

ORIGINAL RESEARCH



Correlation between income changes in the elderly receiving the basic old-age pension and suicide rates

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Abstract

As of 2018, the highest suicide rates in Korea occur in the elderly, defined as aged 65 or older. There are several factors that influence the suicide rate in the elderly population, but one is economic poverty. The elderly poverty rate is defined as the percentage of elderly people with median or lower incomes. The purpose of this study was to examine the correlation between the basic pension paid to the elderly in Korea and suicide attempts. This study retrospectively reviewed data registered in the Emergency Department-Based Injury In-Depth Surveillance Database in South Korea from 2011 to 2017. In this study, people aged 60 to 64 years formed the control group, and those aged 65 to 69 years formed the treatment group. Difference-in-Differences (DID) was used for analysis. This study confirmed that the rate of suicide attempts among the elderly decreased by about 0.07% when they received the basic pension. The ratio of the number of suicidal patients (self-reported) to the total number of patients aged 60 to 69 was 0.62%; this ratio was reduced by about 10% among 60- to 69-year-olds receiving the basic pension. The same ratio pattern was found by a sensitivity analysis between groups with different age differences. This is the first study to investigate the correlation between the basic pension and suicide ideation in the elderly population of Korea. This study provides valuable insights, which will contribute to finding ways to prevent elder suicides in Korea through social approaches.

Keywords

Emergency department; Geriatric psychiatry; Pension; Suicide

1. Introduction

In most countries, the highest suicide rates occur among the elderly, defined as aged 65 or older [1]. Aging is a critical factor for suicide. The average elderly suicide rate (per 100,000 population) in Organization for Economic Cooperation and Development (OECD) member countries is 18.4, and Korea ranks first with an average rate of 53.3 (2016), which is 2.9 times higher than the OECD average. As of 2018, the elderly in Korea maintained the highest suicide rates among all age groups. The suicide rates were 48.9 and 69.8 per 100,000 people in the 1970s and 1980s, respectively [2]. Finding social solutions for the problem of suicide rates among the elderly is an urgent task for our society because we are on the cusp of being an aging society in earnest.

In general, there are four main contributors to suicide rates: demographic and socioeconomic factors, physical disease, mental illness, and interpersonal relationships. These can be divided into personal and social causes. Previous studies of suicide in Korea have emphasized personal causes, which include psychological aspects, such as depressive disorder [3]. However, most cases of elder suicide are caused by complex causes rather than a single one. Therefore, it is challenging to

understand the causes and phenomenon of elder suicide. To overcome these difficulties, a social approach to prevention of suicide attempts among the elderly is crucial. In particular, understanding factors that are amenable to direct policy intervention, such as economic factors, is important.

The problem of poverty among the elderly in Korea is severe. The elderly poverty rate is defined as the percentage of elderly people with incomes at or below the median among the total elderly population. According to OECD data from 2014 to 2018, Korea's elderly poverty rate is 43.4%, which is the highest by far among OECD countries [4]. There is a critical relationship between high suicide rates among the elderly and poverty in Korea. In the case of Korea, a study has shown that the combination of a high elderly poverty rate, a low level of elderly welfare expenditure, and a low level of life satisfaction are conditions leading to high suicide rates among the elderly [5]. Another study has verified the correlation between economic factors and suicide [6, 7]. However, these previous studies analyzed simple correlations rather than cause-and-effect relationships. Christian *et al.* [8] (2019) confirmed a correlation between economic problems and suicide in 173 countries. However, the cross-sectional data used in this study also made it difficult to prove a causal relationship between

economic problems and suicide. In another study conducted in Brazil [9] there are positive association with lower suicide rate and socioeconomic intervention such as cash transfer program among over than 100 million people covering 12-year period.

Therefore, the purpose of this study was to determine whether expansion of the basic old-age pension in Korea from 100,000 won (\$83) per month to a basic pension of 200,000 won (\$165) per month in July 2014 has reduced suicide attempts among the elderly.

2. Methods

2.1 Change of Korean basic pension

The basic old-age pension and basic pension are non-contributory pensions that are free for elderly persons aged 65 or older and those in the bottom 70% of incomes. Both basic old-age pension and basic pension are systems introduced to alleviate the severe poverty problem among the elderly in Korea. This public pension system is unique to Korea and is similar in character to a basic income because they are paid universally and are free of charge.

In January 2008, the basic old-age pension of 100,000 won (\$83) per month was introduced, but because it did not resolve the elderly poverty problem, it was expanded to a basic pension of 200,000 won (\$165) per month in July 2014. According to the 2020 factual survey on the elderly, the average monthly income of the elderly is South Korean won (KRW) 1,298,000 won (\$1093), which is 15.4% of the average monthly income of the elderly [2].

2.2 Study design and population

This study retrospectively reviewed data registered in the Emergency Department-Based Injury In-Depth Surveillance (EDIIS) database in South Korea from January 2011 to December 2017. This database was developed, and is operated, by the Korea Disease Control and Prevention Agency (KCDA).

Since 2006, 23 emergency centers have participated in EDIIS implementation to proactively collect demographic features and injury-related factors for patients visiting Emergency Departments (Eds). Hospitals participating in this research include tertiary university hospitals, where final treatment for over 30,000 severe emergency patients per year, and over six specialized emergency departments. Participating emergency centers prospectively investigate and enter codes for 58 common items considered damage-related items. Moreover, the participating institutions were subdivided into six in-depth investigative divisions, and six emergency centers participated in the monitoring of suicides to investigate three additional in-depth items: methods of suicide, previous suicide attempts and methods, status of the psychiatric interview with the person who attempted suicide, and reasons for discharge of suicidal patients against medical advice.

The inclusion criteria for this study were (1) patients who were admitted due to suicide attempts and (2) patients aged 60 to 69 years. Cases with insufficient EDIIS data were excluded.

2.3 Data collection

In this study, patients 60 to 64-years-old formed the control group, and patients 65 to 69-years-old formed the treatment group. The age standard for the basic pension, 65 years, was set as random for administrative convenience. If this standard is applied as a quasi-experiment, it is possible to analyze the treatment effect in a strict sense. This study collected data about sex, prior suicide attempts, medical insurance type, and suicide attempt.

2.4 Statistics

Continuous variables are presented as means \pm standard deviations, while categorical variables are presented as counts (percentages). Categorical variables were analyzed using a chi-square test. A p -value < 0.05 was considered statistically significant.

Difference-in-Differences (DID) was the analytical method used.

The regression equation of DID is as follows:

$$Y_{igt} = Group_g + Halfyear_t + X_{ist}\beta + Treat_{gt}\delta + \epsilon_{igt}$$

Y = Suicide attempt: yes (1), no (0)

Group = 65–69 years old (1), 60–64 years old (0)

Half-year = half of year (first half of 2011–second half of 2017)

X = control variable (sex, insurance type)

Treat = age 65 or older and after second half of 2014 (1), others (0)

DID is a representative method to analyze treatment effects by analyzing differences between the treatment and control groups. After the second half of 2014, when the basic pension system was implemented, the treatment group (age 65 or older) received the basic pension, but the control group (age 65 or younger) did not receive the basic pension. However, since the 65-year-old standard was set for administrative convenience, it is random whether a sample will be classified as a member of the treatment or control group. Therefore, it is possible to analyze the treatment effect in a pure sense.

Specifically, in this paper, the treatment and control groups were set as follows:

- (1) 62–64 vs. 65–67 (3 years apart)
- (2) 61–64 vs. 65–68 (4 years apart)
- (3) 60–64 vs. 65–69 (5 years apart)
- (4) 60–64 vs. 65–69 (6 years apart)
- (5) 60–64 vs. 65–69 (7 years apart)

Suicide attempts are not frequent in the population as a whole. Therefore, if the group size is constructed in small (e.g., 1-year) intervals, the variance of the estimation result may increase because a sufficient number of cases could not be observed. Conversely, if the group size is constructed in large (e.g., 7-year) intervals, the bias of the analysis will increase due to increased heterogeneity between the treatment and control groups. By adjusting the sizes by 1-year intervals, treatment and control groups were established to confirm the overall value of the average treatment effect (ATET) that resulted from

expanding the basic old-age pension to the basic pension in July 2014.

3. Results

3.1 Demographic and clinical data of all patients who visited emergency departments before legislation (Fig. 1, Table 1)

Fig. 1 is a graph showing the number of suicide attempts in a year in the treatment (red, 65–69 years old) and control (blue, 60–64 years old) groups. According to this graph, the number of suicide attempts per half-year increased for both the treatment and control groups. This reveals that the frequency of elder suicide has increased in Korea over the past 10 years. From the second half of 2014, when the basic pension system was established, the increase in suicide attempts in the treatment group was lower than those in the control group.

The demographic and clinical data of the patients of the treatment and control groups before pension payment are described in Table 1. There was a difference in sex ratios between the two groups who visited the ED, and the proportion of people who attempted suicide was not significantly different. However, there was a significant difference in the type of medical insurance. There was no statistically significant difference between the two groups in terms of prior suicide attempts.

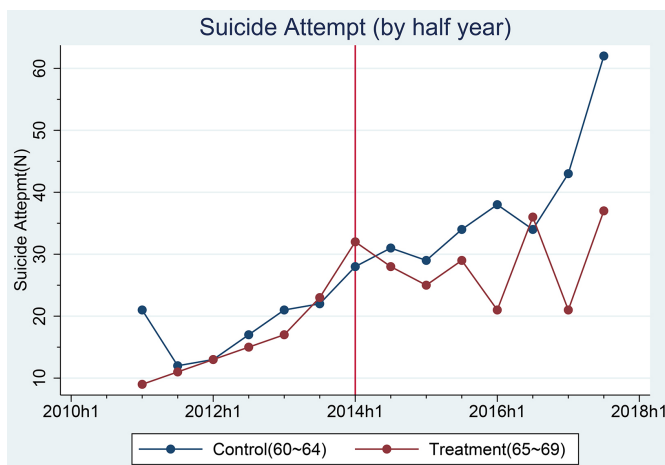


FIGURE 1. Number of suicide attempts per year by age group.

3.2 Treatment effects between two groups after legislation (Fig. 2, Table 2)

In Fig. 2, the treatment and control groups were analyzed via DID using basic pension supply and demand in 2014. The left panel shows the ratio of suicide attempts by year (the number of patients who attempted suicide/total patients who visited the ED), and the right panel shows the ratio of suicide attempts estimated by year using parameters estimated by DID analysis.

The observed means of the two groups in the left panel show similar patterns, and the regression results in the right panel also show similar patterns for the two groups before 2014.

Table 2 shows the results of the Difference-in-Differences

(DID) analysis. ATET refers to the difference between the suicide attempt rates when receiving the basic pension and not receiving the basic pension. In columns (1), (2), (3), (4) and (5) the ATET values are all negative, and all were significant at the level of 90% to 95%. Column (5) indicates that receiving the basic pension reduces the suicide attempt rate by 0.078% (0.078% points).

The ratio of the number of patients who attempted suicide to the total number of patients aged 60 to 69 was 0.62%. Therefore, the 0.078% decrease in the rate of suicide attempts after introduction of the basic pension indicates that the rate of suicide attempts has decreased by about 10%. This ratio was also found in the sensitivity analysis between groups with different age ranges.

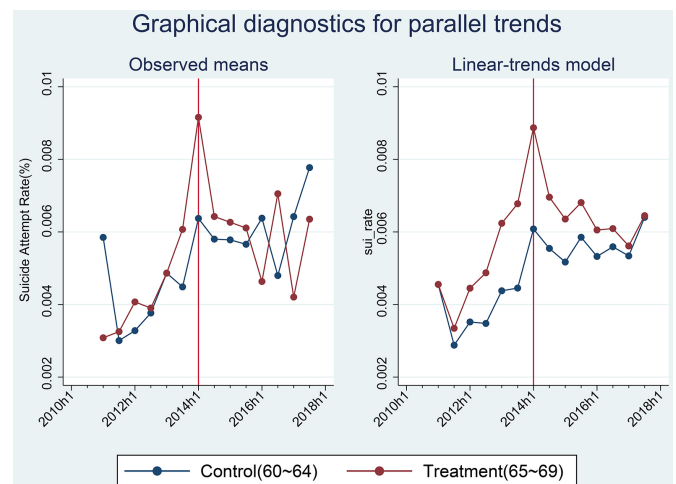


FIGURE 2. Difference-in-Differences analysis of two groups.

4. Discussion

The purpose of this study was to examine the correlation between basic pension paid to the elderly in Korea and suicide attempts. There are several characteristics of basic pension in Korea. Those whom with aged 65 years old, bottom 70% of income without any obligation to pay in advance, can receive a pension. Therefore, it has the characteristics of a basic income. At this time, in this study, the treatment group and the control group are divided by age (age 65). After all, people in the top 30% of income levels are not considered as who would commit suicide with 200,000 won a month. As a result, over the age of 65, it is not unreasonable to consider that they have received all of the basic pension. Christian analyzed whether the cash transfer policy implemented in Indonesia in 2014 reduced Indonesia's suicide rate [8]. Analysis using the DID method confirmed that the number of suicides decreased by 0.36 per 100,000 people when \$22.45 was paid annually to the poor living in villages. However, Indonesia is a developing country with a Gross domestic product (GDP) of about \$4000 per capita. It is necessary to verify whether the policies implemented in developing countries are also valid in Korea, which has a \$30,000 per capita GDP. Moreover, in Indonesia, the policy experiment was aimed at all ages.

TABLE 1. Demographic and clinical data of all patients.

		60–64 years old n=73,757		65–69 years old n=57,665		p-value
		n	%	n	%	
Sex	Male	42,727	57.9%	31,393	54.4%	0.000
Suicide attempt	Yes	405	0.5%	317	0.5%	0.988
Insurance type						
	Insurance-basic*	55,313	75.0%	43,441	75.3%	0.000
	Insurance-01†	2,584	3.5%	2,552	4.4%	
	Insurance-02‡	470	0.6%	119	0.2%	
	Insurance etc.	15,390	20.9%	11,553	20.0%	
Prior suicide attempt	Yes	55	0.1%	36	0.1%	0.406

*Insurance-basic; National health insurance. The National Health Insurance (NHI) system provides healthcare coverage to all citizens. The major sources of NHI funding include contributions from those who are insured and government subsidies. The medical aid program is a form of public assistance that uses government subsidies to provide low-income groups with healthcare services.

†Insurance-01: Type 1 medical benefit; (1) National Basic Livelihood Security Recipient. Households in which people are unable to work, rare patients, severely incurable patients, and facility recipients. (2) Person who uses other methods of insurance. Victims, bereaved families of the costumes and doctors, adopted children under the age of 18, national merit, holders of important intangible cultural properties, North Korean defectors, people involved in the May 18 Democratization Movement, homeless people. (3) Tranquilized patient.

‡Insurance-02: Type 2 medical benefit. Among the beneficiaries of the National Basic Livelihood Security, those who do not meet the criteria for type 1 medical benefits.

In another study conducted in Brazil, they demonstrated that cash transfer is associate with lower suicide rate about 56% [9]. Cash transfer could increase recipients' welfare by providing immediate financial stability because poverty may contribute to the feeling of social injustice generated from inequities. The socioeconomic intervention provided by the government could decrease the outcome of mental illness. As a result, the suicide rate could also be decreased. This fact is consistent with our study.

This study confirmed that the rate of suicide attempts decreased by about 0.07% after introduction of the basic pension for the elderly. The ratio of the number of self-described suicide patients to the total number of patients aged 60 to 69 is 0.62%, which was reduced by about 10% when the basic pension was introduced. This ratio was also found in the sensitivity analysis between different age groups.

Many studies have been conducted previously to study the risk factors for suicide attempts among the elderly with the goal of reducing their suicide rates. Risk factors influencing the suicidal ideation of the elderly include being male, low level of education and social standing, underlying diseases (especially depressive disorder), drug use, and communication problems [9–11]. In addition, studies have shown that low socioeconomic status negatively affects mental health [12, 13]. Ju *et al.* [13] demonstrated that low socioeconomic status, such as the elderly living in poverty, negatively affects mental health factors, such as suicidal ideation [12].

Various strategies to reduce the suicide attempt rate by

reducing such risk factors have been attempted.

However, this study will support the attempt to target larger groups rather than individuals using a social and systematic approach.

Our study has several strengths when compared with previous studies. First, this study used a large national database. Second, this study is one of few empirical analyses that directly analyzed suicide attempts that also investigated the correlation between socioeconomic variables and suicide ideation among the elderly in Korea. Moreover, this study is a basic study that will help establish national policies as preventive measures to reduce suicide attempts in the elderly. In particular, Korea and Japan, which have rapidly aging populations, need suicide prevention programs focusing on the elderly poor. When social support, such as individual pensions, was provided, the effect was clear; therefore, this result indicates that more improved, specific policies are required.

Our study had several limitations. First, the EDIIS data used in this study were those of patients brought to the ED for suicide attempts. EDIIS data include common items (58 items), traffic accident in-depth items (9 items), head and spine injuries (6 items), deep suicide (10 items), deep poisoning (3 items), falls & falls (7 items), damage to preschool children (10 items). Moreover, there are several limitations existed in using EDIIS data. Among common items (59 items), local variables are not provided as personal identification issues. Also among common items, most of the variables for income and education are missing values. Therefore, among

TABLE 2. Difference-in-Differences analysis of five different age groups.

	(1)	(2)	(3)	(4)	(5)
ATET†					
Treat 1	-0.00109** (0.00005)				
Treat 2		-0.00076* (0.00008)			
Treat 3			-0.00106** (0.00005)		
Treat 4				-0.00116** (0.0004)	
Treat 5					-0.00078** (0.00002)

†ATET: average treatment effect.

(1) 62–64 vs. 65–67 (3 years apart)

(2) 61–64 vs. 65–68 (4 years apart)

(3) 60–64 vs. 65–69 (5 years apart)

(4) 60–64 vs. 65–69 (6 years apart)

(5) 60–64 vs. 65–69 (7 years apart)

* $p < 0.1$; ** $p < 0.05$;

the common items (59 items), the main cofactors that could be used were gender, age, intention to damage, and alcohol level. Moreover, selection bias may have occurred because those whose suicide attempts were successful were omitted from this data. In addition, among patients aged 65 or older, those in the top 30% of incomes did not receive basic pensions; however, these patients could not be excluded from the dataset because the incomes of the target patient group were not investigated. However, for those in the top 30% of incomes, basic pension does not significantly affect one's income, so it is not necessary to consider this. Finally, this study could not include socioeconomic factors, such as income and education levels and physical and mental health-related variables, as control variables. This is a fundamental limitation that arose because the EDIIS data does not include these variables. In a future study, we will supplement the EDIIS data by including cause of death statistics with more variables than EDIIS.

Despite these limitations, this study is the first to investigate the correlation between the elderly basic pension and suicide ideation in the elderly population in Korea. Because Korea has the highest elderly poverty and suicide rates among developed countries, this research provides valuable insights for developing solutions for the prevention of suicides among the elderly in Korea through social approaches.

5. Conclusions

This is the first study to investigate the correlation between the basic pension and suicide ideation in the elderly population of Korea. This study provides valuable insights, which will contribute to finding ways to prevent elder suicides in Korea through social approaches.

AVAILABILITY OF DATA AND MATERIALS

The data are not publicly available due to ethical restrictions and regulations of the participating hospitals.

AUTHOR CONTRIBUTIONS

JYL—Conception and design; Acquisition, analysis, and interpretation of data; Study supervision. SHL, YHC and DHL—Drafting the manuscript for intellectual content; JSO—Statistical analysis. All authors reviewed, revised, and approved the manuscript for submissions.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the institutional review board of Ewha Womans University Seoul Hospital, and the requirement for written informed consent was waived (IRB No: 2021-09-015).

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

- [1] National Institute of Mental Health. Distribution of suicide rates (per 100,000), by gender and age. 2000. Available at: <https://www.nimh.nih.gov/health/statistics/suicide> (Accessed: 1 February 2021).
- [2] Korea Institute for Health and Social Affairs. 2020 factual survey on the elderly. 2020. Available at: http://www.mohw.go.kr/react/jb/sjb030301vw.jsp?PAR_MENU_ID=03&MENU_ID=032901&CONT_SEQ=366496&page=1 (Accessed: 1 February 2021).
- [3] Gao J, Chen M, Wang X, Wang H, Zhuo L. Risk factors and prognosis of acute kidney injury in adult hospitalized patients: a two-year outcome. *Minerva Urology and Nephrology*. 2015; 67: 179–185.
- [4] Organization for Economic Cooperation and Development. OECD economic surveys: Korea. 2020. Available at: <https://www.oecd.org/economy/surveys/korea-2020-OECD-economic-survey-overview.pdf> (Accessed: 1 February 2021).
- [5] Lee S, Jung K, Kang E, Kang S, Lee SH, Kim Y. Socio-economic factors

- and policy implication of elderly suicide. The Korea Institute for Health and Social Affairs. 2009; 141–154.
- [6] Bando DH, Brunoni AR, Benseñor IM, Lotufo PA. Suicide rates and income in São Paulo and Brazil: a temporal and spatial epidemiologic analysis from 1996 to 2008. *BMC Psychiatry*. 2012; 12: 127.
- [7] Sareen J, Afifi TO, McMillan KA, Asmundson GJG. Relationship between household income and mental disorders. *Archives of General Psychiatry*. 2011; 68: 419.
- [8] Christian C, Hensel L, Roth C. Income shocks and suicides: causal evidence from Indonesia. *The Review of Economics and Statistics*. 2019; 101: 905–920.
- [9] Sultanoğlu H, Erdem Sultanoğlu T. Evaluation of elderly patients in adult suicide cases admitted to the emergency department. *Journal of Forensic and Legal Medicine*. 2021; 77: 102103.
- [10] Ki M, Seong Sohn E, An B, Lim J. Differentiation of direct and indirect socioeconomic effects on suicide attempts in South Korea. *Medicine*. 2017; 96: e9331.
- [11] Fachola MCH, Lucero R, Porto V, Díaz E, París MdIA. Suicide attempts and suicide ideation among the elderly in Uruguay. *Ciência & Saúde Coletiva*. 2015; 20: 1693–1702.
- [12] Ju YJ, Park E, Han K, Choi JW, Kim JL, Cho KH, *et al.* Low socioeconomic status and suicidal ideation among elderly individuals. *International Psychogeriatrics*. 2016; 28: 2055–2066.
- [13] Park SM, Moon SS. Elderly Koreans who consider suicide: role of healthcare use and financial status. *Psychiatry Research*. 2016; 244: 345–350.

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