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The Factors Associated with Falls and Multiple Falls Among the Korean Elderly

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ABSTRACT

The purpose of this study was to identify the factors associated with multiple falls that have a serious evil effect on the quality of life of the elderly according to the increase in the number of elderly people aged 65 or older in Korea. The data used were 67,834(29.9%) over the age of 65 of 228,381 people who participated in the community health survey conducted by the Korea Centers for Disease Control and Prevention in 2017. The chi-square test and multiple logistic regression analysis were conducted. As a result of the analysis, 8,374 (12.4%) experienced a fall last year more than once, and 3,736 (5.3%) more than twice among the total subjects. Variables related to one or more falls were gender, age, administrative district, marital status, subjective health level, walking, flexibility exercise, muscle strength exercise, diabetes, dyslipidemia, arthritis, cataract, sleep time, depression, suicidal ideation, happiness index, lifetime alcohol drinking and smoking status. Variables related to twice or more falls include age, marital status, subjective health level, walking, flexibility exercise, muscle strength training, dyslipidemia, arthritis, cataract, sleep time, stress, depression, suicidal ideation, happiness index, lifetime alcohol drinking and smoking status. In conclusion, multiple falls among the elderly was related to various factors, and it is necessary to seek measures for comprehensive fall prevention including related factors in the future.

1. Introduction

Given the extension of average life expectancy following the development of medicine and the improvement of quality of life, the elderly population around the world has increased, thereby leading to a super-aged society. Examining the increase in the elderly population aged 65 or older in Korea, in 2000, 7.2% of the total population entered the aging society, 14.3% in 2018, entered the aged society, 20% in 2026, a super-aged society, and in 2030, it is expected to reach the level of 24.5% (Statistics Korea, 2019; 2011).

Falls occur across all age groups, but in particular, the falls among the elderly aged 65 or older have a significant impact on the quality of life. According to the 2014 survey on the condition of the elderly in Korea, 25.1% of all elderly people experienced falls over the past year, with 2.3 falls and 63.4% undergoing hospital treatment, such a high rate (KIHS, 2015; Ministry of Health and Welfare, 2015), according to the foreign literature, one third of the elderly aged 65 years or older experience a fall and 50% of the elderly experience a relapse (Ruchinskas, 2003; Singh, 2003). It was also reported that 63.4% experienced hospital treatment due to a fall, which is among the factors that lowered the quality of life of the elderly, and 47.4% suffered from the aftereffects (KIHS, 2015; Ministry of Health and Welfare, 2015).

In particular, the falls among the elderly lead to fractures and brain damages, thereby causing the serious sequelae of permanent disability, which is the primary cause of reducing the quality of life due to the decline in independent living and fear of falling (Chang, 2016; Oh, 2003). Furthermore, medical expenses increase depending on the degree of injury after a fall, which acts as a social and economic burden (Kim, 2014), and according to the report of the WHO, 646,000 elderly people die every year from falls, the second leading cause of death (WHO, 2017), and according to data from the National Statistical Office of Korea in 2017, the death rate due to falls is 10.0 people per 100,000 people for the elderly in their 60s, 17.0 people for those in their 70s and 41.4 people for those over 80, and hence, as age increases, the mortality rate due to falls also increases (Statistics Korea, 2019; Kannus et al., 2005; Lin et al., 2015; Nordstrom, 2015).

The falls among the elderly occur as a result of the interaction of complex risk factors such as physical (biological) factors, behavioral factors, environmental factors, and socioeconomic factors (WHO, 2007). The physical (biological) factors include gender, age, decline in physical and cognitive abilities, and chronic diseases, while the behavioral factors include multiple uses of drug, excessive drinking, and lack of exercise. The environmental factors include building design, slippery floors and stairs, and dim lighting, while the socioeconomic factors include low income, educational level, poor living environment, lack of social interaction, and limited access to health and social services (WHO, 2007). The psychological factors further exacerbate emotional and mental health problems by adversely affecting sleep quality, stress, depression, suicidal ideation, and happiness index due to social and economic difficulties and psychological anxiety (Cho et al., 2016). The rate of experiencing depression among the elderly was 18.2% for those aged 60 to 69 and 15.2% for those aged 70 or older, and as of 2014, the suicide rate for the elderly aged 65 or older is 55.5 people per 100,000 people, which is higher than 27.3 people per 100,000 people, thereby emerging as a serious social problem (Chang et al., 2017; Lee et al., 2012). In particular, the elderly people who experienced depression experienced a fall 1.23 times higher than those who did not (Lee et al., 2012; Kwon et al., 2014). According to the domestic and foreign papers, potential research results have been reported such that 80% of falls may be prevented and about two thirds of deaths due to falls may be prevented by predicting and identifying the risk of falls in advance for the prevention of falls among the elderly (Kim et al, 2013; Morse et al., 1989; Rubenstein, 2006).

The purpose of this study is to research and analyze the factors related to frequent falls among the elderly over 65 years of age in Korea to provide a basis for use as the basic data for developing a systematic and comprehensive standardized fall intervention program and improving quality of life after fall. The specific purpose of this study is as follows. First, to identify the general characteristics

of frequent falls, obesity and physical activity characteristics, chronic disease characteristics, and mental health characteristics of the study subjects, and second, to analyze the factors affecting the research subject's fall (1 time) and frequent fall (twice or more).

2. Research Subject and Method

2.1 Study subject and data

This study was conducted by the Korea Centers for Disease Control and Prevention from August 16, 2017 to October 31, 2017, with the elderly people aged 65 years or older from the raw data of 228,381 cases of community health surveys of adults aged 19 years or older residing in the sample households at the time of survey, while 67,834 (29.9%) were finally analyzed with the data of this study. Hence, this study was conducted with a cross-sectional design to identify the factors related to frequent falls among the elderly over 65 years of age in Korea.

2.2 Research method

As a racial variable of frequent falls in this study, “falling experience” over the past year was divided into “once or more” and “twice or more” experiences. The falls included slips, trips, stumbles, and falls. As for the independent variables, demographic (general) characteristics, mental health related characteristics, physical activity, and chronic disease characteristics of survey subjects aged 65 or older in Korea were divided into categories.

The general characteristics of survey subjects are consisted of gender, age (65-74 years old, 75 years old or older), region (special/metropolitan cities), educational background (middle school or lower, high school or higher), administrative district (dong, eup/myeon), housing type (house, apartment), marital status (having a spouse, others), household income (less than 1 million won, over 1 million won), and health level (good, average, bad). The physical activity and chronic disease characteristics are consisted of hypertension, diabetes, dyslipidemia, arthritis, cataract, breakfast, subjective body type (thin, normal, obese), BMI index (underweight, normal, obese), number of days of flexibility exercise (3 days or less, more than 4 days), number of days of strength exercise (3 days or less, more than 4 days), and days of walking (3 days or less, more than 4 days). The mental illness related characteristics are consisted of depression, suicidal ideation, lifelong drinking, lifetime smoking, sleep time (less than 7 hours, more than 7 hours), subjective stress (feeling, not feeling), and happiness index (less than 5, greater than 5).

As for the statistical analysis, the R Project program for Windows (R-3.5.3 for Windows) was used, while the analytical method was carried out, first, general characteristics, body shape and physical activity characteristics, chronic disease related characteristics, and the mental disease related characteristics were frequency and percentage, A chi-square test was performed for each characteristic. Second, the multivariate logistic regression analysis was conducted for the factors affecting more than once or more falls and twice or more frequent falls.

3. Research Results

The subjects of this study were 27,987 men (41.2%) and 39,856 women (58.8%), for a total of 67,834 people for analysis. Examining the general characteristics of the number of frequent falls, males were 27,978 (41.2%) and females were 39,856 (58.8%). By age, 36,380 people (53.6%) were 65-74 years old, and 31,454 people (46.4%) were 75 years or older, and by region, Seoul and metropolitan cities had 23,089 people (34.0%), and other 44,745 people (66.0%). As for the level of education, 52,639 people (77.6%) were less than middle school graduates, and 15,195 people were more than high school graduates. 26,235 people (38.7%) were in dong, 41,599 people (61.3%) were in eup-myeon, and by housing type, 54,103 people (79.8%) were in general houses, and 13,731 people (20.2%) were in apartments. In terms of marital status, 42,683 (62.9%) had a spouse, 25,151 (37.1%) were others, and for the household income, 34,837 people (51.4%) had less than 1 million won, 32,997 people (48.6%) had more than 1 million won, and 30,827 people (45.4%) had good health, and 24,146 people (35.6%) had average , and 12,861 (19.0%) were bad. As a result of the comprehensive analysis of frequent falls, 55,723 (82.15%) had no falling experience, 8,374 (12.35%) once, and 3,736 (5.33%) more than two falls. The general characteristics of the number of frequent falls by gender were 24,216 (86.6%) males and 31,506 (79.0%) females, which was higher among the males. For once, 2,573 males (9.2%) and 5,801 females (14.6%) was high in women, and 1,189 (4.2%) were male and 2,549 (6.4%) were female in more than twice. In terms of age, 30,576 people (84.0%) were 65-74 years old, 25,146 people (79.9%) were 75 years old or older, and 65-74 years old was higher, and for once, 4,145 people (11.4%) were 65-74 years old, and 4,229 people (13.4%) were 75 years old or older, and for twice or more, 1,659 people (4.5%) were 65-74 years old, and 2,079 people (6.6%) were 70 years old or older.

42,638 (81.0%) had no middle school graduate or less, and 13,098 (86.2%) had a high school graduate or higher, with 6,843 (13.0%) having a middle school graduate or less, and 1,535 (13.0%) more than a high school graduate. 10.1%), while middle school graduate or less was high, more than twice, middle school graduate or less was 3,158 (6.0%), and high school graduate or higher was 562 people (3.7%), and less than middle school graduate was high. 36,024 people (84.4%) had a spouse in marital status, and 19,698 people (78.3%) had a spouse at another time, and 36,024 people (84.4%) had a spouse for “No” in terms of the marital status, and 19,698 people (78.3%) had a spouse at another time, and 4,676 people (11.0%) had a spouse at once, and 6,698 people (14.7%) others, and 1,983 people (4.6%) said they had a spouse twice or more, and 1,755 other people (7.0%) said they had a spouse. 27,945 people (80.2%) had less than 1 million won in household income, and 27,777 people (84.2%) had more than 1 million won, and more than 1 million won was higher, and less than 1 million won at once was 4,646 people (13.3%). Those with more than 1 million won were 3,728 (11.3%), with less than 1 million won being the highest. In terms of health level, 23,638 (76.7%) were good for none, 20,663 (85.6%) for normal, and 11,421 (88.8%) for bad, in the order of bad, average, and good. 14.9%), and 2,636 (10.9%) were average, and 1,132 (8.8%) were bad, in the order of good, average, and bad, and 2,583 (8.4%) were good, 847 (3.5%) were average, and 308 (2.4%) were bad, which was statistically significant in the order of good, average, and bad ($p<0.001$).

Furthermore, in terms of region, 19,071 (82.6%) were "No" in Seoul and metropolitan cities, 36,651 (81.9%) in others, 2,826 (12.2%) in Seoul and metropolitan cities, and 5,548 (12.4%) in others, and for twice or more, Seoul and metropolitan cities had 1,192 (5.16%), and others had 2,546 (5.7%), demonstrating a statistically significant difference (p=0.012). In the administrative district, there were "No" for 21,540 people (82.1%) in dong, 34,182 people (82.2%) in eup-myeon, 3,314 people (12.6%) in dongs, 5,060 people (12.2%) in eup-myeon, and twice or more, and there were 1,381 people (5.3%) in dong and 2,357 people (5.7%) in eup-myeon, demonstrating a statistically significant difference (p=0.023). For housing type, 44,435 people (82.1%) were for general houses, 11,287 people (82.2%) for apartments, 6,619 people (12.2%) once, and 1,755 people (12.8%) for apartments, twice or more. 3,049 people (5.6%) were in general houses and 689 people (5.0%) in apartments, demonstrating a statistically significant difference (p=0.006). There were significant differences across all variables in the general characteristics of frequent falls (Table 1).

Table 1. Experience of multiple falls among Korean elderly by general characteristics of study subject

Unit: n(%)

Variables	Total	Experience of falls			p-value*
		None	More than once	More than twice	
Gender					
Male	27,978 (41.2)	24,216 (86.6)	2,573 (9.2)	1,189 (4.2)	<0.001
Female	39,856 (58.8)	31,506 (79.0)	5,801 (14.6)	2,549 (6.4)	
Age(years)					
65～74	36,380 (53.6)	30,576 (84.0)	4,145 (11.4)	1,659 (4.6)	<0.001
≥75	31,454 (46.4)	25,146 (80.0)	4,229 (13.4)	2,079 (6.6)	
Area district					
Special·Metropolitan City	23,089 (34.0)	19,071 (82.6)	2,826 (12.2)	1.192 (5.16)	0.012
Others	44,745 (66.0)	36,651 (81.9)	5,548 (12.4)	2,546 (5.7)	
Education level					
≤Middle school	52,639 (77.6)	42,638 (81.0)	6,843 (13.0)	3,158 (6.0)	<.0001
≥High school	15,195 (22.4)	13,098 (86.2)	1,535 (10.1)	562 (3.7)	
Administrative district					
Dong	26,235 (38.7)	21,540 (82.1)	3,314 (12.6)	1,381 (5.3)	0.023
Eup·Myeon	41,599 (61.3)	34,182 (82.2)	5,060 (12.2)	2,357 (5.7)	
Housing type					
Detached house	54,103 (79.8)	44,435 (82.2)	6,619 (12.2)	3,049 (5.6)	0.006
Apartment	13,731 (20.2)	11,287 (82.2)	1,755 (12.8)	689 (5.0)	
Marital status					
Have spouse	42,683 (62.9)	36,024 (84.4)	4,676 (11.0)	1,983 (4.6)	<0.001
Others	25,151 (37.1)	19,698 (78.3)	3,698 (14.7)	1,755 (7.0)	
Household income(KRW)					
＜One million won	34,837 (51.4)	27,945 (80.3)	4,646 (13.3)	2,246 (6.4)	<0.001
≥One million won	32,997 (48.6)	27,777 (84.2)	3,728 (11.3)	1,492 (4.5)	
Subjective health status					
Good	30,827 (45.4)	23,638 (76.7)	4,606 (14.9)	2,583 (8.4)	<0.001
Usual	24,146 (35.6)	20,663 (85.6)	2,636 (10.9)	847 (3.5)	
Bad	12,861 (19.0)	11,421 (88.8)	1,132 (8.8)	308 (2.4)	
Total	67,834 (100.0)	55,723 (82.15)	8,374 (12.35)	3,736 (5.33)	

* by χ^2-test

Examining the distribution of frequent falls by physical activity and chronic disease characteristics, 30,827 people (45.4%) were thin in terms of the subjective body shape, 24,146 people (35.6%) were normal, and 12,861 people (19.0%) were obese, while in terms of the BMI index, 10,272 (15.1%) were underweight, 26,064 (38.4%) were normal, and 31,408 (46.6%) were obese, and in terms of the number of days of flexibility exercise, 23,799 (35.1%) were 3 days or less, and 44,035 (64.9%) were 4 or more days, and as for the number of days of strength training, 7,335 people (10.8%) did less than 3 days, and 60,499 people (89.2%) did more than 4 days, while 33,162 (48.9%) walked for 3 days or less, and 34,672 (51.1%) for 4 or more days, and in terms of hypertension, 37,237 (54.9%) had it, and 30,597 (45.1%) had none, and as for diabetes, 14,606 (21.5%) had it, and 53,228 (78.5%) had none, and as for dyslipidemia, 17,282 (25.5%) had it, and 50,552 (74.5%) had none, and as for arthritis, 23,950 (35.5%) had it, and 43,884 (64.47%) had none, and as for cataract, 24,676 (36.4%) had it, and 43,158 (63.6%) had none.

As a result of the comprehensive analysis of the distribution of frequent falls according to physical activity and chronic disease characteristics, 55,722 (82.14%) had no falling experience, 8,374 (12.34%) once, and 3,738 (5.51%) more than two falls. The physical activity and chronic disease characteristics for the number of frequent falls In terms of subjective body type, 23,638 (76.7%) were thin, 20,663 (85.6%) were normal, and 11,421 (88.8%) were obese. 4,606 people (14.9%) were thin, 2,636 people (10.9%) were normal, and 3,771 people (8.8%) were obese, in the order of skinny, normal, and obese. For twice or more, thin were 2,583 (8.4%), normal 847 (3.5%), obese 308 (2.4%), in the order of skinny, normal, and obese. In terms of the BMI index, 8,046 (78.3%) were underweight, 21,572 (82.8%) were normal, and in terms of obesity, 26,104 (82.8%) were more normal and obese than underweight, and for once, 1,476 (14.4%) were underweight, 3,127 (12.0%) were normal, and in the case of obesity, 3,771 (12.0%) were lower with normal and obese than underweight, and for twice or more, 750 (7.3%) were underweight, 1,355 (5.2%) were normal, and 1,633 (5.2%) were obese, and in terms of obesity, 26,104 (82.8%) were more normal and obese than underweight, and for once, 1,476 (14.4%) were underweight, 3,127 (12.0%) were normal. In the number of days of flexibility exercise, 19,655 people (82.6%) did 3 days or less, 36,067 people (81.9%) did more than 4 days, and 3 days or less was slightly higher. 4 days or more was 5,393 (12.2%), and 3 days or less was slightly higher. In twice or more, 3 days or less was 1,163 people (4.9%), 4 days or more was 2,575 people (5.8%), with 4 days or more being high.

In terms of the number of days of strength exercise, 6,359 people (86.7%) did not exercise for 3 days or less, and 49,363 people (81.6%) for 4 days or more, and more than 4 days was high with 7,644 (12.6%), 246 (3.4%) had 3 days or less in twice or more cases, and 3,492 (5.8%) had 4 or more days, and 4 days or more was high, and 26,652 people (80.4%) did not walk for 3 days or less, 29,070 people (83.8%) for 4 days or more, and 4 days or more was high, and once, 3 days or less was 4,389 people (13.2%), 4 days 3,985 people (11.5%) had more than 3 days, the highest was 3 days or less, twice or more, 2,121 people (6.4%), 4 days or more, 1,617 people (4.7%), 3 days or less was high, and there was a statistically significant difference in the variables ($p=<0.001$). In terms of hypertension, 30,255 people (81.2%) had no blood pressure, 25,467 people (83.2%) had high blood pressure, and 4,729 people (12.7%) had high blood pressure, and 3,645 people (11.9%) had high blood pressure with “No” with 2,253 people (6.1%) had twice or more, and 1,485 people

(4.9%) with "No." In terms of diabetes, 11,718 people (80.2%) had no diabetes, and 44,004 people (82.7%) did not, and for once, 1,926 people (13.2%) had it and 6,448 people (12.1%) had none, and in the second or more, 962 people (6.6%) had it and 2,776 people (5.2%) had none.

In terms of dyslipidemia, 13,827 people (80.0%) had none, 41,895 people (82.9%) had none, and once had 2,334 people (13.5%) had none, and 6,040 people (11.9%) had none, and had more than 2 times in dyslipidemia. 1,121 people (6.5%) had it and 2,617 people (5.2%) had none. The absence of arthritis was high in 18,428 people (76.9%) who had it and 37,294 people (85.0%) who had none. 3,625 (15.1%) with yes, 4,749 (10.8%) with no, and 1,897 (7.9%) with yes, and 1,841 (4.2%) with no for twice or more. 19,322 people (78.3%), and 36,400 people (84.3%) had none, 3,565 people (14.4%), 4,809 people (11.1%) had none for once, and 1,789 people for twice or more (7.2%), and 1,949 people (4.5%) had none, and there was a statistically significant difference in the presence and absence of the disease as a variable (p = <0.001) (Table 2).

Table 2. Experience of multiple falls among Korean elderly according to body condition, physical activities and chronic disease status of study subject

Unit: n(%)

Variables	Total	Experience of falls			p-value*
		None	More than once	More than twice	
Subjective body image					
Skinny	30,827 (45.4)	23,638 (76.7)	4,606 (14.9)	2,583 (8.4)	<0.001
Usually	24,146 (35.6)	20,663 (85.6)	2,636 (10.9)	847 (3.5)	
Obesity	12,861 (19.0)	11,421 (88.8)	1,132 (8.8)	308 (2.4)	
BMI(kg/㎡)					
Under(<20)	10,272 (15.1)	8,046 (78.3)	1,476 (14.4)	750 (7.3)	<0.001
Normal(≥22, ≤25)	26,054 (38.5)	21,572 (82.8)	3,127 (12.0)	1,355 (5.2)	
Over(>25)	31,508 (46.4)	26,104 (82.8)	3,771 (12.0)	1,633 (5.2)	
Flexibility exercise(days/week)					
≤ 3 days	23,799 (35.1)	19,655 (82.6)	2,981 (12.5)	1,163 (4.9)	<0.001
≥ 4 days	44,035 (64.9)	36,067 (81.9)	5,393 (12.2)	2,575 (5.8)	
Muscle strength exercise(days/week)					
≤ 3 days	7,335 (10.8)	6,359 (86.7)	730 (10.0)	246 (3.4)	<0.001
≥ 4 days	60,499 (89.2)	49,363 (81.6)	7,644 (12.6)	3,492 (5.8)	
Walking(days/week)					
≤ 3 days	33,162 (48.9)	26,652 (80.4)	4,389 (13.2)	2,121 (6.4)	<0.001
≥ 4 days	34,672 (51.1)	29,070 (83.8)	3,985 (11.5)	1,617 (4.7)	
Hypertension					
Yes	37,237 (54.9)	30,255 (81.2)	4,729 (12.7)	2,253 (6.1)	<0.001
No	30,597 (45.1)	25,467 (83.2)	3,645 (11.9)	1,485 (4.9)	
Diabetes					
Yes	14,606 (21.5)	11,718 (80.2)	1,926 (13.2)	962 (6.6)	<0.001
No	53,228 (78.5)	44,004 (82.7)	6,448 (12.1)	2,776 (5.2)	
Dyslipidemia					
Yes	17,282 (25.5)	13,827 (80.0)	2,334 (13.5)	1,121 (6.5)	<0.001
No	50,552 (74.5)	41,895 (82.9)	6,040 (11.9)	2,617 (5.2)	
Arthritis					
Yes	23,950 (35.5)	18,428 (76.9)	3,625 (15.1)	1,897 (7.9)	<0.001
No	43,884 (64.7)	37,294 (85.0)	4,749 (10.8)	1,841 (4.2)	
Cataract					
Yes	24,676 (36.4)	19,322 (78.3)	3,565 (14.4)	1,789 (7.2)	<0.001
No	43,158 (63.6)	36,400 (84.3)	4,809 (11.1)	1,949 (4.5)	
Total	67,834 (100.0)	55,722 (82.14)	8,374 (12.34)	3,738 (5.51)	

* by χ^2-test

Table 3. Experience of multiple falls among Korean elderly according to mental illness related characteristics of study subject

Unit: n(%)

Variables	Total	Experience of falls			p-value*
		None	More than once	More than twice	
Sleep time (hours)					
< 7	33,483 (49.4)	27,004 (80.6)	4,419 (13.2)	2,060 (6.2)	<0.001
≥ 7	34,351 (50.6)	28,718 (83.6)	3,955 (11.5)	1,678 (4.9)	
Subjective stress status					
Feeling	21,923 (33.4)	18,233 (83.2)	2,652 (12.1)	1,038 (4.7)	<0.001
Unfeeling	43,779 (66.6)	35,660 (81.7)	5,521 (12.4)	2,598 (5.9)	
Depression					
Yes	4,680 (6.9)	3,245 (69.3)	833 (17.8)	602 (12.9)	<0.001
No	63,154 (93.1)	52,477 (83.1)	7,541 (11.9)	3,136 (5.0)	
Suicidal thought					
Yes	8,075 (11.9)	5,592 (69.3)	1,445 (17.9)	1,038 (12.9)	<0.001
No	59,759 (88.1)	50,130 (83.9)	6,929 (11.6)	2,700 (4.5)	
Happiness index					
< 5	42,992 (63.0)	35,902 (84.9)	4,662 (11.0)	1,730 (4.1)	<0.001
≥5	24,842 (37.0)	19,285 (77.6)	3,594 (14.5)	1,963 (7.9)	
Lifetime alcohol drinking					
Yes	43,899 (64.7)	36,326 (82.8)	5,231 (11.9)	2,342 (5.3)	<0.001
No	23,935 (35.3)	19,396 (81.0)	3,143 (13.2)	1,396 (5.8)	
Lifetime smoking					
Yes	23,235 (34.3)	19,906 (85.7)	2,263 (9.7)	1,066 (4.6)	<0.001
No	44,599 (65.7)	35,816 (80.3)	6,111 (13.7)	2,672 (6.0)	
Total	67,529 (99.55)	55,384 (82.02)	8,328 (12.33)	3,717 (5.50)	

* by χ^2-test

The distribution of the number of frequent falls according to the mental illness related characteristics of the survey subjects was 33,483 people (49.4%) who slept less than 7 hours, 34,351 people (50.6%) who slept more than 7 hours, and felt subjective stress 31,923 people (32.3%), 43,779 people (64.5%) did not feel depressed, 4,680 people (6.9%) had depression, 63,154 people (93.1%) had no feelings of depression, and 8,075 people (11.9%) had suicidal thoughts, 59,759 people had no family (59,759 people). 88.1%), and as for the happiness index, less than 5 was 42,992 (63.0%), 5 or more was 24,842 (37.0%), lifetime drinking was 43,899 (64.7%), none was 23,935 (35.3%), and in terms of lifetime smoking, 23,235 (34.3%) with yes, 44,599 (65.7%) with no. The comprehensive analysis results on mental illness on the number of frequent falls were 55,384 (82.02%) for none and 8,328 (12.33%) for one fall. twice or more were 3,717 (5.50%). As a result of the analysis of mental illness related characteristics on the number of frequent falls, 27,004 (80.6%) had sleep time for less than 7 hours and 28,718 (83.6%) had more than 7 hours. 4,419 people (13.2%) had less than 7 hours for one session, 3,955 people (11.5%), less than 7 hours) in less than 7 hours, 2,060 people (6.2%) had less than 7 hours in twice or more, and more than 7 hours was 1,678 (4.9%), and less than 7 hours was high.

The feeling with no subjective stress was high with 18,233 (83.2%) and no with 35,660 (81.7%), and once felt with 2,652 (12.1%) and no with 5,521 (12.5%). 1,038 people (4.7%) felt once and

felt more than twice, and 2,598 people (5.9%) did not. In terms of depression, 3,245 people (69.3%) with none had a high rate of absence, 52,477 people (83.1%) with no, and 833 people (17.8%) with yes and 7,541 people (11.9%) with no for once, and for twice was 602 people (12.9%), no was high with 3,136 people (5.0%). Regarding suicidal ideation, no was the highest with 5,592 people (69.3%) and non-mindfulness with 50,130 people (83.9%), and for once, no was the highest with 1,445 people (17.9%) had it, and 6,929 people (11.6% 0) had none, 1,038 people (12.9%) had none, 2,700 people (7.9%) had none more than twice, and 35,902 people (less than 5) for happiness index 84.9%), 5 or more with 19,285 (77.6%) less than 5, 4,662 less than 5 for once (11.0%), 5 or more with 3,594 (14.5%) 5 or more, and 5 or more with twice or more Less than 1,730 people (4.1%), 5 or more people 1,963 people (7.9%), 5 or more were high. Lifetime drinking was high with 36,326 people (82.74%), no drinking at 19,396 people (81.04%), and 1 time drinking. 5,231 people (11.91%) with yes, 3,143 people (13.14%) with no, and no with 2,342 people (5.33%) and no with 2,342 people (5.33%) and no with 3,143 people (13.14%), while 19,906 people (85.7%) with yes, 35,816 people (80.3%) with no, and for once, yes was the highest with 2,263 (9.7%%), and 6,111 (13.7%) with no for once, 1,066 with yes (4.6%) for twice or more, and for no, it was high at 2,672 (6.0%), and there was a statistically significant difference (p=<0.001) (Table 3).

To examine and learn about the effect of independent variables on the dependent variable, the multivariate logistic regression analysis was performed by setting the dependent variable criterion for the factors affecting the frequent falls as 0 falls and separating them into 1 or more falls and twice or more falls. The factors affecting the experience of falling more than once were 0.78 times (95% CI 0.21-0.84) lower odds ratio (p<0.001) among the males than the females (p<0.001), and 0.92 times (95% CI 0.88-0.96) decreased (p<0.001). The falls increased 1.06 times (95% CI 1.00-1.13) when the administrative district was the same as eup (p=0.034), and the falls decreased 0.92 times (95% CI 0.88-0.96) when there was a spouse (p<0.001). The better the health level, the higher the rate of fall by 1.61 times (95% CI 1.50-1.72) (p<0.001), and the normal condition increased by 1.17 times (95% CI 1.09-1.25) (p<0.001). There was a 1.08-fold (95% CI 1.04-1.13) increase in the falls (p<0.001) when the number of walking days was 3 days or less, and a 1.13-fold (95% CI 1.08-1.19) increase (p < 0.001) when the number of days of flexibility exercise was 3 days or less. 0.001), and when the number of days of strength training was 3 days or less, the number of falls decreased by 0.92 times (95% CI 0.85-1.00) (p=0.044). The people with diabetes had a 1.05-fold (95% CI 1.00-1.11) increase in the falls (p=0.035), and those with dyslipidemia were 1.09-fold (95% CI 1.04-1.15) (p<0.001). Those with the cataract increased 1.26 times (95% CI 1.21-1.32) (p<0.001), and those with cataract increased 1.21 times (95% CI 1.16-1.26) (p<0.001). The falls increased 1.07 times (95% CI 1.03-1.12) when the sleep time was less than 7 hours (p=0.001). When feeling depressed, the number of falls increased by 1.32 times (95% CI 1.22-1.42) (p<0.001), and those who thought of suicide increased by 1.53 times (1.44-1.62) (p<0.001). The falls declined by 0.84 times (95% CI 0.80-0.88) among the people with a happiness score of 5 or more (p<0.001), and the falls increased 1.11 times (95% CI 1.06-1.18) among the people with lifetime drinking (p<0.001). 0.001).

The factors affecting the number of falls more than once were 0.90 times (95% CI 0.83-0.97) reduced for the age of 65-74 years (p=0.005), and declined by 0.90 times (95% CI 0.84-0.98) in the presence of a spouse (p=0.011). The people with good health demonstrated a 2.23-fold (95%

CI 1.95-2.54) increase in the falls (p<0.001). Furthermore, the people with normal health levels increased the number of falls by 1.26 times (95% CI 1.10-1.45) compared to those with poor health (p=0.001). The falls increased 1.09-fold (95% CI 1.02-1.17) (p=0.014) when the number of walking days was 3 days or less, and 1.10-fold (95% CI 1.02-1.19) (p=0.019) when number of days of flexibility exercise was 3 days or less (p=0.019). When the number of strength training days was 3 days or less, the number of falls decreased by 0.85 times (95% CI 0.74-0.99) (p=0.034). 1.15-fold (95% CI 1.07-1.25) (p<0.001) in those with dyslipidemia, 1.45-fold (95% CI 1.35-1.56) (p<0.001) in those with arthritis, and 1.29 in those with cataract. There was a fold (95% CI 1.21-1.39) increase in the falls (p<0.001). Those who slept less than 7 hours increased the number of falls by 1.11 times (95% CI 1.03-1.18) (p=0.005), and those who felt stress had a 0.91-fold (95% CI 0.84-1.00) decrease in the falls (p=0.042).). Those who felt depressed had a 1.50-fold (95% CI 1.34-1.67) increase in the falls (p<0.001), and those with suicidal thoughts had a 1.88-fold (95% CI 1.72-2.06) increase in the falls (p<0.001). A 5-point or higher happiness level decreased the number of falls by 0.78 times (95% CI 0.73-0.84) (p<0.001), and those with a lifetime drinking experience increased the number of falls by 1.18 times (95% CI 1.08-1.29) (p<0.001) (Table 4).

Table 4. Logistic regression analysis on multiple falls among Korean elderly

Variables		Experience of falls					
		More than once			More than twice		
		OR	95% CI	p-value	OR	95% CI	p-value
Gender(ref. Female)	Male	0.78	0.72 - 0.84	0.000	0.98	0.86 - 1.11	0.714
Age(ref. ≥75 years)	65~74(years)	0.92	0.88 - 0.96	0.000	0.90	0.83 - 0.97	0.005
Area district(ref. Other)	Special/Metropolitan cities	0.98	0.93 - 1.04	0.592	1.02	0.92 - 1.12	0.758
Education(ref. ≥High school)	≤Middle school	1.02	0.96 - 1.08	0.592	1.04	0.94 - 1.16	0.425
Administrative district(ref. Dong)	Eup·Myeon	1.06	1.00 - 1.13	0.034	1.02	0.93 - 1.13	0.657
Housing type(ref. Apartment)	Detached house	0.96	0.90 - 1.01	0.136	1.01	0.92 - 1.11	0.841
Marital status(ref. Others)	Have spouse	0.92	0.88 - 0.96	0.000	0.90	0.84 - 0.98	0.011
Household income (ref. ≥one million won/month)	< one million	1.01	0.96 - 1.06	0.701	0.98	0.91 - 1.06	0.641
Health level(ref. Bad)	Good	1.61	1.50 - 1.72	0.000	2.23	1.95 - 2.54	0.000
	Usually	1.17	1.09 - 1.25	0.000	1.26	1.10 - 1.45	0.001
Walking(ref. ≥4 days/week)	≤ 3 days	1.08	1.04 - 1.13	0.000	1.09	1.02 - 1.17	0.014
Flexibility exercise(ref. ≥4 days/week)	≤ 3 days	1.13	1.08 - 1.19	0.000	1.10	1.02 - 1.19	0.019
Muscle exercise(ref. ≥4 days/week)	≤ 3 days	0.92	0.85 - 1.00	0.044	0.85	0.74 - 0.99	0.034
BMI(ref. Overweight(>25 kg/㎡)	Under(<22)	1.02	0.96 - 1.09	0.513	1.03	0.93 - 1.14	0.530
	Normal(≥22, ≤25)	0.97	0.93 - 1.02	0.252	0.95	0.88 - 1.03	0.217
Hypertension(ref. No)	Yes	0.97	0.93 - 1.01	0.133	1.01	0.94 - 1.08	0.867
Diabetes(ref. No)	Yes	1.05	1.00 - 1.11	0.035	1.07	0.99 - 1.16	0.087
Dyslipidemia(ref. No)	Yes	1.09	1.04 - 1.15	0.000	1.15	1.07 - 1.25	0.000
Arthritis(ref. No)	Yes	1.26	1.21 - 1.32	0.000	1.45	1.35 - 1.56	0.000
Cataract(ref. No)	Yes	1.21	1.16 - 1.26	0.000	1.29	1.21 - 1.39	0.000
Sleep time(ref.≥7 hours)	≤7	1.07	1.03 - 1.12	0.001	1.11	1.03 - 1.18	0.005
Subjective stress(ref. Unfeeling)	Feeling	0.99	0.94 - 1.05	0.838	0.91	0.84 - 1.00	0.042
Depression(ref. No)	Yes	1.32	1.22 - 1.42	0.000	1.50	1.34 - 1.67	0.000
Suicidal thought(ref. No)	Yes	1.53	1.44 - 1.62	0.000	1.88	1.72 - 2.06	0.000
Happiness index(ref. <5)	≥5	0.84	0.80 - 0.88	0.000	0.78	0.73 - 0.84	0.000
Lifetime alcoholic drinking(ref. No)	Yes	1.11	1.06 - 1.18	0.000	1.18	1.08 - 1.29	0.000
Lifetime smoking(ref. No)	Yes	0.95	0.88 - 1.01	0.122	0.91	0.81 - 1.02	0.094

4. Consideration

This study is a cross-sectional study which analyzed secondary data to identify the factors of frequent falls among 67,834 elderly people aged 65 years or older in Korea who participated in the Community Health Survey conducted by the Centers for Disease Control and Prevention in 2017.

As a result of the analysis performed, the rate of falling more than once over the past year turned out to be 12.4%, and the rate of falling more than twice over the last year was 3,736 (5.3%). These results are low compared to 25.1% of the results of the 2014 National Elderly Survey on Local Community Elderly, and the falling experience rate of the elderly in one region is 41.6-45.5%, and the fall prevalence rate in the facilities including nursing homes and hospitals was confirmed to be relatively low when compared to 48.8%, etc. (KIHSA, 2014; Ministry of Health and Welfare, 2015; Ruchinskas, 2003; Singh et al., 2003). This is due to the cross-sectional design of the survey, and it is different from the survey results that reflect the characteristics of specific spaces such as hospitals and nursing homes. As the age increases, the number of fall people among the elderly increases. The proportion of elderly people in Korea increases rapidly from 7.2% in 2000 to 11.0% in 2010, and 14.3% in 2018. This suggests that the frequency of falls will increase in the older age group. Falls occur across all age groups, but in particular, one third of people over the age of 65 experience a fall and 50% of the elderly experience a relapse. Furthermore, 25.1% of the elderly who experienced a fall over the past year reported that 63.4% experienced undergoing hospital treatment due to a fall and 47.4% suffered from sequelae (KIHSA, 2014). In particular, the fall of the elderly leads to fractures and brain damages, thereby leading to a decline in the quality of life due to the decline in independent living and the fear of falling as a serious sequelae of permanent disability.

As a result of deriving significant variables related to falls in this study, the variables related to one or more falls included gender, age, administrative district, marital status, subjective health level, walking, flexibility exercise, strength exercise, diabetes, dyslipidemia, arthritis, cataract, sleep duration, depression, suicidal ideation, happiness index, drinking, and smoking, etc., while the variables related to two or more falls included age, marital status, subjective health level, walking, flexibility exercise, strength exercise, dyslipidemia, arthritis, cataract, sleep time, stress, depression, suicidal ideation, happiness index, drinking, and smoking, each consideration of whose results is as follows.

Among the elderly, the physical health factors such as aging and medications due to chronic diseases demonstrate the results that are closely related to the falls. The odds ratio was 1.50 times, and the odds ratio for those with suicidal thoughts was 1.53 times for one or more times, 1.88 times for two or more times, and the odds ratio was 1.07 times for one or more times, 1.11 times for those who slept less than 7 hours, etc., It is noteworthy that the higher the happiness index was 5 points or more, the lower the rate of fall, with an odds ratio of 0.84 times for one or more times and an odds ratio of 0.78 times for two or more times. This is the result that the higher the happiness index, the lower the rate of fall. This may suggest that the mental health of the elderly is recognized as a very important factor in the falls and that interventions are urgently needed to improve them (van Haastregt et al., 2008).

In this study, the rate of fall was consistent with the results of the previous studies, such as the odds ratio of men falling 0.78 times that of women, which was higher in women than men (Kim et al., 2008; Kim et al., 2011; Yeom et al., 2012). There was a significant decrease in the odds ratio of 0.92 times for those aged 65-74 years old who had one or more falls compared to those aged 75 years or older, and those who had two or more falls by 0.90 times, and it was consistent with the previous domestic and foreign studies that the results of the study were consistent with (Kim et al., 2011; Yeom et al., 2012; Burker et al., 1995).

In the administrative district, the rate of falling experienced by people living in dong-myeon was higher than those living in eup, with an odds ratio of 1.06 times higher for those living in dong-myeon, which was consistent with the analysis of previous studies (Kim et al., 2008; Kim et al., 2011). The cases with a spouse in a marital status had a lower odds ratio of 0.92 times for one or more occasions and 0.90 times for two or more occasions than others, consistent with the results of previous studies in Korea (Kim et al., 2013; Choi et al., 2011).

In terms of the level of health, the odds ratio with normal people than bad was 1.17 times for once or more, 1.26 times for twice or more, and the odds ratio was 1.61 times for people with good health than those with poor health, and odds ratios were 2.23 times for twice or more. As a result different from the results of previous studies, unlike the past, the people with good levels of health are more active leisure activities due to economic activities and economic leisure than those who are not, so the exposure to the risk of falls is also assumed to be higher. (Choi et al., 2014; Hedman et al., 2013). According to the 2020 Elderly Survey, it may be predicted that the elderly aged 65-69 have an economic activity participation rate of 55.1%.

The odds ratio was 1.08 times for those who practiced walking for 3 days or less and 1.09 times for those who practiced walking more than 1 time and 1.09 times more than 4 days or more. In terms of the number of days of flexibility exercise, the odds ratio was 1.13 times for those who did 3 days or less than those who did 4 days or more, and the odds ratio 1.10 times for those who did more than 2 times. The odds ratio was 0.92 times for those who did more than 4 days in the number of days of strength training and 0.85 times for those who did more than 2 times than those who did 3 days or less, etc.

Compared to those without chronic diabetes, as for those who have it, the odds ratio of those who had fallen more than once was 1.05 times, and those who experienced more than two falls were 1.07 times, consistent with the results of previous domestic and foreign studies (Hedman et al., 2013). The people with more than 7 hours of sleep were surveyed with an odds ratio of 1.07 times more than those who slept less than 7 hours, and 1.11 times more than twice. In terms of mental health and disease, the odds ratio was 1.32 times for depression once or more, odds ratio 1.50 times for more than twice, odds ratio 1.53 times for suicidal ideation more than once, and the odds ratio 1.88 times for more than twice, which was consistent with the results of previous domestic studies (Kown et al., 2014; Kim et al., 2011). In particular, as for depression and suicidal ideation, it is inevitable to take a psychotropic drug as a treatment drug, and the elderly people become a direct cause of falls due to abnormal balance and sedative effects. Lifelong drinking was higher than non-drinkers for the odds ratio of 1.11 times for one or more occasions and 1.18 times for two or more occasions, which was consistent with the results of the previous studies

in Korea (Kim et al., 2014; Nam et al., 2014).

This study analyzed the data of the 2017 Community Health Survey, and it is necessary to pay attention to the limitations and interpretation of various study results. First, the existing survey data were used, and the data collection was not planned in advance, and hence, the known existing factors related to falls (WHO, 2007; Cho et al., 2016) could not be considered. Second, since the experience of falling is a subjective experience, questions may arise as to the fact that it is not an objective diagnosis and the understanding of the correct answer. Third, the possibility that information loss occurred in the process of categorization and grouping of variables could not be ruled out. Fourth, given the limitations of the cross-sectional study design, caution must be exercised in terms of interpretation as there may be a logical leap in the causal relevance of the results. Nevertheless, based on the findings above, this study found that there was a strong correlation between the personal and regional characteristics of the elderly and the falling experience rate. The frequent falls of the elderly are related to various factors, and it seems necessary to seek the countermeasures for the comprehensive fall prevention including related factors in the future.

5. Summary and Conclusion

This study attempted to identify the level of frequent falls among the elderly over 65 years of age, and identify the related factors using the 2017 Korea Community Health Survey data. As a result of the multivariate logistic regression analysis performed, the variables related to one or more falls were gender, age, administrative district, marital status, subjective health level, walking, flexibility exercise, strength exercise, diabetes, dyslipidemia, arthritis, cataract, sleep time, depression, suicidal ideation, happiness index, drinking, and smoking, etc. The variables related to two or more falls include age, marital status, subjective health level, walking, flexibility exercise, muscle strength exercise, dyslipidemia, arthritis, cataract, sleep time, stress, depression, suicidal ideation, happiness index, drinking, and smoking, etc. The frequent falls of the elderly are related to the various factors, and it seems necessary to explore a comprehensive fall prevention plan including the related factors in the future.

Conflicts of Interest

The author declare that they have no conflict of interest.

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