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Depressive Symptoms and Mortality Among Middle-Aged and Older Adults in South Korea

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Objective This study's aim is to verify the longitudinal effect of depressive symptoms on all-cause mortality depending on the age group.

Methods The Korean Longitudinal Study of Aging's data from 2006 to 2016 were assessed using longitudinal data analysis, and 10,145 participants (age [mean±standard deviation], 61.7±11.1 years; males, 4,426 [43.6%]; females, 5,719 [56.4%]; middle-aged adults, 6,036 [59.5%]; older adults, 4,109 [40.5%]) were included at baseline. The chi-square test, log-rank test, factor analysis, and Cox proportional hazards models were used to investigate the association between depressive symptoms and mortality. To verify that which feelings and behaviors are associated with mortality, factor analysis was used to Center for Epidemiologic Studies Depression (CES-D) scale and it was divided into two factors: negative and positive affects.

Results The hazard ratio (HR) of all-cause mortality for the Q1 (high) of the negative affect factor was higher than the Q3 (low) of this factor (HR, 1.489; 95% confidence interval, 1.284–1.728). Additionally, the association between negative affect and all-cause mortality was stronger in middle-aged adults than older adults.

Conclusion The study provided evidence of the longitudinal effect of depressive symptoms on all-cause mortality regardless of age. However, middle-aged adults could be more sensitive to negative feelings and behaviors than older adults.

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Keywords Longitudinal effect; Cox proportional hazards; Depressive symptoms; All-cause mortality; Middle-aged adults; Older adults.

INTRODUCTION

South Korea is one of the most rapidly aging countries in the world. According to the United Nations report, it is expected to have the highest predicted growth rate (23.0%) of population aged 65 years and above (hereinafter referred to as older adults) in East Asia.[1] The number of elderly Koreans increased from 6.757 million in 2016 to 8.125 million in 2020, and the share of older adult is expected to account for 42.5% of the Korean population by 2065.[2]

The population of older adults suffering from depressive symptoms is also increasing significantly due to the increase in their population. In fact, according to the Ministry of Health and Welfare,[3] the proportion of people experiencing depression in 2017 was the highest (17.3%) among older adults aged 70 years and above. As the number of elderly people receiving medical treatment for depressive episodes increases, social and economic costs have also increased sharply from approximately 89 billion Won in 2016 to about 1.1 trillion Won in 2018, and depression is predicted to be among the top three diseases that would cause a global burden by 2030.[4,5]

Depressive symptoms negatively affect individuals' various functional areas, including physical health.[6] In particular, depression in old age can cause chronic diseases to deteriorate, increase the likelihood of other psychiatric diseases such as dementia, and ultimately shorten the life expectancy, as well as reduce the quality of life.[7,8] Furthermore, mental illness such as depression can increase the risk of death.[9,10]

Meta-analyses and longitudinal studies that analyzed the

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relationship between depression and risk of death in patients suffering from type 2 diabetes,[11] heart diseases (including failure, acute myocardial infarction, cardiovascular diseases, etc.),[12,13] end-stage renal disease,[14] stroke,[15] and cancer[16] found that these patients' risk of death increased significantly as they became more depressed.

As such, it has been reported relatively consistently that depressive symptoms are significantly related to the risk of mortality.[11,17,18] However, most previous studies had limitations in estimating the causal relationship between the two variables having used a cross-sectional design. In addition, the effect of depressive symptoms on mortality may vary depending on the age group, but a detailed study is lacking. Therefore, this study aims to verify the longitudinal effect of depressive symptoms on all-cause mortality after controlling age, education, sex, residential region, marital status, employment status, health insurance, and a number of comorbidities, as covariates. In addition, the longitudinal effects of depression between middle-aged adults (aged 64 and below) and a group of older adults were compared.

METHODS

Study sample and design

This study was conducted by the Korea Employment Information Service for this rapidly growing population by obtaining de-identified data from the first wave of the 2006 Korean Longitudinal Study of Aging (KLoSA), including the data of community-dwelling Korean participants aged 45 years or older, until the follow-up in 2016. KLoSA conducted a multistage stratified cluster sampling based on 15 geographical areas and housing types across the nation to create nationally representative longitudinal data of Koreans aged 45 years or older required by the Korea Labor Institute. The data is composed of 7 categories: population, family, health, employment, income, wealth, subjective expectations, and life expectations. In the first baseline survey in 2006, 10,254 individuals from 6,171 households (1.7 per household) were interviewed. To estimate the association between the feelings and behaviors during the past week and mortality among people aged 45 years or older, we included 10,145 participants with no missing information at baseline 2006.

This study used public data that can use freely, so approval from IRB is not essential.

Independent variables

We utilized the 10-item version of the Center for Epidemiologic Studies Depression (CES-D) scale to assess feelings and behaviors during the past week. In our database, the survey on feelings and behaviors of the past week consists of 10 items that measure a continuum of subjective probabilities by obtaining responses to the following components: 1) Annoying and hard feelings everyday, 2) difficulty concentrating, 3) depressive symptoms, 4) tough feelings about everything, 5) I thought I was doing relatively well, 6) fear of something, 7) I think I cannot sleep well, 8) the idea of living without great dissatisfaction, 9) loneliness that gives the feeling of being alone in the world, and 10) I feel as though I cannot do anything. To analyze the correlations between the items and variables, and identify the factors with high correlations, we performed exploratory factor analysis, a statistical technique, in which varimax rotation is a second step in exploratory factor analysis and principal component analysis. The exploratory factor analysis indicated two categories of 10 items for measuring depressive symptoms. In this study, it was equally classified into 3 groups: Q1 (high), Q2 (average), and Q3 (low) using the SAS Rank function (SAS Institute, Cary, NC, USA) which ranks according to the number of observations based on factor scores (factor loading). The Cronbach' alpha of CES-D short form in previous study was 0.80,[19] and in this study was 0.86.

Dependent variables

The all-cause mortality during the time interval—conducted every two years, the first wave in 2006 to the end of follow-up sixth wave in 2016—was the main outcome of the study. Deaths over a maximum follow-up period of 10 years were determined by death certificates.

Covariates

The covariates collected were age (45−54, 55−64, 65−74, and 75 years and older), education (elementary, middle, high school, and college and above), sex (male and female), residential region (urban and rural), marital status (married and single, including separated and divorced), employment status (yes and no), health insurance (national health insurance and medical aid), smoking status (non-smoker, former smoker, and smoker), alcohol use (non-drinker, former drinker, and drinker), and comorbidities of hypertension, diabetes, cancer, chronic obstructive pulmonary diseases, liver diseases, heart diseases, cerebrovascular diseases, mental illness, and arthritis or rheumatoid arthritis (0, 1, 2, 3 and above).

Statistical analysis

The chi-square test, log-rank test, exploratory factor analysis, and Cox proportional hazards models were used to investigate the associations between the feelings and behaviors of the past week and mortality. The adjusted hazard ratio (HR) was calculated using the Cox proportional hazards model. The participants' covariates of interest were added to the model to

Table 1. Sociodemographic characteristics

	Total	Mortality		p-value
		No	Yes	
Annoying and hard feelings for everyday				<0.001
I thought that for a moment, or I didn't (1 day or less)	7,611 (75.0)	6,731 (88.4)	880 (11.6)	
Sometimes I thought (1–2 days)	1,794 (17.7)	1,432 (79.8)	362 (20.2)	
I often felt like that (3–4 days)	546 (5.4)	382 (70.0)	164 (30.0)	
I always thought that (5–7 days)	194 (1.9)	129 (66.5)	65 (33.5)	
Difficulty concentrating				<0.001
I thought that for a moment, or I didn't (1 day or less)	7,663 (75.5)	6,811 (88.9)	852 (11.1)	
Sometimes I thought (1–2 days)	1,862 (18.4)	1,469 (78.9)	393 (21.1)	
I often felt like that (3–4 days)	464 (4.6)	303 (65.3)	161 (34.7)	
I always thought that (5–7 days)	156 (1.5)	91 (58.3)	65 (41.7)	
Depressive symptom				<0.001
I thought that for a moment, or I didn't (1 day or less)	7,488 (73.8)	6,628 (88.5)	860 (11.5)	
Sometimes I thought (1–2 days)	1,867 (18.4)	1,471 (78.8)	396 (21.2)	
I often felt like that (3–4 days)	609 (6.0)	450 (73.9)	159 (26.1)	
I always thought that (5–7 days)	181 (1.8)	125 (69.1)	56 (30.9)	
A tough feeling about everything				<0.001
I thought that for a moment, or I didn't (1 day or less)	6,873 (67.8)	6,113 (88.9)	760 (11.1)	
Sometimes I thought (1–2 days)	2,094 (20.6)	1,701 (81.2)	393 (18.8)	
I often felt like that (3–4 days)	857 (8.5)	649 (75.7)	208 (24.3)	
I always thought that (5–7 days)	321 (3.2)	211 (65.7)	110 (34.3)	
I thought I was doing relatively well				<0.001
I thought that for a moment, or I didn't (1 day or less)	3,925 (38.7)	3,378 (86.1)	547 (13.9)	
Sometimes I thought (1–2 days)	1,739 (17.1)	1,382 (79.5)	357 (20.5)	
I often felt like that (3–4 days)	2,069 (20.4)	1,744 (84.3)	325 (15.7)	
I always thought that (5–7 days)	2,412 (23.8)	2,170 (90.0)	242 (10.0)	
Fear of something				<0.001
I thought that for a moment, or I didn't (1 day or less)	7,775 (76.6)	6,881 (88.5)	894 (11.5)	
Sometimes I thought (1–2 days)	1,790 (17.6)	1,405 (78.5)	385 (21.5)	
I often felt like that (3–4 days)	448 (4.4)	310 (69.2)	138 (30.8)	
I always thought that (5–7 days)	132 (1.3)	78 (59.1)	54 (40.9)	
I think I can't sleep well				<0.001
I thought that for a moment, or I didn't (1 day or less)	7,062 (69.6)	6,218 (88.0)	844 (12.0)	
Sometimes I thought (1–2 days)	1,853 (18.3)	1,505 (81.2)	348 (18.8)	
I often felt like that (3–4 days)	796 (7.9)	608 (76.4)	188 (23.6)	
I always thought that (5–7 days)	434 (4.3)	343 (79.0)	91 (21.0)	
The idea of living without great dissatisfaction				<0.001
I thought that for a moment, or I didn't (1 day or less)	4,688 (46.2)	4,083 (87.1)	605 (12.9)	
Sometimes I thought (1–2 days)	1,804 (17.8)	1,419 (78.7)	385 (21.3)	
I often felt like that (3–4 days)	1,645 (16.2)	1,391 (84.6)	254 (15.4)	
I always thought that (5–7 days)	2,008 (19.8)	1,781 (88.7)	227 (11.3)	
Loneliness that seems to be alone in the world				<0.001
I thought that for a moment, or I didn't (1 day or less)	7,296 (71.9)	6,484 (88.9)	812 (11.1)	
Sometimes I thought (1–2 days)	1,991 (19.6)	1,576 (79.2)	415 (20.8)	
I often felt like that (3–4 days)	646 (6.4)	476 (73.7)	170 (26.3)	
I always thought that (5–7 days)	212 (2.1)	138 (65.1)	74 (34.9)	

Table 1. Sociodemographic characteristics (continued)

	Total	Mortality		p-value
		No	Yes	
I feel like I can't do anything				<0.001
I thought that for a moment, or I didn't (1 day or less)	7,455 (73.5)	6,641 (89.1)	814 (10.9)	
Sometimes I thought (1–2 days)	1,797 (17.7)	1,432 (79.7)	365 (20.3)	
I often felt like that (3–4 days)	639 (6.3)	457 (71.5)	182 (28.5)	
I always thought that (5–7 days)	254 (2.5)	144 (56.7)	110 (43.3)	
Age (yr)				<0.001
45–54	3,268 (32.2)	3,168 (96.9)	100 (3.1)	
55–64	2,768 (27.3)	2,561 (92.5)	207 (7.5)	
65–74	2,657 (26.2)	2,158 (81.2)	499 (18.8)	
≥75	1,452 (14.3)	787 (54.2)	665 (45.8)	
Education				<0.001
≤Elementary school	4,752 (46.8)	3,721 (78.3)	1,031 (21.7)	
Middle school	1,644 (16.2)	1,488 (90.5)	156 (9.5)	
High school	2,695 (26.6)	2,494 (92.5)	201 (7.5)	
≥College	1,054 (10.4)	971 (92.1)	83 (7.9)	
Sex				<0.001
Male	4,426 (43.6)	3,636 (82.2)	790 (17.8)	
Female	5,719 (56.4)	5,038 (88.1)	681 (11.9)	
Residential region				<0.001
Urban	6,604 (65.1)	5,753 (87.1)	851 (12.9)	
Rural	3,541 (34.9)	2,921 (82.5)	620 (17.5)	
Marital status				<0.001
Married	7,896 (77.8)	6,979 (88.4)	917 (11.6)	
Single (including separated, divorced)	2,249 (22.2)	1,695 (75.4)	554 (24.6)	
Employment status				<0.001
Yes	3,931 (38.8)	3,677 (93.5)	254 (6.5)	
No	6,214 (61.3)	4,997 (80.4)	1,217 (19.6)	
National health insurance				<0.001
Health insurance	9,523 (93.9)	8,211 (86.2)	1,312 (13.8)	
Medical aid	622 (6.1)	463 (74.4)	159 (25.6)	
Smoking status				<0.001
Never	7,218 (71.2)	6,310 (87.4)	908 (12.6)	
Former smoker	972 (9.6)	747 (76.9)	225 (23.1)	
Smoker	1,955 (19.3)	1,617 (82.7)	338 (17.3)	
Alcohol use				<0.001
Never	3,855 (38.0)	3,382 (87.7)	473 (12.3)	
Former drinker	680 (6.7)	490 (72.1)	190 (27.9)	
Drinker	5,610 (55.3)	4,802 (85.6)	808 (14.4)	
Number of chronic disease				<0.001
0	5,344 (52.7)	4,810 (90.0)	534 (10.0)	
1	2,932 (28.9)	2,444 (83.4)	488 (16.6)	
2	1,296 (12.8)	1,003 (77.4)	293 (22.6)	
≥3	573 (5.7)	417 (72.8)	156 (27.2)	
Total	10,145 (100.0)	8,674 (85.5)	1,471 (14.5)	

determine their effects on the mortality probability. The outcome variable was survival time, which was measured from the date of enrollment until death or censoring (up to 10 years). For all analyses, the criterion for statistical significance was $p<0.05$, two-tailed. All analyses were conducted using the SAS statistical software package, version 9.4 (SAS Institute).

RESULTS

Sample characteristics

The participants' baseline characteristics are shown in Table 1. Of the 10,145 participants whose data were collected at baseline, 1,471 (14.5%) were reported deceased by the end of the follow-up period. In terms of age, the middle-aged (45−64 years) comprised 6,036 (59.5%) and older adults 4,109 (40.5%). In relation to deaths at the end of the follow-up period, there were 100 (3.1%) deaths among 3,268 participants aged 45−54 years, 207 (7.5%) deaths among 2,768 participants aged 55−64 years, 499 (18.8%) deaths among 2,657 participants aged 65−74 years, and 665 (45.8%) deaths among 1,452 participants aged 75 years and above. General characteristics of education, sex, residential region, marital status, labor, health insurance, smoking status, alcohol use, and number of chronic diseases are also listed in Table 1.

Factor analysis

The Kaiser-Meyer-Olkin (KMO) index values of 0.91, and the Bartlett's Test of Sphericity ($p<0.001$), verified the normality distribution and the adequacy of the sample size for exploratory factor analysis. Table 2 indicates the exploratory factor analysis for categorizing a few elements consisting of feelings and behaviors of the past week. We categorized 2 groups (negative and positive affect factors), according to their exploratory factor analysis scores.

Table 2. Results of factor analysis

	Factor 1	Factor 2
Item		
Depressive symptom	0.874	-0.056
A tough feeling about everything	0.858	-0.035
I feel like I can't do anything	0.854	-0.040
Difficulty concentrating	0.841	-0.057
Annoying and hard feelings for everyday	0.836	-0.030
Loneliness that seems to be alone in the world	0.815	-0.028
Fear of something	0.805	-0.042
I think I can't sleep well	0.619	0.157
The idea of living without great dissatisfaction	0.029	0.909
I thought I was doing relatively well	-0.070	0.906
Eigenvalue	5.347	1.675
Proportion	0.535	0.168

Factor 1, negative affect factor; factor 2, positive affect factor

Relationship between depressive symptoms and all-cause mortality

Table 3 shows that after adjusting for age, education, sex, residential region, marital status, labor, health insurance, smoking status, alcohol use, and number of chronic diseases, the HR of all-cause mortality for the Q1 (high) of the negative affect (factor 1) was 1.489 times higher ($p<0.001$; 95% confidence interval [CI]=1.284−1.728) than in the Q3 (low) of the negative affect factor. However, the HR of all-cause mortality for the Q1 (high) of the positive affect (factor 2) was not significantly higher ($p=0.427$; HR, 0.942; 95% CI, 0.813−1.092) than in the Q3 (low) of the positive affect factor.

Relationship between depressive symptoms and all-cause mortality according to age

Table 3 represents the adjusted effect between depressive symptoms and all-cause mortality according to age. After adjusting for all confounders, the HR of all-cause mortality was 1.807 times higher ($p<0.001$; 95% CI, 1.313−2.488) and 1.390 times higher ($p<0.001$; 95% CI, 1.175−1.644) in middle-aged and older adults, respectively, with Q1 (high) of negative affect factor as compared to those with Q3 (low) of negative affect factor. However, the HR of all-cause mortality for the Q1 (high) of the positive affect (factor 2) was not significantly higher than in the Q3 (low) of the positive affect factor in middle-aged adults ($p=0.298$; HR, 0.848; 95% CI, 0.622−1.156) and older adults ($p=0.817$; HR, 0.980; 95% CI, 0.828−1.160).

Kaplan-Meier survival curves

Kaplan-Meier survival curves assessed whether factor patterns affected significantly all-cause mortality and result of survival plots was in Figure 1. In the case of factor 1, there was a significant difference ($p<0.001$) in the cumulative survival rate as a result of the log-rank test between the three groups, whereas there was no significant difference in the case of factor 2 ($p=0.776$).

DISCUSSION

This study's primary purpose was to examine the association between depressive symptoms and all-cause mortality in middle-aged and older adults using the longitudinal models for nationally representative data from 2006 to 2016 in South Korea. The following are the main results of this study.

First, this study used the 10-item version of the CES-D scale

Table 3. Result of cox proportional hazards model

	Total			Mortality (≤64 years)			Mortality (≥65 years)		
	HR	95% CI	p-value	HR	95% CI	p-value	HR	95% CI	p-value
Factor 1									
Q1 (high)	1.489	1.284–1.728	<0.001	1.807	1.313–2.488	<0.001	1.390	1.175–1.644	<0.001
Q2 (average)	1.069	0.905–1.262	0.432	1.215	0.869–1.700	0.255	1.017	0.840–1.232	0.864
Q3 (low)	1.000								
Factor 2									
Q1 (high)	0.942	0.813–1.092	0.427	0.848	0.622–1.156	0.298	0.980	0.828–1.160	0.817
Q2 (average)	0.910	0.795–1.042	0.174	0.822	0.613–1.103	0.192	0.942	0.808–1.097	0.442
Q3 (low)	1.000								
Age (yr)									
45–54	1.000			1.000				N/A	
55–64	1.842	1.440–2.356	<0.001	1.635	1.259–2.125	<0.001			
65–74	3.710	2.932–4.696	<0.001		N/A		1.000		
≥75	9.434	7.393–12.038	<0.001				2.648	2.340–2.996	<0.001
Education									
≤Elementary school	1.490	1.173–1.892	0.001	1.950	1.243–3.058	0.004	1.280	0.965–1.697	0.087
Middle school	1.149	0.878–1.504	0.312	1.409	0.880–2.257	0.153	1.015	0.729–1.414	0.929
High school	1.085	0.839–1.403	0.535	1.328	0.854–2.065	0.208	0.966	0.702–1.331	0.834
≥College	1.000								
Sex									
Male	2.499	2.141–2.916	<0.001	3.731	2.653–5.246	<0.001	2.155	1.805–2.572	<0.001
Female	1.000								
Residential region									
Urban	1.000								
Rural	1.262	1.134–1.404	<0.001	1.366	1.085–1.720	0.008	1.224	1.085–1.382	0.001
Marital status									
Married	1.000								
Single (including separated, divorced)	1.423	1.251–1.619	<0.001	1.797	1.341–2.408	<0.001	1.290	1.115–1.493	0.001
Labor									
Yes	0.570	0.489–0.666	<0.001	0.479	0.369–0.623	<0.001	0.646	0.533–0.782	<0.001
No	1.000								
National health insurance									
Health insurance	0.959	0.809–1.136	0.628	0.877	0.580–1.324	0.531	0.994	0.824–1.199	0.948
Medical aid	1.000								
Smoking status									
Non-smoker	1.324	1.114–1.575	0.002	1.170	0.787–1.738	0.438	1.351	1.114–1.639	0.002
Former smoker	1.426	1.227–1.657	<0.001	1.278	0.930–1.756	0.130	1.427	1.202–1.696	<0.001
Smoker	1.000								
Alcohol use									
Non-drinker	1.000								
Former drinker	1.213	1.019–1.444	0.030	1.236	0.830–1.842	0.297	1.211	0.997–1.472	0.054
Drinker	1.179	1.028–1.353	0.019	1.178	0.886–1.567	0.259	1.182	1.010–1.383	0.038

Table 3. Result of cox proportional hazards model (continued)

	Total			Mortality (≤64 years)			Mortality (≥65 years)		
	HR	95% CI	p-value	HR	95% CI	p-value	HR	95% CI	p-value
Number of chronic disease									
0	1.000								
1	1.039	0.916–1.179	0.552	1.122	0.848–1.483	0.421	0.996	0.865–1.148	0.961
2	1.301	1.122–1.508	0.001	1.488	1.052–2.105	0.025	1.229	1.044–1.448	0.013
≥3	1.413	1.171–1.705	<0.001	1.995	1.279–3.112	0.002	1.273	1.034–1.568	0.023

HR, hazard ratio; CI, confidence interval, N/A, not applicable

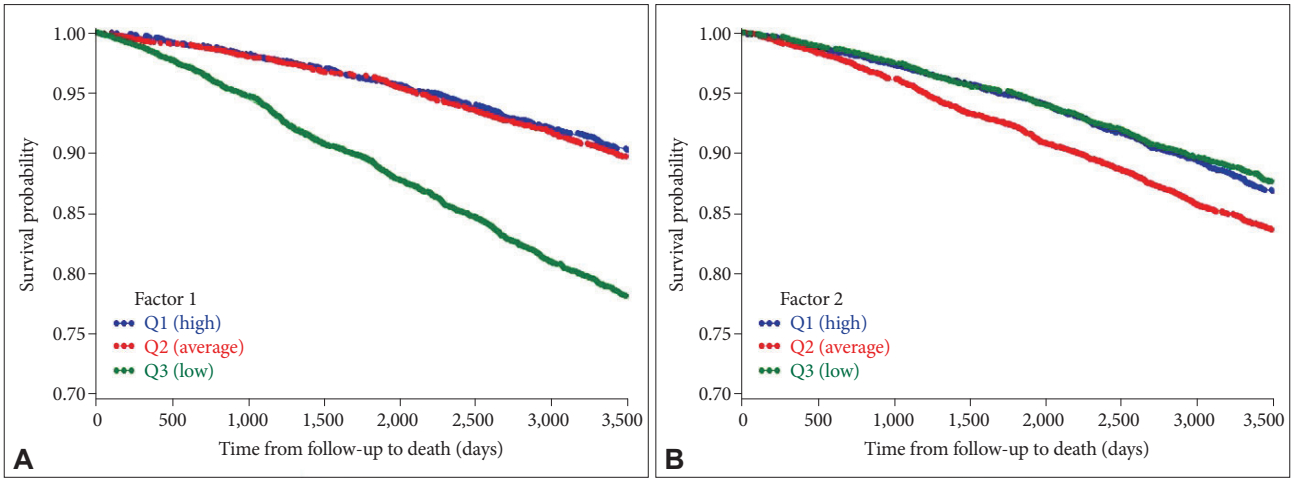

Figure 1. Difference for all-cause mortality. A: In factor 1 (negative affect factor). B: In factor 2 (positive affect factor).

to assess feelings and behaviors during the past week, and categorized these items as two factors (negative and positive affects) using exploratory factor analysis. These results support the various studies that had analyzed CES-D,[20,21] and found that it was composed of two factors.

Second, Q1 (high) of the negative affect factor was significantly associated with the increased risk of all-cause mortality, whereas Q1 (high) of the positive affect factor was not significantly associated with the risk of all-cause mortality. In particular, it was found that the risk of mortality increased significantly in both the middle-aged and older adults, when they experienced more negative affect factors. These results suggest there is a possibility that people who experiencing negative affects more than recognizing lack of positive things in daily life could be more vulnerable to the depression. Depressive symptoms were significantly associated with the risk of mortality, and these mechanism could be explained by response expectancy theory.

According to the response expectancy theory, negative mood regulation (NMR) expectancies could be defined as "the expectancy that some behavior or cognition will alleviate a negative mood state."[22] NMR expectancies are a major variable influencing not only how to control emotions when facing stress or negative affects in daily life, but also on how to interpret these emotions and choose the appropriate coping strategies, and are closely related to the severity and longevity of depressive symptoms.[23,24] When people with lower NMR expectancies experience negative feelings and behaviors in daily life, it is difficult to alleviate their negative moods because they tend to use avoidant coping strategies, and this maladaptive coping which worsens their depressive symptoms is likely to lead to a decrease in NMR expectancies again.[22] Additionally, depressed people who have a low-level NMR expectancies tend to see the future pessimistically and expect a shorter lifespan than others.[8] Since subjective expectations for the future play an important role in decision making,[25,26] negative subjective expectations for the future can lead to hopelessness, low well-being, or negative lifestyles. People who suffered from psychological distress were more likely than nondepressed people to choose and maintain maladaptive behaviors, including a tendency to be less physically active, adopt more avoidance coping, become underweight/overweight, or indulge in substance abuse.[6,12,25,27] Also, since maladaptive behavior increases the likelihood of re-increasing depression, this negative cycle could be a cause of the increased risk of mortality.

Third, regarding age-specific associations with depressive

symptoms and all-cause mortality, Q1 (high) of negative affect factors were likely to increase the risk of all-cause mortality regardless of age. Middle-aged adults who experienced negative feelings and behaviors in their life had a higher risk of all-cause mortality than older adults. This result could be interpreted by Korean social perspectives. According to the Korean Statistical Information Services,[28] the participation rate in economic activities was 31.5% for those aged over 65 years, whereas it was 81.1% and 77.0% for those in their 40s and 50s, respectively. Older adults were often unemployed due to retirement and were more likely than other age groups to receive pensions, aid through government policies, or financial support from their children, which is why they experienced relatively less negative stress when they were socially and economically active.[25] However, middle-aged adults actively engage in economic activities and incur a large amount of expenditure due to child rearing expenses, including private education expenses,[29] so they cannot discontinue their economic activities, even if they experience negativism in social activities. Thus, there is a possibility that middle-aged adults are more sensitive to negative experiences because they are more likely to be exposed to negative emotions, behaviors, and stress from relationships with others or from their surroundings, whereas older adults are more likely to develop depression due to loneliness caused by social isolation.[30,31]

The limitation of this study is the result that Q1 (high) of positive affect factors were not significantly associated with the risk of all-cause mortality even though all the individual items were significantly associated with it, which may have been due to the relatively small number and vague content of items about positive feelings and behaviors. According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition,[32] loss of interest or pleasure is essential symptom to diagnose major depressive disorder. However, factor 2 items that translated in Korean and used in KLoSA to check positive affect were not only small in number as two questions but also consisted of ambiguous content to measure loss of interest or pleasure (e.g., do you think you've been relatively doing well for the past week?).[33] Therefore, future studies need to consider increasing the number and clarifying the content of items on positive affects and assessing other factors that may account for the association between depressive symptoms and mortality, such as family medical history or kinds of occupation.

Despite these limitations, this study has strengths and contributions. In particular, we used a nationwide representative sample and the 10-year follow-up database. These findings suggest that confirming the longitudinal effects of the negative affect factor on the risk of mortality provide clear information on depressive symptoms influencing the increase in all-cause mortality even when covariates such as demographic variables and health status are in control, as against the limitation of previous studies that focused only on the relationship between depression and suicide. In addition, through exploratory factor analysis, it was confirmed that the negative affect had a more significant effect on the worsening of depressive symptoms and the increase in mortality than the positive affect on the relief from the depressive symptoms and mortality. Also, middle-aged adults could be more sensitive to negative feelings and behaviors than older adults. Therefore, the results of this study suggest that specialized psychological services or programs for every age group are needed to help in adaptively dealing with negative feelings and behaviors in daily.

Availability of Data and Material

The datasets generated or analyzed during the current study are available in the [KOREA EMPLOYMENT INFORMATION SERVICE] repository, [https://survey.keis.or.kr/klosa/klosadownload/List.jsp].

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: all authors. Data curation: Jae-Hyun Kim. Formal analysis: Jae-Hyun Kim. Investigation: Hyeon-Seung Yun. Methodology: Jae-Hyun Kim. Project administration: Sung-Man Bae. Supervision: Sung-Man Bae. Validation: Jae-Hyun Kim. Visualization: Jae-Hyun Kim. Writing—original draft: Hyeon-Seung Yun. Writing—review & editing: all authors.

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REFERENCES

1. United Nations. World population ageing 2019: highlights. Available at: https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2019-Highlights.pdf. Accessed August 18, 2020.
2. Statistics Korea. Population projections for Korea. Available at: http://kosis.kr/conts/nsportalStats/nsportalStats_0102Body.jsp?menuId=10&NUM=1014&searchKeyword=&freq. Accessed September 20, 2020.
3. Ministry of Health and Welfare. Korea national health & nutrition examination survey. Available at: http://www.index.go.kr/unify/idx-info.do?idxCd=4236. Accessed August 11, 2020.
4. Vyas CM, Okereke OI. Late-life depression: a narrative review on risk factors and prevention. Harv Rev Psychiatry 2020;28:72-99.
5. Yun HS, Bae SM. Influence of health status, cognitive function, and social capital on depressive symptoms in Korean older adults. J Psychosoc Nurs Ment Health Serv 2020;58:24-31.
6. Belvederi Murri M, Ekkekakis P, Magagnoli M, Zampogna D, Cattedra S, Capobianco L, et al. Physical exercise in major depression: reducing the mortality gap while improving clinical outcomes. Front Psychiatry 2019;9:762.
7. Gertner AK, Domino ME, Dow WH. Risk factors for late-life depression and correlates of antidepressant use in Costa Rica: results from a

nationally-representative longitudinal survey of older adults. J Affect Disord 2017;208:338-344.
8. Gilman SE, Sucha E, Kingsbury M, Horton NJ, Murphy JM, Colman I. Depression and mortality in a longitudinal study: 1952-2011. CMAJ 2017;189:E1304-E1310.
9. Holwerda TJ, van Tilburg TG, Deeg DJ, Schutter N, Van R, Dekker J, et al. Impact of loneliness and depression on mortality: results from the Longitudinal Ageing Study Amsterdam. Br J Psychiatry 2016;209:127-134.
10. Pratt LA, Druss BG, Manderscheid RW, Walker ER. Excess mortality due to depression and anxiety in the United States: results from a nationally representative survey. Gen Hosp Psychiatry 2016;39:39-45.
11. Naicker K, Johnson JA, Skogen JC, Manuel D, Øverland S, Sivertsen B, et al. Type 2 diabetes and comorbid symptoms of depression and anxiety: longitudinal associations with mortality risk. Diabetes Care 2017;40:352-358.
12. Chiu M, Vigod S, Rahman F, Wilton AS, Lebenbaum M, Kurdyak P. Mortality risk associated with psychological distress and major depression: a population-based cohort study. J Affect Disord 2018;234:117-123.
13. Gathright EC, Goldstein CM, Josephson RA, Hughes JW. Depression increases the risk of mortality in patients with heart failure: a meta-analysis. J Psychosom Res 2017;94:82-89.
14. Farrokhi F, Abedi N, Beyene J, Kurdyak P, Jassal SV. Association between depression and mortality in patients receiving long-term dialysis: a systematic review and meta-analysis. Am J Kidney Dis 2014;63:623-635.
15. Pan A, Sun Q, Okereke OI, Rexrode KM, Hu FB. Depression and risk of stroke morbidity and mortality: a meta-analysis and systematic review. JAMA 2011;306:1241-1249.
16. Cuijpers P, Vogelzangs N, Twisk J, Kleiboer A, Li J, Penninx BW. Comprehensive meta-analysis of excess mortality in depression in the general community versus patients with specific illnesses. Am J Psychiatry 2014;171:453-462.
17. Machado MO, Veronese N, Sanches M, Stubbs B, Koyanagi A, Thompson T, et al. The association of depression and all-cause and cause-specific mortality: an umbrella review of systematic reviews and meta-analyses. BMC Med 2018;16:112.
18. Russ TC, Stamatakis E, Hamer M, Starr JM, Kivimäki M, Batty GD. Association between psychological distress and mortality: individual participant pooled analysis of 10 prospective cohort studies. BMJ 2012;345:e4933.
19. Irwin M, Artin KH, Oxman MN. Screening for depression in the older adult: criterion validity of the 10-item center for epidemiological studies depression Scale (CES-D). Arch Intern Med 1999;159:1701-1704.
20. Wang M, Armour C, Wu Y, Ren F, Zhu X, Yao S. Factor structure of the CES-D and measurement invariance across gender in Mainland Chinese adolescents. J Clin Psychol 2013;69:966-979.
21. Zhang W, O'Brien N, Forrest JI, Salters KA, Patterson TL, Montaner JS, et al. Validating a shortened depression scale (10 item CES-D) among HIV-positive people in British Columbia, Canada. PLoS One 2012;7:e40793.
22. Brockmeyer T, Holtforth MG, Pfeiffer N, Backenstrass M, Friederich HC, Bents H. Mood regulation expectancies and emotion avoidance in depression vulnerability. Pers Individ Differ 2012;53:351-354.
23. Kassel JD, Bornovalova M, Mehta N. Generalized expectancies for negative mood regulation predict change in anxiety and depression among college students. Behav Res Ther 2007;45:939-950.
24. Pfeiffer N, Kaemmerer A, Mearns J, Catanzaro SJ, Backenstrass M. Generalized expectancies for negative mood regulation and major depressive disorder: the role of previous depressive episodes and comorbid mental disorders. Psychopathology 2011;44:152-157.
25. Choi JW, Kim JH, Yoo KB. Subjective expectations for future and mortality among middle-aged and older adults. Medicine (Baltimore) 2020;99:e19421.
26. Elder TE. The predictive validity of subjective mortality expectations: evidence from the Health and Retirement Study. Demography 2013;50:569-589.
27. Carver CS, Scheier MF, Segerstrom SC. Optimism. Clin Psychol Rev 2010;30:879-889.
28. Korean Statistical Information Services. Economically active population survey. Available at: http://kosis.kr/statHtml/statHtml.do?orgId=101&tblId=DT_1DA7002S&vw_cd=MT_ZTITLE&list_id=B11&seqNo=&lang_mode=ko&language=kor&obj_var_id=&itm_id=&conn_path=MT_ZTITLE. Accessed September 13, 2020.
29. Korean Statistical Information Services. Private Education expenditures survey for elementary, middle and high school students in 2017. Available at: http://kosis.kr/conts/nsportalStats/nsportalStats_0102Body.jsp;jsessionid=uw9dDzFjpaApQMH8t75atWxy4MDL5Vj0Kmhb0l0AQ0fULjuNVgBudC7axnSK3wT4.STAT_WAS2_servlet_engine4?menuId=14&NUM=1142&cntUpdate=Y. Accessed July 11, 2020.
30. Bodner E, Bergman YS. Loneliness and depressive symptoms among older adults: the moderating role of subjective life expectancy. Psychiatry Res 2016;237:78-82.
31. Kang BR, Oh HY, Seo YJ, Gil EH, Jo AR. Experience of depression regarding psychosocial factors in middle-class Korea workers: comparison of life cycle analysis. Korean J Occup Health Nurs 2020;29:49-57.
32. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition. Arlington: American Psychiatric Publishing; 2013.
33. Lim KH. Development and validation of gratitude disposition scale. Korea Journal of Counseling 2010;11:1-17.