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Cultural Adaptation and Pilot Testing of the CDC's Stopping Elderly Accidents, Deaths, and Injuries (STEADI) Program for Older Adults in a Low and Middle-Income Country

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Abstract: Older adults in low-and middle-income countries experience a disproportionate burden of non-communicable diseases (NCDs). Unintentional injuries are among the major NCDs, and falls are the second leading cause of these injuries and deaths worldwide, including in Thailand. We aimed to culturally adapt the CDC's Stopping Elderly Accidents, Deaths, and Injuries (STEADI) for Thai older adults and explore the feasibility, appropriateness, and acceptability of using STEADI in primary care via trained community health workers (CHWs) and care managers (CMs). STEADI takes a coordinated care approach that consists of three steps: screening, assessing, and intervening. In Step a, CHWs screened fall risk in 20 community-dwelling older adults using three key questions and found that all of them had fall risk, then CHWs screened with a Stay Independent questionnaire (range 0-14) and found that 100% have high fall risk (total scores 9.7± 2.4). In Step b, CMs assessed balance, vision, footwear, postural hypotension, medications, and CHWs assessed home hazards. They found that 50% had poor balance, 70% took 4+ medications,75% fell on the walkway, and 70% had no bathroom modifications. In Step c, individual participants received fall prevention interventions to mitigate their specific fall risk factors. CHWs and CMs indicated high acceptability (19.20±.1.31 of 20 total), appropriateness (18.80± 1.79 of 20 total), and feasibility (18.60±1.67 of 20 total) of the Thai-STEADI intervention. Our study showed that the community-based multifactorial Thai-STEADI delivered by CHWs and CMs is feasible and acceptable to prevent falls in older adults with limited access to health care.

Keywords: assessment; community; fall prevention; low-income; non-communicable diseases; public health; older people; risk; primary care

1. Introduction

Falls are a chronic condition [1] that require long-term care and support services to fully meet the older populations' needs[2].   More than 37 million falls each year require medical attention, 684,000 people globally die from falls, and over 80% are from low-and middle-income countries (LMICs)[3]. In addition, more than 1 billion older adults in LMICs do not have access to resources to help them stay healthy [4,5] thus, they are exposed to a high risk of falls and long-term adverse consequences. For example, Thailand will have one of the largest older populations (25%,~17 million in 2040) among LMICs in Asia. Thailand is facing an overburdened public healthcare system.[6] One-

third to half of Thai adults aged ≥ 60 years acknowledged having falls and/or fear of falling.[7] Falls were also reported in 10.4-53.5% of older people living in the community in Asia.[8]

A review of international fall prevention strategies indicated that no country has been able to eliminate falls in older adults.[9] Several behavioral interventions developed in high-income countries effectively reduce falls, however, there are many barriers to incorporating these types of initiatives in LMICs. Large-scale implementation research in Thailand demonstrates the benefits of using trained community-health workers (CHWs) and care managers (CMs) to reduce behavioral and psychological symptoms of dementia [10]. We conducted a systematic review related to evidence-based fall interventions for older adults and selected the US CDC's STEADI based on several considerations including (a) effectiveness based on published evidence in improving fall risk screening, reducing fall-related hospitalizations and medical costs in the US;[11–15] (b) the intervention fits the needs of Thai older adults; and (c) three components of STEADI would be implemented in the long-term care system using existing resources in primary care settings.

Implementation programs, such as the US Centers for Disease Control and Prevention (CDC)' s Stopping Elderly Accidents, Deaths, and Injuries (STEADI) program, illuminate vital elements of coordinated care and fall prevention for healthcare providers. STEADI also provides strategies to help older adults acknowledge their fall risk and fear of falling and stay independent [16]. STEADI was developed in 2013[1] based on three conceptual models including the Chronic Disease Care Model,[17] health communication,[1] and Transtheoretical Stages of Change Model [18].   STEADI effectively improves fall-risk screening and reduces fall-related hospitalizations and medical costs in the U.S.[11–15] STEADI implementation in primary care settings suggests that fall-risk screening, assessments, and individualized care plans (e.g., exercise) are effective at reducing falls and preventing chronic conditions[11,13,19,20]. STEADI Algorithm of screening, assessment, and intervention has the potential to be implemented in LMICs, but has yet to be adapted and systematically implemented in any LMICs.

Cultural adaptation is an essential action and natural step in the implementation process to improve the adoption of evidence-based interventions in LMICs. Culturally adapted STEADI for LMICs is needed and has the potential to benefit a large population. Adaptation of evidence-based interventions is needed when patients' engagement in service falls below what is expected, culturally specific risks/protective factors need to be incorporated into the intervention, and patient outcomes are not achieved.[21] Large-scale implementation research in Thailand demonstrates the benefits of a cultural adaptation of evidence-based intervention [22]. Thus, proper adaptations of STEADI to the Thai context are necessary for creating a sustainable and effective implementation program in Thailand. We aimed to culturally adapt the CDC's Stopping Elderly Accidents, Deaths, and Injuries (STEADI) for Thai older adults and assess the acceptability, appropriateness and feasibility of the Thai-STEADI in primary care delivered by trained community health workers (CHWs) and care managers (CMs).

2. Materials and Methods

Design This study consists of two phases, including cultural adaptation of the CDC's Stopping Elderly Accidents, Deaths, and Injuries (STEADI) for Thai older adults and assess the acceptability, appropriateness and feasibility of the Thai-STEADI in primary care delivered by trained community health workers (CHWs) and care managers (CMs).

Phase I: Cultural adaptation of   STEADI

STEADI's tools for screening (Step a) and assessment (Step b) were culturally adapted into the Thai context[23,24] and a 1-year prospective study (N=480) showed that these tools have high sensitivity (93.9%, 95% CI 88.8, 92.7) and specificity (75%, 95% CI   70, 79.6) to predict falls.[24]   We culturally adapted STEADI Step c: intervene using the following steps: 1) assess the community; 2) understand/select the intervention; 3) consult with experts/stakeholders and decide what needs to be adapted and adapt the original program; and 4) train staff and pilot test the adapted materials.[25,26]

<u>**First,**</u> *Assessed the current care delivery system and resources in the communit*y. We met with the representatives from the Thai Ministry of Public Health, National Health Security Office, and local

public health to assess their need and receive support to launch the study when funded. All parties agreed to select the city of Mahasarakham as the study site.

Second, *Selected EBI that matches the population and context.* We conducted a systematic review related to evidence-based fall interventions for older adults and selected the US CDC's STEADI based on several considerations including (a) effectiveness based on published evidence in improving fall risk screening, reducing fall-related hospitalizations and medical costs in the US;[11–15] (b) the intervention fits the needs of TOA; and (c) three components of the STEADI would be implemented using existing delivery resources in primary care.

Third, Seven researchers and clinicians in the US and Thailand met via zoom meetings   and in-persons in Thailand to decide what needs to be adapted. Table 1 compares the original STEADI with the adapted STEADI in Thai context.   Table 1 shows a comparison of   the original STEADI with the adapted STEADI in Thai context.

Finally, we trained 5 CHWs and 2 CMs, aged 57.2±.3.3 (aged range 53-62), all female and 60% have 10+ years of experience in their roles to conduct the pilot study in phase II.

Table 1. Comparison of   the original STEADI with the adapted STEADI in Thai context. .

	Original STESDI Protocol	**Thai-STEADI Protocol**
Number of sessions	3 steps annually when patients check-in for an appointment	3 steps in 24 weeks
Providers of the intervention to patients	Medical assistant for screening, nurse for assessments, physician/Nurse practitioner/ physician assistant for intervening	Community health worker (CHW) for screening and care manager (CM) for assessments and intervening
Place of delivery	Intergrating within electronic health record tools and usual clinic flow	Could-based system for delivery and mobile application for communication
Recipients	65 years and older	60 years and older
Follow-up methods/person	Visits at primary care by a care coordinator	Home visits by CHW
Language	English	Thai

Phase II: Acceptability, appropriateness, and feasibility of the Thai-STEADI.

Setting and sample. Participants were recruited from low-income communities in Mahasarakham Province, Thailand. The screening, assessment and fall intervention procedures were carried out at older participants' homes, a community center, and a primary care unit. Twenty participants who met the following inclusion criteria were enrolled: 1) ≥60 years old of age and 2) live in their own homes. Exclusion criteria were: 1) a medical condition precluding fall risk assessments using a timed up-and-go test (e.g., on a wheelchair or bedridden), and 2) currently receiving a treatment program from a rehabilitation facility.

Measures

Fall risk

Fall risk was assessed by the CDC's Stay Independent fall risk checklist. It consists of 12 statements related to physical and psychological fall risk factors with yes or no answers. A score of 4 points or higher indicates a risk of falling.[16] The sensitivity of this checklist with discriminating fallers and predicting future fallers for community-dwelling older adults is 73-80%.[27]

Time-up and go test

Timed Up and Go (TUG) test has been widely used to assess functional mobility and predict fall risk.[28,29] It provides reliable data and is validated among community-dwelling older adults.[30] The TUG has an acceptable sensitivity (87%) and specificity (87%) for assessing older adults who are prone to falls.[31]. For the TUG test, participants stand up from a standard armchair, walk at a normal

pace for 3 meters, return, and sit down again.[32] Participants who complete the TUG test in less than 12 seconds will be classified as having low fall risk.[33]

Acceptability, appropriateness and feasibility

We assess the acceptability, appropriateness and feasibility of Thai-STEADI using the three newly developed implementation outcome measures.[34] Time to complete is less than 5 minutes per measure. Scales values range from 1 to 5 (1=completely disagree and 5= completely agree). Scales can be created for each measure by averaging responses. No items need to be reverse coded.[34] Higher scores indicate greater acceptability, appropriateness and feasibility of the Thai-STEADI.

Data collection and pilot testing of Thai- STEADI

Thai-STEADI consists of three steps including screening, assessing, and intervening.[35]

Step 1 Screening fall risk: Community Health Worker (CHW) provided older adults a Stay Independent self-assessment checklist or perform a quick screening to identify persons at high risk for falls and further assess multiple fall risk factors such as fear of falling, which could detect care needs early and thereby prevent the future need for more intensive long-term care. CHW documented the risk in the STEADI flowsheet and sent it to the Care Manager (CM).

Step 2 Assessing fall risk: Care Manager (CM) conducted fall risk assessments to determine specific fall risk factors including balance tests, vision test, medications review, comorbidities, and home hazards. CM documented the assessments in the STEADI flowsheet and shared it to CHWs.

Step 3 Intervening: After identifying the risk factors, the CM developed a plan based on the modifiable risk factors including a strength and balance program, medication management, corrective eyewear, cataract surgery, orthotics and exercise, vitamin D supplementation, and home modification.[35] The CM intervened via several techniques such as assisting older adults in understanding their fall risk and successfully making behavior changes based on the Stages of Change model.[18] If an older adult need assistive devices (e.g., walking sticks) and home modification, the Universal Coverage (UC) scheme supported by national taxation (National Health Securtiy Office) and district and local municipal funds usually support these needs, respectively. In addition, our program integrates with a long-term care system that can refer individuals who need specialists to the community hospital where Thai citizens can access medical care as part of three schemes including Social Health Insurance, Civil Servant Medical Benefit and UC under the national health insurance program. Besides the three steps, older adults receive the STEADI's information pamphlet (Thai language) related to fall risk, how to prevent falls, check for safety, postural hypotension, and chair rise exercise.[16]

Data analysis

Data was analysed using descriptive statistics such as pecentage, mean and standard deviation using SPSS program (IBM SPSS Statistics 29.0).

3. Results

The majority of participants (90%) were women, mean age was 76.4 (SD=5.4, range 61 to 89) years, 85% have hypertension and 60% have diabetes. Table 2 presents the descriptive characteristics of 20 older participants.

Table 2. Descriptive characteristics and screening fall risk of the older participants (n=20). .

Variable	Number (%)
Age Mean (SD)	76.35 (6.39)
Min - Max	61 - 89
Gender	

Female	18 (90%)
Male	2 (10%)
Chronic conditions/diseases	
Diabetes	12 (60%)
Hypertension	17 (85%)
Hypercholesterol	10 (50%)
Chronic pain	5 (25%)
Cardiovascular disease/stroke	1 (2%)
Dementia	1 (5%)
Parkinson disease	1 (5%)
Admited in the hopital in the last 6 months	7 (37%)

Step a: *Screening at home or in community.*

Community health workers screened for fall risk in 20 older adults using 3 key quick questions. If older partcipants have at least one issue from the three,　they are high risk to fall. In the quick screening, CHWs found that 100% of older partcipants have high risk to fall. Next, CHWs used the CDC's Stay Independent fall risk checklist (range 0-14) and found that 100% of　older partcipants have the total score at least 4 which indicated that all of them have high risk to fall (total scores mean 9.7 and SD= 2.4). In addition, the majority (80%) reported that they are worried about falling, 95%　reported that they need to push with their hands to stand up from a chair　and 90%　have some troble stepping uo onto a curb.

Table 3. Screening fall risk from older participants by communty health workers .

Variable	Number (%)
Step 1.1 Screening fall risk using 3 key questions	
I have fallen in the past year	12 (60%)
Simetimes I feel unsteady when I am walking	15 (75%)
I am worried about falling	16 (80%)
Step 1.2 Screening fall risk using the Stay Independent	
I have fallen in the past year	12 (60%)

I use or have been advised to suse a cane or walker to get around safely	16 (80%)
Simetimes I feel unsteady when I am walking	15 (75%)
I steady myself by holding onto furniture when walking at home	18 (90%)
I am worried about falling	16 (80%)
I need to push with my hands to stand up from a chair	19 (95%)
I have some troble stepping uo onto a curb	18 (90%)
I often have to rush to the toilet	16 (80%)
I have lost some feeling in my feet	15 (75%)
I take medicine that sometimes makes me feel ligh-headed or more tired than usual	10 (50%)
I take medicine to help me sleep or improve my mood	5 (25%)
I often feel sad or depressed	6 (30%)
Total score Min=5 Max=14, Mean =9.70 (SD=2.364)	

Step b: *Assessing.*

Care managers assessed balance, vision, feet, footwear, number of medications and CHWs assessed home hazards. They found that 50% have poor balance (Timed Up and Go score 27.3± 18.2 seconds), 70% take at least 4 types of medications, 50% have vision impairment, 80% lost some feeling in their feet, 75% fell at the walkway and 70% have problems with toilet (e.g., no bar rail).

Step c: Intervening. For this pilot testing, CMs selected 5 older participants who had the highest fall risk scores and provided the interventions that tailored to their risk factors as presented in Table 4.

Table 4. Thai STEADI Intervention activities.

Intervention activities	Target participants
Chair exercises	Older adults with balance impairement by performing at least 10-15 minutes, 2-3 times per week for 2 months.
Installation of grab rails in bathroom and walkway (Figure 1)	Participants with home hazard environment
Blood pressure goal and medications affecting falls	Participants with hypertentsion
Referral for cataract surgery	Participants with visual impartment regarding to cataract

Shoes fit education and medications affecting falls	Participants with diabetes
Pain management	Participants with chronic pain.

Before   **After**

Figure 1. Installation of grab rails in bathroom (Before and after).

Five participants' attendance all sessions. Examples feedback from participants included:

"Being more aware of my fall risk and trying to exercise more" (Male #3).

"I like my community health worker and care manager; they are friendly and care about my health and safety" (Female #5).

Acceptability, Appropriateness and Feasibility of the Thai-STEADI.

Table 5 shows the mean and total scores of acceptability, appropriateness and feasibility from CHWs and CMs' perspectives. *Acceptability*: 80% of CHWs and CMs completely agreed that STEADI meets their approval, appealing to them, they like and welcome it.

Appropriateness: 60-80% of CHWs and CMs completely agreed that STEADI seems fitting, suitable, applicable   and like a good match.   *Feasibility:* 80% of CHWs and CMs completely agreed that STEADI seems implementable, possible, doable, and easy to use. Overal, CHWs & CMs indicated high acceptability (19.20±1.31 of 20 total), appropriateness (18.80±1.79 of 20 total) and feasibility (18.60±1.67 of 20 total) of the STEADI program.

Table 5. Acceptability, Appropriateness and Feasibility of the Thai-STEADI.

	N	Minimum	Maximum	Mean	Std. Deviation
Acceptability of Intervention Measure					
Thai-STEADI meets my approval	5	5	5	5.00	.000
Thai-STEADI I sappealing to me	5	4	5	4.60	.548
I like Thai-STEADI	5	4	5	4.80	.447
I welcome Thai-STEADI	5	4	5	4.80	.447
Total scores of acceptability	**5**	**17**	**20**	**19.20**	**1.304**
Intervention Appropriateness Measure					
Thai-STEADI seems fitting	5	4	5	4.60	.548
Thai-STEADI seems suitable	5	4	5	4.80	.447
Thai-STEADI seems applicable	5	4	5	4.60	.548

Thai-STEADI seems like a good	5	4	5	4.80	.447
Total scores of appropriateness	**5**	**16**	**20**	**18.80**	**1.789**
Feasiblity of Intervention Measure					
Thai-STEADI seems implemenable	5	4	5	4.40	.548
Thai-STEADI seems possible	5	4	5	4.60	.548
Thai-STEADI seems doable	5	4	5	4.80	.447
Thai-STEADI seems easy to use	5	4	5	4.80	.447
Total scores of feasiblity	**5**	**16**	**20**	**18.60**	**1.673**
Total scores	**5**	**49**	**60**	**56.60**	**4.561**

Discussion

We aimed to culturally adapt the CDC's STEADI for Thai older adults and assess the acceptability, appropriateness and feasibility of the Thai-STEADI in primary care delivered by trained CHWs and CMs. To our knowledge , this study presents the first cultural adaptation of the CDC's STEADI for older adults in LMICs which delivered by CHWs and CMs. This study introduces an international fall collaborative and prevention for older people in LMICs. This study also incorporates researchers and clinicians in the US and Thailand.

A recent systematic review of strategies to implement multifactorial fall prevention indicated that the most used implementation strategies at the individual level were tailoring, active learning, personalizing risk, consciousness-raising and participation.[36]   Most strategies at the environmental level were technical assistance, use of lay health workers, peer education, increasing stakeholder influence and forming coalitions.[36] Also, the differences between countries (e.g., culture, environment, exercise preference, sunlight exposure, healthcare and social welfare) may influence the success of implementing falls prevention.[37] A culturally adapted program and systematically implementation have the potential to create a sustainable intervention and improve older adults' engagement in the program and outcomes. Most falls in Thai older adults occur at home the same as other studies[38] and are caused by several modifiable risk factors such as balance impairment, fear of falling and hypertension.[39]

Our study showed that the community-based multifactorial Thai-STEADI delivered by CHWs and CMs is feasible and acceptable to prevent falls in older adults with limited access to health care. A recent scoping review indicated knowledge and awareness of risk, the influence of peers, and general uptake and trust in health services were barriers to implementation in LMICs. [40]   In collaboration with CHWs, a CM (nurse) provided a 3-month simple home-based balance training program and found the intervention group (n=52) improved the timed up and go test, functional reach test and FOF after 3, 6, 9 and 12 months compared with the control group (n=52).[41] In addition, after home modifications, previous study found that participants (n=43) improved their mobility and walking distance. [42] Moreover, all participants' quality of life increased by 0.203 from 0.346 at baseline to 0.549 after the modifications.[43] Previous study in Thailand indicated that home modification in low-resourced settings are technically and financially feasible and can lead to improving physical function and quality of life.[43] Large-scale implementation research in Thailand demonstrates the benefits of using trained community-health workers and care managers to reduce behavioral and psychological symptoms of dementia [10]. Incorporating peer support into the healthcare system may reduce the burden on the healthcare system [44]. Also, peers and community partners may influence the general uptake of and trust in health services, even in rural environments where accessibility may be difficult.

Limitations

This study had several limitations. First, the pilot study with small sample sizes and a cross-sectional design limited the ability to drawn the effects of Thai-STEADI and establishment of causal

relations. Second, social desirability may lead older participants to under or over-reporting their fall risk.   Finally, the selection of participants was not random.

Conclusions

Primary care systems and community partners can be leveraged to stop falls and enhance older adults' well-being in LMICs. Community-health workers and care managers are leaders in their communities, at the forefront of primary prevention, and play an essential role in reducing the burden on the healthcare system. The STEADI of screening, assessment, and intervention for primary care providers could be used in LMICs or low-income settings with limited resources. A culturally adapted program and systematically implementation have the potential to create a sustainable intervention and improve older adults' engagement in the program and outcomes. This project incorporates researchers and clinicians in the US and Thailand, builds on successful projects that use community health workers, students, and care managers to assess, educate and facilitate change, and has the potential to reduce fall rates and concern for falling in Thailand, with implications for other LMICs.

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