

Effective Community Participation in Environmental Risk Management for Household Accident Prevention among Elders

Duriyang Wassana¹ and Banchong Witthayawirasak²

*¹Environmental Management Program
Faculty of Environmental Management,
Prince of Songkla University, Songkhla, Thailand
²Faculty of Environmental Management,
Prince of Songkla University, Songkhla, Thailand
Corresponding author: banjong.v@gmail.com*

Abstract

This research aimed to manage environmental risks in order to prevent accidents at homes of the elderly. A participatory action research (PAR) was implemented by 29 core researchers and 51 participants. Five steps were utilized, including 1) defining issues, goals and preparing research, 2) methodology and data collection, 3) data analysis, 4) risk management, and 5) evaluation. Several tools were developed by the researchers, including interview forms, questionnaires, and home environmental risk checklists. The target population were 51 households with elderly residents. A total of 71 elderly people were interviewed and 34 caregivers were asked to answer self-report questionnaires for caregivers. Each household was surveyed of risk environments and documented of any incidence of accident occurred at home during the years 2013-2015. The process of PAR improved the community awareness of the home environmental risk to the elders and increased the participation on the risk management. Many unsafe environments were found in their home, especially in the bathrooms and kitchens. Accordingly, the risk management plan was proposed. Many activities were included, such as toilet improvement, accident prevention training, motivational walking campaigns, mentoring and counseling on home risk management.

Subsequently, the implementation of the plan led to ongoing management of the risks and successful accident reduction. Follow-up visits found that elderly people had their knowledge increased 20.6% ($p < .01$) and unsafe behaviors decreased 15.2% ($p < .01$). The caregivers' knowledge also increased 4.8% ($p < .01$), and safe elderly care practice increased 8.6% ($p < .01$). In addition, the use of home safety devices increased 28.2% ($p < .01$). The home risk factors declined 21.4% ($p < .01$). The accident incidence fell 63.8%. The environmental risk fell in all areas. The PAR created the community empowerment and a continuity of the risk management process which led to sustainability of the operation.

Keywords: Community Participation; Home Environment; Risk Management; Accident Prevention; Elderly People

Introduction

The elderly population is rapidly increasing as a higher proportion of total population, resulting in an “aging society” (World Health Organization, 2012). It is predicted that the elders will increase in population more than three times, from 600 million to 2,000 million during the year 2000-2050 (United Nations, 2010; World Health Organization, 2011). In Thailand, since family planning had been added as a national master plan, the rate of population increased only 0.4 percent, as the childhood population declined. The proportion of elderly people will likely to increase almost three fold in the next 35 years, from 9.2 percent in 2000, to 25 percent in 2035. During this time, the number of caregivers will decrease as well (Poorves, et al., 2008).

There is a challenge of ensuring an appropriate care for the elders, along with their security (World Health Organization, 2012). In Thailand, home accidents are important problems of elderly people since about 34.8 percent has fall accident (Sorysang, et al., 2014), 40.4 percent of these accidents lead to injury (Thai elderly research and development foundation, 2009). The injury is likely to lead to higher mortality (Bureau of Epidemiology, 2012). Among elderly people, those aged 80 years and over were most seriously injured and the risk of accidents increased with increasing age (Koski, et al., 1996; Bureau of Epidemiology, 2012). For the research area, elderly people are treated in the health center 13.8 percent due to accidents (Donprado Health Center, 2013).

Because most seniors will spend much of the day at home, if the home environment is unsafe, it may pose significant daily risk (Lan et al., 2009; Gilhooly, 2011), especially among elders with health conditions who cannot help themselves or who have disabilities (Lan, et al., 2009). About 71.7 percent of accidents among the elders occurred at home and 80 percent of the home environments had at least one risk (Donmez and Gokkoca, 2003; Acimis, et al., 2009). The environmental risks reportedly found in elder’s households consisted of slippery areas, bumpy carpets, too-low chairs (Lin and Lane, 2005), no stairway rails (Larsen, et al., 2004; Lan, et al., 2009), no handrails in the bathroom, inadequate lighting (Baraff, et al., 1997), holes in the ground, excessively hard floors, unsafe furniture, damaged electrical switches, and

inappropriate shelving (Rodriguez, et al., 1995), as well as the external environment of residential buildings (Borst, et al., 2008). Accident frequency varied with areas, such as bathrooms, stairways, kitchens, living rooms, bedrooms, and dining rooms (Rodriguez, et al., 1995; Lee, et al., 1999; Hamzaoglu, et al., 2002; Gilhooly, 2011). Falling down was the most frequent accident, including falling on unlevelled surfaces, falling down stairs, sliding down sloped surfaces and/or ramps (Lee, et al., 1999; Donmez and Gokkoca, 2003; Acimis, et al., 2009). Non-falling accidents included tripping, slipping, bumping into stationary objects, falling, burns or scalding, and cuts (Hamzaoglu et al., 2002; Acimis et al., 2009; Gilhooly, 2011). For this reason, environmental risks which can cause injury to elders at home need to be prevented. Creating a safe home environment is considered an important health intervention (World Health Organization, 2012).

Communities can be self-empowered by addressing these issues using community skills and resources for appropriate solutions (McKenzie, et al., 2002). The appropriate process is participatory action research (PAR) which brings theory and practice together (Watters et al., 2010). It focuses on social engagement and collaboration, freedom of thought in solving problems and flexibility in operation (Kemmis and McTaggart, 2007; Blair and Minkler, 2009). Community empowerment and involvement can be used to develop an environmental risk management model for preventing home accidents that affect the elders. The PAR is not just a process of learning together and changing behavior in the community but also creating and sustaining community participation (Blair and Minkler, 2009).

Methods

This PAR was carried out during the years 2013-2015 in a community at Moo 4, Don Pra Do subdistrict, Pak Phayun district, Phatthalung Province. The community had elderly residents 21.0 percent of its total population (Phatthalung Provincial Health Office, 2012). The study population were 51 households with elderly residents. The participants consisted of 29 core researchers and 25 co-researchers. The core researchers who were community member, stakeholder in the implementation of research, has the authority to

solve the problem, happy to participate in the research, and can had actively involved in all processes since the beginning of the study. Some of the core researchers were members of the study households, while others might be community volunteers, senior citizens, community leaders, representatives of village health volunteers, representatives of elderly club members, representatives of village fund management, and local government officers. The co-researchers were caregivers living in the study households and could not be involved in all processes of the study but were willing to collaborate with the core researchers. The accidents involved in this research were falling, tripping, bumping into stationary objects, falling from high levels, burns or scalding, and cuts.

The PAR consisted of five steps:

Step 1 defining issues, goals and preparing research

The community was approached by creating a good relationship with the community leaders, issues of elderly people's risk of home accidents and injuries were raised. A research team was recruited from the community members and representatives of the 51 households with elderly residents. Subsequent preparation included educating about elderly home accident and risk prevention, providing related videos for further study, defining the issues and developing the goals of the study with focus group discussion and brainstorming among core researchers and some co-researchers.

Step 2 methodology and data collection

The participants reviewed literature and designed research tools that are appropriate to the context and people in the area including an interview form for interviewing elderly people, questionnaires for collecting data from the caregivers, accident report for examining practices associated with the accidents, and walk-through survey checklist for surveying home environments. The research tools were validated by three experts in the fields of architecture and design, occupational health and safety, and nursing and public health. The interview form had reliability in term of KR20 = 0.709 on knowledge test, and reliability in term of Cronbach's alpha coefficient = 0.716 on risk behavior test. The questionnaire had reliability in term of KR20 = 0.712 on

knowledge test, and reliability in term of Cronbach's alpha coefficient = 0.755 on elderly care practice. The PAR was conducted in 51 households by interviewing 71 elderly residents, asking 34 caregivers to answer questionnaires, and conducting walk-through surveys in the study households with the environmental risk checklist. The data was collected twice, before and after the risk management.

Step 3 Data Analysis

Data analysis conducted by 29 core researchers and used frequency, percent, risk matrix (Ruleworks, 2012) for evaluate the level of the environmental risk in each area of elderly home, and compared the difference between before and after risk management with wilcoxon signed rank test and accident rate in elderly homes. Information was presented in the form of tables and meeting to present the results of the risk analysis to individuals.

Step 4 Risk management

Risk management plan and guidelines were derived from a consensus agreement among 51 represented households. The risk management plan included toilet improvement, accident prevention training, accident risk management, motivational walking campaigns, mentoring and counseling, and collaboration of the community on implementation of the risk management plan to the 51 households.

Step 5 Evaluation

Evaluation of the risk management conducted by 29 core researchers and was achieved by comparing number of risk environments and number of accident incidence before and after the risk management for 51 household, as well as continuous progress of improvement.

Results

Risk management in this study required participation of citizens in the community. It utilized discussions on safety problems and accidents in the home of the elders among the participants in order to get to know and

understand relevant safety issues. In the first community meeting, it was found that there were multiple incidents of elderly residents falling in the bathrooms, with many cases resulted in fatalities. So far, the community had not successfully managed to provide a safe environment for the elders, but had agreed that accidents happening to the elderly people was an important issue that everyone had to be concerned and should join together to prevent and resolve it. A number of core researchers (n=29) and co-researchers (n=25) were recruited at the end of the meeting.

In the second community meeting, there were 56.9 percent attendance. Activities in the meeting included lecturing and watching videos on prevention of home accidents from the elderly people to reinforce previous knowledge sharing, and to set the research goals through focus group discussion and brainstorming. The acquired goals were to reduce the risk to minimal level and to reduce the number of accidents occurring in the home of the elderly people. Later, several small meetings were arranged to address the issues and to get feedback from the community. A total of 98 percent of the community population attended and agreed on the issues and goals of the proposed research.

The study revealed that there were 71 elderly people in this community. Many of them (46.5%) were between 60-69 years of age. Most of them (80%) could help themselves on daily routine activities. However, 66.2% of them were taken care by another person. Some of them (40.8%) were taken care by their offspring. In addition, 46.5% of them had chronic problems and 43.7% of them had vision problems. Many of the elders' homes were considered unsuitable and unsafe, especially their bathrooms, 12 of which were considered at risk. Other risk areas were kitchens and dining rooms, 7 of which were considered at risk (Table 1). The number of accidents occurred to the 71 elders during six-month period were 80 cases (112.7%), meaning that some elderly people had more than one accident. The area where most accidents occurred was around the house, followed by the kitchen, dining room, outdoor corridor, and bathroom. Ranking of the risk with risk matrix showed that around the house had the highest degree of risk due to the high incidence and injury severity.

Table 1 Number of environmental risks found in each area of the elders’ homes after walk-through surveys.

Area	Number of environmental risks in each area		
	Maximum	Minimum	Mean
1. Bathroom	12	2	5.71
2. Kitchen	7	0	1.49
3. Stairs	6	0	2.65
4. Living room	6	0	0.69
5. Bedroom	6	0	1.67
6. Hallway	5	1	1.44
7. Area around the house	5	0	0.94
8. Balcony	4	0	1.34
9. Outside walkway	3	0	1.20
10. Hall	2	0	0.29

The information from Table 1 was presented during the 4th community meeting. Appropriate interventions were proposed and agreed by the participants. Two safe bathrooms for the elders were built for public use and demonstration, one at the health center and another at the local temple. The budget came from individual and community donations with partial supports from local temples. The community members could use the displayed bathrooms as a model for improvement of their own bathrooms. A feedback survey later found that the seniors’ satisfaction of the displayed bathrooms increased 48.6 percent ($p < .01$).

Accident prevention training for elderly people and caregivers was provided to target audiences who were elderly or who were living with elderly residents, with the purpose of enhancing knowledge and understanding of how accidents occur at home and how to avoid it. It turned out that 82.4% of the participants joined the first training and the remaining 17.6% joined the second training.

A walking campaign was also launched with participations from local residents and community leaders. The campaign went from door to door to all households. An instruction was provided on how to reduce the risk of home accidents by utilizing data from the accident report and the elders’ home surveys. It was entitled “Instructions on how to improve the home environment for the safety of the elderly people.” People in the community were encouraged

to read the billboards at four locations, including health center, temples, community bus stop, and community hall. Actions were taken to raise public awareness by the core researchers during their visits to each household for data collection. To create motivation, awards were given to the winners who had the safest home for elderly people. The core researchers found that home safety was improved by 78.6 percent (based on how much the instructions were followed). Awards were also given to homeowners who did the best risk management of home accident. The Elder's home risk was reduced by 47.1 percent. The core researchers served as consultants to the public on how to rearrange or remodel the home to improve the elders' safety.

Results of the risk management were shown below (Table 2). The elderly knowledge scores of self-care practices increased 20.6 percent ($p < .01$). The risk behavior was reduced by 15.2 percent ($p < .01$). The Caregivers' knowledge scores of elderly care and accident prevention increased 4.8 percent ($p < .01$). Elderly care behaviors increased 8.6 percent ($p < .01$). The elderly households with safety equipment increased 28.2 percent ($p < .01$). Number of environmental risks in the elderly homes declined 21.4 percent ($p < .01$). Accident rates in the homes of the elderly people declined 63.8 percent.

Table 2 Test of the difference of scores before and after the risk management among elderly people and caregivers. Other variables are also compared.

Variable	Number	Mean score		Z	p-value
		Before	After		
Elderly People					
Knowledge score	68	15.82	19.10	6.612	.000
Risk behaviors	68	1.76	1.50	4.052	.000
Caregivers					
Knowledge score	34	18.97	19.88	3.842	.000
Elderly care behaviors	34	3.26	3.55	3.354	.001
Safety equipment					
Having safety equipment	51	1.39	1.78	3.328	.001
Environment risk					
Environment risk area	404	1.81	1.42	4.309	.000

P-value by wilcoxon signed rank test

The number of locations of accidents in the elderly’s homes declined 33.3 percent, from nine locations before the risk management (bathrooms, kitchens, stairs, living rooms, bedrooms, hallways, walkway outside the house, balcony, and area around the house) to six locations (hallway, area around the house, bathrooms, bedrooms, hallways, and kitchens). The environmental risk levels in the elderly homes analyzed using risk matrix also declined in 9 areas (Table 3).

Table 3 Environmental risk levels in various areas determined from risk matrix before and after the risk management

Indoor area	Risk level		Differences
	Before	After	
1. Bathroom	4B = Medium	2B = Low medium	Declined
2. Kitchen	4B = Medium	3B = Low medium	Declined
3. Stairs	2B = Low medium	1C = Low	Declined
4. Living room	3C = Medium	1C = Low	Declined
5. Hall	1C = Low	1C = Low	Unchanged
6. Bedroom	3B = Low medium	2B = Low medium	Declined
7. Hallway	3A = Low medium	2A = Low	Declined
8. Outside walkway	4C = High	2A = Low	Declined
9. Balcony	3B = Low medium	1C = Low	Declined
10. Area around the house	5C = High	4B = Medium	Declined

Discussion

The study community represented an aging society as defined by the World Health Organization (World Health Organization, 2012). It was imperative that the community focused on accident prevention (O’Meara and Smith, 2006), given the proportion of elders in the community with illness and health conditions (Lan, et al., 2009). Those aged 65 years and over were found to be at greater risk of home accident (Koski, et al., 1996). Most elders were found to live in unsafe houses which contributed to accidents (Lan, et al., 2009; Gilhooly, 2011).

Data collected before the implementation of the risk management intervention found that both senior citizens and caregivers possessed only basic knowledge regarding accident prevention. Though the local health

offices had previously provided training on accident prevention, no serious action was taken. As a result, risky behaviors were often observed among elders and they were found to be vulnerable to accidents. Furthermore, many environmental risks were found in their homes.

Accidents among the elderly subjected them to severe injury and death (Rocket and Smith, 1989), and caused panic, fear, stress and activity limitation (Gilhooly, 2011; Lim, et al., 2011). This in turn resulted in isolation and long term loss of confidence as well as severe depression (Kannus, et al., 2005), severely affecting health and quality of life (Lin and Lane, 2005; Lim, et al., 2011). Accidents happened to the elderly also had economic consequences for the affected families (Donmez and Gokkoca, 2003), as well as psychological effects, and caused time wasted in long-term care (Donmez and Gokkoca, 2003; Lin and Lane, 2005).

PAR was used to apply theory to practice for implementation of risk management (Kemmis & McTaggart, 2007). It encouraged mutual learning between core researchers and other participants via active learning, and gave the public more understanding and skills of accident prevention in the real situation. It also increased their sense of appreciation and control, allowing for easier, sustainable community implementation of better accident prevention (Blair and Minkler, 2009). The research provided an opportunity for the public to participate in the action from the beginning until the evaluation process. These process began by creating familiarity, reducing public distrust, understanding of research implementation, and clarifying of the benefits to community. Once this process was achieved, many people voluntarily joined the research project. They were willing to devote their time and energy arranging several meetings for learning new knowledge, planning and setting goal together, designing research tools and research methodology, collecting data, analyzing data, risk evaluation and risk communication to the public, proposing risk management approaches to the community and allowing the community to decide by themselves. The chosen approaches of risk management included toilet improvement, accident prevention training, accident risk management, motivational walking campaigns, mentoring and counseling. Each of the approaches were conducted and mobilized resources

by the community themselves. In addition, the evaluation step gave the community learning of their success through community participation.

Senior citizens and caregiver's knowledge of home safety increased after getting education (Stevens, et al., 2001; Weatherall, 2004; Becker, et al., 2003; Jensen, et al., 2003; Gitlin, et al., 2006), resulted in environmental improvement (Becker, et al., 2003), increased knowledge about general health via training activities (Hamzaoglu, et al., 2002), awareness of chances, campaign signs, and public awareness of related issues. Visiting caregivers could explore the related risks and risk behaviors (Vetter, et al., 1992; Tinetti, et al., 1994; Close, et al., 1999; Cumming, et al., 1999; van Haastregt, et al., 2000; Hogan, et al., 2001; Stevens, et al., 2001; Pardessus, et al., 2002) as well as stimulating enactment of the evaluation plan (Hogan, et al., 2001). This in turn resulted in changing behaviors among elderly adults and caregivers. Applying new public knowledge into action were found to help reducing and eliminating accident risks at home (Baraff, 1997; Day, et al., 2002; Weatherall, 2004; Kannus, et al., 2005; Klitzman, et al., 2005; Mahoney, et al., 2007).

Subsequently, it was found that the elderly homes had been modified to lower risk, decrease accidents, and achieve overall reduction of risk level in the home environment. There was room for ongoing improvement in accident hazard elimination. An example was the bathroom preparation. Installation of prototype devices has been shown to improve elders' satisfaction and safety (Tinetti, et al., 1994; Stevens, et al., 2001; Day, et al., 2002; Jensen, et al., 2003; Lyons, et al., 2009; Turner, et al., 2011). In addition, the consultation gave guidance in risk management, (Pardessus, et al., 2002; Becker, et al., 2003; Jensen, et al., 2003; Nikolaus and Bach, 2003), as well as proper housekeeping to reduce environmental risk (Baraff, 1997; Day, et al., 2002; Weatherall, 2004; Kannus, et al., 2005; Klitzman, et al., 2005; Mahoney, et al., 2007). Here incentives were used to improve the home environment and encourage cooperation. The PAR proved that community involvement was important to ensure ongoing cooperation and to establish a system to facilitate improvements in environmental risk reduction (Cumming, et al., 1999; Nikolaus and Bach, 2003) by organizing the community for assistance (Hendriks, et al., 2008). Finally, community volunteering, ongoing

community educational activities, visiting with counseling, advising during new home building for seniors, and educating the community builders are all to be deployed for the increasing home safety for the elderly.

Conclusions

This PAR found the unsuitable and unsafe environment in the elderly homes, especially in the bathrooms and kitchens. Guidelines of risk management were suggested by the community, including toilet improvement and accident prevention training, accident risk management, motivational walking campaigns, mentoring and counseling of risk management at the elderly homes. Subsequently, this led to ongoing management of risks and effective accident reduction. Environmental risk management for home accidents was successful due to the cooperation of the community using theory and practice together through participatory action research. The operation is flexible and can be adjusted to fit in context for each community. There is an opportunity for the public to join in from the beginning and it can be developed continually by creating the policy or annual activity plan of the related organizations including supporting some budget for the operation.

Acknowledgements

This research was financially supported from a grant by the Graduate School, Prince of Songkla University.

References

- Acimis, N. M., Mas, N., Yazici, A. C., Gocmen, L., Isik, T., & Mas, R. (2009). Accidents of the elderly living in Kocaeli Region (Turkey). *Archives of Gerontology and Geriatrics*, 49(2), 220–223.
- Baraff, L. J., Della, P. R., Williams, N., & Sanders, A. (1997). Practice guideline for the ED management of falls in community-dwelling elderly persons. *Annals of Emergency Medicine*, 30(4), 480-489.
- Barringer & Associates, Inc. (2006). *Risk Matrix*. Retrieved on August 16, 2012, from http://www.barringer1.com/nov04prb_files/Risk-Matrix.pdf
- Becker, C., Kron, M., Lindemann, U., Sturm, E., Eichner, B., Walter-Jung, B., & Nikolaus, T. (2003). Effectiveness of a multifaceted intervention on falls in nursing home residents. *Journal of the American Geriatrics Society*, 51(3), 306-313.
- Blair, T., & Minkler, M. (2009). Participatory Action Research With Older Adults: Key Principles in Practice. *The Gerontologist*, 49(5), 651-662.
- Borst, H. C., Miedema, H. M. E., Vries, S. I., Grahama, J. M. A., & van Dongena, J. E. F. (2008). Relationships between street characteristics and perceived attractiveness for walking reported by elderly people. *Journal of Environmental Psychology*, 28(4), 353–361.
- Bureau of Epidemiology. (2012) *Annual epidemiological surveillance report 2012*. Retrieved on July 25, 2017, from http://www.boe.moph.go.th/Annual/AESR2012/main/AESR55_Part1/file10/5755_SIDAF.pdf
- Carter, S. E., Campbell, E. M., Sanson-Fisher, R.W., Redman, S., & Gillespie, W. J. (1997). Environmental hazards in the homes of older people. *Age and Ageing*, 26(3), 195-202.
- Close, J., Ellis, M., Hooper, R., Glucksman, E., Jackson, S., & Swift, C. (1999). Prevention of falls in the elderly trial (PROFET): a randomized controlled trial. *The Lancet*, 353(9147), 93-97.

- Cumming, R. G., Thomas, M., Szonyi, G., Salkeld, G., O'Neill, E., Westbury, C., & Frampton, G. (1999). Home visits by an occupational therapist for assessment and modification of environmental hazards: a randomized trial of falls prevention. *Journal of the American Geriatrics Society*, 47(12), 1397-1402.
- Day, L., Fildes, B., Gordon, I., Fitzharris, M., Flamer, H., & Lord, S. (2002). Randomised factorial trial of falls prevention among older people living in their own homes. *British Medical Journal*, 325(7356), 128-131.
- Donmez, L., & Gokkoca, Z. (2003). Accident profile of older people in Antalya City Centre, Turkey. *Archives of Gerontology and Geriatrics*, 37(2), 99-108.
- Edwards, J. (2002). *Risk-Era: The Swedish Rescue Service's Tool for Community Risk Management*. Esri conference 2002 Paper #00307. Retrieved on August 16, 2012, from <http://proceedings.esri.com/library/userconf/proc02/pap0307/p0307.htm>
- Gilhooly, M. L. M. (2011). *Home Accidents amongst Elderly People: A Locality Study in Scotland*. Retrieved on August 6, 2011, from <http://www.gerobilim.com/index.php?id=23>
- Gitlin, L. N., Winter, L., Dennis, M. P., Corcoran, M., Schinfeld, S., & Hauck, W. (2006). A randomized trial of a multicomponent home intervention to reduce functional difficulties in older adults. *Journal of the American Geriatrics Society*, 54(5), 809-816.
- Hamzaoglu, O., Ozkan, O., & Janson, S. (2002). Incidence and causes of home accidents at Ankara Cigiltepe apartments in Turkey. *Accident Analysis and Prevention*, 34(1), 123-128.
- Hendriks, M. R., Bleijlevens, M. H., Van Haastregt, J. C., Crebolder, H. F., Diederiks, J. P., Evers, S. M., Mulder, W. J., Kempen, G. I., van Rossum, E., Ruijgrok, J. M., Stalenhoef, P. A., & van Eijk, J. T. (2008). Lack of effectiveness of a multidisciplinary fall-prevention program in elderly people at risk: a randomized, controlled trial. *Journal of the American Geriatrics Society*, 56(8), 1390-1397.

- Hogan, D. B., MacDonald, F. A., Betts, J., Bricker, S., M. Ebly, E., Delarue, B., S. Fung, T., Harbidge, C., Hunter, M., J. Maxwell, C., & Metcalf, B. (2001). A randomized controlled trial of a community-based consultation service to prevent falls. *Canadian Medical Association Journal*, 165(5), 537-543.
- International Risk Management Institute, Inc. (2012) *domino theory*. Retrieved on November 27, 2012, from <http://www.irmi.com/online/insurance-glossary/terms/d/domino-theory.aspx>
- Jensen, J., Nyberg, L., Gustafson, Y., & Lundin-Olsson, L. (2003). Fall and injury prevention in residential care effects in residents with higher and lower levels of cognition. *Journal of the American Geriatrics Society*, 51(5), 627-635.
- Kannus, P., Sievänen, H., Palvanen, M., Järvinen, T., & Parkkari, J. (2005). Prevention of falls and consequent injuries in elderly people. *The Lancet*, 366(9500), 1885-1893.
- Keall, M. D., Baker, M., Howden-Chapman, P., & Cunningham, M. (2008). Association between the number of home injury hazards and home injury. *Accident Analysis and Prevention*, 40(3), 887-893.
- Kemmis, S., & McTaggart, R. (2007) *Participatory Action Research*. Retrieved on June 28, 2015, from file:///C:/Users/ajtex/Desktop/journal/PARTICIPATORY ACTION RESEARCH.pdf.
- Klitzman, F., Caravanos, J., Belanoff, C., & Rothenberg, L. (2005). A multihazard, multistrategy approach to home remediation: Results of a pilot study. *Environmental Research*, 99(3), 294-306.
- Koski, K., Luukinen, H., Laippala, P., & Rothenberg, L. (1996). Physiological factors and medications as predictors of injurious falls by elderly people. *Age and Ageing*, 25(1), 29-38.
- Lan, T. Y., Wu, S. C., Chang, W. C., & Chen, C. Y. (2009). Home environmental problems and physical function in Taiwanese older adults. *Archives of Gerontology and Geriatrics*, 49(3), 335-338.
- Larsen, E. R., Mosekilde, L., & Foldspang, A. (2004). Correlates of falling during 24 h among Elderly Danish community residents. *Preventive Medicine*, 39(2), 389-398.

- Lee, V. M. S., Wong, T. W., & Lau, C. C. (1999). Home accidents in elderly patients presenting to an emergency department. *Accident and Emergency Nursing*, 7(2), 96-102.
- Lim, J. Y., Jang, S. N., Park, W. B. Oh, M. K., Kang, E. K., & Paik, N. J. (2011). Association between exercise and fear of falling in community-dwelling elderly Koreans: results of a cross-sectional public opinion survey. *Archives of Physical Medicine and Rehabilitation*, 92(6), 954-9.
- Lin, J. T., & Lane, J. M. (2005). Falls in the elderly population. *Physical Medicine and Rehabilitation Clinics of North America*, 16(1), 109–128.
- Lyons, R. A., John, A., Brophy, S., Jones, S.J., Johansen, A., Kemp, A., Lannon, S., Patterson, J., Rolfe, B., Sander, L. V., & Weightman, A. (2009). Modification of the home environment for the reduction of injuries (Review). The Cochrane Collaboration. Retrieved on June 1, 2012, from [http://www.intmed.aubmc.org.lb/downloads/geriatrics/geriatrics I-E.pdf](http://www.intmed.aubmc.org.lb/downloads/geriatrics/geriatrics-I-E.pdf)
- Mahoney, J. E., Shea, T. A., Przybelski, R., Jaros, L., Gangnon, R., Cech, S., and Schwalbe, A. (2007). Kenosha County falls prevention study: a randomized, controlled trial of an intermediate-intensity, community-based multifactorial falls intervention. *Journal of the American Geriatrics Society*, 55(4), 489-498.
- McKenzie, J. F, Pinger, R. R., & Kotecki, J. E. (2002). *An Introduction to Community Health*. 4th Ed. London: Jones & Bartlett Publishers International.
- Morgan, R. O., DeVito, C. A., Stevens, J. A., Branche, C. M., Virnig, B. A., Wingo, P. A., & Sattin, R. W. (2005). A self-assessment tool was reliable in identifying hazards in the homes of elders. *Journal of Clinical Epidemiology*, 58(12), 1252–1259.
- Nikolaus, T., & Bach, M. (2003). Preventing falls in community-dwelling frail older people using a home intervention team (HIT): results from the randomized Falls-HIT trial. *Journal of the American Geriatrics Society*, 51(3), 300-305.

- O'Meara, D. M., & Smith, R. M. (2006). The effects of unilateral grab rail assistance on the sit-to-stand performance of older aged adults. *Human Movement Science*, 25(2), 257–274.
- Pardessus, V., Puisieux, F., Di, P. C., Gaudefroy, C., Thevenon, A., & Dewailly, P. (2002). Benefits of home visits for falls and autonomy in the elderly: a randomized trial study. *American Journal of Physical Medicine and Rehabilitation*, 81(4), 247-252.
- Phatthalung Provincial Health Office. (2012). *Population Data 2008-2012*. Retrieved on December 3, 2012, from http://203.157.229.18/pop2555/rep_pop_agegrp_area.php
- Poorves, S., Tammarattanapruek, P., and Pong, C. (2008). *Knowledge of elderly*. 2nd Ed Bangkok: Ministry of Social Development and Human Security.
- Reason, P., & Bradbury, H. (2008). *The Sage Handbook of Action Research: Participative Inquiry and Practice*. CA: Sage.Robertson
- Rocket, I. R. H., & Smith, G. S. (1989). Homicide, suicide, motor vehicle crash, and fall mortality: United States? experience in comparative perspective. *The American Journal of Public Health*, 79(10), 1396-1400.
- Rodriguez, J. G., Baughman, A. L., Sattin, R. W., deVito, C. A., Ragland, D. L., Bacchelli, S., & Stevens, J. A. (1995). A standardized instrument to assess hazards for falls in the home of older persons. *Accident Analysis and Prevention*, 27(5), 625-631.
- Ruleworks (2012). *The risk management guide*. Retrieved on August 16, 2012, from <http://www.ruleworks.co.uk/riskguide/risk-profile.htm>
- Sorysang, L., Khompraya, J., & Natetanasombut, K. (2014). A study of fall prevention guideline in older adult living in mitraphappatana community. *Journal of the Royal Thai Army Nurses*, 15(1), 122-129.
- Stevens, M., Holman, C. D., Bennett, N., & de Klerk, N. (2001). Preventing falls in older people: outcome evaluation of a randomized controlled trial. *Journal of the American Geriatrics Society*, 49(11), 1448-1455.
- Thai elderly research and development foundation. (2009). *Situation of the Thai elderly 2008*. Bangkok: TQP Company Limited.

- Tinetti, M. E., Baker, D. I., McAvay, G., B. Claus, E., Garrett, P., Gottschalk, M., L. Koch, M., Trainor, K., & Horwitz, R. I. (1994). A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *New England Journal of Medicine*, 331(13), 821-827.
- Turner, S., Arthur, G., Lyons, R. A., Weightman, A. L., Mann, M. K., Jones, S. J., John, A., & Lannon, S. (2011). Modification of the home environment for the reduction of injuries (Review). The Cochrane Collaboration. Retrieved on June 1, 2012, from <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003600.pub2/pdf/standard>
- UNEP. (1992). *Hazard Identification and Evaluation in a Local Community*. Paris: United Nation Publication.
- United Nations. (2004). *Population Age Composition. Department of Economic and Social Affairs*. Retrieved on May 6, 2012, from http://www.un.org/esa/population/publications/WPP2004/WPP2004_Vol3_Final/Chapter2.pdf
- United Nations. (2010). *World Population Prospects, the 2010 Revision. Department of Economic and Social Affairs*. Retrieved on May 6, 2012, from <http://esa.un.org/unpd/wpp/population-pyramids/population-pyramids.htm>
- Van Haastregt, J. C. M., Diederiks, J. P. M., van Rossum, E., de Witte, L. P., Voorhoeve, P. M., & Crebolder, H. F. (2000). Effects of a programme of multifactorial home visits on falls and mobility impairments in elderly people at risk: randomised controlled trial. *British Medical Journal*, 321(7267), 994-998.
- Vetter, N., Lewis, P., & Ford, D. (1992). Can health visitors prevent fractures in the elderly people. *British Medical Journal*, 304(6831), 888-890.
- Wang, J., Chen, Z., & Song, Y. (2010). Falls in aged people of the Chinese mainland: Epidemiology, risk factors and clinical strategies. *Ageing Research Reviews*, 291(9), 5.

- Watters, J., Comeau, S., & Restall, G. (2010). *Participatory Action Research: An Educational tool for Citizen-Users of Community Mental Health Services*. MB, Canada: School of medical Rehabilitation, University of Manitoba.
- Weatherall, M. (2004). Multifactorial risk assessment and management programmes effectively prevent falls in the elderly. *Evidence-Based Healthcare and Public Health*, 8(5), 270–272.
- World Health Organization. (2011). *What are the public health implications of global ageing?*. Retrieved on May 6, 2012, from <http://www.who.int/features/qa/42/en/index.html>
- World Health Organization. (2012). *Ageing*. Retrieved on May 6, 2012, from <http://www.who.int/topics/ageing/en/>