Introduction
Diabetes can present at any age but in older people the presence of other medical problems complicates its management. It is even difficult to define ‘older’ as there is no direct link between chronological age and functional performance. We will take the accepted cut off of 65 years of age to mean ‘older’, with the important proviso that many people with diabetes in this age group are extremely fit and well and should be managed in the same way as their younger counterparts.

Incidence of diabetes in older people
Despite all the publicity about the increasing prevalence of type 2 diabetes, the incidence in the UK appears to have plateaued since 2004. The encouraging explanation for this paradox is that people with diabetes are living longer. The incidence data come from several sources which include the following:

- The Health Improvement Network (THIN), which analysed more than 8 million electronic records from 550 GP practices, broadly representative of the UK population, between 2000 and 2013.
- The Scottish national diabetes register, which published data from 2004 to 2013.

THIN reported an overall rise in incidence of type 2 diabetes from 3.69 to 3.99 per 1000 person-years at risk (PYAR) in men and from 3.06 to 3.73 per 1000 PYAR in women. The peak incidence in 2004 coincided with the introduction of the quality outcomes framework (QOF), which may have encouraged the recording of new diagnoses. The Scottish study shows that the overall incidence of type 2 diabetes in Scotland has been stable between 2004 and 2013 at 4.88 per 1000 PYAR in men and 3.3 in women. Both UK and Scottish data show an increase in prevalence of type 2 diabetes from 2–3% to 5% over the

Key words
older people; type of diabetes; treatment targets; hypoglycaemia; care homes
Diagnosis and management of diabetes in older people

Review

Diabetes in older people is often more gradual, leading to misdiagnosis as type 2 diabetes.

Determining the type of diabetes in older people

People diagnosed over the age of 65 years are likely to have type 2 diabetes but, as with all adults, the possibility of type 1 must be considered. Those with type 2 diabetes are usually overweight but over-weight people may also develop type 1 diabetes, so weight is not an absolute discriminator. The classical presentation of type 1 diabetes – rapid onset of severe symptoms, significant weight loss and ketonuria – should raise suspicion of type 1 diabetes but this is not the norm in older patients. Type 1 diabetes in this age group frequently has a gradual onset of symptoms, only recognised as type 1 when oral medication fails to have an effect.5

The term LADA (latent autoimmune diabetes in adults) has been used to describe people with the immunological characteristics of type 1 diabetes (anti-GAD, insulin autoantibodies, islet cell antibodies) who do not require insulin within the first six months of diagnosis.6 LADA is linked with other autoimmune conditions within the spectrum of type 1 diabetes and shares a similar genetic profile.7 There is debate about whether LADA is a separate entity or part of the spectrum of type 1 diabetes since the only feature which distinguishes it from type 1 is the delayed need for insulin. The UK Prospective Diabetes Study found that in a cohort of people aged 55–65 at the time of diagnosis of type 2 diabetes, 4% had islet cell antibodies and 7% had anti-GAD antibodies. In this older cohort, antibody-positive individuals were phenotypically identical to those with type 2 diabetes but were more likely to require insulin within the first six years compared with their antibody-negative peers.8

The messages are:

• Type 1 diabetes does not always present in a classical way in older people.
• Adults of all ages may develop more slowly progressive autoimmune type 1 diabetes, sometimes known as LADA.
• The possibility of type 1 diabetes should be considered in anyone who does not respond to oral therapy, particularly those who are not overweight at diagnosis.

Prognosis

Whether older people develop diabetes in middle age or later in life, they have more than double the risk of cardiovascular disease and end stage renal disease, compared with their non-diabetic peers. Retinopathy is more common in those who have had diabetes since middle age but, retinopathy apart, the increased risks associated with diabetes in the >65 years age group do not seem to be linked to duration of diabetes. This is probably because the other microvascular complications (nephropathy and peripheral neuropathy) are both associated with premature death, which has a greater impact on those diagnosed in middle age.9 Although there is evidence that major amputation rates are decreasing overall in people with diabetes, the diabetic population aged over 75 years has twice the risk of a major lower limb amputation compared to the 40–64 age group.10

Treatment targets

As people age, additional factors must be considered when agreeing targets for glycaemia, blood pressure and cholesterol. The risks of polypharmacy increase and side
effects such as hypoglycaemia, dehydration, and postural hypotension can have serious consequences. Evidence on which to base targets is sparse, as many trials exclude older people and those with comorbidities. Targets need to be individualised, balancing potential benefits against the risks of tight glycaemic and blood pressure control; the risk of adverse effects restricts the treatment choice.

Glycaemic targets
What can we learn from the trials of the effect of glycaemic control on diabetes complications? The UKPDS provides good evidence for the medium- and long-term benefit of early tight control (HbA\textsubscript{1c} 53–59mmol/mol) but subsequent trials (ACCORD, ADVANCE and VADT), which recruited older people and targeted a lower HbA\textsubscript{1c} (<42–48mmol/mol), failed to show such clear benefits. The ACCORD trial was notorious for showing that tight glycaemic control was linked to higher mortality. The excess mortality was in the under 65 age group, but those over 75 had twice the number of hospital visits for severe hypoglycaemia.\textsuperscript{11}

An observational study of 72 310 people aged >60 years showed a U-shaped association between HbaA\textsubscript{1c} and mortality, with the risk of diabetes complications or death rising when the HbaA\textsubscript{1c} was above 64mmol/mol and mortality rising when the HbaA\textsubscript{1c} fell below 42mmol/mol.\textsuperscript{12} No difference was detected between age groups 60–69, 70–79 and >80 years.

Doubts raised by these studies have led the American Diabetes Association and the European Diabetes Working Party (EDWP) for Older People to caution against tight control and to advise taking functional state rather than chronological age into account when determining the target for an individual. It takes up to six years for the benefits of good control to emerge, so factors reducing life expectancy (advanced age, frailty and comorbidities) should be taken into account. Tight glycaemic control in older people carries its own risks of cardiovascular events and hypoglycaemia. The EDWP suggests a target HbaA\textsubscript{1c} of 53–58mmol/mol for fit older people and 59–69mmol/mol for the frail.\textsuperscript{13} However, even a target of 69mmol/mol may be risky in frail patients, where the aim should be to avoid hypoglycaemia and symptomatic hyperglycaemia. It is essential to agree goals and management strategy with patients and/or carers.

Blood pressure
The evidence for lowering blood pressure comes from large trials, which included older people with diabetes, and benefit was seen within one year of starting treatment. The need to treat high systolic pressure is undisputed but the ideal target is not clear. Given that a low diastolic pressure is a risk factor for mortality in the elderly, and that over-zealous treatment increases the risk of postural hypotension and falls, individual risk should be taken into account. Evidence from a post hoc analysis of the VADT study suggests that the target systolic pressure should be less than 140mmHg but the diastolic should not be lower than 70mmHg.\textsuperscript{14}

Cholesterol
Large trials of cholesterol lowering treatments have included people with diabetes and those aged >80 years. A meta-analysis of 14 trials of statin therapy in primary prevention included 18 686 people with diabetes and showed a 20% relative reduction in major adverse vascular outcomes in those under and over 65 years.\textsuperscript{15} Similar outcomes have been demonstrated for secondary prevention and, as the effect is seen relatively rapidly (within one to two years), only those with limited life expectancy will fail to benefit.

Treatment options
Lifestyle
Diet and exercise are the central pillars of lifestyle changes recommended to people newly diagnosed with diabetes but advice should be modified depending on functional status, not chronological age. For those who are fit and well, recommendations should be as for younger people. Advice should be adapted for those with disabilities.

The normal ageing process leads to sarcopenia and an irreversible reduction in the number of neurons supplying the muscles;\textsuperscript{16} older people with diabetes may have additional nerve damage due to neuropathy, which further reduces their activity.\textsuperscript{17} A number of physiological and psychological factors cause people to slow down with age and when this process begins to interfere with normal daily living, it can be described as frailty.

Although there is no universally agreed definition of frailty, it is a useful concept and approximately 10% of people aged 65–75 and 50% of those over 80 years meet this description. Frailty covers a wide range of conditions and, while its course is typically downhill, there is always an opportunity to reverse the process by increasing physical activity. Even people who have been sedentary throughout their lives can increase longevity and cognition by taking up an exercise programme in old age.\textsuperscript{18,19} However, it appears that serious exercise is needed to make a difference: 45 minutes of moderate intensity exercise two to three times a week.\textsuperscript{20} There seem to be no risks associated with programmes involving light or moderate exercise but intense exercise regimens carry a risk of one cardiovascular event per 100 years of vigorous activity.\textsuperscript{21} Despite all the positive evidence, the uptake of formal activity programmes is low in older people, which reflects the difficulty of changing behaviour in this age group.

Oral therapy and GLP-1 analogues
The range of medication available for treatment of type 1 and type 2 diabetes in older people is the same as for younger age groups, but the choice may be limited by impaired renal function, risk of hypoglycaemia or inability to cope with complex regimens. As people age it is important to be on the lookout for changes which may require a change in treatment:

- Decline in renal function.
- Reduced or erratic nutritional intake (risk of hypoglycaemia).
- Weight loss (leading to reduction in insulin resistance).
- Cognitive or visual impairment (may lead to dosage errors).
Older people taking sulphonylureas are at particular risk of hypoglycaemia and this may become chronic, presenting as confusion or cognitive impairment (case study 1).

Those with cognitive impairment may forget to eat, increasing the risk of hypoglycaemia. An HbA1c below 53mmol/mol should raise the possibility of hypoglycaemia and this should prompt dose reduction or total withdrawal of the sulphonylurea. Higher HbA1c levels do not exclude the possibility of hypoglycaemia. Table 1 shows the treatment options and the modifications which may be required.

**Insulin**

Whether the person has type 1 or type 2 diabetes, the insulin regimen should be tailored to the needs of the patient and adapted if circumstances change. Age in itself is not a factor in determining the regimen; people who develop type 1 diabetes later in life can learn to manage a basal bolus regimen or even an insulin pump (case study 2). However, if functional status declines and cognition is impaired, the insulin regimen must be simplified and glycaemic targets relaxed. It is important to reassess the person’s ability to manage their diabetes with this in mind. For people with frailty or comorbidities, a single daily insulin regimen, designed to avoid hyper- and hypoglycaemia, possibly supervised by a district nurse, may be safer than a combination of oral therapies.

**Residential and nursing homes**

There is increasing concern about the way diabetes is detected and managed in care homes. Diabetes UK produced practical guidelines for diabetes care in residential homes in 2010; awareness and uptake of these guidelines were audited in 2014.

In the audit, 2043 out of 9000 care homes (23%) responded to a diabetes questionnaire. The prevalence of diabetes was surprisingly low at 10.4%, which suggests that they are not carrying out the recommended routine screening for diabetes, which would increase the prevalence to 20% or more. The

<table>
<thead>
<tr>
<th>Medication</th>
<th>Risks for older people</th>
<th>Action</th>
</tr>
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<tbody>
<tr>
<td>Metformin</td>
<td>Impaired renal function increases risk of lactic acidosis</td>
<td>Reduce dose if eGFR &lt;50 and stop if &lt;30</td>
</tr>
<tr>
<td>DPP-4 inhibitors</td>
<td>Dose reduction required in impaired renal function (except linagliptin)</td>
<td>Reduce dose or change to linagliptin if the eGFR &lt;50</td>
</tr>
<tr>
<td>SGLT2 inhibitors</td>
<td>Postural hypotension and dehydration</td>
<td>Do not use if eGFR &lt;60. Not recommended for people &gt;75 years of age</td>
</tr>
<tr>
<td>Pioglitazone</td>
<td>Fluid retention and increased risk of heart failure. Increased fracture risk</td>
<td>Do not use if risk of heart failure</td>
</tr>
<tr>
<td>Sulphonylureas</td>
<td>Hypoglycaemia</td>
<td>Use short-acting sulphonylurea only (e.g. gliclazide). Look out for evidence of hypoglycaemia and reduce or stop if hypos identified</td>
</tr>
<tr>
<td>GLP-1 agonists</td>
<td>Do not use if impaired renal function</td>
<td>Reduce dose if eGFR &lt;50 and stop if &lt;30</td>
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Message

- Sulphonylureas can cause unexplained confusion and frailty, which may be corrected by stopping the drug

**Case study 1: Ernest**

- Aged 82 years. Living with wife in own home
- Type 2 diabetes on metformin 500mg bd and gliclazide 40mg od
- HbA1c: 46mmol/mol
- Concern about his ability to cope at home; frequent falls and increasing confusion
- Admitted following a fall. Very confused
- Blood glucose 2.8mmol/L on admission
- Treated for hypoglycaemia but usual medication continued
- Fasting blood glucose 2–4mmol/L for next 3 days
- Gliclazide stopped. Fasting blood glucose rose to 7–8mmol/L
- Over next few days mobility improved and confusion resolved
- Discharged home to wife
- Diagnosis: chronic hypoglycaemia

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**Case study 2: Felicity**

- New diagnosis of diabetes aged 67
- Body mass index 23kg/m²
- Failed to respond to oral therapy
- Anti-GAD positive. Diagnosis of type 1 diabetes (latent autoimmune diabetes in adults)
- Insulin commenced
- Changed from twice-daily mixture to basal bolus
- DAFNE course
- Blood glucose very labile with swings from high to hypo, causing great anxiety
- HbA1c: 84mmol/mol
- Insulin pump approved
- Significant improvement in blood glucose control and confidence
- HbA1c: 60mmol/mol with few hypos

Message

- An insulin pump may transform lives at any age
important findings of the audit were as follows:

- 47% were unaware of the Diabetes UK guidelines.
- 37% had no written policy for hypoglycaemia management.
- 65% had no policy for screening for diabetes.
- 63% had no designated staff member with responsibility for diabetes.
- 64% did not have a copy of the resident’s annual diabetes review (i.e. poor communication with primary care).
- 33% did not provide staff with access to training in diabetes care.

Under pressure from professional organisations, the Care Quality Commission has produced guidance for those inspecting the quality of care for diabetes in care homes.25Sadly, residential homes are subject to increasing financial constraints and they will find it hard to achieve the high standards demanded by the CQC.

Declarations of interests

There are no conflicts of interest declared.

References