

The Association Between the Basic Old-Age Pension and Depression of the Older Adults in Korea

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Objectives: The purpose of this study was to investigate the association between the Basic Old-Age Pension (BOP), which is a non-contributory pension, and depression in BOP beneficiaries in Korea.

Methods: We used the second and third waves (2007-2008) of the Korea Welfare Panel Study to identify the effect of the BOP on mental health in the year of its introduction. The Center for Epidemiological Studies-Depression Scale, applied in a Korean context, was used to evaluate mental health. To analyze the effect of the BOP, a difference-in-difference approach was used in analyses of all subjects and subgroups.

Results: For this study population of 760 adults, the BOP did not have a statistically significant relationship with depression in its beneficiaries. After controlling for type of household, the BOP was still not associated with lower reporting of depression, either in single-beneficiary or double-beneficiary households, in the year of the benefit.

Conclusions: The BOP policy had no significant relationship with the level of depression among recipients. However, this should not be interpreted as implying that income subsidy programs for older adults, such as the BOP, do not affect mental health, considering the importance of economic hardship in this population and the program's socioeconomic effects.

Key words: Pensions, Depression, Mental health, Public policy

INTRODUCTION

Insufficient economic resources or economic instability can cause material limitations, induce stress and anxiety, and even become the root of family discord. Therefore, economic insecurity may harm mental health. For people over 65 years of age who have difficulty participating in the labor market, eco-

nomonic stability is an especially important issue. In Korea, economic hardship is the greatest challenge among older adults, followed by health problems.

Although there are several pension systems in Korea, they provide a limited safety net depending on the type of job (e.g., public employee annuities versus the national pension) and working period. For example, one can receive the national pension only if he/she contributes to it for at least 10 years before the age of 65 years. Furthermore, the amount of the pension is insufficient. An insufficient public pension system in a rapidly aging society is likely to make older adults even more distressed.

In 2008, to stabilize the living situation of older adults affected by poverty, the Basic Old-Age Pension (BOP) was introduced. In the first half of 2008, through the BOP, people aged 70 years and above in the bottom 60% income group received

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a maximum of about 100 000 Korean won (about US\$100) per month irrespective of their contribution to the pension. In the second half of 2008, the policy entitlement criteria changed to being over 65 years old and having an income in the lower 60%.

Although the amount of the benefit may seem small, it had a meaningful effect considering the high poverty rate among older adults. Notably, the BOP was found to be very helpful for reducing their economic burden. Several studies have shown that the BOP reduced the poverty rate of older adults [1]. The most recent study, by Lee et al. [2], conducted a comprehensive analysis of the effects of introducing the Basic Pension, an upgraded version of BOP in 2014, including on total consumption, non-consumption expenditures, poverty rate and poverty gap. They used a more sophisticated methodology than that of previous studies, but still focused only on material well-being. From a health perspective, it is possible that the benefits of a non-contributory pension plan, such as the BOP, may positively influence the mental health of older adults by relieving economic stress.

To start with, pensions provide material benefits, accompanied by changes in consumption behavior [3]. In addition, a pension benefit diversifies income sources and enhances economic stability. Galiani et al. [4] showed that a non-contributory pension had positive effects on mental health by increasing income and/or providing relief from economic stress as a consequence of a shift in income source. Additional social security income increases the likelihood of independent living [5] and reduces the psychosocial stress associated with financial hardship. Salinas-Rodríguez et al. [6] found that pension beneficiaries were relieved of the pressure of labor. Fox [7] suggested that people whose prior income was lower and who did not have a pension after retirement tended to work longer. The BOP gives a pension benefit to those who do not receive a pension benefit from the contributory pension system; therefore, it may reduce the frequency of involuntary labor performed to make a living.

However, few studies have considered the effect of pension benefits on the mental health of older adults [4], as previous research has tended to focus on more direct economic effects (e.g., poverty reduction). Kim et al. [8] analyzed the impact of the national pension (the contributory pension system) in Korea, on depression among older adults. However, an analysis of a non-contributory pension is advantageous because (1) we do not need to consider time preferences, unlike when analyzing

contributory pension plans, and (2) a non-contributory pension is related to the issue of basic income. Time preferences influence participation in contributory pensions because people are required to sacrifice their present consumption to save for their future life [9]. Because economic burdens or insecurity may be a major source of psychological stress, the relationship between receiving a pension and changes in psychological status needs to be investigated.

We used depression to evaluate mental health in this study, taking into consideration that depression is a negative indicator of mental health and may also aggravate one's physical condition. Moreover, the principal theories explaining the manifestation of depression [10] divide relevant factors into risk factors that provoke depression and protecting factors that buffer against depression or reduce its severity. In this study, we regarded the BOP benefit as an economic buffer. In addition, the high prevalence of depression among older adults in Korea is linked to a high suicide rate [11]. Considering its social impact, depression is a representative indicator for measuring mental health in older adults in Korea. The aim of this study was to examine the effects of BOP benefits on mental health, specifically on depression.

METHODS

Data Source and Subjects for the Analysis

We used the Korea Welfare Panel Study (KoWEPS), a nationally representative longitudinal survey of the whole country (Korea) conducted by the Korea Institute for Health and Social Affairs, which is affiliated with the Seoul National University Institute of Social Welfare. The KoWEPS covers a wide range of variables including demographic, socioeconomic, health status, and welfare/health services utilization. The first sample was from the Population and Housing Census (2005), excluding islands and special facilities and based on a multistage area probability design. A sample of 7072 households was surveyed in 2006, the first year of KoWEPS, and the original sample retention rates in 2007, 2008, and 2009 were 92.1%, 86.6%, and 83.9%, respectively.

To investigate the effects of the BOP policy starting in January 2008, we chose the second and third waves of the panel study, which represented the status of the respondents in 2007-2008, because the positive effects of receiving a pension might have been caused by the "honeymoon period" [12]. We analyzed the period immediately before the policy (2007) and the

year when the policy was introduced (2008), when its effects would be clearest. However, since respondents' economic status (e.g., income, assets, and pension benefit) was surveyed in the previous fiscal year, we merged the second-wave data with the third-wave's responses for economic characteristics and the third-wave data with the fourth wave's responses for economic characteristics.

Our subjects were households that included older adults in their 70's. The proportions of households that included over-65-year-olds were 31.7% (2083 households) in the second-wave and 30.7% (1936 households) in the third-wave. We limited the characteristics of the subjects to clarify the policy effects. First, only those in their 70s were included because the entitlement was given to those aged 70 and over with an income in the lower 60% bracket when the BOP was established in the first half of 2008. Those aged 80 and over were not included because they are classified as the oldest old [13], and they are a distinct group with regard to various characteristics.

The KoWEPS asked the participants only about the annual sum of their BOP benefits, and we classified households into single-beneficiary and double-beneficiary households using that information. The households not classified into either beneficiary group were excluded from the empirical analysis.

Entitlement to the BOP is determined based on the level of household income and assets; thus, there is expected to be a large gap in economic status (income and assets) between non-beneficiary and beneficiary households. Because the BOP does not fundamentally solve economic difficulties, it would not be appropriate to compare the BOP beneficiary group with a high socioeconomic status (SES) group [14]. To enhance the comparability, the maximum values of household income and assets of the non-beneficiary group were set to be the same as those of the beneficiary group. This was an adjustment for a potential confounding factor [15] that may influence the association between the BOP benefit and depression. If participants' data for any variables were missing, they were also not included in the analysis.

Of the 1331 subjects, 310 were excluded because of incomplete data, and 261 were excluded because of limits on the amount of benefits/income and assets.

Measures

Outcome measure

As a dependent variable, depression were assessed using an abridged version of the Center for Epidemiological Studies

Depression Scale (CES-D) in the KoWEPS. It only includes 11 items, instead of the 20 items in the original version. A shortened version of the CES-D (CES-D11) can reduce the burden on the respondents; therefore, the CES-D11 is actively used, especially in panel studies where respondents of all ages have to answer many questions, and its measurement invariance was tested by Heo et al. [16]. We constructed a dichotomous variable for depression referring to Yokoyama et al. [17], who suggested different breakpoints for overall populations and older adults. In the CES-D11, a score of 6.7, which is comparable to a score of 16 in the CES-D 20, was considered to indicate probable depression. Subjects with the CES-D11 score equal to or higher than 6.7 were considered to be depressed.

Measures for control variables

To test the policy effect of the BOP, general demographic and socioeconomic factors should be controlled in the statistical analysis. According to Kim and Sohn [18], we categorized the confounding factors associated with depression in this study as follows: demographic variables (age, sex, marital status, educational level, household scale [number of family members], and family structure), economic variables (household assets and current income per year, house ownership, other public transfers [e.g., the national pension plan], and economic participation), relational variables (satisfaction with social and/or family relationships), and health-related variables (chronic disease and hospital healthcare utilization).

The following dummy variables were used: sex, marital status, family structure, house ownership, and satisfaction with social and/or family relationships. Though not common as a control variable, family structure is meaningful for the old in Korea. In structurally defective homes, such as grandparent(s)-grandchild families, or single elderly household, older adults experience stress from raising their grandchildren [19] or from the absence of their spouse and other family members and the consequent lack of emotional support [20]. Satisfaction with relationships was measured with a Likert scale (1-5) that was translated to a dummy variable: satisfied (3-5) and unsatisfied (1-2).

Statistical Analysis

We used a multilevel model to reflect household-level and individual-level variables. In the survey, respondents were asked about their personal demographic characteristics, such as age and sex, as well as household-level characteristics such

as assets and current income. To clarify the effects of the individual-level and household-level variables, it is possible to equalize household-level variables by the number of household members or to use a hierarchical model, like a multilevel analysis. In a multilevel model, the same household members are nested in one household. In this model, multiple levels can be considered in an econometric analysis; that is, clustering is reflected. Because a multilevel model appropriately accounts for dependencies among responses in the same cluster, the standard errors of the regression coefficients are not underestimated, thereby avoiding an overstatement of statistical significance [21].

Because the BOP might be regarded as a form of public assistance for older adults in the lower 60% income group, beneficiaries and non-beneficiaries were expected to be systematically different. In other words, they were not randomly assigned, and the beneficiaries might mostly be considered to have a lower SES and possibly even poorer health status. Thus, it was necessary to control for their characteristics before entitlement to the pension was decided; otherwise, the identifica-

tion of the policy effect might not be correct.

Studies analyzing the impact of social security schemes often use difference-in-difference (DD) or regression discontinuity (RD) design methods [2]. We used a DD model to control for pre-policy characteristics and to estimate the policy effect of the BOP on depression. The equation is shown in Supplemental Material 1.

The DD model compares changes in the beneficiaries and non-beneficiaries in the pre-policy and post-policy periods. In other words, an estimate of the policy effects could be obtained by comparing the change in the probability of depression among the beneficiaries between the pre-policy and post-policy periods relative to the change in the probability of depression in the control group (non-beneficiaries) over the same period.

The amount of the BOP benefit varied depending on the number of beneficiaries in each household; therefore, we divided households according to the number of beneficiaries and carried out the DD analysis separately in single-beneficiary and double-beneficiary households. In our KoWEPS data,

Table 1. Characteristics of BOP beneficiaries and non-beneficiaries in 2007

Category	Variables	BOP		χ^2/t -value
		Beneficiaries (n=339)	Non-beneficiaries (n=421)	
Depression	Probable depression, CES-D11 \geq 6.7 (%)	54.3	39.0	29.2***
Demographic characteristics	Age, mean (y)	72.7	71.9	-6.4***
	Sex, female (%)	69.0	48.5	65.1***
	Marital status, without partner (%)	51.3	24.5	113.8***
	Education (level)			133.9***
	No education: 1	35.0	17.1	
	Elementary/middle school: 2	58.2	55.3	
	High school: 3	6.8	27.6	
	Household scale, person (n)	2.3	2.2	-1.3
Family structure, structurally defective home (%)	29.7	20.0	19.7***	
Economic characteristics	Household assets (10 ⁶ KRW)	44.5	119.2	9.2***
	Household current income per year (10 ⁶ KRW)	15.7	20.2	4.3***
	Public pension income (other than BOP) per year (10 ⁴ KRW)	31.6	518.9	14.4***
	Private transfer income per year (10 ⁴ KRW)	373.4	436.9	3.0**
	Economic participation, active (%)	29.8	28.5	0.2
	Homeownership, non-homeowner (%)	25.1	8.0	81.6***
Relational characteristics	Social relationships, satisfied (%)	62.2	68.4	4.8*
	Family relationships, satisfied (%)	64.0	78.9	21.7***
Health characteristics	Chronic disease, patient (%)	83.2	84.3	0.4
	Hospital healthcare, utilization (%)	16.5	20.2	10.9**

BOP, Basic Old-Age Pension; CES-D, Center for Epidemiological Studies Depression Scale; KRW, Korean won.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

there was no item about the number of beneficiaries in each household, so we inferred the number of beneficiaries. Using the maximum benefit for 1 person or a couple, we selected households that received the maximum subsidy per month for 12 months. To set the control group, the entitlement age for the BOP was used. If there was a person aged 70 and over in 2007, the potential number of beneficiaries was 1 (control group for the single-beneficiary group). If there were 2 such people and they were married, the potential number of beneficiaries was 2 (control group for the double-beneficiary group). After the DD analysis, we conducted a stratified DD analysis for these 2 subgroups.

Generally, in DD analyses, there is a time gap in estimating the policy effects between the pre-policy and post-policy periods. However, because of the honeymoon effect [12], the time lag between the pension benefit and its effect on mental health was minimized to estimate the policy effect. For statistical analysis, *xtmelogit* in Stata version 14.0 (StataCorp., College Station, TX, USA) was used. The variables included in the analysis as covariates are shown in Table 1.

Ethics Statement

This study was exempted from institutional review board (IRB) approval due to the use of secondary data, as a result of the deliberation by the Seoul National University IRB (IRB No. E1606/003-004).

RESULTS

Sample Characteristics

As presented in Table 1, our sample consisted of 760 individuals, including 339 beneficiaries (single-beneficiary group: 188; double-beneficiary group: 151) and 421 non-beneficiaries (controls for the single-beneficiary group: 204; controls for the double-beneficiary group: 217). In both the pre-policy and post-policy periods, the BOP beneficiary group had a higher probability of depression and lower SES than the non-beneficiary group.

The BOP beneficiary group was older than the non-beneficiary group and had a higher proportion of females and the spouseless. Considering the positive relationship between aging and depression, the higher age of the BOP beneficiary

Table 2. Characteristics of double-beneficiary households and non-beneficiaries of BOP in 2007-2008 (n=368)

Category	Variables	BOP			
		Beneficiaries (n=151)		Non-beneficiaries (n=217)	
		2007	2008	2007	2008
Depression	Probable depression (CES-D11 score)	6.7±5.3	6.3±5.2	6.2±5.9	5.6±5.5
Demographic characteristics	Age (y)	72.3±2.7	73.7±2.7	72.2±2.6	73.2±2.6
	Sex (female)	52.9	52.9	53.5	53.5
	Education (level)				
	No education: 1	23.2	23.2	16.6	16.6
	Elementary/middle school: 2	67.6	67.6	59.9	59.9
	High school: 3	9.3	9.3	23.5	23.5
	Household scale (person)	2.4±1.0	2.4±0.9	2.3±0.8	2.3±0.8
	Family structure (structurally defective home)	0.0	0.0	0.9	0.9
Economic characteristics	Household assets (10 ⁶ KRW)	34.5±101.6	35.9±84.5	139.5±183.6	159.6±233.7
	Household current income per year (10 ⁶ KRW)	13.9±14.1	16.2±15.0	20.8±14.1	22.7±16.1
	Public pension income (other than BOP) per year (10 ⁴ KRW)	25.1±66.3	33.3±81.9	586.9±929.9	606.5±957.7
	Private transfer income per year (10 ⁴ KRW)	473.7±382.4	513.1±560.1	500.9±617.2	561.5±640.1
	Economic participation (active)	35.8	32.5	27.2	27.6
	Homeownership (non-homeowner)	15.9	17.2	2.8	4.1
Relational characteristics	Social relationships (satisfied)	62.9	62.3	68.7	60.4
	Family relationships (satisfied)	71.5	72.2	86.7	82.0
Health characteristics	Chronic disease (patient)	80.8	88.1	82.9	86.2
	Hospital healthcare (utilization)	13.3	11.9	19.8	27.6

Values are presented as mean ± standard deviation or percentage.

BOP, Basic Old-Age Pension; CES-D, Center for Epidemiological Studies Depression Scale; KRW, Korean won.

group might contribute to depression. In addition, having a spouse is beneficial to the mental health of older adults; therefore, the presence of a higher number of the spouseless in the BOP group might be related to their higher risk of depression. The number of household members was lower among the BOP beneficiaries because many older people from this group lived alone. There were more structurally defective homes, such as grandparent-grandchild families, among the BOP beneficiaries than among the non-beneficiaries.

The economic assets and income levels of the BOP beneficiaries were lower, and their public pension income level was less than one-tenth of that of the non-beneficiary group. Almost 50% of the non-BOP beneficiaries received public pension benefits other than the BOP; however, only 14% of the BOP beneficiaries received other kinds of public pension benefits. Economic participation was higher in the BOP beneficiaries, and likely reflected involuntary work for their livelihood, considering their low income level. In addition, the percentage of non-owner-occupiers was more than three times higher in the BOP beneficiary group.

Satisfaction with social and family relationships was lower in the BOP beneficiary group. In the BOP beneficiary group, the number of the chronically ill was about the same; however, inpatient care was less common. Tables 2 and 3 present characteristics in double beneficiary - control households, and single beneficiary - control households, respectively.

The Policy Effect of the Basic Old-Age Pension Benefit on Depression

In the DD analysis, the association between the BOP and depression in older adults was not statistically significant for the whole sample (Table 4). The statistical non-significance of the DD analysis might be attributed to the small amount of the BOP benefit. The non-BOP beneficiary group had more access to other income sources than the BOP beneficiary group. Therefore, it is difficult to state that the BOP benefit can sufficiently offset the lower ability of the BOP beneficiaries to access additional funds, such as other kinds of public pension benefits or private transfers.

However, as shown in previous studies [8], public pension

Table 3. Characteristics of single-beneficiary households and non-beneficiaries of BOP in 2007-2008 (n=392)

Category	Variables	BOP			
		Beneficiaries (n=188)		Non-beneficiaries (n=204)	
		2007	2008	2007	2008
Depression	Probable depression (CES-D11 score)	9.0±5.9	7.3±5.4	6.9±6.6	6.0±5.7
Demographic characteristics	Age (mean, years)	73.1±2.8	74.1±2.8	71.5±2.3	72.5±2.3
	Sex (women, percent)	81.9	81.9	43.1	43.1
	Education				
	No education: 1	92.6	93.6	50.5	52.9
	Elementary/middle school: 2	44.2	44.2	17.2	17.2
	High school: 3	51.1	51.1	52.0	52.0
	Household scale (person)	4.8	4.8	30.9	30.9
	Family structure (structurally defective home)	2.2±1.6	2.1	2.1±1.3	2.0
	Household assets (10 ⁶ KRW)	53.7	53.7	40.2	40.2
Economic characteristics	Household current income per year (10 ⁶ KRW)	52.6±151.9	58.8±165.1	97.6±165.7	140.6±275.6
	Public pension income (other than BOP) per year (10 ⁴ KRW)	17.1±21.0	20.0±27.3	19.5±16.8	21.2±19.5
	Private transfer income per year (10 ⁴ KRW)	36.9±187.7	33.9±185.8	446.5±805.6	449.3±805.2
	Economic participation (active)	292.9±377.7	301.1±378.5	368.8±503.0	413.3±500.3
	Homeownership (non-homeowner)	25.0	19.7	29.9	29.9
	Social relationships (satisfied)	32.5	32.5	13.7	13.2
Relational characteristics	Family relationships (satisfied)	61.7	56.4	68.1	67.2
	Chronic disease (patient)	58.0	69.2	70.6	71.6
Health characteristics	Hospital healthcare (utilization)	85.1	92.0	85.8	87.8
	Probable depression (CES-D11 score)	19.2	15.4	20.6	19.1

Values are presented as mean ± standard deviation or percentage.

BOP, Basic Old-Age Pension; CES-D, Center for Epidemiological Studies Depression Scale; KRW, Korean won.

Table 4. DD analysis of the effects of the BOP on probable depression in older adults (n = 760)

Category	Variables	OR (95% CI)
After policy (I)		0.836 (0.596, 1.173)
Beneficiary (II)		1.228 (0.794, 1.899)
BOP effect (I*II)		0.900 (0.552, 1.467)
Demographic characteristics	Age	0.987 (0.932, 1.046)
	Sex (female)	1.412 (0.991, 2.013)
	Marital status (without partner)	1.316 (0.778, 2.224)
	Educational level	0.770 (0.588, 1.010)
	Household scale	1.004 (0.833, 1.211)
	Family structure (structurally defective home)	1.440 (0.777, 2.666)
Economic characteristics	Household assets	0.999 (0.998, 1.000)*
	Household current income per year	0.993 (0.981, 1.004)
	Public pension income (other than BOP) per year	1.000 (0.999, 1.000)*
	Private transfer income per year	1.000 (1.000, 1.000)
	Economic participation (active)	0.951 (0.669, 1.351)
	Homeownership (non-homeowner)	1.314 (0.851, 2.028)
Relational characteristics	Social relationships (satisfied)	0.747 (0.556, 1.003)*
	Family relationships (satisfied)	0.560 (0.403, 0.776)***
Health characteristics	Chronic disease (patient)	1.663 (1.096, 2.523)*
	Hospital healthcare (utilization)	1.881 (1.323, 2.673)***

DD, difference-in-difference; BOP, Basic Old-Age Pension; OR, odds ratio; CI, confidence interval.

* $p < 0.05$, *** $p < 0.001$.

benefits such as the national pension, which was one of the control variables, affected mental health positively (Table 4). Nonetheless, private transfers did not contribute to mental health.

The utility of the BOP may vary depending on the amount of the benefit or the characteristics of the beneficiary; thus, we conducted a stratified DD model according to the household type (Table 5). No statistical significance was observed for the BOP benefit in either the double-beneficiary or the single-beneficiary group. Thus, the BOP benefit was not helpful for alleviating depression of older adults in their 70's.

DISCUSSION

This study provided information regarding the effect of the BOP on depression in Korea. We used the DD approach instead of RD for several reasons. First, RD is based on the idea that observations just below and just above the threshold are fairly comparable [22]. However, over-65-year-olds and under-65-year-olds are considerably different, especially in Korea. Most welfare policies for the old (e.g., the national pension and support for out-of-pocket healthcare payments) are for those over 65 years of age. The average retirement age in Korea is 62.5

Table 5. Stratified DD analysis of the effect of the BOP on probable depression in older adults by household type

Category	Variable	Double-beneficiary (n = 368)	Single-beneficiary (n = 392)
After policy		0.729 (0.461, 1.154)	0.928 (0.950, 1.568)
Beneficiary		0.812 (0.447, 1.474)	1.931 (0.955, 3.905) [†]
After policy * Beneficiary (BOP effect: DD)		1.470 (0.742, 2.914)	0.529 (0.252, 1.107) [†]
Demographic characteristics	Age	1.021 (0.945, 1.103)	0.947 (0.857, 1.046)
	Sex (female)	1.884 (1.202, 2.954)	0.542 (0.243, 1.207)
	Marital status (without partner)	(omitted)	3.573 (1.286, 9.924)*
	Educational level	0.763 (0.533, 1.092)	0.706 (0.450, 1.107)
	Household scale	0.996 (0.730, 1.358)	1.108 (0.777, 1.333)
	Family structure (structurally defective home)	0.574 (0.033, 10.100)	1.622 (0.705, 3.731)
Economic characteristics	Household assets	0.999 (0.997, 1.000)	0.999 (0.998, 1.000)
	Household current income per year	0.996 (0.977, 1.016)	0.992 (0.975, 1.008)
	Public pension income (other than BOP) per year	1.000 (0.999, 1.000)*	1.000 (0.999, 1.000)
	Private transfer income per year	1.000 (1.000, 1.001)	1.000 (1.000, 1.001)
	Economic participation (active)	1.188 (0.742, 1.903)	0.808 (0.448, 1.460)
	Homeownership (non-homeowner)	2.167 (1.038, 4.524)	1.039 (0.570, 1.893)
Relational characteristics	Social relationships (satisfied)	0.703 (0.471, 1.050)	0.756 (0.471, 1.213)
	Family relationships (satisfied)	0.668 (0.413, 1.081)	0.528 (0.324, 0.861)*
Health characteristics	Chronic disease (patient)	1.265 (0.744, 2.150)	2.872 (1.391, 5.931)**
	Hospital healthcare (utilization)	2.084 (1.300, 3.340)	1.660 (0.943, 2.921) [†]

Values are presented as odds ratio (95% confidence interval).

DD, difference-in-difference; BOP, Basic Old-Age Pension.

[†] $p < 0.1$, * $p < 0.05$, ** $p < 0.01$.

years; therefore, the economic situations of under 65 year-olds and over 65 year-olds are not proper to compare. In other words, RD analysis between the elderly and non-elderly may be not suitable in Korea. Second, our beneficiary groups were defined as those who got the benefit for the whole year. In the first half of the year, the eligible age was 70 and over. In other words, the age group 65-69 years should not be included in our subject population. Because RD needs a certain cut-off point (threshold), RD is not appropriate for this study. Even though we don't need a cut-off point in fuzzy regression discontinuity [23], which the probability of treatment increases at the cut-off but is not deterministic in, we thought that it is more clear not to have a fuzzy area to find intervention's effect.

In the analysis, the basic pension benefit was not statistically significant for the whole beneficiary group. Likewise, a previous study showed that the BOP benefit was not considered to be substantial enough to resolve poverty or relative deprivation [14]. While an income increase following the BOP benefit could cause economic satisfaction, though only to a limited extent [14], it does not seem to have to do with a decreased level of depression symptoms, which are a more complex mental status.

Nonetheless, economic resources such as household assets and public pension income have a statistically significant relationship, despite their slight impact. This point can be seen from a life course perspective. Household assets are a cumulative resource, and therefore reflect an individual's economic life. Additionally, to receive a contributory public pension benefit like the national pension, a person has to make pension contributions for 10 years or more. Therefore, having more assets and receiving a public pension mean that a person had spare money to save and was economically active and stable when he or she was young. Those factors contribute to the economic instability in vulnerable and old people, and therefore could affect their mental health by increasing their risk of depression.

In addition, satisfaction with family relationships and chronic diseases affected depression in the single-beneficiary group. This implies that for old females without a spouse, who formed the majority of the single-beneficiary group, intimate relationships with family members are important [20]. Family relationships and family structure have a huge impact on the mental health of older adults because of their reduced social interactions [24]. Similarly, chronic diseases are a major risk factor for depression in that population [25]. The educational

level of BOP beneficiaries was also lower, which from a life-course perspective implies that they could have had a low SES throughout their lives and that they suffered from its cumulative effect. In a survey in 2017, over 70% of respondents thought that economic status in adolescence might have an influence on economic status in older age [26]. In addition, more economic concerns were shown among those with a lower education (43.2%) than among those with a higher education (25.3%) [27].

In the DD and the stratified DD analyses, the BOP benefit did not show a statistically significant effect on depression for either type of household, using a significance level of 0.05. However, this result should not be interpreted as implying that there is no relationship between income security and mental health. In Korea, economic problems are the largest problem in older adults, both those living alone and in couples (25.8%) [28]. Consistent stressful situations might make people depressed and reduce their self-efficacy. Mental health problems such as depression are linked to suicidal ideation and suicide attempts [29,30]. In 2017, the National Survey of Older Koreans showed that the most important reason for suicidal ideation was economic problems (27.7%) [31]. Therefore, the high suicide rate among older Koreans is likely to be due to economic problems.

In this regard, regular economic assistance such as the BOP benefit can be helpful because it can ease the burdens of older adults regarding their livelihood [32]. This kind of support increases both income itself and income stability. Therefore, it can relieve stress from changing income sources [4]. While unrecoverable and ongoing economic difficulties are a chronic stressor [33], a regular and stable income stream can be a positive influence. This alleviation effect is more evident in vulnerable groups such as females, low-educated households [34], low-income households, and the chronically ill [35]. In other words, the positive effect of the BOP benefit might be crystallized in vulnerable beneficiaries who have limited access to other economic resources. In this analysis, the difference came closer to statistical significance in single-beneficiary households, which are a more vulnerable group. From an economic perspective, this means that one's utility from BOP is affected by the availability of its substitutes.

This study has a few limitations. First, the CES-D was used as a measure of the outcome variable. The predictive power of the CES-D might vary depending on race [36] and disease manifestation. Therefore, the CES-D might not be an adequate tool

to capture the effects of economic stress. Nonetheless, the CES-D is one of the best indicators in non-clinical settings [37] and is widely used, making its compatibility high [38]. Second, we used a DD design to consider the honeymoon effect [12] in our analysis. Therefore, we captured only the immediate impact of the BOP, not its long-term effects or changes in the policy impact. Further research is needed to overcome this. Third, when the parallel assumption is not satisfied, the DD estimator is biased. In this study, since we had only 1 time point before the research period, it was not proper to check the assumption because of the lack of data. Despite these limitations, this is one of a few studies to consider the health effects of a pension system, specifically, a non-contributory pension plan.

This study investigated the impact of the BOP on depression among older adults in Korea. In this study, the BOP had no statistically significant relationship with depression, using a statistical significance threshold of 0.05. However, further research may more fully explore the positive impact of the BOP. As income sources become more stable, as through weighted increases in the public pension, mental health improves [39], which is an effect separate from that caused by income level. The BOP might enable income increment or stabilization regardless of labor participation, which most older adults are unwilling to do, especially for vulnerable groups such as widowed older females. Although the positive effects of the BOP on mental health were not confirmed, its potential positive impact may be high.

SUPPLEMENTAL MATERIALS

Supplemental material is available at <https://doi.org/10.3961/jpmp.20.024>.

CONFLICT OF INTEREST

The authors have no conflicts of interest associated with the material presented in this paper.

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AUTHOR CONTRIBUTIONS

Conceptualization: JK, TJL, CSK. Data curation: JK. Formal analysis: JK. Methodology: JK. Writing – original draft: JK. Writing – review & editing: JK, TJL, CSK.

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