An International Position Statement on the Management of Frailty in Diabetes Mellitus

Expert Working Group

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A Summary of Recommendations based on this comprehensive review of this subject is published online at:

Abstract*

**Aim:** the *International Position Statement* provides the opportunity to summarise all existing clinical trial and best practice evidence for older people with frailty and diabetes. It is the first document of its kind and is intended to support clinical decisions that will enhance safety in management and promote high quality care.

**Methods:** the Review Group sought evidence from a wide range of studies that provide sufficient confidence (in the absence of grading) for the basis of each recommendation. This was supported by a given *rationale* and *key references* for our recommendations in each section, all of which have been reviewed by leading international experts. Searches for any relevant clinical evidence were generally limited to English language citations over the previous 15 years. The following databases were examined: *Embase, Medline/PubMed, Cochrane Trials Register, Cinahl, and Science Citation*. Hand searching of 16 key major peer-reviewed journals was undertaken by two reviewers (AJS and AA) and these included *Lancet, Diabetes, Diabetologia, Diabetes Care, British Medical Journal, New England Journal of Medicine, Journal of the American Medical Association, Journal of Frailty & Aging, Journal of the American Medical Directors Association, and Journals of Gerontology - Series A Biological Sciences and Medical Sciences*.

**Results:** two scientific supporting statements have been provided that relate to the area of frailty and diabetes; this is accompanied by evidence-based decisions in 9 clinical domains. The *Summary* has been supported by diagrammatic figures and a table relating to the inter-relations between frailty and diabetes, a frailty assessment pathway, an exercise-based programme of intervention, a glucose-lowering algorithm with a description of available therapies.

**Conclusions:** we have provided an up to date evidence-based approach to practical decision-making for older adults with frailty and diabetes. This Summary document includes a user-friendly set of recommendations that should be considered for implementation in primary, community-based and secondary care settings.

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Foreword

This Position Statement on the management of frailty in diabetes mellitus was considered a necessary development following recent publications of international clinical guidelines addressing the special needs of older people with diabetes. In these various documents, recommendations for managing diabetes in older people were presented with a great deal of consistency in relation to glucose targets, the importance of functional assessment, and the management of hypoglycaemia. What was less clear was a uniform approach to identifying and treating those with both frailty and diabetes, and what outcome measures serve the clinician best in providing optimal overall care.

Whilst the International Diabetes Federation Global Guidance on managing older people with type 2 diabetes provided for the first time care recommendations for those with dependency including frailty, the Review Group felt that there were many areas where specific advice was still needed and indeed would offer the clinician extra value in decision making.

In planning the Position Statement, the International Review Group have acknowledged that frailty is a common finding and may be present in 32-48% of adults aged 65 years and over with diabetes and is associated with adverse outcomes and reduced survival. At the same time, the Group have recognised the scarcity of specific studies of glucose-lowering treatments in older patients with frailty and diabetes, the lack of an operational definition of frailty, the urgent need for health professionals involved in diabetes care to acquire new skills and competencies in assessment of functional status, and the need for education and practical guidance for clinicians in managing frailty in those with diabetes. The Group firmly identifies frailty as a pre-disability condition that creates opportunity for intervention to enhance functional performance.

We have assembled an international group of diabetes experts to consider the key issues that require attention in supporting the highest quality of care for older people with frailty and diabetes on a global scale. This Position Statement is unique as it has been developed to provide the clinician with recommendations that assist in clinical management of a wide range of older adults with various stages of ill-health associated with functional impairment characteristic of frailty and provide specific perspectives in different clinical settings.

This Position Statement has been structured into main chapter headings dealing with expected areas such as assessment of frailty, hypoglycaemia, management of glucose levels, care home diabetes, and so on, but also includes less commonly addressed areas such as primary care, education, exercise interventions and influencing commissioners of diabetes services to include frailty care pathways.

The group has also recognised that frailty management in diabetes should be an individualized process as it is apparent that for many older people with diabetes, frailty care is sub-optimal and often fragmented leaving a substantial proportion of adults with unmet clinical and social need.

This Position Statement has tried to address these shortfalls in care by listing a comprehensive set of practical recommendations that are as evidence-based as possible bearing in mind the relative lack of published data of clinical trials in older people with frailty and diabetes. We
hope that all clinicians involved in this arena of clinical care will be encouraged to implement many of our recommendations to improve the health status and quality of life of this vulnerable sector of the diabetes population.

Professor Alan Sinclair  
Professor Bruno Vellas

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Introduction and Rationale for this Position Statement

Global population ageing is unparalleled, with remarkable growth in the last half-century. Increases in the proportions of older persons (60 years or older) will mean that one in four of the world population will be an older person by the year 2050. This change will create greater need for welfare, pension, and healthcare systems in both developing and developed nations.

Diabetes mellitus, predominantly type 2 diabetes, occurs more frequently in ageing populations, and as this condition can be associated with increased healthcare expenditure in managing diabetes-related hospital admissions and the associated vascular complications, the challenge of providing focused and effective diabetes care to an ageing population is daunting. This problem is compounded by variations of diabetes care across different countries where there may be political, socioeconomic, and cultural factors that influence the quality and standards of care delivered.

It is now increasingly recognised that modern day recommendations for managing diabetes in older people are more closely-aligned with additional individual characteristics such as functional status, presence of frailty and dependency, comorbidity profiles, maintaining quality of life, and life expectancy. This is because the presence of these features are likely to influence treatment goals, the care model adopted, and how the clinician plans on-going care. This has always been an imperative requirement for managing older people with diabetes and in this Position Statement we have placed a strong emphasis on this approach.

We have also recognized that the syndrome of frailty has received little or no attention in the management plans of older people with diabetes and have only relatively recently has some attempt been made to consider this clinical area. As diabetes is now also recognised as an independent risk factor for frailty, and that frailty is a major determinant of disability in diabetes populations, the review group has developed this Position Statement in a timely fashion to be the first comprehensive attempt to produce relevant and practical recommendations for managing frailty in older people with diabetes. Its clear intention is to form a significant support platform for clinicians in several clinical settings including primary and secondary healthcare, as well as in care homes.

Main Purpose of the Position Statement:

(1) Arrive at a consensus on how we approach the management of important issues of managing frailty in older people with diabetes.
(2) Identify a series of key recommendations in key areas that will support clinicians in everyday clinical practice to manage more effectively the complex issues seen in ageing individuals with frailty
(3) Provide a platform for commissioners of healthcare and policy makers to plan and coordinate care pathways in their local regions for those older people with diabetes who are developing frailty (pre-frail), have developed frailty, and those progressing to disability
**Definition of Frailty**

For the purposes of this *Position Statement* the review group characterises frailty as a summary concept based on:

- as a vulnerability state that leads to a range of measurable adverse outcomes such as falls or a decline in physical performance
- a decline in physiological reserve and the inability to resist to physical or psychological stressors
- a pre-disability condition

We have defined practical and easy to implement measures to diagnose frailty and have discussed its original phenotypic description and contrasted it with the accumulation of deficits model. The review group leaves the choice of measurement to the clinician irrespective of whether it is based on a particular understanding of the cause or nature of the condition.

The review group has also recognised that the age-related progressive loss of muscle and function called sarcopaenia may be an underlying pathophysiological process in frailty and many of the clinical recommendations in this *Position Statement* can be applied logically to older patients with diabetes who are sarcopaenic.

This *Position Statement* places a major emphasis on the importance of focused assessment of both physical and cognitive domains in assisting the clinician in making decisions about the functional status and comorbidity level of individuals as a guide to treatment strategies adopted. Physicians predominately working with older people often combine this series of assessments into a management tool called a comprehensive geriatric assessment (CGA). This is coupled with advice on safe glucose lowering therapies, key aspects of patient safety, avoiding hospitalization and aged care home residency, and avoiding hypoglycaemia.

The review group has also concluded that relevant outcome measures will also prove to have an important influence in deciding if a specific management strategy is worthwhile in routine clinical care of older people with diabetes and frailty. Apart from glycaemia targets, two other key outcomes that require assessment but usually are not a feature of every day diabetes clinical practice are quality of life and physical performance measures. The review group recognise that to introduce these measures will require a culture change by the diabetes healthcare team and a phase of upskilling in assessment procedures. Other outcomes such as rates of admission to hospital, falls rate, changes in cognition and balance, and other functional measures such as grip strength estimation and walking speed need to become a routine part of the annual review process.

An important limiting factor for producing specific evidence-based clinical recommendations for older people with diabetes and frailty is the relative lack of clinical evidence from randomised controlled trials involving older subjects with both index conditions. As frailty is also a specific entity and is only now emerging as a diagnosable condition, it is also not possible to extrapolate evidence from clinical studies in younger adults as the condition would have been absent in the latter in most cases. The review group has considered this implication and has sought evidence from a wide range of studies that provide sufficient confidence for the basis of each recommendation. This limitation influenced our decision
not to grade our recommendations at a particular level of evidence but we have provided the rationale and key references for our recommendations in each chapter.

The *Position Statement* acknowledges that even in well-funded healthcare systems, the provision of diabetes services for older people may be associated with problems such as poor access to care services, lack of educational resources, lack of specialist input, and poor follow-up practices. With this in mind, the review group has placed emphasis on how to enhance the quality of overall public health by providing recommendations for the prevention of both diabetes and frailty, and specific guidance in the area of primary care and in the education of health and social care professionals.

The review group has taken the decision to develop this *Position Statement* to address management decisions in older people aged 70 years and over with frailty and diabetes. We accept that on a global scale the viewpoint is that people aged 60+ years are part of the older population and indeed might be more appropriate when the demographics of developing nations are considered. However, these definitions can be quite arbitrary and are compounded by the lack of correlation between chronological and biological age in different continents. We feel that a threshold of 70+ years ensures that people with diabetes will more likely to exhibit those characteristics of functional loss associated with frailty and that these better determine the recommendations we have given. Age thresholds for management, however, can be an ad hoc viewpoint and that the clinician has the important responsibility to decide what clinical guideline is most appropriate for their older patients by determining their functional status, level of medical comorbidities, and degree of frailty. As it has been recognised elsewhere an age threshold of 70+ years also usually signifies a change in social role and the emergence of changes in dependency.

This *Position Statement* has included sufficient information to guide providers of diabetes or geriatric medicine services on where to direct resources to manage older people with diabetes and frailty optimally and creates the opportunity for clinical care standards to be adopted. Insufficient research evidence, however, limits the sequential steps that need to be employed in the design of a ‘frailty care pathway’. The review group has attempted to address this shortfall in available research by asking all chapter authors to provide an evidenced-based rationale and specify key references.

We hope that this *Position Statement* will form a platform for all clinicians as part of renewed emphasis on specific management approaches to those who are frail and have diabetes.

**Key Principles of Position Statement**

The review group has established a number of key principles which form a framework for this *Position Statement*. These principles incorporate the important elements of managing older adults with frailty and diabetes which include:

- individualising goals of care with functional status, complexity of illness including comorbidity profiles, and life expectancy
- Where possible, all therapeutic decisions should be based on comprehensive geriatric assessment and risk stratification including
Identifying and subsequent assessment of key risks in frail older adults with diabetes: hypoglycaemia, worsening ADL and IADL with mobility disorder, falls, and adverse events from treatment

- A management strategy that is clearly defined and agreed with all parties that aims to avoid disability both from diabetes vascular complications and deterioration in functional status
- A clear focus on patient safety, avoiding hospital/emergency department admissions and institutionalization by recognizing the deterioration early and maintaining independence and quality of life to a dignified death
- A management plan that incorporates educational support for families and caregivers, and health and social care professionals
- A recognition that older people from minority ethnic populations are likely to have specific education and care needs
- An emphasis to promote locally relevant interdisciplinary diabetes care teams to develop specific pathways for frail older people with diabetes
- An encouragement to promote high quality clinical research and audit in the area of frailty management in diabetes
Sections with Recommendations and References

Scientific Supporting Chapter: Inter-relationships between Frailty, Sarcopaenia and Diabetes Mellitus

The prevalence of diabetes is increasing especially among individuals between the ages of 60 to 79 years old.\(^1\) In older people with diabetes, sarcopenia and frailty are emerging as a new complication leading to disability.\(^2\) Both ageing and diabetes have negative effects on muscle structure and function that predispose to sarcopenia and frailty. (See Figure 1)

**Ageing effect**

With increasing age loss of muscle mass, especially lower extremities, and increase in visceral fat occur that lead to increased insulin resistance.\(^3, 4\) Insulin stimulates protein synthesis including that in the muscle and defects in insulin signalling may lead to reduced muscle protein synthesis and increased protein degradation that lead to sarcopenia and frailty.\(^5\) Age-related inadequate nutrition especially poor protein intake, reduced physical exercise and reduced growth and sex hormones are another predisposing factors to poor muscle function.\(^6\) Ageing associated mitochondrial dysfunction that leads to less energy production and the decline of neuromuscular junction may lead to the development of sarcopenia and frailty.\(^7, 8\) Muscle quality defined as reduced muscle strength/muscle mass ratio has been shown to be associated with increasing age. This suggests that the strength decline is much more rapid than the concomitant loss of muscle mass with ageing leading to a decline in muscle quality.\(^9\)

**Diabetes effect**

Sarcopenia and frailty are likely to result from an imbalance between anabolic and catabolic pathways that control muscle mass. The presence of diabetes will accelerate the reduction of muscle mass and strength because of the associated diabetes complications and insulin resistance.\(^10\) Poor glycaemic control in older people with diabetes is associated with accelerated loss of muscle quality.\(^11\) Persistent hyperglycaemia associated with diabetes increases the production of advanced glycation end products that accumulate in the muscle and cartilage causing muscular stiffness and reduced muscle function.\(^12, 13\) Peripheral neuropathy and reduction in motor neurons is another cause of sarcopenia and frailty in diabetes. Patients with peripheral neuropathy had higher calf inter muscular adipose tissue volume which has been shown to be associated with poor muscle strength and function.\(^14\) Increased oxidative stress and inflammatory cytokines associated with diabetes such as tumour necrosis factor and interleukin-6 have negative effects on muscle mass, strength and physical performance.\(^15\) Poor dentition, dry mouth, reduced taste sensation, palatability and appetite change in older people with diabetes are all associated with suboptimal nutritional state that may lead to sarcopenia and frailty.\(^16\)

**Reciprocal relations: frailty, sarcopaenia and diabetes**

Sarcopenia, frailty and diabetes seem to be reciprocally related and may share a similar pathogenetic pathway. As diabetes leads to sarcopenia, it is also plausible that sarcopenia
leads to lower muscle glucose uptake, hyperglycaemia and hyperinsulinaemia and eventually insulin resistance which are the precursor to diabetes development. Muscle weakness has been shown to be associated with increased risk of diabetes (OR 1.69, 95% CI 1.37 to 2.10). Muscle fat infiltration or myosteatosis may also alter glucose metabolism setting off insulin resistance and promoting the development of sarcopenia and diabetes. Chronic low grade inflammation is another link or contributing factor to the occurrence of chronic diseases associated with ageing such as diabetes, sarcopenia and frailty. Diabetes and frailty have also been shown to share a common cardiovascular risk factors pathway suggesting a reciprocal relationship. Obesity is another factor associated with inflammation, oxidative stress and insulin resistance and may have a pathophysiological burden potentiating sarcopenia, frailty and diabetes. The term sarcopenic obesity has been used to describe sarcopenia plus increased visceral fat and has been shown to be associated with increased risk of atherosclerosis more than obesity alone. This suggests that sarcopenia combined with visceral obesity may have a synergistic effect increasing the risk of vascular complications and metabolic syndrome that lead to diabetes and frailty.

References
Scientific Supporting Chapter: Muscle Changes in Frailty and Diabetes Mellitus

Ageing is associated with declines in muscle function and cardiorespiratory fitness, resulting in an impaired capacity to perform daily activities and maintain independent functioning. Skeletal muscle power, however, decreases to a greater rate of muscle strength with advancing age and is more strongly associated with functional test performance than muscle strength in older populations.

One of the major contributing factors to the loss of strength and power is a gradual of reiterating cycles of degeneration/regeneration of spinal motor neurons. Partial functional muscle denervation following by reinnervation of abandoned fibers is believed also to occur, resulting in an increased size of remaining motor units, which results in an impaired force steadiness and fine motor control with aging. Moreover, age-related decline in strength may also be due to decreased maximal voluntary activation of the agonist muscles or changes in degree of agonist-antagonist coactivation.

The age-related loss of spinal MNs leads to a decline in in the size and/or number of individual muscle fibers, especially of fast-twitch fibers (i.e. sarcopenia). The consequences are related with an impaired mechanical muscle performance (i.e reduced maximal muscle strength, power) that can adversely affect the ability of an older person to remain functionally independent to perform daily activity tasks (i.e. walking, stair walking, rising from a chair). Along with a decrease in muscle size, aging is also associated with a decrease in muscle quality as a consequence of increased amount of intramyocellular adipose tissue (i.e., muscle fat infiltration) and connective tissue. Physical inactivity greatly exacerbates the catabolism and atrophy of skeletal muscle that are associated with normal ageing.

Sarcopenia is a hallmark sign of frailty syndrome, which results in loss of muscle strength, poor mobility and balance and, consequently, increased risk of falls, adverse health outcomes, dependency, institutionalization and death. Sarcopenia not only has been related with substantial reorganization in the neuromuscular system and the central nervous system, but also is associated with numerous factors, many of which are biological mechanisms contributory of aging, such as low-grade chronic inflammation, decline in mitocondrial function and biogénesis, reduced satellite cell numbers that impaired regenerative capacity, apoptosis activation and decline in hormones that are important in muscle mass maintainance (i.e. IGF-1, DHEA, Testosterone and Estrogens).

Aging patients with Type 2 diabetes exhibit greater declines in muscle strength and functional capacity and more rapid loss of muscle mass than normoglycemic controls. Indeed, diabetes complications such as peripheral vascular disease and peripheral neuropathy are associated with poor gait ability, impaired balance and increased risk of falls. Although aging patients with Type 2 diabetes exhibit greater decreases in the muscle strength and functional capacity, it has been shown that uncomplicated diabetes does not accelerate age-related sarcopenia. Moreover, the preservation of functional capacity should be specifically addressed in aging diabetic patients because in contrast to other chronic conditions, diabetes care is dependent on the patients’ ability to perform self-care tasks. Therefore, in addition to metabolic control, effective strategies are needed to prevent the exacerbated loss of strength and functional capacity in aging diabetic patients.
because these individuals exhibit an increased risk of the development of frailty syndrome, institutionalization and disability.\textsuperscript{18}

Key messages

- Physical inactivity greatly exacerbates the catabolism and atrophy of skeletal muscle that are associated with normal ageing.
- In older populations, along with metabolic and cardiovascular diseases, diabetes is also associated with reduced muscle strength, poor muscle quality, and accelerated loss of muscle mass.
- Diabetes mellitus and insulin resistance increase risk for the development of frailty syndrome with associated impairment of lower limb function, and may contribute to the increased incidence of falls, institutionalization and disability.

References

Sections with Recommendations

Assessment Processes for Frailty

Recommendations

- Requirements for screening tools are as follows: quick, no need for special equipment and time consuming measurements involving use of cut-off values, no need for administration by professional staff, validated against consensus definitions and/or clinical assessments.
- Examples of screening tools* that fulfil the above criteria include the FRAIL score for frailty screening; the SARC-F for sarcopenia; the Rapid Cognitive screen (RCS) for cognitive impairment; and the simplified nutrition questionnaire (SNAQ).
- Health and social professionals engaged in direct patient care should acquire the basic skills to assess for functional status and frailty.
- Those with abnormal screening results should undergo further examination by a clinician to detect underlying reversible conditions if any, such as hypothyroidism, vitamin D deficiency, anaemia, etc.
- Optimal Group nutrition plus resistance exercise classes should be prescribed as a continuing regular activity.
- Management of diabetes should be individualized based on the presence/absence of these syndromes, using re-ablement and goal setting as targets in addition to blood parameters.

*Référence to Morley JE and Adams EV (2010) for a description of the tools (online access)

Rationale and evidence base

Older adults with diabetes who are also frail are at increased risk of IADL, ADL and mobility disability, falls, hospitalization and mortality (2, 3). Those with diabetes and sarcopenia have lower muscle mass, strength and poorer physical performance measures compared to those without diabetes (4), which has adverse impact on insulin resistance. They are more likely to have cognitive dysfunction such as attention, executive function and visuospatial deficits (5, 6). Underlying aetiology include recurrent hypoglycaemia, cerebral infarcts and white matter lesions (7). Dietary advice for patients with diabetes emphasizes restriction of food types and amount, and in the context of the common phenomenon of anorexia of aging, may result in undernutrition (8).

Screening for co-existing geriatric syndromes, followed by a comprehensive geriatric assessment and multidisciplinary management, allows for abnormalities to be detected, reversible underlying causes to be managed, and for diabetes management strategies to be personalized taking into account the co-existing geriatric syndrome profile. Such an approach have been shown to result in better functional outcomes as well as reduce health service utilizations and mortality (9-11). Many tools have been proposed for use in the community setting mainly in developed countries, such as EasyCare, Gerontopole frailty screening, the Kihon checklist, and assessed with respect to feasibility and validity (12-14). A rapid geriatric assessment [RCA] covering frailty, sarcopenia, cognitive function and
nutritional status which takes 3-5 minutes to administer (1) has been used in the primary care setting in the US. The frailty (FRAIL score) and sarcopenia (SARC-F) component has been validated in other countries (15-17). Nutrition combined with resistance exercise regimes have been shown to be effective for frailty, sarcopenia, and cognitive decline (18-20). A simplified approach to assessment has been given in Figure 2 (A), and a more detailed assessment algorithm with separation into primary care evaluation and specialist care given in Figure 2 (B).

How to implement the recommendations into routine clinical practice
Recommendations should be presented based on evidence in order to change existing practice. Support from influential bodies such as the IDF, IAGG, WHO in the format of guidelines or best practice statements would be essential. A database of pilot studies from different countries showing good outcomes from the patients’ perspective as well as service utilization would reinforce the recommendations. There is a need to create community partners, empower older people themselves through public education programs, and to form social network groups where community group activities may become part of regular programs.

Key references
Glucose Regulation in Frail Older People with Diabetes

Recommendations

- Prescribed glucose-lowering medications should have a low risk of hypoglycaemia, minor side effects profile and be cost-effective.\(^1\,^2\).
- “Start low and go slow” when dosing and titrating medications in frail older adults.
- The glycaemic goal should be individualized based on comorbid medical conditions in addition to cognitive and functional status\(^3\,^4\). In mild to moderate frail older adults, an A1C target range of 7 – 8.0% (53 – 64 mmol/mol) is appropriate depending on self-care management abilities and presence of additional risk factors for hypoglycaemia; in severe frailty, a HbA1c range of 7.5 – 8.5% (59 – 69 mmol/mol) is more protective.\(^1\,^5\).
- Many frail older adults have medical conditions that interfere with HbA1c measurements. In such cases, focus on random blood glucose targets at 120-200 mg/dl (6.7 – 11.1 mmol/l) throughout the day, instead of HbA1c targets.\(^6\,^7\).
- Metformin should be used as the first line of therapy due to its low risk of hypoglycaemia, low cost, and good tolerability. In frail patients, weight loss and gastrointestinal side effects should be watched for carefully.
- DPP-4 inhibitors should be considered for those older adults requiring smaller post-prandial glucose lowering, or used in combination with basal insulin.\(^8\).
- GLP-1 agonists should be used for post-prandial glucose lowering. They have a low risk of hypoglycaemia but are only available in injectable form. They should be considered when carer-support is needed for injections, due to their availability in once-a-week formulations, as well as availability in combination with basal insulin. Caution should be present where further weight loss might be an issue.
- Sulfonylurea and non-sulfonylurea secretagogues have a high risk of hypoglycaemia and should be avoided in frail older adults due to poor consequences such as traumatic falls. However, they are useful when the cost of medications is an issue or other costlier agents are not available.
- Before initiating insulin therapy, the physical and cognitive capabilities of a frail older adult should be evaluated. Once-a-day basal insulin should be used with other non-insulin agents if further glucose lowering is required.
- Intensive therapy with a complex insulin regimen is not recommended in older adults. Simplified therapies should be the goal in frail older adults with diabetes.\(^9\).
- Carers should receive basic education and training on hypoglycaemia and its treatment.

Rationale and Evidence Base

Relatively few large studies have been conducted specifically assessing the use of various hypoglycemic drugs in older adults. Meta-analysis, observations and conclusions made from smaller studies and subgroup analyses have helped to guide practical management in older adults.\(^10\,-\,^14\). Recent guidelines by EASD/ADA describe a patient-centered approach to management in all adults with type 2 diabetes.\(^15\). The factors that are important to consider when choosing the class of glucose-lowering medications include the risk of hypoglycaemia, the efficacy of the medication, the side-effect profile, its impact on weight, and the cost of the medications. These factors should be considered when choosing second or third line of agents, if metformin (first line agent) is inadequate or contraindicated.

Insulin can be used safely and effectively in older adults when used as part of the right strategy.\(^16\). The availability of basal insulin has helped to improve glycemic control with a lower risk of hypoglycaemia than multiple daily insulin therapies. In general, de-intensification is recommended.
for frail older adults who are on complex insulin regimens. The simplification of the insulin regimen can decrease the risk of hypoglycaemia, without worsening glycemic control in older adults with diabetes.17

How to implement the recommendations into routine clinical practice
Algorithms that provide direction for choosing hyperglycaemia-lowering medications in frail older adults should be provided to improve existing clinical practice (Figure 3). Guidelines specifically addressing the patient-centered approach are now available from various organizations such as IDF, EASD/ADA15. The risk of hypoglycaemia and its impact on morbidity and mortality in frail older adults should be stressed when glycemic goals are determined18. Clinicians should also be made aware of a “reverse algorithm” to de-intensify complex insulin regimens in frail older adults who are not coping well with their multi-dose insulin therapy.

Key references

Table 1

Narrative: Each class of agent can be used in frail people with diabetes but cautions are present: numerous factors must be taken into account in prescribing a safe but effective glucose-lowering agent.

<table>
<thead>
<tr>
<th>Class of Agent</th>
<th>HbA1c Reduction</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Vignette in Frail Population</th>
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<tbody>
<tr>
<td>Metformin</td>
<td>1% (11 mmol/mol)</td>
<td>Low hypoglycaemia risk Low cost Well tolerated generally</td>
<td>Many contraindications in population with high comorbidity burden May cause weight loss, GI upset in frail patients</td>
<td>Can be used until eGFR &lt;30 ml/min Extended release formulation has lower complexity and fewer GI side effects Assess and replace vitamin B12</td>
</tr>
<tr>
<td>Sulfonylureas</td>
<td>1% (11 mmol/mol)</td>
<td>Low cost Established glucose-lowering medication Can be used in moderate to severe renal impairment</td>
<td>High risk of hypoglycaemia Avoid glibenclamide (glyburide) Avoid in patients with inconsistent eating pattern High risk of hypoglycaemia during acute illness or weight loss Consider discontinuing if already receiving substantial amount of insulin (approximately &gt;40 units/day) Can be withheld if patient refuses to eat any particular meal</td>
<td></td>
</tr>
<tr>
<td>Meglitinides</td>
<td>0.4-0.9% (4.4-9.9 mmol/mol)</td>
<td>Shorter duration of action compared with sulfonylurea</td>
<td>Higher cost than sulfonylurea Increased regimen complexity due to multiple daily doses with meals</td>
<td>Can be withheld if patient refuses to eat any particular meal</td>
</tr>
<tr>
<td>TZDs, Pioglitazone</td>
<td>1% (11 mmol/mol)</td>
<td>Low hypoglycaemia risk Once a day dosing Can be used in moderate to severe renal impairment</td>
<td>Many contraindications in population with high comorbidity burden such as CHF, leg edema, anemia Possible risk of bladder cancer, fractures</td>
<td>Good efficacy in older patients with high insulin resistance</td>
</tr>
<tr>
<td>DPP-4 inhibitors</td>
<td>0.5-0.8% (6-9 mmol/mol)</td>
<td>Low hypoglycaemia risk Once a day oral medication Well tolerated Can be used in renal impairment but dose adjustment required (except linagliptin) No additional cardiovascular adverse effects</td>
<td>Medium / high cost</td>
<td>Can be combined with basal insulin for a low complexity regimen</td>
</tr>
<tr>
<td>SGLT-2 inhibitors</td>
<td>0.8-1.0% (9-11 mmol/mol)</td>
<td>Low hypoglycaemia risk Reasonable efficacy Risk of other adverse effects moderate</td>
<td>High cost Limited experience in older population but evidence increasing</td>
<td>In frail adults, watch for increased urinary frequency, incontinence, low BP, dehydration; do not initiate if eGFR is &lt;60 ml/min; dose reduction required in the presence of renal impairment</td>
</tr>
<tr>
<td>GLP-1 agonists</td>
<td>0.8-1.0% (9-11 mmol/mol)</td>
<td>Low hypoglycaemia risk Once a day and once a week formulation New formulations available in combination with basal insulin</td>
<td>High cost Injectable</td>
<td>Monitor for anorexia, weight loss; do not use in severe renal impairment (eGFR &lt;30 ml/min); dose reduction needed in moderate impairment (except for Liraglutide)</td>
</tr>
<tr>
<td>Insulin</td>
<td>&gt;1% (&gt;11 mmol/mol)</td>
<td>No ceiling effect Many different types including high concentrated forms have variable serum half-life and can be used to target hyperglycaemia at different times of the day; can be used in renal impairment</td>
<td>High risk of hypoglycaemia Need for matching carbohydrate content in patients with variable appetite when using prandial insulin Carer education and training needed if involved in administration</td>
<td>Use of basal insulin with other agents to lower post-prandial glucose can lower complexity and reduce the risk of hypoglycaemia</td>
</tr>
</tbody>
</table>

Abbreviations

HbA1c: glycosylated haemoglobin; eGFR: estimated glomerular filtration rate; GI: gastrointestinal; TZDs: thiazolidinediones; DPP-4: dipeptidyl peptidase 4 ; SGLT-2: sodium-glucose cotransporter 2 ; GLP-1: glucagon-like peptide - 1
Exercise Interventions

Summary of the evidence for exercise interventions in frail older adults with diabetes

Recommendations

Along with pharmacological and dietary interventions, physical training including resistance and endurance training is required for effective benefits to be realised.

In addition to the beneficial effects of exercise interventions on glycaemic control, and on the cardiovascular risk factors associated with diabetes, physical exercise should be employed as an effective intervention to improve neuromuscular and cardiorespiratory function, as well as functional capacity and quality of life in elderly diabetic patients.

The combination of resistance and endurance training should be considered to be the most effective exercise intervention to promote overall physical fitness in older diabetic patients.

On the basis of recent evidence, exercise strategies to improve neuromuscular and cardiovascular parameters and functional performance in frail older individuals should include the following:

- Resistance-training programs should be performed two to three times per week, with two to three sets of 8–12 repetitions at an intensity that starts at 30%–40% and progresses to 80% of 1RM.

- To optimize the functional capacity of individuals, resistance training programs should include exercises in which daily activities are simulated, such as the sit-to-stand exercise. Part of resistance training exercises (especially lower limbs) should be performed as fast as possible (muscle power training) in order to optimize skeletal power output and, consequently, functional capacity.

- Endurance training should include walking with changes in pace and direction, treadmill walking, step-ups, stair climbing, and stationary cycling. Endurance exercise may start at 5–10 min during the first weeks of training and progress to 15–30 min for the remainder of the program. The intensity should start between 40 and 50 % of HR_max and progress to 70.80 % of HR_max.

- The Rate of Perceived Exertion scale is an alternative method for prescribing the exercise intensity, and an intensity of 12–14 on the Borg scale appears to be well tolerated. This method can be applied to: multi-directional weight lifts, heel-toe walking, line walking, stepping practice, standing on one leg, weight transfers (from one leg to the other), and modified Tai Chi exercises.

- Multi-component training programs should include gradual increases in the volume, intensity, and complexity of the exercises, along with the simultaneous performance of resistance, endurance, and balance exercises.
Loss of muscle mass in older adults with diabetes may be a part explanation why diabetes is associated with an increased risk of disability\(^1\) and along with changes in muscle quality (e.g., by fat infiltration) and part explain the observation of an association between diabetes and gait speed.\(^2\)

Physical inactivity is a key factor contributing to the onset of muscle mass and function decline (i.e., sarcopenia), which in turn appears to be a vital aspect related to frailty \(^3\). Poor health, disability, and dependency are not inevitable consequences of aging. The promotion of a healthy lifestyle and physical exercise, and the avoidance of sedentariness use clinical preventive services, and continue to engage with family and friends are more likely to remain healthy, live independently, and incur fewer health-related costs. Recently, it has been also proven that physical activity, as an intervention, is one of the most important components in improving the functional capacity of frail seniors \(^4\)-\(^8\). Furthermore, physical exercise administration is relatively free of potential unwanted side effects caused by common medications that are prescribed in patients with multiple comorbidities.

Among the several comorbidities that may coexist in frailty syndrome, diabetes is one of the most prevalent \(^9\). In frail patients with diabetes, enhancement in functional capacity is crucial and may be more beneficial than attention to metabolic control alone \(^9\). Accordingly, an important conceptual idea for frailty is that the focus should be on functionality and not on the diagnosis of disease for older patients.

Exercise interventions, including resistance training, together with pharmacological and dietary interventions, represent the cornerstones of type 2 diabetes mellitus (T2DM) management \(^10\)-\(^12\). Along with the beneficial effects of exercise interventions to older diabetic patients on glycemic control \(^10\)-\(^12\), increased insulin sensitivity, decrease the amount of intra-abdominal adipose tissue and muscle fat infiltration \(^13\) as well as, on the cardiovascular risk factors associated with diabetes, physical exercise is an effective intervention to improve muscle mass, strength, power output, cardiovascular function and functional capacity in elderly diabetic patients \(^13\). Another aspect that should be taken into consideration with respect to the benefits of exercise to older diabetic patients is the role of exercise in the prevention of cognitive impairment and dementia. In this regard, exercise may also help to prevent dementia and to improve muscle functional capacity in elderly patients with dementia and that these characteristics may be a consequence of diabetes complications \(^5\),\(^14\).

Combined resistance and endurance training appears to serve as an effective exercise intervention to promote overall physical fitness in elderly diabetic patients \(^4\),\(^5\). In addition, in frail elderly diabetics with severe functional decline, multicomponent exercise programs composed of resistance, endurance, balance, and gait retraining should be employed to increase functional capacity and quality of life, and to avoid falls, institutionalization and disability. However, the studies in which systematic resistance training was performed (either alone or as part of multi-component exercise programs) revealed greater strength gains in the elderly with physical frailty or severe functional declines. Exercise prescription, especially in elderly diabetic frail must be carefully adapted to provide a sufficient stimulus for improving the functional capacity \(^7\). Furthermore, because muscle power is an important predictor of functional capacity, strategies to develop skeletal muscle power
in this population must be included to prevent or postpone functional limitations and subsequent disability.  

**How to implement in routine clinical practice**

The above findings are especially important because they suggest that physical training can prevent or slow the progression of functional decline in diabetes in older people.

Health professional educational programmes on the importance of exercise in promoting functional independence and preventing decline in physical performance should be commissioned by local healthcare services.

Recently, the Vivifrail Project, an EU-funded Project as part of the Erasmus+ program, focuses in provide training and design material on how to promote and prescribe physical exercise in older adults (www.vivifrail.com) and Figure 4.

As a consequence, it is worth promoting healthy and dignified ageing by helping countries to make their health systems more efficient to implement pilot programs that can interact directly with frail older patients, aiming to measure the response to multicomponent sport exercise programs for tackling late-life disability.

**References**

Management of Multimorbidities

Recommendations

• Screening for dementia and cognitive problems is recommended to implement safe and quality care and to provide support for carers.
• Targets for care for comorbidities should be established in each case and adapted according to the patient’s health status: this should form part of an individualised care plan.
• The glycaemic goal should be individualised based on the presence or not of frailty and other comorbid medical conditions in addition to cognitive and functional status.
• In mild to moderate frail older adults, an A1C target range of 7 – 8.0% (53 – 64 mmol/mol) is appropriate depending on self-care management abilities and presence of additional risk factors for hypoglycaemia; in severe frailty, a HbA1c range of 7.5 – 8.5% (59 – 69 mmol/mol) is more protective.
• Many frail older adults have medical conditions that interfere with HbA1c measurements. In such cases, focus on random blood glucose targets at 120-200 mg/dl (6.7 – 11.1 mmol/l) throughout the day, instead of HbA1c targets.
• Hypertension is commonly associated with type 2 diabetes and adds to the increased risk for cardiovascular disease. Therefore, screening and treating hypertension in older people with diabetes is essential.
• A target of 140/90 mmHg is reasonable but systolic blood pressure <140mmHg may be associated with adverse events. All major antihypertensive drug classes can be used to achieve the target.
• Dyslipidaemia often co-exists with diabetes and statin therapy is recommended in order to reduce cardiovascular risk unless specifically contraindicated.
• The addition of fibrate or niacin to statin therapy has no benefit and should not be considered for older people with diabetes.
• In those with a frequent history of urinary or chest infections, reduce infection risk by adjusting the HbA1c to be ≤ 8.5% (≤ 69 mmol/mol).
• Bladder control may be improved by aiming for a HbA1c of ≤ 8.5% (≤ 69 mmol/mol) owing to the resulting decrease of polyuria linked to hyperglycemia.
• Nutritional status and oral health should be assessed with the purpose to optimise nutrition and physical function.
• The patient with both cancer and diabetes requires integrative care to lower the potential toxicities during cancer treatment and to continue to favor active treatment and outcomes.

Rationale and Evidence Base

The risk of having several severe co-morbidities is increased in older frail people with diabetes compared with those without diabetes or frailty (see Table 2) 1-8. Severe comorbidities increase healthcare utilization and costs 2 and are related to quality of life impairment 9. There is an interaction between the number of comorbidities and insulin/sulfonylurea treatment towards increasing the risk of severe hypoglycaemia 4,10. A
significant reduction in incidence of cardiovascular diseases, cancer, depression and miscellaneous conditions related to frailty was observed with long term use of metformin even in those with frailty trajectories. Falls risk is higher with diabetes. Neuropathy is associated with lower gait speed and fall risks. Incontinence is more frequent. Infections risk is multiplied by 2 to 4 with diabetes in population-based studies particularly in subjects with comorbidities. HbA1c >9% (> 75 mmol/mol) in adults increases the rate of severe infections. Reduction of systolic blood pressure to 140mmHg is associated with cardiovascular benefit but further reduction <140mmHg is associated with an increased risk of cardiovascular mortality. All major antihypertensive drug classes are effective in reducing mortality suggesting that the cardiovascular benefit is likely to be due to lowering of the blood pressure and achieving the target rather than a class effect. The benefits of statin therapy in older people with diabetes is likely to be higher than in younger people due to their higher baseline risk. There is no extra benefits of adding fibrate or niacin to statin therapy. Cognitive troubles (memory problems, executive functions), MCI or dementia of any type are more frequent in diabetes. The risk of hypoglycaemia is also elevated in these subjects. Cognitive troubles are associated with less self-care and a higher need for support. Mortality due to cancer is higher with diabetes. Pancreas, liver, breast, colon, urinary tract, and female reproductive organs are the main tumour sites associated with diabetes. In colo-rectal cancers a sharp increase of the association with diabetes was observed during the last decade. Both comorbidities and diabetes treatment interfere with the conduction and the prognosis of oncological treatments.

Table 2: Comorbidities: Crude estimates of prevalence of comorbidities in people with diabetes older than 65 years.

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>Rate %</th>
<th>Rate (%) in other people in population based-study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>86.3 [1]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>86.9 [4]</td>
<td></td>
</tr>
<tr>
<td>Arthritis</td>
<td>61.2 [1]</td>
<td>69.0 [5]</td>
</tr>
<tr>
<td></td>
<td>65.2 [5]</td>
<td></td>
</tr>
<tr>
<td>Obesity</td>
<td>34.9 (&gt; 80y, 24.2) [6]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24.8 [1]</td>
<td>5.9 [4]</td>
</tr>
<tr>
<td></td>
<td>30.0 [5]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23.5 [4]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.4 [6]</td>
<td></td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>15.5 [2]</td>
<td>5.3 (stroke) [5]</td>
</tr>
<tr>
<td></td>
<td>2.8 (stroke) [1]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.2 (stroke) [5]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.6 (stroke) [6]</td>
<td></td>
</tr>
<tr>
<td>Lower limb ischemic disease</td>
<td>7.0 [4]</td>
<td>3.9 [4]</td>
</tr>
</tbody>
</table>
Amputation & 1.5 [6] 
& 40 (distance vision) [8] & 31 (case-control) [8] 
Cancer & 8.7 [2] & 15.9 [1] 
Chronic obstructive pulmonary disease & 23.1 [1] 

Although BMI is higher in diabetes the prevalence of overweight and obesity decreases with ageing (6) and one in four has a malnutrition risk according to MNA screening in the community (24). In-hospital malnutrition was found in 7% of older subjects with diabetes (25). Comorbidities are naturally associated with polymedication, mainly due to treatment for cardiovascular comorbidities, pain and depression and lipids or glucose lowering agents (5).

### How to implement the recommendations into routine clinical practice

Comprehensive geriatric assessment (CGA) is an efficient process to deal with complex situations/illness in older people and to achieve integrated care. CGA consists in a systematic, multidisciplinary assessment in four domains associated with frailty: comorbidities, psychology, function, and social status and results in a global care plan. A list of comorbidities is drawn up using records extraction, clinical and paraclinical routine examination. Depression and cognition can be screened using several available instruments – Geriatric Depression Score (GDS), MiniMental State Examination Score (MMSE), MiniCog or Montreal Cognitive Assessment (MoCA), with ADL and IADL testing for disability (26). Education about healthy life style to reduce cardiovascular risk is essential. Blood pressure should be measured in each visit or regularly monitored by patients at home if feasible. Antihypertensive medications and statins must be reviewed. Medications need to be adjusted if not achieving targets, changed if side effects developed or deintensified if patients are getting frailer. Nutritional assessment includes MNA scoring, swallowing capacities, and oral health examination due to frequent periodontal disease identified in older patients with diabetes. Creatinine clearance is estimated. Treatment conciliation and treatment optimization should be employed using lists of potentially inappropriate prescription and the concept of “misused, overused and underused” treatments (27) examined which can then conclude CGA. CGA contributes to set the goals for blood glucose control, for other vascular risk factors, including blood pressure control and comorbidities care. The need for care and social support is also assessed and addressed according to the available resources.
References


Hypoglycaemia management

Recommendations

- Frail older people with diabetes should have their hypoglycaemia risk regularly assessed.
- Educational programmes should be available to patients and their carers that suit their cognitive abilities.
- A care plan that includes an individualised optimum blood glucose range should be in place.
- Cognitive function and instrumental daily activities ability should be regularly checked especially in patients on insulin therapy.
- Blood glucose monitoring is useful in certain patients at risk of hypoglycemia such as those on insulin.
- A relaxed HbA1c target of 59-69 mmol/mol (7.5-8.5%) is appropriate in moderate to severe frailty.
- Hypoglycaemic medications with lower hypoglycaemic potential should be used if there are no contraindications.
- Simplification of insulin regimens from multiple to once daily basal insulin injection is recommended when feasible.
- Regular review and de-intensification of hypoglycaemic medications in patients with tight glycaemic control is recommended.
- Complete withdrawal of hypoglycaemic medications may be considered in patients with significant weight loss and recurrent hypoglycemia.
- Patients on end of life or palliative care will require an approach that focuses on comfort and symptom control.

Rationale and evidence base

Hypoglycaemia is the most common side effect of tight glycaemic control. In older people, clinical recognition may be less clear due to altered counterregulatory hormone secretion and reduced awareness of hypoglycaemic warning symptoms. Inconsistent oral intake, multiple comorbidities, polypharmacy and organ dysfunction may lead to unpredictable responses to hypoglycaemic medications and increased risk of hypoglycaemia. The development of cognitive dysfunction further increases the risk of hypoglycaemia that lead to hospitalisation. On the other hand hypoglycaemia increases the risk of cognitive dysfunction and therefore the needs of older people with diabetes and their cares should be regularly assessed to construct a tailored care plan. Blood glucose monitoring is useful in patients treated with insulin but may have no benefit in those on oral hypoglycaemic medications. A relaxed HbA1c value is appropriate in frail older people with diabetes but this may not completely eradicate the risk of hypoglycaemia. Continuous glucose monitoring has shown that asymptomatic hypoglycaemia is common in this population regardless of HbA1c levels. Many frail older people with diabetes still have tight glycaemic control (HbA1c <53mmol/mol or 7%). Among tightly controlled
patients, 75% used medications which increased the risk of hypoglycaemia such as sulfonylureas and/or insulin. 11 It has also been shown that older (≥80 years) patients who had recurrent episodes of hypoglycaemia had reduced cognitive ability, heavy burden of comorbidities, tight glycaemic control (HbA1c 5.9%) and were treated with long acting sulphonylureas. 12 Therefore, whenever possible medications with less hypoglycaemic potential should be chosen in these patients. Many others are unnecessarily intensively treated increasing their risk of hypoglycaemia. In a retrospective analysis of database of 31542 patients with type 2 diabetes, unnecessarily intensive treatment was prevalent in 20% of patients and it doubled the incidence of severe hypoglycaemia in clinically complex patients (≥75 years old, had dementia, end-stage renal disease or ≥3 comorbidities). Intensive treatment (defined as the use of more hypoglycaemic medications than recommended by practice guidelines at specific index HbA1c levels) significantly increased the risk-adjusted probability of severe hypoglycaemia from 1.74% (95% CI, 1.28% to 2.20%) with standard treatment to 3.04% (1.91% to 4.18%) with intensive treatment. 13 This has also been shown in the retrospective analysis of data from the US Veterans Health Administration where 20% of older patients (>70 years old) with diabetes and low HbA1c (<6.4%) were over treated. 14 Simplification of insulin regimens, deintensification of therapy burden or even complete withdrawal of hypoglycaemic medication when appropriate is feasible without compromising glycaemic control. In an intervention study, simplification of insulin regimen was achieved by switching multiple dose insulin injections to a once daily injection with or without noninsulin agents and resulted in less hypoglycaemic episodes, stable HbA1c levels and improvement in diabetes-related distress score. 15 Hypoglycaemic medications have been shown to safely de-intensified or completely withdrawn in frail older patients with type 2 diabetes who had significant weight loss, tight glycaemic control and recurrent hypoglycaemia without deterioration of their glycaemic control. 16, 17 Therefore, health care providers should be educated about setting appropriate glycaemic targets that suit patients changing needs and weigh the balance between the benefits of glycaemic control with the risks of hypoglycaemia. 18

Implementation in clinical practice

Due to the predominance of neurological rather than autonomic symptoms, the clinical diagnosis of hypoglycaemia is difficult. Another diagnostic challenge is the similarity in the clinical presentation of hypoglycaemia with that of dementia where people may present with agitation, increased confusion or behavioural changes. 19 Therefore, educational programmes for patients, carers and health care professionals should be in place to facilitate the early recognition of this atypical presentation of hypoglycaemia. Patients should be regularly reviewed to identify factors that increase the risk of hypoglycaemia such as impaired organ function, multiple comorbidities, polypharmacy and sulfonylurea or insulin therapy. Once dementia develops diabetes self-care deteriorates and risk of hypoglycaemia increases therefore, clinicians need to check for cognitive dysfunction if non-adherence to self-care tasks or recurrent hypoglycaemia occur. The Mini Cog test is a simple screening tool for dementia which has a sensitivity of 86.4% (95% CI 64.0 to 96.4%) and a specificity of 91.1% (85.6 to 94.6%) and takes only three minutes to perform. 20 Care for older people with diabetes and dementia is a challenge. For example, hydration should be maintained because of impaired thirst sensation to avoid risk of volume depletion and hyperglycaemic crises. In people treated with insulin, once daily insulin analogues may be a
good option as they reduce the risk of hypoglycaemia. People who have erratic eating patterns and unpredictable caloric intake could be managed with a regimen where short-acting insulin analogues are administered only after meal consumption, thus reducing the risk of hypoglycaemia if a meal is missed or only partly consumed. The complex needs of these patients should be identified early to allow for greater support for patients and their carers from the healthcare system.

References


Primary and Community Care

Recommendations

- Care must be individualized in terms of setting appropriate glycemic, blood pressure, and lipid targets and choice of medication.
- Older patients with both diabetes and frailty may have significant co-morbidities or reduced life expectancy that alters the risk–benefit balance of aggressive management of cardiovascular risk: optimal management of these co-morbidities and risks requires a broad range of health practitioner expertise and is ideally suited to a primary and community health environment.
- Additional issues such as polypharmacy, mental illness, risk of falls, urinary incontinence, social isolation, persistent pain, and medication adherence all need to be considered as part of the management plan.
- Primary health practitioners are also best placed to advise and assist their patients in relation to those lifestyle behaviours most likely to prevent or delay the development of type 2 diabetes and/or frailty: this requires a public health perspective that includes attention to the social determinants of health and strong collaboration with public health and social services.
- Older people with diabetes in care homes are often frail and thus are highly vulnerable and require complex nursing and medical care in addition to assistance with personal hygiene.
- Risk factors for hypoglycaemia are highly prevalent in residents of care homes.
- Maintaining health status and functional capacity, and eventually a dignified end of life using individualized care plans are key care goals for all residents with diabetes and frailty.
- Where possible, primary and community care teams need to work with local care homes to ensure that each care home with diabetes residents should have an agreed Diabetes Care Policy or Protocol.

Rationale and Evidence Base

Older individuals with diabetes experience greater morbidity and mortality than those without diabetes\(^1\) and have higher risks for polypharmacy, cognitive impairment, frailty, depression, falls, urinary incontinence, impaired mobility, and persistent pain\(^2\). Optimally managing these co-morbidities and risks requires a broad range of health practitioner expertise and is ideally suited to a primary health environment.

The rising prevalence of diabetes in ageing communities and the added impact of both diabetes and frailty in the community make it inevitable that in all countries economic and health workforce resources will come under increasing strain as a result. Consequently, systems of care need to evolve in order to cope with this increasing diabetes population, and in many countries this has already resulted in a shift in care status, from secondary to primary. Along with managing those already diagnosed with diabetes and/or frailty, primary health
practitioners are best placed to advise and assist their patients in relation to those lifestyle behaviours most likely to prevent or delay the development of type 2 diabetes.

While the importance of primary care is now generally accepted as central to providing more equitable, inclusive, and affordable health care within a community setting ³, there is a large variation in the strength of primary care across different countries ⁴. As there is still a large variation in the organization, structure, and funding base of primary care between countries, no one country can claim to have a primary care system that adequately addresses all current and emerging health challenges and this would be particularly so for the complex illness of diabetes and frailty ⁵.

There is evidence demonstrating the effectiveness of community-based care for diabetes compared to hospital-based care. When care in general practice was shared across a team of health practitioners using computerized reminder systems, HbA1c levels were lower in general practice and continuity of care was greater in general care with fewer patients lost to follow up ⁶, ⁷.

In contrast, community-based care with less-developed support systems showed evidence of worse outcomes. A review in 1998 of five studies looking at the differences between community and hospital care found that unstructured community care was associated with a range of poor outcomes, ranging from poorer follow-up and glycemic control to increased mortality when compared to hospital care ⁶-⁸. A randomized controlled study comparing hospital care to general practice care without any systematic recall system showed increased medical admissions, increased deaths, and higher HbA1c in the general practice group ⁹. However, the meta-analysis established that a computerized recall system in a general practice setting can achieve standards of care as good as – or even better than – hospital outpatient care, at least in the short term ⁷. Studies in managing older people with both diabetes and frailty are absent although the preliminary outcomes of the MIDFRAIL project (a European Union-funded study) suggest that a protocol of resistance-training and nutritional education carried out in both secondary and primary care settings in patients aged 70 years and over leads to a significant improvement in functional performance associated with some quality of life benefits ¹⁰.

Diabetes in care home populations is extremely common, with prevalence rates varying from 5.8% to over 26% depending on the type of facility, age range and gender of residents, and way in which diabetes is diagnosed ¹¹. One of the first comprehensive prevalence studies showed that many cases are undiagnosed since the prevalence rate rose from 12% of known diabetes at baseline to 27% following oral glucose tolerance testing ¹².

Treatment priorities when treating frail care home residents with diabetes are less about prevention of long-term macrovascular and microvascular complications and more about maximizing quality of life, preserving autonomy, and avoiding hospitalization ¹³, ¹⁴. This requires a focus on avoiding acute diabetes complications such as hyperglycaemia, hypoglycaemia, infection, and dehydration. It also requires a careful consideration of factors such as cognitive impairment, risk of falls, and nutrition status when determining individual management strategies ¹³, ¹⁴. Optimal care in these situations also requires excellent
communication between all members of the primary care team, including nursing home staff and the patient or patient’s family, and any agreed treatment targets should be clearly documented in the patient’s individual care plan 13.

Within primary and community care settings, there should be an emphasis on active screening for both diabetes and frailty risk factors and associated complications 11. These include:

- Macrovascular complications such as cardiovascular and cerebrovascular disease – treatment of hypertension, smoking cessation, treating abnormal lipid profiles
- Diabetic foot disease, nephropathy and neuropathy
- Cognitive impairment, Dementia, Depression
- Falls
- Social isolation and loneliness

All risk factor interventions and preventative strategies must allow for the severity of functional loss and frailty and some guidance on these approaches are now available 15.

It is also recommended that primary care teams working with older people with diabetes should have well-structured protocols for shared care with agreements on management of new cases, criteria for hospital admission, access to specialist services, and follow-up 16.

The following criteria for urgent referral to hospital specialist care for older people with diabetes we have previously stated could also apply to those patients with frailty but with some changes 16:

[bl]
- patients with severe vascular complications associated with lower limb functional impairment
- patients who require treatment for diabetes eye disease, foot ulceration or nephropathy who without treatment will escalate the risk of disability
- other patients with increasing dependency and immobility
- patients with unstable cardiovascular disease
- patients with poor metabolic control where it is proving very difficult to control safe and rational HbA1c, lipids or blood pressure to agreed targets
- patients who have repeated hypoglycaemic episodes despite lowering the risk by changes in oral hypoglycaemic agents or insulin therapy
Implementation in Clinical Practice

All health care professionals working in primary and community care settings who provide direct clinical care to older people with diabetes should be trained in comprehensive geriatric assessment which will include the detection of frailty. Clinical Guidelines about the care of older people with diabetes and its complications (including frailty) should be readily available within GP practices and other community care settings and medical, nursing and support staff should have educational and training in their implementation.

Care home nursing and support staff should be made aware of clinical guidance that lays the foundation for improving clinical care of older residents with diabetes including those with frailty, and where available, care staff should be allowed/encouraged to attend any local diabetes courses on care home diabetes.

Primary and community diabetes care teams should consider designating nurse practitioner leads in frailty management and have regular case study meetings to discuss particularly difficult cases. This will help coordinate the diabetes service and implement guidelines and policies and ensure that frailty has an important place on the priority list of diabetes care in each locality.

References


Inpatient Care

Recommendations

- Random blood glucose level should be checked in all older patients acutely admitted to hospital to screen for undiagnosed cases.
- Diabetes status for older people with diabetes including diabetes-related complications and hypoglycaemic medications should be clearly documented in medical records on admission.
- Routine blood testing should include renal and liver functions along with blood glucose and HbA1c check.
- Blood glucose should be regularly monitored during hospital admission to help adjust hypoglycaemic therapy.
- Random blood glucose levels should be maintained above 6mmol (108 mg/dl) (to minimise hypoglycaemia) but below 15 mmol/L (270 mg/dl) to avoid osmotic symptoms.
- Patients should have access to diabetes specialist multidisciplinary team assessment when needed.
- Hospitals should have clearly written medical guidelines for the treatment of diabetes-related emergencies such as diabetic ketoacidosis and hypoglycaemia.
- A Hypoglycaemia Treatment Kit should be available in each ward and staff should be familiar with its use.
- Patients who can self-administer their insulin should be encouraged with minimal supervision from the staff.
- The routine use of sliding scale insulin is not encouraged due to its complications and inconsistent messages.
- Patients should be well hydrated and their renal function checked before having any radiologic investigation that includes contrast injection.
- At discharge, patients should have clear documentations of any change of medications and future care plans smoothly communicated to primary care teams.

Rationale and evidence base

Both ageing and diabetes increases the risk of hospitalisation. The Atherosclerosis Risk in Communities (ARIC) Study has shown that the rate of hospitalisation increased with age and the rates were almost 3 times higher in persons with a diagnosis of diabetes compared to those without.\(^1\) Hyperglycaemia prevalence is also common in hospitalised older patients (>65 years old) affecting up to 70% of critically ill patients and up to one third of other medical or surgical patients.\(^2,3\) Hyperglycaemia is associated with increased risk of mortality in critically ill older patients independent of the severity of illness.\(^4\) On the other hand hypoglycaemia is also a predictor of increased hospital mortality especially in older people. In a case-control study involving hospitalised patients ≥70 years of age, hypoglycaemia was associated with twofold increased in in-hospital and 3-month mortality.\(^5\) Older people are more prone to hypoglycaemia during hospitalisation because of the high...
prevalence of comorbidities, polypharmacy, organ dysfunction, malnutrition, malignancies, dementia and frailty. Therefore avoidance of both hypo and hyperglycaemia is required to improve outcomes. For the frail hospitalised older people a relaxed glycaemic target of random blood glucose >4 but <15mmol/L is appropriate as values outside this range are likely to be associated with symptoms especially impaired cognition. Insulin infusion may be required in critically ill patients to achieve prompt glycaemic control but for most patients basal insulin, alone or in combination with prandial insulin, is more effective and safer than the sliding scale insulin which may result in undesirable hypoglycaemia or hyperglycaemia and increased risk of hospital complications. Treatment with a dipeptidyl peptidase 4 inhibitor, alone or in combination with basal insulin, may represent a safe alternative for the management of hyperglycaemia in hospitalised older patients with a reduced risk of hypoglycaemia and a convenience of once daily administration. Access to a diabetes service dedicated for in-patient older people with diabetes may result in a reduction of the length of hospital stay. Discharge plans from hospital including a problem list, management goals communicated appropriately to the community care team involving a nurse case manager devoted to diabetes could be very efficient in the general follow up of patients in the community. Continuity of care in the community by general practitioner has shown a reduction of hospitalisation rate in patients who have access to regular follow ups compared to those who have not (53.5% vs 68.2% respectively).

Implementation in clinical practice

Health care professionals looking after older people with diabetes should be trained in comprehensive geriatric assessment including the recognition of frailty. Guidelines about the care of older people with diabetes and its complications should be available in each ward and staff are made familiar with its use. Access to food and snacks should be available with liberal diet plans to reduce the incidence of dehydration and hypoglycaemia especially in patients with variable oral intake. A diabetes specialist nurse dedicated to older people and trained in geriatric assessment and old age problems such as dementia and erratic eating pattern is a valuable resource. Her experience can be disseminated through the creation of nurse champions, linked to diabetes specialist team, in each ward. This will help coordinate the diabetes service and implement guidelines and policies.

References

Educational Aspects for Health Professionals in Clinical Settings

Recommendations for education providers

- Education programs should encompass reflection in and on practice, and use individual experiences to enhance learning.
- Health professionals involved in diabetes care should adopt positive proactive approaches to older age to help dispel ageist attitudes and stereotypes.
- Frail older people with diabetes should be engaged in education programmes for clinicians when possible and relevant. People’s stories are powerful teaching/learning tools.
- Traditional teaching and modern technology such as simulation, short podcasts, and online learning resources should be used to deliver frailty education e.g. Geriatric E-learning Modules (MiniGEMS),1 Camden Education Module-frailty 2 and De Villiers Continuing Medical Education Program 3.

Recommendations for clinicians from all disciplines working in all health care settings

- Clinicians should provide coordinated interdisciplinary team care.
- Clinicians should not use ageist language and stereotypes of older people. Older people are not a homogenous group. Obese and thin older people can be frail.
- Clinicians should provide frailty care within an holistic person-centred model of care and decide the care plan with the individual.
- Clinicians should know how to undertake frailty assessments, what ‘frailty tools’ to use, and when to refer an individual for a comprehensive geriatric assessment.
- Clinicians should commence screening older people with diabetes for prefrailty and frailty before age 70.
- Clinicians should undertake frailty assessments during diabetes complication screening programs, when health status changes and before hospital admissions.
- Clinicians should undertake medicine reviews before prescribing new medicines and at regular intervals to determine whether any medicines or medicine combinations might contribute to frailty.
- Clinicians should include light to moderate resilience training to improve function and reduce falls risk soon after admission to hospital or aged care home.
- Clinicians should use self-administered questionnaires to complement physical assessments e.g. The Flourishing Scale. 4
- Clinicians should include frailty education in the individual’s diabetes education and care plan.
- Clinicians should tailor frailty education to suit older people with diabetes’ health literacy/education level and their pre- and frailty risk, social situation and life expectancy.
- Clinicians should consult family carers; they can provide very useful information about the individual’s social situation, functional changes and health status.
Key learnings for clinicians

Frailty is common in older people with diabetes. Frailty can be present in overweight individuals as well as thin people. It is important to begin screening for frailty early, before age 70, and then at each annual assessment. Provide tailored frailty education for older people with diabetes and their families as part of their personalised care plan. Frailty is associated with low health literacy.

Recommendations for service providers

- Service providers should ensure clinicians have access to relevant technology to support optimal frailty care and education.
- Service providers should ensure guidelines, algorithms, policies and referral pathways are based on the best available evidence and are accessible.
- Service providers must ensure resources are available to support clinicians to deliver quality care and frailty education.
- Service providers should promote frailty education resources for older people with diabetes and their family carers that meet readability standards.

Rationale and evidence base

To learn how to treat a disease [frailty] one must learn how to recognise it (Charcot 1825-1893). The prevalence of frailty increases with age \(^6,7\): 20% of community-dwelling older Americans < 70 years and > 50% over age 80 are prefrail \(^7\). Older people lose lean tissue faster than younger people during prolonged periods of inactivity \(^7\). The prevalence of frailty is likely to increase in the future because population of most countries is ageing, and diabetes prevalence increases with age.

Diabetes is associated with complications such as cardiovascular and renal disease, neuropathy, sensory changes, eating disorders, functional deficits and polypharmacy \(^6\). These complications predispose older people with diabetes to prefrailty and frailty and associated adverse outcomes, including falls. Frailty reduces peoples’ ability to cope with stressors, which reduces immunity and prolongs recovery from illness \(^8\). Muscle mass, strength, power and function decline soon after an individual is confined to bed \(^7\). Exercise, nutrition and psychological approaches have positive effects on sarcopaenia and frailty \(^9,10\). Therefore, early ambulation and strength training are important to maintain/restore function. Older people with diabetes often have three or more comorbidities such as atherosclerosis, heart failure and renal disease, which increase their risk of functional decline and frailty \(^11\). Frailty may predict surgical complications and medicine adverse events \(^7\). Proactive admission and discharge planning before admission could help reduce the risks. Frailty and diabetes both affect survival. Frailty and deteriorating function should be detected as soon as possible to enable treatment to be initiated early \(^6\) and palliative care plans to be developed to reduce unnecessary admissions to intensive care units and burdensome treatment.

Maintaining muscle mass and flexibility is important to reducing sarcopaenia and functional decline in older people. Bed rest reduces protein synthesis and accelerates loss of muscle mass and reduces strength, power, and function and is compounded by pre-existing
sarcopenia (7). Strategies to help limit loss of muscle mass and function in older adults include providing 25-30 g of quality protein with each meal, incorporating regular exercise to build muscle strength and flexibility such as tai chi and intervene early to reduce loss of muscle mass during catabolic states such as hyperglycaemia and during hospital admissions 7.

Significantly, frailty is not highlighted in most current diabetes guidelines or education programs. Service providers and educators need to be more proactive about promoting geriatric assessments and increase clinicians’ awareness about the importance of including frailty in diabetes guidelines, policies and interdisciplinary team/referral pathways 1. Operational processes that enable interdisciplinary team care include effective communication processes and care coordination 12,13 and could include interdisciplinary clinician education programs.

Frailty is more common in people with low health literacy/educational level 14. In addition older people with diabetes may have varying degrees of cognitive changes that affect their capacity to learn, concentrate, attention span, visual perception, the way they process information, the ability to multitask and executive functions 15. Education materials designed for older people must consider all of these issues, conform to readability, design and layout standards, and be tested before they are released 6.

Education should encompass reflection in action and after action e.g. during and after an episode of care 16. Education interventions, for clinicians and older people with diabetes that stimulate in-depth discussion and challenge commonly held beliefs lead to more effective learning. Creating opportunities for reflection promotes professional and personal growth and leads to active learning and deeper insight into the lived experiences of older people 17.

How to implement the recommendations

- Include frailty in undergraduate and post graduate diabetes education programs and continuing professional development programs for all clinician disciplines and care settings.
- Conduct interdisciplinary seminars, workshops and journal clubs that focus on diabetes and frailty.
- Include frailty assessment and management strategies in future diabetes guidelines, policies and treatment algorithms.
- Provide specific recommendations about how to implement the guidelines in populations with diabetes when guidelines are developed.
- Identify contextual facilitators and identify barriers that influence willingness to use guidelines and recommendations so the implementation process can be tailored to the specific setting and stakeholders 18.
- Include frailty assessment in annual diabetes complication screening programs, driving license assessments and medicine reviews.
- Develop interdisciplinary care pathways and communication processes across the care continuum that encompasses transitions among services.
References


Research Directions

Recommendations

- A multidisciplinary approach is required to produce effective worthwhile research: participants from basic science, pharmacologists, geriatricians, endocrinologists, nurses, health economists, physiotherapists, epidemiologists, and engineers.
- Basic science approaches need to examine the key underlying interrelationships: insulin resistance, endothelial dysfunction, low-grade pro-inflammatory activity, low testosterone levels, impairments in the bioenergetics response to exercise, the role of different signalling routes such as PGC1-alpha between both entities (diabetes and frailty).
- The development of aging models should be of help to study in depth some of these underlying mechanisms, and be used to raise hypotheses that fit clinical observations.
- Clinical and epidemiological science should provide new knowledge on the components of frailty and diabetes that have prognostic value in terms of clinical outcomes, modulation of health trajectories, and survival.
- The design and implementation of information and communication platforms to screen, early diagnose and manage patients with frailty and diabetes is needed; this will enable patients (and their families) to be empowered; validation of such platforms in real clinical settings is an important requirement.
- The development of Randomised Clinical Trials, going beyond traditional outcome assessments is needed with a focus on changes in function (physical and cognitive), quality of life, use of resources, costs, and survival.

Rationale and evidence base

The joint effect of frailty and diabetes in older people, its mechanisms 1,2, its clinical management 3 and its consequences regarding the best way of providing care 4,5, with a special mention to those presenting some particular features or attended in some specific settings 6 are very relevant issues taking into account their high prevalence 7 and its impact on function 8-10, quality of life 11, the use of health resources 11,12 and their costs 12. Additionally, research on older frail adults meets many peculiarities ranging from the outcomes to be assessed to the design of the study 13,14. The high prevalence of comorbidity and functional impairment usually found in these patients, jointly to other socio-economic factors, impose an entirely different framework for the design of both observational and interventional studies. The high rate of attrition and risk of bias in the observational studies and the problem for recruitment/inclusion, due usually to an extended (an many times unnecessary) exclusion criteria, or for follow-up (usually associated to a highly frequent visits, many of them unnecessary) are only a few examples of the changes in the design of the studies in older people. Moreover, these peculiarities stem not only from the way of older adults for getting sick, but also from the aims of the management of these persons and the time frame in which the outcomes take place and the interventions need to produce their effects 15.
Previous reports from group of experts \(^{15,16,17}\) and scientific societies \(^{5,18}\) have proposed the need of a minimum data-base set of variables to be collected in the studies done in older people with diabetes and the priorities to meet in order to solve some of the research questions existing in this population. Table 3 shows the main topics that should be address in the next few years.

**How to implement the recommendations into routine practice**

The usual ways to implement research priorities include national and international public and private (including scientific societies like IAGG) competitive calls convened by different bodies, RCTs promoted by the phamas, patronage and some intramural activities. Moreover, there is a need to train researchers with different professional backgrounds, in order to provide a well-trained force, able to design, implement, analyze and disseminate the data from high quality research studies \(^{19,20}\). With this background RCTs like MID-FRAIL have shown to provide significant findings \(^{13}\) using a design fitted to the characteristics of these older patients, with outcomes that can impact the daily clinical practice.

Jointly to these usual approaches, it is necessary to promote the participation of older people as co-investigators at all stages of the research process, including planning, design and implementation. Doing research with, not just for, older people according to the recommendation of the WHO \(^{19}\).

Table 3. Main research topics in older people with diabetes and frailty

| **Application of the frailty concept in diabetes** |
| Mechanisms linking frailty and diabetes, with a special focus on intrinsic capacity, sarcopenia and vascular impairment |
| Role of comorbidities associated with diabetes in producing frailty |
| Role of comorbidities associated with diabetes in modulating the progress from frailty to disability |
| Functional trajectories in older frail people with diabetes and effects of modulators |

| **Managing frailty in routine clinical practice** |
| Assessment of feasibility and usefulness of existing and new frailty diagnostic tools in older people with diabetes |
| Systems for detecting and minimizing the risk of hypoglycaemia |
| Identification of subpopulations with different prognosis, aims and management |
| Building synthetic risk indexes combining disease-associated and functional biomarkers |

| **Research Clinical Trials focused on functional issues, cognition, quality of life** |
| Development of methodology to assess interventions in frail older people with diabetes |
| Assessment of interventional physical exercise (different programs) and nutrition |
| Assessment of best clinical targets according to different functional status |
| Assessment of traditional and new classes drugs for treating frailty, with emphasis on safety |
| Assessment of interventions in frail people with diabetes resident in nursing homes |
| Assessment of the benefits of a comprehensive approach to different clusters of patients embracing comorbidities and functional Stata |

| **Influencing commissioners of clinical diabetes and geriatric services** |
| Assessment of different models of care and clinical pathways |
| Health economic analyses of interventions |
| Study designs that allow relevant and appropriate cost comparisons |
| Assessment of the usefulness, adherence and feasibility of technology in the provision of clinical services |
References


19. WHO. World report on ageing and health. 2015

Key Conclusions

This Position Statement represents the first comprehensive international guidance for health professionals for the management of frailty in older people with diabetes. Wherever possible, the rationale and evidence base for each recommendation has been provided but we must recognise that some recommendations reflect good clinical practice points as research in some key areas is still needed to be undertaken.

Frailty and sarcopenia are now clearly recognised as diabetes-related complications even though the direction of causality may be reversed: both former conditions can also create a physiological platform for insulin resistance and the onset of diabetes. With this recognition comes an obligation by doctors, nurses and other health professionals to be more aware of frailty and sarcopenia in older people with diabetes, to recognise their importance in an ageing society, and ensure they have the skills and knowledge to detect these conditions in everyday routine clinical practice. This will require gaining experience of utilising several questionnaire and procedure-based methods for the detection of frailty which require minimal training – some of these methods are discussed in this Position Statement.

The Position Statement provides guidance on how health professionals can modify the individual goals of care for a patient with frailty and diabetes by emphasising the importance of defining functional categories, the likely need for carer assistance, and how this can be translated into 3-5 key clinical action points.

A clear message at present is that we have available the key interventions (exercise, nutrition, medical optimisation) to maintain or improve functional performance in those with frailty and diabetes, and that the success of this implementation will depend on a strong uptake by primary care teams. With further research from randomised clinical trials, newer muscle-specific drug therapy to increase muscle strength may provide the needed boost in treatment for those who have limited abilities to participate in a multi-component intervention strategy in these conditions.

Finally, it is imperative to emphasise to commissioners of health and social services that the detection of frailty and the subsequent management of this condition in patients with diabetes is an important community-based action that should be supported by clinical care pathways for frailty.
Figures

1 – Frailty – Sarcopenia – Diabetes Inter-relations*

2 - Assessment Algorithms

2 (A): Simplified Version

![A Simplified Approach to Assessment of Frailty and Functional Status in DM in Older Adults](image)

ACTION

- Usual Care
- Aids
- Reablement
- Group intervention
- Nutrition
- Nutritional + resistance exercise
- Investigation for reversible underlying cases
- Yearly follow-up
- Calories
- Protein, Leucine and other essential amino acids
- Vitamin B12
- Vitamin D

N=Normal; A=Abnormal;
DM=Diabetes mellitus; IADL=Instrumental activities of daily living; ADL=Activities of daily living; SARC-F=Sarcopenia; COG=cognitive impairment; Nutr=nutrition.
2 (B): Detailed Assessment Pathway

Frailty Assessment Pathway in Diabetes

Patient-related symptoms / concerns
- Falls
- Mobility change
- Post-hospital decrease in ADL
- Weight loss/Fatigue

Initial GP visit

Primary Care

Assessment procedures
- Clinical review
- 4m Gait Speed
- Get Up and Go Test
- Electronic Frailty Index (eFI)

Confirm or exclude presence of frailty

Opportunity for Referral

Diabetes Specialist/Geriatrician

Assessment procedures
- Clinical review
- Fried Score
- Frail score
- SF-36
- Gait speed
- 4m Gait Speed
- Diagnosis of sarcopenia (DEXA scan)
- Exclude peripheral neuropathy (monofilament or vibration perception)
- Ankle brachial index for PVD

Initial Management Plan

- Comprehensive assessment of functional status
- Confirmation of Frailty diagnosis
- Review of glycemic goals
- Exclude vascular and neuropathic causes of mobility impairment

Promote Positive Lifestyle Intervention with regular exercise
Nutritional Assessment and exclude vitamin D deficiency
Review glucose control and medications according to functional status

Abbreviations
ADL - Instrumental activities of daily living
SF-36 - Short physical performance battery
PVD - Peripheral vascular disease
3 - Treatment Algorithm – Glucose Regulation

**Figure 1: Treatment Algorithm for Glucose Regulation in Frail Adults with Type 2 Diabetes**

**Early-moderate frailty**
- SPPB > 6; 4MG5 ≥7.5 mmol/L
- Adequate protein intake, vitamin D supplements, good hydration status
- Resistance exercise training
- Medication selection will be influenced by the presence of other factors such as:
  - Agreed glycaemic goals
  - Renal function
  - Hypoglycaemia risk
  - Weight loss
  - Patient tolerance
- **First line**
  - Metformin.
- **Second line**
  - DPP-4 inhibitors, GLP-1 agonists, SGLT2 inhibitors.
- **Third line**
  - Sulfonylureas, glinides, basal insulin, basal-bolus insulin, premixed insulin.

**Severe frailty**
- SPPB ≤ 5; 4MG5 ≥ 7.5 mmol/L
- Simplification of treatment is the key
- Metformin is not an option in poor renal function (eGFR <30 ml/min)
- Diabetes self-management skills are need for care of frail
- Risk of volume depletion and urinary infection will prompt SGLT2 inhibitor use
- Key objectives:
  - Reduce symptom profile
  - Avoid hypoglycaemia
  - Avoid unnecessary hospital admission for diabetes-related causes
  - Posture disability

**Metformin or DPP4 inhibitor**
- First line

**Metformin or DPP4 inhibitor plus basal insulin**
- Second line

**Abbreviations:** SPPB, Short Physical Performance Battery; 4 MG5 – 4 metre gait speed
Based on Sinclair AI, Abdelhadi A, Rodriguez Maros J (2017)
4- Exercise Programmes for Frailty in Diabetes
Figure 4 (continued)