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World guidelines for falls prevention and management for older adults

a global initiative

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GUIDELINE

World guidelines for falls prevention and management for older adults: a global initiative

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Abstract

Background: falls and fall-related injuries are common in older adults, have negative effects on functional independence and quality of life and are associated with increased morbidity, mortality and health related costs. Current guidelines are inconsistent, with no up-to-date, globally applicable ones present.
Objectives: to create a set of evidence- and expert consensus-based falls prevention and management recommendations applicable to older adults for use by healthcare and other professionals that consider: (i) a person-centred approach that includes the perspectives of older adults with lived experience, caregivers and other stakeholders; (ii) gaps in previous guidelines; (iii) recent developments in e-health and (iv) implementation across locations with limited access to resources such as low- and middle-income countries.
Methods: a steering committee and a worldwide multidisciplinary group of experts and stakeholders, including older adults, were assembled. Geriatrics and gerontological societies were represented. Using a modified Delphi process, recommendations from 11 topic-specific working groups (WGs), 10 ad-hoc WGs and a WG dealing with the perspectives of older adults were reviewed and refined. The final recommendations were determined by voting.
Recommendations: all older adults should be advised on falls prevention and physical activity. Opportunistic case finding for falls risk is recommended for community-dwelling older adults. Those considered at high risk should be offered a comprehensive multifactorial falls risk assessment with a view to co-design and implement personalised multidomain interventions. Other recommendations cover details of assessment and intervention components and combinations, and recommendations for specific settings and populations.
Conclusions: the core set of recommendations provided will require flexible implementation strategies that consider both local context and resources.

Keywords: falls, injury, aged, guidelines, recommendations, clinical practice, world, global, consensus, older people

Key Points

- The world's population is ageing. Falls and related injuries are increasingly common, making their prevention and management a critical global challenge.
- Opportunistic case-finding is necessary as older adults may not present following a fall and may be reluctant to report falls.
- Multidomain interventions tailored to individual's risks factors, when delivered, are effective.
- Engaging older individual's beliefs, attitudes and priorities about falls and their management is essential.
- Application of some of these recommendations may need modification to meet low resource settings and country's needs.

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'It takes a child one year to acquire independent movement and ten years to acquire independent mobility. An old person can lose both in a day'

Professor Bernard Isaacs (1924–1995)

Introduction

This quote from Bernard Isaacs portrays the unfortunate consequences that an older adult may experience after a single fall [1]. Falls occur at all ages and are an inevitable part of a bipedal gait and physical activity. They occur in 30% of adults aged over 65 years annually [2], for whom the consequences are more serious, despite concerted efforts of researchers and clinicians to understand, assess and manage their risks and causes. In addition to personal distress, falls and fall-related injuries are a serious health care problem because of their association with subsequent morbidity, disability, hospitalisation, institutionalisation and mortality [1, 3, 4]. In Europe, total deaths and disability-adjusted life years due to falls have increased steadily since 1990 [5]. The Global Burden of Disease study reported nearly 17 million years of life lost from falls in 2017 [3]. Related societal and economic consequences are substantial. In high-income countries, approximately 1% of health care costs are fall-related expenditures [6].

The number of falls and related injuries will likely further increase [7, 8], partly as there are more older adults, but also because of increasing prevalence of multimorbidity, polypharmacy and frailty among them. There appears to be differences in falls prevalence between and within regions of the world [3, 5]. For example, rates among ethnic Chinese populations across South East Asia have been reported as between 15 and 34% [4] and in the Latin America and Caribbean region rates ranged from 22% in Barbados to 34% in Chile [9]. These differences may be due in part to cultural and lifestyle differences [10]. There are also differences between settings with the incidence of falls being higher for older adults living in care homes or during a hospital stay [10]. This suggests that risk factors may differ across locations and settings, which could have relevance for preventative strategies.

The need for new guidelines

The World Falls Guidelines (WFG) Task Force was created following discussions in 2019 between 14 international experts to consider whether new guidelines on falls prevention were needed to reflect new evidence and clinical service challenges. A subsequent systematic review identified gaps in and inconsistencies between the existing guidelines developed nationally or by specialist international bodies and concluded that a new set of clinical practice guidelines should be created to address these issues and that the guidelines should incorporate an international perspective [7].

The National Institute for Health and Care Excellence in England (NICE) undertook a systematic assessment in 2019 of the need to update its 2013 guidelines [8] and concluded that new evidence reported up to February 2019 had likely impact on case-finding, falls risk assessments and preventative interventions. With further findings since then, there is now a substantial volume of research evidence that has not been systematically evaluated. Observational studies have clarified how to identify levels of risk among community dwelling and clinical populations [2, 11, 12]. Mechanistic and epidemiological studies have improved our understanding of falls in older adults with cognitive impairment [12–16]. The potential roles for e-health including wearables, virtual reality applications and environmental monitoring devices [17–19] have not been previously considered by prior guideline recommendations.

Falls are more common among older adults in clinical care settings, e.g. hospitals, subacute and rehabilitation units, assisted living settings and care homes. The risk factors in these settings and consensus on how to address them are not well captured in current clinical practice guidelines, but evidence specific to these settings is now available on which to base recommendations.

Perspectives of older adults with living experience, carers and other stakeholders have been inconsistently incorporated [7], but there is now emerging evidence that such views may inform the suitability and feasibility of guideline recommendations [20–22].

Purpose and scope of the guidelines

We believe that these guidelines will contribute to improving the health and well-being of older adults globally, which is the overarching aim of the United Nations Decade of Healthy Ageing (2021–2030). Healthy ageing relies on 'the functional ability to be or to do what you have reason to value' [23]. Reducing the incidence of falls and related injuries, notably fractures and head injuries, and enabling preserved functional mobility and reducing concerns about falling, which may limit activity, would all contribute to achieving this. Therefore, the objective of the WFG is to provide guidelines for healthcare and other professionals working with older adults on how to identify and assess the risk of falls and which interventions, alone or in combination, to offer as part of a person-centred approach. These guidelines are novel in systematically considering: (i) a person-centred approach, including the perspectives from older adults with lived experience, caregivers and other stakeholders: (ii) gaps detected in previous guidelines; (iii) recent developments in e-health and (iv) challenges of implementation across settings and locations with limited resources, including low- and middle-income countries (LMIC).

We adopted the World Health Organisation definition: *a fall is an event which results in a person coming to rest inadvertently on the ground or floor or other lower level. Falls, trips and slips can occur on one level or from a height* [24]. This definition of a fall includes syncopal events. In the health and social care systems of many countries, older adults are regarded as those aged 65 years or over, but in some circumstances, age 60 years may be more appropriate depending on the context and health expectancies. There is

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inconsistency in the ages of older participants in the research evidence underpinning these guidelines. There is no scientific rationale for the application of a strict chronological definition of older age when using these guidelines.

The guidelines are focused on individual person level actions. The intended beneficiaries include older adults living in the community and care homes, and hospital inpatients. We also considered the specific features of assessment and/or prevention applicable to older adults with common medical conditions associated with higher falls risk and where the evidence supported this (i.e. Parkinson's disease [PD], post-stroke, post-hip fracture and significant cognitive impairment) we developed separate recommendations for these conditions.

The challenges of implementing falls prevention guidelines in LMIC, where barriers to accessing human and technical resources may be encountered, have not been previously considered [25]. As well, the most predictive risk factors for falls and the favoured interventions to prevent them may well differ in these countries compared with high-income ones. Accordingly, we have tried to include these considerations in the recommendations made and the advice provided for their implementation.

Management of fall-related injuries is beyond the scope of these guidelines, but as there is a close epidemiological and clinical relationship between falls and fragility fractures, explicit linkage is needed with clinicians and services that can assess bone health, identify osteoporosis and fracture risk and provide management for maintaining bone health. While details of these activities are not included in these guidelines, there are well developed multilingual ones available elsewhere [26, 27].

How should these guidelines be used?

Healthcare clinicians for whom these guidelines were developed include physicians, nurses, physiotherapists, occupational therapists, pharmacists and other allied health professionals. Application of these guidelines involves actions by non-specialist as well as specialist healthcare professionals, and service design of care pathways linking primary and community services to specialists where necessary. Therefore, optimal implementation will require actions at the operational level in healthcare and social care sectors. While adaptation to local context, healthcare arrangements and resources is inevitable, our recommendations encompass the global population of older adults. Population level approaches such as public health initiatives and community level actions such as environmental design and age-friendly communities that may directly or indirectly impact falls rates are beyond our scope.

We anticipate that the flexible application of our recommendations will support meeting the different needs of individuals with varying characteristics and priorities and residing in diverse settings and countries with variable resource availability and are consistent with the person-centred approach [28] described below.

Predictive: utilisation of available information to determine an individual's risk of falls and fall-related injuries.

Preventative: focused on intention to prevent falls and related injuries whilst optimising functional ability.

Personalised: utilisation of identified fall risks factors and other relevant clinical information, such as cognition, to develop individualised fall prevention plans.

Participatory: intervention goals and plan developed in collaboration with the older adult, and others as they wish, to consider priorities, values and resources, such as carer support.

How were these guidelines produced?

A full description of the process is provided in Appendix 1, available in *Age and Ageing* online. The World Falls Guidelines Task Force assembled 96 experts from 39 countries and across 5 continents, with representation from 36 scientific and academic societies. Details how this task force was assembled have been previously described [25]. A Steering Committee developed the strategy and guided the project. Feedback from older adults was obtained through early and meaningful involvement in the consensus process, with the goal of making these guidelines better suited to the needs of older adults residing in the community and long-term care facilities. We conducted a systematic review in 2020 that examined existing falls prevention and management guidelines. The gaps identified informed the creation of specific working groups (WGs) addressing topics considered to be relevant or controversial [7]. Eleven topic specific WGs developed preliminary graded recommendations based on systematic reviews as described in detail in each of their WG Reports in Appendix 2, available in *Age and Ageing* online. Each WG was responsible for creating its own search strategy and their own PICO question. Details on selecting and appraising the articles are clarified in the full report for each WG in Appendix 2, available in *Age and Ageing* online. A further WG considered older adult's perspectives as a cross-cutting theme. Ten ad hoc expert groups performed additional rapid reviews [29] of clinical areas not covered by the WGs. An international Experts Group provided external review and feedback on the preliminary and revised recommendations through a four-stage modified Delphi process, which culminated in a final vote on the recommendations that involved Steering Committee members and WG leaders and informed by structured feedback from an older adults' panel.

In addition, an ad hoc WG of 8 clinician experts developed a falls assessment and management algorithm, linking risk stratification, assessment and interventions, based on the evidence provided by the WGs. The full membership lists of committees and WGs are shown in Appendix 4b, available in *Age and Ageing* online.

Grading of recommendations is presented according to the strength (1 strong to 2 weak-conditional) and quality of the contributing evidence (A–C, high to low) using a modified version of the widely used Grading of Recommendations, Assessment, and Evaluation (GRADE)

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Table 1. Modified GRADE system description

Strength of Recommendation	1	**Strong**: benefits clearly outweigh undesirable effects
	2	**Weak or conditional**: either lower quality evidence or desirable and undesirable effects are more closely balanced
Quality of evidence	A	**High:** 'further research is unlikely to change confidence in the estimate of effect'
	B	**Intermediate:** 'further research is likely to have an important impact on the confidence in the estimate of effect and may change the estimate'
	C	**Low:** 'further research is very likely to have an important impact on the confidence in the estimate of effect and is likely to change the estimate'
No evidence Available	E	**Experts:** 'When the review of the evidence failed to identify any quality studies meeting standards set or evidence was not available, recommendations were formulated expert consensus'

criteria (Table 1) [30]. This modified GRADE is based on the original system, where numbers are used to indicate the strength of the recommendation. Where evidence was lacking, but a recommendation considered necessary, this modified system allowed for a recommendation to be graded as 'E' (expert consensus advice recommendation) (Tables 2 and 3).

Framework of the guidelines

- *Fall Risk Stratification*: a standard approach to assess an individual's estimated level of risk for falls, in order to apply a proportionate detailed assessment and intervention according to level of risk.
- *Assessment:* process of identifying and measuring the falls risk factors across multiple domains, using recommended tools if available, to indicate potentially modifiable areas for intervention. Combined with other components of a comprehensive geriatric assessment (CGA), this enables a person-centred approach.
- *Management and Interventions*: description of various approaches to fall prevention including recommended treatments or actions which can reduce the risk of falls and may be suitable as single interventions or in combinations.
- *Assessment and Treatment Algorithm:* this links the three stages of initial risk stratification, assessment and management, and encourages a 'person-centred' approach to design an individualised intervention.

Key messages

- The world's population is ageing. Falls and related injuries are increasingly common, making their prevention and management a critical global challenge.
- Many falls can be prevented. Fall and injury prevention needs multidisciplinary management.
- Engaging older adults is essential for prevention of falls and injuries: understanding their beliefs, attitudes and priorities about falls and their management is crucial to successfully intervening.
- Managing many of the risk factors for falls (e.g. gait and balance problems) have wider benefits beyond falls prevention such as improved intrinsic capacities (physical and mental health), functioning and quality of life.
- Estimates of risk of future falls can be done by trained clinicians with simple resources.
- Multidomain interventions (i.e., a combination of interventions tailored to the individual), when delivered, are effective for reducing the rate of falls in high-risk community-dwelling older adults.
- In care homes and hospital settings all older adults should be considered as high risk and a standard comprehensive assessment followed by multidomain interventions should be considered.
- Vitamin D supplementation to prevent falls should be reserved for those at risk of vitamin D deficiency.
- Modification to the approaches for assessment and interventions may be needed for older adults with certain medical conditions associated with an increased likelihood of falling.
- Application of some of these recommendations may need modification to meet the needs of older adults in settings and locations with limited resources such as LMIC.

Falls risk stratification and algorithm

Following the seminal guidelines produced by the AGS /BGS/ AAOS panel on falls prevention and management published in 2001 and updated in 2011, we created a falls prevention and management approach and algorithm to be applied in community older adults. We stratified falls risk into the following three categories [31, 32], which was also used in our falls risk detection and management algorithm for community dwelling older adults (Figure 1):

- older adults at low risk for falls who should be offered education about falls prevention and exercise for general health and/or fall prevention if interested;
- older adults at intermediate risk for falls, who in addition to the above should be offered targeted exercise or a physiotherapist referral in order to improve balance and muscle strength, and reduce their fall risk; and

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Table 2. Taxonomy used in the World Falls Guidelines

Fall	An unexpected event in which an individual comes to rest on the ground, floor, or lower level
Recurrent falls	Two or more falls reported in the previous 12 months
Unexplained fall	When no apparent cause has been found for a fall on performing a multifactorial falls risk assessment and it cannot be explained by a failure to adapt to an environmental hazard or by any other gait or balance abnormality
Severe fall	Fall with injuries that are severe enough to require a consultation with a physician; result in the person lying on the ground without capacity to get up for at least one hour; prompt a visit to the emergency room (ER); associated with loss of consciousness
Fall related injury	An injury sustained following a fall. This includes an injury resulting in medical attention including hospitalisation for a fall such as fractures, joint dislocation, head injury, sprain or strain, bruising, swelling, laceration, or other serious injury following a fall
Fall risk stratification	A single or set of assessments performed to grade an individual's risk of falling, to guide what further assessments or interventions might be necessary
Multifactorial falls risk assessment	A set of assessments performed across multiple domains to judge an individual's overall level of risk of falling to identify the individual risk factors - potentially modifiable and non-modifiable -to inform the choice of an intervention
Caregiver	A caregiver provides assistance in meeting the daily needs of another person. Caregivers are referred to as either 'formal' or 'informal.' 'Formal' caregivers are paid for their services and have had training in providing care. This may include services from home health agencies and other trained professionals. 'Informal' caregivers, also called family caregivers, are persons who give care to family or friends usually without payment. A caregiver gives care, generally in the home environment, for an ageing parent, spouse, other relative or unrelated person, or for an ill, or disabled person. These tasks may include transportation, grocery shopping, housework, preparing meals. Also giving assistance with getting dressed, getting out of bed, help with eating and incontinence.
Exercise	Exercise is a subset of physical activity that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness. Physical fitness is a set of attributes that are either health- or skill-related
Fall risk increasing drugs (FRIDs)	Medications known to increase the risk of falls
Fall risk stratification algorithm	The systematic process of decision-making and intervention that should occur for falls risk case findings
Low- and Middle- income countries (LMIC)	As defined by World Bank Classification for Low- and Middle- Income Countries https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2021-2022
Multicomponent exercise	This type of programme combines strength, aerobic, balance, gait and flexibility training
Multidomain interventions	A combination of two or more intervention components across two or more domains (e.g.: an exercise program and environmental modification) based on a multifactorial falls risk assessment and intended to prevent or minimise falls and related injuries
Multicomponent interventions	These are fixed combinations of two or more intervention components that are not individually tailored following a multifactorial falls risk assessment. Multicomponent interventions vary widely: for illustration, an example could be a medication review, home modifications and generic exercise advice
Physical activity	Any bodily movement produced by skeletal muscles that results in energy expenditure. The energy expenditure can be measured in kilocalories. Physical activity in daily life can be categorised into occupational, sports, conditioning, household, or other activities
Telehealth	Involves communicating with individuals at home via telephone or video calls
Smart home systems	System that aims to decrease environmental hazards and forecast potentially impending falls using sensors and Artificial Intelligence (AI) technology

- older adults at high risk for falls who should be offered a multifactorial falls risk assessment to inform individualised tailored interventions.

Categorisation into these three groups should occur during either opportunistic case-finding or when older adults present with a fall or related injury.

Opportunistic case-finding

Strong recommendation. Clinicians should routinely ask about falls in their interactions with older adults, as they often will not be spontaneously reported. **GRADE: 1A.**

Expert recommendation. Older adults in contact with healthcare for any reason should be asked, at least once yearly, if they have (i) experienced one or more falls in the last 12 months, and (ii) about the frequency, characteristics, context, severity and consequences of any fall/s. **GRADE: E.**

Expert recommendation. If resources and time are available, we conditionally recommend to additionally ask (iii) if they have experienced dizziness, loss of consciousness or any disturbance of gait or balance and (iv) if they experience any concerns about falling causing limitation of usual activities. **GRADE: E**.

Strong recommendation. Older adults who affirm any of the above inquiries should be offered an objective assessment of gait and balance for differentiating intermediate and high from low risk of falls as a component of initial falls risk stratification. **GRADE: 1A**.

Recommendation details and justification

- Clinicians cannot rely solely on older adults reporting falls, as studies indicate that many do not for a variety of reasons [33]. This is particularly true for men with less than a third mentioning them to their clinician if not directly asked (Appendix 2, available in *Age and Ageing* online) [34].

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Table 3. List of acronyms used in the text of the WFGs

3IQ	Three Incontinence Questionnaire
3KQ	Three Key Questions
ADL	Activities of Daily Living
BMI	Body mass index
CFS	Clinical Frailty Scale
CGA	Comprehensive geriatric assessment
CST	Chair Stand Test
DT	Dual tasking
FES-I	Falls Efficacy Scale International
FOG	Freezing of gait
FP	Frailty phenotype
FRIDs	Fall risk increasing drugs
GDS	Geriatric Depression Scale
GRADE	Grading of Recommendations, Assessment, and Evaluation
IADL	Instrumental Activities of Daily Living
ICFSR	International Conference on Frailty and Sarcopenia
LMIC	Low- and middle-income countries
MCI	Mild Cognitive Impairment
MDS-UPDRS	Movement Disorders Society Unified Parkinson's Disease Rating Scale
MNA	Mini Nutritional Assessment
MoCA	Montreal Cognitive Assessment
NEADL	Nottingham Extended Activities of Daily Living
NICE	National Institute for Health and Care Excellence
NSAIDs	Non-steroidal anti-inflammatory drugs
PD	Parkinson's Disease
RCT	Randomised controlled trial
Short FES-I	Short Falls Efficacy Scale International
SNRIs	Serotonin norepinephrine reuptake inhibitors
SPPB	Short Physical Performance Battery
TMT	Trail Making Test
TMT-B	Trail Making Test Part B
TUG	Timed Up and Go
WFG	World Falls Guidelines
WGs	Working groups

Older adults presenting with falls or related injuries

Expert recommendation. Older adults presenting with a fall or related injury should be asked about the details of the event and its consequences, previous falls, transient loss of consciousness or dizziness and any pre-existing impairment of mobility or concerns about falling causing limitation of usual activities. **GRADE: E.**

Expert recommendation. An adult who sustains an injury requiring medical (including surgical) treatment, reports recurrent falls (≥2) in the previous 12 months, was laying on the floor unable to rise independently for at least one hour, is considered frail or is suspected to have experienced a transient loss of consciousness should be regarded as at high risk of future falls. **GRADE: E**.

Recommendation details and justification

- These recommendations apply to the group of older individuals who present to Emergency departments or another facility [35, 36] such as to primary care physicians or a fracture service due to a fall-related injury or are seen at home by paramedics, and also to older adults whose fall was understood by the clinician to have been precipitated by an acute medical illness, such as infection [28, 37].

Assessment and algorithm flow

Our proposed algorithm has two entry points (Figure 1): first, opportunistic case finding, case finding during a health visit or using 'e-health records', and second, when older adults present to healthcare services as a result of a fall or related injury. Opportunistic case-finding is necessary as older adults may not present following a fall and may be reluctant to report falls [38–41]. Furthermore, recollection of the occurrence or date (e.g., how many months ago) of previous falls is unreliable [42]. Therefore, the 1-year timing is a pragmatic compromise between accuracy of recollection and the natural history of falls risk factor progression [43].

Opportunistic case finding starts with the single question 'Have you fallen in last 12 months'. This single question is highly specific in predicting future falls [31, 32] but has a low sensitivity as it takes no account of common risk factors, and consequently, results in a high rate of false negatives.

Tools that assess more than one fall risk factor, such as the 'three key questions' (3KQ) [41], have a higher sensitivity. The questions are: (i) Have you fallen in the past year, (ii) Do you feel unsteady when standing or walking? (iii) Do you have worries about falling. If resources are available, we conditionally recommend its use. The Stay Independent self-risk assessment consisting of 12 self-administered questions,

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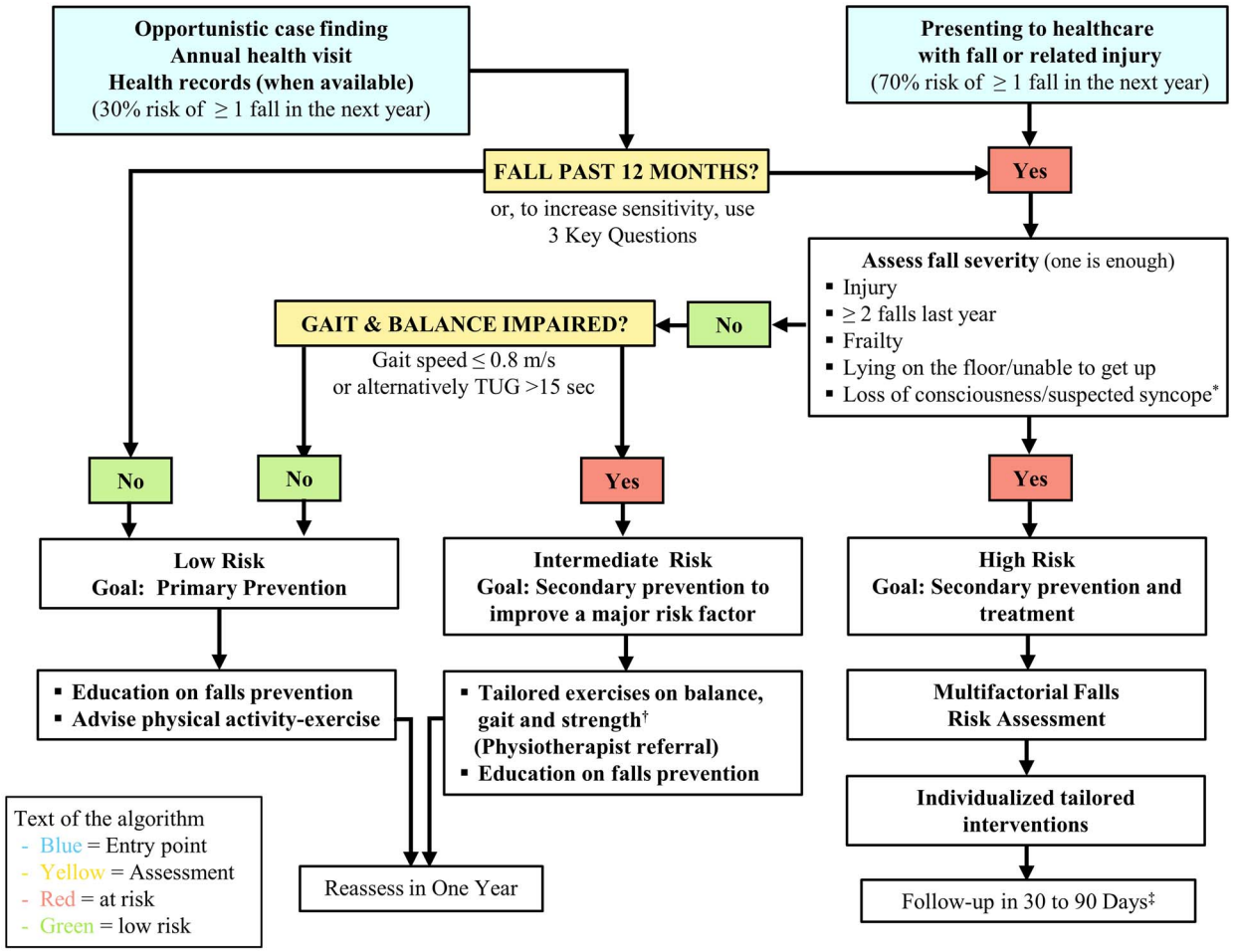

Notes: 3 Key Questions (3KQ) any positive answer to a) Has fallen in the past year? b) Feels unsteady when standing or walking? or c) Worries about falling? prompts to "fall severity" step. **Fall severity**: fall with injuries (severe enough to consult with a physician), laying on the ground with no capacity to get up, or a visit to the emergency room, or loss of consciousness/suspected syncope. **Frailty.** Commonly used frailty assessment tools include the Frailty Phenotype and the Clinical Frailty Scale.
*Syncope suspicion should trigger syncope evaluation/management. †Exercises on balance/leg strength should be recommended for the intermediate group. Evidence shows that challenging balance exercises are more effective for fall prevention. In several settings, this intermediate group is referred to a physiotherapist. ‡ High risk individuals with falls can deteriorate rapidly, and close follow up is recommended and should be guided on the frequency of consequent health service utilization. **TUG:** timed up and go test

Figure 1. Algorithm for risk stratification, assessments and management/interventions for community-dwelling older adults.

which is a component of the Centres for Disease Control and Prevention's STEADI toolkit, can also be used as a sensitive approach to detecting future fall risk [44, 45]. Age distribution of the older adult population when selecting a fall risk screening tool is important, since sensitivity of the single question 'Have you fallen in the past 12 months' increases from 43% in those between 65 and 74 years old, to 67% in those over 85 years old. Gait or balance disturbances should be assessed following a positive answer to history of fall or any of the 3 key questions [31].

Strong recommendation. Regarding specific tests, we recommend including Gait Speed for predicting falls risk. **GRADE: 1A**. As an alternative, the Timed Up and Go Test can be considered, although the evidence for fall prediction is less consistent. **GRADE: 1B.**

Recommendation details and justification

- There are several tests for assessing gait and balance impairment. For risk stratification, we recommend use of gait speed, with a cut-off value of <0.8 m/s on the basis of its predictive ability and simplicity [46]. Resources with simple instructions on how to measure gait speed can be found at www.worldfallsguidelines/resources.
- Alternatively, the Timed Up and Go (TUG) test can be used, with a cut-off value of >15 seconds, although evidence for fall risk stratification is mixed. There is evidence that he TUG is predictive of falls in lower functioning adults [46].

An older adult who does not have a history of falling, or who had a single non-severe fall and no gait or balance

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problems, is deemed as being at low risk. Since low risk does not mean 'no risk at all', we recommend primary prevention for these older adults. This 'low risk' group should be reassessed annually. Older adults who had a single non-severe fall but also have gait and or balance problems, should be considered as being at 'intermediate risk' and would benefit from a strength and balance exercise intervention since evidence shows that this type of exercise is effective in reducing falls risk [2]. Finally, those at 'high risk' include older adults with a fall and one or more of the following characteristics: (i) accompanying injury, (ii) multiple falls (≥2 falls) in the previous 12 months, (iii) known frailty, (iv) inability to get up after the fall without help for at least an hour and (v) accompanied by (suspected) transient loss of consciousness. These high-risk older adults should be offered a multifactorial falls risk assessment. Suspicion of a syncopal fall should trigger syncope evaluation and management. With regard to frailty for risk stratification, this can be either previously identified frailty or a positive result on a validated instrument used for its detection. Commonly used frailty assessment instruments include the Frailty phenotype (FP) [47] and the Clinical Frailty Scale (CFS) [48]. The FP includes 5 criteria: slow gait speed, low physical activity, unintentional weight loss, exhaustion and muscle weakness; where ≥3 components categorises an individual as 'frail', 1 or 2 as prefrail, and 0 as not frail. The CFS is a semi-quantitative scale with pictograms that ranges from 1 (very fit) to 9 (terminally ill).A score ≥4 is considered as frail (https://www.dal.ca/sites/gmr/our-tools/clinical-frailty-scale.html). The algorithm for stratification and management in Figure 1 summarizes this approach.

Assessment

The purposes of the assessment are to address the mechanism of the fall, the consequences of the fall (e.g., injury, functional deficits, psychological effects such as concerns about falling), and the identification of potentially contributing fall risk factors.

Assessment with a view to reducing the risk of falling needs to consider the older adult's history of falling and: their frequency; characteristics and context; presence of falls risks factors; their physical, cognitive, psychological and social resources; and, their goals, values, beliefs, and priorities. An assessment with a view to co-designing an intervention with the older adult requires a broad approach, as exemplified by a CGA. Our recommendations (based on the WG evidence-based reviews) describe the assessments needed to identify the key modifiable falls risk factors. In Table 4, we provide an overview of potential approaches for assessment of a number of individual modifiable fall risk factors.

We will not cover all components of a CGA, for which there is guidance elsewhere [49], but we do note the important associations of falls with other geriatric syndromes [50] and conditions, the management of which may be important for some individuals. Falls in older adults, particularly those living with frailty, should be considered a warning sign of potentially unidentified underlying conditions. A fall may be the presenting feature of acute medical conditions such as pneumonia (particularly if accompanied by delirium [51]) or myocardial infarction without chest pain [52]. Choice of assessments in clinical practice should thus consider the clinical characteristics of the older adult (e.g. frail vs. non-frail), the setting (e.g. community, outpatient clinic, acute care, long-term care) and the resources available (e.g. cost, training, equipment).

Incorporating the perspective of the older adult

Strong recommendation. As part of a multifactorial falls risk assessment clinicians should enquire about the perceptions, the older adult holds about falls, their causes, future risk and how they can be prevented (Appendix 2, available in *Age and Ageing* online). **GRADE: 1B.**

Expert recommendation. As part of a multifactorial falls risk assessment clinicians should enquire about the goals and priorities; attitudes to activities, independence and risk; and willingness and capability of older adults to inform decision making on potential interventions. **GRADE: E.**

Recommendation details and justification

- Studies indicate that older adults, particularly men, are reluctant to report falls with less than a third mentioning them to their clinician if not directly asked [34].
- Many older adults have low levels of knowledge about causes and prevention of falls, with erroneous beliefs about the causes, their own risk of falling and how best to minimise the likelihood of future falls [53–57]. Knowing what their beliefs are would allow clinicians the opportunity to answer questions, address misconceptions and provide accurate information about falls and their prevention.

Multifactorial falls risk assessment

Strong recommendation. Offer multiprofessional, multifactorial assessment to community-dwelling older adults identified to be at high risk of falling, to guide tailored interventions (Appendix 2, available in *Age and Ageing* online). **GRADE: 1B**.

Recommendation details and justification

- A multifactorial falls risk assessment for those at high risk of falling, which enables advice for falls prevention and management interventions, includes the following domains: gait and balance, muscle strength, medications, cardiovascular disorders including orthostatic hypotension, dizziness, functional ability and walking aids, vision and hearing, musculoskeletal disorders, foot problems and footwear, neurocognitive disorders (including delirium, depression, dementia, behavioural issues such as impulsiveness and agitation), neurological disorders (e.g. PD,

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Table 4. Potential measurement instruments and approaches for multifactorial falls risk assessment

Domains for assessment	Fall risk factor	Measurement/approach
Mobility	Balance	Screen for balance disorders for example by Tandem Stand, One Leg stand. If indicated, perform full assessment in structured manner, for example by Berg Balance Scale, Tinetti test, POMA (subscale balance), Mini-BEST test. Consider referral to physiotherapist.
	Gait	Assess both qualitatively and quantitatively using 4-m walking length (<0.8 m/s), POMA (subscale gait), Dual Task test, Functional Gait Assessment. Screen for mobility problems using a structured approach for example by Short Physical Performance Battery (SPPB), Timed Up and Go (TUG), Get Up and Go including qualitative assessment).
	Muscle strength	Screen quantitatively using for example CST or handgrip strength If indicated assess structurally specific muscle groups (MRC-scale)
	Walking aid	If applicable, assess for appropriateness and proper of use of walking aid including potential mechanical deficits.
	Footwear and foot problems	Screen for potential inappropriate footwear (including bare footedness) Assess for potential foot problems. Consider referral to podiatrist.
	Fear of falling	Assess Fear of (concerns about) Falling, preferably in structured manner, for example by Falls Efficacy Scale (FES-I) or short FES-I If indicated: assess for anxiety disorder, preferably by HADS. Consider referral to specialist.
Sensory function	Dizziness/vestibular	Screen with history taking and on indication perform Dix-Hallpike, Head Impulse Test. Consider referral to ENT/ORL specialist.
	Vision	Assess subjective vision problems (history taking). Objective assessment of visual problems and acuity and appropriate use of glasses (including check multi−/bifocal glasses) If indicated, refer to ophthalmologist or optometrist
	Hearing	Assess subjective hearing problems (history taking). Objective assessment of hearing problems. If indicated, refer to audiologist or ENT/ORL specialist.
Activities of daily living	Functional ability	Assess Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) in structured manner, preferably by modified Katz (community dwellers) or NEADL or Barthel (personal care, also suitable for care home residents)
Cognitive function	Cognition	Screen for cognitive disorders including executive functioning for example by using clock drawing test or Montreal Cognitive Assessment (MoCA) or Trail Making Test Part B (TMT-B). If indicated, further assessment and additional testing, e.g. full neuropsychological test battery.
	Delirium	Assess presence of delirium, preferably structured by, e.g. 4AT Delirium Assessment Tool (4AT), Delirium Observation Screening Scale (DOS) or Confusion assessment method (CAM), with clinical judgement.
	Behaviour	Assess behaviour, preferably structured.
Autonomic function	Orthostatic Hypotension	Measure blood pressure first supine (after minimum of 5 minutes of bed rest) and repeatedly upon standing. Preferably continuously, or alternatively at 1 minute intervals up to minimal 3 minutes and optimally 5 minutes , check for symptom recognition.
	Urinary incontinence	Assess with the 3IQ screening test. Additional testing and/or referral to urologist/gynaecologist.
Disease history	Cardiovascular disorders	Assess by focused history taking about cardiovascular symptoms, history of cardiovascular disease, focused cardiovascular physical examination, measurement of orthostatic hypotension (see below for details), 12-lead surface electrocardiogram. If indicated, further assessment (may include tilt table testing including carotid sinus massage, ambulatory rhythm monitoring and/or blood pressure monitoring). Consider referral to cardiologist or syncope specialist.
	Contributing diseases/atypical disease presentation	Perform a clinical geriatric assessment (history taking, physical examination, laboratory measurements, additional testing when indicated) with specific attention towards diabetes mellitus, osteoarthritis, neurological disorders including PD, polyneuropathy and stroke, cardiovascular diseases (see above), cognition (see above), depressive disorders (see below), delirium, anaemia, electrolyte disorders, thyroid disease, frailty, sarcopenia and fracture risk (osteoporosis). Assess for potential atypical disease presentation of acute conditions such as pneumonia, especially in acute care setting.
	Parkinson Disease	Assess mobility problems (gait and balance control, strength, see above) including FOG, cognition including dual tasking (DT) (see above) and orthostatic hypotension (see above).
	Depressive disorders	Screen for depressive disorder (minimally 2 screening questions) for example by Geriatric Depression Scale (GDS). Consider referral to specialist.
Medication history	Medication	Perform a structured medication review that entails considering deprescribing of psychotropic, cardiovascular and other FRIDs, for example by applying STOPPFall or STEADI instrument.
Nutrition history	Nutritional status	Screen for malnutrition for example by MNA, Malnutrition Universal Screening Tool (MUST), Malnutrition Screening Tool (MST); for obesity; for sarcopenia (including sarcopenic obesity); for vitamin deficiencies (vitamin D see below; vitamin B1, B12, folic acid) and for substance abuse as well as light-moderate alcohol use.
	Vitamin D	Assess vitamin D status in community dwellers based on local guidelines. If at high risk for deficiency (care home residents, home bound) measurement is not indicated as standard supplementation applies.
Environmental risk	Environment	Recommended assessment tools for hazards are Westmead Home Safety Assessment and the Falls Behavioural Scale for the Older Person. In LMIC non-occupational therapists and self-administered home hazard assessment checklists are available

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Table 5. List of recommendations from the WFGs by Working Groups*

WG/domains	Area or Domain	Recommendation	Grade
WG 1 Gait and Balance Assessment Tools to Assess Risk for Falls	Stratification	We recommend including gait speed for predicting falls risk.	1A
		As an alternative the Timed Up and Go Test can be considered, although the evidence for fall prediction is less consistent.	1B
	Assessment	We recommend that Gait and Balance should be assessed.	1B
WG 2 Polypharmacy, Fall Risk Increasing Drugs, and Falls	Assessment	We recommend assessing for fall history and the risk of falls before prescribing potential fall risk increasing drugs (FRIDs) to older adults.	1B
	Assessment	We recommend the use of a validated, structured screening and assessment tool to identify FRIDs when performing a medication review or medication review targeted to falls prevention in older adults.	1C
	Intervention	We recommend that medication review and appropriate deprescribing of FRIDs should be part of multidomain falls prevention interventions.	1B
	Intervention	We recommend that in long-term care residents, the falls prevention strategy should always include rational deprescribing of fall-risk-increasing drugs.	1C
WG 3 Cardiovascular Risk Factors for Falls	Assessment	We recommend, as part of a multifactorial falls risk assessment, that a cardiovascular assessment that initially include cardiac history, auscultation, lying and standing orthostatic blood pressure, and surface electrocardiogram should be performed.	1B
	Assessment	In the absence of abnormalities on initial cardiovascular assessment, no further cardiovascular assessment is required, unless syncope is suspected (i.e. recurrent unexplained falls).	1C
	Assessment	We recommend that the further cardiovascular assessment for unexplained falls should be the same as that for syncope, in addition to the multifactorial falls risk assessment.	1A
	Intervention	We recommend that management of orthostatic hypotension should be included as a component of multidomain intervention in fallers.	1A
	Intervention	We recommend that interventions for cardiovascular disorders identified during assessment for risk of falls should be the same as that for similar conditions when associated with syncope, in the addition to other interventions based on the multifactorial falls risk assessment.	1B
WG 4 Exercise Interventions for Prevention of Falls and Related Injuries	Exercise Intervention	We recommend exercise programmes for fall prevention for community-dwelling older adults which include balance challenging and functional exercises (e.g. sit-to-stand, stepping), with sessions three times or more weekly which are individualised, progressed in intensity for at least 12 weeks and continued longer for greater effect.	1A
	Exercise Intervention	We recommend inclusion, when feasible, of Tai Chi and/or additional individualised progressive resistance strength training.	1B
	Exercise Intervention	We recommend individualised supervised exercise as a falls prevention strategy for adults living in long-term care settings.	1B
	Exercise Intervention	We recommend that adults with PD at an early to mid-stage and with mild or no cognitive impairment are offered individualised exercise programmes including balance and resistant training exercise	1A
	Exercise Intervention	We conditionally recommend that adults after a stroke participate in individualised exercise aimed at improving balance/strength/walking to prevent falls	2C
	Exercise Intervention	We recommend that adults after sustaining a hip fracture participate in individualised and progressive exercise aimed at improving mobility (i.e. standing up, balance, walking, climbing stairs) as a fall prevention strategy.	1B
	Exercise Intervention	We conditionally recommend that such programmes after a hip fracture be commenced as in-patients and be continued in the community.	2C (In-patients) & 1A (Community)
	Intervention	We recommend that community-dwelling adults with cognitive impairment (mild cognitive impairment and mild to moderate dementia) participate in exercise to prevent falls, if willing and able to do so.	1B
WG 5 Falls in Hospitals and Care Homes	Hospital Assessment	We recommend that hospitalised older adults >65 years of age have a multifactorial falls risk assessment. We recommend against using scored falls risk screening tools in hospitals for multifactorial falls risk assessment in older adults.	2B
	Hospitals management and interventions	We recommend that tailored education on falls prevention should be delivered to all hospitalised older adults (≥65 years of age) and other high-risk groups.	1A
	Hospitals management and interventions	We recommend that personalised single or multidomain falls prevention strategies based on identified risk factors or behaviours (or situations) be implemented for all hospitalised older adults (≥65 years of age), or younger individuals identified by the health professionals as at risk of falls.	1C (Acute care) & 1B (Sub-acute care)
	Care homes assessment	We recommend against falls risk screening to identify care home residents at risk for falls and we recommend that all residents should be considered at high risk of falls.	1A
	Care homes assessment	We recommend performing a multifactorial falls risk assessment at admission to identify factors contributing to fall risk and implementing appropriate interventions to avoid falls and fall-related injuries in care home resident older adults.	1C
	Care homes assessment	We recommend conducting a post-fall assessment in care home residents following a fall in order to reassess fall risk factors, adjust the intervention strategy for the resident and avoid unnecessary transfer to acute care.	E

(Continued)

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Table 5. Continued.

WG/domains	Area or Domain	Recommendation	Grade
	Care Homes Management and Interventions	We recommend a multifaceted approach to falls reduction for care home residents including care home staff training, systematic use of a multidomain decision support tool and implementation of falls prevention actions	1B
	Care homes management and interventions	We recommend against the use of physical restraints as a measure for falls prevention in care homes.	1B
	Care homes management and interventions	We recommend nutritional optimisation including food rich in calcium and proteins, as well as vitamin D supplementation as part of a multidomain intervention for falls prevention in care home residents.	1B
	Care homes management and interventions	We recommend including the promotion of physical activity (when feasible and safe) as part of a multidomain falls prevention intervention in care homes.	1C
WG 6 Cognition and Falls	Cognition Assessment	We recommend that routine assessment of cognition should be included as part of multifactorial falls risk assessment in older adults.	1B
	Cognition Assessment	We recommend including both the older adult's and caregiver's perspectives, when creating the individual falls prevention care plans for adults with cognitive impairment since this strategy has shown better adherence to interventions and outcomes.	1C
WG 7 Falls and PD and Related Disorders	Assessment	We conditionally recommend a falls risk assessment for older adults with PD, including a self-report 3-risk factor assessment tool, which includes a history of falls in the previous year, FOG in the past month, and slow gait speed	2B
	Management and Intervention	We conditionally recommend that older adults with PD be offered multidomain interventions	2B
	Management and Intervention	We recommend that adults with PD at an early to mid-stage and with mild or no cognitive impairment are offered individualised exercise programmes including balance and resistance training exercise.	1A
	Management and Intervention	We conditionally recommend exercise training, targeting balance and strength, be offered to people with complex phase PD if supervision by a physiotherapist or other suitably qualified professional is available.	1C
WG 8 Falls and Technology	Assessment and Interventions	We conditionally recommend using telehealth and/or smart home systems (when available) in combination with physical exercise as part of the falls prevention programmes in the community.	2C
	Interventions	Current evidence does not support the use of wearables for falls prevention. Emerging evidence show that when wearables are used in exercise programmes to prevent falls, they may increase participation.	2C
WG 9 Falls in Low- and Middle-Income Countries	Implementation	Local context needs to be considered when implementing fall prevention programmes in LMIC.	1B
	Assessment	We conditionally recommend prioritising assessments of risk factors for cognitive impairment, obesity including sarcopenic obesity, diabetes, lack of appropriate footwear and environmental hazards as falls risk factors in LMIC	2C
	Assessment	We conditionally recommend that in LMIC settings clinicians and caregivers use validated tools that are freely available in their country of residence to assess mobility, dependent on resource availability.	E
WG 10 Multifactorial Assessment and Interventions for Falls (Environment recommendations informed by the ad hoc expert group on Environment and Falls)	Multifactorial Assessment	We recommend multiprofessional, multifactorial assessment should be offered to community-dwelling older adults identified to be at high risk of falling, to guide tailored interventions.	1B
	Multidomain Interventions	We recommend multidomain interventions, informed by a multiprofessional, multifactorial falls risk assessment, should be offered to community-dwelling older adults identified to be at high risk of falling.	1B
	Multifactorial (Environmental) Assessment	We recommend identification of an individual's environmental hazards where they live and an assessment of their capacities and behaviours in relation to them, by a clinician trained to do so, should be part of a multifactorial falls risk assessment.	1B
	Multifactorial (Environmental) Interventions	We recommend modifications of an older adult's physical home environment for fall hazards that consider their capacities and behaviours in this context, should be provided by a trained clinician, as part of a multidomain falls prevention intervention.	1B
WG 11 Older Adults' Perspectives on Falls	Stratification	We recommend clinicians should routinely ask about falls in their interactions with older adults**.**	1A
	Assessment	As part of a comprehensive fall assessment, clinicians should enquire about the perceptions the older adult holds about falls, their causes, future risk, and how they can be prevented.	1B
	Interventions	A care plan developed to prevent falls and related injuries should incorporate the goals, values and preferences of the older adult.	1B
WG 12 Concerns about Falling and Falls	Assessment	We recommend including an evaluation of concern about falling in a multifactorial falls risk assessment of older adults	1B
	Assessment	We recommend using a standardized instrument to evaluate concerns about falling such as the Falls Efficacy Scale International (FES-I) or Short FES-I in community-dwelling older adults.	1A
	Assessment	We recommend using the FES-I or especially the Short FES-I for assessing concerns about falling in acute care hospitals or long-term care facilities.	1B
	Assessment	We recommend exercise, cognitive behavioural therapy and/or occupational therapy (as part of a multidisciplinary approach) to reduce fear of falling in community-dwelling older adults.	1B

*Note: these are the 12 original Working Groups that addressed the knowledge gaps identified from the review of previous clinical practice guidelines.

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neuropathy), underlying diseases (acute and chronic), concerns (fear) about falling, environmental hazards, nutritional status (including protein intake and vitamin D), alcohol consumption, urinary incontinence and pain.
- The evidence for a multifactorial falls risk assessment follows from evidence that effective multidomain interventions should be based on modification where possible of the fall risks factors identified in the individual, and not on a generic intervention regardless of individual characteristics.
- The strength of the evidence differs per component. Details can be found below in the section addressing individual components.

Assessment details for individual components

Gait and balance assessment

Strong recommendation. Gait and Balance should be assessed as part of the risk assessment of falls (see Table 4; Appendix 2, available in *Age and Ageing* online). **GRADE: 1B.**

Recommendation details and justification

- Gait and balance impairment is one of the domains that most consistently predicts future falls [32].
- Physical function tests of gait and balance can help choose fall prevention exercises, prescribe level of difficulty and dose and monitor progress.
- Assessment tools that are useful and commonly used in the assessment of gait and balance include: gait speed, The Timed Up and Go (TUG) test, the untimed Get Up And Go test, Berg Balance Scale, the Chair Stand test (CST) and Short Physical Performance Battery (SPPB).
- The SPPB includes timed tests of sit to stand, balance in standing and walking and has been found sensitive to change in intervention studies [58]. The TUG is another popular choice as it combines assessment of rising from sitting, walking and turning [59]. The untimed Get Up and Go test provides similar qualitative information [60].
- For more impaired populations, tools that include more basic tasks will be more useful, such as the DEMMI [61], which also includes bed mobility. In more able populations, tools that include more challenging tasks can be used such as the Berg Balance Scale [62], which also includes single leg stance, turning and stepping onto a stool.
- It may also be useful to assess rising from the floor and dual task activity performance. Other tests used in gait and balance assessment include the CST [42], One Leg Stand [63], Functional Reach [64], Dual Task tests [65], the Tinetti test/POMA (balance and gait subscales) [66], the MiniBEST Test [67] and the Physiological Profile Assessment Performance test [68].
- The choice of test will also depend on equipment availability, resources, space and time available as well as familiarity and training. The Rehabilitation Measures Database provides a useful description of options and their clinimetric properties (www.sralab.org/rehabilitation-measures).
- A structured assessment of gait by a trained clinician can be helpful in directing investigations for underlying conditions that may increase falls risk by impairing gait [69, 70].
- The Floor Transfer Test is a reliable and valid measure for screening for physical disability, frailty and functional mobility [71, 72].

Medication assessment

Strong recommendation. Assess for fall history and the risk of falls before prescribing potential fall risk increasing drugs (FRIDs) to older adults (Appendix 2, available in *Age and Ageing* online). **GRADE: 1B.**

Strong recommendation. Use a validated, structured screening and assessment tool to identify FRIDs when performing a general medication review or medication review targeted to falls prevention. **GRADE: 1C.**

Recommendation details and justification

- There is strong evidence that certain medications' use increases fall risk in older adults, that a structured approach improves FRID identification and that medication review and deprescribing of FRIDs can significantly reduce fall risk [73–79].
- Before prescribing potential FRIDs to older adults, enquire about falls and consider the relative benefits and risks of initiating therapy. For example, the following initiatives have listed FRIDs: Centre for Disease Control and Prevention's STEADI initiative [80] and STOPPFall [76].
- Medication-review tools such as the STOPP/START, STOPPFall, STOPPFrail, Beers Criteria, FORTA or Web-based Meds 75+ Guide [6, 76, 81–83] are suitable to systematically identify medication-related fall risks in older adults and to optimise deprescribing.
- STOPPFall is a screening tool used to identify drugs that increase the risk of falls in older adults [84]. An online interactive version of the STOPPFall deprescribing tool is freely available: https://www.eugms.org/research-cooperation/task-finish-groups/frid-fall-risk-increasing-drugs.html.

Cognitive assessment

Strong recommendation. Assessment of cognition should be included as part of a multifactorial falls risk assessment in older adults (Appendix 2, available in *Age and Ageing* online). **GRADE: 1B.**

Recommendation details and justification

- Dementia and mild cognitive impairment double the risk of falls and falls-related injuries including hip fractures, fractures of the arm and head injuries [41].
- Low cognitive performance in older adults, particularly of executive function, even in the absence of a known cognitive impairment or formal diagnosis of dementia, is

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associated with an increased risk of falls, justifying cognitive testing as part of comprehensive falls risk assessment in all older adults [85].
- Because executive dysfunction is strongly associated with falls, global cognitive screening tests that include executive function components such as the Montreal Cognitive Assessment (MoCA) or specific executive function tests, such as the Trail Making Test (TMT) part B, can be used [86].
- Training on the administration of the cognitive tests used, to improve execution is recommended.

Concerns about falling and falls

Strong recommendation. Include an evaluation of concerns about falling in a multifactorial falls risk assessment of older adults (Appendix 2, available in *Age and Ageing* online). **GRADE: 1B.**

Strong recommendation. Use a standardized instrument to evaluate concerns about falling such as the Falls Efficacy Scale International (FES-I) or Short FES-I in community-dwelling older adults. **GRADE: 1A.**

Recommendation details and justification

- We recommend clinicians adopt a holistic approach, combining concern about falling with balance and/or gait assessment as this will help to put the degree of concern in context, when assessing older adults in the community. Concerns about falling—or the closely related notion of fear of falling—shows heterogeneous results in predicting future falls in the community. The rationale for including concerns about falling as part of a comprehensive fall assessment is that this is a measure of an older adult's perceptions about the falls they have experienced, the impact falls have had on their quality of life, their openness to various interventions (e.g. an older adult inappropriately very fearful of falling may be reluctant to increase their physical activity and follow an exercise programme if this is not dealt with), and as a treatment outcome in a subset of older adults.
- The Falls Efficacy Scale International (FES-I) and the Short Falls Efficacy Scale International (Short FES-I) have a strong to moderate level of evidence for their use in older adults living in the community. There is evidence from a recent systematic review and meta-analysis of 59 studies that the FES-I and Short FES-I are reliable and valid tools when used with both healthy older adults and those with conditions that put them at a greater risk of a fall (e.g. multiple sclerosis, stroke, vestibular disorders, PD) [87]. Both instruments demonstrate good internal consistency, test–retest reliability, inter-rater reliability and construct validity in these populations [87].
- The complexity of the terms used for fall-related psychological effects arises from their different underlying constructs. These terms include 'concerns about falling', 'fear of falling', anxiety, 'balance-related confidence' and 'self-efficacy'. More recent models are linking anxiety, fear of falling and self-efficacy [88, 89].
- While fear of falling is the term used in much of the available peer-reviewed literature, making enquiries about concerns offers advantages to fear of falling. It is 'less intense and emotional (and therefore may be more socially acceptable for older adults to disclose)' [90], while fear has 'psychiatric connotations implying analogy to phobias which may or may not be accurate' [91].
- The older adult panel we consulted about the recommendations preferred the term concern over fear. Based on this, we recommend that clinicians use the term concerns about falling when making enquiries. This is also congruent with the wording of the recommended FES-I questionnaires (Appendix 2, available in *Age and Ageing* online).
- FES-I and Short FES-I are available free of charge in over 30 languages from www.fes-i.org and can be self-administered or done as part of a clinical interview. The 7-item Short FES-I can be useful for clinicians for a rapid assessment.

Cardiovascular assessment

Strong recommendation. Perform, as part of a multifactorial falls risk assessment, a cardiovascular assessment that initially includes cardiac history, auscultation, lying and standing orthostatic blood pressure, and surface 12-lead electrocardiogram (Appendix 2, available in *Age and Ageing* online). **GRADE: 1B.**

Strong recommendation. In the absence of abnormalities on initial cardiovascular assessment, no further cardiovascular assessment is required, unless syncope is suspected (i.e. described or witnessed syncope/pre-syncope or recurrent unexplained falls). **GRADE: 1C.**

Strong recommendation. We recommend that the further cardiovascular assessment for unexplained falls should be the same as that for syncope, in addition to the multifactorial falls risk assessment. **GRADE: 1A.**

Recommendation details and justification

- Recurrent unexplained falls are most likely associated with a cardiovascular cause [92–95].
- The commonest cardiovascular causes of falls in rank order are orthostatic hypotension, vasovagal syndrome, carotid sinus hypersensitivity, bradyarrhythmias and atrial and ventricular tachyarrhythmias [96].
- The investigation (and subsequent management and specialist referral criteria) of syncope, and therefore, recurrent unexplained falls can be performed according to locally applicable guidelines such as the 2018 European Society of Cardiology Guidelines for the diagnosis and management of syncope [94].
- If orthostatic hypotension is suspected but not detected using traditional methods—oscillometer or sphygmomanometer, referral for beat-to-beat orthostatic measurement is recommended as the association of falls with orthostatic hypotension measured using beat-to-beat methods is more consistent [97].
- If vasovagal syncope or delayed orthostatic hypotension is suspected and diagnostic uncertainty remains, older adults should be referred for head up tilt tests [94, 98].

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- If arrhythmias are suspected after clinical assessment, based on locally applicable guidelines individuals should be referred for external or internal cardiac monitoring [19, 94, 99].
- For assessment for orthostatic hypotension, individuals should be supine for at least 5 minutes before baseline blood pressure is recorded; on standing, blood pressure should be taken as soon as possible (40–60 seconds), followed by measurements at 1-minute intervals up to 3 minutes, or up to 5 minutes if symptoms suggested a delayed orthostatic hypotension response [94, 100].
- Orthostatic hypotension most commonly occurs as a result of dehydration, concomitant medications, autonomic dysfunction and with alpha synucleopathy diseases (such as PD, dementia with Lewy Bodies or multisystem atrophy). It is also common in older adults with hypertension [96, 101].
- Short-term 24–48 hours cardiac rhythm monitoring is not indicated unless events occur daily. Prolonged external or internal ambulatory cardiac monitoring is indicated if arrhythmias are suspected as a cause of falls or syncope, after clinical assessment [19, 94, 99].
- Older adults with unexplained syncope, suspected syncope or unexplained falls who require carotid sinus massage or head up tilt tests should be referred to an appropriate specialist, according to locally applicable guidelines [94].

Dizziness and vestibular disorders assessment

Expert recommendation. Routinely ask about dizziness symptoms, and undertake follow-up assessment as necessary to identify cardiovascular, neurological and/or vestibular causes (Appendix 2, available in *Age and Ageing* online). **GRADE: E.**

Recommendation details and justification

- Dizziness is a common complaint in older adults who fall, with different meanings between individuals, and often no single explanatory cause. Careful history taking is of particular importance. Presyncope and observable unsteadiness or ataxia may be present.
- Additionally, the vestibular system has a key role in the control of posture and gait, and there is evidence of a high incidence of both benign paroxysmal positional vertigo and vestibular dysfunction in those presenting with falls [102–105]. In younger adults, such disorders can often be identified in the clinical history by a reported sensation of vertigo with clear positional or motion-provoked triggers. Identifying cases of vestibular dysfunction is more challenging in older adults due to more variable symptoms.
- Where vertigo is reported, positional tests should be used to identify cases of benign paroxysmal positional vertigo from non-cases (e.g. Dix-Hallpike, Head Impulse Test); however, the sensitivity of case-finding algorithms based purely upon symptoms compared with screening with positional testing in older adults is unknown [102–105].

Vision and hearing assessment

Expert recommendation. Enquire about vision impairment as part of a multifactorial falls risk assessment, measure visual acuity and examine for other visual impairments such as hemianopia and neglect where appropriate. **GRADE: E.**

Expert recommendation. Enquire about hearing impairment as part of a multifactorial falls risk assessment, measure and examine for hearing impairments and refer to a specialist where appropriate. **GRADE: E.**

Recommendation details and justification

- Impaired vision is an important and independent risk factor for falls in older adults who live in the community. Vision loss is the third most common chronic condition in older adults, and about 20% of people aged 70 years or older have a visual acuity of less than 6/12 [106]. Many older adults wear spectacles with outdated prescriptions or no spectacles at all and would benefit from wearing new spectacles with the correct prescription. This indicates the importance of regular eye examinations to prevent vision-related impairment and improve the quality of life.
- Visual screening should not be limited to measurement of visual acuity and should incorporate contrast sensitivity and depth perception.
- Impaired hearing is an independent risk factor for falls in older adults [107]. Possible explanations for the association between hearing loss and falls include coexistent vestibular pathology that increases fall risk, reduction in cognitive capacity for maintaining balance given the cognitive load of hearing loss and a loss of auditory perception leading to reduced spatial awareness [108]. Hearing loss itself is a highly prevalent condition among older adults that can be readily treated with amplification
- Accessibility to hearing and visual assessments in LMIC should be enhanced and their additional benefit of falls prevention should be emphasised.

Delirium

Delirium, cognitive impairment and dementia are independent risk factors for falls in older adults in hospital settings, residential aged care, at home and in the community [78]. The key to preventing falls in older adults with these conditions is to deliver evidence-based, person-centred care. When delirium, dementia and cognitive impairment are managed well, falls are less prevalent [109]. Adapting the environment to promote safety and educating caregivers in strategies for safe mobility can also be of benefit in older adults with delirium. There is some evidence that staff education can help to reduce falls of hospitalised older adults experiencing delirium [110, 111]. Multidomain strategies which have been shown to reduce the risk of delirium include cognitive stimulation, daily orientation, early mobilisation, vision and hearing, fluid management, constipation management, feeding assistance, sleep and family involvement [112, 113]. At present, there is evidence that these strategies might reduce falls, therefore they should be considered as part of

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a comprehensive care package for older adults in hospital [114]. Promoting mobility to maintaining independence is important, yet there is a tension that needs to be managed between promoting mobility and preventing falls, especially in very frail older adults [115].

Urinary symptoms and incontinence assessment

Expert recommendation. Enquire about urinary symptoms as part of a multifactorial falls risk assessment **GRADE: E.**

Recommendation details and justification

- A recent comprehensive systematic review and meta-analysis included 38 articles (total participants 230,129) and found that urinary incontinence was significantly associated with falls [116]. Subgroup analyses based on the age and sex of the participants revealed a significant association between urinary incontinence and falls in older (≥65 years) participants, and in both men and women.
- A subgroup analysis showed that a significant association between urinary incontinence and falls was observed in older adults with both urgency urinary incontinence and stress urinary incontinence [116]. A recent systematic review and meta-analysis also showed that nocturia is associated with a 1.2-fold increased risk of falls and possibly a 1.3-fold increased risk of fractures [117].
- The 3IQ screening questions for urinary incontinence can help to differentiate between stress, urge and mixed types of incontinence [118].

Pain assessment

Expert recommendation. Enquire about pain as part of a multifactorial falls risk assessment, followed as indicated by a comprehensive pain assessment. **GRADE: E.**

Recommendation details and justification

- Pain is an established risk factor for falling [107, 119]. Symptoms of pain are common in older adults, with over 60% of community dwelling older adults reporting pain, mostly in multiple sites [120]. The most prevalent condition resulting in pain is arthritis, which is an independent risk factor for falling [107]. Other chronic conditions resulting in pain in older adults include diabetic complications, cancer-related pain and post-stroke pain [121].
- A comprehensive pain assessment is needed to guide appropriate management. This includes defining its cause, type (nociceptive, neuropathic) and intensity by using a pain rating scale designed for older adults [122].

Environmental assessment

Strong recommendation. Identification of an individual's environmental hazards where they live and an assessment of their capacities and behaviours in relation to them, by a clinician trained to do so, should be part of a multifactorial falls risk assessment. **GRADE:1B.**

Recommendation details and justification

- Environmental factors are important in many falls. Environmental risk factors are influenced by the interaction between a person's exposure to environmental fall hazards (such as slippery stairs, poor lighting at entrances, lack of a grab rail), risk taking behaviour (such as clutter in walkways, unsafe climbing on chairs or ladders) and their physical capacity [123].
- Assessment by a clinician trained to do so (e.g. occupational therapists) needs to include the assessment of environmental hazards, capacities and behaviours of the individual and an understanding of the effect of the environment on function [77, 124].
- Other elements considered crucial are using an assessment tool validated for the broad range of home fall-hazards and fall risk assessment along with consideration of the functional capacity of the person (including habitual behaviours, functional vision, cognition and mobility) within the context of their environment [77, 124]. Recommended assessment tools for hazards are the Westmead Home Safety Assessment and the Falls Behavioural Scale for the Older Person [125, 126].
- If applicable, assess for appropriateness and proper use of walking aids including that the aid is not damaged or unsafe.
- In LMIC, addressing environmental hazards by trained clinicians is also considered a priority. Due to lack of resources in some LMIC, training of personnel to conduct assessments, appropriate prescription of walking aids, along with the availability of affordable equipment and maintenance should be emphasised in LMIC settings.
- The wording and grading of these recommendations are informed by a forthcoming update of the Cochrane systematic review [127].

Depression assessment

Expert recommendation. Enquire about depressive symptoms as part of a multifactorial falls risk assessment, followed by further mental state assessment if necessary and referral to a specialist where appropriate. **GRADE: E.**

Recommendation details and justification

- Depression is a common and important cause of morbidity and mortality in older adults worldwide, affecting around 10–15% of community-dwelling older adults. If left untreated, symptoms may persist for years. Both untreated depression and antidepressant use contribute to fall risk [107, 128]. For details on fall risk and antidepressant use, we refer to the outcomes and recommendations of WG 2 (fall-risk increasing drugs, FRIDs).
- Untreated depression is independently associated with increased fall risk: a meta-analysis showed a 37% of increased risk [107].
- The pathophysiologic mechanisms underlying the association between depression and falling are complex. Major mechanisms are psychomotor retardation,

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deconditioning, gait and balance abnormalities, impaired sleep and impaired attention. Often, multiple pathways interact and co-occur. Also, excessive concern about falling contributes to increased fall risk in depressed older adults. It negatively influences gait and balance and thereby increases tendency to fall [128].
- Antidepressants are FRIDs and contribute to (or cause) falling through causing sedation, impaired balance/reaction time, orthostatic hypotension, hyponatremia, cardiac conduction delay/arrhythmia and/or drug-induced Parkinsonism [128].
- Screening for depression as a risk factor for falls should be considered in older individuals in LMIC. Strategies to raise awareness and reduce stigma of depression and mental illness are needed in these countries. However, longitudinal and interventions studies are required before firm recommendations can be made in this area.

Nutritional assessment including vitamin D

Expert recommendation. Assess nutritional status including vitamin D intake as part of a multifactorial falls risk assessment, followed by supplementation where appropriate. **GRADE: E.**

Recommendation details and justification

- Nutritional assessment is an important part of the multifactorial falls risk assessment and should include assessment of adequate vitamin D intake and serum 25 OH vitamin D levels, when appropriate, and substance abuse and excessive alcohol intake, as well.
- A recent systematic review showed that both nutritional status and body mass index (BMI) are associated with the risk of falls in community-dwelling older adults. In particular, being at risk of malnutrition or being malnourished may increase the risk of a fall. BMI showed a U-shaped association with the risk of falls, and BMI values between 24.5 and 30.0 were associated with the lowest risk of fall [129].
- Poor nutritional status can be both a consequence of underlying morbid conditions and a causal factor of pathological ageing process and higher mortality. Underweight and undernourished individuals may both have increased risk of falls due to sarcopenia, impaired mobility and walking instability, as well as worse functional and clinical status. On the other hand, excess weight in obese people may also have a negative impact on postural stability, self-sufficiency and physical activity, all factors that may be associated with the falls [129].
- Malnutrition assessment can be performed by using validated tools, such as the Mini Nutritional Assessment (MNA) [130].

Assessment of fracture risk

- Osteoporotic fractures are associated with high morbidity, mortality and cost to society in terms of the use of health and social services. Both bone fragility and propensity to fall are important determinants of fracture risk. International consensus advises that fracture prevention should include identification of older adults at high falls risk, interventions to reduce that risk, identifying those with bone fragility (including osteoporosis) and instituting measures to reduce fracture risk (both pharmacological and non-pharmacological [131]).
- Adults with low trauma fractures and those with osteoporosis should have a falls risk assessment. Fracture liaison services, which identify people with recent fractures, are now in place in many areas and their remit should include identification of those at high falls risk in addition to investigating for osteoporosis [132].
- Conversely, those identified as having a moderate to high falls risk should have a bone health assessment using local protocols. In this regard, fracture risk assessment tools such FRAX, Garvan and QFracture can be employed to identify older adults at high fracture risk, and bone densitometry can be used to confirm osteoporosis [133, 134]. International consensus osteoporosis management guidelines are in place to guide treatment [135].
- Individuals aged 60 years and over with pre-existing comorbidities and increased risk of fractures should be assessed regularly for modifiable falls risk factors in LMIC. Furthermore, in individuals with fractures or increased risk of fractures within LMIC, falls risk assessments should be incorporated into their management strategies.

Management and interventions

Management of older adults at low fall risk

Expert recommendation. Provide advice on how to maintain safe mobility and optimise physical functioning to older adults at low risk of falls from a clinician trained to do so. Such advice should consider the circumstances, priorities, preferences and resources of the older adult. This advice should reinforce health promotion/prevention messaging relevant to falls and fracture risks such as those on physical activity, lifestyle habits and nutrition including vitamin D intake (see algorithm, Figure 1). **GRADE: E.**

Recommendation details and justification

- Older adults classified as low risk by our algorithm have an incidence of a single fall in the next year of approximately 20–30% [2, 136], but the individual risk varies according to easily recognisable attributes such as vision, hearing and foot problems, but also less measurable factors such as: context (what does the individual need to do and in what environment?); behaviours (is the person cautious, impulsive, erratic?); and, transient factors such as illness, or absence of usual support. Our recommendations promote a generic primary preventative approach which can be adapted to individual circumstances and characteristics.

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- There is a growing body of evidence showing a relationship between physical activity and fall risk at a population level, and evidence for effective interventions on habitual physical activity and exercise programmes for older adults at low to intermediate risk for falls [2, 137]. While the interventions may well merit a higher grade, this recommendation on provision of advice is at Grade E, as there is insufficient evidence on how this is best provided, taking into consideration the potential risks, including falls, to habitually inactive people who embark on activities such as brisk walking.
- Recommendations on types and amounts of habitual physical activity and the avoidance of being sedentary are provided by national and international guidelines, such as the World Health Organisation [138] guidelines on physical activity and sedentary behaviour, the American College of Sports Medicine, and the UK Chief Medical Officers' Physical Activity Guidelines.
- The WHO and the UK Physical Activity guidelines take a life course approach and include a specific focus on functional mobility and falls, as well as considering the merits of various activities and sports. The American College of Sports Medicine provides a wide range of exercise prescriptions for various situations.
- The WHO and the UK Physical Activity guidelines recommend activities which challenge balance and include resistance training twice per week. General physical activity alone (e.g. walking) is unlikely to prevent falls.
- We recommend that, where possible and safe, older adults should aim to participate in 150–300 minutes per week of intermediate-intensity physical activity or 75–150 minutes per week of vigorous-intensity physical activity. There is evidence from observational studies that meeting physical activity guidelines of moderate to vigorous intensity activity reduces future falls risk and reduces the chance of an individual falling, although these findings remain uncertain [139]. This promotion of healthy lifestyle can be expected to decrease fall risk indirectly through its positive impact on deconditioning, frailty, sarcopenia and cardiovascular health.
- Uptake and adherence to exercise interventions and to increasing habitual physical activity may be helped by behaviour-change approaches such as coaching, supervision, group activity and educational material.
- Generic health promotion guidelines include advice on lifestyle habits, periodic vision and hearing checks and footcare. WHO has provided guidelines on primary and community-based assessment and first level responses across five key domains which are collectively predictive of future disability [140].
- Falls prevention advice in low risk older adults may include referral to local community health promotion or 'ageing well' programmes where available.
- We recommend inclusion of fracture risk management (including need for osteoporosis treatment) to reduce fracture risk.

Interventions for community dwelling older adults at intermediate fall risk

Expert recommendation. Offer an exercise programme based on an individual assessment and according to the recommendations in the Exercise Interventions section (see algorithm, Figure 1). **GRADE: E.**

Recommendation details and justification

- Supervised exercises that target balance and strength prevent falls [141]. Fall prevention exercise should focus on maintaining balance during functional tasks needed for daily life. The most relevant tasks for individuals vary according to lifestyle, domestic needs, physical function, environment and preferences.
- Effective fall prevention programmes include individualised exercises that enable or support daily tasks or similar movements. Such exercises include sit-to-stand, squats, reaching which standing, standing with a narrower base of support, stepping and walking in different directions, speeds, environments and while dual tasking. Weights can be added to some exercises to increase difficulty. Exercises should be challenging (to enhance neural, muscular and skeletal function) but safe (to prevent injuries) and achievable (for sufficient dose and sense of mastery). Exercises should be reviewed and progressed regularly to ensure that optimal level of difficulty is maintained.

Multidomain interventions for community dwelling older adults at high fall risk

Developing a person-centred intervention

We recommend that a falls prevention plan be based on a holistic multifactorial falls risk assessment as previously described with shared decision being used to develop agreed goals and interventions (see Algorithm, Figure 1). This means paying attention to the entire clinical assessment and considering the priorities, beliefs, resources of the older person and other relevant individuals, such as caregivers in order to develop a feasible plan that addresses individually relevant risk factors in the context of other geriatric syndromes and conditions (Appendix 2, available in *Age and Ageing* online).

Strong recommendation. A care plan developed to prevent falls and related injuries should incorporate the values and preferences of the older adult. **GRADE: 1B.**

Strong recommendation. When creating falls prevention care plans for older adults with cognitive impairment, both the older adults' and their caregivers' perspectives should be included as it improves adherence to interventions and outcomes. **GRADE: 1C**.

Recommendation details and justification

- Engaging older adults in a discussion about their preferences coupled with shared decision-making can improve

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adherence with recommendations and outcomes [142]. The aspects identified in a scoping review of 52 studies included: the meaning of falls, perceived causes, assessment of personal risk, reaction to this perceived risk and priority given to falls as a health concern.

- For those with cognitive and functional limitations, the development and then implementation of a care plan to prevent falls and related injuries will also require the involvement and training of informal (unpaid) and/or formal (paid) caregivers.
- Fall prevention interventions can be time-consuming, intensive and of long duration. An older adult should be informed of both benefits and burdens of falls prevention therapy, to enable them to make an informed choice about participation. An older adult's knowledge and attitudes about falls and the priority they give to their prevention will determine whether, or what type, of therapeutic interventions they would be willing to engage in.

Multidomain falls risk intervention

Strong recommendation. Offer multidomain interventions, informed by a multiprofessional, multifactorial falls risk assessment to community-dwelling older adults identified to be at high risk of falling (Appendix 2, available in *Age and Ageing* online). **GRADE: 1B.**

Recommendation details and justification

- Multidomain interventions encompass two or more components, individually targeted to the older adult based on findings from a multifactorial (or comprehensive) falls risk assessment. It is not a standardized set of interventions applied to everyone.
- A multidomain intervention in older community-dwelling adults at a minimum should include: strength and balance exercise, medication review, management of orthostatic hypotension and cardiovascular diseases, management of underlying acute and chronic diseases, optimising vision (cataract surgery for those who need it, refraction) and hearing, addressing foot problems and appropriate footwear, vitamin D supplementation, optimising nutrition, continence management, interventions to address concerns about falling, individual education and environmental modification (including assisted devices and use of technology).
- The recommended components are derived from the following literature: a 2021 comprehensive systematic review and network meta-analyses [79] on interventions for preventing falls in community dwelling older adults, two Cochrane systematic reviews [77, 143] assessing multidomain interventions for prevention of falls in older adults living in the community and two WHO summary reports on falls prevention in community dwelling older persons [24, 144].
- The findings of two recent pragmatic RCTs [145, 146] suggest that both exercise and multifactorial strategies that have been shown to reduce falls in efficacy trials cannot easily be applied with sufficient fidelity through current existing services (RCTs based in UK and USA, respectively) to achieve equivalent benefits. These trial outcomes suggest the importance of the provision of sufficient resources to roll out and support high-quality sustainable delivery of fall prevention programmes that are in line with previous high quality successful efficacy trials [147, 148]. Though disappointing, the results of these two pragmatic trials did not substantively alter network meta-analysis results or our recommendations [79].

Component interventions

Exercise and physical activity interventions

Strong recommendation. Exercise programmes for fall prevention for community-dwelling older adults that include balance challenging and functional exercises (e.g. sit-to-stand, stepping) should be offered with sessions three times or more weekly which are individualised, progressed in intensity for at least 12 weeks and continued longer for greater effect (Appendix 2, available in *Age and Ageing* online). **GRADE: 1A.**

Strong recommendation. Include, when feasible, of Tai Chi and/or additional individualised progressive resistance strength training. **GRADE: 1B.**

Recommendation details and justification

- The first recommendation applies to all older adults regardless of their assessed risk of falling or age. We recommend programmes that include balance and functional exercises (e.g. sit-to-stand, stepping): **GRADE: 1A,** programmes that include multicomponent exercise (i.e. multiple types of exercise), most commonly balance and functional exercises with strength exercise**: GRADE: 1B,** and Tai Chi: **GRADE: 1B** [137, 141].
- Exercise programmes that need to be of sufficient intensity and duration should be delivered in a way that ensures safety and considers functional abilities.
- Exercise programmes should be delivered by appropriately trained professionals who can adapt exercises appropriately to functional status and co-morbidities. These professionals could be physiotherapists, exercise physiologists or kinesiologists, trained exercise instructors or other allied health professionals. We acknowledge that this will be difficult in some settings but note that the vast majority of interventions found to be effective in trials used trained providers [137, 141].
- Exercise needs to be progressive initially and maintained once a plateau is reached.
- Benefits of exercise are lost on cessation so opportunities to continue with appropriate activity at the end of the programme are important. If individuals withdraw due to concurrent health issues or caring duties, they should be encouraged to return and programmes should be modified to ensure that the difficulty level and dose are appropriate [137, 141].

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- Exercise programmes can be delivered in a group or taught and supported as an individualised home exercise programme or a mix of both in order to achieve an effective dose [137, 141].
- Group exercise, individualised home exercise or a combination of both may lead to better exercise programme adherence. In people with more severe cognitive impairment, smaller group or individual supervision may be necessary [149, 150].
- Higher supervision levels or smaller group numbers are recommended for those at higher risk of a fall including those who are frail [137, 141].
- An important aspect to consider is avoiding 'long-lies' and harm from being unable to get up from the floor. One in 8 older adults who fall report lying on the floor for more than 1 hour [151] and in those over the age of 90, up to 80% cannot rise from the floor after a fall [35]. Lying on the floor for more than an hour is associated with dehydration, electrolyte disturbance, renal failure, hypothermia, pneumonia and urinary tract infections, skin damage and pain [152, 153], and declines in mobility and restrictions in activity, probably due to fear of a repeat fall. 'Lift and assist' call outs should trigger falls prevention interventions [154]. Pendent or wrist alarms, telehealth falls detectors, cord alarms or mobile telephones are also important in enabling people to call for help if they cannot get up if they live alone (see section on technology) [35]. However, the oldest old often still lie on the floor for a long time before they use a call alarm so it is important to help them regain this skill if they have had a previous long-lie.
- Regaining the skill to rise from the floor is most successfully re-learnt through practice of each of the specific movements required (often called backward-chaining) where the last step in the chain is taught first [155]. Some falls prevention exercise programmes also have a specific focus on this skill and have shown success in regaining this function [156].

Medication interventions

Strong recommendation. A medication review and appropriate deprescribing of FRIDs should be part of multidomain falls prevention interventions (Appendix 2, available in *Age and Ageing* online). **GRADE: 1B.**

Strong recommendation. We recommend that in long-term care residents, the falls prevention strategy should always include rational deprescribing of fall-risk-increasing drugs. **GRADE: 1C.**

Recommendation details and justification

- Medication review with the aim of deprescribing FRIDs is a standard component of multidomain interventions to prevent falls, which have been proven effective in reducing the rate of falls (for details, we refer to WG 10) [24, 77]. It has also been shown to be one of the effective components of a multidomain intervention in a recent systematic review and network meta analyses [79].
- Older adults characteristics, including frailty status, polypharmacy, co-morbidities, life expectancy, individual preferences and other geriatric syndromes, should be considered when performing a medication review as part of shared decision-making approach [157].
- Successful implementation of deprescribing interventions to reduce risk of falls in older adults is supported by education of the older adult, family members and health care professionals, and ongoing monitoring and documentation [76, 158].
- Shared decision-making results in better-informed older adults who tend to opt for deprescribing more often. Furthermore, shared decision-making improves compliance.

Cardiovascular interventions

Strong recommendation. Management of orthostatic hypotension should be included as a component of a multidomain intervention (Appendix 2, available in *Age and Ageing* online). **GRADE: 1A.**

Strong recommendation. Interventions for cardiovascular disorders identified during assessment for risk of falls should be the same as that for similar conditions when associated with syncope, in addition to other interventions based on the multifactorial falls risk assessment. **GRADE 1B.**

Recommendation details and justification

- Whereas many multidomain fall prevention programmes have included strategies to treat orthostatic hypotension, including modification of possible culprit medications, rehydration, compression garments and medications (e.g. fludrocortisone and midodrine), there are no single intervention studies for orthostatic hypotension in falls prevention. In older adults with hypertension, symptoms may be ameliorated by the judicious use of antihypertensive medications titrated very slowly and with careful monitoring after changing the dose.
- For the management of syncope, we advise following local syncope guidelines (e.g. European Cardiac Society Task force on Syncope [94]). Many multifactorial fall prevention programmes that have shown benefit for fall prevention have included strategies to modify orthostatic blood pressure.
- The presence of more than one cardiovascular risk factor for falls is not uncommon. Clear causality for a single risk factor may be difficult to establish; therefore, all modifiable cardiovascular risk factors should be treated.
- Interventions for bradycardic disorders (sinus node disease, atrioventricular conduction disorders, vasovagal syndrome and carotid sinus syndrome) and tachyarrhythmias (atrial fibrillation, supraventricular and ventricular tachycardia) include modification of culprit medications, specific anti-arrhythmic medication and, in some cases, implantable devices (such as pacemakers and implantable cardioverter-defibrillators) and are as per local syncope guidelines.

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Telehealth and technology interventions

Expert recommendation. Use telehealth and/or smart home systems (when available) in combination with exercise training as part of falls prevention programmes in the community (Appendix 2, available in *Age and Ageing* online). **GRADE: E.**

Conditional recommendation. Current evidence does not support the use of wearables for falls prevention. However, emerging evidence show that when wearables are used in exercise programs to prevent falls, they may increase participation**. GRADE: 2C.**

Recommendation details and justification

- There is emerging evidence in research settings that using wearable technology, i.e. devices worn on the body, to detect and prevent falls, could be efficacious for detection and prevention [159–171].
- A recent systematic review and meta-analysis [172] that included 31 studies and a total of 2,500 older adults from 17 countries found that tele-health (telephone-based education) combined with exercise training were able to reduce fall risk by 16%. Notably, despite not being statistically significant, telehealth alone showed a point fall risk reduction of 20% in this meta-analysis [172].
- A recent study showed [173] that for participants from the community who followed an exercise programme that included aerobic exercise or resistance training, those participants using a wearable device for physical activity monitoring had fewer falls compared with those not using the wearable device, suggesting better intervention adherence.
- For optimal use of resources, it is advised to withhold this recommendation for LMIC until evidence on effectiveness and implementation of technology in LMIC settings become available.

Environmental interventions

Strong recommendation. Recommendations for modifications of an older adult's physical home environment for fall hazards that consider their capacities and behaviours in this context should be provided by a trained clinician, as part of a multidomain falls prevention intervention. **GRADE: 1B.**

Recommendation details and justification

- Interventions to reduce fall-hazards in and about the home can reduce the rate of falls and the number experiencing a fall [124, 127].
- The greatest reductions are seen when the intervention is delivered to those at highest risk of falling [77, 124, 127, 174, 175].
- Environmental assessment should be offered to older adults assessed as at high falls risk, such as older persons with a history of falling in the past year and an impairment in daily living activity or recently hospitalised from a fall, and those with severe vision impairment [77, 124, 127].
- Evidence from randomised trials also provides evidence that the intervention is more effective when the aim of the visit, the assessment process and the intervention are highly tailored to falls, the outcome of interest. It is also more likely effective when delivered by an occupational therapist [124, 127].
- Criteria for a quality home-fall hazard intervention include the use of a problem-solving approach involving the participant in identifying hazards and prioritising action, education relevant to falls, function and hazards; an action plan for removing or changing hazards and modifying risky behaviours; and adequate follow-up and support for adaptations and modifications [124, 125].

Vestibular interventions

Expert recommendation Managing vestibular issues should be considerd as part of multifactorial approach. **GRADE: E**

Recommedation details and justification

- Particle repositioning (Epley) manoeuvres are an effective treatment for benign paroxysmal position and vertigo [176] and may reduce falls rates [177, 178], but evidence is limited. Vestibular rehabilitation therapy improves postural and gait stability in cases of vestibular dysfunction [179] although the optimal approach is still unclear as is the effect on falls rates.
- As the risks of harm are low and improvements in health-related quality of life are potentially high, therapeutic interventions should always be sought where vestibular benign paroxysmal position and vertigo or vestibular dysfunction is identified. These treatments require trained staff but are low-cost and could be potentially applied in low resource settings.

Pain interventions

Expert recommendation. Adequate pain treatment should be considered as part of the multidomain approach. **GRADE: E.**

Recommendation details and justification

- Adequate pain relief is likely to reduce the risk of falling while physically active. A personalised approach considering both non-pharmacological and pharmacological options is necessary to minimise risk of adverse events [180, 181]. Non-pharmacological approaches include physiotherapy and cognitive behavioural therapy.
- Some analgesics, and in particular opioids, increase fall risk [182]. The mechanisms of fall risk associated with opioids in older adults include sedation, orthostatic hypotension and hyponatremia. Therefore, while the STOPP/START criteria suggest use of opioids for severe pain or when paracetamol and NSAIDs are ineffective [6], these potential adverse effects need to be anticipated, identified and managed. Weak opioids are preferably avoided, as the adverse events risk may outweigh the benefit. For neuropathic pain, first line treatment includes serotonin norepinephrine reuptake inhibitors, gabapentinoids and transdermal lidocaine or capsaicin [183]. For all analgesics,

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it is advisable to start slow, go slow and monitor efficacy and adverse effects. For general deprescribing recommendations, we refer to WG2 recommendations.

Concerns about falling and falls interventions

Strong recommendation. We recommend exercise, cognitive behavioural therapy and/or occupational therapy (as part of a multidisciplinary approach) to reduce concerns about falling in community-dwelling older adults (Appendix 2, available in *Age and Ageing* online). **GRADE: 1B.**

Recommendation details and justification

- Different types of interventions can be effective in reducing concerns about falling, such as exercise interventions [184–186], cognitive behavioural therapy [187, 188] and occupational therapy [189], with small to moderate effect sizes. Two recent systematic reviews highlighted that supervised holistic exercise interventions in community settings, such as Pilates or yoga, had the largest effect sizes in reducing concerns about falling compared with other interventions [185, 186].
- Existing fall prevention strategies, i.e. exercise interventions, can reduce concerns about falling in older adults.
- Cognitive behavioural therapy and occupational therapy interventions can also reduce concerns about falling and should be considered as part of a multidomain fall prevention approach when available.

Vision interventions

Expert recommendation. Management of impaired vision should be considered as part of the multifactorial approach. **GRADE: E**.

Recommendation details and justification

- Evidence from randomised controlled trials and prospective studies indicates cataract surgery for the first eye, [190] and both eyes [191] and achieving optimal safe functional vision by active older adults avoiding the wearing of multifocal glasses when outside [192] are effective fall prevention strategies.
- Occupational therapy interventions involving home hazard reductions are also effective in preventing falls in older adults with severe visual impairments [193].
- Although interventions involving vision assessment and provision of new spectacles undoubtedly improve performance in visual tests in community-dwelling older adults, such interventions have not yet been shown to reduce the risk of falls [194]. In fact, it is recommended that optometrists counsel their clients about likely short-term increased fall risk when dispensing new prescription glasses.

Vitamin D interventions

- If older adults are considered at risk of deficiency, daily vitamin D supplementation should be recommended in accordance with national nutrition guidelines, but current evidence does not support universal vitamin D supplementation for preventing falls.
- Vitamin D supplementation of ≥1,000 IU daily did not reduce falls in older community dwelling adults who achieved mean 25 (OH) vitamin D levels of ≥30 ng/ml versus those with levels <30 ng/ml. [195]. The key is to target its use in a manner that will confer benefit. Many studies on vitamin D supplementation and outcomes lack information on 25 (OH) vitamin D levels, thereby limiting definitive conclusions about the actual benefit of vitamin D supplementation.
- Very frail individuals and those living in care homes are more likely to be frankly vitamin D deficient, and these are the individuals in whom supplementation is most likely to yield benefits. There is evidence that vitamin D can prevent falls in residential care, probably because levels are very low among residents [78].
- Recent evidence from the VITAL trial shows that 2,000 or 4,000 IU daily is not harmful [196]. For older adults at increased risk for vitamin D deficiency, it is still reasonable to take 800–1,000 IU vitamin D per day, following established international recommendations [197–199].

Falls in hospitals

Risk stratification and assessment

Conditional recommendation. Perform a multifactorial falls risk assessment in all hospitalised older adults >65 years of age. We recommend against using scored falls risk screening tools in hospitals for multifactorial falls risk assessment in older adults (Appendix 2, available in *Age and Ageing* online). **GRADE: 2B.**

Strong recommendation. We recommend using the FES-I or especially the Short FES-I for assessing concerns about falling in acute care hospitals. **GRADE: 1B.**

Expert recommendation. We recommend conducting a post-fall assessment in hospitalised older adults following a fall in order to identify the mechanism of the fall, any resulting injuries, any precipitating factors (such as new intercurrent illness, complications or delirium), to reassess the individual's fall risk factors, and adjust the intervention strategy accordingly. **GRADE: E.**

Recommendation details and justification

- Falls risk screening tools and multifactorial falls risk assessments are sometimes used interchangeably, but there are substantial differences. There is a case for dis-investing from fall risk screening tool scoring in the hospital setting as it does not reduce falls and takes valuable time. Falls risk assessment is a more detailed process used to identify underlying risk factors and inform the development of a care plan to reduce falls and injuries. Falls risk assessments should be reviewed if there is a change in a individual condition or if the older adult falls.
- A stepped-wedge, cluster-RCT investigating the impact of removing a falls risk screening tool from an overall falls risk

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assessment programme found no impact on the falls rate [200].
- Admission with a fall is defined as a severe fall incident in accordance with the risk stratification section and algorithm. Thus, older adults admitted with a fall are considered at high risk of a recurrent fall. Therefore, besides injury treatment, they should have the mechanism of the fall defined, and a multifactorial falls risk assessment. For details on the risk stratification and the multifactorial falls risk assessment, we refer to the respective sections.

Management and interventions

Strong recommendation. A tailored education on falls prevention should be delivered to all hospitalised older adults (≥65 years of age) and other high-risk groups (Appendix 2, available in *Age and Ageing* online). **GRADE: 1A.**
Strong recommendation. Personalised single or multidomain falls prevention strategies based on identified risk factors, behaviours or situations should be implemented for all hospitalised older adults (≥65 years of age), or younger individuals identified by health professionals as at risk of falls. **GRADE: 1C** (Acute care), **GRADE: 1B** (Sub-acute care).

Recommendation details and justification

- A Cochrane review of 24 RCTs found that a multifactorial falls risk assessment, followed by implementation of multidomain interventions, may reduce the rate of falls in hospitals, but the very low-quality evidence precluded a definite conclusion. Reduction in falls rates was judged to be more likely in rehabilitation or geriatric ward settings [78].
- The individual's cognitive status (i.e. delirium or dementia) should be considered when implementing the education programmes. Use of several education modes (e.g. face-to-face discussions, handouts, videotapes) should be considered [201].
- There is currently no robust research evidence to recommend the use of (i) bed/chair alarms, (ii) grip socks/non-slip socks for the purpose of falls prevention and (iii) the use of physical restraints when the sole purpose is falls prevention in hospitals.
- We recommend that all hospitals should have protocols, policies and/or procedures for the prevention of falls consistent with best practice guidelines [202–205].

Falls in care homes

Risk stratification and assessment

Strong recommendation. Do not perform falls risk screening to identify care home residents at risk for falls as all residents should be considered at high risk of falls (Appendix 2, available in *Age and Ageing* online). **GRADE: 1A.**
Strong recommendation. Perform a comprehensive multifactorial assessment at admission to identify factors contributing to fall risk and implement appropriate interventions to avoid falls and fall-related injuries in care home older adults. **GRADE: 1C.**
Expert recommendation. We recommend conducting a post-fall assessment in care home residents following a fall in order to identify the mechanism of the fall, any resulting injuries, to reassess the resident's fall risk factors, adjust the intervention strategy for the resident and avoid unnecessary transfer to hospital. **GRADE: E.**
Strong recommendation. We recommend using the FES-I or especially the Short FES-I for assessing concerns about falling in long-term care facilities. **GRADE: 1B.**

Recommendation details and justification

- All care home residents have a high risk of falling and may benefit from a multifactorial falls risk assessment and tailored intervention strategy.
- A multifactorial falls risk assessment at admission should include identifying falls risk factors and be repeated at least once annually or when the resident's condition changes, based on resource availability in each setting.

Management and interventions

Strong recommendation. Take a multifaceted approach to falls reduction for care home residents including care home staff training, systematic use of a multidomain decision support tool and implementation of falls prevention actions (Appendix 2, available in *Age and Ageing* online). **GRADE: 1B.**
Strong recommendation. Do not use of physical restraints as a measure for falls prevention in care homes. **GRADE: 1B.**
Strong recommendation. Perform nutritional optimisation including food rich in calcium and proteins, as well as vitamin D supplementation as part of a multidomain intervention for falls prevention in care home residents. **GRADE: 1B.**
Strong recommendation. Include the promotion of exercise training (when feasible and safe) as part of a multidomain falls prevention intervention in care homes. **GRADE: 1C.**

Recommendation details and justification

- The effectiveness of the multifaceted approach is based on one recent RCT [206]. The focus of implementation interventions should be on modifiable barriers and facilitators such as communication, knowledge and skills.
- Examples of physical restraint devices that should be avoided for the purpose of falls prevention include lap belts, bed rails, Posey restraints or similar, chairs with tables attached, and chairs or mattresses that are difficult to get out of such as recliner chairs, water chairs, bean bags and curved edge mattresses [207, 208]. Use of some of these items may be justified for other well-defined purposes, subject to careful assessment and review and when agreed with the resident or their advocates.
- Most residents in care homes are deficient in Vitamin D; therefore, we recommend vitamin D supplementation as

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part of a multidomain intervention for falls prevention in care home residents.
- Individual supervised exercises in care homes as a prevention strategy are effective and should be offered in those who are willing and able to participate [138]. Programmes likely to be the most effective when individualised to residents' functional abilities and preferences, incorporate a combination of exercises including balance and strength, as well as environmental modifications and staff training in falls prevention [209, 210].
- Given the high level of disability in this group, where possible, an exercise specialist (physiotherapist, exercise physiologist) should be consulted to provide specialist, tailored advice on exercise and physical activity [209].

Specific clinical populations

Older adults with the clinical conditions included in this section may have specific falls risk factors and other attributes associated with their condition, in addition to the general risk factors found in the older population. Identifying these condition-associated factors may help n deciding on the most appropriate individually tailored intervention, by (i) suggesting a focus on a specific condition-related impairment or capacity, (ii) altering the likelihood of benefit from an effective intervention for the general older population, or (iii) changing the feasibility or acceptability of an intervention.

The recommendations in this section should be considered along with the general guidelines on multifactorial falls risk assessment and interventions.

Falls and PD and related disorders

Falls are very frequent in older adults with PD and related disorders. Current clinical practice guidelines do not address this population and their distinctive risks for falls and fall-related injuries and emerging strategies to reduce falls in this group are available but not yet represented in general guidelines (Appendix 2, available in *Age and Ageing* online).

Assessment

Conditional recommendation. Consider a falls risk assessment for older adults with PD, including a self-report 3-risk factor assessment tool, which includes a history of falls in the previous year, freezing of gait (FOG) in the past month, and slow gait speed. **GRADE: 2B.**

Recommendation details and justification

- 'Freezing' is an important falls risk factor in older adults with PD and can be targeted with specific interventions [211–216].
- Both increases and decreases in falls rates have been observed in older adults with PD at a complex stage and/or cognitive impairment participating in exercise interventions [217, 218].
- Frequent falls may occur at an early stage of Parkinson's Plus syndromes and may merit specialist diagnostic assessment prior to considering a falls prevention intervention [219].
- The self-report 3-risk factor assessment tool can be found at A Self-Reported Clinical Tool Predicts Falls in People with Parkinson's Disease.

Management and interventions

Conditional recommendation. Older adults with PD should be offered multidomain interventions, based on PD specific assessment and other identified falls risk factors. **GRADE: 2B.**

Strong recommendation. Older adults with PD at an early to mid-stage and with mild or no cognitive impairment should be offered individualised exercise programmes including balance and resistance training exercise. **GRADE: 1A.**

Strong recommendation. Consider offering exercise training, targeting balance and strength to people with complex phase PD if supervised by a physiotherapist or other suitably qualified professional. **GRADE: 1C.**

Recommendation details and justification

- As a guide, a Movement Disorders Society Unified Parkinson's Disease rating Scale (MDS-UPDRS) motor score $\geq$34 can be regarded as complex stage PD [220].
- Supervision and modification of exercise interventions with PD individuals at a complex stage or with moderate or severe cognitive impairment requires specialist skills [221].
- Falls prevention exercise interventions should be integrated in general mobility and ADL rehabilitation [221].
- The effect of exercise on falls in older adults with PD that is more advanced (e.g. MDS-UPDRS motor score $\geq$ 34) and/or with substantial cognitive impairment is uncertain, but limited data indicate that minimally supervised exercise may increase the risk of falls [221].
- A higher level of supervision is necessary in older adults with intermediate cognitive impairment, as such individuals may not be able to follow a self-directed programme, and for safety [221].
- Specific subgroups of individuals (e.g. with FOG) may benefit from specifically targeted interventions (i.e. progressive balance and lower limb strengthening exercises) [212, 221].
- Although preliminary evidence on the effectiveness of (pro-)cholinergic medications on falls is promising, the design, outcome assessment and size of clinical trials to date are inadequate to produce definitive evidence [221, 222].
- Optimisation of medications to maximise motor function and minimise side effects (such as dyskinesia and hypotension) are critical first steps to falls prevention in PD treatment [221].

Stroke

Conditional recommendation. Older adults after a stroke should be offered participation in individualised exercise

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programmes aimed at improving balance/strength/walking to prevent falls. **GRADE: 2C.**

Recommendation details and justification

- The recommendation is based on systematic review evidence of health benefits of exercise aimed at improving strength/balance/walking in this clinical group [138].
- Falls prevention exercise should be integrated in more general mobility and ADL rehabilitation.
- Higher supervision is warranted when there are more impairments following stroke.

Mild cognitive impairment and dementia

Strong recommendation. Community-dwelling older adults with cognitive impairment (mild cognitive impairment and mild to moderate dementia) should be offered an exercise programme to prevent falls. **GRADE: 1B.**

Recommendation details and justification

- It has been shown that physical activity is feasible to perform by community-dwelling older adults with mild cognitive impairment or mild or moderate dementia [223–226].
- Exercise interventions were found to be more effective to prevent falls in community dwelling older adults than in those living in residential care suggesting that these interventions may be more effective for individuals with relatively well-preserved abilities [223, 224].
- Examples of effective stand-alone exercise interventions include balance training (e.g. Tai Chi) and multicomponent exercise (resistance + balance training) [227, 228].
- Clinicians can promote better adherence to a care plan designed to reduce falls in older adults with cognitive impairment by involving caregivers of patients with cognitive impairment in (i) identifying and modifying environmental falls risk factors; (ii) modifying lifestyle in terms of diet/nutrition and exercise routines to reduce falls risks; (iii) detailed recording of falls incidents and (iv) determining what is prioritised and acceptable to the adult living with cognitive impairment, including attitudes to risks.

Hip fracture

Strong recommendation. Older adults after sustaining a hip fracture should be offered an individualised and progressive exercise programme aimed at improving mobility (i.e. standing up, balance, walking, climbing stairs) as a fall prevention strategy. **GRADE: 1B.**
Conditional recommendation. Such programmes for older adults after a hip fracture are best commenced in hospital (**GRADE: 2C**) and continued in the community (**GRADE: 1A**).

Recommendation details and justification

- The strength of evidence for exercise in preventing falls in older adults after hip fracture is moderate [229]. This recommendation places a high value on preventing falls in this population with focus on mobility rehabilitation after hip fracture, including balance training and adequate pain control (see World Health Organisation guidelines). Furthermore, the minimal risk of harm contributes to the justification for a strong positive recommendation [230].

Falls in low- and middle- income countries

The majority of older adults alive today reside in a low- to middle- income country (LMIC). Correspondingly, as the population in LMIC ages at a rapid rate, the volume of research evidence emerging from these countries is now also increasing rapidly. Considering the heterogeneity of LMIC populations, as well as potential issues unique to these countries, this section specifically provides recommendations where LMIC may differ from higher income countries. The other recommendations in these guidelines apply to LMIC with the modifications and special considerations previously noted (Appendix 2, available in *Age and Ageing* online).
Strong recommendation. Local context needs to be considered when implementing fall prevention programmes in LMIC. **GRADE: 1B**

Recommendation details and justification

- We advise that in LMIC, community dwelling adults aged 60 years and over should be screened opportunistically for fall risk during any clinical encounter, at least once a year, by enquiring about the presence of falls in the past 12 months.
- Falls prevention should be included in LMIC policies using culturally sensitive strategies and tailored to local levels of expertise and resource availability.

Conditional recommendation. We conditionally recommend prioritising assessments of risk factors for cognitive impairment, obesity including sarcopenic obesity, diabetes, lack of appropriate footwear and environmental hazards as falls risk factors in LMIC. **GRADE: 2C.**

Recommendation details and justification

- This recommendation highlights prominent risk factors for falls in LMIC which should be prioritised as part of the multifactorial falls risk assessment for falls.
- The prevalence of obesity and diabetes is increasing rapidly in LMIC and these two conditions are more common in older adults. Available evidence from LMIC has linked obesity, particularly sarcopenic obesity, with falls, while diabetes emerges as a prominent risk factor in LMIC with high prevalence of diabetes [231–237].
- Cognitive impairment is also rising in prevalence in LMIC with their rapidly ageing populations [238]. Multifactorial falls risk assessments in LMIC should include cognitive assessment using non-educationally and culturally biased tools that have been evaluated locally.

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- Footwear and environmental issues differ in LMIC, and hence, assessment and educational interventions should consider the cultural differences in footwear practices as well as in environmental safety [239].

Expert recommendation. Clinicians and caregivers in LMIC settings should preferably use validated tools that are freely available in their country of residence to assess mobility and fall risk. **GRADE: E.**

Recommendation details and justification

- We recommend clinicians in LMIC begin with simple questions pertaining to fall history, followed by gait and balance assessments in individuals who screen positive to having had a fall in the past year.

Frailty, sarcopenia and falls

Falls are a common and important area of health care for older adults and relate closely, clinically and epidemiologically, to other common 'geriatric syndromes.' Here, we highlight sarcopenia and frailty for particular attention.

Frailty

Frailty is associated with an increased falls risk. Frailty is a state of increased vulnerability for developing dependency or mortality when exposed to a stressor. The prevalence for frailty is approximately 15% in the over 65 years of age group rises to more than 25% in those aged over 85 years, although the prevalence varies according to the definition and diagnostic methods used and the population studied [240]. A recent systematic review showed that frailty doubles the risk of recurrent falls while being pre-frail increases this risk by 30% [241]. Frailty has been associated with more injuries due to falls and hip fractures. As previously noted, our falls stratification algorithm includes frailty as marker of higher fall risk. A task force of the International Conference of Frailty and Sarcopenia has developed international clinical practice guidelines for the identification and management of physical frailty [240].

Further work is required to develop consensus on how to incorporate the frailty concept into management of older adults who fall and whether such an approach will reduce the risk of falls. Due to the association between frailty status and gait speed, the latter could potentially be considered a proxy of frailty [242].

Further studies are needed to assess the potential added value of using frailty as a proxy for intermediate to high fall risk and an entry point for personalised multifactorial falls risk assessment. From an implementation point of view, such an approach is promising as it would enable direct linkage to existing services and care pathways that opportunistically screen for frailty in the general older population.

Sarcopenia

Sarcopenia is a condition characterised by an age-associated loss of skeletal muscle mass and strength/function but also associated with low physical activity levels, other clinical conditions, and an increased risk of falls in older adults. The prevalence of sarcopenia and its association with falls varies according to the diagnostic definition used and the population studied. In the longitudinal iLSIRENTE study, the prevalence of sarcopenia was approximately 25% in people aged 80 years and above, and participants with sarcopenia were three times more likely to fall during a follow-up period of 2 years [243]. International clinical practice guidelines exist for the screening, diagnosis and management of sarcopenia [244, 245]. A growing number of clinicians and researchers advocate paying more attention to diagnosing and treating sarcopenia in older adults identified as being at a high risk of falls, although further research is required on how this should be conducted and whether applying non-exercise interventions for sarcopenia such as protein supplementation will reduce falls.

Delivery of these recommendation in the healthcare sector

Some of the recommendations provided in these guidelines explicitly apply only to certain countries (e.g. LMIC), care settings (e.g. hospitals or care homes) or populations (e.g. community-dwelling older adults).

In addition to considering the above, users of these guidelines should recognise that the ability to implement them successfully depends on the available resources and incentive structures, organisational culture and current processes of care delivery in a healthcare system, among other factors. Put simply, successful implementation requires a supportive organisational context, which should be assessed prior to implementing an organisational change addressing falls. Tools exist to help guideline implementers assess context (e.g. Consolidated Framework for Implementation Research) [246].

Context matters because many of the recommendations in these guidelines involve complex interventions.There are 'multiple components or mechanisms of change' and/or 'how the intervention generates outcomes is dependent on exogenous factors, including the characteristics of recipients, and/or the context or system within which it is implemented' [247]. For example, multifactorial programmes to prevent falls, by their nature, may involve multiple steps (screening, assessment and/or intervention) and multiple intervention components, which add complexity. In addition, many guideline recommendations will depend on the receptivity of various stakeholders to guideline implementation, because such recommendations might involve (i) reorganizing the delivery of healthcare services (e.g. setting up a robust process for referral of older adults from healthcare systems to community exercise programmes), which requires healthcare professional behaviour change; and (ii) asking for substantial behaviour change on the part of older adults (e.g. older adults' willingness to exercise regularly and indefinitely).

Implementing some recommendations may require resources beyond what is currently available, requiring substantial buy-in at all levels of the healthcare system, which

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may or may not be present in a particular setting. Identifying the barriers and potential facilitators for changes required for implementing the recommendations at individual, clinical setting and health system levels should be part of developing a successful implementation strategy. For these reasons, guidelines should be implemented thoughtfully and deliberately, after verification of a favourable context to begin implementation. The implementation process should use quality improvement approaches and rigorous process evaluations to iteratively refine and improve intervention delivery, through measurement of care processes as well as regular interaction and engagement with key stakeholders involved in the changes being made [248, 249]. Finally, while there are studies of the barriers and facilitators of guideline uptake, there are very few outcome evaluations of the population impact of guidelines on fall occurrence. This research question poses complex methodological challenges that should be given priority as part of future guideline development.

Dissemination and implementation support

Our results and recommendations are accessible through our website (www.worldfallsguidelines.com) that provides many links to suggested resources and toolkits to facilitate implementation in different scenarios with accompanying decision trees and tools. We also have linked information on ongoing initiatives with regard to knowledge dissemination, implementation and evidence building. This includes links to advice and information produced by WHO and other international agencies, and eventually documents and tools to support implementation of these guidelines that will be developed in collaboration with older adults with lived fall experience. Our initiative does not conclude with these guidelines, which we plan to update regularly.

Limitations and concluding remarks

Our ambitious attempt at creating clinical practice guidelines for falls prevention and management based on an international consensus of experts and other stakeholders is not free of limitations. Although our team of experts from all relevant disciplines has a significant worldwide representation, one continent, Africa, is underrepresented. The input from older adults with lived experience on our process and recommendations was composed of English speaking older adults residing in high-income nations. We need to obtain more diverse feedback on our work.

Although we aimed for our recommendations and accompanying algorithm to be pragmatic and easy to apply and adaptable to older persons' needs in different scenarios, no formal testing and validation of it was performed. Finally, we have tried to address areas where remaining knowledge gaps were detected, including e-technology, but evidence was still too scarce to provide strong recommendations. Several key areas for future research, where evidence is promising but inconclusive, were identified in each WG's full report (Appendix 2, available in *Age and Ageing* online).

We believe that our guidelines will help clinicians around the world choose for their setting and resource availability effective approaches for the assessment and management of fall risk in older adults.

Supplementary Data: Supplementary data mentioned in the text are available to subscribers in *Age and Ageing* online.

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