Aetiology and prevalence
The prevalence of diabetes increases with increasing age. In a recent report it was found that diabetes affects 21% of adults 65 years of age and older.1 The increase in the prevalence of glucose intolerance with increasing age is closely associated with impaired β-cell function and a simultaneous increase in insulin resistance.2 The combined effect of increasing insulin resistance and declining β-cell function on plasma glucose is illustrated in Fig. 1.

Diabetes and carcinoma of the pancreas
In a recent report from the Mayo Clinic it was found that diabetes was present in 47% of 512 patients (mean age 68 years) diagnosed with carcinoma of the pancreas.4 In the majority of patients diabetes was of fairly recent onset and diagnosed in the 2 years preceding the diagnosis of pancreatic cancer. Diabetes associated with carcinoma of the pancreas often resolved after pancreatectomy, indicating a remote (paraneoplastic) effect of the tumour on carbohydrate metabolism.

Diagnosis and screening
Fasting plasma glucose concentrations do not rise significantly with age.5 However, a small but significant increase in plasma glucose concentration 2 hours after a 75 g oral glucose load does occur in older individuals.3 The increase in the prevalence of glucose intolerance with increasing age is closely associated with impaired β-cell function and a simultaneous increase in insulin resistance.5 The combined effect of increasing insulin resistance and declining β-cell function on plasma glucose is illustrated in Fig. 1.

Fasting plasma glucose concentrations do not rise significantly with age.

Co-morbidities and geriatric syndromes
Chronic diseases such as diabetes mellitus, coronary heart disease and congestive heart failure often co-occur in elderly patients with geriatric conditions such as urinary incontinence and injurious falls.6 Nevertheless, the management of diabetes in the elderly has received surprisingly little attention in the past.7 The following geriatric syndromes are commonly present in the elderly patient with diabetes: functional impairments, falls and fractures, urinary incontinence, depression, impaired cognitive function, dementia, malnutrition and sarcopenia.7

The prevention, screening and treatment of both traditional diabetic complications and geriatric syndromes should be integrated in a management plan to optimise the patient’s overall health status and quality of life.6 In particular, malnutrition and sarcopenia with consequent muscle weakness and frailty should be prevented at all costs in both diabetic and non-diabetic elderly patients.8 Care of the elderly patient is best accomplished by following a comprehensive geriatric assessment strategy (Fig. 2).

Management
There is currently no evidence that improved diabetes control in elderly patients prevents the development of macrovascular complications, although a case for improved diabetes control and the prevention of microvascular complications can be made.7 Useful life-expectancy tables for patients suffering from type 2 diabetes have been developed.10 It must be cautioned that these tables were developed from data obtained from the ageing UKPDS population and cannot be extrapolated to frail elderly patients.

It is useful to distinguish between the older diabetic patient in ‘good health’ and frail patients affected by multiple pathologies (‘unsuccessful ageing’).7 Table I gives an indication of the overall life expectancy of elderly patients, while Table II provides treatment targets for two categories of elderly patients.

The 2009 SEMDSA guidelines6 for glycemic control in patients with type 2 diabetes may be applied to the elderly, keeping the following pitfalls in mind:

Fasting plasma glucose concentrations do not rise significantly with age.

Fig. 1. The combined effect of increasing insulin resistance and declining β-cell function on plasma glucose as a function of time (aging).2

Fig. 2. Domains to be evaluated in the comprehensive assessment of the geriatric patient.
The following are key messages with regard to blood pressure lowering in elderly patients with type 2 diabetes:

- Treatment of hypertension in elderly diabetics should be part of a multifactorial intervention approach to minimise cardiovascular risk and to prevent diabetes-related complications.
- Strict control of blood pressure may be of greater therapeutic importance than glucose control to reduce cardiovascular risk.

The SEMDSA guidelines\(^1\) for lipid lowering in type 2 diabetes remain valid. The following points are worthwhile emphasising with regard to the elderly patient with type 2 diabetes:

- Coronary heart disease remains the most common cause of mortality in this age group.
- Optimal management of blood lipids is essential to optimise vascular outcomes.
- Patients with diabetes and advanced age are under-treated as far as lipid goals are concerned.
- Statin therapy is well tolerated and can be safely used in elderly patients.
- Primary prevention – in patients without a history of cardiovascular disease a statin should be offered to those with an abnormal lipid profile if their 10-year cardiovascular risk is >15%.
- Secondary prevention (including stroke prevention) – a statin should be offered to patients with an abnormal lipid profile who have proven cardiovascular disease.
- Fibrate therapy is well tolerated and can be safely used when indicated in older patients with diabetes.

Complications

Over and above the conventional macro- and microvascular complications, elderly patients with diabetes are especially at risk of geriatric syndromes such as functional disabilities, falls and fractures, incontinence, depression and dementia, sarcopenia and malnutrition.\(^9\) These geriatric syndromes may go undetected for too long if a comprehensive approach is not followed. Because of a shortage of essential health care workers in the public sector, such as physiotherapists, dietitians, social workers, podiatrists, certified diabetes educators and pharmacists, comprehensive care (Fig. 2) for the elderly diabetic is currently one of the most neglected areas in our health care system.

Risk factors for foot ulceration and lower limb amputation (Table III) may already be abundantly present in elderly patients with diabetes, especially those with co-morbidities and geriatric syndromes. The principles of prevention and treatment of foot ulcers in the elderly are the same as those in younger patients but may be much more difficult to achieve, e.g. many elderly patients cannot reach or see their feet.

### Table I. Mean life expectancy in the UK\(^1\)

<table>
<thead>
<tr>
<th>Age at Birth</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>77 years</td>
<td>81 years</td>
<td></td>
</tr>
<tr>
<td>20.5 years</td>
<td>24 years</td>
<td></td>
</tr>
<tr>
<td>13 years</td>
<td>16 years</td>
<td></td>
</tr>
<tr>
<td>7.5 years</td>
<td>9 years</td>
<td></td>
</tr>
</tbody>
</table>

### Table II. Glycaemic, blood pressure and lipid treatment targets for elderly patients\(^5\)

<table>
<thead>
<tr>
<th>Fasting blood glucose</th>
<th>Older diabetic patient in good health</th>
<th>Frail older diabetic patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c</td>
<td>5.0 - 7.0 mmol/l</td>
<td>7.0 - 8.9 mmol/l</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>6.5 - 7.5%</td>
<td>7.5 - 8.5%</td>
</tr>
<tr>
<td>Threshold for treatment:</td>
<td>BP ≥140/80 mmHg for longer than 3 months measured on at least three occasions during a period of lifestyle management advice</td>
<td>Acceptable BP: &lt;150/&lt;90 mmHg</td>
</tr>
</tbody>
</table>

### Table III. Risk factors for diabetic foot ulceration\(^7\)

- Previous ulceration
- Peripheral/autonomic neuropathy
- Peripheral vascular disease
- Diabetic nephropathy
- Diabetic retinopathy/visual loss
- Limited joint mobility/bony deformities
- Advanced age
- Poor foot care
- Living alone/social deprivation
- Smoking and alcohol

The epidemiology of diabetic retinopathy in the elderly has been poorly studied.\(^9\) While diabetic retinopathy remains an important cause of visual loss in elderly patients with type 2 diabetes, other more important causes of severe visual loss include cataract, glaucoma and age-related macular degeneration.\(^7\) It is worthwhile emphasizing that diabetes remains a strong risk factor for cataracts. A change in visual acuity of two or more lines on a Snellen chart may be the first indication of a macular problem.\(^7\) In elderly patients with miosis, using 0.5 - 1.0% tropicamide appears to be safe with a very low risk of inducing glaucoma. Unfortunately, the sensitivity of detecting diabetic retinopathy by screening with direct ophthalmoscopy often fails to reach the 80% threshold, even in the best of hands, making the referral of patients to an ophthalmology service essential.\(^7\)

While diabetic nephropathy in type 1 diabetes is mainly a glomerular disease progressing through well-defined stages, type 2 diabetes-related kidney disease can result from another cause, especially hypertension.\(^7\) In a landmark study of patients with type 2 diabetes and chronic kidney disease it was found that diabetic retinopathy and albuminuria (micro- or macroalbuminuria) were absent in 30% of individuals with a glomerular filtration rate (GFR) of less than 60 ml/min/1.73m\(^2\).\(^7\) The results of this study suggest that clinicians should measure serum creatinine levels and estimate GFR in addition to monitoring urine albumin excretion and funduscopic changes to screen for kidney disease in patients with type 2 diabetes mellitus. The following key points are worthwhile emphasising:\(^7\)

- Smoking and alcohol
- Poor foot care
- Diabetes complications (diabetic retinopathy, nephropathy, and neuropathy)
- Kidney disease
- Cataract and glaucoma
- Joint mobility and bony deformities
- Living alone/social deprivation
- Smoking and alcohol

### Table IV. Management advice for foot ulceration\(^7\)

- Preventative foot care
- Foot hygiene and care
- Regular foot checks
- Foot care education
- Early intervention
- Regular follow-up

### Table V. Management of foot ulceration\(^7\)

- Offloading (e.g. leg elevation, splints, casts)
- dressings
- Wound care
- Infection control
- Nutritional support
- Ongoing care

### Table VI. Management of foot ulceration complications\(^7\)

- Pressure reduction
- Wound care
- Infection control
- Nutritional support
- Ongoing care

### Table VII. Management of foot ulceration complications\(^7\)

- Pressure reduction
- Wound care
- Infection control
- Nutritional support
- Ongoing care

### Table VIII. Management of foot ulceration complications\(^7\)

- Pressure reduction
- Wound care
- Infection control
- Nutritional support
- Ongoing care

### Table IX. Management of foot ulceration complications\(^7\)

- Pressure reduction
- Wound care
- Infection control
- Nutritional support
- Ongoing care

### Table X. Management of foot ulceration complications\(^7\)

- Pressure reduction
- Wound care
- Infection control
- Nutritional support
- Ongoing care

### Table XI. Management of foot ulceration complications\(^7\)

- Pressure reduction
- Wound care
- Infection control
- Nutritional support
- Ongoing care

### Table XII. Management of foot ulceration complications\(^7\)

- Pressure reduction
- Wound care
- Infection control
- Nutritional support
- Ongoing care

### Table XIII. Management of foot ulceration complications\(^7\)

- Pressure reduction
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- Infection control
- Nutritional support
- Ongoing care

### Table XIV. Management of foot ulceration complications\(^7\)

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- Infection control
- Nutritional support
- Ongoing care

### Table XV. Management of foot ulceration complications\(^7\)

- Pressure reduction
- Wound care
- Infection control
- Nutritional support
- Ongoing care

### Table XVI. Management of foot ulceration complications\(^7\)

- Pressure reduction
- Wound care
- Infection control
- Nutritional support
- Ongoing care

### Table XVII. Management of foot ulceration complications\(^7\)

- Pressure reduction
- Wound care
- Infection control
- Nutritional support
- Ongoing care

### Table XVIII. Management of foot ulceration complications\(^7\)

- Pressure reduction
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- Infection control
- Nutritional support
- Ongoing care

### Table XIX. Management of foot ulceration complications\(^7\)

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- Infection control
- Nutritional support
- Ongoing care

### Table XX. Management of foot ulceration complications\(^7\)

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- Wound care
- Infection control
- Nutritional support
- Ongoing care

### Table XXI. Management of foot ulceration complications\(^7\)

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### Table XXII. Management of foot ulceration complications\(^7\)

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### Table XXIII. Management of foot ulceration complications\(^7\)

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### Table XXIV. Management of foot ulceration complications\(^7\)

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### Table XXV. Management of foot ulceration complications\(^7\)

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### Table XXVI. Management of foot ulceration complications\(^7\)

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### Table XXVII. Management of foot ulceration complications\(^7\)

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### Table XXVIII. Management of foot ulceration complications\(^7\)

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### Table XXIX. Management of foot ulceration complications\(^7\)

- Pressure reduction
- Wound care
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- Ongoing care

### Table XXX. Management of foot ulceration complications\(^7\)

- Pressure reduction
- Wound care
- Infection control
- Nutritional support
- Ongoing care
• Microalbuminuria is a strong risk factor for cardiovascular disease in the elderly. Treatment with an angiotensin-converting enzyme (ACE) inhibitor is particularly advantageous in elderly patients with type 2 diabetes and microalbuminuria, even in the absence of hypertension.

• Overt proteinuria is a strong risk factor for progression to kidney failure. It requires specific therapy with ACE inhibitors or angiotensin II receptor blockers.

• Although moderate renal insufficiency (GFR 30 - 60 ml/min) does not require specific therapy, doses of drugs mainly eliminated via the renal route may need to be adjusted.

• A protein-restricted diet may delay the progression of kidney insufficiency but may contribute to malnutrition and sarcopenia.

The number of patients suffering from various chronic diseases who develop end-stage renal disease is increasing. A considerable proportion of these patients are elderly and in need of palliative care. Unfortunately very little attention is given to palliative care for patients with non-cancerous diseases such as end-stage renal failure. The following symptoms are common in the final stages of a patient's life and may require special attention and skills: chronic pain, nausea, constipation, depression, dyspnoea, pruritus and delirium.

Prevention
Twenty per cent of subjects in the Diabetes Prevention Program (DPP) study were 60 years or older. In the study the advantage of lifestyle intervention compared with placebo over a 3-year period to prevent diabetes was significantly greater in older compared with younger individuals (71% decrease in those ≥60 years versus 11% in the 25 - 44-year age group). Although metformin compared with placebo significantly reduced the incidence of diabetes in younger individuals it was not effective in older individuals. In the STOP-NIDDM trial acarbose compared with placebo decreased the development of diabetes by 30% after 3.3 years in older subjects (>55 years). It has also been shown that participation in self-selected exercise activities is independently associated with delaying the onset and progression of frailty in elderly subjects. Regular structured physical activity may therefore prevent or delay the onset of diabetes and frailty – two common and debilitating conditions in the elderly population.

Conclusion
It is a major challenge for health care workers responsible for the health of elderly patients to facilitate successful ageing in the growing diabetic population. Diabetes and its chronic complications impact negatively on successful ageing and every effort should be made to prevent the development of diabetes and frailty in the ageing population. Those who are already frail and subject to the burden of multiple chronic diseases and disability require special and skilled attention that is unfortunately not widely available in South Africa.

References available at www.cmej.org.za

In a nutshell
• Diabetes affects 21% of adults 65 years of age and older.
• The recommended diagnostic criteria for diabetes remain the same for all age groups.
• The clinical presentation of diabetes in the elderly may be insidious or atypical, and vague symptoms such as fatigue, weight loss and mood change are not uncommon.
• Annual screening for diabetes in asymptomatic but high-risk elderly patients should be considered as the detection rate is high.
• There is currently no evidence that improved diabetes control in elderly patients prevents the development of macrovascular complications, although a case for improved diabetes control and the prevention of microvascular complications can be made.
• It is useful to distinguish between the older diabetic patient in ‘good health’ and frail patients affected by multiple pathologies (unsuccessful ageing).
• Over and above the conventional macro- and microvascular complications elderly patients with diabetes are especially at risk of geriatric syndromes such as functional disabilities, falls and fractures, incontinence, depression and dementia, sarcopenia and malnutrition.
• Risk factors for foot ulceration and lower limb amputation may already be abundant-ly present in elderly patients with diabetes, especially in those with co-morbidities and geriatric syndromes.
• Regular structured physical activity may therefore prevent or delay the onset of diabetes and frailty – two common and debilitating conditions in the elderly population.