Factors Influencing Suicide Dimensions in the Elderly

Byung Deog Hwang[1], Jae Woo Park[2†] and Ryoung Choi[3]

[1]*Catholic University of Pusan, Department of Hospital Management*
[2]*Graduate School of Catholic University of Pusan, Department of Hospital Management,*
[3]*Dongshin University, Department of Health Administration*

Abstract

This correlational study provides basic data concerning important factors influencing suicide dimensions among the elderly by determining the characteristics of health behavior among the elderly and analyzing their association with suicide. This study used primitive data from "The 6th Korea National Health and Nutrition Examination Survey, the 1st year (2013)" conducted by the Ministry of Health and Welfare and Centers for Disease Control and Prevention. A total of 2,458 study subjects aged over 55 participated in this study. Statistical analysis of the study data was performed using SPSS 21.0. Frequency analysis was performed on the sociodemographic characteristics of the subjects, and a Chi-squared test was used to examine the correlations between the study variables in relation to the sociodemographic characteristics of the subjects. Logistic regression analysis was performed to determine the odds ratio for the correlation analysis. The results of this study were as follows. First, variations in suicide dimension factors according to elderly classifications and the presence of chronic diseases showed statistically significant differences in relation to the presence of economic activities, the presence of a spouse, and overall health behavior factors. Second, of all the main factors that affect suicide dimensions, the presence of a spouse, subjective health status, restriction of physical activities, and stress level were shown to have statistically significant effects. To reduce the suicide dimensions of the elderly, it will be necessary to help them escape chronic diseases, increase their physical functions with regular physical activities and health status maintenance, and manage their depression, which is the first stage of the suicide dimension. This can only be accomplished by developing social programs based not only on individual efforts but also on an accurate understanding of the elderly population.

Keywords: elderly, health behaviors, suicide dimensions, elderly classification

1. Introduction

The suicide rate in Korea has constantly risen among all age groups since its rapid increase after the financial crisis of the 1990s. Suicide among the elderly accounts for 30% of all suicides, and this has led to various social problems. The suicide rate among the elderly in Korea is 4 times higher than the average among all other OECD countries. Although the suicide rates among the elderly have been constantly decreasing among the OECD countries in the last 10 years, Korea's rate is currently highest and has shown a 2.3-fold increase in recent years. Elderly suicide is a serious problem in Korea, and the need is emerging for proper alternatives to reduce suicide rates among the elderly.

Although there have not been many problems among the elderly in Korea compared to other countries, due to the traditional social values and sentiments of respecting the elders, the elderly have become exposed to various problems without adequate preparation because of changes in their social environment, values, and the surrounding culture due to rapid economic development. It is a fact that Koreans in average has been well off and government expenditure for the elderly has been skyrocketing [1]. Furthermore, from the

aspect of welfare, Korea has experienced dramatic and unprecedented aging that is making it difficult to keep up with the quickly growing welfare demands.

The elderly are people whose aging has achieved a certain level according to functional changes of the mind and body, and their physical and mental weaknesses have a major effect on elderly suicide rates. Moreover, various factors, such as economic deficiency and problems with the isolation of the elderly have been determined to be causes of elderly suicide [2]. Old adults experience many losses in their life which include loss of health, loss of social role, financial power and relationship with their loved ones. Having experienced all those losses, elderly became more vulnerable to depressions [3]. Previous studies on elderly suicide were restricted to depression and stress or have deduced cross-sectional conclusions concerning the causes of suicide. Hence, studies addressing various perspectives are still lacking.

Suicidal thoughts connect suicide attempts and suicide acts and may even lead to them [4]. Reynolds [5] classified suicide into 4 dimensions: suicidal thoughts, suicide plans, suicide attempts, and suicidal death. Because studying people who have attempted suicide is difficult due to ethical restrictions and their low numbers, previous studies have tended to focus on suicide predictor variables, such as suicidal thoughts and suicide attempts [6], [7]. Furthermore, existing studies of the elderly have analyzed suicidal thoughts and suicide attempts independently, and it is hard to find studies that viewed the 4 suicide dimensions (experiencing depression, suicidal thoughts, suicide plans, and suicide attempts) as one continuous process and compared and analyzed the factors that influence each dimension simultaneously.

Therefore, by dividing suicide dimensions into 4 stages (experiencing depression, suicidal thoughts, suicide plans, and suicide attempts), this study examined the differences in the elderly suicide dimensions according to their general characteristics and sequentially investigated the factors influencing them.

The specific aims of this study are as follows:

- First, to determine the sociodemographic characteristics, health behaviors, and suicide dimensions of the elderly.
- Second, to examine the differences between the study variables according to the characteristics of the elderly.
- Third, to determine the factors influencing the suicide dimensions among the elderly.

2. Methods

2.1 Study Subjects and Methods

The study subjects were 2,458 people over the age of 55 living in 3,182 households (30.7%) out of a possible 8,018 elderly people identified from "The 6th Korea National Health and Nutrition Examination Survey, the 1st year (2013)," which was conducted by the Ministry of Health, Welfare, and Centers for Disease Control and Prevention.

The study tool that was used was primitive data from the National Health and Nutrition Examination Survey, which were analyzed by extracting 7 questions concerning sociodemographic characteristics, 7 questions concerning health behavior, and 4 questions concerning suicide dimensions.

The statistical analysis of the study data was conducted using SPSS 21.0. Frequency analysis was performed on sociodemographic characteristics of the subjects, and a Chi-squared test was used to determine correlations between the study variables in relation to the subjects' sociodemographic characteristics. Logistic regression analysis was performed to determine the odds ratio for the correlation analysis.

2.2 Operational Definition of Variables

Sociodemographic Characteristic Variables

The sociodemographic characteristic variables used in this study were gender (male/female), residential area (metropolitan area/non-metropolitan area), economic status(lower/lower-middle/upper-middle/upper), health care financing (health insurance/medical care assistance), presence or absence of spouse (present/absent), and presence or absence of economic activities (present/absent).

Elderly Classification. Neugarten, *et al.,* [8] classified the elderly population into the young-old (age 55-65), middle-old (age 65-75), and old-old (over age 75), and Schiffman and Sherman [9] classified elderly consumers into mature-adult (age 55-64), young-elderly (age 65-74), and old-elderly (over age 75). Korea's "Elderly Welfare Act" and "National Basic Living Security Act" define the elderly as those who are over age65. Although the "National Pension Act" set the age of over 60 as the standard for receiving an old-age pension, the "Senior Citizen Employment Promotion Act" regarding the elderly labor force utilization defines those aged over 55 as "senior citizens" and those ages 50-54 as "semi-senior citizens." Such discrepancies in the definition of ages for the elderly population are caused by the increasing numbers of elderly aged over 65 among the total population as the average life span of humans extends past 70, due to the improvements in living environments and the advancement of medical technology. The standard age for what could be defined as the lower limit of the "elderly" category is gradually decreasing.

Therefore, our study defined the elderly as those aged over 55, according to the age classification made by Neugarten, Sherman, and Schiffman, and we classified the elderly into young old (age 55-64), old (age 65-74), older old (age 75-84), and oldest old (age over 85) age groups following the elderly classification by the U.S. National Association of Social Workers (NASW).

Health Behavior Characteristic Variables. The health behavior characteristic variables used in this study were subjective health status (good/fair/poor), presence or absence of physical activity restrictions, smoking, excessive drinking, healthy physical activity attainment, presence or absence of chronic disease, and stress level (high/medium/low).

Subjective health status was divided into good/fair/poor, according to the usual individually perceived health status. Smoking indicated the current status of smoking, excessive drinking indicated more than one excessive drinking occurrence per week, and healthy physical activity attainment was assessed by the presence or absence of intermediate-level physical activity of more than 30 minutes performed more than 5 days per week.

Suicide Dimension Characteristic Variables. The suicide dimension characteristic variables used in this study were the presence or absence of experiencing depression, the presence or absence of suicidal thoughts, the presence or absence of suicide plans, and the presence or absence of suicide attempts.

3. Results

3.1 Sociodemographic Characteristics of Subjects

There were a total of 2,458 subjects, with 1,062 males (43.2%) and 1,396 females (56.8%). As for residential area, the percentage of non-metropolitan areas among the participants' residences was 63.5%, and the percentage of metropolitan areas was 36.5%.

The percentage breakdowns for the participants' economic status were 36.2% in the lower class, 27.5% in the lower-middle class, 19.3% in the upper-middle class, and 17.0% in the upper class. Health insurance accounted for 94% of the participants' medical payments and 73.4% of the participants were currently married. The percentage breakdown of the elderly classification was as follows: young old (41.8%), old (35.5%), older old (19.4%), and oldest old (3.3%). Economic activities were absent in 61.5% of the cases (see Table 1).

Table 1. Sociodemographic Characteristics of Subjects Unit: Person(%)

Variables	Classification	Male	Female	Total
Residential area	Metropolitan area	388(15.8)	509(20.7)	897(36.5)
	Non-metropolitan area	674(27.4)	887(36.1)	1,561(63.5)
Economic status	Upper	339(13.8)	551(22.4)	890(36.2)
	Upper-middle	286(11.6)	390(15.9)	676(27.5)
	Lower-middle	229(9.3)	247(10.0)	476(19.3)
	Upper	208(8.5)	208(8.5)	416(17.0)
Health care system	Health insurance	1,016(41.3)	1,308(53.2)	2,324(94.5)
	Medical care assistance	46(1.9)	88(3.6)	134(5.5)
Spouse	Present	938(38.2)	864(35.2)	1,802(73.4)
	Absent	124(5.0)	532(21.6)	656(26.6)
Elderly classification	Young old	444(18.1)	582(23.7)	1,026(41.8)
	Old	390(15.9)	481(19.6)	871(35.5)
	Older old	197(8.0)	279(11.4)	476(19.4)
	Oldest old	31(1.2)	54(2.1)	85(3.3)
Economic activities	Present	524(21.3)	422(17.2)	946(38.5)
	Absent	538(21.9)	974(39.6)	1,512(61.5)
Total		1,062(43.2)	1,396(56.8)	2,458(100.0)

3.2 Health Behaviors and Suicide Dimension According To Elderly Classification

Among all age groups, the young old group had the highest percentage (39.6%) living in metropolitan areas, and the oldest old had the highest percentage living in non-metropolitan areas (72.9% (p<.05). The percentage breakdown of presence or absence of economic activities was as follows: young old (54.4%), old (34.1%), older old (18.9%), and oldest old (1.2%) (p<.001). The percentages of those participants with a spouse were 84.6%,74.6%, 55.0%, and 25.9% in the young old, old, older old, and oldest old groups, respectively (p<.001).

For subjective health status, the reported percentages were as follows: the young old group had 22.3% and 56.7% in good and fair health respectively; the oldest old had 36.5% in poor health (p<.001). As for physical activity restrictions, the percentages were 21.2%, 18.1%, 18.0%, and 10.1% in the oldest old, older old, old, and young old groups, respectively (p<.001). The young old group had the highest percentage of smokers, with 15.1% (p<.001). They also had the highest percentage of excessive drinkers, with 15.5% (p<.001). The healthy physical activity attainment percentages were as follows: 41.3%, 37.5%, 31.3%, and 18.8% in the old, young old, older old, and oldest old, respectively(p<.001). Those with chronic diseases were 69.1%, 63.5%, 41.3%, and 37.5% in the older old, oldest old, old, and young old groups, respectively (p<.001).

The old group had 18.4% in the high stress category, the young old group had 66.0% with medium stress levels, and 42.4% of the oldest old group had low stress (p<.001) (see Table 2).

Table 2. Differences in General Characteristics According to Elderly Classification Unit: person(%)

Variables		Young old (n=1,026) N(%)	Old (n=871) N(%)	Older old (n=472) N(%)	Oldest old (n=85) N(%)	χ^2	p
Gender	Male	444(43.3)	390(44.8)	197(41.4)	31(36.5)	3.091	.378
	Female	582(56.7)	481(55.2)	279(58.6)	54(63.5)		
Residential area	Metropolitan area	406(39.6)	307(35.2)	161(33.8)	23(27.1)	9.506	**.023**
	Non-metropolitan area	620(60.4)	564(64.8)	315(66.2)	62(72.9)		
Economic activities	Present	558(54.4)	297(34.1)	90(18.9)	1(1.2)	243.691	**.000**
	Absent	468(45.6)	574(65.9)	386(81.1)	84(98.8)		
Health care system	Health insurance	1,003(97.8)	830(95.3)	422(88.7)	69(81.2)	83.002	**.000**
	Medical care assistance	23(2.2)	41(4.7)	54(11.3)	16(18.8)		
Spouse	Present	868(84.6)	650(74.6)	262(55.0)	22(25.9)	246.526	**.000**
	Absent	158(15.4)	221(25.4)	214(45.0)	63(74.1)		
Subjective health status	Good	229(22.3)	170(19.5)	75(15.8)	12(14.1)	32.823	**.000**
	Fair	582(56.7)	457(52.5)	248(52.1)	42(49.4)		
	Poor	215(21.0)	244(28.0)	153(32.1)	31(36.5)		
Physical activity restriction	Present	104(10.1)	157(18.0)	86(18.1)	18(21.2)	31.560	**.000**
	Absent	922(89.9)	714(82.0)	390(81.9)	67(78.8)		
Smoking	Present	155(15.1)	114(13.1)	31(6.5)	5(5.9)	25.800	**.000**
	Absent	871(84.9)	757(86.9)	445(93.5)	80(94.1)		
Excessive drinking	Present	159(15.5)	81(9.3)	21(4.4)	1(1.2)	54.443	**.000**
	Absent	867(84.5)	790(90.7)	455(95.6)	84(98.8)		
Healthy physical activity attainment	Present	385(37.5)	360(41.3)	149(31.3)	16(18.8)	25.802	**.000**
	Absent	641(62.5)	511(58.7)	327(68.7)	69(81.2)		
Chronic diseases	Present	457(44.5)	537(61.7)	329(69.1)	54(63.5)	101.172	**.000**
	Absent	569(55.5)	334(38.3)	147(30.9)	31(36.5)		
Stress level	High	171(16.7)	160(18.4)	85(17.9)	12(14.1)	97.239	**.000**
	Medium	677(66.0)	485(55.7)	211(44.3)	37(43.5)		
	Low	178(17.3)	226(25.9)	180(37.8)	36(42.4)		
Experience of depression	Present	131(12.8)	117(13.4)	63(13.2)	9(10.6)	0.652	.884
	Absent	895(87.2)	754(86.6)	413(86.8)	76(89.4)		
Suicidal thoughts	Present	57(5.6)	57(6.5)	30(6.3)	4(4.7)	1.141	.767
	Absent	969(94.4)	814(93.5)	446(93.7)	81(95.3)		
Suicide plans	Present	16(1.6)	22(2.5)	6(1.3)	1(1.2)	3.825	.281
	Absent	1,010(98.4)	849(97.5)	470(98.7)	84(98.8)		
Suicide attempts	Present	10(1.0)	11(1.3)	4(0.8)	0(0)	1.562	.668
	Absent	1,016(99.0)	860(98.7)	472(99.2)	85(100.0)		

3.3 Health Behaviors and Suicide Dimensions According To Economic Status

More males were in the upper class (50%) than in any other economic class, while more females (61.9%) were in the lower class (p<.001). Most of the upper class participants (48.3%) lived in metropolitan areas, while most of the lower class (72.0%) lived in non-metropolitan areas (p<.001). Concerning those who were still involved in economic activities, 49.8% were in the upper, 47.5% in the upper-middle, 42.4% in the lower-middle, and 25.6% in the lower class groups (p<.001). Regarding spouses, 88.0%, 83.6%, 74.7%, and 59.9% had one in the upper, upper-middle, lower-middle, and lower classes, respectively (p<.001).

The upper class had the highest reported percentage of subjects in good health(29.6%), the upper-middle class showed the highest percentage in fair health (58.2%), and the lower class had the highest percentage in poor health (34.3%) (p<.001). The lower class had the most reported physical activity restrictions (21.3%) (p<.001). The upper-middle class had the highest percentage (15.3%) of smokers (p<.05), and the upper class had the highest percentage of excessive drinkers (15.4%) (p<.001). Concerning the percentages of healthy physical activity attainment, 42.0%, 39.2%, 36.2%, and 33.9% were in the upper-middle, upper, lower-middle, and lower classes, respectively(p<.05). The percentages of participants with chronic disease were 62.9%, 55.2%, 54.4%, and 44.5% in the lower, lower-middle, upper-middle, and upper classes, respectively (p<.001). Regarding the highest stress level percentages within economic groups, 21.1% of the lower class had high stress, 64.3% of the upper-middle class had medium stress, and29.9% of the lower class had low stress (p<.001).

Concerning depression and social class,17.8%, 11.5%, 10.3%, and 8.4%in the lower, lower-middle, upper-middle, and upper classes, respectively, experienced depression (p<.001). Those in the lower, lower-middle, upper-middle, and upper classes reported the following percentages of suicidal thoughts: 9.8%, 5.2%, 3.4%, and 2.4%, respectively (p<.001) (see Table 3).

Table 3. Differences in General Characteristics According to Economic Status Unit: Person(%)

Variables		Lower (n=890) N(%)	Lower-middle (n=676) N(%)	Upper-middle (n=476) N(%)	Upper (n=416) N(%)	χ^2	p
Gender	Male	339(38.1)	286(42.3)	229(48.1)	208(50.0)	22.205	**.000**
	Female	551(61.9)	390(57.7)	247(51.9)	208(50.0)		
Residential area	Metropolitan area	249(28.0)	246(36.4)	201(42.2)	201(48.3)	59.699	**.000**
	Non-metropolitan area	641(72.0)	430(63.6)	275(57.8)	215(51.7)		
Economic activities	Present	228(25.6)	285(42.2)	226(47.5)	207(49.8)	104.696	**.000**
	Absent	662(74.4)	391(57.8)	250(52.5)	209(50.2)		
Health care system	Health insurance	767(86.2)	665(98.4)	476(100.0)	416(100.0)	191.541	**.000**
	Medical care assistance	123(13.8)	11(1.6)	0(0)	0(0)		
Spouse	Present	533(59.9)	505(74.7)	398(83.6)	366(88.0)	154.211	**.000**
	Absent	357(40.1)	171(25.3)	78(16.4)	50(12.0)		
Subjective health status	Good	134(15.1)	124(18.3)	105(22.1)	123(29.6)	77.644	**.000**
	Fair	450(50.6)	393(58.2)	262(55.0)	224(53.8)		
	Poor	306(34.3)	159(23.5)	109(22.9)	69(16.6)		

Physical activity restriction	Present	190(21.3)	83(12.3)	58(12.2)	34(8.2)	50.600	**.000**
	Absent	700(78.7)	593(87.7)	418(87.8)	382(91.8)		
Smoking	Present	100(11.2)	92(13.6)	73(15.3)	40(9.6)	8.763	**.033**
	Absent	790(88.8)	584(86.4)	403(84.7)	376(90.4)		
Excessive drinking	Present	63(7.1)	69(10.2)	66(13.9)	64(15.4)	27.020	**.000**
	Absent	827(92.9)	607(89.8)	410(86.1)	352(84.6)		
Healthy physical activity attainment	Present	302(33.9)	245(36.2)	200(42.0)	163(39.2)	9.746	**.021**
	Absent	588(66.1)	431(63.8)	276(58.0)	253(60.8)		
Chronic disease	Present	560(62.9)	373(55.2)	259(54.4)	185(44.5)	40.420	**.000**
	Absent	330(37.1)	303(44.8)	217(45.6)	231(55.5)		
Stress level	High	188(21.1)	109(16.1)	69(14.5)	62(14.9)	41.831	**.000**
	Medium	436(49.0)	409(60.5)	306(64.3)	259(62.3)		
	Low	266(29.9)	158(23.4)	101(21.2)	95(22.8)		
Experience of depression	Present	158(17.8)	78(11.5)	49(10.3)	35(8.4)	29.834	**.000**
	Absent	732(82.2)	598(88.5)	427(89.7)	381(91.6)		
Suicidal thoughts	Present	87(9.8)	35(5.2)	16(3.4)	10(2.4)	38.587	**.000**
	Absent	803(90.2)	641(94.8)	460(96.6)	406(97.6)		
Suicide plans	Present	24(2.7)	9(1.3)	9(1.9)	3(0.7)	7.510	.057
	Absent	866(97.3)	667(98.7)	467(98.1)	413(99.3)		
Suicide attempts	Present	13(1.5)	5(0.7)	6(1.3)	1(0.2)	5.029	.170
	Absent	877(98.5)	671(99.3)	470(98.7)	415(99.8)		

3.4 Health Behavior and Suicide Dimensions According To Chronic Disease

The absence of chronic disease was reported among 48.0% of males, and chronic disease presence was reported by 60.6% of females (p<.001). Economic activity absence was reported by 45.2% of the participants with chronic disease, and its presence was reported by 33.2%(p<.001). For those with a spouse, chronic disease was absent among 79.4% and present among 68.6% (p<.001).

The reported absence of chronic disease was 25.3% and 59.4% in good and fair health, respectively. The reported presence of chronic disease was 34.7% among those in poor health (p<.001). Chronic disease was present among 18.7% of those with physical activity restrictions, and it was absent among 15.0% of those who smoke (ps<.001). Regarding healthy physical activity attainment, 38.9% had chronic disease, while 34.6% did not (p<.05). Regarding stress levels, 19.7% of the high stress and 27.2% of the low stress group had a chronic disease, but 62.8% of the medium stress group did not have a chronic disease (ps<.001).

For those who experienced depression, chronic disease was present among 14.9% and absent among 10.6% (p<.001). Chronic disease was present among 6.8% and absent among 5.1% of those who had suicidal thoughts (p<.05) (Table 4).

Table 4. Differences in General Characteristics According to Chronic Disease Unit: Person(%)

Variables		Present (n=1,377) N(%)	Absent (n=1,081) N(%)	χ^2	p
Gender	Male	543(39.4)	519(48.0)	18.158	**.000**
	Female	834(60.6)	562(52.0)		
Residential area	Metropolitan area	489(35.5)	408(37.7)	1.300	.136
	Non-metropolitan area	888(64.5)	673(62.3)		
Economic activities	Present	457(33.2)	489(45.2)	37.129	**.000**
	Absent	920(66.8)	592(54.8)		
Health care system	Health insurance	1,280(93.0)	1,044(96.6)	15.409	**.000**
	Medical care assistance	97(7.0)	37(3.4)		
Spouse	Present	944(68.6)	858(79.4)	36.210	**.000**
	Absent	433(31.4)	223(20.6)		
Subjective health status	Good	212(15.4)	274(25.3)	128.007	**.000**
	Fair	687(49.9)	642(59.4)		
	Poor	478(34.7)	165(15.3)		
Physical activity restriction	Present	257(18.7)	108(10.0)	36.026	**.000**
	Absent	1,120(81.3)	973(90.0)		
Smoking	Present	143(10.4)	162(15.0)	11.796	**.000**
	Absent	1,234(89.6)	919(85.0)		
Excessive drinking	Present	137(9.9)	125(11.6)	1.657	.111
	Absent	1,240(90.1)	956(88.4)		
Healthy physical activity attainment	Present	536(38.9)	374(34.6)	4.864	**.015**
	Absent	841(61.1)	707(65.4)		
Stress level	High	271(19.7)	157(14.5)	24.247	**.000**
	Medium	731(53.1)	679(62.8)		
	Low	375(27.2)	245(22.7)		
Experience of depression	Present	205(14.9)	115(10.6)	9.656	**.001**
	Absent	1,172(85.1)	966(89.4)		
Suicidal thoughts	Present	93(6.8)	55(5.1)	2.970	**.034**
	Absent	1,284(93.2)	1,026(94.9)		
Suicide plans	Present	27(2.0)	18(1.7)	0.295	.350
	Absent	1,350(98.0)	1,063(98.3)		
Suicide attempts	Present	14(1.0)	11(1.0)	0.098	.576
	Absent	1,363(99.0)	1,070(99.0)		

3.5 Factors that Influence Suicide Dimension

Logistic regression analysis was conducted to determine the relative influence of sociodemographic and health behavior factors on suicide dimensions. The results were as follows:

To determine the single influence of major variable groups, the subjects were divided into Model I, in which sociodemographic variables were controlled, and Model II, in which sociodemographic variables were all included. Then, the before and after were compared.

First, for the experience of depression in Model I, with good subjective health status as a reference, fair and poor health statuses were higher by 1.4-(0.94-2.09) and 3.3-fold (2.17-5.04), respectively (p<.05, p<.001). For those without physical activity restrictions, experience of depression was 0.5-fold (0.35-0.64), compared to those with physical activity restrictions (p<.001). For stress level, with high as a reference, medium was 0.2-(0.15-0.25) and low was 0.1-fold (0.03-0.14) in the experience of depression (p<.001, p<.001). For suicidal thoughts, with good subjective health status as a reference, poor was higher by 2.9-fold (1.67-5.27) (p<.001). Those without physical activity restrictions had suicidal thoughts by 0.4-fold (0.28-0.60), compared to those with physical activity restrictions (p<.001). For stress level, with high as a reference, medium was 0.2- (0.15-0.31) and low was 0.1-fold (0.02-0.11) for suicidal thoughts (p<.001, p<.001). For suicide plans, using high stress level as a reference, medium was 0.4- (0.20-0.72), and low was 0.1-fold (0.02-0.40)(p<.01, p<.01). For suicide attempts, using high stress levels as a reference, medium was 0.2- (0.07-0.43), and low was 0.1-fold (0.03-0.59) (p<.001, p<.01).

Second, experiencing depression in Model II was higher in females by 1.9-fold (1.41-2.65) (p<.001), and it was higher for those without a spouse by 1.4-fold (1.05-1.99) (p<.05). Using good subjective health as a reference, fair was higher by 1.3- (0.88-1.99), and poor was higher by 3.0-fold (1.96-4.60) (p<.05, p<.001). Those without physical activity restrictions experienced depression by 0.5-fold (0.36-0.66), compared to those with physical activity restrictions (p<.001). For stress levels, with high as a reference, those with medium and low stress experienced depression by 0.2-(0.16-0.27) and 0.1-fold (0.03-0.12), respectively (p<.001, p<.001). Suicidal thoughts were higher in female than males by 1.2-fold (0.76-1.77) (p<.05)and were higher in those without a spouse by 1.6-fold (1.05-2.36) (p<.05). Using good subjective health as a reference, it was higher in poor by 2.8-fold (1.58-5.01) (p<.001).

Those without physical activity restrictions had suicidal thoughts 0.4-fold (0.29-0.65) more often (p<.001). For stress levels, with high as a reference, medium and low had suicidal thoughts by 0.2- (0.15-0.32) and 0.1-fold (0.02-0.11), respectively (p<.001, p<.001). Suicide plans were higher among those without a spouse by 2.2-fold (1.12-4.47) (p<.05). For stress levels, with high as a reference, those with medium and low stress planned suicide more often by 0.4- (0.20-0.76) and 0.1-fold (0.02-0.40), respectively (p<.01, p<.01). Suicide attempts were higher among those without a spouse by 1.1-fold (0.40-3.03) (p<.05). For stress level, with high as a reference, those with medium and low stress attempted suicide by 0.2- (0.06-0.39) and 0.1-fold (0.03-0.61), respectively (p<.001, p<.01) (see Tables5 and 6).

Table 5. Factors that Influence Suicide Dimensions (Model I)

Variables		Suicide dimension			
		Experience of depression OR(95%CI)	Suicidal thoughts OR(95%CI)	Suicide plans OR(95%CI)	Suicide attempts OR(95%CI)
Gender	Male				
	Female				
Elderly classification	Young old				
	Old				
	Older old				
	Oldest old				
Residential area	Metropolitan area				
	Non-metropolitan area				
Economic activities	Present				
	Absent				
Health care system	Health insurance				
	Medical care assistance				
Spouse	Present				
	Absent				
Subjective health status	Good	1	1	1	1
	Fair	**1.400** **(0.938-2.092)***	1.184(0.607-1.596)	0.984(0.350-2.770)	1.496(0.313-7.158)
	Poor	**3.306** **(2.170-5.037)*****	**2.971** **(1.673-5.277)*****	**3.094** **(1.098-8.721)***	**4.412** **(0.915-21.262)***
Smoking	Present	1	1	1	1
	Absent	0.980(0.667-1.437)	0.811(0.485-1.357)	0.745(0.318-1.745)	0.379(0.144-0.993)
Excessive drinking	Present	1	1	1	1
	Absent	1.061(0.691-1.630)	1.212(0.641-2.290)	0.861(0.321-2.307)	1.593(0.351-7.217)
Physical activity restrictions	Present	1	1	1	1
	Absent	**0.480** **(0.358-0.645)*****	**0.408** **(0.276-0.602)*****	**0.451** **(0.229-0.888)***	**0.340** **0.140-0.826)***
Healthy physical activity attainment	Present	1	1	1	1
	Absent	**1.142** **(0.880-1.481)***	**1.331** **(0.913-1.941)***	1.284(0.686-2.582)	1.062(0.450-2.508)
Chronic disease	Present	1	1	1	1
	Absent	**0.909** **(0.702-1.177)***	1.070(0.742-1.543)	1.199(0.638-2.255)	1.520(0.659-3.503)
Stress level	High	1	1	1	1
	Medium	**0.191** **(0.145-0.250)*****	**0.212** **(0.146-0.308)*****	**0.382** **(0.202-0.723)****	**0.168** **(0.066-0.426)*****
	Low	**0.051** **(0.030-0.087)*****	**0.045** **(0.018-0.112)*****	**0.090** **(0.021-0.393)****	**0.129** **(0.028-0.589)****

Table 6. Factors that Influence Suicide Dimensions (Model II)

Variables		Suicide dimensions			
		Experience of depression OR(95%CI)	Suicidal thoughts OR(95%CI)	Suicide plans OR(95%CI)	Suicide attempts OR(95%CI)
Gender	Male	1	1	1	1
	Female	**1.937** (1.416-2.650)***	**1.160** (0.762-1.766)*	0.874(0.423-1.804)	0.589(0.238-1.462)
Elderly classification	Young old	1	1	1	1
	Old	0.855 (0.639-1.143)	0.929(0.619-1.396)	1.234(0.623-2.444)	0.988(0.398-2.456)
	Older old	0.698 (0.482-1.011)	0.713(0.427-1.192)	0.463(0.168-1.271)	0.599(0.171-2.099)
	Oldest old	**0.399** (0.183-0.872)*	**0.355** (0.117-1.078)*	0.293(0.036-2.384)	0(0)
Residential area	Metropolitan area	1	1	1	1
	Non-metropolitan area	1.047(0.804-1.364)	0.976(0.672-1.417)	1.104(0.572-2.133)	0.904(0.375-2.182)
Economic activities	Present	1	1	1	1
	Absent	1.081(0.815-1.435)	1.090(0.729-1.629)	1.598(0.775-3.297)	1.213(0.475-3.101)
Health care system	Health insurance	1	1	1	1
	Medical care assistance	**1.836** (1.164-2.896)**	**1.954** (1.091-3.498)*	1.047(0.357-3.067)	2.136(0.575-7.934)
Spouse	Present	1	1	1	1
	Absent	**1.407** (1.053-1.881)*	**1.576** (1.052-2.363)*	**2.239** (1.123-4.465)*	**1.112** (0.408-3.029)*
Subjective health status	Good	1	1	1	1
	Fair	**1.325** (0.883-1.987)*	0.857(0.481-1.527)	0.915(0.323-2.589)	1.437(0.298-6.921)
	Poor	**3.005** (1.964-4.596)***	**2.809** (1.576-5.005)***	**2.862** (1.009-8.116)*	**4.552** (0.931-22.246)*
Smoking	Present	1	1	1	1
	Absent	0.821(0.538-1.252)	0.871(0.497-1.527)	0.882(0.352-2.208)	0.534(0.186-1.530)
Excessive drinking	Present	1	1	1	1
	Absent	0.782(0.495-1.237)	1.051(0.542-2.037)	0.761(0.272-2.130)	1.779(0.383-8.271)
Physical activity restriction	Present	1	1	1	1
	Absent	**0.489** (0.361-0.663)***	**0.436** (0.293-0.650)***	**0.505** (0.252-1.012)*	**0.377** (0.150-0.951)*
Healthy physical activity attainment	Present	1	1	1	1
	Absent	1.075(0.825-1.401)	1.274(0.869-1.867)	1.301(0.664-2.551)	1.074(0.447-2.576)
Chronic disease	Present	1	1	1	1
	Absent	0.932(0.714-1.216)	1.100(0.757-1.598)	1.245(0.657-2.360)	1.479(0.633-3.453)
Stress level	High	1	1	1	1
	Medium	**0.205** (0.155-0.271)***	**0.219** (0.150-0.321)***	**0.393** (0.203-0.759)**	**0.151** (0.058-0.394)***
	Low	**0.052** (0.030-0.089)***	**0.045** (0.018-0.113)***	**0.089** (0.020-0.395)**	**0.130** (0.028-0.610)**

4. Discussion and Conclusion

4.1 Discussion

This study was conducted to recognize the severity of the elderly suicide problem that is annually increasing annually and to analyze the causes and factors influencing suicide dimensions among the elderly to provide data that can be used to establish alternatives for reducing each of the factors.

In this study, factors influencing suicide dimension in the elderly were divided into socio demographic and health behavior characteristics. By conducting hierarchical logistic regression analysis, which introduces these factors sequentially, the explanatory power of the model for each stage was additionally analyzed. The results of logistic regression analysis using the predictor variables that significantly affect the suicide dimensions among the elderly show that subjective health status, physical activity restrictions, and stress levels all had statistically significant effects in Model I and Model II. Specifically, those who had a poor subjective health status experienced depression, suicidal thoughts, suicide plans, and suicide attempts 3 times more than those with good health. This is consistent with the studies of Joo-Hee In [10] and Hee-Ah Choi [11] and in opposition to the study results of Sam-Sung Han [12]. Concerning physical activity restrictions, those without had lower suicide dimensions by 0.4-fold than those with them. This is consistent with the study by Chun Young Koo [13], and the suicidal thoughts were higher among those with physical activity restrictions for both males and females.

For stress levels, with high as a reference, suicide dimensions were lower for those with medium and low stress by 0.2- and 0.07-fold, respectively. Numerous previous studies, including those by Eun-Seok Lee [14] and Yeon-Hee Choi [15], concluded that stress affects suicidal thoughts, and the study by In-Kyun Seo [16] argued that it does not. This is likely because the elderly group was divided into those who live alone and those who do not.

For the healthy physical activity attainment in Model I,those without it had more experience of depression and suicidal thoughts by 1.2-fold than those with healthy physical activity attainment. In a study by Jeon-Eun Kim [17], the effects of depression experiences were not significant, but this is likely because they studied healthy physical activity attainment by dividing it into high intensity, intermediate level, walking, muscle strength, and flexibility exercises. Seul Ki Lee [18] studied a group restricted to females and concluded that adequate physical activity levels reduced depression, which is consistent with the findings of our study. With the experiencing of depression among suicide dimensions, those without chronic disease experienced depression less than those with chronic disease by 0.9-fold. A study by Mi-Suk Lee [19] showed a similar result and determined that chronic disease was the factor with the highest explanatory power in relation to increasing depression symptoms.

In Model II, socio demographic characteristics were all included, and the presence or absence of a spouse was determined to have a significant effect on suicide dimensions. For this factor, all aspects of suicide dimensions were higher for those without a spouse by around 1.5-fold. The study by In-Kyun Seo [16] showed a different result than our study and showed that elderly people who live with spouses or other individuals have elevated stress levels because of these relationships, and this leads to the increased effects on depression and suicidal thoughts.

The limitations of this study are as follows:
- First, it has the limitation of being a cross-sectional study. Although cross-sectional analysis on factors influencing suicide dimensions among the elderly is important, it is also necessary to conduct static studies incorporating the characteristics of the annual report.
- Second, it uses secondary data. Since there are restrictions in measuring

detailed variables due to the nature of secondary data, primary data analysis should be complemented in the future.

Despite such limitations, this study is significant in that it provides basic data by analyzing the factors influencing elderly suicide according to suicide dimensions using representative data from the Korea National Health and Nutrition Examination Survey.

4.2 Conclusion

Korea will become a super-aged society in about 10 years, when the elderly population will account for 20% of the total population. This predicts not only a quantitative increase in the aged population but also extensive changes in all related fields. Furthermore, due to lifestyle changes in the elderly population that have never before been seen, interest has increased from a psychological health standpoint; thus, many related studies have been produced. However, suicide rates among the elderly are continually increasing, and there is an emerging need for a multidirectional approach to the elderly suicide phenomenon. Because suicide has a higher probability of progressing in stages, our study divided suicide into 4 dimensions and conducted a study for each stage.

Our study results showed that the major factors influencing suicide dimensions in the elderly were subjective health status, physical activity restrictions, and stress levels. With a poor subjective health status, physical activities are restricted, and the stress level becomes high. These combined effects on suicide dimensions were negative. Elderly classification according to age characteristics did not show huge effects on the overall study. This is likely due to the nature of the Korea National Health and Nutrition Examination Survey, which was not conducted only on the elderly and thereby made detailed classifications of chiefly elderly characteristics difficult. In conclusion, increasing physical functioning through regular physical activities and health status maintenance, and escaping chronic disease and physical activity restrictions are believed to be effective ways of reducing the suicide dimensions of the elderly. Furthermore, developing social programs based not only on individual efforts but also on an accurate understanding of the elderly population will have a positive impact on reducing depression, and consequently, suicide rates among the elderly.

References

[1] M. A. Lee, "Risk Factors for Suicide Attempts of Korean Elderly: Relative Effects of Individual Traits and Social Quality", International Journal of Bio-Science and Bio-Technology, vol. 7, no. 1, (2015), pp. 51-60.

[2] B. D. Hwang, J. W. Park and R. Choi, "Factors Influencing Suicidal Ideation in the Elderly", Advanced Science and Technology Letters, vol. 104, no. 10, (2015), pp. 43-47.

[3] M. H. Park, C. S. Son and S. K. Kim, "Developing a Hybrid Decision Support Model to Discover Evidence Based Knowledge of the Elderly with Depression", International Journal of Bio-Science and Bio-Technology, vol. 5, no. 4, (2013), pp. 245-254.

[4] N. M. Hong, "Effects Of Parental Abuse And Peer Victimization on Adolescents' Suicidal Ideation: The Mediating Pathway of Interpersonal Needs And Hopelessness", Korea J. Soc. Welfare, vol. 64, no. 1, (2012), pp. 151-175.

[5] W. M. Reynolds, "Psychometric Characteristics of the Adult Suicidal Ideation Questionnaire in College Students", J. Pers. Assess, vol. 56, no. 2, (1991), pp. 289-307.

[6] S. Y. Yang, "Study On The Relationship Between Suicidal Ideation And Stress of Adolescents [MD thesis", Han-nam University, Daejeon, (2004).

[7] H. J. Lee, K. S. Kim, K. H. Kim, G. W. Nam, K. W. Min, S. S. Lee, C. H. Jeong, H. S. Lee and J. H. Park, "Factors that Affect the Suicidal Thoughts of High School in Korea: Focusing on the Socio demographic Characteristics and Delinquent Behaviors", The Korea Instit. Electron. Commun. Soc., vol. 8, no. 7, (2013), pp. 1025--1032.

[8] B. L. Neugarten, R. J. Havighurst and S. S. Tobin, "Disengagement Pattern of Aging", In Neugarten, B. L. (ed), Middle age and aging. University of Chicago Press, Chicago, (1993).

[9] E. M. Sherman and L. G. Schiffman, "Applying Age-Gender Theory from Social Gerontology to Understand the Consumer Well-Being of the Elderly", Advances Cons. Res., vol. 11, no. 1, (1984), pp. 569-573.

[10] J. H. In, "Association between physical functioning and depressive symptom [MD thesis]", Ajou

University, Suwon, **(2009)**.

[11] H. A. Choi, "An Analysis On Depression And Suicide Ideation Of Korean Adults By Using Korea National Health And Nutrition Examination Survey [MD thesis]", Kangwon National University, Gangwon, **(2011)**.

[12] S. S. Han, "Analysis of the Determining Factor of Depression Among the Elderly In Korea [MD thesis]", Daegu Haany University, Daegu, **(2010)**.

[13] C. Y. Koo, J. S. Kim and J. O. Yu, "A Study On Factors Influencing Elders' Suicidal Ideation: Focused On Comparison Of Gender Differences", J. Korean Acad Community Health Nurse, vol. 25, no. 1, **(2014)**, pp. 24-32.

[14] E. S. Yi and S. J. Lee, "The Stress, Depression, Suicidal Thoughts, and the Buffering Effect of Leisure Sports Participation Among the Elderly in Rural Area", Korean J. Sociol. Sport., vol. 22, no. 2, **(2009)**, pp. 35-54.

[15] Y. H. Choi and S. H. Kim, "Suicide Ideation and Related Factors according to Depression in Older Adults", J. Korean Gerontol. Soc., vol. 28, no. 2, **(2008)**, pp. 345--355.

[16] I. K. Seo and H. C. Cho, "Mediation Effects of Depression in the Relationship Between Stress And Suicidal Ideation of the Elderly: A Comparative Study on People who Live Alone and those Who Live with Family", J. Welfare Aged, vol. 61, no. 1, **(2013)**, pp. 135-163.

[17] J. E. Kim, "A Study On the Mental Health And Regular Exercise Of The Aged [MD thesis]", University of Seoul, Seoul, **(2009)**.

[18] S. G. Lee, "The Effects of Elderly Women's Participation in Physical Activity on her Basal Physical Fitness, Depression, and Self-Esteem [MD thesis]", INHA University, Inchun, **(2013)**.

[19] M. S. Lee, "Chronic Diseases, Depressive Symptoms, and the Effects of Social Networks in Korean Elderly Population", J. Health Med. Sociol, vol. 27, no. 2, **(2010)**, pp. 5-30.