



The Effects of Fall Health Belief and Knowledge of Fall on the Prevention of Fall in the Elderly: Mediating and Moderating Effects of Fall Fear

Jang, Insun¹⁾ · Park, Seungmi²⁾ · Kim, Yeon Sook³⁾

¹⁾Associate Professor, Department of Nursing, Korean Bible University, Seoul

²⁾Associate Professor, Department of Nursing · The Research Institute for Basic Sciences, Hoseo University, Asan, Korea

³⁾Assistant Professor, Department of Nursing, California State University San Bernardino, California, USA

Purpose: This descriptive study investigated the mediating and moderating effects of fear of fall on the relationships between health belief on fall, fall-related knowledge and fall prevention behaviors among older adults. **Methods:** We enrolled 229 older adults residing in a senior citizen hall and community welfare center, and investigated their health belief on fall, fall-related knowledge, fall prevention behavior, and fear of fall. Descriptive statistics, ANOVA and t-test were used to analyze differences in variables. Pearson correlation and multiple regression were used to investigate mediating and moderating effects of the fear of fall on the relationships between health belief on fall, fall-related knowledge, and fall prevention behaviors. **Results:** The fear of fall significantly mediated the health belief on fall and fall prevention behaviors, but there was no significant mediation between knowledge of fall and fall prevention behaviors. The fear of fall did not have a moderating effect on the relationships between health belief on fall, knowledge of fall, and fall prevention behaviors. **Conclusion:** It is important to investigate and implement health belief on fall and fear of fall among older adults to improve their fall prevention behaviors.

Key Words: Accidental falls; Health belief; Knowledge; Prevention; Fear

INTRODUCTION

Korea has the highest growing rate of the elderly, with the population of 65 years or more being 13.8% of the entire population in 2017, and projected at 41.0% in 2060 (Statistics Korea, 2017). The growth of senior citizens results in increased health care costs towards this population; the health care cost for citizens above 65 years was 38.7% of the health care cost for the entire population, and on an average, one elder spends three times more on health care expenses than an individual (National Health Insurance Service, Health Insurance Review & Assessment Service, 2016). Increased health care costs are majorly due to treatments for safety-related accidents, especially falls; 25.1% of the elderly experienced a fall in the past year, and hospitalization was required in 63.4% of these cases due to injuries resulting from the fall (Ministry of Health Welfare, 2014). This indicates that a fall is a common accident among older adults. Falls may be accompanied by numerous problems including serious injuries,

decreased daily activities, fear of fall, loss of self-confidence, activity intolerance, decreased quality of life (Deshpande et al., 2008), and even death due to associated complications (Tinetti, 2002). However, since it is a preventable occurrence rather than an unfortunate accident (Kim & Eun, 2014), it is important to focus on fall-prevention.

Prior studies regarding fall prevention behaviors have shown that fall-related knowledge is positively associated with fall-prevention among older adults (Hwang & Shin, 2013; Yoo, Jeon, & Kim, 2013). Studies for nurses and caregivers also reported similar findings (Kim & Eun, 2014; Yoo, 2017). These studies indicate that adequate knowledge of fall has a key role in preventing falls among the elderly.

Health belief on fall is a protective predictive factor of fall-prevention behaviors (Jo, Kim, Lee, & Jeong, 2004). Studies have also investigated the effect of health belief on fall-prevention activities amongst nurses and caregivers (Jung, Park, & Jung, 2015; Park & Kim, 2014). A study by Jang and Song (2015) reports that factors influencing fall-

Corresponding author: Park, Seungmi

Department of Nursing, Hoseo University, 20 Hoseo-ro, 79 Beon-gil, Baebang-eup, Asan 31499, Korea.
Tel: +82-41-540-9533, Fax: +82-41-540-9558, E-mail: seungmipark@hoseo.edu

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prevention behaviors are subcategories of health belief on fall; these include perceived fall risk, perceived benefit, and efficacy of fall-prevention behaviors (Jang & Song, 2015).

One of the negative impacts of a fall, the fear of fall (Lee & Kim, 2011), can help older adults avoid a risk of falls to a certain degree. However, strong fears could result in older adults avoiding activities they are capable of performing, thereby weakening them and increasing the risk of fall and a decrease in the quality of life (Chang, 2009; Jung, Lee, & Chung, 2006). One study reported that fear of fall decreases with increasing knowledge and efficacy in preventing falls (Kwon, 2010). Another study showed that fear of fall decreases after conducting a fall-prevention exercise program (Kang, 2016), whereas a contradictory study reported no effectiveness of the program towards fear of fall (Shin, Kim, Kang, & Yeo, 2016). Therefore, appropriate studies that thoroughly investigate the fear and fall-prevention related programs are required.

Fall-related knowledge and health belief on fall are predictive factors for fall prevention behaviors. In the previous studies, the fear of fall was assumed to be an independent predictor of fall prevention behavior with other fall risk factors. The purpose of this study is to investigate whether fear of fall has mediating effects or moderating effects between fall-related knowledge and health belief on fall.

This study aims to provide data for developing various interventions to enhance fall-prevention behaviors. This study endeavors to integrate all the concepts related to falls that were previously examined separately; these include knowledge of fall, health belief on fall, fear of fall, and fall-prevention behaviors. This study also investigated if fear of fall mediated or moderated between health belief and knowledge of fall and fall-prevention behaviors. It would be significant that if the fear of fall is identified as a mediating or moderating factor, fall-prevention behaviors can be improved through intervening the fear.

We therefore include three objectives in pursuit of ach-

ieving our goal: To examine the above mentioned factors in the elderly

To examine differences in the factors based on the socio-demographic characteristics of the subjects

To correlate the various factors examined

To examine the mediating and moderating effects of fear of fall on the various factors (Figure 1).

METHODS

1. Design and Participants

This cross-sectional descriptive study investigates the mediating and moderating effects of fear of fall on health belief on fall, knowledge of fall, and fall-prevention behaviors in Korean elderly. We recruited subjects from senior community centers we visited, located in 6 counties. Between August 7th to August 18th 2017, we enrolled 229 participants, 65 years and above, who understood the purpose of this study and content of the survey, regardless of previous experience of fall.

2. Data Collection / Ethical Consideration

This study was approved by the Institutional Review Board at X University (KBUIRB-201707-SB-045-02). After receiving the written consent, the subjects completed the survey with help from the junior nursing students trained for the survey. The average time spent for each survey was 15 to 20 minutes. Using the G*Power program (version 3.1.3) for an α of 0.05, a power of 0.95, and an effect size of 0.15, this study required a sample size of 119 participants.

3. Measurements

1) General characteristics of participants

All participants lived at home. The questions included details of gender, age, marital status, education level, monthly income, daily activities, and experience of a fall.

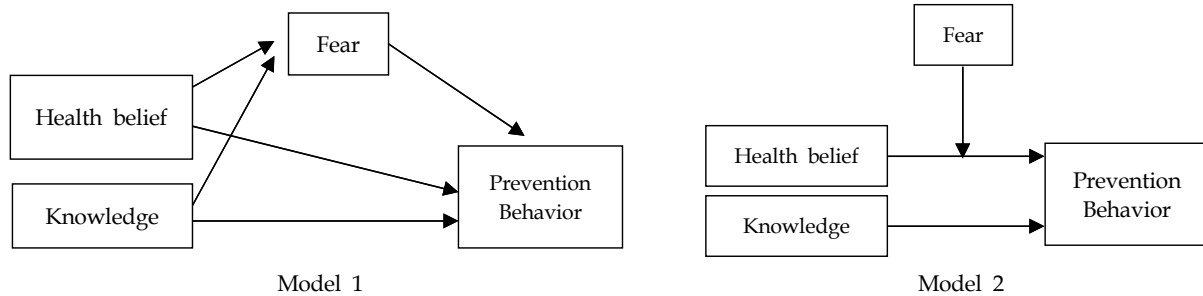


Figure 1. Mediating effect (Model 1) and moderating effect (Model 2) among fall-related variables.

2) Health belief on fall

We assessed health belief on fall using the protocol followed in a previous study by Jang and Song (Jang & Song, 2015). This tool consists of 28 items divided into 4 sub-categories, and scored with a 5-point Likert scale: perceived susceptibility (10 items), perceived severity (6 items), perceived benefit (5 items), and perceived barrier (7 items). Higher scores indicate stronger health belief on fall. In the study by Jang and Song, Cronbach's α values for perceived susceptibility, perceived severity, perceived benefit, and perceived barrier were 0.90, 0.82, 0.90, and 0.76, respectively (Jang & Song, 2015), and the values in this study are 0.90, 0.86, 0.84, and 0.64, respectively. In the current study, Cronbach's α value for this tool was 0.87.

3) Knowledge of fall

The revised protocol of Kim, M. Y. applied by Hwang and Shin for a study in older adults dwelling in the community (Hwang & Shin, 2013) was employed to measure the knowledge of fall. The revised tool contains 18 questions regarding definition of a fall, physical risk factors related to a fall, drugs increasing the risk of a fall, etc. Participants answered each question; scoring was '1' for a correct answer, '0' for an incorrect answer, and '0' for 'I don't know'. The score range was 0 to 18, and a higher score indicated more knowledge of fall. The Kuder-Richardson Formula 20 (K-R 20) was 0.86 in the study by Hwang and Shin (Hwang & Shin, 2013), and 0.74 in this study.

4) Fear of fall

The translated version of the Survey of Activities and Fear of Falling in the Elderly (SAFE), developed by Lachman et al. (1998), measured the fear of fall. The translated version of the survey was created and used in a previous study by Sohng, Moon, Kang, and Choi (2001). This tool has 11 items scored with a 4-point Likert scale, with higher scores indicating greater fear of fall. Cronbach's α was 0.91 in this study as well as the study by Sohng et al. (2001).

5) Fall prevention behaviors

The tool developed by Gu et al. (2002) assessed the compliance of fall prevention behaviors. This tool comprises 14 items including safe shoe-wearing, safe walking, alcohol intake limitation, taking medication, etc. In the current study, researchers used 11 out of 14 items, since 3 items were defined as having a low reliability; the excluded items were bedroom temperature while sleeping, exercise, and environment arrangement. Each item was scored '2' for answering 'yes' and '1' for answering 'no'; the total score ranged from 11 to 22. Higher scores indicate a higher

compliance of fall prevention behaviors. Cronbach's α was 0.78 in the study by Hyeon, Park, Park, and Kim (2010) and 0.64 in the current study.

4. Data Analysis

IBM SPSS Statistics for Windows (version 21.0) analyzed the data in this study, with following statistical applications: Descriptive statistics, ANOVA and t-test to analyze differences in health belief on fall, knowledge of fall, fear of fall, and fall prevention behaviors according to the socio-demographic characteristics of the elderly. Pearson correlation coefficients to analyze correlations between health belief on fall, knowledge of fall, fear of fall, and fall prevention behaviors, multiple regression to investigate mediating and moderating effects of the fear of fall on the relationships between health belief on fall, knowledge of fall, and fall prevention behaviors. This study was analyzed to verify the mediating effect of the fear of fall according to the procedure of Baron and Keny (1986), which consists of 1) identifying the effect of health belief and knowledge on the fear of fall, 2) examining the effect of the fear of fall on fall prevention behaviors, and 3) identifying the effect of the fear of fall on the relationship of health belief, knowledge, and fall prevention behaviors. The Sobel test measured the significance of the mediating effect. We used the mean centering method to avoid multicollinearity (Lee, 2014). Each interacting variable of [(health belief on fall) \times (fear of fall)] and [(knowledge of fall) \times (fear of fall)] was used in regression analysis, where \times indicates multiplication. We then verified the moderating effect of fear of fall according to the coefficient of determination. Normality of each variable calculated by the Kolmogorov-Smirnov test showed normal distribution. The Durbin-Watson statistic was 1.702 indicating no autocorrelation between variables. The range of tolerance was 0.600 to 0.905, and the variation inflation factors (VIF) were <10 , indicating no multicollinearity, i.e., there was no correlation between independent variables.

RESULTS

1. Health Belief on Fall, Knowledge of Fall, Fear of Fall, and Fall Prevention Behavior among the Elderly

The score for health belief on fall was 3.63 ± 0.52 ($M \pm SD$). Among the subcategories assessed, perceived benefit had the highest score at 4.10 ± 0.70 , followed by perceived severity (3.97 ± 0.83), perceived susceptibility (3.55 ± 0.91), and perceived barrier (2.89 ± 0.72). The score for know-

ledge of fall was 10.28 ± 3.09 , fear of fall 2.10 ± 0.79 , and fall prevention behaviors 7.93 ± 2.16 , which was also higher than the median (Table 1).

Table 1. Distribution of Variables (N=229)

Variables	M±SD	Min~Max
Fall health belief	3.63±0.52	2~5
- Perceived susceptibility	3.55±0.91	1~5
- Perceived severity	3.97±0.83	1~5
- Perceived barrier	2.89±0.72	1.43~5.00
- Perceived benefit	4.10±0.70	2~5
Fall knowledge	10.28±3.09	1~17
Fall fear	2.10±0.79	1~4
Fall prevention behavior	7.93±2.16	1~11

2. Differences in Health Belief on Fall, Knowledge of Fall, Fear of Fall, and Fall-prevention Behavior according to the Socio-demographic Characteristics of the Participants

The study participants included 162 (70.7%) females and 67 (29.3%) males. The average age was 79.46 ± 6.90 years, with the age group of 80~89 years having the maximum subjects (111, 48.5%). Independent daily activities were achieved by 162 (70.7%) subjects, whereas 67 (29.3%) required partial help. Totally, 75 participants (32.8%) were elementary school graduates, followed by 63 (27.4%) high school graduates or higher, 62 (27.1%) with no school education, and 29 (12.7%) middle school graduates. The monthly income of 165 (72.1%) participants was <₩500,000 followed by 49 (21.4%) participants with ₩500,000~₩1,499,999 (3.9%), with ₩1,500,000~₩1,999,999, and 6 (2.6%) with ₩2,000,000 or more. Marital status included 141 (61.6%) bereaved, 69 (30.1%) married and 19 (8.3%) single or divorced. A fall accident was experienced by 94 (41.0%) participants; 21 subjects (22.3%) had a surgery for the fall, and 41 (43.6%) participants reported hospitalization.

Health belief on fall was statistically and significantly different with respect to age, education level, income, marital status, experience of a fall, and treatment after a fall. Scheffé's test revealed that participants 65 to 69 years had significantly lower health belief on fall than subjects in the 80 to 89 years and 90 years or older age groups ($F=5.20$, $p=.002$). Also, participants without school education had higher health belief on fall than those with middle school education and high school or higher education ($F=8.42$, $p<.001$). Participants with an income <₩500,000 and ₩500,000~₩1,499,999 had higher health belief on fall than

those with income exceeding ₩2,000,000 ($F=8.05$, $p<.001$). Married individuals had lower health belief on fall than the single, divorced or bereaved participants ($F=5.89$, $p<.001$). Older adults who had prior experience of a fall showed higher health belief on fall than those without a fall experience ($t=4.26$, $p<.001$). Participants who underwent surgery for the fall injury had higher health belief on fall than those who had no treatment or surgery ($F=6.23$, $p=.003$).

Knowledge of fall was higher in older adults with prior fall than those who had no falls ($t=2.14$, $p=.034$). Fear of fall was significantly different when considering the socio-demographic characteristics of gender, age, daily activities, education level, income, marital status, and fall experience. The fear of fall was higher in females ($t=-3.96$, $p<.001$), older adults requiring partial help with daily activities ($t=-5.60$, $p<.001$), participants with no school education as compared to high school education or higher ($F=5.44$, $p<.001$), subjects with income <₩500,000 compared to income >₩2,000,000 ($F=6.25$, $p<.001$), bereaved participants as against married subjects ($F=12.87$, $p<.001$), and adults who had prior falls ($t=4.77$, $p<.001$).

Fall prevention behaviors were higher in females ($t=-2.76$, $p=.007$), subjects older than 90 years as compared to those between 65 and 69 years ($F=3.23$, $p<.023$), elderly subjects who needed partial help ($t=-6.25$, $p<.001$), bereaved participants ($F=6.51$, $p=.002$), and participants who had prior fall ($t=3.81$, $p<.001$) (Table 2).

3. Correlations of Health Belief on Fall, Knowledge of Fall, Fear of Fall, and Fall Prevention Behaviors

Fall prevention behaviors of the participants significantly correlated with health belief on fall ($r=.337$, $p<.001$), knowledge of fall ($r=.236$, $p<.001$), and fear of fall ($r=.409$, $p<.001$). Fear of fall also correlated significantly with health belief on fall ($r=.523$, $p<.001$) and knowledge of fall ($r=.237$, $p<.001$) (Table 3).

4. Mediating Effect of Fear of Fall on the Association between Health Belief on Fall, Knowledge of Fall, and Fall Prevention Behaviors

Four analyses verified the mediating effect of fear of fall on the relationships between health belief on fall, knowledge of fall, and fall prevention behaviors (Table 4). Simple regression analysis showed that health belief on fall ($\beta=.50$, $p<.001$) and knowledge of fall ($\beta=.13$, $p=.025$) significantly influenced fear of fall (Step 1). Also, health belief on fall ($\beta=.30$, $p<.001$) and knowledge of fall ($\beta=.17$,

Table 2. Differences in Fall Health Belief, Fall Knowledge, Fall Fear, and Fall Prevention Behavior according to Socio-demographic Characteristics (N=229)

Characteristics	Categories	n (%) or M±SD	Fall health belief		Fall knowledge		Fall fear		Fall prevention behavior	
			M±SD	t or F (p) Scheffé	M±SD	t or F (p) Scheffé	M±SD	t or F (p) Scheffé	M±SD	t or F (p) Scheffé
Gender	Male	67 (29.3)	3.55±0.45	-1.49 (.137)	10.31±2.90	0.79 (.937)	1.82±0.64	-3.96 (<.001)	7.27±2.47	-2.76 (.007)
	Female	162 (70.7)	3.66±0.55		10.28±3.18		2.22±0.83		8.20±1.96	
Age (year) (79.46±6.90)	65~69	22 (9.6)	3.29±0.65 ^a	5.20 (.002)	10.0±2.73	0.20 (.895)	1.70±0.70 ^a	4.17 (.007)	6.95±2.44 ^a	3.23 (.023)
	70~79	84 (36.7)	3.60±0.47 ^{ab}	a < b	10.27±3.43		1.98±0.77 ^a		7.68±2.12 ^{ab}	
	80~89	111 (48.5)	3.69±0.51 ^b		10.41±2.94		2.26±0.81 ^a		8.23±2.10 ^{ab}	a < b
	≥ 90	12 (5.2)	3.93±0.42 ^b		9.83±2.98		2.27±0.75 ^a		8.75±1.76 ^b	
Limitation of activity	Free	162 (70.7)	3.60±0.50	-1.43 (.153)	10.17±3.07	-9.23 (.357)	1.93±7.50	-5.60 (<.001)	7.43±2.12	-6.25 (<.001)
	Partial help	67 (29.3)	3.71±0.57		10.58±3.16		2.53±7.39		9.13±1.77	
Educational level	No formal education	62 (27.1)	3.85±0.47 ^b	8.42 (<.001)	10.85±3.12	1.50 (.214)	2.36±0.77 ^b	5.44 (<.001)	8.47±1.88	2.01 (.113)
	Primary school	75 (32.8)	3.67±0.55 ^{ab}	a < b	10.25±2.98		2.09±0.79 ^{ab}	a < b	7.68±2.27	
	Middle school	29 (12.7)	3.52±0.48 ^a		9.41±3.17		2.21±0.88 ^{ab}		8.03±2.06	
	Above high school	63 (27.4)	3.42±0.478 ^a		10.17±3.14		1.82±0.70 ^a		7.65±2.28	
Income (10,000 won)	< 50	165 (72.1)	3.70±0.51 ^b	8.05 (<.001)	10.50±3.11	1.36 (.255)	2.23±0.82 ^b	6.25 (<.001)	8.04±2.26	0.72 (.544)
	50~150	49 (21.4)	3.54±0.43 ^b	a < b	9.61±2.72		1.84±0.64 ^{ab}	a < b	7.53±1.84	
	150~200	9 (3.9)	3.28±0.37 ^{ab}		9.56±4.50		1.71±.059 ^{ab}	a < b	8.00±1.73	
	> 200	6 (2.6)	2.86±0.85 ^a		11.17±3.06		1.32±0.40 ^a		8.17±2.40	
Marital status	Single or divorce	19 (8.3)	3.72±0.54 ^b	5.89 (.001)	9.79±2.59	0.49 (.615)	2.02±0.73 ^{ab}	12.87 (<.001)	7.16±2.50 ^a	6.51 (.002)
	Married	69 (30.1)	3.42±0.53 ^a	a < b	10.13±3.27		1.73±0.60 ^a	a < b	7.33±2.17 ^{ab}	
	Bereavement	141 (61.6)	3.72±0.50 ^b		10.43±3.08		2.30±0.82 ^b		8.33±2.02 ^b	a < b
Fall experience	Yes	94 (41.0)	3.80±0.45	4.26 (<.001)	10.81±2.98	2.14 (.034)	2.39±7.41	4.77 (<.001)	8.56±1.94	3.81 (<.001)
	No	135 (59.0)	3.51±0.54		9.93±3.14		1.90±0.77		7.49±2.21	

Table 3. Correlations of Fall Health Belief, Fall Knowledge, Fall Fear, and Fall Prevention Behavior (N=229)

Variables	Fall health belief	Fall knowledge	Fall fear	Fall prevention behavior
Fall health belief	1			
Fall knowledge	.218 (<.001)	1		
Fall fear	.523 (<.001)	.237 (<.001)	1	
Fall prevention behavior	.337 (<.001)	.236 (<.001)	.409 (<.001)	1

$p=.007$) significantly influenced fall prevention behaviors (Step 2). Furthermore, fear of fall significantly influenced fall prevention behaviors ($\beta=.41, p<.001$) (Step 3). When fear of fall was anticipated, fall prevention behaviors were less influenced by health belief on fall ($\beta=.15, p=.031$) and knowledge of fall ($\beta=.13, p=.033$). Fear of fall partly mediated the relationships between health belief on fall, knowledge of fall, and fall prevention behaviors ($\beta=.30, p<.001$) (Step 4). However, the Sobel test revealed that fear of fall significantly mediated the health belief on fall and fall prevention behaviors ($Z=3.79, p<.001$), but there was no significant mediation between knowledge of fall and fall prevention behaviors ($Z=1.95, p=.051$) (Table 4).

5. Moderating Effect of Fear of Fall on the Relationships between Health Belief on Fall, Knowledge of Fall, and Fall Prevention Behaviors

The Model I regression analysis showed that health belief on fall and knowledge of fall significantly affected fall prevention behaviors ($F=18.65, p<.001$) with 13.4% prediction (Adj. $R^2=0.134$). In Model 2, fear of fall ($\beta=.30, p<.001$) significantly affected fall prevention behaviors with 6.0% prediction when the effect of health belief on fall and knowledge of fall was controlled. In Model 3, prediction of fall prevention behaviors decreased from 19.4% to 19.2% when interacting variables were added to control independent and moderator variables in pursuit of verifying

Table 4. Mediating Effect of Fall Fear in the Relationship between Fall Health Belief, Fall Knowledge, and Fall Prevention Behavior (N=229)

Variables	Step 1	Step 2	Step 3	Step 4
	Fall fear	Fall prevention behavior	Fall prevention behavior	Fall prevention behavior
	β (<i>p</i>)	β (<i>p</i>)	β (<i>p</i>)	β (<i>p</i>)
Fall health belief	.50 (<.001)	.30 (<.001)		.15 (.031)
Fall knowledge	.13 (.025)	.17 (.007)		.13 (.033)
Fall fear			.41 (<.001)	.30 (<.001)
R ² (Adj. R ²)	.29 (.28)	.14 (.130)	.17 (.16)	.20 (.19)
F (<i>p</i>)	46.12 (<.001)	18.65 (<.001)	45.53 (<.001)	19.27 (<.001)
Sobel test 1* (<i>Z</i>)				3.79 (<.001)
Sobel test 2* (<i>Z</i>)				1.95 (.051)

Table 5. Moderating Effect of Fall Fear in the Relationship between Fall Health Belief, Fall Knowledge, and Fall Prevention Behavior (N=229)

Variables	Categories	β (<i>p</i>)	R ²	Adj. R ²	F (<i>p</i>)
Model 1	Fall health belief	.30 (<.001)	.142	.134	18.65 (<.001)
	Fall knowledge	.17 (.007)			
Model 2	Fall health belief	.15 (.031)	.204	.194	19.27 (<.001)
	Fall knowledge	.13 (.033)			
	Fall fear	.30 (<.001)			
Model 3	Fall health belief	.17 (.021)	.210	.192	11.85 (<.001)
	Fall knowledge	.13 (.045)			
	Fall fear	.30 (<.001)			
	Fall health belief × Fall fear	.07 (.242)			
	Fall knowledge × Fall fear	-.05 (.462)			

moderating effect (F=11.85, *p*<.001). Added interacting variables were not statistically significant. Therefore, fear of fall did not have a moderating effect on the relationships between health belief on fall, knowledge of fall, and fall prevention behaviors (Table 5).

DISCUSSION

Considering the four subcategories of health belief on fall, this study showed higher scores in perceived benefit, perceived severity, and perceived barrier, but a lower score in perceived susceptibility, when compared with the study by Jang and Song (Jang & Song, 2015). This difference can be attributed to dissimilar participants in both studies. All participants in the study by Jang and Song (2015) had arthritis, whereas none of our study subjects were afflicted. Participants in our study were enrolled during visits to senior community centers, and they were relatively active. Accordingly, we consider that these ac-

tive elders had lower perceived fall risks.

For knowledge regarding fall, this study scored 10.28 out of 18 points, which was 8.99 points higher than the scoring of hospitalized older adults in a previous study (Hwang & Shin, 2013). However, this study scored lower than the study for older adults at senior community centers, who scored 25.9 out of 30 points in knowledge of fall (Kwon, 2010). The contradictory result may arise from different populations, in other words, the elderly at the senior community center are more likely to be exposed to various fall related education programs than the elderly at hospital or home.

On an average, the fear of fall scored at 2.10, which was similar to the study by Sohng et al. (2001). This fear was higher in females, participants requiring partial help for daily activities, subjects with no school education, monthly income <\$500,000, bereaved, and who had prior experience of a fall. This result was similar to previous studies, which reported higher fear in females, no school educa-

tion, low economic status, living alone, limited daily activities, poor health, and previous experience of a fall or falls (Kwon, 2010; Lee & Kim, 2011; Sohng et al., 2001).

Fall prevention behaviors had a mean score of 7.93 out of 11 points in this study, which was lower than a previous study (Sohng et al., 2001) that reported 23.63 out of 28 points. Fall prevention behaviors were higher in females, older, partial help for activities, bereaved, and experience of a fall. However, another study (Hwang & Shin, 2013) showed higher fall prevention behavior scores among participants with no activity limitation and who required a caregiver. These inconsistent results indicate the necessity for a repeat study.

In the current study, we observe significant correlations and influences between fall prevention behaviors and health belief on fall, knowledge of fall, and fear of fall. Older adults had more fall prevention behaviors as they had higher health belief on fall, knowledge of fall, or fear of fall. A previous study also reported higher fall prevention behavior score as hospitalized older adults had lower efficacy in preventing fall, more knowledge of fall, and higher self-awareness of a fall risk (Hwang & Shin, 2013). We believe that the lower efficacy in preventing fall comes from increased fear of fall that intensifies the fall prevention behaviors (Tinetti, Richman, & Powell, 1990).

Our study also revealed fear of fall as a partial mediator in the association between health belief on fall and fall prevention behaviors, which was similar to a previous study (Jang & Song, 2015) that reported health belief on fall affected fall prevention behaviors. Jang and Song (Jang & Song, 2015) recommend that strategies for fall prevention should focus on decreasing fear of fall and increasing efficacy of fall prevention, rather than perceived susceptibility or severity

In this study, when older adults had higher fear of fall they had more fall prevention behaviors, including wearing comfortable footwear, using bright lights, walking while holding the rail, etc. Fear of fall can limit physical activities or regular exercise among the elderly (Fletcher & Hirdes, 2004), especially when they are in chronic pain (Stubbs, Patchay, Soundy, & Schofield, 2015). Examination of fear of fall, along with enhancement of self-awareness of falls and health belief on fall, can help fall prevention behaviors. Especially, females in need of partial help for activities or who have experienced fall had an increased fear of falling. Therefore, strategic planning to promote fall prevention behaviors is necessary by reinforcing self-confidence related to falls and raising daily activities, rather than reducing fear of fall only.

Knowledge of fall influenced fall prevention behaviors

without any mediating or moderating effects in this study, which was similar to previous studies (Blalock, Gildner, Jones, Bowling, & Casteel, 2016; Hwang & Shin, 2013; Kim & Eun, 2014). Educating older adults regarding falls improves the fall prevention behaviors when considering the fall risk factors of the individual, family, and community (Kim & Eun, 2014; Pfortmueller & Lindner, 2014). Since falls in older adults are predictable and preventable, positive behaviors in fall prevention were reported after imparting fall-related education (Hyeon et al., 2010; Jo & Kim, 2017; Shin et al., 2016; Yoo et al., 2013). Yoo et al. (2013) suggest effective ways for comprehension of older adults on fall prevention, such as using visual learning materials, repetition of contents, individualized sessions, compliance check for fall prevention behaviors, and refresher learning courses.

It is essential to approach falls as a social problem rather than a personal accident, examine fall risk factors, and develop programs to prevent and intervene falls. It is also necessary to disseminate programs to implement fall prevention at various places for the elder citizens (e.g. senior community centers, churches, etc.) for their easy access.

Our study indicates that fear of fall mediates health belief on fall and subsequent effect on fall prevention behaviors. Accordingly, it is important to investigate and implement health belief on fall and fear of fall among older adults to improve their fall prevention behaviors. They also need to become self-confident to accomplish fall prevention behaviors, despite fall risk factors. Older adults need guidance to actively conduct fall prevention behaviors instead of being dependent or limiting their activities.

CONCLUSION

This descriptive study investigated the mediating and moderating effects of fear of fall on the relationships between health belief on fall, knowledge of fall, and fall prevention behaviors among older adults. We observed an increase in fall prevention behaviors as the health belief on fall, knowledge of fall, and fear of fall increased. Our results also indicate that fear of fall has a mediating effect on the relationship between health belief on fall and fall prevention behaviors in older adults.

There are few limitations to this study. Since we conducted this study for older adults living in a local community, there is a limitation of generalizing the results. In addition, this cross-sectional study is unable to explain the relationships between cause and effect among variables. However, this study is significant because our results provide fundamental data in establishing programs to pre-

vent falls among the elderly population dwelling in communities, by presenting the need to increase health belief on fall and to examine fear of fall in pursuit of improving fall prevention behaviors. To test the mediating effects, we used the Sobel test that requires the normality assumption of the data. Recently, the bootstrap test, which does not require normality assumption can be selected in next study.

A repeated study is recommended 1) to investigate various factors that could improve fall prevention behaviors, 2) to inaugurate policies in developing and disseminating easily applicable fall prevention programs, handouts, and resources, and 3) to evaluate the effectiveness of the programs once they are implemented.

REFERENCES

- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173-1182.
<https://doi.org/10.1037//0022-3514.51.6.1173>
- Blalock, S. J., Gildner, P. L., Jones, J. L., Bowling, J. M., & Casteel, C. H. (2016). Relationship between perceived risk of falling and adoption of precautions to reduce fall risk. *Journal of the American Geriatrics Society*, 64(6), 1313-1317.
<https://doi.org/10.1111/jgs.14136>
- Chang, C. M. (2009). A Study on relations between physical function, psychological status, falls, and quality of life in elderly people living at home. *Korea Care Management Research*, 3, 71-89.
- Deshpande, N., Metter, E. J., Lauretani, F., Bandinelli, S., Guralnik, J., & Ferrucci, L. (2008). Activity restriction induced by fear of falling and objective and subjective measures of physical function: A prospective cohort study. *Journal of the American Geriatrics Society*, 56(4), 615-620.
<https://doi.org/10.1111/j.1532-5415.2007.01639.x>
- Fletcher, P. C., & Hirdes, J. P. (2004). Restriction in activity associated with fear of falling among community-based seniors using home care services. *Age and Ageing*, 33(3), 273-279.
<https://doi.org/10.1093/ageing/afh077>
- Gu, M., Kang, Y., Kim, S., Kim, E., Kim, E., Ahn, H., et al. (2002). *Growing younger and more active*. Seoul: Hyunmoon.
- Hwang, S. Y., & Shin, S. J. (2013). Predictors of fall prevention behaviors in elderly inpatients. *Korean Journal of Health Promotion*, 13(2), 76-85.
- Hyeon, I. S., Park, M., Park, K. M., & Kim, C. N. (2010). The effects of a fall prevention program on the low-income elderly at risk of falls. *Journal of Korean Academy of Community Health Nursing*, 21(2), 200-209.
<https://doi.org/10.12799/jkachn.2010.21.2.200>
- Jang, K. S., & Song, R. (2015). A structural equation model of fall prevention behavior among community-dwelling older adults with osteoarthritis. *Korean Journal of Adult Nursing*, 27(6), 684-694.
<https://doi.org/10.7475/kjan.2015.27.6.684>
- Jo, H. E., & Kim, M. J. (2017). Effects of a fall prevention program on physical fitness, fall efficacy and fall prevention behavior among community-dwelling older adults. *The Korean Journal of Rehabilitation Nursing*, 20(1), 22-32.
- Jo, H., Kim, C., Lee, H., & Jeong, H. (2004). A meta-analysis of health related behavior study based on health belief model in Korean. *The Korean Journal of Health Psychology*, 9(1), 69-84.
- Jung, J., Park, Y., & Jung, G. H. (2015). Effects of long term care hospital care-givers fall prevention self efficacy and fall prevention health belief on fall prevention awareness. *The Journal of the Korea Contents Association*, 15(2), 333-343.
<https://doi.org/10.5392/JKCA.2015.15.02.333>
- Jung, Y., Lee, S., & Chung, K. (2006). Prevalence and associated factors of falls according to health status in elderly living in the community. *Journal of the Korean Gerontological Society*, 26(2), 291-303.
- Kang, K. (2016). The effects of the fall prevention exercise program focussed on activity of daily living, fear of fall and quality of life for the senior citizen center elderly. *Journal of the Korea Academia-Industrial cooperation Society*, 17, 267-272.
<https://doi.org/10.5762/KAIS.2016.17.8.267>
- Kim, M. S., & Eun, Y. (2014). Fall-related knowledge and caring behaviors for fall prevention among care workers in nursing home. *Journal of Muscle and Joint Health*, 21(1), 11-18.
<https://doi.org/10.5953/JMJH.2014.21.1.11>
- Kwon, M. S. (2010). Relations among knowledge, fear and efficacy of fall in the community dwelling elderly. *Journal of Korean Academy of Community Health Nursing*, 21(2), 139-147.
<https://doi.org/10.12799/jkachn.2010.21.2.139>
- Lachman, M. E., Howland, J., Tennstedt, S., Jette, A., Assmann, S., & Peterson, E. W. (1998). Fear of falling and activity restriction: the survey of activities and fear of falling in the elderly (SAFE). *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 53(1), 43-50.
<https://doi.org/10.1093/geronb/53B.1.P43>
- Lee, I. (2014). *Easyflow regression analysis*. Seoul: Hannarae Publishing Co.
- Lee, S., & Kim, H. (2011). Factors influencing the fear of falling in elderly in rural communities. *Journal of Agricultural Medicine and Community Health*, 36(4), 251-263.
<https://doi.org/10.5393/JAMCH.2011.36.4.251>
- Ministry of Health and Welfare. (2014). Survey of elderly state. Retrieved June 1, 2014, from <http://repository.kihasa.re.kr:8080/handle/201002/13710>
- National Health Insurance Service, Health Insurance Review & Assessment Service. (2016). 2016 National health insurance

- statistical yearbook. Retrieved January 23, 2018, from <http://www.nhis.or.kr/menu/boardRetriveMenuSet.xx?menuId=F3321>
- Park, M. K., & Kim, H. (2014). Effects of health belief on fall prevention activities of emergency room nurses. *Journal of Korean Academy of Nursing Administration*, 20(2), 176-186. <https://doi.org/10.11111/jkana.2014.20.2.176>
- Pfortmueller, C., Lindner, G., & Exadaktylos, A. (2014). Reducing fall risk in the elderly: Risk factors and fall prevention, a systematic review. *Minerva Medica*, 105(4), 275-281.
- Shin, J., Kim, Y., Kang, M., & Yeo, H. (2016). Effects of fall prevention program on muscle strength, postural balance, and fear of falling in elderly. *Journal of Korean Clinical Nursing Research*, 22, 10-19.
- Sohng, K. Y., Moon, J. S., Kang, S. S., & Choi, J. H. (2001). The survey of activities and fear of falling in the community dwelling elderly. *Journal of Korean Public Health Nursing*, 15(2), 324-333.
- Statistics Korea. (2017). Future population estimation. Retrieved January 23, 2018, from <http://kosis.kr/publication/publicationThema.do>
- Stubbs, B., Patchay, S., Soundy, A., & Schofield, P. (2014). The avoidance of activities due to fear of falling contributes to sedentary behavior among community-dwelling older adults with chronic musculoskeletal pain: a multisite observational study. *Pain Medicine*, 15(11), 1861-1871. <https://doi.org/10.1111/pme.12570>
- Tinetti, M. E. (2003). Preventing falls in elderly persons. *New England Journal of Medicine*, 348(1), 42-49.
- Tinetti, M. E., Richman, D., & Powell, L. (1990). Falls efficacy as a measure of fear of falling. *Journal of gerontology*, 45(6), 239-243. <https://doi.org/10.1093/geronj/45.6.P239>
- Yoo, J., Jeon, M. Y., & Kim, C. (2013). Effects of a fall prevention program on falls in frail elders living at home in rural communities. *Journal of Korean Academy of Nursing*, 43(5), 613-625. <https://doi.org/10.4040/jkan.2013.43.5.613>
- Yoo, K. S. (2017). Knowledge, attitude and prevention activities related to fall among of geriatric hospital nurse. *Journal of Korean Public Health Nursing*, 31(3), 436-450. <https://doi.org/10.5932/JKPHN.2017.31.3.436>