European Diabetes Working Party for Older People 2011 Clinical Guidelines for Type 2 Diabetes Mellitus. Executive Summary

A Report of the European Diabetes Working Party for Older People (EDWPOP) Revision Group on Clinical Practice Guidelines for Type 2 Diabetes Mellitus

Expert Revision Group

Alan J Sinclair MSc MD FRCP, Chair[a,], Giuseppe Paolisso PhD MD[b], Marta Castro MD[c], Isabelle Bourdel-Marchasson PhD MD[d], Roger Gadsby MD FRCGP[e], Leocadio Rodriguez Mañas MD[c]*

[a] *The Institute of Diabetes for Older People (IDOP), Beds & Herts Postgraduate Medical School, Luton LU2 8LE, UK*
[b] *Department of Geriatric Medicine and Metabolic Disease, Piazza Miraglia 2- 80138, University of Napoli, Italy*
[c] *Servicio de Geriatría, Hospital Universitario de Getafe, Ctra. de Toledo, Km. 12,5 28905-Getafe, Spain*
[d] *UMR 5536 CNRS/Université Bordeaux Segalen ; Pôle de Gerontologie Clinique, Centre Henri Choussat, Hopital Xavier Arnozan 33604 Pessac cedex, France*
[e] *The University of Warwick Medical School, Coventry, CV4 7AL, UK*

Abstract

Aim – The Clinical Guidelines provide an opportunity to summarise the interpretation of relevant clinical trial evidence for older people with diabetes. They are intended to support clinical decisions in older people with diabetes and the primary focus is enhancing high quality diabetes care by the use of best available evidence.

Methods – The principles used for developing the recommendations are drawn from the Scottish Intercollegiate Guidelines Network (SIGN) based in Edinburgh, Scotland. Using SIGN 50, the Guidelines developer's handbook, each reviewer evaluated relevant and appropriate studies which have attempted to answer key clinical questions identified by the Working Party. Searches were generally limited to English language citations over the previous 15 years but the wide experience and multinational nature of the Working party ensured that citations in Italian, French Spanish, and German were considered if relevant. All relevant published articles were identified from the following databases: Embase, Medline/PubMed, Cochrane Trials Register, Cinahl, and Science Citation. Hand searching of 13 key major peer-reviewed journals was undertaken by two reviewers and included the Lancet, Diabetes, Diabetologia, Diabetes Care, Diabetes and Metabolism, British Medical Journal, New England Journal of Medicine, and the Journal of the American Medical Association.

Results – Key evidenced-based recommendations were made in 18 clinical domains of interest and Good Clinical Practice points identified. A glucose-lowering algorithm has been provided for frail older patients with diabetes.

Conclusion – We have provided an up-to-date evidenced-based approach to practical clinical decision-making for older adults with type 2 diabetes of 70 years and over. We have included a user-friendly set of recommendations to aid clinical decision-making in primary, community-based and secondary care settings.
© 2011 Elsevier Masson SAS. All rights reserved.

Keywords: Diabetes; Elderly; Older; Guidelines; Recommendations; Frailty; Review

Résumé

Recommandations pour la pratique clinique 2011 du Groupe de travail européen du Diabète de type 2 de la personne âgée. Synthèse

Objectif – Ces recommandations cliniques sont l'occasion de faire la synthèse des résultats apportés par les essais cliniques pertinents pour les personnes âgées atteintes de diabète de type 2. Elles sont destinées à soutenir les décisions thérapeutiques chez les personnes âgées diabétiques et leur objectif principal est de promouvoir une prise en charge de haute qualité fondée sur les meilleures preuves disponibles.

Méthodes – Les principes qui ont permis de développer les recommandations sont issus du Scottish Intercollegiate Guidelines Network (SIGN) localisé à Edimbourg en Écosse. À l'aide de la procédure SIGN 50, chaque lecteur a recensé et évalué les études

*Corresponding author.
E-mail address:* Sinclair.5@btinternet.com (A.J. Sinclair).

pertinentes ayant tenté de répondre aux questions cliniques clés identifiées par le groupe de travail. Les recherches ont été limitées en général aux publications écrites en anglais mais la nature multinationale du groupe de travail garantit que les publications en italien, français, espagnol et allemand ont pu être prises en compte si elles étaient pertinentes. Tous les articles publiés au cours des 15 dernières années ont été identifiés dans les bases de données suivantes : *Embase, Medline/PubMed, Cochrane Trials Register, Cinahl*, and *Science Citation*. Une recherche manuelle a été réalisée par deux lecteurs critiques dans les 13 principaux journaux pour le thème: *Lancet, Diabetes, Diabetologia, Diabetes Care*, *Diabetes and Metabolism, British Medical Journal, New England Journal of Medicine, and the Journal of the American Medical Association.*

Résultats – Les recommandations clés fondées sur les preuves ont été établies dans 18 domaines cliniques et des points de bonne pratique clinique ont été identifiés. Un algorithme de correction de la glycémie pour le sujet âgé fragile est fourni.

Conclusions – Nous avons mis à disposition une approche actualisée fonée sur les preuves de la prise de décision clinique pour les personnes âgées de plus de 70 ans atteinte d'un diabète de type 2. Nous avons produit un jeu convivial de recommandations pour l'aide à la décision pour les soins primaires au domicile ou pour les structures de soins secondaires.

Mots clés: Diabète de type 2 ; Sujet âgé ; Gériatrie ; Recommandations de pratique Clinique ; Fragilité ; Revue générale

---

1. Introduction

This *Executive Summary* of the Clinical Guidelines provides an opportunity to summarise the interpretation of relevant clinical trial evidence for older people with diabetes. They are intended to support clinical decisions in older people with diabetes and the primary focus is enhancing high quality diabetes care by the use of best available evidence. Where possible, recommendations which have a cost-effective component will be employed.

The original *European Diabetes Working Party for Older People (EDWPOP)* was established in December 2000 to ensure that older people in societies across the European Union have consistent and high quality diabetes care throughout their lives. It developed from the Elderly Diabetes Working Group (Chair: Professor A J Sinclair, UK) of the St Vincent Declaration Primary Care Diabetes Group chaired by Dr Paul Cromme (Netherlands).

Modern diabetes care systems for older people require integrated care between general practitioners, hospital specialists, and other members of the healthcare team. These should have a multi-dimensional approach with an emphasis on prevention of diabetes and its complications, early intervention for vascular disease, and assessment of disability due to limb problems, eye disease, stroke, and other causes.

Although management of diabetes in older people can be relatively straightforward especially when patients have no other co-morbidities and when vascular complications are absent. In many cases, however, special issues arise which increase the complexity of management and lead to difficult clinical decision-making.

Variations in clinical practice are common in most healthcare systems resulting in inequalities of care. For older people with diabetes, this may be manifest as lack of access to services, inadequate specialist provision, poorer clinical outcomes and patient and family dissatisfaction. Our response to these concerns has been to develop ***Clinical Guidelines*** for older patients with type 2 diabetes mellitus based on the best available scientific and clinical trial evidence.

We anticipated a series of possible advantages for developing the guidelines and these have been summarised in Table 1. Other benefits of this approach include: (a) provide an up-to-date evidenced-based approach to practical clinical decision-making for older adults with type 2 diabetes of 70 years and over; and (b) provide a user-friendly set of recommendations to aid clinical decision-making in primary, community-based and secondary care settings.

Little, if any, published work exists which examines the ethical and moral dimensions of providing diabetes care for older people. Issues which might pose specific problems include aims and strategies of care, patients' compliance, and risks of hypoglycaemia, choice of priorities, cost-effectiveness, and the presence of dementia or depression. Decision-making needs to reflect consideration of quality of life, life expectancy, cognitive and physical skills and the presence or otherwise of frailty. In the full set of ***Guidelines*** launched in 2004, those sections where ethical and/or moral issues are apparent, these have been highlighted and discussed, and practical advice provided.

In preparing the original full version EDWPOP identified various primary areas of concern and produced a series of

Table 1
Advantages of Clinical Guidelines for older people with type 2 diabetes mellitus in the European Union.

Improve clinical diabetes care and health outcomes
Increase consistency of diabetes care across Europe
Influence European public policy where appropriate
Improve professional and public knowledge about clinical care and services
Identify major gaps in knowledge where research is warranted
Complement existing clinical diabetes guidelines, *e.g.* IDF guidelines
Support quality improvement activities
Improve cost effectiveness in diabetes care

target areas for concerted action (Table 2) [1-7]. These were based on common but important clinical issues relevant to most people with diabetes, but, in addition, other areas were identified which were deemed to satisfy a series of additional criteria: each has a significant impact on the lives of older people with diabetes and their families; in each case, some supporting evidence was available but careful scrutiny by an experienced review group would be necessary to derive an appropriate grade of recommendation; for each targeted area either existing Guidelines for adult diabetes had failed to discuss or specific guidance was thought necessary.

The lack of a sufficient clinical evidence base for establishing recommendations on best practice was recognised and highlighted by the absence of any large-scale intervention studies in older people with type 2 diabetes, no substantial evidence of benefit for glucose or lipid lowering, no evidence of large studies in diabetic residents of care homes, and no evidence to recommend a particular care model.

This extensive literature review has revealed numerous gaps in our knowledge of diabetes in older adults. In several Sections of the full Guideline (but not in this document) the Working party has tried to identify important research areas which might be addressed by the diabetes research community in the form of a randomised controlled trial or some form of epidemiological research.

2. Further developments of clinical guidelines

The original comprehensive version of Clinical Guidelines represents an important step in highlighting the special needs of older people with diabetes mellitus. A first draft of the *Guidelines* were presented at the 18th International Diabetes Federation (IDF) Congress in Paris, France, 24-29th August 2003, and later in Florence, Italy at the 2nd Congress of the European Union Geriatric Medicine Society (EUGMS), 27-29th August 2003. A complete version then underwent critical review by an International External Advisory Board and, between 2004 and 2007, has been subsequently presented in 10 countries including the United States. They were again presented at the IDF Congress in Cape Town in December 2006. A full set of the Guidelines have been available on www.instituteofdiabetes.org since 2008 and published in parts in several journals.

The *Guidelines Revision Group* was set up in May 2008 to review new clinical trial evidence and provide a document more

readily available as a publication source. The members of the Group consist of acknowledged experts in medicine of older people and diabetes and endocrinology. The revision process also provided the opportunity to examine better implementation strategies for the *Guideline* across the European Union and more globally.

2.1. Methodology underpinning the full clinical Guidelines

Every attempt has been made to ensure that the recommendations are evidenced-based (where evidence is available) and the principles used for developing them are drawn from the Scottish Intercollegiate Guidelines Network (SIGN) based in Edinburgh, Scotland. Using SIGN 50, the Guidelines developer's handbook, each reviewer evaluated relevant and appropriate studies which have attempted to answer key clinical questions identified by the Working Party. Reviewers assigned a level of evidence and grade of recommendation based on Section 6 of the SIGN handbook for each major recommendation. In addition, reviewers completed a Considered Judgement form for each key area/question, and produced Good Clinical Practice Points where a practical management issue needs to be highlighted and is unlikely to be addressed *via* research.

Searches were generally limited to English language citations over the previous 15 years but the wide experience and multinational nature of the Working party ensured that citations in Italian, French Spanish, and German were considered if relevant. The primary strategy attempted to locate any relevant systematic reviews or meta-analyses, but randomised controlled trials were a main focus. Every effort was made to avoid bias in selection of evidence and all members of the Revision Group were asked to provide disclosure statements or indicate any ongoing relationship with the Industry.

The following *databases* were examined: Embase, Medline/PubMed, Cochrane Trials Register, Cinahl, and Science Citation. *Hand searching* of 13 key major peer-reviewed journals was undertaken by two reviewers and included the *Lancet, Diabetes, Diabetologia, Diabetes Care*, *Diabetes and Metabolism, British Medical Journal, New England Journal of Medicine, and the Journal of the American Medical Association.*

2.2. Classification of recommendations

All recommendations in this *Executive Summary* have been assigned both a Level of Evidence and a Grade of Recommendation in keeping with the revised SIGN grading system.

For areas without evidence or where evidence was minimal, reviewers came to a consensus view following a structured process where practicable. In general, recommendations made in this way are graded as D. In some cases, when the level of evidence is weak, *e.g.* 2, or 3 or 4, the reviewers have assigned a higher grade of recommendation, *e.g.* C, or

---

Table 2
Areas of clinical importance and targets for concerted action: type 2 diabetes mellitus in older people.

Importance of functional and vascular risk assessment
Relationship between functional outcome and metabolic control
Management of diabetes in primary care
Detection of cognitive impairment and depression
Management of specific major complications: *e.g.* foot disease, visual loss, hypoglycaemia, pain
Care Home diabetes
Ethical and moral aspects of treatment

Levels of evidence	
1++	High quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias
1+	Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
1-	Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias
2++	High quality systematic reviews of case-control or cohort or studies High quality case-control or cohort studies with a very low risk of confounding, bias, or chance and a high probability that the relationship is causal
2+	Well conducted case-control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal
2-	Case-control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not causal
3	Non-analytic studies, *e.g.* case reports, case series
4	Expert opinion

Grades of recommendation	
A	At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population; or A systematic review of RCTs or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1++or 1+
C	A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2++
D	Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2+

higher, but their justification has given. The overall process has been rigorously tied to a ***Guidelines Development Plan*** where each of the key steps has been specified.

Following methodological review, the draft of the guidelines was scrutinised by the External International Advisory Group whose membership was multidisciplinary, professional and also involved patients and carers. In addition, the draft guidelines were examined by several relevant bodies where preliminary revisions were instituted as part of an overall peer review process.

Further review for methodological soundness was conducted by the reviewers and final revisions developed. A pre-testing phase was introduced before the final guidelines were presented.

Every effort has been made to assign a proper level of evidence and grade of recommendation in each clinical area, but readers should allow for some variation in the analysis particularly where the medical literature is not specific to older people. An important message throughout the ***Guidelines*** is that the identification of individuals most likely to benefit from

metabolic interventional strategies is a paramount concern, equalled only by the need for structured and integrated diabetes care.

It is hoped that this Executive Summary and the accompanying full Guidelines (available at www.instituteofdiabetes. org) will be frequently accessed by all health professionals and those affected by diabetes as an important learning and educational resource.

3. Recommendations for enhancing the practice and quality of diabetes care

Table 3
Rationale for High Quality Diabetes Care for Older People.

Screening and early diagnosis may prevent progression of undetected vascular complications: *Level of evidence 1+, Grade of recommendation (A)*
Overall improved metabolic control will reduce cardiovascular risk: *Level of evidence 1+, Grade of recommendation (A)*
Improved screening for maculopathy and cataracts will reduce visual impairment and blind registrations: *Level of evidence 2+, Grade of recommendation (C)*
An integrated approach to management of peripheral vascular disease and foot disorders will reduce amputation rate: *Level of evidence 1+, Grade of recommendation (A)*

3.1. Aims of care [8-9]

1. The physician should aim to establish a contract between himself/herself and the patient or principal carer in relation to treatment aims and goals of care, designed to optimise patient empowerment at all times. *Evidence Level 2++, Grade of recommendation B*

2. The decision to offer treatment should be based on the likely benefit/risk ratio of the intervention for the individual concerned, but factors such as vulnerability to hypoglycaemia, ability to self-manage, the presence or absence of other pathologies, the cognitive status, and life expectancy must be considered. *Evidence level 2++, Grade of recommendation B*

3.2. Education and nutrition [10-14]

1. Structured patient education should be made available to all older people with diabetes. *Evidence level 1+, Grade of recommendation B.*

2. Each educational package should have following elements: based on best principles of adult learning; provided by adequately trained multidisciplinary staff; and provided both individually and as groups; techniques adapted to the special needs of older people. *Evidence level 2+, Grade of recommendation C.*

3. Educational sessions should be accessible to all older people and take into account culture, language, nutritional preferences, ethnicity, disability and geographical factors. *Evidence level 2+, Grade of recommendation B.*

4. Nutritional assessment is recommended for all older patients with diabetes at the time of diagnosis and regularly thereafter. This will also allow the identification of patients with undernutrition. *Evidence level 2++, Grade of recommendation B.*

3.3. Screening and diagnosis [15-18]

1. Clinical presentation of diabetes in old age is often asymptomatic and non-specific and clinical diagnosis may be delayed. *Evidence level 2++, Grade of recommendation B.*

2. In general, screening for and diagnosis of diabetes in older subjects should be in accordance with published international/national criteria and guidelines and no age-modified criteria are currently recognised. *Evidence level 1+, Grade of recommendation A.*

3. The prevalence and incidence rates of diabetes mellitus in elderly subjects (> 65 years) may be underestimated when using only fasting plasma glucose. *Evidence level 1+, Grade of recommendation A.*

4. The presence of isolated post-challenge hyperglycaemia (IPH) is common in older subjects and should alert the clinician to screen for cardiovascular disease and institute risk intervention strategies to minimise premature death. *Evidence level 1+, Grade of recommendation A.*

5. In high-risk older subjects with a normal fasting glucose, and where an OGTT is not feasible, determination of HbA_{1c} may be helpful in the diagnosis of diabetes. A value of HbA_{1c} > 6.5% may indicate the likely presence of diabetes. *Evidence level 2++, Grade of recommendation B.*

3.4. Prevention and lifestyle change [19-22]

1. In older adults with impaired glucose tolerance (IGT) regular exercise as part of a lifestyle change can reduce the risks of developing type 2 diabetes independently of BMI. *Evidence level 2++, Grade of recommendation B.*

2. Lifestyle intervention is preferable to treatment with metformin in reducing the risks of type 2 diabetes in non-obese older adults with elevated fasting and post-load plasma glucose levels. *Evidence level 1++, Grade of recommendation A.*

3.5. Functional evaluation [23-26]

1. Each older patient with type 2 diabetes should have an assessment of their functional status by a multidisciplinary team skilled in evaluation using well-validated assessment tools. *Evidence level 1+, Grade of recommendation A.* This should be at the time of diagnosis and annually thereafter.

2. Each functional assessment must include a measure of the three major domains of function: global/physical, cognitive and affective. *Evidence level 1+, Grade of recommendation A.*

3.6. Renal disease [27-30]

1. At the time of diagnosis and annually thereafter, all older people with type 2 diabetes have a measured serum creatinine, an estimated glomerular filtration rate, and an albumin-creatinine ratio undertaken. *Evidence level 1+, Grade of recommendation B.*

2. In older people with type 2 diabetes who have a raised albumin/creatinine ratio (>2.5 mg/mmol, women; > 3.5 mg/mmol, men), treatment with an ACE inhibitor is recommended – extrapolated data. *Evidence level 1+, Grade of recommendation B.*

3. In older patients with diabetes and microalbuminuria, maintaining a blood pressure target of 140/80 or less, and a HbA_{1c} range of 6.5-7.5%, may help to reduce the development of chronic kidney disease (CKD). *Evidence level 2++, Grade of recommendation B.*

4. Specialist review by a nephrologist at an earlier stage of CKD may prevent late referrals of older patients with diabetes for renal replacement therapy and improve outcomes. *Evidence level 2++, Grade of recommendation B.*

4. Recommendations for treatment

4.1. Managing cardiovascular risk [31-36]

1. At initial assessment, all older patients aged less than 85 years with diabetes should have a cardiovascular risk assessment undertaken. *Evidence level 1+, Grade of recommendation A.*

2. All older patients with type 2 diabetes aged less than 85 years should have a review and discussion of modifiable cardiovascular risk factors and be offered advice on smoking cessation. *Evidence level 2++, Grade of recommendation B.*

3. The ten-year risk of developing symptomatic cardiovascular disease should be calculated for all patients who have 2 or more risk factors to assess the need for primary prevention. *Evidence level 1+, Grade of recommendation B.*

4. There is insufficient evidence at present to routinely recommend low-dose aspirin for older patients with type 2 diabetes for the primary prevention of stroke or cardiovascular mortality. *Evidence level 1+, Grade of recommendation A.*

5. All older patients with type 2 diabetes, irrespective of baseline cardiovascular risk, should be offered aspirin treatment at a dose of 75-325 mg/d for secondary prevention. *Evidence level 2++, Grade of recommendation B.*

4.2. Glucose regulation [37-44]

4.2.1. Targets

1. For older patients with type 2 diabetes, with single system involvement (free of other major co-morbidities), a target HbA_{1c} range of 7-7.5% should be aimed for (DCC T

aligned). *Evidence level 1+, Grade of recommendation A*. The precise target agreed will depend on existing cardiovascular risk, presence of microvascular complications, and ability of individual to self-manage.

2. For frail (dependent; multisystem disease; care home residency including those with dementia) patients where the hypoglycaemia risk is high and symptom control and avoidance of metabolic decompensation is paramount, the target HbA$_{1c}$ range should be 7.6-8.5%. *Evidence level 1+, Grade of recommendation A*.

3. For older patients with type 2 diabetes, with single system involvement (free of other major co-morbidities), a fasting glucose range of 6.5-7.5 mmol/l can be regarded as indicating good control. *Evidence level 2++, Grade of recommendation B*.

4. For frail patients including those residing in care homes, a fasting glucose range 7.6-9.0 mmol/l should minimise the risk of hypoglycaemia and metabolic decompensation. *Evidence level 2+, Grade of recommendation C*.

4.2.2. Use of oral agents

1. In non-obese older people with diabetes in whom target levels of glucose or HbA$_{1c}$ have failed to be maintained on dietary/lifestyle changes, first line therapy with an insulin secretagogue (normally a sulphonylurea) or metformin should be offered. *Evidence level 1++, Grade of recommendation A*.

2. Metformin should normally be first line therapy for overweight older adults with type 2 diabetes (BMI>25.0 kg/m^2). *Evidence level 1++, Grade of recommendation A*.

3. An insulin secretagogue may be used in combination with metformin in normal or overweight patients where glycaemic targets have not been achieved or maintained. *Evidence level 1+, Grade of recommendation B*

4. In those cases where metformin is contraindicated or not tolerated, an insulin secretagogue may be prescribed. *Evidence level 1+, Grade of recommendation B*.

5. Age per se is not a contraindication to the use of metformin but its use is contraindicated in those with renal impairment (serum creatinine>130 µ/litre), severe coronary, cerebrovascular or peripheral vascular disease. *Evidence level 2++, Grade of recommendation B*.

6. Glibenclamide should be avoided for newly diagnosed cases of type 2 diabetes in older adults (>70 years) because of the marked risk of hypoglycaemia. *Evidence level 1+, Grade of recommendation A*.

7. Consider a DPP-4 inhibitor as an add-on to metformin when use of a sulphonylurea may pose an unacceptable hypoglycaemia risk in an older patient with diabetes. *Evidence level 1+, Grade of recommendation A*.

8. In the very obese older patient (age less than 75 years) with type 2 diabetes (BMI>35) a GLP-1 mimetic (*e.g.* exenatide, liraglutide) may be considered as 3rd line therapy to metformin and a sulphonylurea. *Evidence level 2++, Grade of recommendation B*.

4.2.3. Use of insulin

9. When oral agents fail to lower glucose levels adequately, insulin may be given either as monotherapy or in combination with a sulphonylurea or metformin. *Evidence level 1+, Grade of recommendation A*.

10. In older adults with diabetes, the use of pre-mixed insulin and pre-filled insulin pens may lead to a reduction in dosage errors and an improvement in glycaemic control. *Evidence level 2++, Grade of recommendation B*.

11. Use of a long-acting insulin analogue (*e.g.* glargine, determir) rather than NPH-insulin should be considered in older patients who require the assistance of a carer, those residing within a care home, or where there is a defined higher risk of hypoglycaemia. *Evidence level 1+, Grade of recommendation A*.

4.3. Hypoglycaemia

1. All physicians involved in the care of older patients with type 2 diabetes should assess the risk of hypoglycaemia and adjust therapy to minimise this risk. *Evidence level 1+, Grade of recommendation A*.

2. Where the risk of hypoglycaemia is considered moderate (renal impairment, recent hospital admission) to high (previous history, frail patient with multiple co-morbiditities, resident of a care home) use an agent with a lower hypoglycaemic potential, *e.g.* DPP4 inhibitor, lower risk sulphonylurea. *Evidence level 1+, Grade of recommendation A*.

In figure 1, we have presented an algorithm for glucose-lowering for frail older people with diabetes which has attempted to incorporate some of the above evidence-based recommendations but has also simplified the treatment path to avoid unnecessary over-treatment and polypharmacy, and to align more closely with likely treatment targets in a patient with frailty.

4.4. Blood pressure regulation [45-48]

The following decisions are based on the likelihood of reducing cardiovascular risk in older subjects balanced with issues relating to tolerability, clinical factors and disease severity, and targets likely to be achievable with monotherapy and/or combination therapy, and with agreement with primary care colleagues. A lower value of blood pressure should be aimed for in those who are aged less than 80 years and are able to tolerate the therapy and self-manage, and/or those with concomitant renal disease:

1. The threshold for treatment of high blood pressure in older subjects with type 2 diabetes should be 140/80 mmHg or higher present for more than 3 months and measured on at least three separate occasions during a period of lifestyle management advice (behavioural: exercise, weight reduction, smoking advice, nutrition/dietary advice). *Evidence level 2++, Grade of recommendation B*.

Recommended glucose targets:	3-6 months dietary and lifestyle advice	Frailty criteria:

Recommended glucose targets:
Fasting glucose range = 7.6-9.0 mmol/L
HbA$_{1c}$ range = 7.6-8.5%

3-6 months dietary and lifestyle advice

Frailty criteria:
Care home residency
Significant cognitive decline
Major lower limb mobility disorder
History of disabling stroke

Not achieving agreed glucose targets

Metformin contraindicated in renal/hepatic dysfunction, respiratory/heart failure, anorexia, gastrointestinal disease

Metformin

Alternative treatments:
DPPIV inhibitors, or
Lower risk sulphonylureas (SU)
Glinides

Failure to achieve glucose targets

Further weight loss with a GLP-1 agonist may have adverse consequences in a frail patient

Metformin + DPPIV inhibitor

Alternative treatments:
Metformin + lower-risk SU
Metformin + GLP-1 agonist

Failure to achieve glucose targets

Frailty associated with increased hypoglycaemia risk: caution when using insulin or sulphonylurea therapy

Metformin + insulin

Alternative treatments:
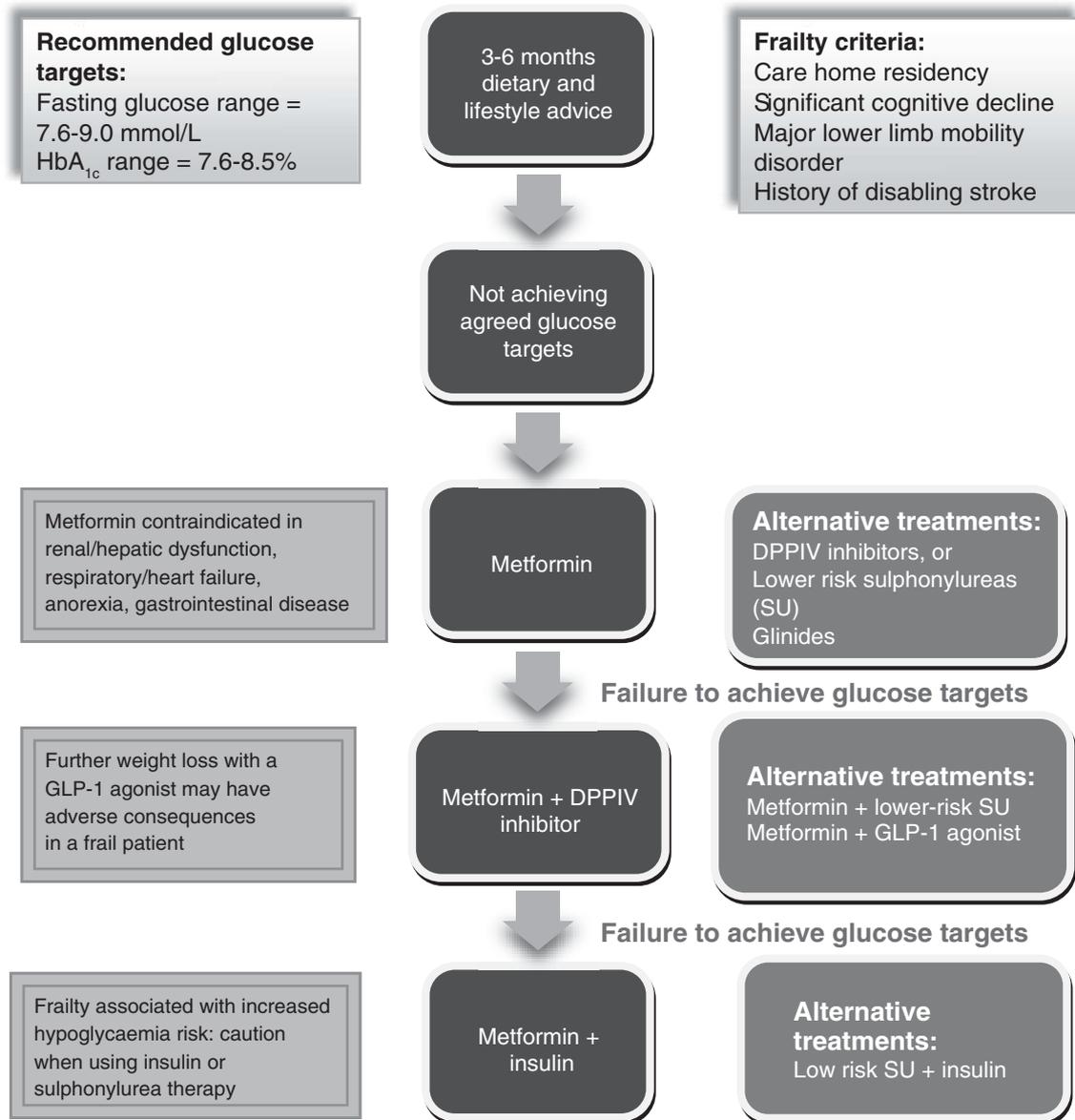Low risk SU + insulin

Fig. 1. Glucose-lowering algorithm for frail patients with type 2 diabetes mellitus.

2. In non-frail subjects with diabetes older than 80 years, an acceptable blood pressure on treatment is a systolic of 140-145 mmHg, and a diastolic less than 90 mmHg. *Evidence level 1+, Grade of recommendation B.*

3. For frail (dependent; multisystem disease; care home residency including those with dementia) patients, where avoidance of heart failure and stroke may be of greater relative importance than microvascular disease, an acceptable blood pressure is <150/90 mmHg. *Evidence level 2+, Grade of recommendation C (extrapolated data).*

4. In older patients with a sustained blood pressure (≥140/80 mmHg) and in whom diabetic renal disease is absent, first-line therapies can include: use of ACE inhibitors, angiotensin II receptor antagonists, long-acting calcium channel blockers, beta blockers or thiazide diuretics. *Evidence level 1+, Grade of recommendation A.*

5. In older patients with a sustained blood pressure (≥140/80 mmHg) with microalbuminuria or proteinuria, treatment with an ACE inhibitor or angiotensin II receptor antagonist is recommended. *Evidence level 1+, Grade of recommendation B.*

6. Use of a perindopril-based regimen in older patients with type 2 diabetes (with or without hypertension) improves both microvascular and macrovascular outcomes. *Evidence level 1+, Grade of recommendation A.*

4.5. Plasma lipid regulation [49-52]

1. In subjects with no history of cardiovascular disease, a statin should be offered to patients with an abnormal lipid profile if their 10-year cardiovascular risk is >15%. *Evidence level 1-, Grade of recommendation A.*

2. A statin should be offered to patients with an abnormal lipid profile who have proven cardiovascular disease. *Evidence level 1+, Grade of recommendation A.*

3. Consider statin therapy in older subjects with diabetes to reduce the risk of stroke as part of secondary prevention of cardiovascular disease. *Evidence level 2++, Grade of recommendation B.*

4. A fibrate should be considered in patients with an abnormal lipid profile who have been treated with a statin for at least 6 months but in whom the triglyceride level remains elevated (≥2.3 mmol/l). *Evidence level 2+, Grade of recommendation C.*

Good Clinical Practice
- Where insulin secretagogues and/or insulin is prescribed, patients (and carers) must be aware of how to recognise the symptoms of hypoglycaemia and be given instruction on how to provide prompt treatment
- As part of the assessment of older newly-diagnosed patients with hypertension, investigations to exclude secondary causes must also be considered, e.g. renovascular causes, hypothyroidism
- In patients with type 2 diabetes and a recent acute stroke (within 4 weeks), consideration should be given to an active treatment approach of raised blood pressure and lipids, vascular prophylaxis with anti-platelet therapy (aspirin), and optimising blood glucose control to reduce the rate of recurrent stroke

---

5. Recommendations for care home diabetes [53-56]

1. In view of the high rate of undiagnosed diabetes in care home residents, at the time of admission to a care home, each resident requires to be screened for the presence of diabetes. *Evidence level 2++, Grade of recommendation B.*

2. At the time of admission to care home, each resident with diabetes should be comprehensively assessed for the presence of functional loss as they are at higher risk of progression of disability. *Evidence level 2+, Grade of recommendation B.*

3. Residents on insulin secretagogues and/or insulin must be regularly reviewed for the presence of hypoglycaemic symptoms. *Evidence level 2-, Grade of recommendation C.*

4. Optimal blood pressure and blood glucose regulation may help to maintain cognitive and physical performance for each resident with diabetes. *Evidence level 2+, Grade of recommendation C (extrapolated data).*

Good clinical practice in care homes
- Each resident should have an annual screen for diabetes
- Each resident with diabetes should have an individualised diabetes care plan with the following minimum details: dietary plan, medication list, glycaemic targets, weight, and nursing plan.
- Each care home with diabetes residents should have an agreed Diabetes Care Policy or Protocol which is regularly audited.
- In larger care homes (>30 beds), access by suitable care home staff to a diabetes education and training course should be available.
- All residents with diabetes require a risk-benefit analysis in terms of medication used, metabolic targets agreed, and extent of investigation of diabetes-related complications.
- Clinical decision making for residents with diabetes by the community diabetes team must be based on the principles of enhancing quality of life, maintaining functional status, and avoiding hospital admission for diabetes-related complications.

---

6. Recommendations in special categories

6.1. Diabetic foot disease [57-59]

1. All older patients with type 2 diabetes should receive foot care education and instruction to self-inspect by suitable health care professionals. *Evidence level 1++, Grade of recommendation A.*

2. All older patients with type 2 diabetes should receive an annual (minimum frequency) inspection (including vascular and neurological examination) of their feet by a health care professional to detect risk factors for ulceration. *Evidence level 2+, Grade of recommendation C.*

3. Use of a 10-g monofilament or test of pin-prick sensation can be used to identify loss of protective sensation in older patients with diabetes. *Evidence level 2++, Grade of recommendation B.*

4. All older people with diabetes at high risk of foot ulceration should be referred to a foot protection team. *Evidence level 2++, Grade of recommendation B.*

Good clinical practice
- All older patients with type 2 diabetes who have additional risk factors for ulceration should be promptly referred to a specialist multidisciplinary protection programme.
- In older subjects, ankle pressure and pressure indices can be falsely elevated in patients with diabetes and should be interpreted with caution

---

6.2. Cognitive impairment and low mood states [60-66]

1. At the time of diagnosis and at regular intervals thereafter, patients aged 70 years and over should be screened for the presence of cognitive impairment using an age- and language-validated screening tool such as the MiniMental State Examination score. *Evidence level 2++, Grade of recommendation B.*

2. Regular screening for cognitive impairment and mood disorder is recommended for residents with diabetes who are at high risk of undetected disease. *Evidence level 2+, Grade of recommendation* B.

3. Optimal glucose regulation may help to maintain cognitive function in older people with type diabetes. *Evidence level 1+, Grade of recommendation A.*

4. Optimal blood pressure regulation should be aimed for to help to maintain cognitive performance and improve learning and memory. *Evidence Base 2++, Grade of recommendation B.*

5. Prevention of repeated hypoglycaemia in older patients with diabetes may decrease the risk of developing cognitive impairment or dementia. *Evidence level 2++, Grade of recommendation B.*

Good clinical practice
- Optimal glucose regulation may help to minimise symptoms of mood disorder in patients with depression and assist in adherence to treatment
- At the time of diagnosis and at regular intervals thereafter, older patients with diabetes should be screened for the presence of low mood disorder using an age- and language-validated screening tool such as the Geriatric Depression score.

6.3. Visual loss and erectile dysfunction [67-72]

1. At the time of diagnosis and at regular intervals thereafter all older people with type 2 diabetes should have a standard visual acuity assessment and retinal examination through dilated pupils looking for evidence of diabetic eye disease. *Evidence level 2++, Grade of recommendation B.*

2. Although direct ophthalmoscopy is a useful tool for opportunistic screening in older patients, they are no substitute for retinal photography and slit lamp examination in the screening for diabetic retinopathy. *Evidence level 2++, Grade of recommendation B.*

3. To maintain vision in older patients with type 2 diabetes and established retinopathy, optimal blood pressure control (≤140/80 mmHg) and optimal glycaemia (HbA$_{1c}$ 7.0 – 7.5%) should be aimed for. *Evidence level 1++, Grade of recommendation A.*

4. Older adults with type 2 diabetes and erectile dysfunction require a comprehensive evaluation of underlying risk factors. *Evidence level 2++, Grade of recommendation B.*

5. A detailed cardiovascular evaluation is required in all older patients with diabetes and erectile dysfunction. *Evidence level 2++, Grade of recommendation B.*

6. Oral phosphodiesterase type 5 inhibitors, unless contraindicated, should be offered (in addition to lifestyle modification, medication review) as a first-line therapy for erectile dysfunction. *Evidence level 2++, Grade of recommendation B.*

> **Good clinical practice**
> - Each older adult with type 2 diabetes and cardiovascular disease should be asked about their sexual health.
> - The provision of low vision aids to older people with diabetes may improve their quality of life.

6.4. Peripheral neuropathy and pain [73-76]

1. At the time of diagnosis and at regular intervals thereafter older patients with diabetes should be questioned about symptoms of neuropathy and examined for the presence of peripheral neuropathy using as a minimum an assessment by a 128 Hz (cycles per second) tuning fork for vibration, a test of pin-prick sensation and a 10 g Semmes-Weinstein monofilament test for pressure perception. *Evidence level 2++, Grade of recommendation B.*

2. Gabapentin can be used in older patients and is superior to placebo in painful diabetic neuropathy and one RCT indicated it to have fewer side-effects than tricyclic antidepressants (TCAs). *Evidence level 1+, Grade of recommendation A.*

3. Duloxetine can be considered as an alternative treatment for diabetes-related neuropathic pain when given at doses of 60mg or 120mg daily. *Evidence level 2++, Grade of recommendation B.*

4. In assessing neuropathic pain in older patients, the use of instruments specifically designed for neuropathic pain (*e.g.* the Brief Pain Directory for Diabetic Peripheral Neuropathy) can provide important insight into patients' pain experience and is recommended. *Evidence level 2+, Grade of recommendation C.*

> **Good clinical practice**
> - Each older adult with type 2 diabetes should be asked about symptoms of persistent pain and offered prompt and appropriate treatment when it is present.

6.5. Falls and immobility [77-81]

1. As part of their functional evaluation at diagnosis and at annual review, older people with type 2 diabetes should have a falls risk assessment. *Evidence level 2++, Grade of recommendation B.*

N.B. This will include identifying risk factors which can be minimised, e.g. certain medications, environmental items, and undertaking measures of gait and balance. It is particularly important to monitor insulin therapy, and where insulin secretagogues are used in a patient with other risk factors for falls, an agent with a lower risk of hypoglycaemia should be substituted.

2. A multidisciplinary Falls Intervention programme should be offered to all patients with a history of a fall or who by virtue of other risk factors have a high risk of falling. *Evidence level 1+, Grade of recommendation A.*

3. Tight glycaemic control (HbA$_{1c}$<7.0%) must be avoided in older patients with type 2 diabetes who are at increased risk of falling. *Evidence level 2++, Grade of recommendation B.*

> **Good clinical practice**
> - Optimising glucose control may help to maintain functional status and may decrease the risk of falls.

6.6. Peripheral arterial disease [81-84]

1. In view of the high prevalence of asymptomatic disease in older patients with diabetes, evaluation by ABI (ankle-brachial index) is recommended. *Evidence level 2++, Grade of recommendation B.*

2. ABI can be used to predict functional status and when combined with the Framingham score can predict risk of cardiovascular events. *Evidence level 2++, Grade of recommendation B.*

3. The use of ABI in detecting peripheral disease in older patients is recommended as a cost-effective tool. *Evidence level 2++, Grade of recommendation B.*

7. Other good clinical practice points

- Healthcare providers should address the following issues in older patients with diabetes and their carers:
  - The need for well structured shared care protocols with agreements on management of new cases, hospital admission criteria, access to specialist services, and follow-up criteria.
  - To avoid excessive carer burden, support is available in the areas of education, access to medical and nursing care, financial assistance, transport facilities and networking with other carers and support groups.

- – Have in place policies supported by enforcement for ensuring dignity, respect and freedom age discrimination all older patients with diabetes.
- A clinical (multidisciplinary) audit cycle can be adopted as a protocol for quality development and evaluating performance of a validated Diabetes Management System (DMS).
- DMS-related outcomes for older people must include clinical (*e.g.* rates of hospitalisation, amputation, cardiovascular mortality, and hypoglycaemia), metabolic, preventative, functional, health-related quality of life, and process-based (*e.g.* annual review, % referral rate to vascular surgeons) indicators.
- An agreed diabetes minimum data (MDS) set provides a consistency of approach to evaluating patients and facilitates the interpretation of randomised clinical trials of interventions.

Aknowledgment

Conflicts statement of interest

No potential conflicts of interest relevant to this article have been reported by any of the authors.

Key References by section

The rationale for delivering high quality diabetes care in older people

[1] Currie CJ, Peters JR, Tynan A, Evans M, Heine RJ, Bracco OL, et al. Survival as a function of HbA1c in people with type 2 diabetes: a retrospective cohort study. Lancet 2010;375:481-9.

[2] Patel A, MacMahon S, Chalmers J, Neal B, Billot L, Woodward M, et al.; ADVANCE Collaborative Group. Intensive blood glucose control and vascular outcomes in patients with type 2 diabetes. N Engl J Med 2008;358:2560-72.

[3] Zoungas S, de Galan BE, Ninomiya T, Grobbee D, Hamet P, Heller S, et al.; ADVANCE Collaborative Group. Combined effects of routine blood pressure lowering and intensive glucose control on macrovascular and microvascular outcomes in patients with type 2 diabetes: New results from the ADVANCE trial. Diabetes Care 2009;32:2068-74.

[4] Cikamatana L, Mitchell P, Rochtchina E, Foran S, Wang JJ. Five-year incidence and progression of diabetic retinopathy in a defined older population: the Blue Mountains Eye Study. Eye (Lond) 2007;21:465-71.

[5] Klein R, Klein BE, Moss SE, Wong TY. The relationship of retinopathy in persons without diabetes to the 15-year incidence of diabetes and hypertension: Beaver Dam Eye Study. Trans Am Ophthalmol Soc 2006;104:98-107.

[6] Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG, et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). J Vasc Surg 2007;45:S5-S67.

[7] Pornet C, Bourdel-Marschasson I, Lecomte P, Eschwege E, Romon I, Fosse S, et al. Trends in the quality of care for elderly people with type 2 diabetes: the need for improvements in safety and quality (the 2001 and 2007 Entred Surveys). Diabetes Metab 2011;37:152-61.

Aims of care

[8] American Diabetes Association. Standards of medical care in diabetes 2009. Diabetes Care 2009;32:S13-S61.

[9] Global Guideline for Type 2 Diabetes Brussels: International Diabetes Federation, 2005

Education and nutrition

[10] Braun AK, Kubiak T, Kuntsche J, Meier-Höfig M, Müller UA, Feucht I, et al. SGS: a structured treatment and teaching programme for older patients with diabetes mellitus--a prospective randomised controlled multi-centre trial. Age Ageing 2009;38:390-6.

[11] Vischer UM, Bauduceau B, Bourdel-Marchasson I, Blickle JF, Constans T, Fagot-Campagna A, et al.; SFGG French-speaking group for study of diabetes in the elderly. A call to incorporate the prevention and treatment of geriatric disorders in the management of diabetes in the elderly. Diabetes Metab 2010;27:918-24.

[12] Klug C, Toobert DJ, Fogerty M. Healthy Changes for living with diabetes: an evidence-based community diabetes self-management program. Diabetes Educ 2008;34:1053-61.

[13] NICE Technology Appraisal TA 60. Diabetes (types 1 and 2) - Patient Education models. April 2003

[14] Miller CK, Edwards L, Kissling G, Sanville L. Nutrition education improves metabolic outcomes among older adults with diabetes mellitus: results from a randomized controlled trial. Prev Med 2002;34:252-9.

Screening and diagnosis

[15] Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Follow-up report on the diagnosis of diabetes. Diabetes Care 2003;26:3160-7.

[16] McBean AM, Yu X. The underuse of screening services among elderly women with diabetes. Diabetes Care 2007;30:1466-72.

[17] Motta M, Bennati E, Cardillo E, Ferlito L, Malaguarnera M. The value of glycosylated haemoglobin (HbA_{1c}) as a predictive risk factor in the diagnosis of diabetes mellitus (DM) in the elderly. Arch Gerontol Geriatr 2010;50:60-4.

[18] DECODE Study Group, the European Diabetes Epidemiology Group. Glucose tolerance and cardiovascular mortality: comparison of fasting and 2-hour diagnostic criteria. Arch Intern Med 2001;161:397-405.

Prevention and lifestyle change

[19] Siegel LC, Sesso HD, Bowman TS, Lee IM, Manson JE, Gaziano JM. Physical activity, body mass index, and diabetes risk in men: a prospective study. Am J Med 2009;122:1115-21.

[20] Amundson HA, Butcher MK, Gohdes D, Hall TO, Harwell TS, Helgerson SD, et al.; Montana Cardiovascular Disease and Diabetes Prevention Program Workgroup. Translating the diabetes prevention program into practice in the general community: findings from the Montana Cardiovascular Disease and Diabetes Prevention Program. Diabetes Educ 2009;35:209-10, 213-4, 216-20 (*passim*).

[21] Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al.; Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med. 2002;346:393-403.

[22] Knowler WC, Fowler SE, Hamman RF, Christophi CA, Hoffman HJ, Brenneman AT, et al.; Diabetes Prevention Program Research Group. 10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program Outcomes Study. Lancet 2009;374:1677-86.

Functional evaluation

[23] Cesari M, Onder G, Russo A, Zamboni V, Barillaro C, Ferrucci L, et al. Comorbidity and physical function: results from the aging and longevity study in the Sirente geographic area (ilSIRENTE study). Gerontology 2006;52:24-32.

[24] Black SA, Markides KS, Ray LA. Depression predicts increased incidence of adverse health outcomes in older Mexican Americans with type 2 diabetes. Diabetes Care 2003;26:2822-8.

[25] Taylor SM, Kalbaugh CA, Blackhurst DW, Cass AL, Trent EA, Langan EM 3rd, et al. Determinants of functional outcome after revascularization for critical limb ischemia: an analysis of 1000 consecutive vascular interventions. J Vasc Surg 2006;44:747-55

[26] Bourdel-Marchasson I, Helmer C, Fagot-Campagna A, Dehail P, Joseph PA. Disability and quality of life in elderly people with diabetes. Diabetes Metab 2007;33:S66-74.

Renal disease

[27] UK Prospective Diabetes Study. Intensive blood glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes. Lancet 1998;352:837-53.

[28] Strippoli GF, Bonifati C, Craig M, Navaneethan SD, Craig JC. Angiotensin converting enzyme inhibitors and angiotensin II receptor antagonists for preventing the progression of diabetic kidney disease. Cochrane Database of Systematic Reviews 2006;4:CD006257006.

[29] UK Prospective Diabetes Study group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes. BMJ 1998;317:703-13.

[30] Schwenger V, Morath C, Hoffman A, Hoffman O, Zeier M, Ritz E. Late referral – a major cause of poor outcome in the very elderly dialysis patient. Nephrol Dial Transplant 2006;21:962-7.

Managing cardiovascular risk

[31] AntiThrombotic Trialists' (ATT) Collaboration, Baigent C, Blackwell L, Collins R, Emberson J, Godwin J, Peto R, et al. Aspirin in the primary and secondary prevention of vascular disease: collaborative meta-analysis of individual participant data from randomised trials. Lancet 2009;373:1849-60.

[32] Ong G, Davis TM, Davis WA. Aspirin is associated with reduced cardiovascular and all-cause mortality in type 2 diabetes in a primary prevention setting: Fremantle Diabetes study. Diabetes Care 2010;33:317-21.

[33] De Ruijer W, Westendorp RG, Assendelft WJ, den Elzen WP, de Craen AJ, le Cessie S, et al. Use of Framingham risk score and new biomarkers to predict cardiovascular mortality in older people: population based observational cohort study. BMJ 2009;338:a3083

[34] Beer C, Alfonso H, Flicker L, Norman PE, Hankey GJ, Almeida OP. Traditional risk factors for incident cardiovascular events have limited importance in later life compared with the health in men study cardiovascular risk score. Stroke 2011;42:952-9.

[35] Ogawa H, Nakayama M, Morimoto T, Uemura S, Kanauchi M, Doi N, et al.; Japanese Primary Prevention of Atherosclerosis With Aspirin for Diabetes (JPAD) Trial Investigators. Low-dose aspirin for primary prevention of atherosclerotic events in patients with type 2 diabetes: a randomized controlled trial. JAMA 2008;300:2134-41.

[36] Bartolucci AA, Tendera M, Howard G. Meta-Analysis of Multiple Primary Prevention Trials of Cardiovascular Events Using Aspirin. Am J Cardiol 2011;107:1796-801.

Glucose regulation and hypoglycaemia:

[37] Currie CJ, Peters JR, Tynan A, Evans M, Heine RJ, Bracco OL, et al. Survival as a function of HbA1c in people with type 2 diabetes: a retrospective cohort study. Lancet 2010;375:481-9.

[38] Patel A, MacMahon S, Chalmers J, Neal B, Billot L, Woodward M, et al.; ADVANCE Collaborative Group. Intensive blood glucose control and vascular outcomes in patients with type 2 diabetes. N Engl J Med 2008;358:2560-72.

[39] Gerstein HC, Miller ME, Genuth S, Ismail-Beigi F, Buse JB, Goff DC Jr, et al.; ACCORD Study Group. Long-term effects of intensive glucose lowering on cardiovascular outcomes. N Engl J Med 2011;364:818-28.

[40] Ray KK, Seshasai SR, Wijesuriya S, Sivakumaran R, Nethercott S, Preiss D, et al. Effect of intensive control of glucose on cardiovascular outcomes and death in patients with diabetes mellitus: a meta-analysis of randomised controlled trials. Lancet 2009;373:1765-72.

[41] Nathan DM, Buse JB, Davidson MB, Heine RJ, Holman RR, Sherwin R, et al. Management of Hyperglycemia in Type 2 Diabetes: A Consensus Algorithm for the Initiation and Adjustment of Therapy: A consensus statement from the American Diabetes Association and the European Association for the Study of Diabetes. Diabetes Care 2008;29:1963-72.

[42] National Institute for Health and Clinical Excellence (NICE). Type 2 diabetes. Guideline 87, March 2010, http://guidance.nice.org.uk/CG66.

[43] Chelliah A, Burge M R. Hypoglycaemia in elderly patients with diabetes mellitus: causes and strategies for prevention. Drugs Aging 2004;21:511-30.

[44] Balkau B, Simon D. Survival in people with type 2 diabetes as a function of HbA1c. Lancet 2010;375:438-40.

Blood pressure regulation

[45] Mancia G, Laurent S, Agabiti-Rosei E, Ambrosioni E, Burnier M, Caulfield MJ, et al. Reappraisal of European guidelines on hypertension management: a European Society of Hypertension Task Force document. J Hypertension 2009;27:2121-2158.

[46] Zoungas S, de Galan BE, Ninomiya T, Grobbee D, Hamet P, Heller S, et al. Combined effects of routine blood pressure lowering and intensive glucose control on macrovascular and microvascular outcomes in patients with type 2 diabetes: New results from the ADVANCE trial. Diabetes Care 2009;32:2068-74.

[47] Beckett NS, Peters R, Fletcher AE, Staessen JA, Liu L, Dumitrascu D, et al.; HYVET Study Group. Treatment of hypertension in patients 80 years of age or older. N Engl J Med 2009;358:1997-98.

[48] Wesley R, Rich MW, Schocken DD, et al. A Report of the American College of Cardiology Foundation Task Force on ACCF/AHA 2011 Expert Consensus Document on Hypertension in the Elderly. Circulation 2011;5:259-352.

Plasma lipid regulation

[49] British Cardiac Society; British Hypertension Society; Diabetes UK; HEART UK; Primary Care Cardiovascular Society; Stroke Association. JBS 2: Joint British Societies' guidelines on prevention of cardiovascular disease in clinical practice. Heart 2005;91:v1-52.

[50] Heart Protection Study Collaborative Group. MRC/BHF Heart Protection Study of cholesterol lowering with simvastatin in 20,536 high-risk individuals: a randomised placebo-controlled trial. Lancet 2002;360:7-22.

[51] Shepherd J, Blauw GJ, Murphy M, Bollen EL, Buckley BM, Cobbe SM, et al, PROSPER Study Group. Pravastatin in elderly individuals at risk of vascular disease (PROSPER): a randomized controlled trial. Lancet 2002;360:1623-30.

[52] Colhoun HM, Betteridge DJ, Durrington PN, Hitman GA, Neil HA, Livingstone SJ, et al. Primary prevention of cardiovascular disease with atorvastatin in type 2 diabetes in the Collaborative Atorvastatin Diabetes Study (CARDS): multicentre randomised placebo-controlled trial. Lancet 2004;364:685-96.

Care home diabetes

[53] Sinclair AJ, Gadsby R, Penfold S, Croxson SCM, Bayer AJ. Prevalence of diabetes in care home residents. Diabetes Care 2001;24:1066-8.

[54] Hauner H, Kurnaz AA, Haastert B, Groschopp C, Feldhoff KH. Undiagnosed diabetes mellitus and metabolic control assessed by HbA1c among residents of nursing homes. Exp Clin Endocrinol Diabetes 2001;109:326-9.

[55] Duffy RE., Mattson BJ., & Zack M. Comorbidities among Ohio's nursing home residents with diabetes. J Am Med Dir Assoc 2005;6:383-9.

[56] Holt RM, Schwartz FL, Shubrook JH. Diabetes care in extended-care facilities. Diabetes Care 2007;30:1454-8.

Diabetic Foot Disease

[57] National Institute of Health and Clinical Excellence (NICE), clinical guideline (CG) 10, Type 2 diabetes - footcare, 2004, http://guidance.nice.org.uk/CG10

[58] Apelqvist J, Bakker K, van Houtum WH, Schaper NC; International Working Group on the Diabetic Foot (IWGDF) Editorial Board. Practical guidelines on the management and prevention of the diabetic foot: based upon the International Consensus on the Diabetic Foot (2007) Prepared by the International Working Group on the Diabetic Foot. Diabetes Metab Res Rev 2008;24:S181-7.

[59] Pataky Z, Vischer U. Diabetic foot disease in the elderly. Diabetes Metab 2007;33:S56-65.

Cognitive impairment and low mood states

[60] Whitmer RA, Karter AJ, Yaffe K, Quesenberry CP Jr, Selby JV. Hypoglycemic episodes and risk of dementia in older patients with type 2 diabetes mellitus. JAMA 2009;301:1565-72.

[61] Peters R, Beckett N, Forette F, Tuomilehto J, Clarke R, Ritchie C, et al.; HYVET investigators. Incident dementia and blood pressure lowering in the Hypertension in the Very Elderly Trial cognitive function assessment (HYVET-COG): a double-blind, placebo controlled trial. Lancet Neurol 2008;7:683-9.

[62] Abbatecola, AM, Rizzo, MR, Barbieri, M, Grella R, Arciello A, Laieta MT, et al. Postprandial plasma glucose excursions and cognitive functioning in aged type 2 diabetics. Neurology 2006;67:235-40.

[63] Lustman PJ, Anderson RJ, Freedland KE, de Groot M, Carney RM, Clouse RE. Depression and poor glycemic control: a meta-analytic review of the literature. Diabetes Care 2000;23:934-42.

[64] Maraldi C, Volpato S, Penninx BW, Yaffe K, Simonsick EM, Strotmeyer ES, et al. Diabetes mellitus, glycemic control, and incident depressive symptoms among 70- to 79-year-old persons: the health, aging, and body composition study. Arch Intern Med 2007;167:1137-44.

[65] Kanaya AM, Barrett-Connor E, Gildengorin G, Yaffe K. Change in cognitive function by glucose tolerance status in older adults: a 4-year prospective study of the Rancho Bernardo study cohort. Arch Intern Med 2004;164:1327-33.

[66] Bourdel-Marchasson I, Lapre E, Laksir H, Puget E. Insulin resistance, diabetes and cognitive function: consequences for preventative strategies. Diabetes Metab 2010;36:173-81.

Visual loss and erectile dysfunction

[67] Matthews DR, Stratton IM, Aldington SJ, Holman RR, Kohner EM; UK Prospective Diabetes Study Group. Risks of progression of retinopathy and vision loss related to tight blood pressure control in type 2 diabetes mellitus: UKPDS 69. Arch Ophthalmol 2004;122:1631-40.

[68] Cikamatana L, Mitchell P, Rochtchina E, Foran C, Wang JJ. 5-year incidence and progression of diabetic retinopathy in a defined older population: the Blue Mountains Eye Study. Eye 2007;21:465-71.

[69] The Royal College of General Practitioners. Clinical Guidelines for Type 2 Diabetes. Diabetic retinopathy: early management and screening. The Royal College of General Practitioners, Diabetes UK, The Royal College of Physicians, The Royal College of Nursing. February 2005.

[70] Rendell MS, Rajfer J, Wicker PA, Smith MD; Sildenafil Diabetes Study Group. Sildenafil for treatment of erectile dysfunction in men with diabetes. A randomized controlled trial. JAMA 1999;281:421-6.

[71] Goldstein I, Young JM, Fischer J, Bangerter K. Vardenafil, a new phosphodiesterase type 5 inhibitor, in the treatment of erectile dysfunction in men with diabetes: a multicenter double-blind placebo-controlled fixed-dose study. Diabetes Care 2003;26:777-83.

[72] Vardi M, Nini A. Phosphodiesterase inhibitors for erectile dysfunction in patients with diabetes mellitus. Cochrane Database Syst Rev 2007;24:CD002187.

Peripheral neuropathy and pain

[73] Gandhi RA, Marques JL, Selvarajah D, Emery CJ, Tesfaye S. Painful diabetic neuropathy is associated with greater autonomic dysfunction than painless diabetic neuropathy. Diabetes Care 2010;33:1585-90.

[74] Kärvestedt L, Mårtensson E, Grill V, Elofsson S, von Wendt G, Hamsten A, et al. The prevalence of peripheral neuropathy in a population-based study of patients with type 2 diabetes in Sweden. J Diabetes Complications 2011;25:97-106.

[75] Strotmeyer ES, de Rekeneire N, Schwartz AV, Resnick HE, Goodpaster BH, Faulkner KA, et al.; Health ABC Study. Sensory and motor peripheral nerve function and lower-extremity quadriceps strength: the health, aging and body composition study. J Am Geriatr Soc 2009;57:2004-10.

[76] Rowbotham MC, Duan WR, Thomas J, Nothaft W, Backonja MM. A randomized, double-blind, placebo-controlled trial evaluating the efficacy and safety of ABT-594 in patients with diabetic peripheral neuropathic pain. Pain 2009;146:245-52.

Falls and immobility

[77] Volpato S, Leveille SG, Blaum C, Fried LP, Guralnik JM. Risk factors for falls in older disabled women with diabetes: the women's health and aging study. J Gerontol A Biol Sci Med Sci 2005;60:1539-45.

[78] Gates S, Fisher JD, Cooke MW, Carter YH, Lamb SE. Multifactorial assessment and targeted intervention for preventing falls and injuries among older people in community and emergency care settings: systematic review and meta-analysis. BMJ 2008;336:130-3.

[79] Costello E, Edelstein JE. Update on falls prevention for community-dwelling older adults: Review of single and multifactorial intervention programs. J Rehabil Res Dev 2008;45:1135-52.

[80] Schwartz AV, Vittinghoff E, Sellmeyer DE, Feingold KR, de Rekeneire N, Strotmeyer ES, et al.; Health, Aging, and Body Composition Study. Diabetes-related complications, glycemic control, and falls in older adults. Diabetes Care 2008;31:391-6.

[81] Nelson JM, Dufraux K, Cook PF. The relationship between glycemic control and falls in older adults. J Am Geriatr Soc 2007;55:2041-4.

Peripheral arterial disease

[82] McDermott MM, Ades P, Guralnik JM, Dyer A, Ferrucci L, Liu K, et al. Treadmill exercise and resistance training in patients with peripheral arterial disease with and without intermittent claudication: a randomized controlled trial. JAMA 2009;301:165-74.

[83] Garg PK, Tian L, Criqui MH, Liu K, Ferrucci L, Guralnik JM, et al. Physical activity during daily life and mortality in patients with peripheral arterial disease. Circulation 2006;114:242-8.

[84] Kennedy M, Solomon C, Manolio TA, Criqui MH, Newman AB, Polak JF, et al. Risk Factors for Declining Ankle-Brachial Index in Men and Women 65 Years or Older. The Cardiovascular Health Study. Arch Intern Med 2005;165:1896-902.