



# Association of Geriatric Depressive Symptoms and Government-Initiated Senior Employment Program: A Population-Based Study

Soyeon Park<sup>1</sup>, Yeojin Kim<sup>1</sup>, Sunwoo Yoon<sup>1</sup>, You Jin Nam<sup>1</sup>, Sunhwa Hong<sup>1</sup>, Yong Hyuk Cho<sup>1</sup>, Sang Joon Son<sup>1,2</sup>, Chang Hyung Hong<sup>1,2</sup>, Jai Sung Noh<sup>1</sup> ✉, and Hyun Woong Roh<sup>1,2</sup> ✉

<sup>1</sup>Department of Psychiatry, Ajou University School of Medicine, Suwon, Republic of Korea

<sup>2</sup>Suwon Geriatric Mental Health Center, Suwon, Republic of Korea

**Objective** The impact of the government-initiated senior employment program (GSEP) on geriatric depressive symptoms is underexplored. Unearthing this connection could facilitate the planning of future senior employment programs and geriatric depression interventions. In the present study, we aimed to elucidate the possible association between geriatric depressive symptoms and GSEP in older adults.

**Methods** This study employed data from 9,287 participants aged 65 or older, obtained from the 2020 Living Profiles of Older People Survey. We measured depressive symptoms using the Korean version of the 15-item Geriatric Depression Scale. The principal exposure of interest was employment status and GSEP involvement. Data analysis involved multiple linear regression.

**Results** Employment, independent of income level, showed association with decreased depressive symptoms compared to unemployment ( $p < 0.001$ ). After adjustments for confounding variables, participation in GSEP jobs showed more significant reduction in depressive symptoms than non-GSEP jobs ( $\beta = -0.968$ , 95% confidence interval [CI] = -1.197 to -0.739,  $p < 0.001$  for GSEP jobs,  $\beta = -0.541$ , 95% CI = -0.681 to -0.401,  $p < 0.001$  for non-GSEP jobs). Notably, the lower income tertile in GSEP jobs showed a substantial reduction in depressive symptoms compared to all income tertiles in non-GSEP jobs.

**Conclusion** The lower-income GSEP group experienced lower depressive symptoms and life dissatisfaction compared to non-GSEP groups regardless of income. These findings may provide essential insights for the implementation of government policies and community-based interventions.

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**Keywords** Senior employment program; Geriatric depression; Employment status; Income level.

## INTRODUCTION

Late-life depression is an essential public health issue worldwide. It deserves attention because it is the cause of suffering, family disruption, disability, worsening of medical conditions, and increase in mortality.<sup>1-3</sup> Globally, the prevalence of

major depression in older adults is reported to be 13.3%.<sup>4</sup> Late-life depression has also become a critical problem in the Republic of Korea owing to the rapidly aging population. In 2019, Korean adults aged 65 or more accounted for 15.5% of the total population, and this number is speculated to escalate to 25.5% in 2030 and 34.3% in 2040.<sup>5,6</sup> Among this large population of older adults, the reported prevalence of late-life depression is approximately 15%, and it can get as high as 33%.<sup>7,8</sup>

In some studies, it is demonstrated that unemployment leads to depression in older adults and impairs mental health.<sup>9,10</sup> Correspondingly, another study revealed that older adults who worked experienced fewer depressive symptoms, better mental well-being, and higher life satisfaction than retirees.<sup>11</sup> The same applies to late-life depression in the Republic of Korea. Studies based on Korean National Health and Nutrition Examination Survey showed that being employed is associated with a low prevalence of depression in older adults.<sup>12,13</sup> It is in-

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✉ **Correspondence:** Jai Sung Noh, MD

Department of Psychiatry, Ajou University School of Medicine, 164 Worldcup-ro, Yeongtong-gu, Suwon 16499, Republic of Korea  
**Tel:** +82-31-219-5180, **Fax:** +82-31-219-5179, **E-mail:** jsnoh@ajou.ac.kr

✉ **Correspondence:** Hyun Woong Roh, MD, PhD

Department of Psychiatry, Ajou University School of Medicine, 164 Worldcup-ro, Yeongtong-gu, Suwon 16499, Republic of Korea  
**Tel:** +82-31-219-7851, **Fax:** +82-31-219-5179, **E-mail:** hansin8607@ajou.ac.kr

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interesting to note that participation of older adults in senior employment programs is associated with low depressive symptoms.<sup>14,15</sup> In the Republic of Korea, the Senior Employment and Social Activity Support Program was launched in 2004 to guarantee supplementary income and promote social participation among older adults aged 65 or more. The program developed, and, in 2020, the number of accumulated participants was 840,673.<sup>16</sup> The majority of jobs that participants engaged in entailed working for public facilities including public health centers, welfare facilities, childcare centers, and libraries. Other jobs involved caring for people with lack of social support such as vulnerable elderly and the handicapped. The mean of monthly income was approximately 474,200 won.

Although there are pre-existing studies that imply that a senior employment program is associated with low depressive symptoms,<sup>14,15</sup> the association has only been studied in a few research with lack of comparison with non-senior employment program jobs. Additionally, despite the point that considering income level is important when examining this relationship, analysis according to income level has not been yet performed. Owing to the point that most jobs of the program provide low income, to observe the association between senior employment programs and geriatric depressive symptoms, senior employment program jobs and non-senior employment program jobs should be compared according to the income level. The relationship between the income level and late-life depression is controversial. It is indicated that low income is associated with depression in old age.<sup>17</sup> According to another study, the prevalence and persistence of depressive symptoms in older adults were associated with socio-economic disadvantage.<sup>18</sup> Similarly, it is also demonstrated that higher socio-economic status was a protective factor for emotional health in older adults.<sup>19</sup> However, another study found that low income was not a risk factor for major depressive disorder in individuals aged 65 years or more.<sup>20</sup>

Therefore, in the present study, we aimed to elucidate the association between geriatric depressive symptoms and government-initiated senior employment program (GSEP) jobs by analyzing 1) the association between being employed and geriatric depressive symptoms, 2) the association between the income level and geriatric depressive symptoms, 3) the association of GSEP employment status (unemployed, non-GSEP jobs, GSEP jobs) with geriatric depressive symptoms, and 4) the association of GSEP employment status (unemployed, non-GSEP jobs, GSEP jobs) with geriatric depressive symptoms based on income levels. We also aimed to identify whether a certain factor (general depressive affect, life satisfaction, withdrawal) of the geriatric depressive symptoms was especially associated in particular.<sup>21</sup> A path diagram that depicts the hypotheses of this study is provided in Supplemen-

tary Figure 1 (in the online-only Data Supplement). We expect that clarifying the association between GSEP jobs and geriatric depressive symptoms compared to non-GSEP jobs according to the income level will provide insights in implementing government policies and interventions regarding senior employment program and geriatric depression in public health aspect.

## METHODS

### Study population and recruitment

In this study, the participants of the Living Profiles of Older People Survey (LPOPS) 2020 were chosen, who were 10,097 individuals aged 65 years or older. LPOPS is a nationwide inspection held every 3 years, starting from 2008. LPOPS 2020 is the fifth survey and was conducted from September 14, 2020 to November 20, 2020. We excluded 810 participants, leaving only 9,287 for analysis (Figure 1). Individuals related to cognitive decline or missing in value ( $n=615$ ), disability affecting survey response ( $n=87$ ), missing in the main outcome (geriatric depressive symptoms) ( $n=0$ ), missing in covariates ( $n=95$ ), and missing in the main exposure (employment status, GSEP, the income level) ( $n=13$ ) were excluded.

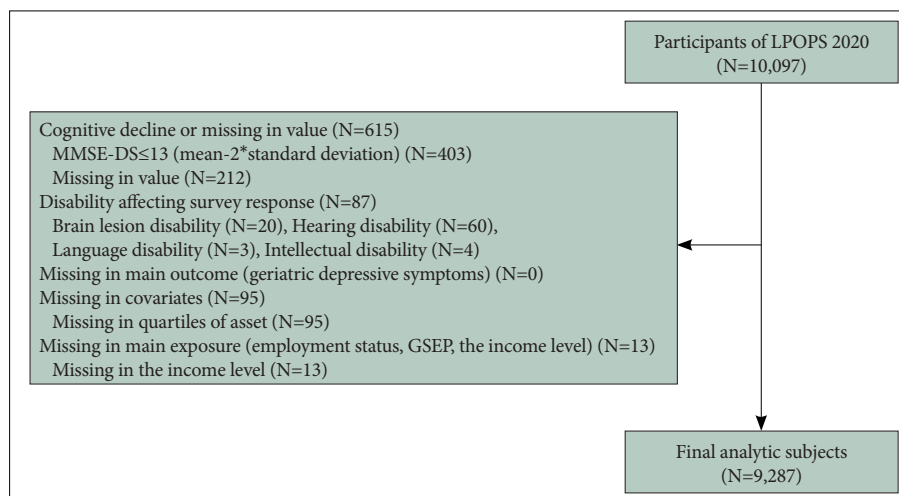
To assess cognitive decline, Mini Mental State Examination-Dementia Screening (MMSE-DS) score was used.<sup>22</sup> The cut-off was “mean–2\*standard deviation (13.702).” Thus, participants with MMSE-DS score of 13 or below ( $n=403$ ) were excluded, and those with missing values of MMSE-DS score ( $n=212$ ) were also excluded. Next, those with disabilities affecting survey response were excluded, including brain lesion ( $n=20$ ), hearing ( $n=60$ ), language ( $n=3$ ), and intellectual disabilities ( $n=4$ ). None were missing in the main outcome, which were geriatric depressive symptoms. Those missing in covariates ( $n=95$ ) were excluded, which were those missing in quartiles of an asset. Lastly, those missing in the main exposure (employment status, GSEP, the income level) ( $n=13$ ) were excluded, which were those missing in the income level.

The study was approved by the Institutional Review Board of Ajou University Hospital (AJOUIRB-EX-2023-016). At the time of the survey, written informed consent was obtained from all participants.

### Study assessments

#### Geriatric depressive symptoms

Geriatric depressive symptoms were the main outcome measured by the Korean version of the 15-item Geriatric Depression Scale (SGDS-K).<sup>23,24</sup> This scale is composed of 15 binary questions about depressive and non-depressive symptoms. After oppositely converting scores of questions about



**Figure 1.** Flowchart of study participants. LPOPS, Living Profiles of Old People Survey; MMSE-DS, Mini Mental Status Examination–Dementia Screening; GSEP, government-initiated senior employment program.

non-depressive symptoms, the scores were added up. The full score was 15, and higher scores meant higher degree of geriatric depressive symptoms.

For analyzing three factors of geriatric depressive symptoms, excluding question #10, the rest 14 questions were classified into three groups: general depressive affect (factor 1: question #3, #4, #6, #8, #12, #14, #15), life dissatisfaction (factor 2: question #1, #5, #7, #11), and withdrawal (factor 3: question #2, #9, #13).<sup>21</sup> The SGDS-K score of each factor was estimated by adding up scores of questions belonging to each factor. In this study, we named the second factor “life dissatisfaction” instead of “life satisfaction” because scores of non-depressive symptoms were converted oppositely.

#### Employment status, GSEP, and income level

Employment status, GSEP, and the income level were the main exposure. First, we studied the association between being employed and geriatric depressive symptoms by classifying participants into those who were currently unemployed and those who were currently employed. Participants who answered that they have worked in the past but are not working in the present and those who answered that they have never worked in their whole life were classified as those who were currently unemployed. Participants who answered that they were working in the present were classified as those who were currently employed. Among total 9,287 participants in this study, 5,692 (61.3%) participants were currently unemployed, and 3,595 (38.7%) participants were currently employed.

Second, we studied the association between the income level and geriatric depressive symptoms by classifying participants into four groups according to the level of average monthly income. First, we set aside those who were currently

unemployed as a separate group. Second, we classified the rest into tertiles of approximately equal numbers of participants (1,180, 1,162, and 1,253, respectively) according to the level of average monthly income. Thus, the first group was those who were currently unemployed. The second group was those whose income level belonged to the lower tertile, which was from 10,000 to 680,000 won (approximately 7 to 472 US dollars). The third group was those whose income level belonged to the middle tertile, which was from 700,000 to 1,750,000 won (approximately 486 to 1,215 US dollars). The fourth group was those whose income level belonged to the upper tertile, which was from 1,800,000 to 50,000,000 won (approximately 1,249 to 34,702 US dollars). The number of participants in each group was 5,692 (61.3%), 1,180 (12.7%), 1,162 (12.5%), and 1,253 (13.5%), respectively.

Third, we examined the association between GSEP and geriatric depressive symptoms by classifying participants into three groups. The first group was those who were currently unemployed. The second group was those who engaged in jobs that were not part of GSEP and included employers, own-account makers, unpaid family workers, regular employees, temporary employees, and daily employed workers who did not engage in GSEP. Non-GSEP jobs were mostly comprised of farming, fishing, cleaning, and cooking. The third group was those who participated in GSEP and included regular employees, temporary employees, and daily employed workers who engaged in GSEP. As previously mentioned, GSEP jobs mostly involved roles at public institutions and assisting individuals with limited social support. The number of participants in each group was 5,692 (61.3%), 2,927 (31.5%), and 668 (7.2%), respectively.

Lastly, we classified the participants into seven groups according to both GSEP and the income level. The first group

was currently unemployed participants. The second, third, and fourth groups engaged in non-GSEP jobs and their income level belonged to the lower, middle, and upper tertiles, respectively. The fifth, sixth, and seventh groups engaged in GSEP jobs and their income level belonged to the lower, middle, and upper tertiles, respectively. The number of participants in each group was 5,692 (61.3%), 577 (6.2%), 1,112 (12.0%), 1,238 (13.3%), 603 (6.5%), 50 (0.5%), and 15 (0.2%), respectively (Figure 2).

### Covariates

Covariates in this study were age, sex, area of residency, years of education, nutrition status, quartiles of asset, frequency of alcohol consumption, smoking, number of chronic diseases, and cognitive function.

In assessing the area of residency, town and township were classified as rural, while the neighborhood was classified as urban. Nutrition status was assessed by “Determine Your Nutrition Health” checklist by Nutrition Screening Initiative. This checklist consists of twelve binary questions about nutritional management during the latest month. We converted “yes” to 1 point, and “no” to 0 point and added them up. The full score was 12, and higher scores meant poorer nutritional status.

The asset was estimated by adding real estate, financial, and other assets and then subtracting debt. Quartiles were divided into approximately equal numbers (2,321, 2,316, 2,342, and 2,308, respectively). The lower quartile was from -499,000,000 to 70,780,000 won (approximately -346,200–49,106 US dollars), the middle quartile from 70,870,000 to 159,040,000 won (approximately 49,169–110,340 US dollars), the upper quartile from 160,000,000 to 300,000,000 won (approximately 111,006–208,136 US dollars), and the fourth quartile from 301,500,000 to 6,000,000,000 won (approximately 209,177–

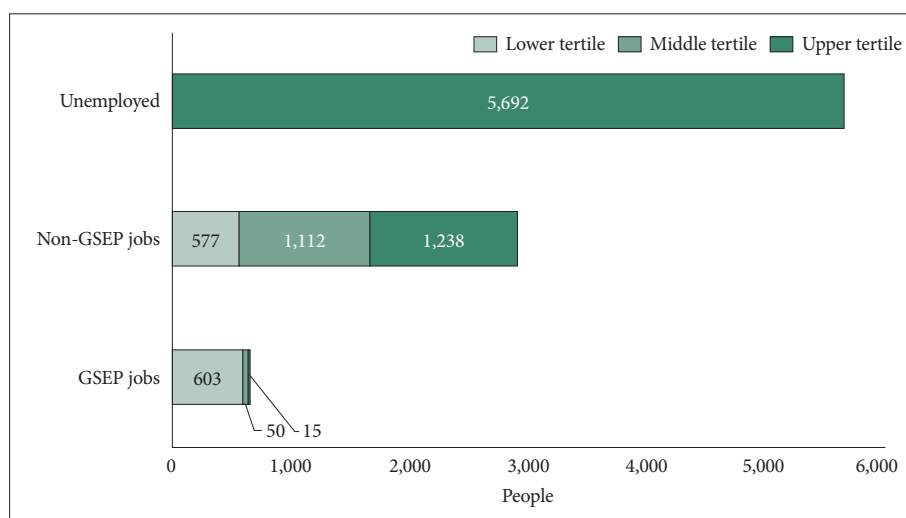
4,162,721 US dollars).

The frequency of alcohol consumption was divided into three groups: no consumption during the latest year, more than once a year to once a week, and 2–3 times a week to everyday. The number of chronic diseases were number of chronic diseases that were diagnosed by a doctor. This included cardiovascular diseases, endocrine diseases, musculoskeletal diseases, pulmonary diseases, neuropsychiatric diseases, eye diseases, ear diseases, dermatologic diseases, cancers, gastrointestinal diseases, genitourinary diseases, and other diseases.

Cognitive function was assessed by MMSE-DS score.<sup>22</sup> MMSE-DS consists of items testing orientation, memory registration, recollection, concentration, naming, language, understanding, and judgment. The full score was 30, and higher scores meant higher cognitive function.

### Statistical analysis

We present continuous variable data as the mean along with the standard deviation (SD). When comparing continuous variables between groups, we selected either the Student's t-test or the Mann-Whitney U test, depending on the normal or non-normal distribution of variables. For comparisons involving three groups, we chose either the analysis of variance test or the Kruskal-Wallis test, again based on the variable distribution. We represented categorical variables as percentages and the number of study participants. To discern differences between categorical variables, we employed either the chi-squared test or Fisher's exact test. Geriatric depressive symptoms measured by the total SGDS-K score were considered as a continuous variable. General depressive affect, life dissatisfaction, withdrawal measured by SGDS-K scores of each factor were also considered as continuous variables. We performed multiple linear regression analyses to examine the



**Figure 2.** Number of members of seven groups. GSEP, government-initiated senior employment program.

significance of associations between geriatric depressive symptoms and employment status, income level, and non-GSEP or GSEP jobs. The goodness of fit of the regression model was confirmed by the Durbin–Watson statistics. The variance inflation factor was used to detect multicollinearity in regression model. A  $p$ -value $<0.05$  was the standard for statistical significance. Data were analyzed by the Statistical Package for Social Sciences (IBM SPSS Statistics 28.0; IBM Corp., Armonk, NY, USA).

## RESULTS

### Baseline characteristics

The mean age of the participants was 73.2 (standard deviation [SD]=6.4). Of the 9,287 participants, 3,739 (40.3%) were men and 5,548 (59.7%) were women. The mean total SGDS-K score (indicating geriatric depressive symptoms) was 3.22 (SD=3.26). We further stratified geriatric depressive symptoms into three distinct dimensions: general depressive affect

**Table 1.** General characteristics of study participants

Variables	Total (N=9,287)	Unem- ployed (N=5,692)	Non-GSEP jobs (N=2,927)			GSEP jobs (N=668)			p*
			Lower tertile income (N=577)	Middle tertile income (N=1,112)	Upper tertile income (N=123)	Lower tertile income (N=603)	Middle tertile income (N=50)	Upper tertile income (N=15)	
Age (yr)	73.2±6.4	74.6±6.6	73.1±6.0	70.2±4.7	68.4±3.6	75.5±5.6	71.5±4.7	69.3±3.8	a, b, c, d
Sex									a, b, c, d
Men	3,739 (40.3)	1,895 (33.3)	182 (31.5)	573 (51.5)	869 (70.2)	182 (30.2)	28 (56.0)	10 (66.7)	
Women	5,548 (59.7)	3,797 (66.7)	395 (68.5)	539 (48.5)	369 (29.8)	421 (69.8)	22 (44.0)	5 (33.3)	
Area of residency									a, b, c
Urban	6,681 (71.9)	4,322 (75.9)	272 (47.1)	675 (60.7)	951 (76.8)	417 (69.2)	34 (68.0)	10 (66.7)	
Rural	2,606 (28.1)	1,370 (24.1)	305 (52.9)	437 (39.3)	287 (23.2)	186 (30.8)	16 (32.0)	5 (33.3)	
Years of education	8.3±4.0	7.8±4.1	7.6±3.6	9.3±3.1	10.7±2.8	6.6±3.7	8.6±3.9	9.6±3.4	a, b, c, d
Nutrition status	1.2±1.7	1.3±1.6	1.6±2.4	1.1±1.8	0.8±1.2	1.7±2.1	1.4±1.7	1.2±1.8	a, b, c
Quartiles of asset									a, b, c, d
Q1 (lowest)	2,321 (25.0)	1,408 (24.7)	190 (32.9)	292 (26.3)	184 (14.9)	227 (37.6)	18 (36.0)	2 (13.3)	
Q2	2,316 (24.9)	1,400 (24.6)	172 (29.8)	308 (27.7)	223 (18.0)	200 (33.2)	9 (18.0)	4 (26.7)	
Q3	2,342 (25.2)	1,376 (24.2)	135 (23.4)	321 (28.9)	373 (30.1)	120 (19.9)	15 (30.0)	2 (13.3)	
Q4 (highest)	2,308 (24.9)	1,508 (26.5)	80 (13.9)	191 (17.2)	458 (37.0)	56 (9.3)	8 (16.0)	7 (46.7)	
Alcohol consumption									a, b, c, d
No drinking	5,817 (62.6)	4,037 (70.9)	377 (65.3)	529 (47.6)	383 (30.9)	463 (76.8)	24 (48.0)	4 (26.7)	
Once a week or less	2,863 (30.8)	1,440 (25.3)	162 (28.1)	474 (42.6)	642 (51.9)	114 (18.9)	22 (44.0)	9 (60.0)	
Two times a week or more	607 (6.5)	215 (3.8)	38 (6.6)	109 (9.8)	213 (17.2)	26 (4.3)	4 (8.0)	2 (13.3)	
Smoking									a, b, c, d
Ex or non-smoker	8,265 (89.0)	5,285 (92.8)	523 (90.6)	927 (83.4)	933 (75.4)	548 (90.9)	39 (78.0)	10 (66.7)	
Current smoker	1,022 (11.0)	407 (7.2)	54 (9.4)	185 (16.6)	305 (24.6)	55 (9.1)	11 (22.0)	5 (33.3)	
Number of chronic diseases	1.8±1.4	2.0±1.5	1.8±1.3	1.5±1.2	1.3±1.2	1.8±1.4	1.7±1.3	1.3±1.1	a, b, c
MMSE score	25.1±4.0	24.6±4.1	24.1±4.3	26.0±3.5	27.3±2.9	24.6±3.5	26.4±3.7	26.5±3.0	a, b, c, d
Total SGDS-K score	3.22±3.26	3.56±3.44	3.18±3.21	2.73±2.91	2.21±2.47	3.07±3.01	2.99±2.94	3.03±3.11	
Factor 1	0.88±1.54	0.95±1.57	0.93±1.65	0.79±1.58	0.54±1.17	1.04±1.75	0.81±1.33	0.43±1.19	
Factor 2	1.34±1.42	1.48±1.47	1.27±1.37	1.15±1.33	1.03±1.24	1.03±1.32	1.27±1.38	1.53±1.63	
Factor 3	0.86±0.91	0.97±0.96	0.82±0.90	0.66±0.78	0.55±0.74	0.83±0.78	0.78±0.94	0.93±1.01	

Values are represented as mean±standard deviation or N (%). \*group comparison results: a) significant difference between unemployed and employed; b) significant difference among unemployed, non-GSEP jobs, and GSEP jobs; c) significant difference among income tertiles within Non-GSEP jobs; d) significant difference among income tertiles within GSEP jobs. GSEP, government-initiated senior employment program; MMSE, Mini Mental Status Examination; SGDS-K, Korean version of the 15-item Geriatric Depression Scale

(factor 1), life dissatisfaction (factor 2), and withdrawal symptoms (factor 3). The mean scores for general depressive affect, life dissatisfaction, and withdrawal were 0.88 (SD=1.54), 1.34 (SD=1.42), and 0.86 (SD=0.91), respectively. More detailed information is provided in Table 1.

### Association between employment status and geriatric depressive symptoms

Employment status was significantly associated with the reduction of geriatric depressive symptoms. Specifically, being employed, compared to being unemployed, was linked to a decrease in overall geriatric depressive symptoms ( $\beta = -0.639$ , 95% confidence interval [CI]= -0.767 to -0.511,  $p < 0.001$ ). Employment was also significantly associated with a decrease across all three factors of geriatric depressive symptoms: general depressive affect (factor 1,  $\beta = -0.171$ , 95% CI= -0.232 to -0.110,  $p < 0.001$ ), life dissatisfaction (factor 2,  $\beta = -0.252$ , 95% CI= -0.313 to -0.190,  $p < 0.001$ ), and withdrawal (factor 3,  $\beta = -0.188$ , 95% CI= -0.225 to -0.151,  $p < 0.001$ ). More detailed information is provided in Table 2.

### Association between the income level and geriatric depressive symptoms

For all income tertiles, being employed was associated with reduced geriatric depressive symptoms compared to unem-

ployment ( $\beta$  of lower, middle, and upper tertiles= -0.753, -0.547, and -0.583, respectively, and  $p < 0.001$  for all tertiles).

Regarding three factors of geriatric depressive symptoms, an intriguing pattern surfaced within factor 2, life dissatisfaction. The employed group with lower income (lower tertile) showed a marked decrease in life dissatisfaction (factor 2,  $\beta = -0.388$ , 95% CI= -0.474 to -0.302,  $p < 0.001$ ). The 95% CI for this group did not overlap with those of the middle and upper tertiles, signifying a distinct trend. More detailed information is provided in Table 3.

### Association of GSEP employment status (unemployed, non-GSEP jobs, GSEP jobs) with geriatric depressive symptoms

Upon comparing unemployed older adults, non-GSEP jobs, and GSEP jobs regarding geriatric depressive symptoms, those in GSEP jobs exhibited a distinct reduction in depressive symptoms ( $\beta = -0.968$ , 95% CI= -1.196 to -0.739).

Regarding three factors of geriatric depressive symptoms, individuals in GSEP jobs demonstrated a more considerable reduction in life dissatisfaction (factor 2,  $\beta = -0.475$ , 95% CI= -0.584 to -0.366). However, this trend was not evident in general depressive affect (factor 1) and withdrawal symptoms (factor 3). More detailed information is provided in Table 4.

**Table 2.** Multiple linear regression analysis for association of employment status and geriatric depressive symptoms\*

Variable	Geriatric depressive symptoms			Factor 1 (General depressive affect)			Factor 2 (Life dissatisfaction)			Factor 3 (Withdrawal)		
	$\beta$	95% CI	p	$\beta$	95% CI	p	$\beta$	95% CI	p	$\beta$	95% CI	p
Unemployed (reference, N=5,692)												
Employed (N=3,595)	-0.639	-0.767 to -0.511	<0.001	-0.171	-0.232 to -0.110	<0.001	-0.252	-0.313 to -0.190	<0.001	-0.188	-0.225 to -0.151	<0.001

\*all p-values were adjusted for age, sex, area of residency, years of education, nutrition status, quartiles of asset, frequency of alcohol consumption, smoking, number of chronic diseases, and cognitive function. Independent variable including all covariates were inserted in a multiple linear regression model. CI, confidence interval

**Table 3.** Multiple linear regression analysis for association of income level and geriatric depressive symptoms\*

Variable	Geriatric depressive symptoms (Total score)			Factor 1 (General depressive affect)			Factor 2 (Life dissatisfaction)			Factor 3 (Withdrawal)		
	$\beta$	95% CI	p	$\beta$	95% CI	p	$\beta$	95% CI	p	$\beta$	95% CI	p
Unemployed (reference, N=5,692)												
Lower tertile (N=1,180)	-0.753	-0.934 to -0.573	<0.001	-0.153	-0.239 to -0.067	<0.001	-0.388	-0.474 to -0.302	<0.001	-0.187	-0.239 to -0.134	<0.001
Middle tertile (N=1,162)	-0.547	-0.735 to -0.359	<0.001	-0.148	-0.237 to -0.058	0.001	-0.180	-0.270 to -0.090	<0.001	-0.195	-0.250 to -0.141	<0.001
Upper tertile (N=1,253)	-0.583	-0.777 to -0.390	<0.001	-0.220	-0.312 to -0.128	<0.001	-0.147	-0.239 to -0.055	0.002	-0.182	-0.238 to -0.126	<0.001

\*all p-values were adjusted for age, sex, area of residency, years of education, nutrition status, quartiles of asset, frequency of alcohol consumption, smoking, number of chronic diseases, and cognitive function. Independent variable including all covariates were inserted in a multiple linear regression model. CI, confidence interval

**Association of GSEP employment status (unemployed, non-GSEP jobs, GSEP jobs) with geriatric depressive symptoms based on income levels**

Two groups of GSEP jobs, whose income level belonged to the middle and upper tertiles, had notably small numbers of group members (50 and 15, respectively). Due to these small sample sizes, these groups were not included in further interpretation and analysis.

In an analysis of geriatric depressive symptoms among un-employed older adults, non-GSEP job workers, and GSEP job workers stratified by income level, it was found that older adults engaged in GSEP jobs in the lower income tertile experienced significant lower depressive symptoms ( $\beta=-1.027$ ,

95% CI=-1.266 to -0.787).

With respect to the three factors of geriatric depressive symptoms, older adults in lower tertile GSEP jobs showed a marked reduction in life dissatisfaction (factor 2,  $\beta=-0.510$ , 95% CI=-0.625 to -0.396). However, this trend was not evident in general depressive affect (factor 1) and withdrawal symptoms (factor 3). More detailed information is provided in Table 5.

**DISCUSSION**

Based on the results of our study, the following four key points can be drawn: 1) Being employed was associated with significant lower geriatric depressive symptoms in compari-

**Table 4.** Multiple linear regression analysis for association of GSEP jobs and geriatric depressive symptoms\*

Variable	Geriatric depressive symptoms (Total score)			Factor 1 (General depressive affect)			Factor 2 (Life dissatisfaction)			Factor 3 (Withdrawal)		
	$\beta$	95% CI	p	$\beta$	95% CI	p	$\beta$	95% CI	p	$\beta$	95% CI	p
Unemployed (reference, N=5,692)												
Non-GSEP jobs (N=2,927)	-0.541	-0.681 to -0.401	<0.001	-0.144	-0.211 to -0.078	<0.001	-0.185	-0.252 to -0.118	<0.001	-0.189	-0.230 to -0.149	<0.001
GSEP jobs (N=668)	-0.968	-1.196 to -0.739	<0.001	-0.261	-0.370 to -0.152	<0.001	-0.475	-0.584 to -0.366	<0.001	-0.183	-0.250 to -0.117	<0.001

\*all p-values were adjusted for age, sex, area of residency, years of education, nutrition status, quartiles of asset, frequency of alcohol consumption, smoking, number of chronic diseases, and cognitive function. Independent variable including all covariates were inserted in a multiple linear regression model. GSEP, government-initiated senior employment program; CI, confidence interval

**Table 5.** Multiple linear regression analysis for association of non-GSEP jobs, GSEP jobs and geriatric depressive symptoms according to the income level\*

Variable	Geriatric depressive symptoms (Total score)			Factor 1 (General depressive affect)			Factor 2 (Life dissatisfaction)			Factor 3 (Withdrawal)		
	$\beta$	95% CI	p	$\beta$	95% CI	p	$\beta$	95% CI	p	$\beta$	95% CI	p
Unemployed (reference, N=5,692)												
Non-GSEP jobs (N=2,927)												
Lower tertile (N=577)	-0.463	-0.709 to -0.217	<0.001	-0.023	-0.140 to 0.095	0.705	-0.258	-0.376 to -0.141	<0.001	-0.179	-0.250 to -0.107	<0.001
Middle tertile (N=1,112)	-0.542	-0.734 to -0.351	<0.001	-0.148	-0.239 to -0.057	0.001	-0.176	-0.267 to -0.085	<0.001	-0.198	-0.253 to -0.142	<0.001
Upper tertile (N=1,238)	-0.576	-0.770 to -0.382	<0.001	-0.215	-0.307 to -0.122	<0.001	-0.142	-0.235 to -0.050	0.003	-0.185	-0.241 to -0.128	<0.001
GSEP jobs (N=668)												
Lower tertile (N=603)	-1.027	-1.266 to -0.787	<0.001	-0.275	-0.389 to -0.161	<0.001	-0.510	-0.625 to -0.396	<0.001	-0.194	-0.264 to -0.125	<0.001
Middle tertile (N=50)	-0.433	-1.220 to 0.354	0.281	-0.049	-0.424 to 0.326	0.797	-0.171	-0.547 to 0.205	0.373	-0.133	-0.362 to 0.096	0.254
Upper tertile (N=15)	-0.346	-1.777 to 1.085	0.635	-0.321	-1.003 to 0.361	0.357	-0.154	-0.837 to 0.530	0.659	0.089	-0.327 to 0.505	0.675

\*all p-values were adjusted for age, sex, area of residency, years of education, nutrition status, quartiles of asset, frequency of alcohol consumption, smoking, number of chronic diseases, and cognitive function. Independent variable including all covariates were inserted in a multiple linear regression model. GSEP, government-initiated senior employment program; CI, confidence interval

son to being unemployed. This effect was consistent across all three factors of geriatric depressive symptoms: general depressive affect, life dissatisfaction, and withdrawal. 2) Regardless of income levels, employment status was associated with lower geriatric depressive symptoms; especially, individuals with lower income tertile notably experienced less life dissatisfaction. 3) Participants in the GSEP showed less geriatric depressive symptoms, particularly life dissatisfaction, highlighting the potential benefits of government-initiated program on senior mental health. 4) Finally, older adults in lower income tertile GSEP roles displayed significantly lower depressive symptoms and life dissatisfaction, despite their limited income. This underlines the considerable effectiveness of GSEP in enhancing mental health outcomes, even among those individuals with lower income.

Our first and second findings shed light on the significant role of employment in the mental health of older adults. Regardless of income level, being employed was associated with a reduction in geriatric depressive symptoms, including general depressive affect (factor 1), life dissatisfaction (factor 2), and withdrawal (factor 3). This association underscores the profound importance of maintaining active employment in geriatric mental health management, suggesting that engaging in work, irrespective of the income earned, provides a sense of purpose and structure that can alleviate depressive symptoms in older adults.<sup>9-13</sup> The results imply that factors beyond income, such as job satisfaction, social interactions, or a sense of self-worth from being employed, may play a considerable role in affecting life satisfaction.<sup>25,26</sup> This observation adds a new facet to our understanding of mental health in older adults, challenging traditional notions that higher income always leads to better mental health outcomes. These findings emphasize the need for further studies to unravel the complex interplay between employment, income level, and mental health.

From our third and fourth findings, we discerned the substantial impact of the GSEP on the mental health of older adults. Our data showed that participants in GSEP reported fewer geriatric depressive symptoms, especially a reduced sense of life dissatisfaction. This suggests that GSEP's potential influence extends beyond the mere provision of employment and income, potentially offering a supportive work environment, fostering social engagement, and bestowing a sense of security and dignity that may contribute significantly to enhancing life satisfaction.<sup>27,28</sup> Interestingly, despite being in the lower income bracket, GSEP participants reported markedly lower depressive symptoms and less life dissatisfaction. This observation underscores the effectiveness of GSEP in improving mental health outcomes, even amongst lower-income individuals. We hypothesize that this can be attributed

to the striking similarities between GSEP jobs and volunteering activities.<sup>14</sup> Various studies have shown that, amongst older adults, volunteering is linked to fewer depressive symptoms, increased well-being, life satisfaction, and overall positive health outcomes.<sup>29-31</sup> This suggests that older adults may engage in GSEP jobs driven more by intrinsic motives than financial incentives. Such motivations could explain why lower-income GSEP participants were associated with fewer geriatric depressive symptoms. This hypothesis is further supported by a study suggesting that intrinsic motives, when participating in bridge employment, are associated with higher life satisfaction compared to financial motives.<sup>32</sup> This compelling outcome highlights the significant role of the quality and nature of employment, beyond its mere availability, in shaping mental health outcomes in the elderly. Moreover, it underscores the potential for government-initiated programs like GSEP to serve as effective tools for enhancing the mental health of seniors, particularly in resource-limited settings. Hence, our findings underscore the need for policy measures to not only focus on providing employment but also on ensuring the quality of job opportunities offered to the elderly, particularly those in the lower income bracket.

The strength of this study is that it is based on LPOPS, a large-scale population-based study. Furthermore, we not only studied geriatric depressive symptoms in general but also three factors of geriatric depressive symptoms, which are general depressive affect, life dissatisfaction, and withdrawal. However, this study also has some limitations. Differences between groups other than the reference group (unemployed) was not strictly statistically verified, limiting interpretation. Also, the cross-sectional design of our study may limit the generalizability of our findings to longitudinal settings, where the relationships between variables may be different. In addition, although we attempted to control for the effects of several confounding variables, there may still have been unmeasured confounders that we were unable to account for. Finally, we must note that our study did not sufficiently reflect certain aspects of GSEP, such as the actual working hours, the exact working environment, and the nature of the work involved. Therefore, future studies need to consider these factors for a more comprehensive understanding of the potential benefits and impacts of GSEP on the mental health of older adults.

In conclusion, our study underlines the significant role of employment and the unique impact of the GSEP in reducing depressive symptoms among older adults. We found that employment, regardless of income levels, was associated with fewer geriatric depressive symptoms, and interestingly, individuals in the lower income tertile reported less life dissatisfaction. GSEP participation, remarkably, led to reduced depressive symptoms and life dissatisfaction, even among



those in lower income tertile. Given these findings, it's vital that future studies further explore these relationships, incorporating additional parameters like actual working hours and job nature in the context of GSEP, and apply longitudinal designs for a comprehensive understanding of GSEP's potential benefits on the mental health of older adults. These efforts will provide valuable insights to shape future policies and interventions aimed at enhancing mental health outcomes in older adults.

### Supplementary Materials

The online-only Data Supplement is available with this article at <https://doi.org/10.30773/pi.2023.0212>.

### Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

### Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

### Author Contributions

Conceptualization: Soyeon Park, Jai Sung Noh, Hyun Woong Roh. Formal analysis: Soyeon Park, Hyun Woong Roh. Funding acquisition: Sang Joon Son, Chang Hyung Hong. Investigation: Soyeon Park, Hyun Woong Roh. Methodology: Soyeon Park, Hyun Woong Roh, Yeojin Kim, Sunwoo Yoon, You Jin Nam, Sunhwa Hong, Yong Hyuk Cho, Sang Joon Son, Chang Hyung Hong. Supervision: Sang Joon Son, Chang Hyung Hong, Jai Sung Noh. Writing—original draft: Soyeon Park, Hyun Woong Roh. Writing—review & editing: Yeojin Kim, Sunwoo Yoon, You Jin Nam, Sunhwa Hong, Yong Hyuk Cho, Sang Joon Son, Chang Hyung Hong, Jai Sung Noh.

### ORCID iDs

Soyeon Park	<a href="https://orcid.org/0000-0001-7957-2471">https://orcid.org/0000-0001-7957-2471</a>
Yeojin Kim	<a href="https://orcid.org/0000-0003-0877-7415">https://orcid.org/0000-0003-0877-7415</a>
Sunwoo Yoon	<a href="https://orcid.org/0000-0001-7501-1781">https://orcid.org/0000-0001-7501-1781</a>
You Jin Nam	<a href="https://orcid.org/0000-0002-6603-5586">https://orcid.org/0000-0002-6603-5586</a>
Sunhwa Hong	<a href="https://orcid.org/0000-0003-0268-6360">https://orcid.org/0000-0003-0268-6360</a>
Yong Hyuk Cho	<a href="https://orcid.org/0000-0002-2570-7278">https://orcid.org/0000-0002-2570-7278</a>
Sang Joon Son	<a href="https://orcid.org/0000-0001-7434-7996">https://orcid.org/0000-0001-7434-7996</a>
Chang Hyung Hong	<a href="https://orcid.org/0000-0003-3258-7611">https://orcid.org/0000-0003-3258-7611</a>
Jai Sung Noh	<a href="https://orcid.org/0000-0002-9610-0756">https://orcid.org/0000-0002-9610-0756</a>
Hyun Woong Roh	<a href="https://orcid.org/0000-0002-1333-358X">https://orcid.org/0000-0002-1333-358X</a>

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### REFERENCES

- Alexopoulos GS. Depression in the elderly. *Lancet* 2005;365:1961-1970.
- Alexopoulos GS, Buckwalter K, Olin J, Martinez R, Waincott C, Krishnan KR. Comorbidity of late life depression: an opportunity for research on mechanisms and treatment. *Biol Psychiatry* 2002;52:543-558.
- Blazer DG. Depression in late life: review and commentary. *J Gerontol A Biol Sci Med Sci* 2003;58:249-265.
- Abdoli N, Salari N, Darvishi N, Jafarpour S, Solaymani M, Mohammadi M, et al. The global prevalence of major depressive disorder (MDD) among the elderly: a systematic review and meta-analysis. *Neurosci Biobehav Rev* 2022;132:1067-1073.
- Statistics Korea. 2019 Population and Housing Census (Register-based Census) [Internet]. Available at: [https://kostat.go.kr/board.es?mid=a20107010000&bid=11739&tag=&act=view&list\\_no=386089&ref\\_bid=](https://kostat.go.kr/board.es?mid=a20107010000&bid=11739&tag=&act=view&list_no=386089&ref_bid=). Accessed April 20 2024.
- Statistics Korea. Population Prospects of Koreans and Foreigners based on the 2019 Population Projections: 2017-2040 [Internet]. Available at: <https://kostat.go.kr/board.es?mid=a20108080000&bid=11748&act=vi>ew&list\_no=391737. Accessed April 20 2024.
- Kim JM, Stewart R, Shin IS, Choi SK, Yoon JS. Subjective memory impairment, cognitive function and depression – a community study in older Koreans. *Dement Geriatr Cogn Disord* 2003;15:218-225.
- Cho MJ, Nam JJ, Suh GH. Prevalence of symptoms of depression in a nationwide sample of Korean adults. *Psychiatry Res* 1998;81:341-352.
- Frese M, Mohr G. Prolonged unemployment and depression in older workers: a longitudinal study of intervening variables. *Soc Sci Med* 1987;25:173-178.
- Paul KI, Moser K. Unemployment impairs mental health: meta-analysis. *J Vocat Behav* 2009;74:264-282.
- Schwengel A, Niti MM, Tang C, Ng TP. Continued work employment and volunteerism and mental well-being of older adults: Singapore longitudinal ageing studies. *Age Ageing* 2009;38:531-537.
- Park H, Hwangbo Y, Nam Y. The effect of employment and occupational factors on late-life depression in Korea. *J Occup Environ Med* 2018;60:e492-e497.
- Park H, Hwangbo Y, Lee YJ, Jang EC, Han W. Employment and occupational effects on late-life depressive symptoms among older Koreans: a cross-sectional population survey. *Ann Occup Environ Med* 2016;28:22.
- Kim SY, Lee MH, Chang SJ. Identifying changes in psychosocial health of elderly participants in a senior employment promotion program. *Korean J Gerontol Soc Welf* 2014;64:371-393.
- Kim EH, Kang JH. Analysis of the effect of job business of the aged on the change in depression of the aged. *Korean Soc Public Adm* 2011;22:363-378.
- KORDI. 2020 Senior Employment and Social Activity Support Program Statistics [Internet]. Available at: [https://www.kordi.or.kr/upload/attach/96/443696\\_202305090921437380.pdf](https://www.kordi.or.kr/upload/attach/96/443696_202305090921437380.pdf). Accessed April 20 2024.
- Schaakxs R, Comijs HC, van der Mast RC, Schoevers RA, Beekman ATF, Penninx BWJH. Risk factors for depression: differential across age? *Am J Geriatr Psychiatry* 2017;25:966-977.
- Mojtabai R, Olsson M. Major depression in community-dwelling middle-aged and older adults: prevalence and 2- and 4-year follow-up symptoms. *Psychol Med* 2004;34:623-634.
- Hendrie HC, Albert MS, Butters MA, Gao S, Knopman DS, Launer LJ, et al. The NIH cognitive and emotional health project: report of the critical evaluation study committee. *Alzheimers Dement* 2006;2:12-32.
- Lee CT, Chiang YC, Huang JY, Tantoh DM, Nfor ON, Lee JF, et al. Incidence of major depressive disorder: variation by age and sex in low-income individuals: a population-based 10-year follow-up study. *Medicine (Baltimore)* 2016;95:e3110.
- Zhao H, He J, Yi J, Yao S. Factor structure and measurement invariance across gender groups of the 15-item geriatric depression scale among Chinese elders. *Front Psychol* 2019;10:1360.
- Kim TH, Jhoo JH, Park JH, Kim JL, Ryu SH, Moon SW, et al. Korean version of mini mental status examination for dementia screening and its' short form. *Psychiatry Investig* 2010;7:102-108. Retraction of: Kim TH, Jhoo JH, Park JH, Kim JL, Ryu SH, Moon SW, et al. *Psychiatry In-*

- vestig 2023;20:182.
23. Sheikh JI, Yesavage JA. Geriatric Depression Scale (GDS): recent evidence and development of a shorter version. In: Brink TL editor. *Clinical Gerontology : a guide to assessment and intervention*. New York: The Haworth Press; 1986. p.165-173.
  24. Bae JN, Cho MJ. Development of the Korean version of the Geriatric Depression Scale and its short form among elderly psychiatric patients. *J Psychosom Res* 2004;57:297-305.
  25. Kim S, Feldman DC. Working in retirement: the antecedents of bridge employment and its consequences for quality of life in retirement. *Acad Manage J* 2000;43:1195-1210.
  26. Zhan Y, Wang M, Liu S, Shultz KS. Bridge employment and retirees' health: a longitudinal investigation. *J Occup Health Psychol* 2009;14:374-389.
  27. Tang F, Chen H, Zhang Y, Mui AC. Employment and life satisfaction among middle- and old-aged adults in China. *Gerontol Geriatr Med* 2018;4:2333721418778202.
  28. Mekonnen HS, Lindgren H, Geda B, Azale T, Erlandsson K. Satisfaction with life and associated factors among elderly people living in two cities in northwest Ethiopia: a community-based cross-sectional study. *BMJ Open* 2022;12:e061931.
  29. Fried LP, Carlson MC, Freedman M, Frick KD, Glass TA, Hill J, et al. A social model for health promotion for an aging population: initial evidence on the Experience Corps model. *J Urban Health* 2004;81:64-78.
  30. Musick MA, Wilson J. Volunteering and depression: the role of psychological and social resources in different age groups. *Soc Sci Med* 2003;56:259-269.
  31. Mui AC, Glajchen M, Chen H, Sun J. Developing an older adult volunteer program in a new york Chinese community: an evidence-based approach. *Ageing Int* 2013;38:108-121.
  32. Dingemans E, Henkens K. Involuntary retirement, bridge employment, and satisfaction with life: a longitudinal investigation. *J Organ Behav* 2014;35:575-591.