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The Thai Version of the Updated Perceived Control Over Falling Scale: A Study of Cross-Cultural Adaptation, Reliability, and Validity in Older Adults

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Abstract:

Objective: To translate and culturally adapt the Updated Perceived Control Over Falling (UP-COF) into the Thai language and evaluate its psychometric properties among older Thai adults.

Material and Methods: The translation and adaptation process followed Beaton's guidelines. A prefinal version was tested with 20 older adults, with minor modifications. Test-retest reliability was assessed in a sample of 50 older adults. Concurrent validity, internal consistency, and discriminatory ability between fallers and non-fallers were evaluated in 88 older adults. Reliability was determined using the intraclass correlation coefficient ICC (2,1). Concurrent validity was investigated by the Pearson correlation coefficient with the Falls Efficacy Scale-International (FES-I). The Receiver Operating Characteristic (ROC) curve analysis determined the ability to differentiate individuals with and without a history of falls in the past year. Statistical significance was defined as p-value<0.05.

Results: The UP-COF showed good test-retest reliability (ICC (2,1)=0.75) and internal consistency (Cronbach's alpha=0.76). The tool demonstrated a significant negative correlation with the FES-I (r=-0.51, 95% CI [-0.65, -0.34], p-value<0.001), supporting its concurrent validity. ROC analysis yielded an area under the curve (AUC) of 0.66, indicating modest discriminatory ability. A cut-off score of ≤16 out of 20 identified individuals with a history of falls, demonstrating a sensitivity and specificity of 68.18%.

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Conclusion: The UP-COF Thai is a reliable and valid instrument for assessing perceived control over falling in Thai older adults, supporting its use in clinical assessment and targeted fall prevention strategies.

Keywords: falling, older adults, perceive control, reliability, validity

Introduction

Falls remain a major public health concern among older adults, as they have long been associated with physical injuries, psychological distress, and a diminished quality of life[1,2]. Globally, approximately 1 in 4 older adults experience a fall each year[3]. The high prevalence emphasizes the need for prevention strategies focused on identifying risk factors and improving self-efficacy in fall prevention[2]. One psychological component in understanding and mitigating fall risk is the perceived control over falling. The term refers to an individual's confidence in their ability to control and manage falls[4,5]. The perceived control over falling model, proposed by Ellmer et al., elucidates the relationship between falls and the state of concern about falling (CaF) in individuals exposed to fall-risk situations[4]. Individuals with greater perceived control are more capable of managing their physical and psychological responses, leading to behaviors that enhance safety and reduce fall risks. Conversely, those with low perceived control exhibit heightened fear of falling, altered physical responses, and reduced mobility behaviors, which may ultimately increase their future fall risk. Research indicated that older adults with higher perceived control experience improved physical, cognitive, psychological, and emotional health, including lower depression levels, fewer chronic illnesses, and milder functional limitations[6-8]. Furthermore, aging leads to declines in physical, cognitive, and psychological health, reducing quality of life and perceived control. Control beliefs grow in early adulthood, peak in midlife, and decline in later years, often due to lower self-efficacy and reduced expectations of control[6,9]. Thus, these findings highlight the significance of perceived control in influencing fall risk, particularly among older adults.

While multiple instruments assess perceived control across various domains[10], the Updated Perceived Control Over Falling Scale (UP-COF) represents a more specific and effective measure for evaluating perceived control over falling in older adults. It provides valuable insights into older adults' perceptions of their ability to prevent and manage falls. The UP-COF was first created in Western countries and showed strong measurement qualities, including good reliability, with an internal consistency score of Cronbach's α=0.751 and excellent test-retest reliability (ICC=0.718). The validity of the UP-COF was reported to have moderate negative correlations with the Short Falls Efficacy Scale International (short FES-I) (r=-0.567) and the Hospital Anxiety and Depression Scale (HADS) anxiety scores (r= -0.410). Additionally, the UP-COF demonstrated its ability to distinguish between repeated fallers and non-fallers, with an area under the curve (AUC) of 0.74. A cut-off score of ≤13/20 was found to effectively identify individuals with low perceived control over falling[4].

Like many other countries with aging populations, Thailand is facing increasing challenges related to falls among older adults, with estimates ranging from 12 to 25 percent[11,12]. and approximately 36% of Thai older adults report CaF[13,14], which refers to persistent feelings of dread and apprehension toward situations perceived to threaten or challenge balance, and leads to both physical and psychological changes, potentially increasing fall risk[15,16].

There is an ongoing debate regarding its benefits and drawbacks. Several studies suggest that CaF may function as a fall prevention strategy when individuals maintain a higher perceived control over falling[4,5,17,18]. Adapting the UP-COF tool for Thai older adults is crucial due to the cultural, environmental, social, and emotional factors, such as CaF, that shape their perceptions and awareness of fall risks. This adaptation will equip healthcare professionals with a reliable tool to assess perceived control and create targeted interventions. Additionally, it will help recognize and address concerns related to the perceived ability to prevent falls among Thai older adults.

The purposes of this study were to translate, culturally adapt, and validate the UP-COF tool for use among older Thai adults: (a) the adaptation process followed established guidelines to ensure equivalence between the original and Thai version, (b) the psychometric properties of the Thai version were evaluated, including reliability, concurrent validity, and discriminatory ability between older adults who experienced falls and those without falls in the previous year.

Material and Methods

This research received ethical approval from the Research Ethics Review Committee for studies involving human participants, Group I, Chulalongkorn University (Approval No. 248/67). This study was a cross-cultural adaptation of the updated perceived control over falling (UP-COF) into the Thai version, which consisted of 2 phases: (1) the translation and cross-cultural adaptation process and (2) the psychometric test process. The psychometric properties test included test-retest reliability, internal consistency, concurrent validity, and discriminatory ability of UP-COF Thai between older adults who experienced falls and those who did not experience falls.

Phase I: translation and cross-cultural adaptation process

The translation and cross-cultural adaptation of the UP-COF into Thai were conducted with permission from the original developers. The process adhered to the guidelines proposed by Beaton et al. (2000), which outline 6 key steps[19].

Step 1: Forward translation

The original UP-COF was independently translated into Thai by 2 bilingual translators whose mother language is Thai: a psychiatrist with clinical translation expertise and a linguist with 3 years of experience but no medical background. Their translations included detailed reports highlighting problematic sentences, ambiguities, and justifications for their translations.

Step 2: Synthesis of the translation

Both translators reviewed their respective translations to identify and resolve discrepancies. Through discussion, a consensus was reached to develop a single synthesized translation of the UP-COF Thai version, ensuring accuracy and clarity.

Step 3: Blind back-translation

Two independent translators, both native English speakers, conducted a back-translation of the synthesized Thai version into English. Both translators produced their translations without access to the original questionnaire. One translator was a professional with no medical background, while the other had familiarity with healthcare terminology and the content area. During this phase, grammatical errors and inconsistencies were identified, ensuring that the translated version accurately reflected the content of the original instrument.

Step 4: Expert committee

An expert committee was assembled, consisting of language professionals, healthcare professionals, and translators involved in the process. They reviewed all the

translated materials and the original version, assessing their equivalence. The committee documented its decisions and provided justifications for any necessary modifications. The finalized prefinal version was then prepared for pilot testing in the subsequent phases.

Step 5: Pilot testing of the prefinal version

A field test was conducted with 20 Thai adults aged 60 and above. Participants assessed the clarity of the instructions and items in the Thai version of UP-COF, with feedback gathered through interviews. Inter-rater agreement was evaluated to enhance equivalence and readability for Thai older adults[19]. A panel of 10 experts reviewed the prefinal version for conceptual equivalency and content validity, using the content validity index (CVI) at both the scale (S-CVI) and item (I-CVI) levels[20]. The minimum acceptable indices for content validity were an S-CVI/Ave of 0.90 or above and an I-CVI of 0.78 or above[21].

Step 6: Submission

The prefinal UP-COF Thai version was submitted to the instrument's developers to confirm adherence to all recommended steps. Upon their approval, the translation was considered acceptable, allowing progression to psychometric testing in the subsequent stage.

Phase II: psychometric evaluation of the UP-COF Thai

Participants

This study recruited Thai adults aged 60 and above from the Bangkok Metropolitan Region, including those living in the community and healthcare facilities. Eligible participants were required to walk independently, with or without a gait aid, perform daily activities independently (as indicated by a Barthel ADL score of at least 12), and be able to speak, read, and understand Thai. The exclusion criteria include individuals with a history of neurological conditions that result in disability (e.g., dementia, stroke), a history of severe psychiatric disorders (e.g., psychosis, panic), or communication impairments.

Sample size

The sample size was determined based on reliability and validity testing requirements. A minimum of 50 participants is necessary to ensure acceptable test-retest reliability[22,23]. For the receiver operating characteristic (ROC) curve analysis, 88 participants were recruited, consisting of 66 non-fallers and 22 fallers. The sample size was calculated using MedCalc® version 22.026, with the expected area under the ROC curve (AUC) set at 0.7. The ratio of non-fall to fall participants was based on the 25% fall prevalence rate among older adults in Thailand[11,14].

Outcomes

(1) Demographic Characteristics

Demographic data collected in this study included participants' age, sex, height, weight, and number of comorbidities. Participants were categorized into faller and non-faller groups based on their self-reported fall history. The occurrence of falls within the past 12 months was assessed using retrospective recall, a method considered valid and appropriate for data collection in observational studies involving healthy, community-dwelling older adults[24].

(2) The prefinal version of the Updated Perceived Control Over Falling Thai (UP-COF Thai)

The UP-COF is a self-administered tool designed to evaluate an individual's perceived control over falling. Originally developed in a Western context, the tool consists of 4 items rated on a five-point Likert scale, with response options ranging from 'strongly disagree' (0) to 'strongly agree' (5). The total score ranges from 0 to 20, with scores of 13 or lower indicating low perceived control over falling[4]. In this study, the tool underwent cultural adaptation into Thai, and a prefinal version was developed for further

psychometric evaluation. The prefinal version of the UP-COF Thai was assessed by both older adults and an expert panel to ensure conceptual equivalence and content validity.

(3) The Falls Efficacy Scale International Thai version (FES-I Thai)

This assessment tool was used to assess CaF. The scale includes 16 items rated on a four-point Likert scale (1–4) on how much they felt concern or fear of doing each activity, with scores categorized as low (16–19), moderate (20–27), and high CaF (28–64)[25,26]. The FES-I Thai has been culturally adapted from the original English version, demonstrating strong construct validity through factor analysis with varimax rotation and high internal reliability with a Cronbach's α of 0.95 and inter-item correlations of 0.67 in older Thai adults[27].

Procedure

Data collection for this study was performed at community centers for older adults and authorized healthcare centers in the Bangkok Metropolitan Region. A total of 88 participants completed the demographic data and self-administered the UP-COF and FES-I Thai during the initial assessment. Participants' fall history over the past year was recorded to categorize them as fallers or non-fallers, in line with the sample size required for ROC analysis[28]. Fifty participants were randomly selected to complete a second administration of the UP-COF Thai within one week to assess test-retest reliability. Participants were instructed to avoid strenuous activities before the second assessment. Those who fell before the second evaluation were excluded. The procedure of psychometric testing is represented in Figure 1.

Data analysis

Statistical Package for the Social Science (SPSS) version 28 for Windows (SPSS Inc., Chicago, IL) was used to analyze test-retest reliability, internal consistency, and concurrent validity. The normality of the data was tested using the Shapiro–Wilk test, which indicated that the data were normally distributed. Test-retest reliability was measured using the intraclass correlation coefficient ($ICC_{2,1}$) of a two-way mixed effects model with absolute agreement. Reliability was interpreted as follows: values below 0.5 indicate poor reliability, values between 0.5 and 0.75 suggest moderate reliability, and values between 0.75 and 0.9 indicate strong reliability. A minimum ICC score of 0.70 was considered an acceptable level of reliability[29]. The internal consistency of the UP-COF was assessed using Cronbach's alpha, with an acceptable range set between 0.7 and 0.9 to ensure reliability while avoiding redundancy[22].

Concurrent validity using Pearson's product-moment correlation coefficient was undertaken for investigating the correlation between the UP-COF and FES-I Thai, which is used clinically for measuring CaF and is relevant to the concept of perceived control over the falling model[4,30]. The values range from 0–0.30, which indicates negligible correlation, 0.30–0.50, little or no correlation, 0.50–0.70, moderate correlation, 0.70–0.90, high correlation, and 0.90–1.00, very high correlation[31].

MedCalc® version 20.014 (MedCalc Software Ltd, Ostend, Belgium) was used to calculate the accuracy of UP-COF. The ROC curve was calculated using sensitivity (y-axis) and 1–specificity (x-axis). The area under the curve (AUC) was used to indicate the accuracy of the UP-COF score and was evaluated as follows: AUC ≥0.90 indicated high accuracy, AUC in the range of 0.70–0.90 indicated moderate accuracy, AUC <0.70 indicated low accuracy, and AUC <0.50 was interpreted as being at chance levels. The optimal criterion value of each test was calculated using the Youden index J. The other parameters obtained through ROC curve analysis were sensitivity and specificity, which could determine the test's ability to identify fallers and non-fallers, respectively[28,32].

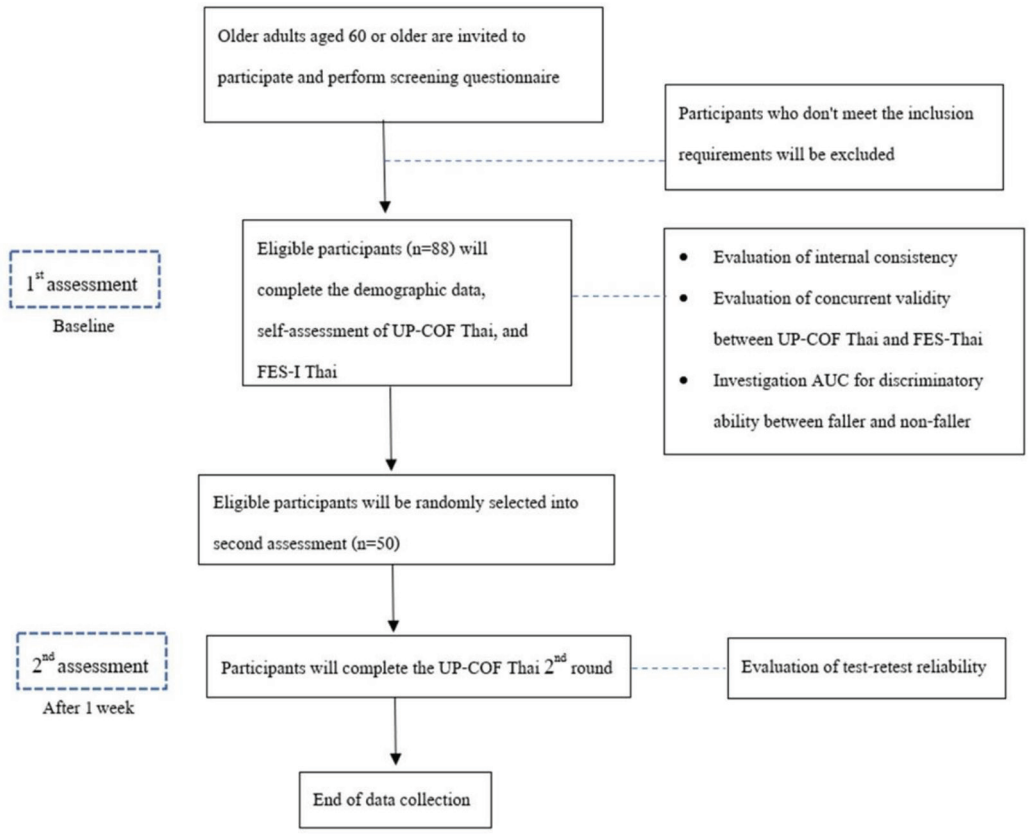

Figure 1 Procedure of psychometric testing

Results

Phase I: translation and cross-cultural adaptation of the UP-COF

The UP-COF was translated and culturally adapted according to the guidelines of Beaton et. al with a rigorous process to maintain both linguistic and conceptual consistency. Although the translation process proceeded smoothly overall, a few challenges emerged but were successfully addressed.

Translation process and pilot testing

During forward translation, certain English words and phrases posed difficulties in finding appropriate Thai equivalents. For instance, in item 2, the phrase *"I can easily put worries about falling out of my mind"* presented issues in conveying the correct meaning in Thai, as different word choices could imply either an ability to suppress feelings or a lack of CaF. Similarly, the term *"overwhelming"* in item 4 was challenging to translate accurately into Thai. These discrepancies were addressed during consensus meetings, leading to the final synthesis translation. Subsequently, 2 back-translations were conducted, and a panel of experts reviewed all the translations with the original versions corresponding with written reports to ensure their equivalence. Minor modifications were made to the instructions, item 4, and the interpretation to enhance clarity. These revisions were determined to be a consensus by the expert panel, and the prefinal version was delivered.

Pilot testing was conducted among 20 older Thai adults (aged 60–88, mean 69.35) to assess its equivalence. The inter-rater agreement met the required minimum of 80%, ranging from 85% to 95% for all the items and instructions. A panel of 10 experts, including health professionals, psychiatrists, and physiotherapists, evaluated the instrument's conceptual and content equivalence. Almost all the items achieved a minimum inter-rater agreement. Minor modifications were made to clarify the instrument's name, instructions, and item 4, which was revised due to ambiguity in the Thai word *«overwhelming»*, simplifying it to be better understood by older Thai adults. Following these revisions, content validity was assessed to further enhance content equivalence. The I-CVI ranged from 0.9 to 1, with an S-CVI/Ave of 0.975, indicating a satisfactory level of content validity. The final UP-COF Thai version was completed and sent to the original instrument developer for verification before proceeding to psychometric testing in the next phase.

Phase II: psychometric testing of UP-COF Thai

Test-retest reliability

Fifty participants completed the test-retest reliability. The demographic characteristics of participants are shown in Table 1. The test-retest reliability was evaluated using $ICC_{2,1}$, yielding a moderate reliability value of 0.75, 95% CI [0.60, 0.85], and p-value<0.001. The mean UP-COF Thai scores at the first and the second assessments are presented in Table 2.

Internal consistency

The demographic characteristics of the participants included in the internal consistency analysis are presented in Table 1. Internal consistency, measured using Cronbach's alpha, was assessed in 88 participants, yielding an acceptable value of 0.76.

Concurrent validity

The demographic characteristics of 88 participants are demonstrated in Table 1. A significant negative correlation

Table 1 Demographic characteristics of participants for the psychometric properties of the UP-COF Thai

Variables/Type of psychometric properties	Test-retest reliability (n=50)		Concurrent validity, internal consistency, and discriminatory ability (n=88)	
	N (%)	Mean (S.D.)	N (%)	Mean (S.D.)
Age (years)	-	70.58 (8.30)	-	72.10 (8.34)
Gender				
Male	32 (64)	-	29 (33)	-
Female	18 (36)	-	59 (67)	-
Weight (kg)	-	62.50 (12.24)	-	60.92 (12.30)
Height (m)	-	158.50 (8.40)	-	157.30 (8.55)
Number of comorbidities				
None	11 (22)	-	15 (17)	-
1-2	28 (56)	-	55 (62.5)	-
≥3	11 (22)	-	18 (20.5)	-
Falls Efficacy Scale International Thai (FES-I Thai)	-	26.14 (10.27)	-	26.67 (10.33)

UP-COF Thai=The updated perceived control over falling scale Thai version, N=numbers of participants

was found between the UP-COF Thai and FES-I Thai scores (r=-0.51, 95% CI [-0.65, -0.34], p-value<0.001), demonstrating a moderate negative correlation (Figure 2).

Discriminatory ability

The sample consists of 88 older adults, with 66 being non-fallers and 22 being fallers. The demographic characteristics are shown in Table 1. Regarding the group between fallers and non-fallers, the UP-COF Thai scores were significantly lower in older adults who had experienced a fall in the past 12 months (mean=15.60, S.D.=2.85, p-value<0.05) compared to non-fallers (mean=17.18, S.D.=2.83, p-value<0.05). The ROC evaluated the ability of UP-COF Thai to differentiate between older adults who had experienced a fall in the previous year and those who had not. The AUC was 0.66, suggesting a modest level of discrimination. An optimal cut-off score of ≤16 out of 20 was established for identifying individuals with a history of falls, which provided a sensitivity and specificity of 68.18% (Figure 3).

Table 2 Test-retest reliability (n=50) and internal consistency of the UP-COF Thai (n=88)

Questionnaire	1st assessment	2nd assessment	$ICC_{2,1}$	Cronbach's alpha	p-value
UP-COF Thai	15.83 (3.60)	16.50 (3.16)	0.75	0.76	<0.001

UP-COF Thai=the updated perceived control over falling scale Thai version, ICC=intraclass correlation coefficient

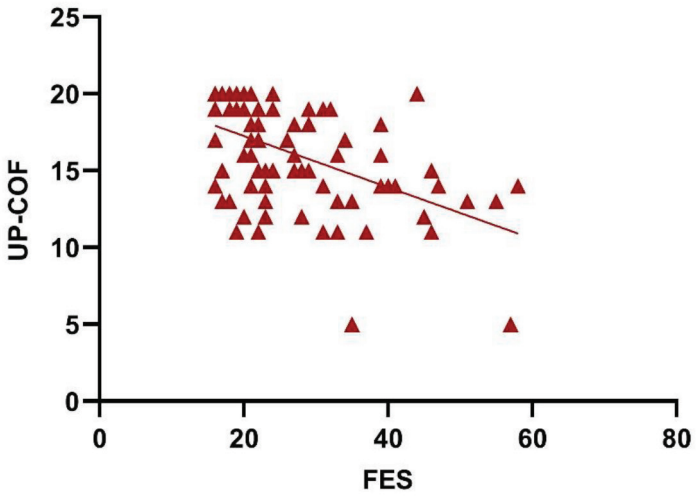

Figure 2 Correlation between the updated perceived control over falling (UP-COF) and the falls efficacy scale (FES)

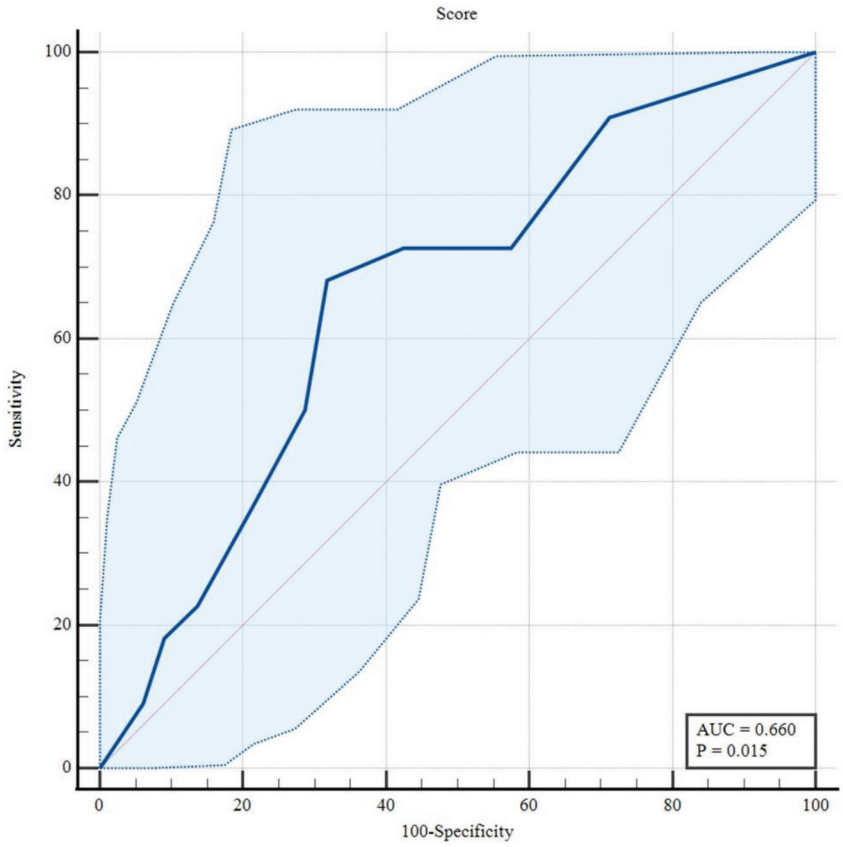

Figure 3 The area under the receiver operating characteristic curve (AUC) of the updated perceived control over falling (UP-COF)

Discussion

The findings of this study provide the cultural adaptation of the Updated Perceived Control Over Falling Scale (UP-COF) for applicability in older Thai adults. The translation and adaptation process adhered to the guidelines set by Beaton et al.[19], resulting in a reliable and valid tool for assessing perceived control over falling. The translation process was successful overall, though minor linguistic and conceptual challenges arose as Items 2 and 4 required careful adjustment. The expert committee reviews, and pilot testing confirmed that the tool retained its intended meaning and was well understood by older Thai adults, with acceptable inter-rater agreement.

The adapted instrument demonstrated moderate test-retest reliability, with an $ICC_{2,1}$ of 0.75, and acceptable internal consistency, as shown by Cronbach's alpha, of 0.76[22]. The one-week interval between assessments was appropriate for evaluating the stability of health measures[33]. These values are consistent with findings from the original UP-COF, supporting the reliability of the adapted version[4]. However, several factors may have contributed to these results, including variability in participant characteristics (e.g., age, health status, or cognitive ability) and potential differences in measurement conditions, such as environmental distractions and properties of the questionnaire items (e.g., clarity of item, or cultural

relevance). Considering these elements would have strengthened the interpretation of the instrument's reliability.

Perceived control over falling is conceptually linked to CaF, which is primarily assessed worldwide using the FES[34,35]. Consequently, the FES-I was used to evaluate the concurrent validity of the UP-COF, consistent with the original version[4]. The concurrent validity further substantiated the robustness of the UP-COF Thai, as evidenced by a significant negative moderate correlation with the FES-I Thai ($r=-0.51$, p-value<0.001). Consistent with prior studies, these findings suggest that lower perceived control is linked to higher CaF, as measured by the FES-I. Reduced perceived control is associated with decreased falls efficacy in older adults, potentially leading to heightened CaF, panic, and persistent worry. These psychological responses can negatively impact movement strategies, ultimately increasing the risk of falling[4]. Previous research indicated that perceived control may promote positive health outcomes, such as improved functional health and increased physical activity[36]. Additionally, lower perceived control in older adults has been associated with greater functional limitations, leading to reduced social engagement[37]. These suggest that older adults with lower perceived control might struggle to maintain functional mobility, which could result in activity limitations and a decline in falls efficacy. In the context of falls, prior research found a link between falls efficacy and perceived control over falling, reinforcing our findings that older adults with heightened CaF exhibit lower self-efficacy (49.1±25.4), have reduced perceived control over falling (14.1±3.2), and have poorer balance performance (16.4±8.1). Furthermore, increased fall self-efficacy is associated with increased perceived control ($r=0.549$, p-value<0.05) and improved balance ($r=0.755$, p-value<0.05), highlighting the interdependent nature of these constructs[38]. Few recent studies have explored the link between falls efficacy and perceived control, but earlier research has shown connections between falls efficacy, CaF, and perceived control, highlighting the need for further study[5,30,35,39].

This study found significant differences in UP-COF Thai scores between fallers and non-fallers, with those who had fallen in the past year scoring lower. This aligns with previous research showing that falls negatively impact health, well-being, and survival, with perceived control acting as a mediator. The history of falls was significantly linked to lower perceived control, which in turn influenced general health, depression, and anxiety. Perceived control also played a key role in the long-term effects of falls on overall well-being[40]. The discriminatory ability of the UP-COF Thai version was shown to be modest in this study, with an AUC of 0.66. A cut-off score of ≤16 yielded a sensitivity and specificity of 68.18% in distinguishing individuals with a history of falls. Notably, the AUC value in this study was lower than that reported in previous research (AUC=0.74), potentially due to various influencing factors, including sociodemographic (e.g., educational level, ethnicity), physical, and psychological factors supported by previous evidence that these factors influence perceived control beyond the history of falls alone[6,7]. Thus, integrating the UP-COF Thai with other assessments may improve the identification of fall risk. In addition, considering that perceived control is shaped by various factors, future research should explore multidimensional factors influencing perceived control over falling.

The adaptation and validation of the UP-COF Thai have important implications for fall prevention by helping healthcare professionals assess perceived control over falling, allowing for fall risk identification, and the implementation of targeted interventions to enhance confidence and self-efficacy, particularly for older adults with CaF. Enhancing perceived control may help mitigate CaF, promote functional mobility, and reduce fall risk. Despite its strengths, the study has limitations. It was conducted only in the Bangkok metropolitan area, limiting generalizability.

Future research should include more diverse populations from urban and rural areas in order to enhance validity. Additionally, while the scale showed modest discriminatory ability, incorporating additional fall-related measures could improve predictive accuracy. Since the study relied on retrospective recall, longitudinal research is needed to better understand the relationship between perceived control and actual falls.

Conclusion

The cross-cultural adaptation and validation of the UP-COF Thai version represent a significant step forward in assessing perceived control over falling in older Thai adults. The findings confirm the reliability, validity, and practical utility of the tool in both clinical and community settings. Integrating this instrument into fall prevention programs could enable healthcare providers to enhance assessments and interventions, ultimately greater confidence, mobility, and overall well-being among older adults.

Acknowledgement

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Conflict of interest

The authors confirm that there are no conflicts of interest to declare.

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