"FACTORS RELATED TO FALLS AMONG THE ELDERLY IN THE EASTERN THAILAND"

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Abstract

Title: Factors related to falls among the elderly in Eastern Thailand

Background: Falls, have a high incidence, are a major health problem among the elderly due to the ageing society change in Thailand.

Method: A mixed study of Secondary data analysis and literature review was used to find the factors related to the falls. The data from the survey among 450 elders age 60 and above, who lived in Eastern Thailand in 2018, will be analyzed between fallers and non-fallers.

Result: Participants in the survey of the age 60-88 years old were 450 elders, from that 121 participants had fallen within 1 year (26.9%), these are 19 men and 102 women. Among fallers, participants with an age more than 80 had the highest proportion of falls. In individual level the reported BMI ($p=0.038$), excessive waist circumference ($p<0.001$), hearing impairment ($p=0.037$), balance impairment ($p<0.001$), and taking sleeping pills ($p=0.027$) were significantly associated with falls. In proximal level it was found that the area around houses, with rough ground and rocks, clear areas, and with incline pathways, were associated to falls. There is no report of association in distal level. Exercise, home hazardous modification and combined interventions were found effective to prevent falls among the elderly.

Conclusion: Risks factor of falls were found because of different levels of causes. Physical status in the individual level are related to falls as environmental hazardous in the proximal level. Preventive interventions, exercise and home hazard modification, are mandatory to decrease fall incidences in elders.

Keyword: falls, elderly, prevention, risk factors, Eastern Thailand

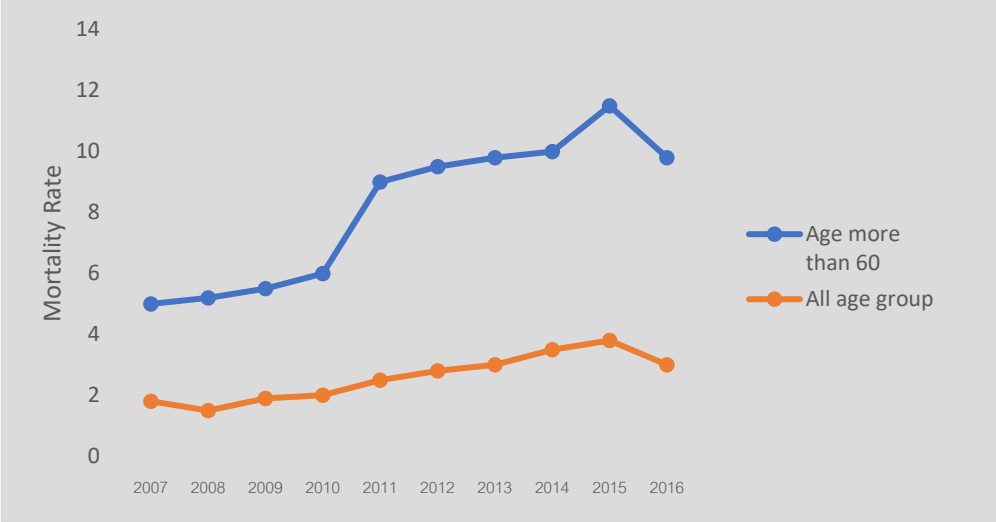
Introduction

Nowadays, most countries around the world are experiencing the growth of the elderly in their countries, due to the development of the health system and the decrease in fertility rate. This demographic changing pattern shows not only the rising in aging of the population but also the falling of the proportion of young children (Figure 4), which causes a higher life expectancy globally(11). The double rise from 12% -22% of population aging globally is expected from 2015 until 2050, in which 80% of these are in low and middle-income countries(12). Thailand has senior citizens in 16.7 % of all population in 2019 (7) and is expected to become a super-aging society, 30 % of the population are at the age of 65 or above, by the next 20 years(13).

The degenerative process of the age changes leads to cognitive impairment, functional impairment and impairment of mobility, especially the last two issues can cause falls, this is one of the common geriatric syndromes, apart from urinary incontinence, pressure ulcers, delirium, and functional decline(14). According to the functional and mobility changes, they may have balance problems, muscle weakness, poor vision, or a long term health condition and cognitive changes such as dementia, which can lead to dizziness and loss of consciousness and fall (9.) Environmental is a part of the precipitate factors of falls, such as using stairs, slippery floors, or other risky structures of the house, that cause problems through their imbalance in movement. Especially when older adults fall, this may lead to many serious health issues, such as fracture, joint dislocation, head trauma, and fatality. Among the aging population, one of the most common injury causes of mortality is falls, which is a public health issue and is considered nowadays as a priority in the world health organization and the Thai Ministry of Health. Comparing with other age groups, falls in the elderly have a higher impact

on the mortality rate(16) (Figure 5) because of physical status, which degenerates by the aging change and including the presence of individual medical conditions.

Figure 1 The Mortality rate of falls Among the elderly and other age groups of the population from 2007-2016 in Thailand



Source: Division of Non-Communicable Disease, Thai Ministry of Health

Available from: http://www.thaincd.com/document/file/info/fall/1-elderly28122560.pdf

According to statistical data in Thailand, the mortality rate caused by falling had continued rising from 8.5/100,000 population in 2011 up to 10.2/100,000 population in 2017 (16). Health region 6, consisting of 7 provinces in the Eastern area, including 1 province from central area Samutprakarn, experienced a high and increasing falls mortality rate, from 9.2 in 2011 to 11.3 in 2017, in which both numbers were above the average rate in the national report(16). According to the mortality rate of falls in Thailand, approximately 5 people died from falling per day, in which 2 of them were elders.

Falls in the elderly could cause a chance of hip fracture 1 in 10, and this situation will increase by age(17). One-fourth of the hip fracture cases in the elderly could lead to death. The consequences of falls cost money in terms of medical and personal care, even though less than half of the elderly attended health facilities afterward. The patients who experienced

falls with hip fractures, or head traumas, will have less independence and mobility, and the pre-fracture function cannot recover. The negative fall affects, such as fear of falls, would remain with them, which will lead to a hypoactive lifestyle and functional decline(14). In case of incapacity to receive the operative treatment when needed, due to the high risk from the procedure, the result can be remaining bedridden, immobility, or inability to move. The outcome of these falls has an impact on living to the elderly themselves, to their caregivers, such as spouses and family members. Notably, the negative result from falls always needs physical, mental, and financial support from family members.

Numbers of research explored the factors of falls among the elderly globally; almost half of them are from western countries. Most of the studies have focused on the environmental factors of falls, such as living conditions and the characteristics of the house. The movement disorders such as disorientated movement or muscle weakness and their causes, were also emphasized as the factors which had the attention in many researches. On the other hand, there are few studies who were exploring overall factors, including community or family support factors, that might affect falls in older adults, instead of focusing on only specific factors. There is no research in falls among the elderly, that has been conducted and studied about all the possible related factors in Eastern Thailand, where the mortality rate of falls has always been higher than the national average rate. This study area is mostly in the urban area and is filled with many industrial factories, which means older adults are left behind staying home, and some of them have responsibilities in taking care of their grandchildren instead of parents, who are fulltime workers.

One survey conducted in the East Thailand had the purpose to explore the related factors to health status and healthy lifestyle among the elderly, which consisted of general information of participants, such as weight, height, education, physical status, medical

condition and life style. Besides, the questionnaire included the participants falls history, level of health literacy, housing, family support, and participating in community activities that is related to falls among the elderly. This study is planned to be published within next year, in it is explored its research question, which is the overall health status, healthy lifestyle and related factors between these issues among the elderly in the Eastern area, but did not explain the linkage specifically between falls and the factors that could link to it.

2.3 Research objective

To explore and analyze the factors associated with falls among the elderly in Eastern Thailand and to give recommendations regarding falls of elderly to Thai MoPH, health facilities, health workers and communities.

2.4 Methodology and analytical framework

This thesis is a mixed-method study that will be done by firstly, secondary data analysis and then literature review.

Secondary data analysis

This method will be done by analyzing the secondary data, collected by the survey among the elderly in the Eastern Thailand in March 2018. The research "The related factors to health status and behaviour in elderly in the Eastern part of Thailand" belongs to Tippawan Jumpang, registered nurse and senior professional working at Health Center 6, Thailand. This was done with the purpose of exploring factors related to healthy lifestyle among the elderly in the health region 6.

The survey was conducted by collecting the data from face-to face-interview, which questions proved the content validity and realizability. Participants were selected by a multi-stage sampling method. The weight, height and waist circumference were measured by the

research team to calculate BMI and identify the normal value for analysing. Questions of incomes, physical status and medical conditions, as same as others questions, were collected from answers of participants. The research survey had been analyzed, the summary report was written and it is planned to be published in Thailand not later than 2021, with the original research heading.

The permission letter has been sent to the research owner for the authorization and the agreement, and the waiver was submitted to the chair KIT REC with the reply of decision. The secondary data analysis is aimed to analyze and explore the specific objectives explained above. The analysis process will be done in each level of causes according to the analytical framework, to study the relation between various factors. The secondary data analysis will be done by analysis data between two independent groups of data, falls and non-falls, to find significant association by using the Chi-Square test.

The survey collected data from 450 elderly who live in health area 6. The number of participants were selected from total 512,857 elders in the Eastern part, by a three-stages cluster sampling method. Firstly, the simple sampling was done to select 3 from totally 8 provinces followed by a simple sampling method to select 3 districts from each province. And lastly, the simple sampling method was used to select 5 subdistricts from each district, in which only elders, who were physically active, were included in this research survey.

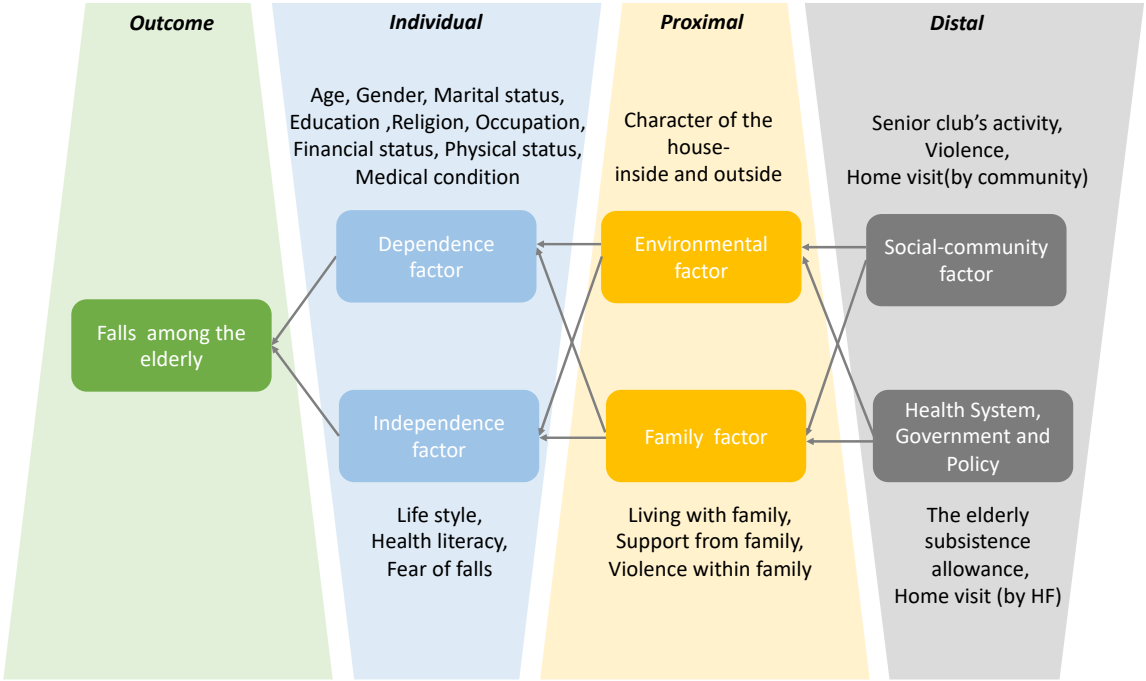
Literature review

The literature review in this thesis will be done according to a systematic approach, to explore all related factors from the published materials, both in the country and also in other countries. This method will be used as the causation conceptual framework, to analyze the factors related to falls among the elderly and to link and compare with the secondary data analysis.

The literature review method in this study used search engines: Google Scholar, VU online library, PubMed. The website of WHO, Thai Ministry of Health, NHS, Thai NSO were used to explore the definition, health information and health data. The searching process was done through Thai and the English language. Keywords in MeSH term are falls in elderly, aged, gender, environmental hazardous, intervention, falls, community, senior housing, family support, elder abuse, policy, healthy lifestyle, medical condition, physical status.

This research study uses the Causation of falls conceptual framework (Figure 6) which is adjusted from a causal-web in "Comparative quantification of health risks: conceptual framework and methodological issues"(18). Both secondary data analysis and literature review will analyze data according to this conceptual framework.

Figure 2 Causation of falls conceptual framework



Results

In this chapter, the result of this study will be reported in 4 categories, general information, individual cause, proximal cause and distal cause and Falls preventive interventions.

General information

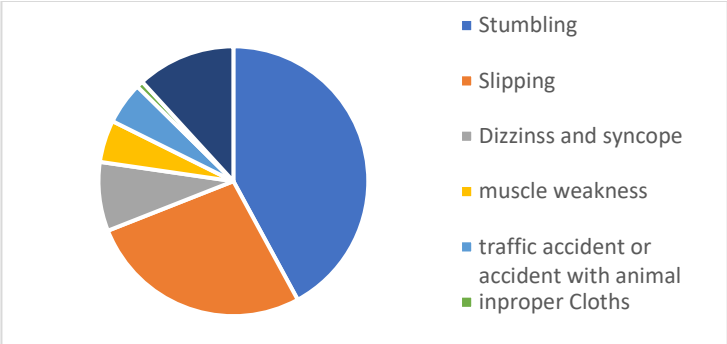
The study reports from totally 450 participants this had 88 male participants and 362 female participants which is approximately the ratio of male to female 1:4. The age of participants ranged from 60 to 88 years old with the mean being 68.45 and SD= 5.852. The descriptive data showed percentage of male in the survey much less than in the regional statistics. The reason of this disproportion was explained by the researcher that the majority of male went out for work during the survey, which was working time. The same reason as in 60-69 age group had lower percentage and in the group age 80 and above had higher percentage comparing to the regional statistic data. Among all participants, 121 elders or 26.9 % were reported with having a history of falls within the 1-year period before the survey.

Table 1 Demographic data of study population among 450 respondents age >60 years old in a survey in Eastern Thailand in 2018

Characteristic		N	%	N, % of population age >60 in Eastern Thailand in 2019 (7) (N total= 719044)
Gender	Male	88	19.6	315119, 43.8%
	Female	362	80.4	403925, 56.2%
Age-group	60-69 yrs	285	63.3	402609, 56%
	70-79 yrs	142	31.6	203451, 28.3%
	>80 yrs	23	5.1	112984, 15.7%
Falls	Have falls history	121	26.9	
	No falls history	329	73.1	

Causes of falls in the research survey were different (Figure 7), the most frequent cause of falls was stumbling, followed by slipping and other causes, which were 41.6% and 26.4% and 11.7%. Other causes indicated in this study were gaps or steps on the floor, during biking, miss stepping, falling from the stair, during physical activities, and muscle sparkling.

Figure 3 Causes of falls pie chart, among 121 respondents age >60 years old who had fallen in the past year in a survey in Eastern Thailand 2018



Among 121 respondents who experienced falls, 71 elders fell inside the house and 53 elders fell outdoors, while 3 among them had fallen both at home and outside the house. The most frequent falls cases inside the house was on the balcony, followed by other places such as at the door, the corridor and the area around the house.

The consequences of falls were a majority injured (n=88) and only 33 among them were non-injured. The most severe result was a bone fracture, which occurred in 6 elders and 4 elders had head laceration wounds. The minor symptoms are contusion (n=49), pain (n=21) and abrasion wounds(n=18). Besides, in the survey 10 elders were recorded with other symptoms such as hematoma, hip joint displacement, tendon injury and teeth injury. Although three forth of falls cases were injured but only one-third (n=42) visited the doctor and 6 elders among those who fell, had to be admitted to hospital. While 34 fallers didn't have any treatment and 45 fallers were self-cured.

Individual cause

Age

The participants in this study were 60 years and older, I have grouped them into a 3 age-group with a 10 years interval, according to the guideline of Foundation of Thai

Gerontology Research and the Development Institute(13). More than half of the participants were in the 60-69 years old age-group and the incidence of falls in this groups was the lowest (n=68, 23.9%) comparing to those who did not fall, while eight from the 23 respondents age over 80, had the highest percentage of falls (34.8%). This study illustrated that the older age-group fell more, although no significant association was reported (see table 3).

There is a cross-sectional study (n=26689) from the national survey of Sophonratanapokin et all that reported the effect of older age to an increasing in chance of falls(19). Likewise, the study of Worapanwisit et all (n=406) in a Southern province had described the correlation of falls with older age(20).

Gender

The result of the study found among male, 19 of them (21.6%) fell, while female fell more (n=102, 28.2%). Females seem to have more effect in falls in the survey, the result of analysis showed no significant association between gender and falls cases (see table 3).

Several Thai articled explained differently, the research of Thai national survey explained that females were likely to fall more than males with a significant association (19).

Education, Marital status, Religion, occupation and financial status

This study aimed to identify the relation between education level and falls, firstly to analyze those who studied and who did not, which results showed no effect of educated and non-educated to falls. Analyzing further between falls and different level of education, the result illustrated participants who had the highest level of education fell most (n=9, 31%), participants who did not fell fewer (n=4, 26.7%) and there was no report of significant association between them (see table 3).

There were a number of articles in Thailand that showed a low level of education effecting on the increasing falls incidence among the elderly with the report of a significant association. The study (n=406) of Worapanwisit et all in a Southern province illustrated elders, who finished primary school, fell most, while older adults who had a bachelor degree fell less (20). In the same way, the large sample size study, in the national survey, observe that the highest proportion of their respondents who fell did not study, while the smallest proportion was among who graduated from colleges or had higher degrees(19).

The result from the survey showed different marital status, religion and occupation were not related to falls, where the statistically analysis reported no significant association.

In this survey the observed participant, who had insufficient income, fell (n=47, 32.2%) than who had sufficient income (n=74, 24.3%), this study reported no significant association between them (see table 3). The result from the survey defined sufficient income by participants' answers, which may be an information bias. While the study from national survey (n=26689), after adjusting potential factors found the odds of falls among elders who had insufficient income were 1.39 times greater than who had sufficient (95% CI= 1.28-1.51). Potential factors that were used in this study were living environment, gender, health status, health behavioural, education and location of home(19).

Table 2 Bivariate analysis of dependent individual factors with falls in a survey in Eastern Thailand 2018

Characteristic	Falls within 1 year: N (% [a])		p-value	OR	95% CI
	Yes	No			
Age (years old) - 60-69 - 70-79 - 80-89	 68 (23.9) 45 (31.7) 8 (34.8)	 217 (76.1) 97 (68.3) 15 (65.2)	0.155		
Gender - Male - Female	 19 (21.6) 102 (28.2)	 69 (78.4) 260 (71.8)	0.211	 0.7 1	 0.40-1.23

Education			0.780		
- No education	4 (26.7)	11 (73.3)		0.99	0.31-3.17
- Literate	117 (26.9)	318 (73.1)		1	
• Primary school	92 (27.6)	241 (72.4)			
• Secondary school	7 (18.4)	31 (81.6)			
• High school	9 (25.7)	26 (74.3)			
• Above high school	9 (31)	20 (69)			
Marital status			0.108		
- Single	4 (16)	21 (84)			
- Married (stay together)	59 (26)	168 (74)			
- Widow	38 (25.7)	110 (74.3)			
- Divorce	20 (40)	30 (60)			
Religion			1.000[c]		
- Buddhist	115 (27.1)	310 (72.9)			
- Christian	0 (0)	1 (100)			
- Muslim	6 (25)	18 (75)			
Occupation			0.749[c]		
- Not working	63 (28.3)	160 (71.7)		1.15	0.76-1.74
- Working	58 (25.6)	169 (74.4)		1	
• Handyman	12 (21.8)	43 (78.2)			
• Farmer	24 (25.3)	71 (74.7)			
• Officer	0 (0)	1 (100)			
• Business owner	16 (26.2)	45 (73.8)			
• Others	6 (40)	9 (60)			
Sufficient incomes:			0.079		
- Yes	74 (24.3)	230 (75.7)		0.678	0.44-1.05
- No	47 (32.2)	99 (67.8)		1	

[a] % of sub-group in each characteristics (in the row)

[b] p-value<0.05: significant association

[c.] Result was analyzed by using Fisher's Exact Test

Physical status (BMI, waist circumference, visual impairment, hearing impairment, balancing impairment, taking sleeping pills)

This study had categorized the level of BMI into 5 groups according to the Thai MoPH guideline, which consists of underweight (BMI<18.5), normal (BMI=18.5-22.9), overweight (BMI=23-24.9), obesity (BMI=25-29.9) and severe obesity (BMI>30). The result illustrated elders with a normal BMI fell 19% (n=26), while the overweight (n=19, 23.8%) and obese group (n=56, 31.5%) fell more and the largest proportion (n=17, 39.5%) was in the severe

obese group. This study well explains the increasing chance of falls in the higher BMI participants and there was a significant association between BMI and falls (see table 6). In addition, older adults who had a low BMI are more likely to fall than normal BMI elders. This study had explored the relation of waist circumference, which is associated to BMI, to falls. The abnormal waist circumference in a Thai male is more than 90 centimetres and more than 80 centimetres for the female, according to the guideline of Thai MoPH. The result of this study found participants who had abnormal value, fell more (n=108, 31.9%) than who had a normal value (n=13, 11.7%) with the evidence strong association (OR=3.52) between having abnormal waist circumference and falls (see table 6).

The study of the physical status aimed to find the effect of visual, hearing, balance impairment and taking sleeping pills, to falls. The result reported respondents with visual impairment fell slightly more than those who had normal vision, however, there was no evidence of significant association. This study found that hearing impairment, balance impairment, and taking sleeping pills had the effect to falls with report of significant association (see table 6). Among these factors, balance impairment was found strongly associated to falls and it can be explained that the odds of falls among participants who had poor balance, were greater almost three time than who had normal balance (see table 6).

Several Thai literatures had studied the effect of physical status among the elderly to falls. The study (n=406) in a Southern province reported the cases of falls, were higher in overweight and obese participants, with a statistically significant association. The same study found elders who had visual problems, fell more with a significant association but their study focussed on participants of a narrower age group (60-69 years old)(20).

3.3.1.e Medical conditions (diabetes mellitus, hypertension, ischemic heart disease, dyslipidemia, depression, cancer, knee osteoarthrosis)

This study aimed to find the relation between falls and medical conditions, which are diabetes mellitus (DM), hypertension (HT), ischemic heart disease (IHD), dyslipidemia (DLP), depression, cancer and knee osteoarthrosis (knee OA). However, diseases listed above were not found associated with falls in this study.

Table 3 Bivariate analysis of dependent individual factors with falls in a survey in Eastern Thailand 2018

Characteristic	Falls (% [a])	None-falls (% [a])	OR	95% CI	p-value
BMI					0.038[b] Cramer's V=0.15
- Underweight	3 (25)	9 (75)			
- Normal	26 (19)	111 (81)			
- Overweight	19 (23.8)	61 (76.3)			
- Obesity	56 (31.5)	122 (68.5)			
- Severe Obesity	17 (39.5)	26 (60.5)			
Excess waist circumference					<0.001[b]
- Yes	108 (31.9)	231 (68.1)	3.52	1.89-6.57	
- No	13 (11.7)	98 (88.3)			
Visual impairment					0.210
- Yes	55 (30.1)	128 (69.9)	1.31	0.86-1.99	
- No	66(24.7)	201 (75.3)			
Hearing impairment					0.037[b]
- Yes	25 (37.3)	42 (62.7)	1.78	1.03- 3.07	
- No	96 (25.1)	287 (74.9)			
Balance impairment					<0.00[b]
- Yes	47 (44.8)	58 (55.2)	2.97	1.87-4.71	
- No	74 (21.4)	271 (78.6)			
Taking sleeping pills					0.027[b]
- Yes	66 (31.9)	141 (68.1)	1.60	1.05-2.43	
- No	55 (22.6)	188 (77.4)			

[a] % of sub-group in each characteristics (in the row)

[b] p-value<0.05: significant association

[c.] Result was analyzed by using Fisher's Exact Test

While the analysis from the survey shows non-association result of knee OA, the study of Chaiwanichsiri (n=213) et all in urban Bangkok, found a strong association between knee

OA and falls. After adjusted potential factors, this study reported the odds of falls among elders with knee OA, were 3.2 times greater than those who did not suffer knee OA. The potential factors were gender, foot pain, and pes planus. This study was done in the hospital, which may be a selection bias. The same study explored other lower extremities diseases, which observed foot pain (OR=2.5) and plantar fasciitis (OR=6.8) which were strongly associated to falls(22), although the survey did not focus on these conditions.

Besides, a descriptive study of Muangpaisan et all (n=80) explained falls occurred most among patients with a neurological disorder (Parkinson's disease and dementia) 40%, followed by musculoskeletal disorder (28.8%), visual impairment (18.8%) and postural hypotension (12.5%). This study only included hip fracture patients, which can be selection bias, but the results can explain more the medical condition cause, that leads to severe falls(25).

Healthy Lifestyle (eating vegetable, drink water, exercise, not smoking, not drinking alcohol)

The Thai MoPH described the definition of a healthy lifestyle in the elderly, which contains 5 essential issues: 1. Doing exercise for 30 minutes not less than 5 days a week, 2. Eating fresh vegetables and fruits regularly, 3. Drink enough water at least 8 cups daily, 4. Not smoking and 5. Not consuming alcohol drinks. These are also included in the Key Performance Indicators among the aging population of Thai MoPH, to achieve the health national target(26).

In general, the results showed slightly lower percentages of falls in the groups with healthy behaviours, compared to those without, however none of those percentages differed significantly to those without healthy behaviours.

Several research conducted in Thailand, aimed to find the effect of healthy behaviours to falls, among the elderly. The large sample size study from the national survey, reported a similar result of no significant association between the regular intake of vegetables, alcohol consumption and falls(19). The same study reported respondents, who did not do regular exercise, fell more than who did with a significant association(19). Similarly results of a medium sample size case control study (n=333), showed that doing sufficient exercise, was the protective factor to falls and it was significantly associated(24).

Level of health literacy

The level of health literacy (HL) refers to the ability of an individual to access, understand, ask, share, exchange the health information with others and behavioural/lifestyle change to obtain good health. This study had analyzed 10 survey questions and was categorized into two levels, which are low (less than 50%) and high (more than 50%). The result of this study showed that the group with a high level of HL fell more. A similar result, when this study grouped HL into 3 levels, which were <50%= Inadequate, 50-80%= Good, >80= Excellent, there was no significant association reported. Although the HL level was not related to falls in this survey, I did not find other researched explored effects of HL to falls (see table 8).

3.3.2.c Fear of falls

The survey did not explore the issue of fear of falls, although it could relate to falls in both risk factor and consequences. Fear of falls can cause restriction in physical activities, and finally can end up with a fall from the effect of gait change(29). The cross-sectional study

(n=386) was conducted to explore the fear of falls and its factors in elderly in Southern Thailand. The result showed half of both fallers and non-fallers were afraid to fall(30).

Proximal cause

Environmental factor

The study in the characteristic of the houses, showed the highest percentage of falls was observed in participants who lived in wooden row houses, followed by two-story houses. Elders who live in one-story housed fell more than elders who live in one-story house with raised floors, although this type of house might have more environmental risk. No significant association between characteristic of the houses and falls was found in this study.

To compare the using of stairs and none-using stairs participants, the result showed that none-using stairs elders fell slightly less (n=71, 26.7%) than the using stairs participants (n=50, 27.2%) but no significant association between them was found.

This study observed having handrails to support their movement in houses not related to falls, due to similar percentages of falls cases in the group with handrails and without. Types of toilets were not associated to falls in the survey. The result showed the highest percentage of falls in those who use seat toilets (n=86, 27.9%), while using squat toilets, might cause more imbalance movement for the elderly, in contrast it had a lower percentage of falls (n=25,25.5%). Type of toilet has a relation to the financial status when a seat toilet is more likely to be found in a new house or in the urban area.

The study also emphasized different characteristics of the toilet floor; coarse, rough and slippery surfaces. Among elders, who had smooth surface toilets fell most (n=27, 37.5%) while who had rough and coarse surfaces of toilet fell less (n=90,25.1%; n=4, 20%). This study explained the higher cases of falls occurring in the slippery toilet, no statistically significant association was reported in this study. The association between the lighting and falls in the

survey was not found, although elders who had dim light in their houses fell much more (n=4, 40%) than those who had sufficient light (n=117, 26.6%) (see table 10).

Table 4 Bivariate analysis of indoor environmental factors with falls in a survey in Eastern Thailand 2018

Characteristic	Falls (% [a])	None-falls (% [a])	OR	95% CI	p-value
Characteristic of the house					0.553[c]
- One-story with raised floor	21 (24.4)	65 (75.6)			
- Two- stories house	40 (30.3)	92 (69.7)			
- Row wooden house	1 (33.3)	2 (66.7)			
- Townhouse	5 (22.7)	17 (77.3)			
- One-story house	49 (25)	147 (75)			
- Others	5 (45.5)	6 (54.5)			
Using stair					0.910
- Yes	50 (27.2)	134(72.8)	1		
- No	71 (26.7)	195 (73.3)	0.976	0.64- 1.49	
Having Handrails in the House					0.921
- Yes	56 (26.7)	154 (73.3)	1		
- No	65 (27.1)	175 (72.9)	1.02	0.67-1.16	
Type of Toilets					0.723
- Squat toilet	25 (25.5)	73 (74.5)			
- Seat toilet	86 (27.9)	222 (72.1)			
- Both	10 (22.7)	34 (77.3)			
Surface of toilet floor					0.076
- Coarse surface	4 (20)	16 (80)			
- Rough surface	90 (25.1)	268 (74.9)			
- Slippery surface	27 (37.5)	45 (62.5)			
Lightening					0.469[c]
- Sufficient light	117 (26.6)	323 (73.4)	0.543	0.15-1.96	
- Insufficient light	4 (40)	6 (60)			

[a] % of sub-group in each characteristics (in the row)

[b] p-value<0.05: significant association

[c.] Result was analyzed by using Fisher's Exact Test

The hazardous outdoor environment was found a risk factor to falls in the survey, which results showed that areas with rocks, obstacles, discarded item, non-clear area and inclined pathways, affect falls among the elderly. The result showed that only a few

participants had wet pathways (n=3), slippery ground (n=3) and potholes (n=2) around their house, which result recorded a similar percentage of falls among who had and who had not this hazardous situation with no significant association was reported. Among participants who had rocks in their pathway, 14 of them falls (42.4%), while participants who had a pathway without rocks fell less (n=107,25.7%). The result showed significant association between falls and a rough pathway with rocks which can be explained that the odds of falling among participants, who had rocks in their pathways, were 2.14 times higher than who did not (see table 11).

The majority of participants had no obstacles around their houses (n=117) and approximately one-fourth of them fell. While four from nine participants with barricades around their house fell, although no significant association was reported. This study is also aimed to explore the connection between the clear area around houses of participants and falls, which results showed 33 elders among who had a non-clear area fell (37.1%), which proportion was higher than who had a clear area (n=88,24.4%). The result showed a significant association and explained the odds of falls among participant who had an unclear area around their houses were 1.83 times higher than the other group (see table 11). The participants who had discarded items around their houses had fallen 36.9% (n=24), while another group fell less (n=97, 25.2%). The result by Chi square test showed a border line significant association but it was not relevant when Odds Ratio was calculated (see table 11). The result of this variable was uncertain, it may be affected by the sample size.

One-fourth of participants who did not have broken things around their houses, fell (n=116), while the other group fell more but no significant association was reported. The study in a sloped pathway in front of the elders' houses found more participants who had this fell more (n=9, 50%) than who did not (n=112, 25.9%). The results showed the odds of falls

among participants who had an inclined pathway were almost 3 times greater than those who did not have (see table 11).

Table 5 Bivariate analysis of outdoor environmental factors with falls in a survey in Eastern Thailand 2018

Characteristic	Falls (% [a])	None-falls (% [a])	OR	95% CI	p-value
Wet pathway with stagnant water					1.000[c]
- Yes	3 (25)	9 (75)	0.904	0.241-3.396	
- No	118 (26.9)	320 (73.1)	1		
Slippery ground					1.000[c]
- Yes	3 (25)	9 (75)	0.904	0.241-3.396	
- No	118 (26.9)	320 (73.1)	1		
The pothole on the ground					1.000[c]
- Yes	2 (25)	6 (75)	0.905	0180-4.545	
- No	119 (26.9)	323 (73.1)	1		
Rough ground with rocks					0.037[b]
- Yes	14 (42.4)	19 (57.6)	2.135	1.034-4.405	
- No	107 (25.7)	310 (74.3)	1		
With obstacles					0.259[c]
- Yes	4 (44.4)	5 (55.6)	2.215	0.585-8.390	
- No	117 (26.5)	324 (73.5)	1		
Clear area					0.015[b]
- Yes	88 (24.4)	273 (75.6)	1,828	1.117-2.992	
- No	33 (37.1)	56 (62.9)	1		
With discarded items around					0.049[b]
- Yes	24 (36.9)	41 (63.1)	1.738	0.999-3.024	
- No	97 (25.2)	288 (74.8)	1		
With broken item around					0.464
- Yes	8 (33.3)	16 (66.7)	1.385	0.577-3.324	
- No	113 (26.5)	313 (73.5)	1		
Incline pathway					0.031[b,c]
- Yes	9 (50)	9 (50)	2.857	1.106-7.378	
- No	112 (25.9)	320 (74.1)	1		

[a] % of sub-group in each characteristics (in the row)

[b] p-value<0.05: significant association

[c.] Result was analyzed by using Fisher's Exact Test

The data analysis observed that the indoor environment did not affect falls, while outdoor environmental hazards were falls risk factors. Literature review found a study

(n=406) of Worapanwisit et all in a Southern province that reported that participants fall outdoor more, and the most common place was the area around their houses, with the evidence of significant association. The kitchen was reported as the most frequent place of falling indoors, followed by the bedroom, and living room with a statistically significant association. This study found the home hazardous environment such as contact with other persons or objects, slippery floor and slope way, affect the incidence of falls among the elderly(20).

A similar result from a large sample size research in the national level of Sophonratanapokin et all observed an increasing incidence of falls related to a slippery first floor and slippery bathroom. (19). The case control study (n=333), also reported a slippery floor is significantly associated to falls, and toilets without handrail were observed as a risk of falls among the elderly (24). The survey and Thai literatures did not find the effect of insufficient light. Poor lighting was reported significant associated to falls in several international studies. Dim light inside the house, especially on the stairs, lead to poor vision during the movement an can lead to falls(31)(32).

Descriptive analysis (n=80) of Muangpaisan et all was done among fall patients who were admitted with hip fractures, documented 78.6% happened indoors, and the most common places were bedrooms and bathrooms. Slippery floor and multi-stories floors, were reported as the most common cause. Only 12.5% of elderly in this study fell outside the house and it most frequent occurred in front of the house, but there was an unspecific character of this area(25). Although this study had a selection bias due to that only patients with hip fractures were included, the result illustrated more likely the factors that lead to severe outcome of falls.

3.4.2 Family factors

3.4.2.a Family support

Living condition and family support were explored in secondary data analysis in order to find their effect to falls. The result illustrated 83 elders who live with their children fell (25.8%), which incidence was lower than participants who lived with spouses (n=23, 28.7%). Elders who lived alone fell the most (n=15, 34.9%), which showed a higher percentage is among this group. No significant association between living with family and falls was reported. This study aimed to find a relation between source of majority income of the elderly, which result showed these variables were not associated to falls. In the same way, the result observed that the main care giver had no impact on falls (see table 13).

Table 6 Bivariate analysis of proximal factors with falls in a survey in Eastern Thailand 2018

Variables	Falls (% [a])	None-falls (% [a])	p-value
Living condition			0.350[c]
- Alone	15 (34.9)	28 (65.1)	
- With spouses	23 (28.7)	57 (71.3)	
- With children	83 (25.8)	239 (74.2)	
- Other (parents, relative)	0 (0)	5 (100)	
Major source of income			0.971[c]
- Elderly themselves	59 (26.5)	164 (73.5)	
- Spouses	8 (29.6)	19 (70.4)	
- Children	53 (27.2)	142 (72.8)	
- Relative	1 (20)	4 (80)	
Main care giver			0.889[c]
- Elderly themselves	24 (29.3)	58 (70.7)	
- Spouses	20 (26.3)	56 (73.7)	
- Children	74 (27)	200 (73)	
- Relative	3 (17.6)	14 (82.4)	
- Neighbor	0 (0)	1 (100)	

[a] % of sub-group in each characteristics (in the row)

[b] p-value<0.05: significant association

[c.] Result was analyzed by using Fisher's Exact Test

Literature review found the study of Sophonratanapokin et all with a large sample size that explained the elderly, who lived with spouses, fell less than who lived alone with a statistically significant association. This can be explained that living with spouses is the protective factor to falls among the elderly (OR= 0.68, 95%CI=0.59-0.78)(19).

3.5 Distal Cause

3.5.1 Social and community support

3.5.1.a Senior citizens club

Senior clubs in Thailand are introduced in the community-level with a reason of improving quality of life in the aging society, in which the club is aimed to organize activities, such as religious, cultural and health promotion(38). The result from the research survey showed 75 participants who were members of senior clubs fell (26.9%), this proportion was more than participants who were not members (n=29, 25%). Participants who attended senior club's activities fell more than those who did not (n=100, 28.2%). This study did not find a significant effect of senior clubs to falls among the elderly.

3.5.1.b Home visit by provincial Administrative Organizations

Among participants that were visited by the provincial administrative organization, 13 of them fell (25%) this proportion is lower than those who were not visited by provincial administrative organizations (n=108, 27.1%). This survey did not state which activities were done during the home visit, but according to the provincial administrative guideline had mentioned health promotion and health follow up activities, which might increase the health knowledge of the elderly. The analysis of this survey showed no association between home visiting by Provincial Administrative Organizations and falls.

While the large sample size study of Sophonratanapokin et all from the national survey, observed association in social-communities factors, that affect to falls among the elderly, but this study did not specify what kind of activity and where was it(19). I did not find the study explored home-visit by the community and its relation to falls.

3.5.2 Health system, Policy and Government factors

The analysis in the cause of falls in policy and governmental level is aimed to explore the effect of providing the elderly subsistence allowance (ESA), home-visiting by health facilities (HFs) and having the individual health recorded notebook, which provided from them. The Thai Government distributed ESA to the elderly monthly, some of them did not receive this due to various reasons. The result reported that participants who receive ESA, fell more (n=112, 27.3%) than those who did not receive (n=9, 22.5%). The same as participants who had been visited by HFs fell more (n=53, 30.6%) than those who had not been visited (24.5%). There was no report of association between receiving ESA, home visit by HFs and falls (see table 13).

The individual health record notebook is one of the health policies for the elderly, to record their health data, both at home and at the health facilities. Although this notebook is provided in health facilities for all elders, but not all of them keep and use it, this also depends on the concerning of individual health. The result showed 33 participants who had a health recorded notebook fell (27.7%), which proportion was slightly lower than participants who did not have. The notebook had also content of health education such as recommended exercise and nutrition, which will benefit elders to be healthier. No significant association between having a recorded book and falls was observed.

The result of this survey did not show the relation between health system, policy and health recorded notebook to falls and I did not find other research that is done in these issues to support the evidence of no association.

Table 7 Bivariate analysis of distal factors with falls in a survey in Eastern Thailand 2018

Characteristic	Falls (% [a])	None-falls (% [a])	OR	95% CI	p-value
Member of Senior Club				0.671-1.812	0.699
- Yes	75 (26.9)	204 (73.1)	1.103		
- No	29 (25)	87 (75)	1		
Attending to Senior Club's activities					0.146
- Yes	100 (28.2)	255 (71.8)	1.382	0.080-2.364	
- No	21 (22.1)	74 (77.9)	1		
Home-visit by Provincial administrative organization				0.460-1.741	0.444
- Yes	13 (25)	39 (75)	0.895		
- No	108 (27.1)	290 (72.9)	1		
Receive the elderly subsistence allowances				0.597-2.805	0.512
- Yes	112 (27.3)	298 (72.7)	1.295		
- No	9 (22.5)	31 (77.5)			
Home-visit by health facilities				0.889-2.073	0.157
- Yes	53 (30.6)	120 (69.4)	1.357		
- No	68 (24.5)	209 (75.5)	1		
Having the health recorded notebook				0.663-1.695	0.809
- Yes	33 (27.7)	86 (72.3)	1.060		
- No	88 (26.6)	243 (73.4)	1		

[a] % of sub-group in each characteristics (in the row)

[b] p-value<0.05: significant association

[c.] Result was analyzed by using Fisher's Exact Test

FALLS PREVENTION AND BEST PRACTICES

Interventions on Motor and balance problems

The research conducted in Thailand, was aimed to find the effectiveness of simple balancing exercises in elderly outpatients, who had experienced falling in the previous year. Kuptniratsaikul et all had introduced participants to seven balancing exercises, which focused on improving strengthening, hip muscle, quadricep muscle, marching, stepping over a bench, standing from the chair and walking heel-to-toe. Participants were evaluated in a balancing ability at baseline, three, six, nine, and 12 months by physical status indicators. The final result of this study showed that 49% of participants did not fall after one year, which explained that the number of falls cases reduced in a one-year period. Likewise, the balancing abilities, which were secondary outcomes of this study, were significantly increased after intervention, except functional reach. This study had a limitation in the lacking of a control group to compare the intervention and participants were recruited from an advertising board in the hospital which might be a selection bias(39).

The randomized controlled trail study in New Zealand conducted the exercise intervention in 240 participants of the age 75 and above. This study had divided participants into exercise and control group. Exercises were muscle strengthening training and an improving balance program, which was introduced by trained nurses, participants were expected to do 30 minutes exercise three times a week. The assessment was done after one year, the result showed in the exercise group had a 46% decrease in number of falls comparing to the control group (IRR=0.54, 95%CI=0.32-0.90. This study explored the cost effectiveness which resulted explained that the exercise program among participants age 80 and older was cost saving $NZ576 per fall case and $NZ1563 per injurious falls case(40).

Interventions on correction visual impairment by Cataract surgery

Cataract surgery was introduced as preventive intervention of falls among the elderly in Vietnam. This cohort study (n=413) was conducted in cataract patients age above 50 and excluded participants who had previous surgery for cataract, cataract from diabetes, glaucoma or other ocular disease, and neurological impairment. The assessments were done to find the outcome, which is an incidence of falls before 1-3 months and in the year after surgery. The result was reported, reducing the prevalence of falls after 1 year in first-eye surgery 1.9% and 6.1% in both eyes surgery. After adjusted potential confounding, the risk of falls after one year decreased by 78% in first-eye surgery and 83% in both-eye surgery. The study did not indicate which variable they used to adjust confounding(41).

Interventions in communities

The randomized controlled trail study (n=391) in southern Germany, introduced the modification of environmental hazards among frail elders after a one-year intervention. The program was implemented after the participant were discharged from the hospital with different medical conditions. This program included regular home-visits in order to access the risks and to advise on possible modifications of the environmental hazard in the house. After a one-year assessment, the result showed a lower 31% of fall rate among the intervention group than the control group. (IRR=0.69, 95%CI=0.51-0.95). This study also illustrated that among participants who fell 2 time or more in the intervention group they had a 37% lower falls rate than in control group (IRR=0.64, 95%CI=0.37-0.99, p=0.047). While the group of participants who did not modify their house and control group explained no difference in the rate of falls. The highest percentage of compliance in home modification was a shower seat, following by an emergency call, grab bars, night light and anti-slipping mat in the bathroom (42).

Interventions at policy level

This study explored intervention in distal level as the preventive program that was introduced in communities, care-facilities and hospitals. One intervention was introduced in the community-based level in Thailand (n=28) by Kittipimpanon et all. It was a combine fall prevention model which consisted of a falls risk assessment, a campaign, education, training for balance improvement, home visit for home hazardous modification and a fall management system. The intervention was implemented in the senior club of the communities and assessed a number of falls before and after a 10 month-period, which result reported a 24.86% reduction of falls incidence with an improvement of legs muscles strengthening, and balancing abilities(43). Although the study had small numbers of participants, it is aimed to find a long-term effect compared to other literature. The result after 3 years found an unchanged percentage of falls. Beside this study conducted qualitative research from program leaders and providers in order to evaluate the process of intervention. The result explained exercise was most effective long-term activity and factors of successful program were well-cooperation between the community, the health care worker in community level and dwellers, funding and recognition of falls prevention's importance(44).

To explore the intervention in care-facilities and hospitals, the Cochrane review studied among 95 randomized controlled trails (138164 participants age >65) and aimed to find a reduction in rates of fall and risk of falls from preventive interventions that were conducted in care facilities and hospitals in 23 countries. This study explored single interventions; exercise training, medication review, vitamin D supplementation, environment technology, social environment, education, psychological training, and multiple/multifactorial interventions. Among the intervention in care facilities, vitamin D supplementation had an effect on the falls reduction (RaR= 0.72, 95% CI=0.55-0.95), while

other interventions reported no reduction of the falls rate with uncertainty in results due to inadequate evidence quality. Among interventions in hospitals, additional exercise with physiotherapy could result in a decreasing risk of falling, although it was reported uncertain due to a very low quality of evidence(45).

Discussion

1.1.1 General

Representativeness of the sample size, comparison with the national level and context

This exploring study covered the Eastern region of Thailand, this area has special characteristic in manufacture industries growing with the increase in the working-age group. This situation brought the Eastern region a different proportion of age-groups from other regions and the percentage of older population was reported the second lowest in the national report (14.85%) in 2019(7). The ratio of male to female elders were approximately 3:4 (7), while the survey had a different proportion (1:4). Few male respondents were explained by the survey researchers that most of them went out for work when the survey was conducted. The same reason can be explained in lower percentage of respondents in age group 60-69 and higher percentage of age group 80 and above comparing to the regional statistic data.

Falls in the survey

The rate of falls among the elderly in the survey was 26.9 %, which is higher than studies in the urban community in Bangkok(19.8%) and in a Southern province(26.1%)(46)(20). The incidence of falls worldwide is 28-35% and this depends on each country such as Chile is 34% while Japan has 20% (47). The elderly fell more inside the house and the most common place is on the balcony. Consequences of falls were in majority injuries,

while only a few cases had bone fractures and head laceration and wounds. Half of the elderly did not go to health care facilities and self-cured.

5.1.2 Individual level

Dependence factors

Although this study did not find a significant association between age and falls in the survey, the higher rate of falls was reported in the older age group. Thai literatures explained that older age had a higher chance of falls with a strong association(48), due to degenerative changes in physical, sensory and cognitive functions including more possibilities of having medical conditions(49).

A number of Thai articles reported an association in that the female gender had a higher chance of falls as same as international literatures (48)(50)(51), while the result of secondary data analysis did not find an association in the survey, even though female elders fell more than males. Different genders have different physical activities, lifestyle and circumstance which influences risks of falls differently(50). Although women had higher incidences of falls, men seem to have more severity, due to greater hospitalization and a mortality rate than women(52).

A study of other demographic status (education, marital status, religion, occupation and income) in the survey was not reported in association to falls, compared with a number of literatures in Thailand found low levels of education resulted in a higher prevalence of falls in older adults. A higher level of education can lead to a reduced chance of falls due to less exposure to harmful jobs and a better health education and health status(20). Insufficient income was reported in relation to an increasing risk of falls in the Thai study. The same result

was found in the Mexican American study (53) in which influences were poor environment, poor nutrition intake and access to health care services(52).

According to the data analysis of physical status and medical conditions, the result found evidence of significant association of BMI, excessive waist circumference, balancing impairment. Hearing impairment can result in falls in the survey as same as the result of a study in the United Arab Emirates and Taiwan(54)(55). Sleeping pills are considered in the group of antidepressant medication, which have been a concern as a risk factor of fall according to the survey as same as an international literature(55). The reason of their side effect causing postural hypotension and some pharmacological groups can cause decreasing bone mineral density, which can lead to falls(56).

Other literatures in Thailand found, visual impairment, OA knee, foot disease strongly associated to falls. Visual impairment can lead to falls among elders directly(57) and indirect influence by decreasing mobility and balancing ability, which finally had an impact on falls(58). The result in the Thai literature review explained neurological disorders such as stroke, Parkinson's disease and dementia are risk factors of falls, likewise the similarly result of Finkelstein et all's study explained the decline of the cognitive function can result in falls among elderly patients which further observed rising in cost of consequence treatment(59).

Independence factors

Although healthy lifestyle was not reported in association to falls in the secondary data analysis of the survey, there was evidence that doing regularly exercise can reduce the incidence of falls in the Thai article. Elders who did not exercise regularly tend to fall more, the assessment of their physical performance were lower than the non-falls elders(55). In the same way, exercise can reduce the chance of falls in terms of controlling BMI, waist

circumference, improving balance, muscle and joint function(60). Another evidence explained the benefit of exercise to falls, that it has an effect on increasing bone density in postmenopausal older women(61).

In this study I did not find that a level of HL has effect to falls, this is the first study to evaluate this association in Thailand, there is no other evidence to support this conclusion. Fear of falls described the feeling that many older adults experienced, due to their history of falls, co-morbid conditions and functional impairments (62). Similarly, the study in Canada found that the elders fear of falls can result in a decrease in physical activities, muscle weakness and finally lead to falls(57). Nevertheless, this can be positive factor when the elderly concern in falls and consequences, then they attempt more to prevent it (52).

5.1.3 Proximal level

Environmental hazardous

Environmental factors have a major impact on falls among the elderly in this study the same as in other international studies(63)(32). A hazardous Indoor home is crucial, as many studies had reported elders fell more inside the house. This study is aimed to explored the risk of falls in different type of the houses, including a raised floor house, that contains stairs and steps, which might be harmful for the elderly. Although data analysis of the survey did not show that the characteristic of the house has an impact on falls, the literature review in hip fracture patients found that multi-stories floor are a risk factor especially for the severe cases. Other literatures in Thailand emphasized more on rooms, types of the floor, and handrails. Kitchen, bathroom, bedroom are places that have a high risk of falls in the house. Same as a slippery floor and a slope way, which characteristics can lead to losing balance

control and end up with falls(31)(32)(63). Having a handrail in the bathroom is a protective factor of falls according to literature review, when elders who have bathroom without this support they seem to fall more(32)(64). Literature review found dim light inside the house is one of the factors related to falls, which can lead to reduced visual ability of the elderly and might result in falls at the end.

The character around the house with rough ground with rocks, unclear area, with discarded items and with an incline pathway are risk factors of falls among older adults according to the survey. These home hazards are essential, while the incidence of falls can be increased when two or more risks are combined(63).

Family support and violence from family members

Although, the survey did not find the relation of family support, the living condition has an impact on falls, when elders who live alone tend to fall more than those who live with their spouses, according to Thai literature. Similarly result explained that living alone can increase the risk of falls, which result might depend on types of house(65), on the other hand, living with spouses can reduce the incidence of falls(66).

Living with a family might have a negative effect on the elderly because it can result in abuse from family members. A high prevalence of elder abuse was reported in Thailand, it becomes a common problem in many countries and most of the cases are caused by family members(67). Negative thoughts of family members play a big role in violence among the elderly, besides, elders who have poor living conditions or live with alcoholic, drug addict family members have a higher chance of abuse. Although living with family member can result in violence there is no well-defined evidence stated that elders abuse caused by family member has the outcome of falls.

5.1.4 Distal level

Social and community factors

Senior clubs provide activities in the community level that are aimed to improving life and health status among elders, through health education and other activities. The engagement of senior club activities in the Eastern region did not relate to falls in the survey and there is no literature exploring the effect of this factor to falls. The same as home-visiting by the community is not related to falls, but elders who had been home-visited by communities seems to falls less, which might be explained by health promotion and health follow up activity during home-visits, can increase awareness and reduce the fall rate. This may have a selection bias when falls rate was low in specific group of participants.

Government and policy factors

This study of data analysis explored that receiving ESA, home visit by HF and having a health recorded notebook, which was introduced by the ageing health policy, did not have an effect on falls among the elderly. Even though, there was lower rate of falls among those who used the health recorded notebook, which might be related to concerns of their health, which leads to more prevention in falls than others. These implementations are crucial in the ageing field; no study reconnoitred its effect to falls. Home-visits by HF were mostly reported as a part of the falls prevention programs, that have an impact on the reducing falls prevalence (68)(42).

5.1.5 Preventive interventions of falls

Exercise was found an effective intervention to improve muscle strength and balance ability of the elderly and reduce the rate of falls among elders. Exercise is found to be a cost-saving intervention of falls among the elderly in developed countries, especially in elders aged

above 80. Thailand, middle-income country may have different results due to a different financial status and no study is done to explore this. Cataract surgery also benefits in falls prevention because this will improve visual ability of elders(69). Interventions in the environmental factors are included in both risk assessment and modification hazardous homes are found to be efficient. Most of the home modifications are removing the hazardous situation, install handrails in the toilet and the stair railing and set the call for a help system for an emergency situation(47).

A combined preventive program in the community level is effective in a long-term reduced number of falls. Especially exercise training is a concern as continuous activity among elders, while a home hazardous modification was found limiting, due to its cost. To prevent falls in care-facilities and hospitals, vitamin D supplementation results in a falls rate reduction and additional exercise combined with physiotherapy can reduce the risk of falls among the elderly. These factors have an unclear effect on falls prevention due to the poor quality of the evidences.

5.1 Limitations onLimitations of the study

The survey is a study to cover all provinces in the eastern part including 1 province in the central part, according to the health region in Thailand. The sampling province, which were included in the survey, were only provinces in the eastern area. The research survey included only older participants who were literate and physically active. The proportion of male and female respondents were different from regional ratio due to many male elders were absent during data collection.

The survey was aimed to explore factors related to a healthy lifestyle among the elderly, which included the data of falls, but some of the data was not specific. There were missing data in membership of senior club and attendance to senior club's activity, which

were excluded during the analysis. In addition to this, the data of the history of falls was collected within 1 year, which may be a recall bias, due to limited memorial abilities of the elderly. Data of insufficient income, medical condition, physical status, and hazardous environments were collected by what participants answer. There was no observation at houses or collection data from a medical record which might be measurement bias in the result of the survey. The data in the HL level was not covered, all 6 categories of health literacy guideline itself and nowadays there was no guideline tool to assess the HL level. This survey is limited to analyze with adjusting confounding due to the small sampling size of data, several literatures in Thailand were analyzed and explained about this.

I did not find Thai literature that explored the impact of senior clubs and using the elderly recorded notebook on falls, as same as elder abuse. Few studies in elderly abuse in Thailand were published, but all of them were not study in falls consequences and in articles concerned events were caused by family members.

The causation conceptual framework was useful to find factors in each level and the linkage between. I have found that the health system, government and policy factor in distal level can link to the social-community factor as same as it can link to independent individual and environmental factors.

Recommendation

This study recommends to develop in ageing health and will be described recommendations in different level of responsivities.

Recommendation for Thai MoPH:

- Develop falls intervention in policy level. Policy option of falls prevention should be different due to different risks of falls between different age group and genders.
- Introduce calcium and vitamin D in the elderly diet guideline, to prevent falls.

- Introduce guideline of falls prevention including environmental hazards modification in HFs, care-facilities and in communities.

Recommendation for health facilities and health care workers and community:

- Cautioning doctors to prescribe sleeping pills, in order to avoid its side effect.
- Provide a health education that will increase the knowledge and understanding to elders and also their family members or care givers.
- Introduce combination program of intervention in community-level, which include environmental hazardous assessment and modification, health promotion, and exercise. However, excessive exercise can also cause falls, which need to be explained to the elderly to be aware.

Research recommendation:

- Research in the HL level and elder abuse to find the descriptive data, relevant cause and effect to health status including falls.
- Research in community and policy level both qualitative and quantitative in senior club's activities home-visit by HF and communities, having the health recorded notebook and other ageing health strategies. In order to find their relation to health status including falls, effectiveness, strength and weakness.
- Research in effectiveness of preventive intervention in exercise training, home hazardous modification including prevention in policy level.

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Annex

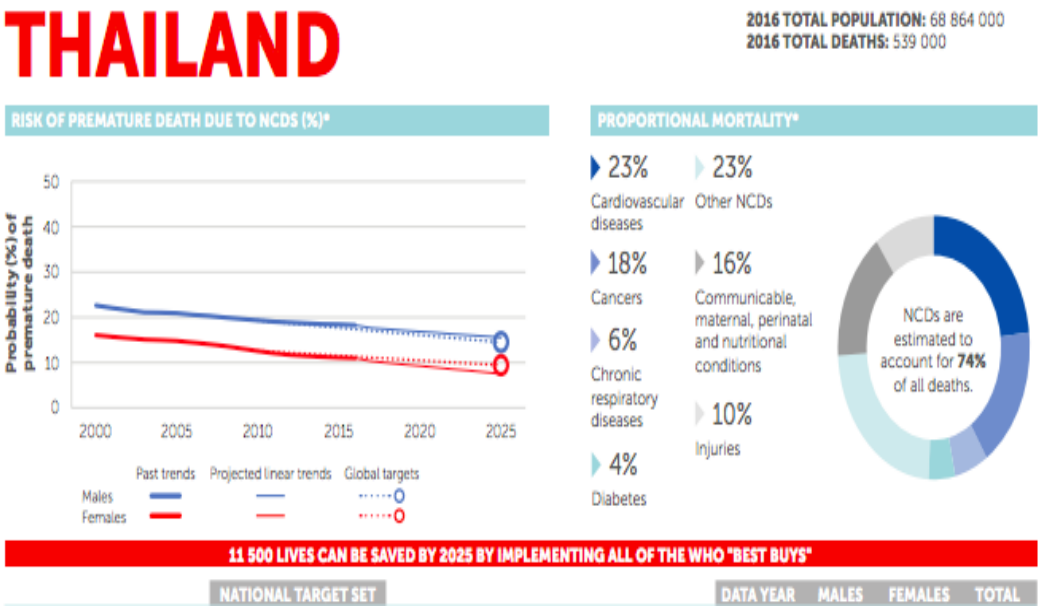
Annex 1

Area of Eastern Economic Corridor in Thailand

Resource: www.aseanbriefing.com

Annex 2

Mortality rate of NCD in Thailand in 2016



Resource : https://www.who.int/nmh/countries/tha_en.pdf?ua=1

Annex 3

Permission letter to use research survey data

To: Ploi Kongkoot

Royal Tropical Institute,
Mauritskade 64, Amsterdam,
The Netherlands

Date: 27 May 2020

Dear Ploi,

REPLY TO THE PERMISSION LETTER TO USE RESEARCH SURVEY DATA

Thank you for your interest in the data from my research survey "The related factors to health status and behavior in elderly in the Eastern part of Thailand". I appreciate that you find it useful for further study in aging health in the Thai population and I am glad to permit you to use my data for your study. Your research topic is interesting and I hope that after all, it will benefit the elderly health in Thailand.

I sincerely hope that your attempt will meet with great success. If you need any clarification or advice, please feel free to contact me.

Yours sincerely,

Tippawan Jumpang
Email: kaeja2521@hotmail.com

Annex 4

Waiver letter

From Ploi Kongkoot

Royal Tropical Institute

Mauritskade 64, Amsterdam,
The Netherlands

11 June 2020,

To: Chair Research Ethics Committee, KIT

Dear Pam Baatsen ,

This letter is to request a waiver of ethical clearance for a study on Factors related to Falls among the Elderly in the Eastern, Thailand. The data used is derived from the research survey "The related factors to health status and behavior in elderly in the Eastern part of Thailand".

The study is done in 2018 by Tippawan Jumpang, registered nurse professional level at Health Center 6, Thailand. The research survey was done with the purpose of exploring health status and healthy lifestyle of the elderly in the health region 6 (Eastern part of Thailand) and to find the related factors according to these issues. A secondary data analysis will be done by Ploi Kongkoot, in the context of KIT thesis research. The purpose of the study is to explore the related factor to falls among the elderly in the Eastern region of Thailand. The study focuses on individual factors, environmental factors, Family-social-community support factors, which cause falls in the old age group population. This secondary data analysis will be emphasized more on the outcome of falls among elderly comparing with the research survey that focuses on general health status and healthy lifestyle. The study results will be used to improve the intervention to reduce the incidence and prevalence of falls among the elderly in Thailand.

I would like to kindly request the Research Ethical Committee to a waiver of ethical clearance for this study for the following reasons:

1. The data has been anonymized.
2. Data (use) has been approved by the data owner, Tippawan Jumpang.
3. Informed consents were given and it would be feasible or practicable to ask informed consent to the participants to whom the data belong.
4. The research has important social, educational, and/or scientific value, namely exploring all the factors related to falls among elderly and best practices in the prevention of falls. The result of the study will be useful for the further plan of intervention and giving the recommendation to the Thai Ministry of Health in order to reduce the incidence of falls in the future.
5. The research poses no more than minimal risks to participants, including social and cultural risks such as discrimination, stigmatization or psychological discomfort or harm; and does not give rise to the disclosure of the participant's identity for privacy. The collected data from participants will be ensured securely keeping. The research

survey's data were asked the permission to use for this study and the data will proceed only after receiving the agreement from the owner of the research. The data can be accessed only authorized person and will only be used for the thesis research purpose.

I hope to have informed you sufficiently on the objective and content of this study to make a decision on my request.

Yours sincerely,

Ploi Kongkoot

Ploi Kongkoot

Co-Signer of academic advisor : Lisanne Gerstel

Co-Signer Signature :

Date: 11 June ,2020

Annex 5

Clearance letter for waiver

RESEARCH ETHICS COMMITTEE

Contact: Meta Willems (secretary REC)
Telephone +31 (0)20 568 8514
m.willems@kit.nl

To: Ploi Kongkoot
KIT ICHD Student
By E-mail: pl_oy_2k@hotmail.com

Amsterdam, 16 June 2020

Subject Decision Research Ethics Committee regarding a waiver for a study on "Factors related to falls among the elderly in Eastern region in Thailand" (S-126)"

Dear Ploi Kongkoot,

The Research Ethics of the Royal Tropical Institute (REC) has reviewed your application for a waiver for a study on "Factors related to falls among the elderly in Eastern region in Thailand" (S-126)" that was submitted on 9 June, 2020.

Your proposal has been exempted from full ethical review based on the following considerations:

1. the data has been anonymized and will be stored in a safe place, only accessible for you for the purpose of your thesis;
2. the data has been approved by the data owner being Tippawan Jumpang a registered nurse at the professional level, working for Health Center 6, the Department of Health in Thailand, who conducted the original study in 2018;
3. informed consent was obtained from the participants for the original study, while the current study objectives are aligned with the objectives of that original study.
4. the analysis has an important public health function;
5. the research poses no more than minimal risks to participants and does not give any rise to the disclosure of the participant's identity.

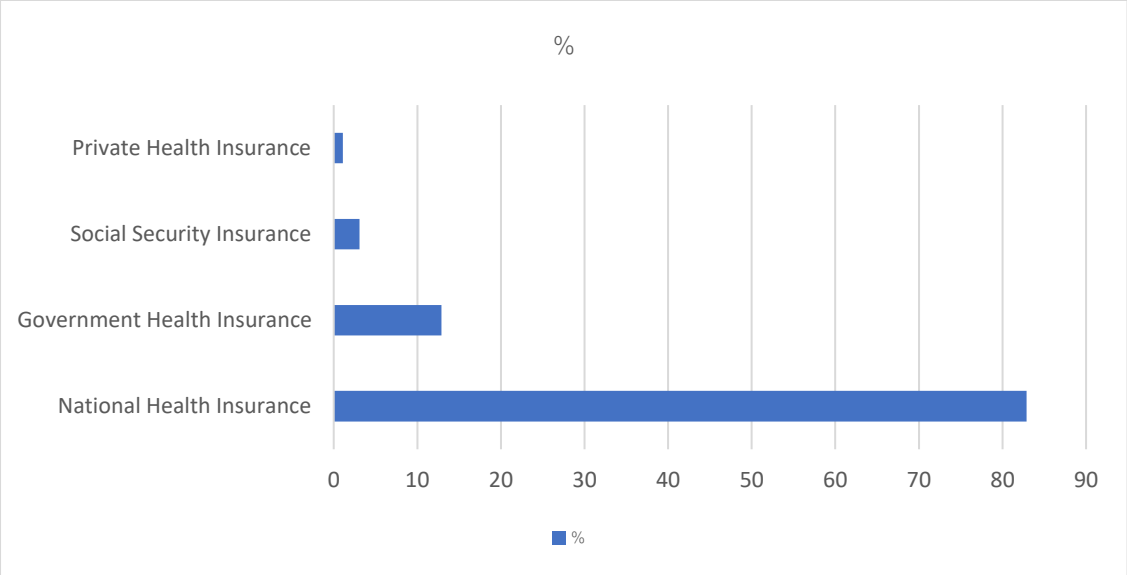
The Committee grants this waiver provided that you inform the KIT GDPR project officer about your research for GDPR monitoring purposes.

The Committee requests you to inform the REC once substantive changes to the protocol are made, important changes to the research team take place or researchers are added to the research team.

Moreover, the Committee requests you to send the final report of the research containing

Annex 6

Bar chart of Type of insurance among 450 respondents age > 60 years old in survey in Eastern Thailand 2018



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