

# **Development and Evaluation of a Community-based Fall Prevention Program for Elderly Thais**

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**Abstract:** This action research was conducted to develop a community-based fall prevention program for elderly Thais, living in an urban Bangkok community, and to evaluate the program's effectiveness. Qualitative and quantitative data were collected via a four-phase plan that included: situation analysis of falls; program development; program implementation; and, program evaluation. The community-based fall prevention program was based on community participation and a PRECEDE-PROCEED framework, as a multi-factorial intervention, that consisted of: a fall campaign; multi-factorial risk assessment; fall education; a balance/exercise program; home visits for medication review and home hazard management; and, a fall management system.

All qualitative data were evaluated via content analysis. Effectiveness of the fall prevention program (quantitative data) was evaluated in terms of: changes in the incidence of elderly falls; changes in elders' fall prevention behaviors; changes in elders' physical performance; modification of environmental hazards; community stakeholders' participation; and, elders' and community stakeholders' satisfaction with the program. A paired t-test was used to examine the difference in mean scores of fall prevention behaviors, while the Wilcoxon Signed Rank Test was used to examine differences in physical performance. Descriptive statistics were used to examine: changes in fall incidence; modifications of environmental hazards; level of community stakeholders' participation; and, elders' and community stakeholders' satisfaction with the program.

After implementation of the fall prevention program, elders' fall incidence was reduced 24.86%. In addition, within the same time frame, the elders' fall prevention behaviors improved, as did their physical performance. Modifications made to home environmental hazards included: use of anti-slip mats in the bathroom; spraying different colors on steps and doorsills to enhance their presence; and, changing the style of toilet. Modifications made to community environmental hazards included: posting warning signs around hazardous areas; and, notifying the organizations responsible for making corrections to hazardous areas within the community. The level of stakeholders' participation with each other was found to be consistent. The elders and the community stakeholders were highly satisfied with the fall prevention program. Thus, the findings suggested the community-based fall prevention program was an effective intervention.

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## **Background**

Falls, because of their prevalence and impact, have become a worldwide public health problem among older adults. Approximately 28–35% of individuals 65 years of age and over fall at least once a year, with 32% to 42% of those over 70 years of age falling yearly.<sup>1</sup> Similarly, 18.5% of Thais over 60 years of age have been found to fall every six

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months.<sup>2</sup> A recent national health survey revealed that older Thais, living in Bangkok, fell one to two times more than older Thais living in other regions of the country,<sup>3</sup> with 34.3 % of elders living in urban Bangkok experiencing one or more falls every six months and 38.4% of them having recurrent falls.<sup>4</sup>

Sustaining a fall can have physical, psychological and social impacts. Specifically, falls have been found to be the second leading cause of severe physical injuries.<sup>5</sup> Approximately 72.3% of older Thais reportedly have sustained physical injury, including hospitalization,<sup>6</sup> secondary to a fall. In addition, over two-third of elderly Thai, who have fallen, have expressed being fearful of falling again, as well as lacking confidence to perform activities of daily living.<sup>7</sup> Since severe injuries often require long and expensive hospitalizations, the economic consequences of a fall can have a significant impact on patients and their families,<sup>8</sup> especially since 32% to 80% of those who fall, and survive their initial hospitalization, encounter permanent disabilities.<sup>9</sup>

Various risk factors (i.e. personal, behavioral and environmental) have been found to contribute to the occurrence of falls among elders,<sup>10</sup> with females being at a higher risk of falls than males.<sup>11-13</sup> In addition, health problems,<sup>11,13</sup> poor vision,<sup>11</sup> gait impairment,<sup>7,14</sup> poor balance,<sup>7, 14</sup> and muscle weakness<sup>8,14-15</sup> have been found to be related to the incidence of falls. The incidence of falls also been found to be related to: lack of awareness of surroundings (i.e. uneven surfaces) and inappropriate footwear /clothing;<sup>1,16</sup> consumption of psychotropic medications and anti-depressants;<sup>17-18</sup> and, daily intake of four or more medications.<sup>7,17</sup> Environmental hazards, such as, slippery floors and hazardous stairs,<sup>8</sup> inadequate lighting,<sup>7</sup> and damaged or obstructed walkways,<sup>7</sup> also have been shown to contribute to the occurrence of falls.

Prior research has shown that multifactor interventions are the most effective means of reducing falls and fall-related injuries.<sup>19-23</sup> Thus, multifactor interventions, such as risk assessment (i.e., vision

testing, identification of medication side effects, home safety analysis), targeted treatments (i.e., exercise, education and home modifications based upon a safety analysis),<sup>19</sup> and appropriate referrals (i.e., care by physicians and physical therapists) for reducing the incidence of falls,<sup>1</sup> should be taken into consideration when developing any type of fall prevention program. However, limited data exists regarding the determinants of fall risk factors among elderly Thais. Furthermore, prior research has failed to demonstrate the importance of the use of a multifactor or community-based approach in the reduction of fall risk factors. Rather, the focus has been on a single intervention being implemented at the individual level.<sup>9,24,25</sup>

Although multifactor interventions have proven effective for fall prevention among communities within Western cultures, they have not been applied among communities within the context of the Thai culture. Since community participation has been shown to provide the means for development of suitable fall prevention programs that lead to sustainable behavioral changes that reduce falls and fall-related injuries, the aim of this study was to develop and evaluate the effectiveness of a “Community-based Fall Prevention Program for Elderly Thais” living in urban Bangkok.

## Conceptual Framework

The PRECEDE-PROCEED model<sup>26</sup> was used as a framework, for this study, because it provided a comprehensive structure for creating a community health promotion intervention/ program. The model consists of two components: **PRECEDE** (Predisposing, Reinforcing and Enabling Constructs in Educational Diagnosis and Evaluation) and **PROCEED** (Policy, Regulatory, Organizational Constructs in Educational and Environmental Development).

The premise of the PRECEDE component is that a diagnosis is needed prior to development and implementation of an intervention plan. The PRECEDE component is comprised of four phases, including

identifying and setting the: ultimate desired results; priorities among the health or community issues, and behavioral and environmental determinants that stand in the way of achieving desired results; predisposing, enabling and reinforcing factors that can affect the behaviors, attitudes and environmental factors identified in phase two; and, administrative and policy factors that influence what can be implemented. The premise of the PROCEED component of the model is that the development, implementation and evaluation of the intervention/program is based upon the diagnoses determined during enactment of the PRECEDE component. The PROCEED component of the model also includes four phases. They are the: design and implementation of the intervention/program; evaluation of the process of what is being done in the intervention/program; evaluation of the impact of the intervention/program on the target population; and, evaluation of the outcome of the intervention/program.

## **Method**

**Design:** Action research was used to accomplish the purposes of the study.

**Ethical Considerations:** Approval to conduct the study was obtained from both the primary investigator's (PI) academic institution and the Bangkok Metropolitan Administration. All potential participants were informed about: the nature of the study; what their participation would involve; confidentiality and anonymity issues; and, the right to withdraw at any time. Those who agreed to participate were asked to sign a consent form.

**Setting:** One community, of five in the catchment area of Ramathibodi Hospital, was selected as the study site. This particular community was chosen because it had: the highest incidence of falls among the five communities in the selected catchment area; strong community leadership; health volunteers and an elderly club; and, strong community networks that focused on fall prevention.

**Sample:** The sample consisted of two groups: 41 elders and 18 community stakeholders. The selected community had 102 identified elders of whom 41 met the inclusion criteria and consented to participate. The 41 elders were accessed by way of a community broadcast system. Inclusion criteria for the elders were: being 60 years of age or older; living in the selected study site community; being able to verbally communicate in Thai; being willing to participate; and, demonstrating adequate cognitive function. The 41 elders ranged in age from 62 to 86 years (mean = 72.93 years). Thirty one (75.6%) of them were women. The elders tended to: be married or have been married (n = 18; 43.9%); have a primary school education (n = 28; 68.3%); be housewives (n = 27; 65.9%); have universal health care coverage (n = 21; 51.2%); have a monthly family income of less than 3,000 Baht (n = 19; 46.7%); be financially supported by either their children or grandchildren (n = 14; 34.1%); report having at least one illness (n = 36; 87.8%) with the most common being hypertension (n = 28; 68.3%) and diabetes mellitus (n = 19; 46.3%); and, take four or more types of medications daily (n = 16; 39%). Thirteen (31.7%) of the elders reported falling, during daylight hours, within the last year. Of those 13, six (46.2%) recently had fallen. The most common causes of falls were slipping (n = 6; 46.1%) and tripping (n = 3; 23.1%). Most (n = 9; 69.2%) falls occurred outside the home (i.e., in the local market, on a community walkway). Eleven (84.6%) elders, who had fallen over the past year, sustained a moderate injury (i.e., bruising and sprains), while two (23.1%) of them fractured an arm. The vast majority, who had fallen, took care of themselves (n = 9; 69.2%), while 30.8% (n = 4) of them visited the emergency room. The 18 community stakeholders included: three community leaders; four public health volunteers; five representatives from the elder club (one was the club's president); one public health nurses; three Crown Property Bureau representatives; and, two District Office representatives.

**Instruments:** Seven measures were used during the development and evaluation of the effectiveness of the fall prevention program. The measures included the researcher-developed *Demographic Data and Fall History Questionnaire*; *Thai Fall Risk Assessment Test*<sup>17</sup>; researcher-developed *Fall Prevention Behavior Questionnaire*; *Environment Hazard Assessment Questionnaire*<sup>27</sup>; four-part *Physical Performance Test*<sup>28-31</sup>; researcher-modified *Partnership Checklist*<sup>32</sup>; and, researcher-developed *Satisfaction with the Fall Prevention Program Questionnaire*.

The researcher-developed *Demographic Data and Fall History Questionnaire (DDFHQ)* was used to obtain information, from each elder, regarding his/her: age; gender; marital status; education; occupation; income; source of income; health problems; name and dosage of medications used; and, detailed history of falls (i.e., number, cause, time, place, injuries and treatments). It took approximately five minutes for each subject to complete the questionnaire.

The *Thai Fall Risk Assessment Test (Thai-FRAT)*<sup>17</sup> was used to identify elders at risk of falling. The instrument assessed six factors, including: history of falls; body balance; gender; medications used; visual acuity; and, style of house. Examples of assessment factors and possible responses included: “Is there a history of falls?” (“yes” = 5 or “no” = 0); “Are there body balance problems [i.e. performing a full tandem stand < 10 seconds]?” (“yes” = 2 or “no” = 0); “Is the gender female?” (“yes” = 1 or “no” = 0); “Are more than four types of medications used per day or are any of the following medications being used: diuretics, antihypertensive, psychotropics or anti-depressants?” (“yes” = 1 or “no” = 0); “Is low visual acuity present [< 6/12]?” (“yes” = 1 or “no” = 0); and, “Are stairs present within the home?” (“yes” = 1 or “no” = 0). A total score, which could range from 0 to 11, was obtained by summing across all items. Higher scores indicated a higher risk of falls. Using 4-point cut-off increments, the instrument has

been found to have a sensitivity of 0.92% and a specificity for high risk falls of 0.83%.<sup>17</sup> It took approximately 10 minutes for the researcher to administer the instrument to each elder.

The researcher-developed *Fall Prevention Behaviors Questionnaire (FPBQ)* consisted of 20 items and was used to assess five areas: fall prevention practices (9 items; i.e., “I wear suitable clothing/shoes”); regular vision assessment (1 item; i.e., “I get my eyes checked every year”); medication use (2 items; i.e., “I consult with my doctor regarding symptoms related to my medications”); exercise (2 items; i.e., “I exercise at least 30 minutes, three times a week”); and, home environment (6 items; i.e., “I turn on the lights before walking into a dark room”). Possible responses to each of the items were: 1 = “don’t practice” to 4 = “regularly practice.” To obtain a total score, which could range from 20 to 80, the response values were summed across all items. A high total score indicated a high level of fall prevention behavior. The content validity index and reliability of the instrument, in this study, were found to be 0.85 and 0.64, respectively. It took approximately ten minutes to administer the instrument to each elder.

The 22-item *Environment Hazard Assessment Questionnaire (EHAQ)*<sup>27</sup> was used to assess four environmental areas: general home area (8 items; i.e., “Are the floors in your home slippery?”); bathroom in home (5 items; i.e., “Do you have devices to help you get on and off the toilet?”); stairs in home (3 items; i.e., “Is there sufficient lighting on the stairs in your home?”); and, community (6 items; i.e., “Is there damage to the walkways in your community?”). Each item required either a “yes” or “no” response. For each response that identified an environmental hazard, a score of “1” was assigned. For each response that did not identify an environmental hazard, a score of “0” was assigned. A total score, which could range from 0 to 22, was obtained by summing the response scores across all items. A high total score suggested a

high presence of environmental hazards. Prior to use in this study, the content validity index of the instrument was assessed by four experts (a gerontological physician and three doctorally prepared professors in geriatric nursing) and found to be 1.00. It took approximately five minutes to administer the instrument to each elder.

The four-part *Physical Performance Test (PPT)*<sup>28-31</sup> was used to assess upper body muscle strength, lower body muscle strength, balance, and balance and gait. Upper body strength (i.e. hand grip strength) was assessed with each elder sitting in a chair, holding a handgrip dynamometer with his/her dominant hand, and having the elder's elbow holding the dynamometer against his/her body. Handgrip strength was determined by the number of kilograms the elder was able to apply, and hold for 5 seconds, when squeezing and applying maximum strength to the dynamometer. A high value indicated a high amount of upper body muscle strength. Older adults who have handgrip strength of less than 18 kilograms (low muscle strength) are known to be at a high risk of sustaining falls.<sup>28</sup> The test-retest reliability of the handgrip test, in this study, was 0.91. Lower body strength was assessed using the "five times sit to stand" activity. This activity required the elder to move from a sitting to a standing position, as quickly as possible, five times. The longer it took the elder to accomplish the activity, the less lower body muscle strength he/she had. Elders who spend more than 15 seconds to complete the activity have been identified as being at a high risk for falls.<sup>29</sup> Test-retest reliability of the activity, in this study, was 0.78. Balance was assessed using the "360 degree turning" activity. The elder was asked to completely turn around (360 degrees) as quickly as possible. Older adults, spending more than 3.8 seconds to accomplish this task, have been found to be at a high risk of sustaining falls.<sup>30</sup> Test-retest reliability of this activity, in this study, was 0.73. Both balance and gait were assessed using the activity of

"timed up and go." To accomplish this activity, the elder was instructed to sit with his/her back against the chair. He/she then was instructed to stand upright and walk, at a normal pace, for three meters (marked with a line on the floor). The elder then was asked to walk around a cone placed on the line on the floor, return to the chair, and sit down. Each elder was timed, in seconds, from when he/she stood up until returning to a seated position in the chair. Elders who spend more than 12 seconds to complete this activity have been determined to be at a high risk of sustaining falls.<sup>31</sup> Test-retest reliability of this activity, in this study, was found to be 0.90.

A modified version of the *Partnership Checklist (PC)*<sup>32</sup> was used to assess the success and sustainability of the partnerships established during development and implementation of the intervention/program in this study. Modification of the checklist involved restating the instrument items so they specifically addressed the fall prevention program. For example, the item, "There is a shared understanding of, and commitment to, this goal among all potential partners," was changed to "There is a shared understanding of, and commitment to, the goal of the fall prevention program among all potential partners." The 35-item modified *PC* was used to assess seven areas: determining the need for a partnership; choosing partners; making certain the partnership works; collaborative planning; implementing collaborative action; minimizing barriers to partnerships; and, reflecting on continuing the partnership. Examples of the items were: "Partners share common ideologies, interests and approaches regarding the fall prevention program" (choosing partners); "All partners are involved in planning and setting priorities for collaborative action in the fall prevention program" (collaborative planning); and, "There is an investment in the partnership of time, personnel, materials or facilities in the fall prevention program (implementing collaborative action). Possible responses for each of the items were 0 =

“strongly disagree” to 4 = “strongly agree.” A total score, which could range from 0 to 140, was computed by summing across all items. Determination of the level of the partnership was based on a score of: 0 to 49 = partnership should be questioned; 50 to 91 = partnership moving in the right direction, but needed more attention; and, 92 to 140 = partnership based on genuine collaboration, with challenge to maintain and build on current success. The content validity and reliability of the instrument, for this study, was 1.00 and 0.95, respectively. It took each stakeholder approximately 10 minutes to complete the questionnaire.

The research-developed Satisfaction with the *Fall Prevention Program Questionnaire (SFPPQ)* was used to determine both the elders’ and stakeholders’ satisfaction with the fall prevention program. The questionnaire consisted of seven items addressing the: overall fall prevention program; multi-factor risk assessment activity; education activity; balance/exercise activity; home visit; environment activity; partnership; and, social networks. Examples of items included: “How satisfied were you with the program’s fall risk assessment activity?”; “How satisfied were you with the overall program?”; and, “How satisfied were you with the support provided by the various stakeholders (partners) in the program?” Possible responses for each of the items were 1= “very low satisfaction” to 5 = “very high satisfaction.” A total score, which could range from 7 to 35, was calculated by summing the responses across all items. A high score suggested a respondent’s satisfaction with the program. It took each elder and stakeholder approximately 3 minutes to complete the questionnaire.

Since the *PC* was the only instrument originally written in English, it required translation and back translation by two individuals fluent in Thai and English. All other instruments were either originally written in Thai or required the researchers to interpret the instrument’s instructions for implementation (i.e. *PPT*).

***The Community-based Fall Prevention Program:*** The program consisted of three major phases. These included: situational analysis; development of the fall prevention program; and, implementation and evaluation of the effectiveness of the program.

*Situational analysis* was conducted in order to explore the fall phenomenon and examine fall risk factors that existed in the selected community. Four stakeholders (public health nurse; elder club president; and, two public health volunteers) were recruited and trained, as members of the analysis team, to administer the *DDFHQ*; *Thai-FRAT*,<sup>17</sup> *FPBQ*; *EHAQ*,<sup>27</sup> and, *PPT*<sup>28-31</sup> to the 41 elders. The assessment process took approximately 30 to 40 minutes to complete. In addition, two focus groups were held for the purposes of: discussing the existence of fall risks among the elders; identifying environmental risks that existed within the community; and, identifying strategies addressing fall prevention. The focus groups included: 10 of the 41 elders who had experienced a fall and eight of the stakeholders (three public health volunteers; the elder club president; a public health nurse; and three community leaders). Data obtained from the administered instruments and focus groups supported the need for development of the fall prevention program.

*Development of the fall prevention program* was accomplished by way of a PI-lead workshop using Appreciation-Influence-Control (AIC) techniques.<sup>33</sup> The workshop participants included three elders and six stakeholders (one public health nurse; two public health volunteers; elder club president; and, two community leaders) who had been involved in the focus groups during the situational analysis phase. The workshop focused on: reflecting on and analyzing elders’ falls; identifying the community’s need for a fall prevention program; identifying partnerships, with public and private organizations, that would support a fall prevention program; and, designing activities for

a fall prevention program. Five organizations (Public Health Center; District Office; Property Bureau; local temple; and, local market) were identified that would support the fall prevention program. Also, the activities for a six-component, individual (*fall prevention campaign; multifactor fall risk assessment; education program; balance/exercise group; home visit*) and community (*fall management system*) level, fall prevention program were developed.

The *fall prevention campaign* was developed to inform community elders about the: purpose of the program; Fall Notification Center; and, teams that would be responsible for fall risk assessments, strengthen and balance training exercises, and home and community fall hazard assessments. The campaign was designed to be implemented, once yearly, in partnership with the Public Health Center. The public health nurse and identified leaders of the fall prevention teams (three public health volunteers, five members of the elder club, one District Office representative, and three elders who had modified their home environment) were to wear a polo shirt advertising the program and walk throughout the community, and visit the homes of elders and their families. Also, stickers with printed slogans and messages, about fall prevention, were to be distributed to elders and their family members. In addition, letters of invitation to participate in the fall prevention education class were to be distributed. During the home visits, the public health nurse and team members were to encourage family members to be aware of and sensitive to the occurrence of falls among their respective elders.

The *multifactor risk assessment*, to be implemented once yearly, was designed as a baseline assessment regarding fall risk factors among elders in the community. The public health nurse was to be responsible for training the team members regarding the activities they were to implement (multifactor fall risk assessment; balance/exercise class; and, home visit). The fall prevention team was to consist of two

groups: the zone team (eight members) and the environment team (three members). The zone team members (three public health volunteers and five elder club members), all of whom were housewives, were to be assigned six to eight elders living near their residences, so that all zone team members would be familiar with the elders to whom they were assigned. The environment team members were to consist of a community leader, the elder club president and an elder who had modified his/her home environment. A leader for the two types of fall prevention teams was to be identified by each respective team. All fall prevention team members were to be trained in personal, behavioral, physical, and home environment assessment of elders using the: *DDFHQ; Thai-FRAT*,<sup>17</sup> *FPBQ; Ehai*,<sup>27</sup> and, *PPT*.<sup>28-31</sup> The Public Health Center was to provide support for this component of the program.

The *fall education program*, to be implemented once yearly, was designed to increase the elders' knowledge and self-awareness regarding behaviors that could lead to fall prevention. The education program, carried out by the public health nurse and the leaders of the fall prevention teams, in a group setting, was to focus on fall risk factors and prevention strategies (i.e., fall prevention behaviors, yearly vision screening, medication use and side effects, balance/exercise strategies, and environment management). The teaching methods were to include: discussion; sharing of experiences; relationship building between elders and fall prevention team leaders; and, distribution of printed fall prevention strategy material to elders. The Public Health Center was to provide support for this activity.

The *balance/exercise group activity*, designed to promote muscle strength and balance, was to be taught and performed in a community setting, by the zone team leader, in bi-weekly 45-minute sessions for 12 weeks. In addition, the elders were to be encouraged to perform the balance/exercise activity daily, on a regular basis. The teaching strategies were to include

one formal class on the balance/exercise activity and distribution of take-home printed materials on each of the balance/exercise activities. The zone team leader was to monitor the elders' participation (i.e., group activity attendance and daily recording of balance/exercise activity). Notification about the date and time of the exercise group was to occur, via billboards and radio broadcasts, one week prior to implementation of the exercise program. The Crown Property Bureau was to provide support for this activity.

The *home visit* was designed to be implemented, twice yearly, for: review of medication use and side effects (i.e., dizziness, vertigo, orthostatic hypotension, fatigue, and muscle weakness); and, identification of and suggestions for modifications of home environmental hazards. Review of medication use and side effects was to be carried out by the zone team members. Identification of and suggestions for modifications of home environmental hazards were to be done by the environment team members, with a 6-month follow-up by the environment team leader to see if the hazards had been corrected. All of these activities were to be reported to and monitored by the public health nurse. The Public Health Center was to provide support of this activity.

The *fall management system*, to be implemented throughout the year, was designed to monitor the incidence of elders' falls. This system was to consist of both surveillance and environmental hazard management. Surveillance was to involve: creation of the Fall Notification Center, where the incidence of falls and fall risk hazards, within the community, were to be reported; development of a form for recording the incidence of falls and fall risk hazards within the community; and, development of guidelines for the public health nurse to use when visiting an elder in his/her home and evaluating fall incidences/fall risk factors. Environmental hazard management was to focus on: fall prevention team members assessment of the fall risk factors in the community (i.e., walkways

and public areas); reporting identified fall hazards to the District Office; and, working with appropriate individuals, associated with the temple and market, regarding identification and correction of fall risk factors within their respective environments. The District Office was to provide support of this activity.

**Implementation and Evaluation of the Effectiveness of the Community-based Fall Prevention Program:** Implementation and evaluation of the effectiveness of the fall prevention program was accomplished, over 10 months, with 28 of the 41 elders. All 41 elders were invited to take part in the program, but only 28 consented. These elders had a mean age of 72.93 years (range of 63 to 86 years) and, primarily, were: female (n = 22; 78.6%); married or previously married (n = 13; 46.4%); primary school graduates (n = 19; 67.9%); housewives (n = 20; 71.4%); and, receiving financial support from their children or grandchildren (n = 11; 39.3%). They also had a monthly income less than 3,000 Baht (n = 12; 42.9%) and health insurance (n = 14; 50%).

After the fall prevention program was developed, the 28 elders were administered, for a second time, the *DDFHQ*, *FPBQ*, *EHAQ*<sup>27</sup> and *PPT*.<sup>28-31</sup> After the instruments were administered, the program was implemented. Upon completion of program implementation, the effectiveness of the program (i.e., changes in elders' fall prevention behaviors, physical performance and incidence of falls, and elders' satisfaction with the program) was assessed through administration of the *FPBQ*, *EHAQ*,<sup>27</sup> *PPT*<sup>28-31</sup> and *SFPPQ*. In addition, the PI asked the elders if they experienced any falls while they were in the program (i.e., "Have you ever fallen during the 10 months of participation in the fall prevention program?"). Upon program completion, the 18 stakeholders were administered the *SFPPQ* and *PC*<sup>32</sup> to: determine their satisfaction with the program; and, assess the sustainability of the community partnerships.

***Data analysis:*** Content analysis was used to assess the qualitative data obtained from the two focus

groups. Descriptive statistics were used to analyze: demographic characteristics; scores for each instrument administered; fall incidence; and, number of environmental modifications accomplished. The paired t-test was used to examine the difference in mean scores, before and after implementation of the fall prevention program, regarding the elders' fall prevention behaviors. The Wilcoxon signed rank test was used to examine the difference in mean scores, before and after implementation of the prevention program, regarding the elders' physical performance.

## Results

Effectiveness of the "Community-based Fall Prevention Program for Elderly Thais" was assessed in terms of: reduction in the fall incidence rate; improvement in fall prevention behaviors and physical performance; and, environmental hazard modifications. Moreover, sustainability of the program was assessed in terms of community stakeholders' participation, as well as satisfaction, of the elders and community stakeholders, with the program.

**Reduction in fall incidence rate:** Only two (7.14%) of the 28 elders reported falling during implementation of the program. Prior to the program, 32% (n = 9) of the elders had experienced a fall. Thus, the incidence of falls was reduced by 24.86%. The two elders who fell tripped over an uneven walkway surface. Both received bruises to their knees, which they cared for themselves.

**Fall prevention behaviors:** A significant improvement in overall fall prevention behaviors was found after elders completed the fall prevention program ( $t = 8.255$ ;  $p \leq .001$ ).

**Physical performance:** The elders demonstrated a significant improvement, after program completion, in lower body strength, balance, and balance and gait (i.e., "five times sit to stand" [ $Z = 4.517$ ;  $p \leq .001$ ]; "turn 360 degrees" [ $Z = 3.097$ ;  $p \leq .01$ ]; and, "timed up & go" [ $Z = 4.509$ ;  $p \leq .001$ ]). Upper body

strength, measured by handgrip strength, improved slightly (not statistically significant) after program completion.

**Environmental hazards:** Prior to program implementation, two common home environmental hazards were noted: slippery bathroom floors ( $n = 20$ ; 71.4%); and, presence of steps ( $n = 10$ ; 35.7%). After program implementation, all households (100%) with slippery bathroom floors were using anti-slip floor mats and all households (100%) with steps had painted the steps and doorsills in colors that made them more noticeable to elders. Some home environmental hazards had been dealt with, but only minimally due to economic limitations or the existing structure of the house. For example, only one household was able to change a "squatting toilet" to a "sitting toilet." Regarding community environmental hazards, warning signs were posted where uneven walkways existed and the District Office was notified regarding the need to correct existing environmental hazards.

**Community stakeholders' participation:** The fall prevention program involved five organizations (Crown Property Bureau, District Office, Public Health Center, local temple and local market). The participation scores for these organizations, in descending order were, the: Public Health Center (122); District Office (110); Crown Property Bureau (100); temple (96); and, market (96). Thus, based upon their scores, these organizations all demonstrated genuine collaboration with the program, and accepted the challenge of maintaining and building on their successes.

**Satisfaction with the fall prevention program:** The elders' mean score for satisfaction with all components of the program was 31.19 (range: 24–35;  $SD \pm 3.28$ ). Regarding the individual components of the program, with which the majority of elders were most satisfied, were the: exercise activity ( $4.61 \pm 0.567$ ); multi-factor risk assessment activity ( $4.57 \pm 0.573$ ); and, community environment activity ( $4.32 \pm 0.612$ ). The 18 stakeholders' mean score for

satisfaction with all components of the program was 32 (range: 26–35;  $SD \pm 2.89$ ), while the individual components of the program, with which the majority of them were most satisfied, were the: exercise activity ( $4.78 \pm 0.428$ ); multi-factor risk assessment activity ( $4.72 \pm 0.461$ ); and health education ( $4.56 \pm 0.511$ ).

## Discussion

This study revealed the use of a multi-factorial approach was an effective means for reducing elders' falls in the selected community. This outcome is congruent with prior evidence-based fall prevention interventions that have reduced the incidence of falls from 7% to 30%.<sup>34,35</sup> Each program component appeared to assist in improving fall prevention behaviors, as well as physical performance. For example, although prior studies have shown that health education can be a helpful component in multi-factorial interventions,<sup>19,34</sup> few have directly addressed the effect of health education on fall prevention behaviors. This study, however, assessed the effect of health education on elders' fall behaviors.

In terms of physical performance, the elders were found to improve their lower body strength, balance, and balance and gait, as a result of the specific strength and balance training exercises that were provided during the program. This finding is congruent with prior research<sup>25,36,37</sup> that has found specific exercises can be helpful in enhancing one's physical performance. However, no significant improvement in upper body strength was found in this study. It is possible the reason this occurred was because the specific exercises taught, during the program, failed to adequately enhance improvement in upper body strength.

The fact a number of elders were able to adequately address home environmental hazards was the result of support and assistance on the part of family members. This finding is similar to prior studies that have indicated the importance of family support<sup>24</sup> and access to funds for home modification<sup>38</sup> in reducing the incidence of falls among elders. Regarding community

environmental hazards, appropriate actions were taken to address possible areas of concern where elders could fall (i.e., posting of warning signs around dangerous areas and notification of hazards areas to appropriate organizations). Although community environmental hazards have been shown to contribute to the occurrence of falls, no existing studies emphasized community environmental modifications for preventing falls. This study included community environmental modifications because the community environment was a common location for the occurrence of elders' falls. This finding showed that the environmental modifications, which could be provided by the community, could reduce the incidence of falls.

The fact that sustainability of the program was found to exist was reassuring. This finding is supported by prior research<sup>39</sup> wherein factors promoting sustainability, which were similar to those found in this study, have been noted. A factor supporting sustainability was that the 18 stakeholders had taken active roles in the development and/or implementation of the program and, therefore, had a vested interest in the program's success. In addition, a sense of ownership was found to exist among members of the two community-based fall prevention teams.

Finally, both the elders and community stakeholders were highly satisfied with the fall prevention program. No doubt this was due to the fact that noticeable changes were observed, among the elders, regarding the occurrence of falls, fall prevention behaviors, and physical performance. In addition, a sense of pride for having taken part in the development and implementation of an important community-based program may have had an effect on everyone's sense of satisfaction.

**Limitations and Recommendations:** Like all studies, this study has some limitations. First, the study was conducted in one community within an urban area. Thus, generalizability, to communities not similar to the community used in this study, is limited. In addition, more than three-quarters of the elders

involved in implementation and evaluation of the effectiveness of the program were women. Therefore, applicability of the findings to elder males may be limited. The study examined the effectiveness of the fall prevention program only upon program completion. As a result, no determination was made regarding what long term effects the program may or may not have on falls among elders. Finally, the home and community environmental modifications that were made were limited in nature. This appeared to be due to families' available financial resources and the time needed, by responsible organizations, to make modifications within the community setting. Thus, generalizability of the effectiveness of the environmental modifications that were made is very limited.

Future studies need to address a replication of this study, across Thailand, in other urban geographic locations, as well as in rural settings. Since this study included primarily elderly females, future studies need to consider the inclusion of more male elders. It also would be helpful to conduct longitudinal studies for the purpose of determining if the program provides positive, long-term effects on the prevention of falls among elders. Finally, in regards to environmental modifications, future studies may need to consider the availability of financial resources for assisting families with needed modifications, as well as the time frame required by responsible organizations to make needed modifications within the community.

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## การพัฒนาและประสิทธิผลของรูปแบบการป้องกันการหลัดตกหลุมของผู้สูงอายุไทย โดยใช้ชุมชนเป็นฐาน

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บทดัดย่อ: การวิจัยครั้งนี้เป็นการวิจัยเชิงปฏิบัติการเพื่อพัฒนาและตีกีมาตรฐานของการพัฒนารูปแบบการป้องกันการหลัดตกหลุมของผู้สูงอายุที่อาศัยอยู่ในเขตเมืองกรุงเทพมหานคร โดยใช้ชุมชนเป็นฐาน การเก็บรวบรวมข้อมูลประกอบด้วยข้อมูลเชิงปริมาณและเชิงคุณภาพ แบ่งออกเป็น 4 ระยะ คือ 1) การวิเคราะห์สถานการณ์การหลุม 2) การพัฒนารูปแบบการป้องกันการหลุม 3) การดำเนินกิจกรรม และ 4) การประเมินผล

รูปแบบการป้องกันการหลัดตกหลุมของผู้สูงอายุ โดยใช้ชุมชนเป็นฐาน ใช้การมีส่วนร่วมของชุมชน และแบบจำลอง PRECEDE-PROCEED เป็นกรอบแนวคิด โดยรูปแบบเป็นการจัดการหล่ายปัจจัย ประกอบด้วย 1) การรณรงค์ป้องกันการหลุมของผู้สูงอายุในชุมชน 2) การประเมินความเสี่ยงต่อการหลุมหล่ายปัจจัย 3) การให้ความรู้ 4) การออกแบบกายเพื่อเพิ่มความสามารถในการทรงตัว 5) การเยี่ยมบ้านเพื่อดูแลการใช้ยา และสิ่งแวดล้อมภายในบ้าน และ 6) การสร้างระบบในการป้องกันการหลุมในชุมชน

ประสิทธิผลของรูปแบบการป้องกันการหลัดตกหลุม ประเมินจากอัตราการเกิดการหลัดตกหลุม พฤติกรรมการป้องกันการหลุม สมรรถภาพทางกาย การมีส่วนร่วมของชุมชน ความพึงพอใจของโปรแกรม ของผู้สูงอายุและผู้มีส่วนได้ส่วนเสียก่อนและหลังเข้าร่วมโครงการ โดยใช้สถิติ Paired T-Test ทดสอบความแตกต่างของพุทธิกรรมการป้องกันการหลุม และ สถิติ Wilcoxon Signed Rank Test ทดสอบความแตกต่างของสมรรถภาพกาย และสถิติบรรยายเพื่อวิเคราะห์ การเปลี่ยนแปลงของอัตราการเกิดการหลุม การปรับเปลี่ยนสิ่งแวดล้อม การมีส่วนร่วมของชุมชน และความพึงพอใจต่อโปรแกรมของผู้สูงอายุและเครือข่าย

ภายหลังเข้าร่วมโครงการ พบร่วม อัตราการเกิดหลุมของผู้สูงอายุในชุมชนลดลงร้อยละ 24.56 ผู้สูงอายุที่เข้าร่วมโครงการมีพุทธิกรรมในการป้องกันการหลุมดี และมีสมรรถภาพทางกายดีขึ้น การปรับสิ่งแวดล้อมที่เสี่ยงภัยในบ้าน ได้แก่ การใช้แผ่นกันลื่น การพ่นสีบริเวณพื้นต่างระดับ และการปรับเปลี่ยนโถส้วม และการปรับเปลี่ยนสิ่งแวดล้อมในชุมชนประกอบด้วย การติดป้ายเตือนบริเวณที่เสี่ยง และรายงานหน่วยงานที่รับผิดชอบทราบเพื่อแก้ไข การดำเนินงานพบว่าชุมชนและเครือข่ายมีส่วนร่วมในโครงการอย่างสม่ำเสมอ ผู้สูงอายุและเครือข่ายที่ความพึงพอใจต่อรูปแบบการป้องกันการหลุมในระดับสูง ซึ่งสนับสนุนว่ารูปแบบการป้องกันการหลุมในผู้สูงอายุที่พัฒนาขึ้นมีประสิทธิผลในการป้องกันการหลุดของผู้สูงอายุไทยในชุมชน

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คำสำคัญ: รูปแบบการป้องกันการหลุดโดยใช้ชุมชนเป็นฐาน, ผู้สูงอายุไทย, ชุมชนเมือง, วิจัยเชิงปฏิบัติการ

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