presence of neuropathy)
- evidence of increased pressure (erythema or haemorrhage under a callus)
- bone deformity
- peripheral vascular disease (decreased or absent foot pulses and /or history of intermittent claudication)
- history of foot ulcers or amputation
- severe nail pathology.

Cardiovascular risk management

Type 2 diabetes, independent of other risk factors, increases the risk of myocardial infarction or stroke two- to threefold and the risk of death twofold.²² The premenopausal protection against coronary heart disease seen in healthy women is lost in those with diabetes and the relative risk of fatal coronary heart disease associated with diabetes is 50% higher in women than in men.²³ Furthermore, diabetic patients without previous myocardial infarction have as high a risk of myocardial infarction as non-

diabetic patients with previous myocardial infarction.²⁴ In patients with juvenile-onset type 1 diabetes the risk of coronary heart disease increases rapidly after the age of 40.²⁵

Cardiovascular risk factors in diabetic patients should therefore be treated as aggressively as in non-diabetic patients with prior myocardial infarction. Each patient's risk of a myocardial infarction should be calculated using, for example, the Framingham risk score tables.²⁶ The 10-year risk of a myocardial infarction in the patient described in Appendix 1 is 37% (well in excess of the background age- and sex-specific population risk of 21%). Each cardiovascular risk factor should be treated individually and aggressively. Referral to a specialist should be considered when targets set out in Table III cannot be achieved within a reasonable period. Additional indications for referral include:

Coronary heart disease

- consider referral for screening for coronary heart disease when the 10-year risk is $\geq 10\%$ or if the patient is >55 years.⁴
- unstable angina
- silent myocardial ischaemia
- autonomic neuropathy
- when congestive heart failure is present
- before embarking on a strenuous exercise programme.

Transient ischaemic attacks or stroke

- A history of transient ischaemic attacks or previous stroke as well as audible murmurs over the carotid arteries.

Peripheral vascular disease

- Intermittent claudication.

Psychological assessment

Emotional well-being is essential for the successful management of diabetes.⁴ It is advisable to refer patients for psychosocial assessment at the time of diagnosis of dia-

Table III. Recommendations for adults with diabetes⁴

Glycaemic control	
HbA _{1c}	<7.0%
Preprandial capillary plasma glucose levels	5.0 - 7.2 mmol/l
Peak postprandial capillary plasma glucose levels (1 - 2 hours after meals)	<10.0 mmol/l
Blood pressure	<130/80 mmHg
Lipids	
LDL-C	<2.6 mmol/l
Triglycerides	<1.7 mmol/l
HDL-C	>1.0 mmol/l

betes and regularly thereafter if possible. Other opportunities for referral include:

- during hospitalisation
- when complications are diagnosed
- when a patient's status changes, e.g. when therapy is intensified
- when an eating disorder is suspected
- when gross non-compliance is suspected
- when depression is diagnosed
- difficult glycaemic control during adolescence.

Dental care

Poorly controlled diabetes mellitus is associated with poor oral health. Periodontal disease is more common, more severe and more extensive in patients with diabetes than in non-diabetic subjects and may also affect diabetes control adversely.²⁷ Even children with diabetes are at increased risk of periodontal disease.²⁸ All diabetic patients should be encouraged to undergo regular dental evaluation and screening for periodontal disease. The most common oral health problems associated with diabetes are:²⁹

- tooth decay
- periodontal (gingival) disease
- salivary gland dysfunction
- fungal infections of the oropharyngeal cavity
- mucosal lichen planus and lichenoid reactions
- infection and delayed healing
- taste impairment.

Conclusion

A recent study found that 20 000 deaths, accounting for 4.3% of all deaths in South Africa during 2000, could be attributed to diabetes, making this disease the 7th commonest cause of death in this country.³⁰ Intensive efforts are necessary to improve health care delivery for patients diagnosed with diabetes to achieve the aims set out in this overview. By following a structured management plan, especially at presentation and during the follow-up visit and by making optimal use of available members of the diabetes health care team, the suffering and excessive death rates attributed to diabetes in South Africa may be reduced.

Appendix 1. A reluctant patient

Mr A is a previously healthy 60-year-old farmer who visits his primary caregiver somewhat reluctantly for a 'general check-up' because his wife insists. He denies having any complaints (his father died suddenly at the age of 62). He is not very physically active and does not smoke. He weighs 103 kg and his height is 1.75 m (BMI=33.6 kg/m²). His waist circumference is 103 cm and blood pressure 158/98 mmHg. A dipstick examination of his urine does not reveal any abnormality. His non-fasting (casual) capillary blood glucose concentration measured in the surgery is 9.1 mmol/l. He is persuaded to report the following morning for a fasting lipogram and fasting plasma glucose measurement, the results of which are as follows: total cholesterol 6.1 mmol/l, HDL-cholesterol 0.81 mmol/l, triglycerides 3.8 mmol/l, LDL-cholesterol 3.59 mmol/l, and glucose 7.2 mmol/l.

Appendix 2. An anxious adolescent and parents

Diana, a 12-year-old adolescent, is brought to the surgery by her parents who are worried about her recent weight loss, polyuria, and increasing lethargy for the last 14 days. She is preparing for mid-year examinations and has already lost 2 days of school. On examination she appears thin and mildly dehydrated. The only abnormalities noted on clinical examination are two areas of vitiligo on the dorsae of both feet. Dipstick urinalysis reveals 3+ glucose and 2+ ketones. Her finger-prick blood glucose concentration is 18 mmol/l.

References

1. Levitt NS, Zwarenstein MF, Doepfmer S, *et al*. Public sector primary care of diabetics – a record review of quality of care in Cape Town. *S Afr Med J* 1996; 86: 1013-1017.
2. International Diabetes Federation. <http://www.idf.org/home/index.cfm?node=7> (accessed 25 June 2007).
3. Laine C, Caro JF. Preventing complications in diabetes mellitus: The role of the primary care physician. *Med Clin North Am* 1996; 80: 457-474.
4. American Diabetes Association. Standards of Care. http://care.diabetesjournals.org/content/vol30/suppl_1/ (accessed 26 August 2007).
5. Dudley JD. The diabetes educator's role in teaching the diabetic patient. *Diabetes Care* 1980; 3: 127-133.
6. Campbell RK. Role of the pharmacist in diabetes management. *Am J Health Syst Pharm* 2002; 59 (S9): 18-21.
7. Mbugua PK, Otieno CF, Kayima JK, Amayo AA, McLigeyo SO. Diabetic ketoacidosis: clinical presentation and precipitating factors at Kenyatta National Hospital, Nairobi. *East Afr Med J* 2005; 82(12 Suppl): S191-196.

8. Nyenwe E, Loganathan R, Blum S, *et al*. Admissions for diabetic ketoacidosis in ethnic minority groups in a city hospital. *Metabolism* 2007; 56(2): 172-178.
9. Joshi N, Mahajan M. Infection and diabetes. In: Pickup JC, Williams G, eds. *Textbook of Diabetes*. 3rd ed. Oxford, UK: Blackwell Science, 2003: 40.1-40.16.
10. Girling J, Dornhorst A. Pregnancy and diabetes mellitus. In: Pickup JC, Williams G, eds. *Textbook of Diabetes*. 3rd ed. Oxford, UK: Blackwell Science, 2003: 65.1-65.39.
11. Watkins PJ. ABC of diabetes: retinopathy. *BMJ* 2003; 326: 924-926.
12. Harris MI, Klein R, Welborn TA, Knudman MW. Onset of NIDDM occurs at least 4-7 yr before clinical diagnosis. *Diabetes Care* 1992; 15(7): 815-819.
13. Klein R, Klein BE, Moss SE, Davis MD, DeMets DL. The Wisconsin epidemiologic study of diabetic retinopathy. II. Prevalence and risk of diabetic retinopathy when age at diagnosis is less than 30 years. *Arch Ophthalmol* 1984; 102: 520-526.
14. Klein R, Klein BE, Moss SE, Davis MD, DeMets DL. The Wisconsin epidemiologic study of diabetic retinopathy. III. Prevalence and risk of diabetic retinopathy when age at diagnosis is 30 or more years. *Arch Ophthalmol* 1984; 102(4): 527-532.
15. Engelgau MM, Geiss LS, Manninen DL, *et al*. Use of services by diabetes patients in managed care organizations. *Diabetes Care* 1998; 21: 2062-2068.
16. Gnudi L, Gruden G, Viberti GF. Pathogenesis of diabetic nephropathy. In: Pickup JC, Williams G, eds. *Textbook of Diabetes*. 3rd ed. Oxford, UK: Blackwell Science, 2003: 52.1-52.22.
17. South African Hypertension Guideline 2006. *S Afr Med J* 2006; 96: 337-358.
18. Tomlinson DR. Pathogenesis of diabetic neuropathies. In: Pickup JC, Williams G, eds. *Textbook of Diabetes*. 3rd ed. Oxford, UK: Blackwell Science, 2003: 50.1-50.12.
19. Young RJ. The clinical features and management of diabetic neuropathy. In: Pickup JC, Williams G, eds. *Textbook of Diabetes*. 3rd ed. Oxford, UK: Blackwell Science, 2003: 51.1-51.22.
20. Young MJ. Foot problems in diabetes. In: Pickup JC, Williams G, eds. *Textbook of Diabetes*. 3rd ed. Oxford, UK: Blackwell Science, 2003: 57.1-57.19.
21. Jeffcoate WJ, van Houtum WH. Amputation as a marker of the quality of foot care in diabetes. *Diabetologia* 2004; 47: 2051-2058.
22. Almdal T, Scharling H, Jensen JS, Vestergaard H. The independent effect of type 2 diabetes mellitus on ischemic heart disease, stroke, and death: a population-based study of 13 000 men and women with 20 years of follow-up. *Arch Intern Med* 2004; 164(13): 1422-1426.
23. Huxley R, Barzi F, Woodward M. Excess risk of fatal coronary heart disease associated with diabetes in men and women: meta-analysis of 37 prospective cohort studies. *BMJ* 2006; 332: 73-78.
24. Haffner SM, Lehto S, Ronnema T, Pyorala K, Laakso M. Mortality from coronary heart disease in subjects with type 2 diabetes and in nondiabetic subjects with and without prior

Diabetes

- myocardial infarction. *N Engl J Med* 1998; 339(4): 229-234.
25. Krolefski AS, Kosinsky EJ, Warram JH, *et al.* Magnitude and determinants of coronary artery disease in juvenile-onset, insulin-dependent diabetes mellitus. *Am J Cardiol* 1987; 59: 750-755.
26. Gibbon CJ, Blockman M, eds. *South African Medicines Formulary*. 7th ed. Cape Town: Health and Medical Publishing Group of the South African Medical Association, 2005: 161.
27. Taylor GW. Bidirectional interrelationships between diabetes and periodontal diseases: an epidemiologic perspective. *Ann Periodontol* 2001; 6: 99-112.
28. Lalla E, Cheng B, Lal S, *et al.* Diabetes mellitus promotes periodontal destruction in children. *J Clin Periodontol* 2007; 34: 294-298.
29. American Dental Association's Division of Communications. Diabetes and oral health. *J Am Dental Assoc* 2002; 133: 1299.
30. Bradshaw D, Norman R, Pieterse D, Levitt N. Estimating the burden of disease attributable to diabetes in South Africa in 2000. *S Afr Med J* 2007; 97: 700-706.
31. Frier BM, Fisher M. Diabetes mellitus. In: Boon N, Colledge NR, Walker BR, Hunter JAA, eds. *Davidson's Principles and Practice of Medicine*. 20th ed. Edinburgh: Elsevier, 2006: 806.
32. Frier BM, Fisher M. Diabetes mellitus. In: Boon N, Colledge NR, Walker BR, Hunter JAA, eds. *Davidson's Principles and Practice of Medicine*. 20th ed. Edinburgh: Elsevier, 2006: 818.

In a nutshell

- Diabetes mellitus is a chronic condition that remains an important cause of morbidity and mortality in South Africa.
- Diabetes mellitus requires lifelong care best delivered in a structured manner by a team of skilled health care professionals.
- Patients should be educated to accept increasingly more responsibility for their condition.
- Primary health care workers including medical practitioners provide the mainstay of diabetes care in South Africa and are best positioned to structure diabetes care optimally according to available resources.
- Glycaemic, metabolic and blood pressure goals should be aggressively pursued.
- The psychological and social needs of patients should not be neglected.

Single Suture

Surgery for diabetes

Duodenal exclusion appears to improve glucose metabolism in type 2 diabetics. Surgeons who perform duodenal exclusion in obese patients with type 2 diabetes have noticed that in around 98% of cases the patient's diabetes spontaneously resolved after a few weeks – too soon to be accounted for by weight loss. Now a team of surgeons have specifically performed duodenal exclusion on 7 patients with type 2 diabetes who were classified as normal weight to see if it had the same effect. Nine months after surgery the first 2 people they operated on no longer needed antidiabetic medication – and both experienced dramatic reductions in their blood sugar and insulin levels in the month following surgery – again, before any weight loss occurred.

New Scientist 2007; 1 September: 13.