The impact of the implementation of a national policy on dementia on healthcare costs in older patients with dementia in Korea: a quasi-experimental difference-in-difference study

*Mingee Choi,[a,b,f] Woorim Kim,[c,d,f] Jong Youn Moon,[e,**] and Jaeyong Shin[a,b,*]*

[a]Institute of Health Policy and Management, Yonsei University College of Medicine, Seodaemun-gu, Seoul, Republic of Korea
[b]Department of Preventive Medicine, Yonsei University College of Medicine, Seodaemun-gu, Seoul, Republic of Korea
[c]National Hospice Center, National Cancer Control Institute, National Cancer Center, Goyang-si, Gyeonggi-do, Republic of Korea
[d]Division of Cancer Control & Policy, National Cancer Control Institute, National Cancer Center, Goyang-si, Gyeonggi-do, Republic of Korea
[e]Department of Preventive Medicine, Gachon University College of Medicine, Incheon, Republic of Korea

Summary

Background Owing to the aging population, the prevalence of dementia is increasing worldwide and has become an important public health problem. In 2018, Korea implemented the National Dementia Care Policy to strengthen the management of dementia and reduce its related burden on medical expenses. This study investigated the effect this policy on total and out-of-pocket costs in elderly patients with dementia.

Methods Data were from the National Health Insurance System. The study population included 10,549,863 individuals aged 65 years or older, recorded between January 1, 2015, and December 31, 2020. The treatment group comprised of dementia patients and the control group those diagnosed with the five most common diseases found in individuals aged 65 years or above. The difference-in-difference was used to explore changes in total and out-of-pocket healthcare costs per diagnosed case between the treatment and control group before and after the intervention period.

Findings Policy implementation was associated with a significant decrease in patient out-of-pocket cost. In the covariate-controlled model, no statistically significant changes were found for total mean healthcare cost. However, patient out-of-pocket cost decreased by 0.05 per diagnosed case.

Interpretation The National Dementia Care Policy led to a reduction in patient out-of-pocket cost in elderly patients with dementia. National policies need to be monitored to reduce the economic burden of patients with dementia while maintaining the financial sustainability of the healthcare system.

Funding This research was financially supported by the Ministry of Trade, Industry and Energy (MOTIE) and Korea Planning & Evaluation Institute of Industrial Technology (Project No. 20024263).

Keywords: Dementia; Healthcare policy; Older adults; Long-term care insurance; Out-of-pocket cost

Introduction

Dementia is characterized by a loss of cognitive ability and deterioration in the ability to function independently.[6] Dementia is one of the most important public health problems worldwide, affecting a large number people.[1] Its prevalence is expected to escalate continuously as many countries have an aging population.[2] In South Korea, the related costs are vast, estimated at approximately 13 billion dollars annually, and are projected to increase.[3,4] An important feature of dementia is that there is currently no available cure, wherein available pharmacological or non-pharmacological

*Corresponding author. Department of Preventive Medicine, Yonsei University College of Medicine, 50 Yonsei-ro, Seodaemun-gu, Seoul, 03722, Republic of Korea.
**Corresponding author. Department of Preventive Medicine, Gachon University College of Medicine, 21, Namdong-daero 774beon-gil, Namdong-gu, Incheon, 21565, Republic of Korea.
E-mail addresses: drshin@yuhs.ac (J. Shin), moonjy@gachon.ac.kr (J.Y. Moon).
[f]Denotes equal contribution.

Research in context

Evidence before this study
The prevalence of dementia worldwide continues to increase, making it one of the important public health problems.[1,2] About 750,000 people in South Korea suffer from dementia, and related costs are vast and are expected to increase steadily.[3,4] Therefore, it is important to understand the relevant economic costs in order to properly implement and adapt medical policies for dementia.

Added value of this study
This study aimed to evaluate changes in medical expenditures after the introduction of the dementia support measures implemented by the Korean government in 2018 using the differential-in-difference (DID) approach. This study used claims data from the National Health Insurance System (NHIS) in Korea from 2015 to 2020 of 11,310,245 older

patients, which is approximately 30% of all older adults in Korea. Policy implementation was associated with a significant decrease in patient out-of-pocket costs.

Implications of all the available evidence
Since dementia has similar characteristics to chronic diseases and dementia patients are expected to continue to increase, proper financial management is essential.[5] No drastic changes have been found, but the results of this study provide important insights by revealing that the national dementia management policy was effective in reducing the cost of patients' own expenses to some extent. It is necessary to continuously monitor and develop policies for dementia to reduce the burden on dementia patients and increase access to quality services without inducing excessive use of unnecessary medical services.

interventions can only alleviate symptoms, placing a heavy burden on the patients, family members, and society.[7] Hence, understanding the related economic burden is important in implementing and adapting healthcare policies on dementia.

The main goals of policies on dementia are to promote earlier diagnosis, slow progression, and provide support by reducing the burden of dementia patients and caregivers.[3,8] Korea implemented the dementia management act in 2012 and has established over 250 dementia counseling centers nationwide, providing services such as counseling and examinations, but the proportion of patients receiving the provided benefits was relatively small due to low public awareness.[7] Accordingly, the government acted to reduce the burden of patients by introducing a strong policy in 2018.[3,4] Specifically, it suggested health insurance coverage up to 90% for dementia-related medical expenses, the expansion of dementia support centers and dementia relief hospitals, and the enlargement of the provision of long-term care services for patients.[3,7]

Regarding long-term care services, dementia support measures were also implemented under the national long-term care insurance (LTCI) scheme in 2018 to strengthen its management and reduce dementia related burden.[9] As shown in Fig. 1, before 2018, dementia patients were entitled to LTCI benefits as they were able to receive a special grade but because the previous grading system was based on physical functioning, mild cognitive impairment patients were often unable to receive the cited special grade and could not benefit from the LTCI. In order to solve this issue, a new grading system considering cognitive function was established so that all older patients with dementia could receive long-term care services.[4] The main components of the LTCI were to enhance support for patients and their caregivers by (i) the establishment of dementia support centers (public health centers) across the nation to provide services such as early screening, personalized counseling, and prevention or therapeutic programs; (ii) the reorganization of the LTCI inclusion criteria to encompass older people with mild dementia;
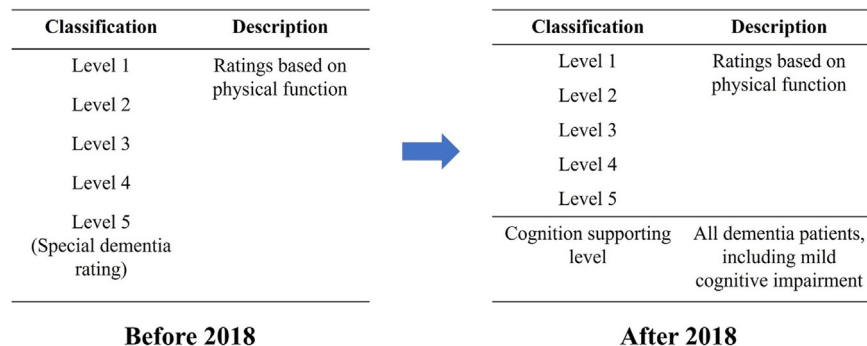
Classification	Description
Level 1	Ratings based on physical function
Level 2	
Level 3	
Level 4	
Level 5 (Special dementia rating)	

Before 2018

Classification	Description
Level 1	Ratings based on physical function
Level 2	
Level 3	
Level 4	
Level 5	
Cognition supporting level	All dementia patients, including mild cognitive impairment

After 2018

Fig. 1: Changes in the long-term care insurance rating system.

(iii) the introduction of wards dedicated to dementia care at long-term care hospitals to provide treatment and care to severe patients with difficulties in receiving care at home, including those experiencing severe symptoms such as hallucination; and (iv) the reduction of out-of-pocket costs for severe patients with lower income.[10] Services that older patients can receive through the LTCI are admission to residential care facilities, home-visit nursing services, and payment support for nursing expenses. Among them, home-visit nursing services can be seen as a particularly important service as patients require continuous observation and management.[7]

As the burden of dementia increases, implementing well-balanced strategies that consider the financial resources of healthcare systems and the benefits of cost-reduction plans for patients and their family members will become increasingly important.[11] However, studies evaluating the economic impact of government dementia support measures are lacking. Therefore, this study aimed to analyze the effect of the National Dementia Care Policy on total and out-of-pocket healthcare costs in older patients with dementia, in which costs were measured per diagnosed dementia case.

Methods

Study design and data

This study used claims data from the National Health Insurance System (NHIS) in Korea from 2015 to 2020 of 11,310,245 older patients, which is approximately 30% of all older adults in Korea (Supplementary Table S1). The data included medical records of patients with dementia (International Classification of Diseases (ICD) codes: F00, F01, F02, F03, and G3) and the five most common diseases (ICD codes: I10–I15, K05, L20, M54, and M17) found in individuals aged over 65 years. The final study population included 9,985,021 individuals aged 65 years or older who were recorded from January 1, 2015, to December 31, 2020. A total of 1,325,220 patients diagnosed with neither dementia nor the five most common disease cited were excluded from the analysis. Detailed information on medical expenses and social demographics considered can be found in Table 1.

This study aimed to evaluate the effect of the dementia support measures implemented by the government to strengthen the management of dementia and reduce its related burden on medical expenses. Changes in medical expenditures after the introduction of this new policy were analyzed based on the differential-in-difference (DID) approach. The DID approach is a quasi-experimental research design used to study causality when conducting randomized controlled experiments, which is infeasible or unethical. This approach compares changes in the outcomes of groups exposed to a policy to estimate its causal effect. Previous studies have used this approach to analyze changes in the

medical expenditure level following the introduction of new healthcare policies.[12–14] By modeling the results before the intervention, differences between groups can be estimated, and appropriate results can be obtained.[15] In this study, in order to show the parallel trend before the intervention, the average annual trend graph before the introduction of the policy by cost was presented, in addition to the annual rate of increase or decrease (Supplementary Figure S1, Supplementary Table S2).

As the policy investigated was first implemented in January 2018, the pre-intervention period was from January 1, 2015, to December 31, 2017, and the post-intervention period ranged from January 1, 2018, to December 31, 2020. The treatment group included patients with dementia aged over 65 years, and the control group comprised those diagnosed with high blood pressure, gingivitis, acute bronchitis, back pain, or knee joint pain, which are the five most common diseases found in individuals aged 65 years or older. Patients with a history of dementia in the control group were excluded. The five major common diseases found in the older patients were identified based on data published by the NHIS using the International Classification of Diseases, 10th revision (ICD-10) codes I10–I15, K05, L20, M54, and M17.[16,17]

The primary outcome was changes in medical expenditures before and after the introduction of the investigated policy on dementia. H$ealthcare\ cost_i$ is the observed response for the ith observation and is the value being measured in each group before and after treatment. Furthermore, b_0 is the intercept of the regression and $Policy_i$ is a dummy variable that takes the value 0 or 1 depending on whether the ith measurement refers to the pre-policy or post-policy period. $Treatment_i$ is a dummy variable that takes the value 0 or 1 depending on whether the ith measurement refers to an individual in the control group (common diseases) or the treatment group (dementia). $(Policy_i*Treatment_i)$ is an interaction term that stores the multiplication of the two dummy variable values for the ith observation. X_i is the covariate term that may be associated with the ith observation. Last, e_i is the error term associated with the ith observation and captures the effect of all factors that the model was not able to adequately represent.

$$Healthcare\ cost_i = b_0 + b_1 Policy_i + b_2\ Treatement_i$$
$$+ b_3 \left(Policy_i{}^* Treatement_i \right) + b_4 X_i + e_i$$

Variables

The outcome variable was healthcare expenditure per diagnosed case, which was categorized into total, inpatient, outpatient, total out-of-pocket, inpatient out-of-pocket, and outpatient out-of-pocket cost. The unit was Korean Won (KRW), in which 1 United States dollar (USD) equals approximately 1300 KRW. The intervention variable was implementation of the National

	Treatment group (Dementia)		Control group (Common diseases in the elderly)	
	Pre (2015~2017)	Post (2018~2020)	Pre (2015~2017)	Post (2018~2020)
Number of patients, N	223,382	338,872	4,741,606	4,681,161
Total cost (KRW), mean	3,567,703	3,796,619	807,224	1,073,345
Inpatient cost (KRW), mean	15,272,670	17,933,125	7,938,197	10,261,934
Outpatient cost (KRW), mean	723,459	822,324	631,571	814,115
Total out-of-pocket cost (KRW), mean	643,960	699,665	150,899	193,215
Inpatient out-of-pocket cost (KRW), mean	2,674,533	3,199,407	1,219,976	1,555,029
Outpatient out-of-pocket cost (KRW), mean	165,371	182,872	125,263	155,496
CCI, mean	2.7	2.6	2.3	2.2
Social demographics				
Sex				
Men, %	41.2	40.2	44.7	44.5
Women, %	58.8	59.8	55.3	55.5
Age, mean	76.8	76.6	74.6	74.5
Type of insurance				
Local-subscriber, %	25.5	26.4	28.6	29.1
Employer-sponsored, %	59.9	59.3	66.3	65.1
Medical care, %	14.6	14.3	5.0	5.7

Note: The unit of medical costs was Korean Won (KRW), in which $1 United States Dollar (USD) equals approximately 1300 KRW.

Table 1: General information of the study population.

Dementia Care Policy. Various covariates were included to account for the individual characteristics of study participants. The included variables were sex (male or female), age, Charlson Comorbidity Index (CCI) score,[18] and type of healthcare insurance. Dementia was excluded from the calculation of the CCI.

Statistical analysis

The DID method was used to compare changes in medical expenditures before and after the implementation of the new healthcare policy. Multivariable generalized linear models with log-link and gamma distribution were applied in the analysis to account for the highly skewed distribution of data on medical expenditures, along with reporting DID estimates in relative changes. Detailed information on the skewness can be found in Supplementary Figure S2. In the cost analysis, the IQR method was used to identify outliers, in which all values outside this fence were considered outliers. All statistical analyses were conducted using the SAS software (version 9.4; Cary, NC, USA).

Statement of ethics

This study protocol was reviewed and approved by Institutional Review Board of Yonsei University Health System, approval number 4-2022-1146.

Consent to participate statement

This study received an exemption from prior consent from the Institutional Review Board of Yonsei

University Health System as a retrospective study, approval number 4-2022-1146.

Results

General characteristics of the study population

The general characteristics of the participants are shown in Table 1. The treatment group comprised of 223,382 individuals in the pre-intervention period and 338,872 in the post-intervention period. The control group included 4,741,606 participants in the pre-intervention period and 4,681,161 in the post-intervention period. In terms of sex, women accounted for a large proportion of both the treatment group and the control group. Regarding the type of healthcare insurance, employee-sponsored insurance accounted for the largest proportion, in which the two groups showed similar results. Additionally, CCI and age tended to be slightly higher in the treatment group.

The total mean medical cost was higher in the treatment than the control group in both the pre- and post-intervention period. Mean total cost tended to increase in both groups in the post-intervention period, with similar trends being found for both inpatient and outpatient cost. Patient out-of-pocket cost was also higher in the treatment than the control group before and after policy implementation. Mean out-of-pocket costs also showed an escalating trend in the post-intervention period.

The effect of the National Dementia Care Policy on healthcare costs

The effect of the implementation of the National Dementia Care Policy on healthcare costs per diagnosed case is presented in Table 2. Model 1 shows the effect of policy implementation without adjustment for covariates. Total cost showed no significant change after policy implementation, although inpatient cost decreased by 0.07 (p-value <0.0001). A significant reduction in total out-of-pocket costs was found per diagnosed case, which decreased by 0.05 (p-value = 0.0006). This tendency was found in both inpatient (0.33, p-value = 0.0008) and outpatient cases (0.04, p-value = 0.0131).

Model 2 shows the effect of policy implementation with adjustment for all covariates. In terms of total cost, no significant change was found after policy introduction, although inpatient cost decreased by 0.08 (p-value <0.0001). Regarding patient out-of-pocket cost, policy implementation was associated with a decrease of 0.05 (p-value = 0.0003) per diagnosed case, in which both inpatient (0.33, p-value = 0.0005) and outpatient (0.03, p-value = 0.0143) showed a declining trend. The effect of policy implementation on each covariate is presented in the Supplementary Table S3.

Discussion

This study examined the effect of the dementia support measures implemented by the Korean government in 2018 on healthcare costs, measured based on cost per diagnosed case, in individuals aged 65 years or older. In patients with dementia, policy implementation was associated with a decrease in total out-of-pocket cost, with significant reductions being found for both inpatient and outpatient cost. However, no significant

	Total cost			Inpatient cost			Outpatient cost		
	Estimate	SE	p-value	Estimate	SE	p-value	Estimate	SE	p-value
Model 1									
Intercept	12.5071	0.0388	<0.0001	15.7612	0.044	<0.0001	12.3131	0.0421	<0.0001
Policy (ref: pre)	−0.0842	0.0534	0.1144	−0.0452	0.08	0.5716	0.0943	0.0674	0.1619
Treatment (ref: control)	−0.0979	0.0765	0.2006	0.1391	0.009	<0.0001	−0.0136	0.0424	0.7496
Treatment*policy (ref: control, pre)	−0.0703	0.1328	0.5968	−0.0741	0.0149	<0.0001	−0.0812	0.0883	0.3577
Model 2 (all covariates included)									
Intercept	11.9408	0.0246	<0.0001	15.3026	0.1743	<0.0001	11.701	0.1624	<0.0001
Policy (ref: pre)	0.0517	0.0025	<0.0001	−0.0458	0.0834	0.5824	0.0811	0.0606	0.1805
Treatment (ref: control)	−0.0797	0.0111	<0.0001	0.1378	0.0088	<0.0001	−0.0317	0.039	0.4156
Treatment*policy (ref: control, pre)	0.0186	0.0138	0.1795	−0.0789	0.0153	<0.0001	−0.168	0.0864	0.0518
Type of insurance (ref: local subscriber) Employer-sponsored	0.0026	0.0027	0.3367	0.0123	0.0131	0.3498	−0.0244	0.0174	0.1612
Sex (ref: male)	0.0936	0.0025	<0.0001	0.0274	0.0096	0.0044	0.1019	0.0203	<0.0001
Age	0.0047	0.0003	<0.0001	0.0046	0.002	0.0189	0.0072	0.0019	0.0002
CCI	0.0264	0.0008	<0.0001	0.0233	0.0008	<0.0001	0.0229	0.0055	<0.0001
	Total out-of-pocket cost			Inpatient out-of-pocket cost			Outpatient out-of-pocket cost		
	Estimate	SE	p-value	Estimate	SE	p-value	Estimate	SE	p-value
Model 1									
Intercept	10.9283	0.0021	<0.0001	13.6138	0.0144	<0.0001	10.8649	0.0021	<0.0001
Policy (ref: pre)	0.037	0.003	<0.0001	0.0353	0.0258	0.1718	0.0359	0.0029	<0.0001
Treatment (ref: control)	0.056	0.0112	<0.0001	0.4194	0.088	<0.0001	0.0593	0.0111	<0.0001
Treatment*policy (ref: control, pre)	−0.0499	0.0146	0.0006	−0.3299	0.0983	0.0008	−0.0355	0.0143	0.0131
Model 2 (all covariates included)									
Intercept	10.7257	0.0296	<0.0001	12.8541	0.0323	<0.0001	10.7181	0.0287	<0.0001
Policy (ref: pre)	0.0381	0.003	<0.0001	0.037	0.0253	0.1439	0.0374	0.0029	<0.0001
Treatment (ref: control)	0.0394	0.0113	0.0005	0.406	0.0857	<0.0001	0.0439	0.0112	<0.0001
Treatment*policy (ref: control, pre)	−0.0534	0.0147	0.0003	−0.3332	0.0952	0.0005	−0.0353	0.0144	0.0143
Type of insurance (ref: local subscriber) Employer-sponsored	0.0112	0.0032	0.0006	0.0303	0.0097	0.0018	0.0086	0.0031	0.0063
Sex (ref: male)	0.0949	0.003	<0.0001	0.0112	0.0134	0.4064	0.086	0.0029	<0.0001
Age	0.0008	0.0004	0.0584	0.0094	0.0004	<0.0001	0.0002	0.0004	0.6193
CCI	0.0322	0.001	<0.0001	0.0084	0.0009	<0.0001	0.0298	0.001	<0.0001

SE: standard error.

Table 2: The effect of the National Dementia Care Policy on healthcare costs.

changes were found in total healthcare cost. In other words, policy implementation was not related to a decrease in total healthcare cost but led to a reduction in patient out-of-pocket expenditure.

The policy on dementia investigated aimed to strengthen the provision of dementia-related services and to reduce the co-payment level for dementia-related services to approximately 10%. The findings reveal that the policy introduced was effective in reducing patient out-of-pocket cost. This trend is noteworthy as dementia is known to impose a heavy monetary burden on patients and their families.[19] Unlike the findings on out-of-pocket expenditure, the introduction of the policy was not significantly associated with changes in the total medical cost. This may have been impacted by the overall increase in the number of dementia patients, which would have led to an overall increase in total medical cost for dementia cases.[2] In fact, the findings of this study reveal that the fraction of dementia cases increased markedly when comparing pre-to post-treatment. Hence, the results infer that while utilization seemed to have escalated noticeably, the price of out-of-pocket spending tended to go down. As spending is the product of utilization and price, considering that out-of-pocket cost showed a decreasing trend whereas utilization increased, the implemented policy likely has led to more total spending on dementia.

As the rate of population aging is expected to accelerate, the Korean government faces various challenges to introduce policies that can promote healthy aging. This inevitably requires the implementation of policies that aim to improve the quality and quantity of services for dementia-related care. Considering that premium rates for the National Health Insurance (NHI) has been increasing recently due coverage expansion, policies should be implemented and continuously revised to promote financial sustainability while ensuring the provision of necessary services.[20] As dementia exhibits many characteristics similar to that of a chronic disease and the number of patients is expected to increase, appropriate management of related financial resources is essential.[5] Although no extreme changes were found, the findings offer important insights by revealing that the National Dementia Care Policy was effective in reducing patient out-of-pocket cost to an extent. Policies on dementia should be continuously monitored and developed to reduce the burden of patients and increase their accessibility to high-quality services without inducing an unnecessary overuse of services.

Limitations

This study had some limitations. First, costs for uncovered medical services could not be considered because of data limitations. Similarly, indirect costs, such as productivity loss due to caregiving, were not available in the data used. Considering that dementia is known to incur large indirect costs, the level of economic burden experienced by patients and their caregivers may be greater than the out-of-pocket costs reported in this study. Second, as dementia was identified solely based on ICD-10 codes, not all individuals with cognitive decline may have been identified. Individuals with the five most common diseases found in individuals aged 65 years or older, were also distinguished using ICD-10 codes. Third, although this study included various confounders, the possibility of residual confounding cannot be completely ruled out. Fourth, a possibility exists that a higher number of undiagnosed dementia patients were included in the pre-treatment compared to the post-treatment period. Since dementia patients on average cost more than non-dementia patients, the pre-treatment period may likely have a control group that reflects the spending of a higher number of hidden cases, which would have caused the control group to have spending that is reduced. Fifth, this study could not identify which support measure for dementia patients was most instrumental in inducing a reduction in out-of-pocket expenditure due to data limitations. Sixth, the analysis could not adjust for the severity of dementia due to data limitations. However, it did consider the difference between patients with dementia and mild cognitive impairment and included only those with dementia in the main analysis (Supplementary Figure S3, Supplementary Table S4). Last, although the data included approximately 30% of the entire elderly population, it may not be entirely generalizable to the total population. Despite these limitations, this study is significant as it is the first to investigate the effect of the dementia support measures implemented by the government on healthcare costs. Future studies addressing the limitations stated above are needed to continuously assess the effect of healthcare policies on dementia.

Conclusion

This study investigated the effect of the National Dementia Care Policy on healthcare cost in patients with dementia aged 65 years or above. Policy implementation was associated with a decrease in patient out-of-pocket cost, but no significant changes were found for total healthcare cost. The findings are noteworthy considering the importance of providing regular care in managing dementia. National policies should be continuously monitored to reduce the economic burden of patients and ensure their access to needed medical services while also emphasizing the financial sustainability of healthcare systems.

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