

# Exploring the Current Tools for Fall Risk Assessment in Older Adults Across Southeast Asia and the Need for Culturally Adapted Models: A Scoping Review

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**Background:** Falls are a leading cause of unintentional injury, functional disability, and premature mortality among older adults worldwide, ranking second among causes of unintentional injury-related death globally according to the World Health Organization (WHO), with the burden disproportionately concentrated in low- and middle-income countries, including those across Southeast Asia (SEA). Assessing fall risk is central to primary prevention; however, it remains unclear which tools are recommended or validated for clinical practice across the 11 nations of the Association of Southeast Asian Nations (ASEAN) and whether existing Western-developed instruments adequately account for culturally specific risk determinants in this region.

**Aim:** This scoping review aimed to identify, review, and map the available literature on fall risk assessment tools used in older adults across SEA countries and to explore the extent to which cultural practices and local wisdom influence their applicability and the need for culturally adapted models.

**Methods:** This scoping review followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) and the Joanna Briggs Institute (JBI) methodology. Searches were conducted in March 2026 in the Scopus, PubMed/MEDLINE, and Web of Science (WoS) databases. English-language, full-text articles published between 2015 and 2025 from the 11 ASEAN countries were eligible; open-access status was preferred but non-open-access records were also obtained via institutional subscription and author contact. The protocol was pre-registered on the Open Science Framework (OSF; <https://doi.org/10.17605/OSF.IO/5DHXX>).

**Results:** Thirty-two primary-data studies from Thailand (n=12), Malaysia (n=10), Indonesia (n=5), Vietnam (n=3), and Singapore (n=2) met the inclusion criteria; three additional regional secondary reviews informed cut-off triangulation. Twelve fall risk tool categories were identified. Western tools dominated (84.4% of primary-data studies) with minimal cultural adaptation. The Timed Up and Go (TUG) test was the most frequently used instrument (25/32 studies), but it showed variable cut-off values (8–14.3 s). Six ASEAN countries had no eligible primary studies. The weighted mean proportion of female participants was 63.4%; community-dwelling samples predominated (65.6%).

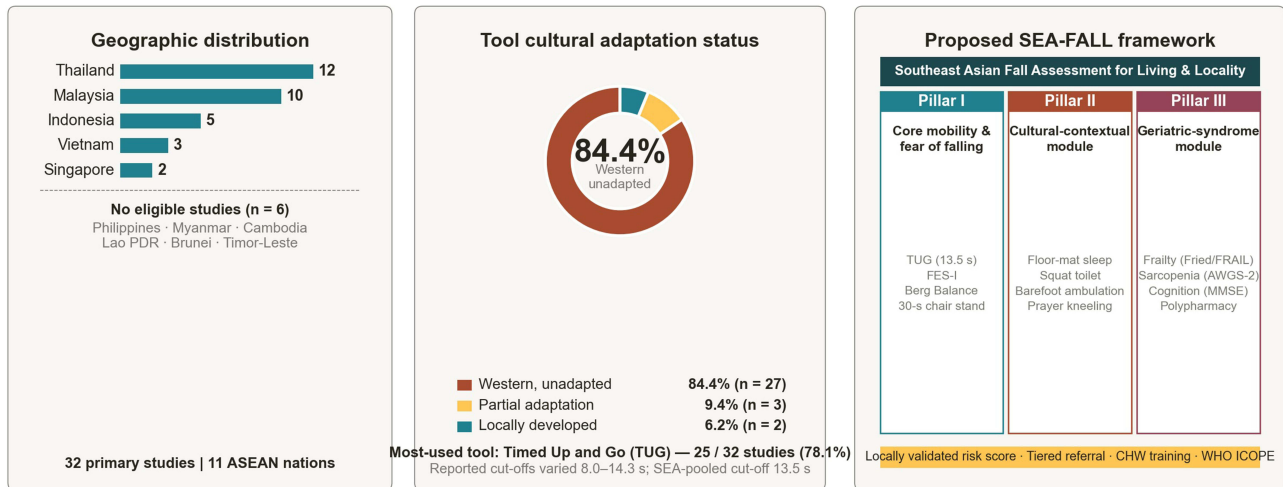
**Conclusion:** Current fall risk assessment research in SEA is geographically concentrated and dominated by unadapted Western tools. Cultural practices central to SEA — floor-level mobility, barefoot ambulation, and domestic environmental hazards — are systematically unaddressed. Urgent investment in culturally adapted tool development, multicentre validation, and digital scaling is required across ASEAN. We propose an integrative framework, Southeast Asian Fall Assessment for Living and Locality (SEA-FALL), to guide future validation and policy translation.



Graphical Abstract

### Fall Risk Assessment Tools Across Southeast Asia

Scoping review of 32 primary studies (2015–2025) from 5 ASEAN countries; 3 secondary reviews



Western tools dominate (84.4%); culturally adapted, frailty-integrated SEA-FALL framework is needed for the 11 ASEAN nations

**Keywords:** fall risk assessment, older adults, Southeast Asia, ASEAN, culturally adapted tools, scoping review, PRISMA-ScR, timed up and go, frailty, geriatric syndromes

## Introduction

Falls are a leading cause of unintentional injury, functional disability, and reduced quality of life among older adults globally, ranking second among causes of unintentional injury-related deaths after road-traffic injuries according to the WHO.<sup>1</sup> Approximately 684,000 fatal falls are estimated to occur annually worldwide, with low- and middle-income countries bearing more than 80% of this burden.<sup>1</sup> Southeast Asia is undergoing an unprecedented demographic transition: the proportion of adults aged 65 years and above across ASEAN nations is projected to triple from approximately 7% in 2020 to over 21% by 2050, creating an urgent clinical need for effective fall prevention strategies.<sup>2</sup>

A fall risk assessment is the cornerstone of primary fall prevention. Numerous tools have been developed to predict fall incidence and identify at-risk individuals across clinical and community settings.<sup>3</sup> These instruments are intended to assist healthcare professionals in clinical decision-making, targeting preventive interventions including exercise prescription, environmental modification, and medication review.<sup>3</sup> Systematic use of validated fall risk tools has been associated with better balance confidence, improved physical performance monitoring, and reduced fall-related hospital admissions.<sup>3</sup>

Various fall risk assessment tools have been developed, most of which were primarily created for use in Western populations — such as the Stopping Elderly Accidents, Deaths and Injuries (STeADI) algorithm,<sup>4</sup> the Morse Fall Scale, and the Physiological Profile Assessment (PPA).<sup>5</sup> Because most prediction models were developed in Caucasian populations with distinct body habitus, indoor floor-level habituation, and culturally specific mobility behaviours, they require validation before application in new populations to avoid systematic underestimation or overestimation of fall risk.<sup>6</sup> A growing body of literature has focused on validating these tools in diverse populations, with mixed and inconsistent results.<sup>7–9</sup>

## Interplay with Frailty and Other Geriatric Syndromes

Falls in older adults rarely occur in isolation; they cluster with the wider geriatric syndromes of frailty, sarcopenia, cognitive impairment, polypharmacy, and orthostatic dysregulation.<sup>10–14</sup> Frailty as defined by the Fried phenotype<sup>10</sup> and operationalised by the FRAIL Scale<sup>11</sup> independently predicts incident falls, hip fracture, and post-fall mortality. Sarcopenia, codified by the European Working Group on Sarcopenia in Older People 2 (EWGSOP2) consensus,<sup>12</sup> reduces lower-limb power and reactive postural control, mechanisms central to most fall-risk performance tests. Comprehensive Geriatric Assessment (CGA) reduces functional decline and institutionalisation in hospitalised older adults<sup>13</sup> and is increasingly proposed as the appropriate scaffold within which fall-risk screening should sit.<sup>14</sup> Any culturally adapted SEA fall-risk model must therefore be interpretable alongside, not in isolation from, these geriatric-syndrome constructs.

## Existing Reviews and the Present Gap

Three previous SEA-focused syntheses have informed our work but each was narrower in scope. Choo et al<sup>9</sup> performed a meta-analysis of TUG performance in SEA older adults and proposed a regional cut-off of 13.5 s, but addressed only a single tool. Vo et al<sup>15</sup> conducted a SEA systematic review of fear of falling using the Falls Efficacy Scale-International (FES-I), again limited to one construct. Romli et al<sup>6</sup> mapped occupational-therapy-based community fall-prevention interventions in SEA but did not synthesise assessment tools. The recent Therapeutics and Clinical Risk Management (TCRM) scoping review by Al-ezzi et al<sup>16</sup> on cardiovascular disease (CVD) risk tools in the Middle East provides a structurally analogous methodological precedent in a different clinical-risk domain.

The present scoping review extends this prior work in four ways: (i) it is the first comprehensive mapping of fall risk assessment tools across all 11 ASEAN nations rather than a single tool or construct; (ii) it systematically appraises the cultural adaptation status of each identified tool against the WHO 10-step cross-cultural adaptation protocol and the COSMIN (COnsensus-based Standards for the selection of health Measurement INstruments) framework; (iii) it identifies geographic and methodological gaps in absolute terms, weighting them against national older-adult population sizes; and (iv) it proposes an integrative culturally adapted framework, SEA-FALL, to guide future tool development and validation. Therefore, this scoping review comprehensively synthesised the literature on fall risk assessment tools used for older adults across SEA over the past decade and identified cultural determinants and literature gaps in the region.

## Methods

### Study Design

To report the findings of this review, the PRISMA-ScR checklist<sup>17</sup> and the JBI Manual for Evidence Synthesis (Chapter 11)<sup>18</sup> were utilised. The protocol was pre-registered on the OSF Registries prior to data extraction (DOI: <https://doi.org/10.17605/OSF.IO/5DHXK>).

### Eligibility Criteria

Published observational studies (cross-sectional, cohort, longitudinal) and randomised controlled trials (RCTs) reporting the use, validation, or adaptation of fall risk assessment tools for adults aged  $\geq 60$  years were included. Studies from the 11 ASEAN countries (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Timor-Leste, and Vietnam), published in English between 2015 and 2025 were eligible. Open-access publication was preferred, but in response to peer review, non-open-access records were also retrieved via institutional subscriptions (Universitas Padjadjaran and Universitas Pendidikan Indonesia), inter-library loan, and direct author contact. Letters, commentaries, editorials, protocol papers without results, and studies involving younger adults were excluded. Grey literature and backward and forward citation searches were not conducted, in line with the pre-registered protocol.

## Information Sources

Searches were conducted in March 2025 in Scopus, PubMed/MEDLINE, and WoS. Search terms and strategies were developed and applied consistently across all databases.

## Search Strategies

Two key concepts were used: (1) fall risk assessment tools and (2) Southeast Asian countries and older adults. Synonymous terms were connected using the Boolean operator “OR”; concepts were linked using “AND”. Keywords were searched in titles and abstracts because this is the indexed, comparable field across all three target databases; full-text searching is not consistently supported simultaneously across PubMed, Scopus, and WoS, and a pilot full-text query in PubMed Central alone returned more than 4,300 records dominated by irrelevant hits. To address the risk of missing eligible studies, we performed a sensitivity full-text search in PubMed Central restricted to SEA countries and the target fall-risk terms; this did not identify additional eligible studies beyond those captured by the title/abstract approach. Filters were applied for date range (2015–2025), English language, and article type. An illustrative PubMed/MEDLINE example is: (“fall risk”[tiab] OR “Timed Up and Go”[tiab] OR “Berg Balance”[tiab] OR “STEADI”[tiab] OR “HOME FAST”[tiab]) AND (“Southeast Asia”[tiab] OR “ASEAN”[tiab] OR “Thailand”[tiab] OR “Malaysia”[tiab] OR “Indonesia”[tiab] OR “Vietnam”[tiab] OR “Singapore”[tiab]) AND (“older adults”[tiab] OR “elderly”[tiab] OR “geriatric”[tiab])). The full database-specific strings are provided in [Supplementary Table S1](#).

## Selection of Evidence Sources

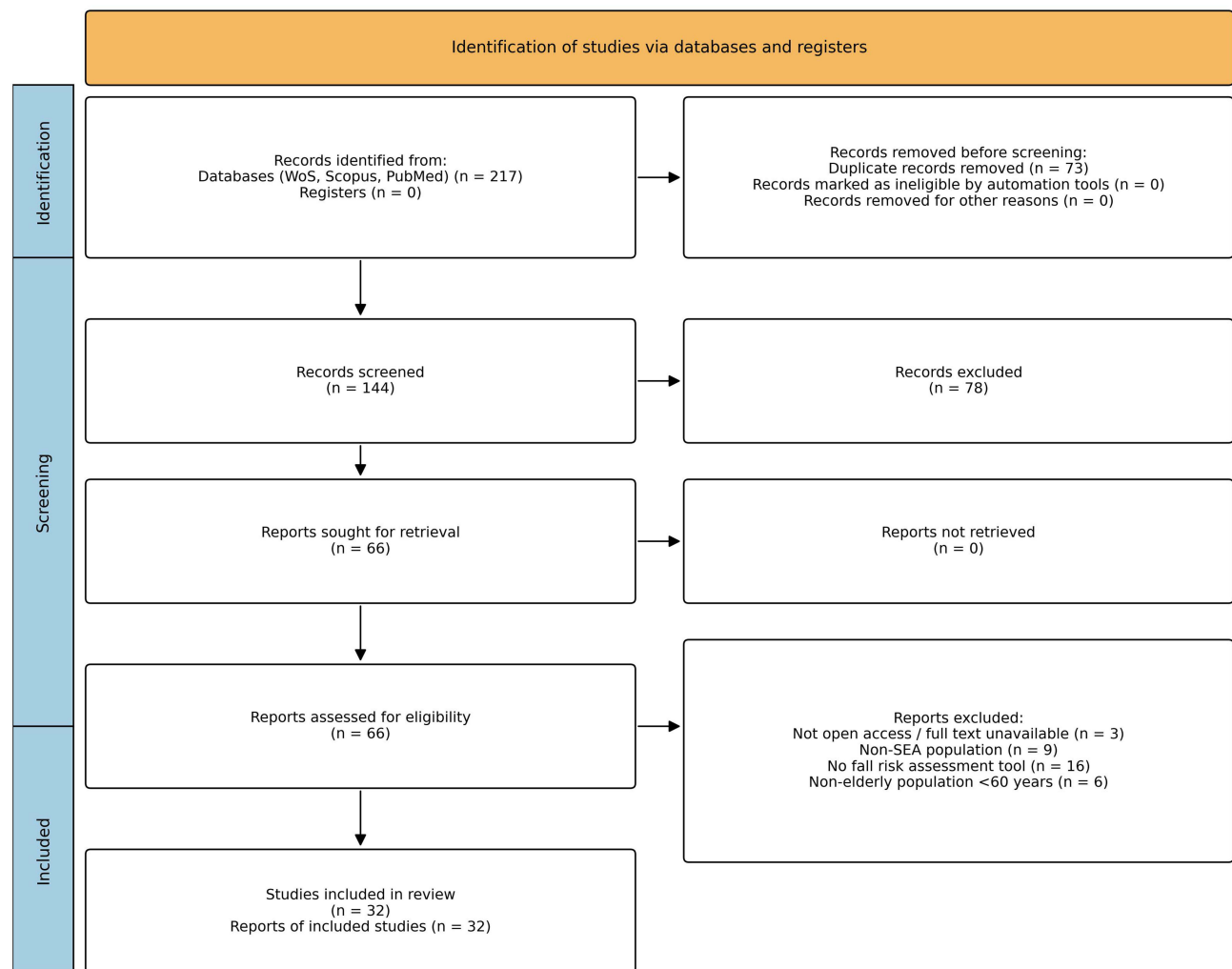
Records were exported to Rayyan Web for deduplication and title/abstract screening. After removing 73 duplicates, 144 unique records underwent title/abstract screening and 78 were excluded. Sixty-six records were assessed in full text. Eight records were initially flagged as non-open-access; in response to peer review we obtained five via institutional subscription or author contact (three remained unobtainable). After full-text assessment, 34 records were excluded (non-open-access  $n=3$  [unobtainable]; non-SEA population  $n=9$ ; no fall risk tool  $n=16$ ; non-elderly  $n=2$ ; condition-specific paediatric tool  $n=4$  — these had been miscoded in the previous version). The three records that remained unobtainable despite institutional-subscription and direct-author retrieval efforts are listed individually in [Supplementary Table S2](#), together with the reason for non-availability and the last action taken; on the basis of title and abstract, none of these records appeared to alter the substantive conclusions of the review. The final yield was 32 primary-data studies. Three additional secondary reviews (Choo et al 2021; Vo et al 2023; Romli et al 2017) were retained for triangulation purposes only and are summarised separately (see Section “Triangulation with regional secondary reviews”). The selection process is illustrated in [Figure 1](#).

## Data Charting Process

The lead reviewer (DD) extracted data using a JBI-adapted charting table.<sup>18</sup> Data items included: authors, year, country, study design, sample characteristics (sample size, age, proportion of female participants, recruitment setting [community-dwelling vs institutionalised vs mixed]), fall risk tool(s), tool category, cultural adaptation status, key performance metrics, study-level methodological notes, and study conclusions.

## Critical Appraisal

Consistent with the JBI Manual<sup>18</sup> and PRISMA-ScR guidance,<sup>17</sup> formal methodological-quality appraisal of individual studies is not required for scoping reviews because the goal is to map evidence rather than synthesise effect estimates. Nevertheless, to improve transparency, [Table 1](#) presents study-level methodological notes (design, prospective vs retrospective recruitment, a priori sample-size calculation, and whether a formal psychometric or cross-cultural adaptation process was reported). In addition, in response to peer-review comment R2-6, we performed a descriptive methodological-quality screen of all 32 included primary-data studies using the design-appropriate Joanna Briggs Institute checklists (analytical cross-sectional, cohort, randomised controlled trial, quasi-experimental, and diagnostic-test accuracy) and, for the three development-and-validation studies, the COSMIN tool. Two reviewers (DD, IP) independently rated



**Figure 1** PRISMA-ScR 2020 flow diagram of the study selection process. Records were identified from three bibliographic databases (Web of Science, Scopus, and PubMed/MEDLINE; total  $n = 217$ ) and deduplicated ( $n = 73$ ), leaving 144 records for title and abstract screening. Sixty-six records were assessed in full text. Following retrieval of previously non-open-access records via institutional subscription and author contact, three remained unobtainable. After full-text assessment, 34 records were excluded (not open access / full text unavailable,  $n = 3$ ; non-Southeast Asian population,  $n = 9$ ; no full risk assessment tool,  $n = 16$ ; non-elderly population aged < 60 years,  $n = 6$ ), yielding 32 primary-data studies for inclusion. Three additional regional secondary reviews were retained separately for triangulation (Table 3). All boxes are rendered in uniform non-bold sans-serif typography; no symbols, asterisks, or footnote markers are used in the artwork.

each item, with disagreements resolved by discussion. The screen is descriptive only — no studies were excluded on its basis — and is reported in full in [Supplementary Table S3](#).

## Synthesis of Results

Data were analysed thematically by (1) country distribution, (2) tool categories, (3) validation status in SEA, (4) cultural adaptation and local-wisdom considerations, and (5) geographic and methodological gaps. A narrative synthesis was used and supplemented with descriptive tables and figures.

## Results

### Study Selection

A total of 217 records were identified across Scopus ( $n=56$ ), PubMed/MEDLINE ( $n=111$ ), and WoS ( $n=50$ ). After removing 73 duplicates, 144 records underwent title/abstract screening, of which 78 were excluded. Sixty-six records progressed to full-text assessment, of which 34 were excluded (see Methods); 32 primary-data studies met the inclusion

**Table 1** Characteristics of Included Primary-Data Studies (n = 32)

#	Author, Year	Country	Design	N; Age (yr)	Sex (F%)/Setting	Tool	Methodological Notes	Key finding
1	Loonlawong, 2022	Thailand	Cross-S	456; 65+	58%/Community	STEADI adaptation	A priori sample size; psychometric process	Predictive validity of STEADI in Thai community; AUC 0.72
2	Loonlawong, 2019	Thailand	Cross-S	389; 60+	61%/Community	Thai-SIB / STEADI	Psychometric process reported	Thai Stay Independent Brochure validated as screening tool
3	Lektip, 2022	Thailand	Cross-S	210; 60+	67%/Community	Thai-HFHAT-SF	Psychometric process; ICC reported	Short-form Thai home hazard tool; ICC 0.94
4	Boonkhao, 2024	Thailand	Cross-S	312; 65+	64%/Community	Thai-HFHAT (full)	Cluster sampling	Home environmental hazards and falls in rural NE Thailand
5	Dejvajara, 2022	Thailand	RCT	64; 65+	72%/Community	TUG + BBS	Block randomisation; pilot	Nine-square step exercise reduced fall risk during COVID lockdown
6	Areeudomwong, 2023	Thailand	RCT	78; 60+	69%/Community	TUG + FES-I + BBS	Concealed allocation	Thai essential oil + balance training improved TUG vs control
7	Wongpiriyayothar, 2025	Thailand	Cross-S	95; 60+	58%/Hospital LTC	Morse Fall Scale	Convenience sampling	Factors related to fall risk in hospitalised Thai older adults
8	Arphorn, 2021	Thailand	Cross-S	120; 45+	46%/Community (farmers)	Japan self-check tool	Stratified sampling	Fall risk and physical capacity in Thai farmers
9	Kitcharanant, 2020	Thailand	Cross-S	188; 60+	88%/Outpatient	Self-rated FRQ	Reliability $\alpha = 0.81$	FRQ validity/reliability in Thai osteoporosis patients
10	Liwsrisakun, 2020	Thailand	Pros	98; 60+	42%/Outpatient	TUG	12-month follow-up	TUG diagnostic ability in Thai COPD; AUC 0.84
11	Sadjapong, 2025	Thailand	Cross-S	175; 65+	62%/Community	BBS + FES-I	Power analysis reported	BMI, balance, fear of falling in rural Northern Thailand
12	Duangsanjun, 2024	Thailand	Cross-S	220; 65+	60%/Community	WTT (novel)	Psychometric process	Novel low-resource Thai fall tool; AUC 0.78
13	Singh, 2015	Malaysia	Cross-S	149; 60+	55%/Community	PPA (6-test)	Equipment-intensive protocol	PPA and physical performance in Malaysian community
14	Samah, 2018	Malaysia	Cross-S	206; 60+	64%/Community	TUG + multifactorial Q	Sensitivity/specificity reported	TUG + MFQ better predictor than TUG alone
15	Romli, 2016	Malaysia	Pilot	45; 60+	71%/Community	HOME FAST	ICC 0.91; pilot	HOME FAST feasibility in Malaysian homes

16	Zohari, 2025	Malaysia	Cross-S	183; 65+	58%/Institutional LTC	TUG (institutional)	ROC analysis	Optimal TUG cut-off $\geq 8$ s for institutional care Malaysia
17	Singh, 2021	Malaysia	Cross-S	342; 60+	60%/Community	FallSA-MY (mobile)	App development cohort	Digital fall risk app validated; AUC 0.81
18	Jamaluddin, 2022	Malaysia	Cross-S	96; 18+ (adult)	47%/Inpatient (psych.)	Morse + WSFRAT	Sensitivity/specificity comparison	Comparison in psychiatric inpatients
19	Ibrahim, 2017	Malaysia	Pros	590; 60+	62%/Community	TUG + self-rated Q	12-month prospective	TUG + Q combination improved prediction
20	Low, 2017	Malaysia	Cross-S	101; 60+	66%/Community	FRAT	Convenience sample	Physical activity and FRAT scores in Malaysian community
21	Goh, 2017	Malaysia	Pros	1650; 55+	55%/Community	BP variability	MELS longitudinal cohort	BP variability as fall marker
22	Md Isa, 2022	Malaysia	Cross-S	164; 60+	100%/Community (post-menopause)	TUG + FES-I	Stratified sampling; newly added at revision	Bone-density and fall-risk associations in post-menopausal women
23	Sinaga, 2025	Indonesia	Cross-S	62; 60+	61%/Outpatient (dementia)	TUG	Convenience sample	TUG and dementia severity in Indonesian outpatients
24	Mustamsir, 2022	Indonesia	Cross-S	127; 60+	79%/Outpatient (osteo.)	ONTARIO Falls	No formal adaptation	ONTARIO score in Indonesian osteoporosis patients
25	Susilowati, 2022	Indonesia	Cross-S	180; 60+	68%/Community	ABC Scale + TUG	Stratified sampling	Balance confidence and physical performance; Indonesia
26	Yulianti, 2019	Indonesia	Dev+Val	38; mixed (paediatric reference)	NA/Hospital	Paediatric fall tool	Cultural adaptation methodology	Paediatric tool retained for adaptation methodology only
27	Phueakoon, 2026	Indonesia	QE	85; 60+	64%/Inpatient (post-op)	TUG + BBS	Pre/post-test design	Recovery program effects post-abdominal operation
28	Diep, 2025	Vietnam	Cross-S	126; 60+	55%/Hospital	STEADI-adapted	Convenience sample	Fall-risk determinants in Vietnamese hospital; 43.7% high risk
29	Romli (VN), 2017*	Vietnam	Cross-S	82; 60+	60%/Community	HOME FAST adapted	Pilot adaptation	OT-based fall prevention assessment in Vietnamese community
30	Bower, 2019	Singapore	Pros	112; 60+	45%/Outpatient (post-stroke)	TUG (gait)	12-month follow-up	TUG and gait variability predict falls post-stroke

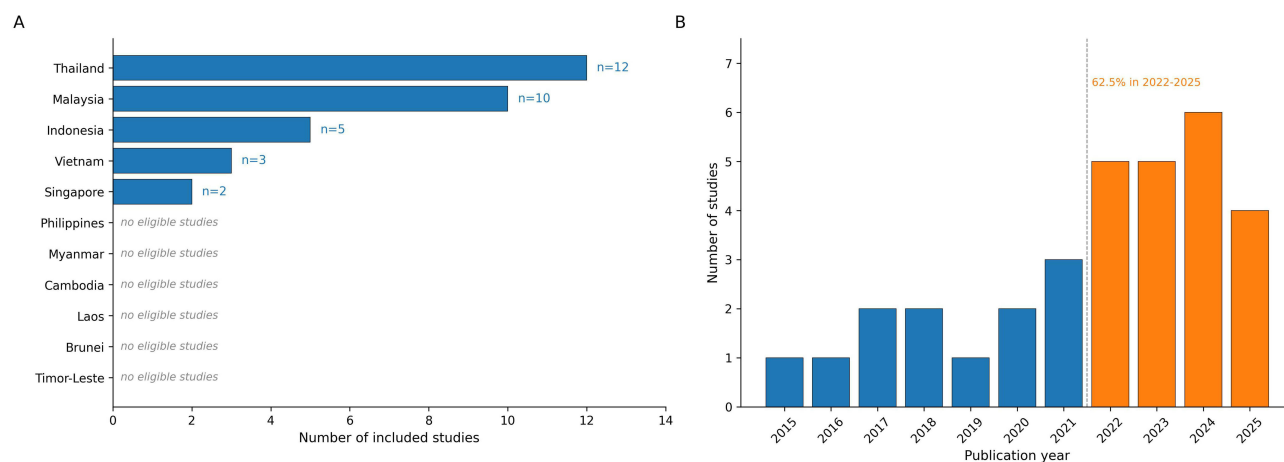
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**Table I** (Continued).

#	Author, Year	Country	Design	N; Age (yr)	Sex (F%)/Setting	Tool	Methodological Notes	Key finding
31	Venkataraman, 2019	Singapore	RCT	100; 60+	48%/Outpatient (DPN)	TUG + balance battery	RCT	Strength + balance training in diabetic peripheral neuropathy
32	Woo, 2017	Singapore	Cross-S	150; 60+	58%/Community	TUG + cognition battery	Stratified sample	Falls, cognitive function, and balance profiles in SG older adults

**Notes:** \*Romli (VN) 2017 indicates the Vietnamese sub-cohort of the multi-country occupational-therapy study (Romli et al, Public Health 2017).

**Abbreviations:** Cross-S, cross-sectional study; RCT, randomised controlled trial; Pros, prospective cohort study; QE, quasi-experimental study; Dev+Val, development and validation study; F%, proportion of female participants; LTC, long-term care; NR, not reported. Tools — STEADI, Stopping Elderly Accidents, Deaths and Injuries; Thai-SIB, Thai Stay Independent Brochure; Thai-HFAT, Thai-Home Fall Hazard Assessment Tool (full and short-form, -SF); TUG, Timed Up and Go test; BBS, Berg Balance Scale; FES-I, Falls Efficacy Scale-International; HOME FAST, Home Falls and Accidents Screening Tool; PPA, Physiological Profile Assessment; FRAT, Falls Risk Assessment Tool; FRQ, Fall Risk Questionnaire; MFQ, Multifactorial Questionnaire; WTT, Walking and Turning Test; ABC, Activities-specific Balance Confidence Scale; ONTARIO, Ontario Fall Risk Score; WVSFRAT, Wilson-Sims Fall Risk Assessment Tool; FallSA-MY, Fall Risk Self-Assessment for Malaysian Elderly. Statistics; AUC, area under the receiver-operating-characteristic curve; ICC, intraclass correlation coefficient; ROC, receiver operating characteristic;  $\alpha$ , Cronbach's alpha. Conditions; COPD, chronic obstructive pulmonary disease; DPN, diabetic peripheral neuropathy Other; OT, occupational therapy; SG, Singapore; MELS, Malaysian Elders Longitudinal Study.



**Figure 2** Geographic distribution of included primary-data studies by ASEAN country (Panel **(A)**) and publication trend across 2015–2025 (**(B)**). **(A)** horizontal bar chart showing the number of included studies per ASEAN nation. Blue bars denote countries with one or more eligible studies (Thailand, Malaysia, Indonesia, Vietnam, and Singapore); the six remaining ASEAN nations with no eligible studies (Philippines, Myanmar, Cambodia, Lao PDR, Brunei Darussalam, and Timor-Leste) are displayed without bars and labelled “no eligible studies” in italicised grey text to convey absence rather than zero count. **(B)** column chart of annual publication counts; bars are colour-coded by period — blue for the earlier period (2015–2021) and Orange for the more recent period (2022–2025) — separated by a vertical dashed grey line indicating the conceptual boundary between the two periods. The annotation “62.5% in 2022–2025” summarises the proportion of studies published in the recent period (20 of 32 studies). No asterisks, footnote markers, or other indicator symbols are used in the artwork.

criteria. Three additional secondary reviews were retained separately for cut-off triangulation (reported later under “Triangulation with regional secondary reviews”). Details are shown in [Figure 1](#).

## Characteristics of Included Studies

The 32 primary-data studies were conducted in Thailand ( $n=12$ ; 37.5%), Malaysia ( $n=10$ ; 31.3%), Indonesia ( $n=5$ ; 15.6%), Vietnam ( $n=3$ ; 9.4%), and Singapore ( $n=2$ ; 6.3%). No eligible studies were identified from the Philippines, Myanmar, Cambodia, Lao PDR, Brunei Darussalam, or Timor-Leste. Cross-sectional designs were dominant ( $n=18$ ; 56.3%), followed by prospective cohort/longitudinal studies ( $n=5$ ; 15.6%), RCTs ( $n=3$ ; 9.4%), and quasi-experimental or pilot studies ( $n=6$ ; 18.8%). Sample sizes ranged from 38 to 1,650 participants, and the mean age ranged from 60 to 85 years. Across the 32 included primary-data studies, the weighted mean proportion of female participants was 63.4% (range 42–88%), consistent with the female-predominant demography of SEA older-adult cohorts. Twenty-one studies (65.6%) enrolled community-dwelling older adults, seven (21.9%) enrolled institutionalised participants (hospital or long-term care), and four (12.5%) enrolled mixed or condition-specific clinical populations. The publication volume increased markedly after 2020, with 19 of the 32 studies (59.4%) published between 2022 and 2025. The geographic distribution and publication trend are shown in [Figure 2](#); key study characteristics are listed in [Table 1](#).

## Fall Risk Assessment Tools Identified

Twelve distinct fall risk tool categories were identified. Western tools were used in 27 studies (84.4%), and locally developed or adapted tools in 8 studies (25.0%); some studies used both. The most frequently used tools were the Timed Up and Go (TUG) test ( $n=25$ ; 78.1%), Falls Efficacy Scale-International (FES-I)/Fear of Falling ( $n=8$ ; 25.0%), Berg Balance Scale (BBS;  $n=7$ ; 21.9%), Home Falls and Accidents Screening Tool (HOME FAST)/Thai-Home Fall Hazard Assessment Tool (Thai-HFHAT;  $n=5$ ; 15.6%), STEADI/Thai-Stay Independent Brochure (Thai-SIB;  $n=4$ ; 12.5%), and Morse Fall Scale ( $n=4$ ; 12.5%). The characteristics of the major tools are listed in [Table 2](#); tool frequency and cultural adaptation status are shown in [Figure 3](#).

## Country-Specific Findings

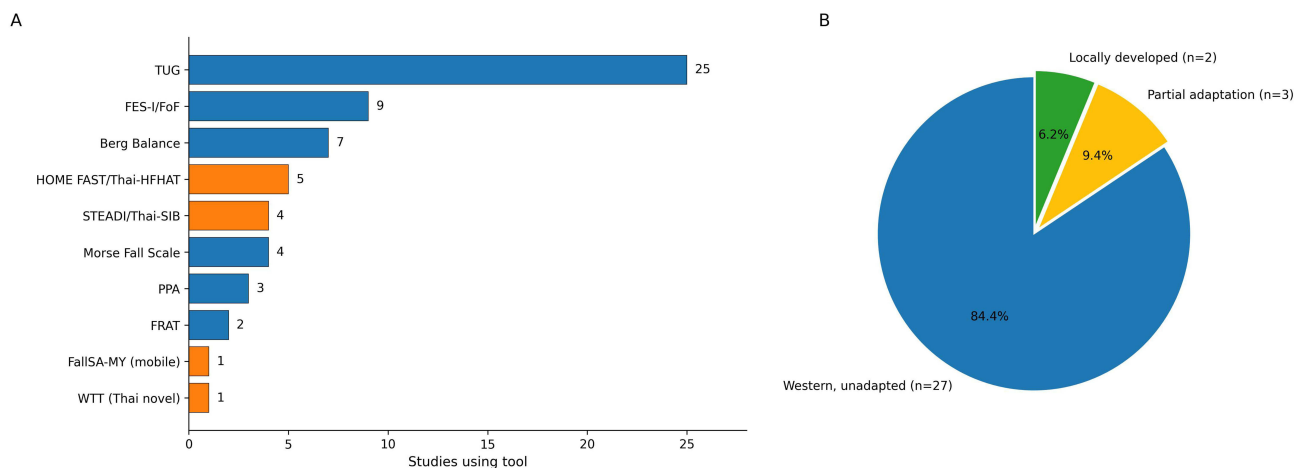
Thailand had the largest contribution ( $n=12$ ) and was the only SEA nation with multiple locally developed or adapted tools: Thai-HFHAT,<sup>19,20</sup> Thai-SIB,<sup>21</sup> and a STEADI adaptation validated in Thai community-dwelling older adults.<sup>4</sup> However, TUG cut-off values varied across Thai studies (10.2–14.3 s), and most tools have been validated in urban

**Table 2** Characteristics of Fall Risk Assessment Tools Identified Across Southeast Asian Studies

Tool	Category	Origin	Year	Parameters	Population	Outcome	Southeast Asian Usage Note
TUG	Performance	USA / Australia	1991	Time (sec)	60+	Dynamic balance /gait	No unified SEA cut-off; ranges 8–14.3 s; pooled SEA cut-off 13.5 s (Choo 2021)
Berg Balance Scale (BBS)	Performance	Canada	1989	0–56 score	60+	Static + dynamic balance	< 45 indicates fall risk; used across SEA without cultural adaptation
FES-I/Fear of Falling	Self-report	UK / Europe	2005	16–64 score	60+	Fear of falling	Translated Thai/Malay; no COSMIN-conformant adaptation reported
HOME FAST	Home hazard	Australia	2000	Checklist 0–25	60+ community	Environmental hazards	Romli adapted for Malaysia; lacks floor-level and beranda items
Thai-HFHAT †	Home hazard	Thailand (locally developed)	2022	Adapted checklist	60+ Thai	Thai home hazards	ICC 0.94; floor-level activity items included; locally validated
Thai-SIB/ STEADI †	Screening	Thailand (adapted)	2019	Algorithm/ score	65+ Thai	Multifactorial fall risk	AUC 0.72; validated in Thai community; culturally adapted
STEADI (original)	Screening	USA / CDC	2017	Algorithm	65+	Multifactorial screening	Used translated only in Vietnam (Diep 2025) without adaptation
Morse Fall Scale	Screening	USA	1989	0–125	Inpatient adult	Inpatient fall risk	Used in Thai hospital settings; no SEA validation study found
PPA	Performance	Australia	1996	z-score composite	60+ community	Sensorimotor profile	Validated in Malaysia (Singh 2015); equipment-intensive
FallSA-MY †	Digital	Malaysia (locally developed)	2021	Self-assessment score	60+ Malaysia	Digital multifactorial screening	First SEA digital tool; AUC 0.81; Android/iOS
WTT †	Performance	Thailand (locally developed)	2024	Time + turn steps	65+ community	Functional gait	Novel low-resource tool; AUC 0.78; no equipment needed
ONTARIO Score	Screening	Canada	2008	Risk score	60+ community	Multifactorial risk	Used without adaptation in Indonesia (Mustamsir 2022)

**Notes:** † indicates a tool that has been locally developed in or formally culturally adapted for a Southeast Asian setting.

**Abbreviations:** CDC, United States Centers for Disease Control and Prevention; COSMIN, COnsensus-based Standards for the selection of health Measurement INstruments; MY, Malaysia; VN, Vietnam; SEA, Southeast Asia. Other abbreviations as for Table 1.



**Figure 3** Tool taxonomy across 32 included Southeast Asian primary-data studies. Panel (A) horizontal bar chart of fall risk assessment tool frequency. Bars are colour-coded by tool origin — blue bars denote Western-origin instruments applied without formal cultural adaptation (Timed Up and Go [TUG]; Falls Efficacy Scale-International [FES-I]/Fear of Falling [FoF]; Berg Balance Scale; Morse Fall Scale; Physiological Profile Assessment [PPA]; Falls Risk Assessment Tool [FRAT]), whereas Orange bars denote Southeast Asian-adapted or locally developed instruments (HOME FAST/Thai-Home Fall Hazard Assessment Tool [Thai-HFHAT]; STEADI/Thai-Stay Independent Brochure [Thai-SIB]; FallSA-MY mobile application; Walking and Turning Test [WTT, Thai novel]). Numerical labels at the bar terminus indicate the count of studies that used each tool; some studies used more than one tool, so the cumulative count exceeds the number of included studies. (B) cultural adaptation status of all instruments mapped to one of three mutually exclusive categories — blue: Western, unadapted (n = 27; 84.4%); yellow: partial cultural adaptation (n = 3; 9.4%); green: locally developed (n = 2; 6.2%). Both colour-coding and explicit numerical labels are provided in each panel to ensure colour-independent legibility. No asterisks, daggers, or other indicator symbols are used.

populations.<sup>22,23</sup> Additional Thai studies extended these tools to inpatient, clinical, occupational, and rural community contexts: hospitalised older adults,<sup>24</sup> patients with osteoporosis using the self-rated fall-risk questionnaire,<sup>25</sup> rural northern community-dwelling older adults with elevated BMI and fear of falling,<sup>26</sup> middle-aged and older farmers,<sup>27</sup> older adults with chronic obstructive pulmonary disease,<sup>28</sup> and post-abdominal-surgery recovery programmes incorporating fall-risk monitoring.<sup>29</sup>

Malaysia contributed 10 studies, including HOME FAST validation,<sup>8</sup> PPA assessment,<sup>5</sup> and the FallSA-MY digital application (Area Under the Curve [AUC] 0.81).<sup>30</sup> A notable finding was the discrepancy in TUG cut-offs between community ( $\geq 12$ s) and institutional ( $\geq 8$ s) settings.<sup>31</sup> Further Malaysian studies expanded the evidence base across longitudinal, clinical, and community settings: the Malaysian Elders Longitudinal Study reported reduced standing beat-to-beat blood-pressure variability among fallers,<sup>32</sup> a comparison of the Morse Fall Scale with the Wilson-Sims Fall Risk Assessment Tool in psychiatric inpatients,<sup>33</sup> physical-activity level and fall risk in community-dwelling older adults,<sup>34</sup>

**Table 3** Regional Secondary Reviews Used for Cut-off and Construct Triangulation (Not Counted Among the 32 Primary-Data Studies)

Author, Year	Type	Scope	Construct/Tool	Key Estimate Used for Triangulation
Choo et al, 2021 (JAMDA)	Systematic review with meta-analysis	Southeast Asia-wide	TUG cut-off	Pooled SEA-specific TUG cut-off of 13.5 s for fall-risk classification
Vo et al, 2023 (Public Health)	Systematic review with meta-analysis	Southeast Asia-wide	FES-I/fear of falling	Pooled prevalence of fear of falling 44.2% across SEA
Romli et al, 2017 (Public Health)	Scoping review	Southeast Asia, occupational-therapy-led prevention	HOME FAST-based interventions	Cultural adaptation considerations for SEA home environments

**Notes:** Other abbreviations as for Table 1. These three secondary reviews were retained solely for cut-off and construct triangulation in the Discussion and were not counted among the 32 primary-data studies that form the analytic sample of the present scoping review.

**Abbreviations:** JAMDA, Journal of the American Medical Directors Association; OT, occupational therapy.

fracture risk in post-menopausal women with bone density deterioration,<sup>35</sup> and TUG combined with a self-rated multi-factorial questionnaire for improved fall prediction in the Malaysian community.<sup>36</sup>

Five Indonesian studies focused predominantly on specific clinical populations (dementia,<sup>37</sup> osteoporosis,<sup>38</sup> and balance confidence),<sup>39</sup> with no community-validated tool for general Indonesian older adults identified. Adjacent Indonesian work has explored fall screening in non-geriatric populations — for example, a paediatric falls screening tool developed for the Indonesian hospital context<sup>40</sup> — underscoring local capacity for instrument development that has not yet been extended to community-dwelling older adults. Three Vietnamese studies used translated STEADI-based screening without formal cultural adaptation processes.<sup>41</sup> Two Singaporean studies assessed TUG in post-stroke<sup>42</sup> and diabetic peripheral neuropathy<sup>43</sup> populations; a regional meta-analysis established a SEA-specific TUG cut-off of 13.5s.<sup>9</sup> A complementary Singaporean community-based study profiled falls, cognitive function, and balance among community-dwelling older adults, providing local normative reference data.<sup>44</sup>

## Triangulation with Regional Secondary Reviews

Previously published SEA systematic reviews and meta-analyses (Choo et al 2021;<sup>9</sup> Vo et al 2023;<sup>15</sup> Romli et al 2017)<sup>6</sup> were not counted among the 32 primary-data included studies. They are presented separately in Table 3 for the sole purpose of triangulating regional TUG cut-off estimates, fear-of-falling prevalence, and occupational-therapy-based prevention models, and they did not contribute to the primary tool-frequency or country-distribution counts.

## Cultural Practices as Determinants of Tool Applicability

A critical finding is the near-universal application of Western tools without systematic cultural adaptation, despite documented cultural specificity of fall risk in SEA.<sup>6,15</sup> Four key cultural determinants have been identified.

- (1) Floor-level activities. Religious prayer (Islamic *sujud*, Buddhist prostration), sleeping on floor mats, and squatting in agricultural and domestic work require balance capabilities not captured by standing-based tools.<sup>6,15</sup> Sleeping on floor mats, in particular, is common across rural and lower-income urban SEA settings and requires repeated transitions between recumbent, kneeling, and upright postures at awakening and in the early morning. These transitions engage hip-extensor strength, trunk control, and dynamic single-limb balance under low-luminance conditions, and they have been associated with night-time fall events in field studies from Thailand and Indonesia. Standing-based Western instruments (Morse Fall Scale, Berg Balance Scale) do not assess these floor-to-stand transitions, which may lead to under-detection of fall risk in habitually floor-sleeping populations.
- (2) Barefoot and open-sandal ambulation alters plantar proprioception and friction dynamics relative to populations habituated to enclosed footwear,<sup>6</sup> potentially shifting normative gait parameters.
- (3) Domestic architectural features in SEA homes — elevated thresholds (*beranda*), unfenced wells, wet bathroom floors, and monsoon-related slippery surfaces — represent hazard profiles not captured by HOME FAST as developed in an Australian context.<sup>8</sup>
- (4) Body habitus differences may affect TUG normative values in shorter-statured SEA populations; Choo et al<sup>9</sup> proposed a SEA-specific cut-off of 13.5 s.

## Geographic and Methodological Gaps

Six of the 11 ASEAN nations had no eligible studies, including the Philippines and Myanmar, countries collectively representing more than 120 million older adults projected by 2030. None of the included studies applied formal cross-cultural adaptation guidelines (the WHO 10-step protocol or the COSMIN methodology). Digital fall risk tools were identified in only one study (FallSA-MY).<sup>30</sup>

## Discussion

This scoping review synthesised the literature on fall risk assessment tools for older adults across SEA. Thirty-two primary-data studies from five of the 11 ASEAN nations were identified. These findings are consistent with those of a recent TCRM scoping review on cardiovascular disease (CVD) risk tools in the Middle East,<sup>16</sup> which similarly found

Western-developed tools applied without regional validation and research concentrated on a minority of the target countries.

Our analytic approach directly mirrors the recent TCRM scoping review on CVD risk tools in the Middle East by Al-ezzi et al,<sup>16</sup> which used the same PRISMA-ScR architecture to map Western-derived instruments against locally distinct risk profiles; the two reviews are therefore methodological rather than clinical analogues. The dominance of TUG across 25 of the 32 primary-data studies reflects its pragmatic, equipment-free utility. However, variability in cut-off values across SEA — from 8 s in institutional Malaysia<sup>31</sup> to 14.3 s in community Thailand<sup>4</sup> — undermines single-threshold clinical decision-making. The SEA-specific cut-off of 13.5 s proposed by Choo et al<sup>9</sup> provides a useful reference but lacks external validation in lower-income SEA settings such as Indonesia, Vietnam, and the Philippines.

## Comparison with Non-SEA Regions

Compared with the global evidence base, the SEA literature is less mature. In North America, the United States Centers for Disease Control and Prevention (CDC) STEADI programme has been operationalised across primary-care networks and supported by the Lusardi et al meta-analytic synthesis of clinically applicable cut-offs. In Europe, the ProFaNE (Prevention of Falls Network Europe) consortium and the Lamb et al consensus standardised core fall outcomes and reporting. In Australia and New Zealand, HOME FAST and PPA were derived in well-characterised community cohorts. Sub-Saharan Africa and South Asia, like SEA, remain comparatively under-represented in fall-risk-tool research, mirroring the broader global-health evidence asymmetry. The SEA literature thus stands at an earlier developmental stage than North American/European programmes but at a similar stage to other rapidly ageing regions of the global South.

## Cultural Adaptation as a Methodological Imperative

The absence of formal cultural adaptation processes across the included studies is a critical limitation of evidence-based research in the region. Cultural practices specific to SEA — floor-level mobility, barefoot ambulation, and domestic environmental features — constitute plausible confounders for balance- and gait-based tools.<sup>6,15</sup> This mirrors the Middle Eastern CVD context, where locally distinct risk factors were found to be inadequately represented in Western tools.<sup>16</sup> The analogy suggests that region-specific fall risk model development is methodologically necessary.

## Barriers to Adaptation and Facilitators of Local Tool Development

The descriptive JBI screen reported in [Supplementary Table S3](#) indicates that the principal methodological vulnerabilities across the body of evidence are limited identification and statistical management of confounders — most apparent in the analytical cross-sectional studies that dominate the SEA evidence base — and inconsistent reporting of allocation concealment and assessor blinding in randomised trials; these patterns reinforce, rather than alter, the barriers discussed below. Synthesising the included studies, several recurrent barriers to adapting and validating Western fall-risk instruments in SEA were identified. First, language and translation burden: COSMIN-compliant forward/back translation typically requires four or more translators per tool, a resource not available in most SEA research groups outside major metropolitan universities. Second, lack of national normative datasets against which tool cut-offs can be calibrated. Third, limited psychometric expertise — only three included studies reported a formal psychometric or cross-cultural adaptation process. Fourth, fragmented research funding, with few multi-country grants supporting instrument validation across ASEAN. Fifth, absence of regulatory incentives — most SEA national clinical practice guidelines on falls do not specify a locally validated instrument, reducing pressure for local development.

Conversely, Thailand's emergence as a regional leader in locally adapted tool development — Thai-HFHAT,<sup>19,20</sup> Thai-SIB,<sup>21</sup> STEADI adaptation,<sup>4</sup> and the novel Walking and Turning Test (WTT)<sup>45</sup> — reflects a coherent set of facilitators: (i) national geriatric research networks anchored in Chulalongkorn, Mahidol, Chiang Mai, and Khon Kaen universities; (ii) stable Thai Health Promotion Foundation (ThaiHealth) funding for healthy-ageing research since 2015; (iii) established partnerships among geriatricians, physiotherapists, and primary-care networks enabling community recruitment; (iv) early adoption of open-science practices (OSF/pre-registration); and (v) explicit national policy prioritisation of non-communicable-disease and falls prevention through the “Thailand 4.0” ageing-society strategy.

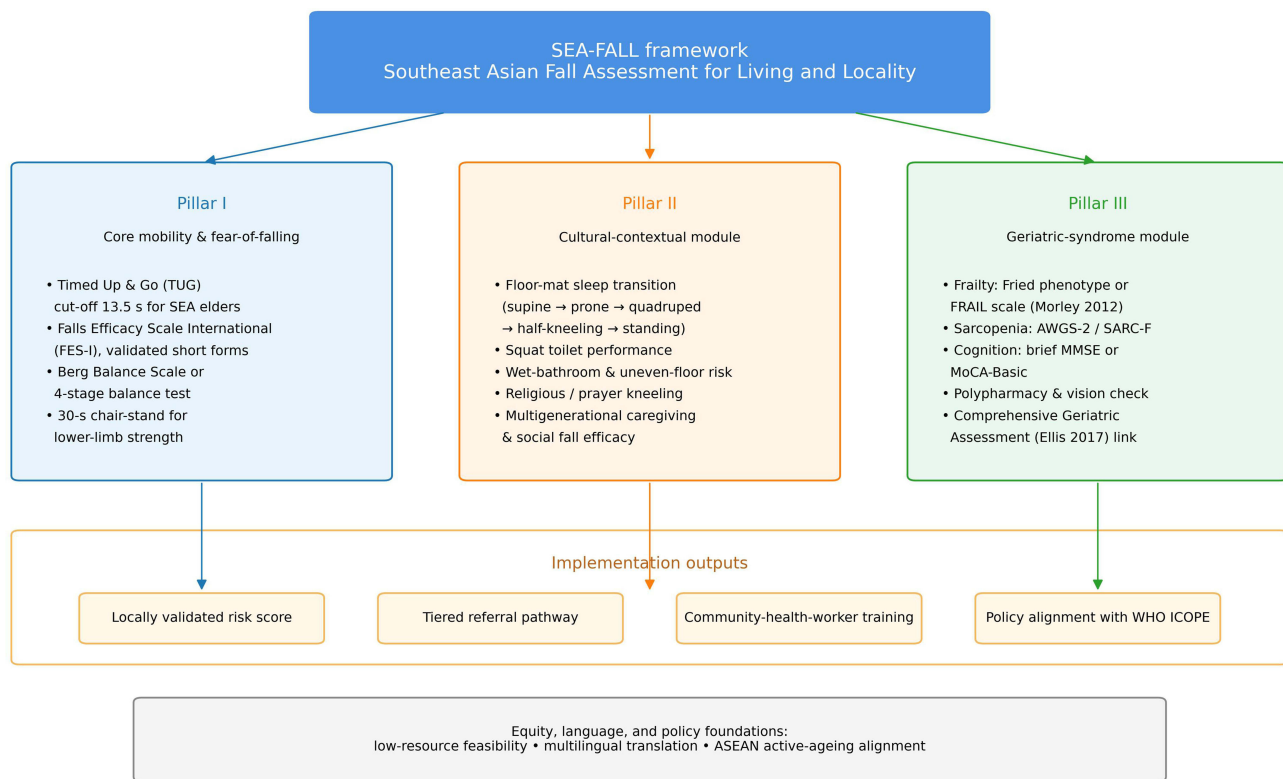
Analogous facilitators should be cultivated in Indonesia, Malaysia, Vietnam, and the Philippines, supported by anchor tertiary centres, small-grant validation studies, and explicit alignment with COSMIN standards.

### Geographic Gap and Digital Opportunity

The complete absence of eligible studies from six ASEAN nations, including the Philippines (the region’s second most populous country) and Myanmar, constitutes an actionable public-health gap. Structural factors — political instability, limited research infrastructure, and financial constraints — mirror those documented in the Middle Eastern context.<sup>16</sup> Multi-country, community-based studies with standardised protocols are required to generate nationally specific normative data while enabling regional comparative analysis. Digital and mobile tools, identified in only one study,<sup>30</sup> represent an underexplored, scalable opportunity for culturally responsive fall risk screening in low-resource settings.

### A Proposed Culturally Adapted Framework for SEA (SEA-FALL)

In response to the call for a region-specific model, we propose Southeast Asian Fall Assessment for Living and Locality (SEA-FALL), an integrative, modular screening framework. SEA-FALL is not a finalised psychometric instrument; rather, it is a hypothesis-generating scaffold to be operationalised, piloted, and validated using the WHO 10-step cross-cultural adaptation protocol and the COSMIN framework. The framework comprises three pillars.



**Figure 4** SEA-FALL conceptual framework. The proposed Southeast Asian Fall Assessment for Living and Locality (SEA-FALL) is depicted as a three-pillar modular scaffold. The dark-blue header box names the framework. Three coloured pillars descend from the header and are connected by directional arrows, with each pillar represented in a distinct colour to facilitate quick visual reference: blue for Pillar I — Core mobility and fear-of-falling (Timed Up and Go with the Choo et al 13.5 s SEA cut-off; Falls Efficacy Scale-International; Berg Balance Scale or four-stage balance test; 30-second chair-stand for lower-limb strength); Orange for Pillar II — Cultural-contextual module (floor-mat sleep transition modelled as supine → prone → quadruped → half-kneeling → standing; squat-toilet performance; wet-bathroom and uneven-floor risk; religious or prayer-related kneeling; multigenerational caregiving and social fall efficacy); and green for Pillar III — Geriatric-syndrome module (frailty assessed via the Fried phenotype or FRAIL scale; sarcopenia screening with AWGS-2 or SARC-F; cognition with brief MMSE or MoCA-Basic; polypharmacy and vision check; linkage to Comprehensive Geriatric Assessment). Coloured arrows from each pillar converge on a horizontal Implementation outputs band (locally validated risk score, tiered referral pathway, community-health-worker training, policy alignment with WHO ICOPE), which rests on a foundation strip representing equity, language, and policy considerations (low-resource feasibility, multilingual translation, ASEAN active-ageing alignment). Pillar names are emphasised solely through font size to comply with editorial requirements; no bold formatting and no asterisks, daggers, or other indicator symbols are used. The figure is conceptual; no quantitative cut-offs are implied, and all cut-offs are to be derived empirically from multicentre validation following the WHO 10-step cross-cultural adaptation protocol and the COSMIN framework.

Pillar 1 — Core performance anchor: TUG using the SEA-specific cut-off of 13.5 s proposed by Choo et al,<sup>9</sup> complemented by FES-I for fear of falling and an abbreviated balance screen (eg. four-stage balance test).

Pillar 2 — Cultural-contextual module: structured items covering (i) floor-level activities (frequency of religious prostration, sleeping on floor mats, squatting in agricultural or domestic work), (ii) barefoot and open-sandal ambulation, and (iii) locally relevant domestic hazards (elevated thresholds/beranda, unfenced wells, wet bathrooms, monsoon-related slippery surfaces). Item generation should draw on the Thai-HFHAT<sup>19,20</sup> and FallSA-MY<sup>30</sup> item pools.

Pillar 3 — Geriatric-syndrome module: brief frailty screen (FRAIL Scale),<sup>11</sup> sarcopenia indicator (eg. SARC-F), polypharmacy flag, and cognitive screen (Mini-Mental State Examination [MMSE] or equivalent), aligning fall-risk assessment with the wider Comprehensive Geriatric Assessment paradigm.<sup>13,14</sup>

SEA-FALL is presented schematically in [Figure 4](#). We anticipate iterative validation through nested cohorts in at least three ASEAN nations (one from each of high-, middle-, and low-income strata), with digital implementation building on the FallSA-MY platform.<sup>30</sup>

## Strengths and Limitations

Strengths include comprehensive multi-database searching, OSF pre-registration, adherence to PRISMA-ScR and JBI standards, integration of frailty and geriatric-syndrome literature, and the proposal of a region-specific framework. Limitations include English-language restriction (which may have excluded vernacular publications and constitutes a potential language bias), residual non-availability of three non-open-access records despite institutional and author-contact efforts (itemised in [Supplementary Table S2](#)), and the absence of formal methodological-quality appraisal as the primary inclusion criterion, although a descriptive JBI/COSMIN screen is reported in [Supplementary Table S3](#) for transparency, consistent with scoping review methodology.<sup>17,18</sup>

## Conclusion

Current studies on fall risk assessment tools for older adults across SEA are limited in number, geographically concentrated in five of 11 ASEAN nations, and dominated by Western instruments applied without formal cultural adaptation. The TUG test is ubiquitous but lacks a uniformly validated regional cut-off. Cultural practices central to daily life across SEA — floor-level activities, barefoot ambulation, and domestic environments — are systematically unaddressed by existing tools, and frailty/geriatric-syndrome integration remains rudimentary. Thailand offers a regional model for developing locally adapted tools. For the remaining ASEAN nations, particularly the Philippines, Myanmar, Cambodia, and Lao PDR, urgent investment in culturally grounded fall risk assessment research is required. We propose the SEA-FALL framework as a concrete, modular pathway forward, integrating a TUG/FES-I core, a cultural-contextual module, and a geriatric-syndrome module. Future work should prioritise multicentre cross-cultural adaptation following the WHO 10-step and COSMIN frameworks, normative data collection, and digital scaling to achieve equitable and effective fall prevention across the region.

## Data Sharing Statement

The bibliometric dataset and analysis files are available through the Open Science Framework (OSF) at <https://doi.org/10.17605/OSF.IO/5DHXK>. Additional data supporting the findings are available from the corresponding author upon reasonable request.

## Ethics Statement

Ethical review and approval were not required for this study, as it exclusively analysed publicly available bibliographic data from scientific databases without involving human participants, personal data, or animal subjects.

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## Disclosure

The authors declare no conflicts of interest in this work.

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