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Development and Initial Validation of a Brief Multidimensional Falls Efficacy Scale

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Abstract

Objective: To develop and evaluate the initial psychometric properties of the Multidimensional Falls Efficacy Scale (MdFES). **Methods**: Stage 1 involved content development and validation through literature review and expert consensus. Stage 2 included psychometric testing with 179 older adults. Analyses included exploratory factor analysis (EFA), internal consistency, construct validity, and ROC analysis for clinical cut-offs. **Results**: EFA supported a two-factor structure, explaining 65.4% of the variance. The MdFES showed good internal consistency (α = 0.84). Construct validity was supported by moderate correlations with the Activities-specific Balance Confidence scale (ρ = 0.51), the Balance Recovery Confidence scale (ρ = 0.67), and a negative correlation with the Short Falls Efficacy Scale-International (ρ = −0.46). ROC analyses demonstrated moderate discriminative ability for identifying fallers (AUC = 0.65), high concerns about falling (AUC = 0.73), and poor balance (AUC = 0.71). A cut-off score of ≤13 balanced sensitivity and specificity. **Conclusion**: The MdFES is a brief, valid instrument capturing the multidimensional nature of falls efficacy. It may support clinical screening and guide targeted intervention. Further research is needed to elucidate the value of the MdFES.

Keywords: Accidental Falls, COSMIN Guidelines, Patient Reported Outcome Measures, Psychometrics, Self Efficacy

Introduction

Falls are a significant public health issue and a major adverse event that older adults may experience in later life. Globally, falls represent a leading cause of disability-adjusted life years, contributing significantly to morbidity and mortality[1]. Beyond physical injuries, approximately 60% of older adults aged 65 years and above report significant concerns about falling (CaF)[2]. CaF has been associated with adverse psychosocial outcomes, including depression, social isolation, and reduced participation in daily activities[3]. Although CaF has been widely studied, it has often been conflated with falls efficacy due to the conceptual complexity of these terms. Distinguishing between the two constructs is critical for both research and practice[4]. CaF, as an emotional construct, may arise from apprehension caused by the unpredictable nature of falls, heightened sense of vulnerability, increased environmental vigilance, and concern about potential injury after a fall[5]. In contrast, falls efficacy, grounded in Bandura's self-efficacy theory[6], refers to an individual's belief in their ability to prevent and manage falls effectively[7]. It is therefore essential to select measurement instruments that align with the specific construct of interest. Failure to do so may lead to an incomplete understanding of the individual's

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problem or an inaccurate conclusion of the effectiveness of the intervention being evaluated.

Falls efficacy encompasses four key domains: balance confidence, balance recovery confidence, safe landing confidence, and post-fall recovery confidence[8]. Operationalising falls efficacy across these four domains offers several advantages. First, this form of self-efficacy reflects an individual's perceived ability to manage the threat of a fall. It includes confidence in remaining steady while performing various activities of daily living. It also encompasses one's belief in their ability to react quickly and recover balance when experiencing a significant perturbation. In situations where balance recovery is not possible, individuals may perceive themselves as capable of protecting themselves during the fall and be able to get up independently. Second, conceptualising falls efficacy as a cognitive process that underlies emotions helps to distinguish it from CaF. This provides greater clarity for clinicians that the loss of confidence might not be due to CaF, but rather to other causes, such as physical impairments like joint stiffness and muscle weakness, or movement deficits. Third, low self-efficacy in preventing and managing falls is closely linked to functional decline. Individuals who lack confidence in their abilities are more likely to avoid activities. This could lead to further physical deconditioning and an increased risk of falls. Pre-emptive actions should be taken to help these individuals build their confidence, enhance their physical abilities, and encourage them to engage in functional activities.

Reliable and valid measurement instruments are essential for capturing individuals' beliefs about their ability to manage falls. They are crucial both for identifying deficits and informing the design of targeted interventions to improve confidence, reduce CaF, and mitigate the age-related physiological changes. However, several challenges limit the use of these patient-reported outcome measures (PROMs) in assessing falls efficacy. A key challenge is that many existing measurement instruments focus on individual domains of falls efficacy. For example, measurement instruments such as the Falls Efficacy Scale[9], the Activities-specific Balance Confidence (ABC) scale[10], and the CONFBal Scale[11] primarily assess balance confidence. In contrast, the Balance Recovery Confidence (BRC) scale[12] assesses confidence in arresting a fall through reactive balance strategies. Balance recovery confidence differs from general balance confidence due to the rapid and dynamic nature of the recovery actions required to arrest a fall[13]. A gap remains in comprehensive measures that capture the full range of falls-related self-efficacy, including safe landing and post-fall recovery confidence[14]. Combining different PROMs to cover all domains can result in lengthy assessments, which may deter clinicians from incorporating them into routine practice due to time constraints and concerns about patient burden[15]. A single-item measure has been posited to be useful in terms of utility and efficiency[15]. A brief version of a falls efficacy measurement tool covering a broader spectrum of confidence towards falls prevention and management might be helpful for clinical practice.

Two versions of the falls efficacy-related measurement instruments, the Perceived Ability to Manage Falls and Falling (PAMF) scale[16] and the Perceived Ability to Prevent and Manage Fall Risks (PAPMFR) scale[17], might be useful choices for assessing the multidimensional nature of falls efficacy. The PAMF scale was developed in 1998 as part of a randomised, controlled trial investigating the effectiveness of a group intervention to reduce fear of falling and associated activity restriction in older adults[16], whereas the PAPMFR was developed in 2019 to assess the effectiveness of a multicomponent fall prevention program[17]. The items from both scales cover respondents' confidence in their balance, ability to protect themselves if they fall, and ability to get up after a fall. However, neither scale assesses balance recovery confidence, which is a critical measure of fall prevention strategies. Furthermore, there has been limited evidence on the psychometric properties of these scales[14]. A comprehensive measurement instrument that evaluates all four domains of falls efficacy would provide more insights about the effectiveness of fall prevention and management programs. Having a multidimensional falls efficacy tool could further help identify specific areas of low confidence, prompting in-depth assessment to support better planning and individualisation of interventions. Ultimately, this measure would facilitate a holistic approach to falls management while enhancing individuals' sense of agency.

This study aimed to develop and validate the Multidimensional Falls Efficacy Scale (MdFES) following COSMIN's quality standards[18] to ensure that the scale meets key psychometric criteria. The COSMIN standards are widely recommended for evaluating the methodological quality of studies that develop and assess new measurement instruments. In this context, the MdFES is designed to provide clinicians with a concise, multidimensional tool that can be readily implemented in clinical settings to gain valuable insight into older adults' perceived abilities to prevent and manage falls.

Methods

A two-stage methodological study (Supplementary Material 1) was applied to develop the MdFES, focusing on key psychometric properties, including content development and validity, structural validity, internal consistency, construct validity, known-group validity, and ROC analysis for discriminative ability (Supplementary Material 2).

Stage 1 – Content development and validation of the MdFES

Content development and validity are considered to be the most critical psychometric properties of a measurement instrument[19]. Content development involves making the construct explicit and constructing suitable items to measure the targeted construct[20]. In contrast, content validity is the degree to which the content of an instrument is an adequate reflection of the construct to be measured[20].

To develop the content, falls efficacy was defined as the perceived ability to prevent and manage falls across the aspects of balance confidence, balance recovery confidence, safe landing confidence, and post-fall recovery confidence[7]. Content items were generated from commonly used falls efficacy-related measurement instruments, including the Falls Efficacy Scale[9], the ABC scale[10], the BRC scale[12], the PAMF scale[16], and the PAPMFR scale[17]. The validity and reliability of these scales have also been reported in other literature[14,21-23]. To ensure that the MdFES would be simple and easy to use in clinical settings, one item was designed for each domain of falls efficacy, making it a four-item scale. Content validity was examined by an invited team comprising seven medical and healthcare professionals with at least five years of work experience, as well as four adults aged 65 years and older. All participants evaluated the appropriateness of the given content to assess falls efficacy using the RAND/UCLA appropriateness scale[24], a nine-point Likert scale ranging from 1 (inappropriate) to 9 (appropriate). Appropriateness was defined as the importance, relevance and clarity of measuring the targeted construct. Participants were also able to provide additional feedback through open-ended responses.

Stage 2 – Psychometric evaluation of the MdFES

Two groups of older adults were recruited through convenience sampling at this stage. One group of older adults was from a community hospital, and the other group was community-dwelling older adults from the active ageing centres in Singapore. Hospitalised older adults included individuals aged 65 or older admitted to a community hospital under the admission diagnostic code "deconditioning". The "deconditioning" code was assigned to individuals meeting the following criteria: (a) had a fall at least once in the last 6 months with underlying symptoms and (b) required an individualised rehabilitation care plan or was considered as frail. Community-dwelling adults were aged 65 or older, independently mobile at home, and without severe cognitive impairments. For both groups, participants with severe cognitive impairments or inability to provide informed consent were excluded. All participants completed the MdFES. For the group of community-dwelling older adults, they completed three additional self-reported measurement instruments (i.e., the Balance Recovery Confidence scale, Activities-specific Balance Confidence scale, and Short Falls Efficacy Scale-International). Exploratory factor analysis and internal consistency were investigated using the MdFES scores obtained from two groups of older adults. Construct validity, 7-day test-rest reliability and the ROC analysis were examined using the dataset of community-dwelling older adults to explore potential cut-off scores. Measurement invariance of the MdFES was evaluated to determine whether the construct was measured equivalently across two distinct groups of older adults.

Outcome measures

The Multidimensional Falls Efficacy Scale (MdFES) is a 4-item measurement instrument that measures an individual's perceived ability to prevent and manage falls from pre-fall to completed fall scenarios. The four items were rated using a 5-point scale ranging from 0 (not at all confident) to 4 (completely confident). The total possible score was 16, and the total score was recorded. A higher score denoted higher confidence.

The Balance Recovery Confidence Scale (BRC)[12] is a 19-item measurement instrument designed to assess an individual's perceived ability to recover balance across several scenarios depicting different perturbations such as a slip, a trip, or volitional movements. Nineteen items were rated using an 11-point scale ranging from 0 (Not at all confident) to 4 (Extremely confident). The total possible score was 190, and the total score was recorded. A higher score denoted a higher certainty of confidence in arresting a fall.

The Activities-Specific Balance Confidence Scale (ABC)[10] is a 16-item measurement instrument designed to assess individuals' confidence in performing several progressively more challenging balance and mobility tasks without losing balance. There were 16 questions, with scoring options ranging from 0 (no confidence) to 100 (complete confidence). The average score was recorded. A higher score depicted a greater degree of confidence in performing activities steadily.

The Short Falls Efficacy Scale-International (Short FES-I)[25] is a 7-item measurement instrument designed to assess the individual's CAF with basic and more demanding activities. Seven questions were answered with a four-grade scale[1-4] of 'not at all concerned', 'somewhat concerned', 'fairly concerned' and 'very concerned'. The total score, which ranged from 7 to 28, was recorded. A higher score reflected a greater level of CaF.

Statistical analysis

Stage 1 - Content validity

The MdFES content was evaluated using the RAND/UCLA appropriateness scale, a nine-point Likert scale ranging from 1 (inappropriate) to 9 (highly appropriate). Item ratings were classified as appropriate if the panel median was between 7 and 9, with no disagreement. Items scoring 4–6 or showing disagreement were considered uncertain, while scores between 1–3 without disagreement were considered inappropriate. Five study team members (SS, HK, YO, JO, HT) conducted a descriptive analysis to report the results of the content validity process.

	Community-dwelling older adults Rand Rating			Medical and healthcare professionals Rand Rating			Overall Rand rating
	MR[a]	APPL[a] (A/U/I)[b]	AGRL[a] (+/-/?)[c]	MR[a]	APPL[a] (A/U/I)[b]	AGRL[a] (+/-/?)[c]	MR[a]/APPL[a]/AGRL[a] (A/U/I)[b]/(+/-/?)[c]
Name of the scale	8.5	A	+	7	A	+	8 / A / +
Instructions in the scale	8	A	?	8	A	+	8 / A / ?
Rating options	8	A	?	8	A	?	8 / A / ?
MdFES Item 1	8.5	A	+	7	A	?	8 / A / +
MdFES Item 2	6	U	?	7	A	+	7 / A / ?
MdFES Item 3	5.5	U	?	7	A	?	6 / A / +
MdFES Item 4	5.5	U	?	8	A	+	7 / A / ?
Comprehensiveness of the 4 items	8	A	?	7	A	?	7 / A / ?
Face validity	7	A	?	7	A	?	7 / A / ?

[a]MR: Median rating; APPL: Appropriateness level; AGRL: Agreement level
The level of appropriateness and agreement is determined based on the RAND/UCLA criteria.
[b]A: Appropriate; U: Uncertain; I: Inappropriate
[c]+: Agreement; -: Disagreement; ?: Indeterminate

Table 1. The list of content for the MdFES that achieved consensus using the RAND/UCLA appropriateness method.

Stage 2 - Evaluation of psychometric properties

Three study team members (SS, HK, and JO) conducted the analyses using R software (version 4.5.1). Data completeness and acceptability were assessed by calculating the percentage of missing data, with less than 5% considered acceptable. Score distributions were examined for normality using histograms and the Shapiro-Wilk test. Skewness and kurtosis statistics were also computed. Scale targeting was assessed by reviewing score distributions, skewness, and the presence of floor and ceiling effects, which were defined as ≥15% of responses occurring at the lowest or highest possible scores.

Structural validity was assessed through exploratory factor analysis (EFA). The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity were applied to confirm the suitability of the data for factor analysis. Parallel analysis was conducted to determine the optimal number of factors to retain. EFA was performed using the minimum residual (minres) extraction method with oblimin rotation to explore the factor structure. Factor loadings of ≥0.40 were considered meaningful.

Internal consistency was evaluated by calculating inter-item correlations, item-total correlations, and Cronbach's alpha coefficient. Alpha values ≥0.70 were interpreted as evidence of acceptable internal consistency. The seven-day test–retest reliability was assessed at the item level using weighted Cohen's kappa on a subsample of community-dwelling older adults (n = 53) who completed the MdFES at two time points approximately one week apart. Kappa values were interpreted as 0 - 0.20 as slight; 0.21-0.40 as fair; 0.41-0.60 as moderate; and 0.61- 0.80 as substantial.

Construct validity was evaluated using Spearman's rank correlation coefficients due to the non-normal distribution of total MdFES scores, as confirmed by the Shapiro-Wilk test and histogram inspection. Correlations between the total MdFES score and other relevant measures were examined, including the Activities-specific Balance Confidence (ABC) scale, the Balance Recovery Confidence (BRC) scale, and the Short Falls Efficacy Scale-International (Short FES-I).

Receiver Operating Characteristic (ROC) analyses were conducted to evaluate the ability of the MdFES total score to discriminate between key clinical outcomes. Three separate ROC analyses were performed to investigate MdFES as the predictor variable on the dependent outcomes of fallers, high CaF, and poor balance using the source data obtained from self-reported fall history, Short FES-I, and the Mini-BESTest, respectively.

Measurement invariance of the Multidimensional Falls Efficacy Scale (MdFES) was evaluated across community-dwelling and hospitalised older adults using multi-group confirmatory factor analysis. A two-factor model was specified based on the hypothesised structure of the MdFES. Configural invariance was assessed to establish whether the latent construct is conceptualised similarly in both populations. Model fit was evaluated using standard indices, including the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardised Root Mean Square Residual (SRMR).

	Hospitalised older adults	Community-dwelling older adults
Number of participants	60	119
Age range (mean)	66-90 (78.2)	65-91 (73.7)
Female gender	35 (58%)	101 (85%)
Educational - Primary	17 (28%)	28 (24%)
Educational - Secondary	20 (33%)	63 (53%)
Educational - College/University	12 (20%)	25 (21%)
No education stated	11 (19%)	3 (2%)
Require the use of a walking aid	N/A	12 (10%)
Experience one or more falls in the past year	50 (83%)	27 (23%)
MdFES Item 1 score range (mean)	0-4 (2.6)	1-4 (3.5)
MdFES Item 2 score range (mean)	0-4 (1.9)	0-4 (2.8)
MdFES Item 3 score range (mean)	0-4 (1.8)	0-4 (2.7)
MdFES Item 4 score range (mean)	0-4 (1.5)	0-4 (2.7)
Mean total score range of the MdFES	0-16 (7.7)	2-16 (11.7)
Mean score of balance confidence (average score of 100)	N/A	83
Mean score of balance recovery confidence (total score of 190)	N/A	134
Mean score of concerns about falling (total score: 28)	N/A	10.9

Table 2. Demographic characteristics of the participants.

Results

Stage 1 - Content validity

All invited medical and healthcare professionals, as well as community-dwelling older adults, participated in the discussion. Consensus within the panel indicated that the overall content and face validity are appropriate (Table 1). No disagreement was identified among the participants' ratings regarding the content. Some revisions were made to item descriptors to enhance clarity based on minor inputs given. All items were then discussed with the panel to ensure no further issues were identified. The finalised MdFES is presented in Supplementary Material 3.

Stage 2 - Evaluation of psychometric properties

Field testing was conducted between September 2023 and December 2024. Demographic characteristics of participants are presented in Table 2. A total of 179 older adults (60 hospitalised older adults and 119 community-dwelling older adults) participated, with a mean age of 75.1 years; 76% were female. Over 90% of participants had some level of formal education, and approximately 20% held college or university qualifications. Hospitalised older adults had lower mean MdFES scores (mean = 7.7) compared to community-dwelling older adults (mean = 11.7), indicating lower perceived falls efficacy among hospitalised participants.

For acceptability and data completeness, the MdFES demonstrated excellent performance, with all response options (0–4) utilised across all items. Data completeness was excellent, with no missing responses recorded for any MdFES items. The total MdFES scores were not normally distributed (Shapiro-Wilk test: $W = 0.92$, $p < 0.001$), exhibiting a left-skewed distribution (skewness = −0.83, kurtosis = −0.06). Floor and ceiling effects were minimal, with no single total score category exceeding 15% of responses.

The Kaiser-Meyer-Olkin measure was 0.79, and Bartlett's Test of Sphericity was significant ($p < 0.001$), confirming the suitability of the data for factor analysis. Parallel analysis reported a two-factor model accounting for 65.4% of the total variance (Factor 1 = 34.9%, Factor 2 = 30.5%). In this two-factor solution, Factor 1 included items related to confidence towards falls prevention, while Factor 2 comprised items addressing confidence surrounding falls management. The two factors were highly correlated ($\rho = 0.82$), indicating that they were related constructs.

The MdFES demonstrated good internal consistency ($\alpha = 0.84$). Inter-item correlations ranged from 0.46 to 0.66, indicating moderate associations without redundancy. Item-total correlations ranged from 0.619 to 0.740, confirming that all items contributed meaningfully to the overall construct. There was an acceptable level of stability for item-level responses over the 7-day interval.

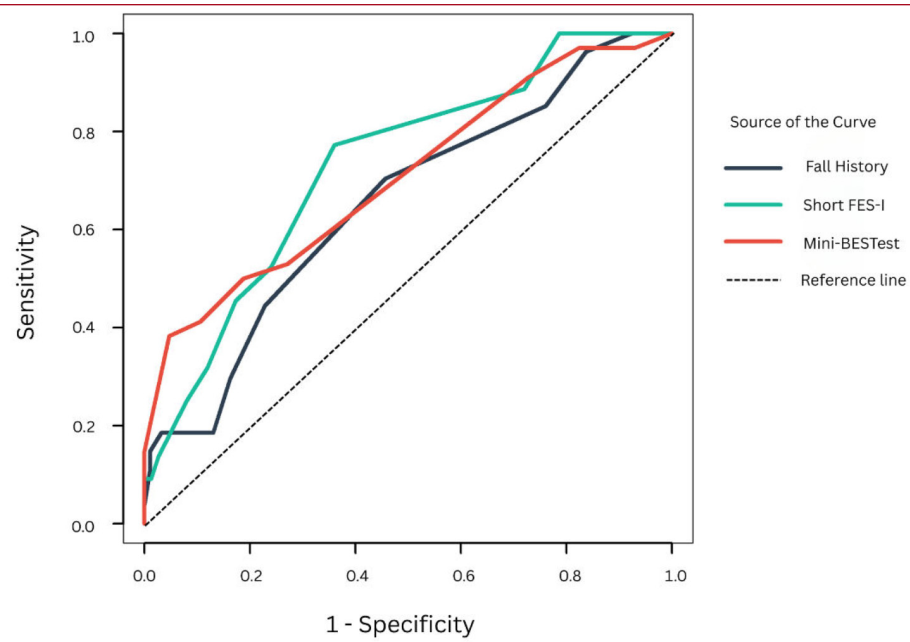

Figure 1. Receiver Operating Characteristic (ROC) Curves of the Multidimensional Falls Efficacy Scale (MdFES) Predicting Fallers, High Concerns About Falling (Short FES-I), and Poor Balance Performance (Mini-BESTest).

Kappa values ranged from 0.352 to 0.450. Specifically, Item 1 ($\kappa = 0.398$, $p < 0.001$), Item 2 ($\kappa = 0.352$, $p = 0.005$), and Item 3 ($\kappa = 0.364$, $p = 0.006$) demonstrated fair agreement, while Item 4 ($\kappa = 0.450$, $p < 0.001$) demonstrated moderate agreement.

Construct validity of the MdFES was supported by the observed correlation patterns. Moderate positive correlations were found between total MdFES scores and both the ABC score ($\rho = 0.506$, $p < 0.001$) and the Mini-BESTest ($\rho = 0.348$, $p < 0.001$). Additionally, a moderate negative correlation was observed between total MdFES scores and the Short FES-I ($\rho = -0.461$, $p < 0.001$), which is consistent with the predefined hypotheses. These findings indicate that higher falls efficacy is associated with higher balance confidence and better functional balance, as well as lower CaF.

ROC analyses demonstrated that the MdFES exhibited moderate to good discriminative ability across key outcomes (Figure 1). For predicting fallers, the AUC was 0.653, with a cut-off score of 13 yielding a sensitivity of 70.7% and specificity of 54.3%. This suggested that the MdFES had moderate accuracy in distinguishing individuals with a history of falls. For identifying individuals with high CaF (Short FES-I > 10), the AUC was 0.73, with an optimal cut-off of 13, producing a sensitivity of 77.3% and a specificity of 60%. This reflected that the MdFES had good discriminative capacity. In relation to poor balance performance (Mini-BESTest ≤ 20), the AUC was 0.707, and the optimal MdFES cut-off was 8.5, offering a sensitivity of 82.4% and specificity of 59.2%, reflecting moderate discriminative ability. These findings suggest that the MdFES has potential clinical utility to identify falls risk, CaF, and balance impairment, although specific clinical priorities regarding sensitivity and specificity should guide the choice of cut-off score.

Multi-group confirmatory factor analysis revealed that the model demonstrated excellent fit, indicating that the hypothesised two-factor structure was consistent across both groups. Fit indices for the configural model were CFI = 1.000, RMSEA = 0.000, and SRMR = 0.009, which met the thresholds for good model fit (CFI ≥ 0.95, RMSEA ≤ 0.06, SRMR ≤ 0.08).

Discussion

This study shows the development of the Multidimensional Falls Efficacy Scale (MdFES) using key COSMIN methodological recommendations[18]. To our knowledge, this is the first study reporting the psychometric properties of a falls efficacy-related measurement instrument focusing on assessing individuals' perceived ability to prevent and manage falls across four domains of falls efficacy: balance confidence, balance recovery confidence, safe landing confidence, and post-fall recovery confidence. The scale was designed to enable clinicians to use MdFES as part of routine assessment. The involvement of the target users, including older adults and medical and healthcare professionals, affirmed the scale's content and face validity.

Psychometric evaluation supported the internal structure, reliability, and validity of the MdFES. The MdFES has a two-factor structure explaining 65.4% of the variance, corresponding to falls prevention (Item 1: On balance confidence and Item 2: On balance recovery confidence) and falls management (Item 3: On safe landing and Item 4: On post-fall recovery confidence). This supports the theoretical model underpinning the scale. The MdFES has good internal consistency. Construct validity was reinforced by significant, moderate correlations between MdFES scores and established measures such as the Activities-specific Balance Confidence (ABC) scale, the Balance Recovery Confidence (BRC) scale, and the Short Falls Efficacy Scale-International (Short FES-I). Importantly, this study reinforces the growing literature that falls efficacy and CaF are distinct, despite being closely related. While CaF measures can help clinicians distinguish between adaptive and maladaptive concerns[26], the MdFES allows for the identification of specific confidence deficits. Uniquely, the MdFES assesses perceived ability across various critical domains of falls management and prevention. Clinicians may therefore consider using the MdFES alongside CaF measures. Given that baseline concern about falling is a well-established predictor of future falls in older adults[26], incorporating the MdFES could help guide targeted, domain-specific interventions to address individual needs more effectively.

The MdFES demonstrates moderate discriminative ability across clinically relevant outcomes, with stronger discriminative performance in identifying individuals with high CaF and poor balance. For predicting fallers, the MdFES showed an AUC of 0.65, with a cut-off of 13 providing balanced sensitivity (70.7%) and specificity (54.3%). The discriminative ability was higher for detecting high CaF (AUC = 0.73) and poor balance performance (AUC = 0.71), with optimal cut-offs of 13 and 9, respectively. These findings underscore the scale's potential for clinical use and risk stratification, although the focus of the clinicians should guide the choice of the cut-off scores.

Importantly, clinicians should examine individual item scores when applying the MdFES. As the MdFES captures falls efficacy as a multidimensional construct, two individuals with similar total scores (e.g., a mid-range score of 12) may have distinctly different profiles. For example, one may have low confidence in preventing a fall, while another may have low confidence in managing a fall. Clinicians should use the individual item and subscale scores to identify the specific domains requiring intervention, ensuring that treatment is tailored to the individual's needs rather than guided solely by the total score. For example, one with low balance confidence could benefit from balance and strength training[27]. For individuals with low balance recovery abilities, perturbation-based training[28] could be usefully considered. Safe landing techniques training could be applied to enhance confidence to protect oneself upon falling[29]. If safe landing training is deemed inappropriate for frail older adults, they should at least learn strategies to get up from the floor[30] or identify ways to get help after a fall[31]. Addressing low falls efficacy could mitigate excessive CaF, support more proactive behaviour and empower individuals better.

Field testing demonstrated that the MdFES was practical and acceptable among older adults. The four-item scale required less than three minutes to complete, making it feasible for integration into clinical workflows without imposing excessive burden on practitioners or patients. This ease of use could encourage broader adoption in routine assessments and therapeutic planning, supporting self-awareness, patient engagement, and targeted intervention delivery.

This study has some limitations. The sample included more community-dwelling older adults than hospitalised individuals, contributing to a left-skewed distribution of MdFES scores, with many participants reporting high falls efficacy. This may limit the scale's sensitivity in detecting subtle differences among highly confident individuals and may not fully reflect the spectrum of falls efficacy in frailer or more impaired populations. Future research should examine other aspects of psychometric properties (i.e., the Minimal Clinically Important Difference) of the MdFES, particularly in diverse clinical populations such as individuals with stroke, Parkinson's disease, or osteoarthritis. Further cross-cultural validation is also warranted to ensure the broader applicability of these findings.

In conclusion, the MdFES represents an innovative, psychometrically sound tool for assessing falls efficacy, which is defined as the perceived capacity to prevent and manage falls. It offers significant potential to complement existing measures in older adult care, guiding more personalised, effective falls prevention strategies.

Ethics Approval

Ethical approval was obtained from the Singapore Institute of Technology Institutional Review Board (Reference number: RECAS-0197).

Consent to participate

Written consent was obtained from the participants of both studies.

Authors' contributions

Shawn Leng Hsien Soh: Conceptualisation, Methodology, Formal analysis, Supervision, Writing – Original Draft. Henry Fee Siang Koh, Dorothy Hong Yu Ng, Jillian Rui Ci Ong, Yew Long Ong, Xin Yi Lim, Mohamad Irfan Syafiq Bin Mohamad Khizar, Jiaying Ho, Hazel Xu Teng Ting, Wenshan Yang:Methodology, Investigation, Formal analysis, Writing

– Review and Editing. Tan Yan Fang Cheryl: Methodology, Formal analysis, Supervision, Writing – Review and Editing. All authors read and approved the final version of the manuscript.

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Supplementary Material 1. Two-stage process for the development and validation of the Multidimensional Falls Efficacy Scale (MdFES)

Stage one – Content development and validation: A systematic review was previously conducted by the study team to evaluate existing falls efficacy-related scales. Based on these identified scales, key items were adapted to construct a conceptual model of falls efficacy. Drafted content was reviewed by a panel of experts comprising medical and healthcare professionals (n = 7) and community-dwelling older adults aged 65 years and older (n = 4).

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Stage two – Evaluation of psychometric properties: Psychometric evaluation included assessments of data completeness, acceptability, and score distribution. Structural validity was examined via exploratory factor analysis (EFA) using the minimum residual method and oblimin rotation, with the Kaiser-Meyer-Olkin measure and Bartlett's Test of Sphericity confirming suitability for factor analysis. Internal consistency was evaluated using Cronbach's alpha, inter-item correlations, and item-total correlations. Construct validity was assessed via Spearman's rank correlations between MdFES scores and scores on the ABC scale, BRC scale, and Short FES-I. Known-groups validity was tested by comparing MdFES scores between fallers and non-fallers, individuals with poor versus good balance, and those with high versus low concerns about falling. ROC analyses were performed to identify optimal cut-off scores for the MdFES in distinguishing these groups, with sensitivity, specificity, and AUC values reported.

Supplementary Material 2. Definition of the different psychometric properties

Psychometric property	Definition	Quality standard
Scale development and content validity	The degree to which the content of a scale adequately reflects the construct to be measured.	The scale's relevance, comprehensiveness, and comprehensibility should be ensured through systematic item generation, expert review, and cognitive testing. Both patients and professionals should be engaged to evaluate the scale's relevance, comprehensiveness, and clarity.
Structural validity	The degree to which the scores of a scale reflect the dimensionality of the construct being measured. It can also refer to model fit in factor analysis or item response theory models.	The scale's structure is assessed using exploratory or confirmatory factor analysis. Alternatively, model fit may be evaluated using item response theory or Rasch analysis.
Internal consistency	The degree of interrelatedness among items within a scale.	Internal consistency is typically assessed using Cronbach's alpha, with values ≥ 0.70 considered acceptable. Inter-item and item-total correlations should also be evaluated.
Construct Validity (including Hypotheses Testing and Known-Groups Validity)	The degree to which scores on a scale relate to other measures in a manner consistent with theoretically derived hypotheses.	Construct validity is supported when correlations with related instruments are consistent with expectations (convergent validity), and when the scale distinguishes between groups known to differ on the construct (known-groups validity).
Known-Groups Validity	The ability of a scale to differentiate between groups known or expected to differ on the construct being measured.	Differences between groups (e.g. fallers vs. non-fallers, high vs. low concerns about falling) should be statistically significant and in the expected direction.
ROC Analysis for Discriminative Ability	The capacity of a scale to discriminate between individuals based on clinically relevant outcomes.	Receiver Operating Characteristic (ROC) analysis is performed to determine optimal cut-off scores, sensitivity, specificity, and the area under the curve (AUC).

Supplementary Material 3. The Multidimensional Falls Efficacy (MdFES) Scale.

The MdFES is a quick and simple method for rating a person's confidence in their ability to prevent and manage falls.

Instructions:
We would like to ask you some questions about your confidence in your ability to prevent and manage the threat of falls.
For each of the following questions, please rate your confidence level by recording a number from 0 to 4 using the scale given below. The levels of confidence you can choose from are 0 = not at all confident; 1 = slightly confident; 2 =somewhat confident; 3 = quite confident; and 4 = completely confident.
Please provide a score of your current ability based on your own judgement for all questions.

	Item	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Completely confident
1	How confident are you in walking steadily?	0	1	2	3	4
2	How confident are you in stopping yourself from falling when you lose your balance?	0	1	2	3	4
3	How confident are you in protecting yourself if you fall?	0	1	2	3	4
4	How confident are you in getting up from the ground after a fall?	0	1	2	3	4

Scoring Instructions:
Scoring will be based on the targeted construct of interest. Each item of the MdFES represents a distinct domain of falls efficacy: Item 1 for balance confidence; Item 2 for balance recovery confidence; Item 3 for safe landing confidence; and Item 4 for post-fall recovery confidence.

To facilitate interpretation:
- The individual item score could be used to identify domain-specific confidence deficits.
- The combined scores of Items 1 and 2 represent an individual's perceived ability to prevent a fall, or their perceived balance control. The combined scores of Items 3 and 4 reflect the individual's confidence in managing a fall.
- The total score (sum of all four items) indicates the individual's falls efficacy. Users are encouraged to interpret both total and domain-specific scores carefully to avoid masking specific aspects of low confidence.