AGMR
Annals of Geriatric Medicine and Research

Original Article
pISSN 2508-4798 eISSN 2508-4909
Ann Geriatr Med Res 2023;27(1):50-57
https://doi.org/10.4235/agmr.22.0149

Effects of a Dementia Special Care Unit on the Changes in Physical Function, Cognitive Function, and Problematic Behaviors among Nursing Home Residents

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Received: December 5, 2022
Revised: January 29, 2023
Accepted: February 16, 2023

Background: This study compared changes in physical function, cognitive function, and problematic behaviors among nursing home residents with dementia between the dementia specialized care and general units. **Methods:** To assess the effects of a dementia specialized care unit (D-SCU), this study applied the difference-in-differences method. While the D-SCU was introduced in July 2016, the service was provided in January 2017. We defined the pre-intervention period as July 2015 to December 2016 and the post-intervention period as January 2017 to September 2018. We matched long-term care (LTC) insurance beneficiaries using the propensity score matching method to minimize selection bias. After this matching, two new groups were obtained, each with 284 beneficiaries. To characterize the actual effects of the D-SCU on physical function, cognitive function, and problematic behaviors among dementia beneficiaries, we conducted a multiple regression analysis that controlled for demographics, LTC need, and LTC benefit utilization. **Results:** The physical function score significantly increased according to the time effect, and the interaction term between time and the use of D-SCU was significant. Therefore, the activities of daily living (ADL) score of the control group increased by 5.01 points more than that in the group of beneficiaries using the D-SCU ($p<0.001$). However, the interaction term had no significant effect on cognitive function or problematic behavior. **Conclusion:** These results revealed the partial effect of the D-SCU on LTC insurance. Further research is required that considers the variables of service providers.

Key Words: Dementia, Activities of daily living, Nursing homes, Propensity score

INTRODUCTION

The number of people with dementia is predicted to increase globally, from 57.4 million in 2019 to 152.8 million in 2050.[1)] With rapid aging, the prevalence of dementia in South Korea is estimated to increase from 8.7% in 2010 to 15.1% in 2050, increasing the number of dementia patients from approximately 420,000 in 2008 to approximately 2.71 million in 2050.[2)]

Most people with dementia initially receive care at home but are transferred to institutions due to the informal caregiver burden related to behavioral symptoms and the need for more skilled care.[3)] In nursing homes, providing care to dementia residents requires knowledge and skills specific to the physical, cognitive, and support needs of these individuals and their families.[4)] As traditional nursing homes are similar to hospitals and cannot meet the unique care needs of residents with dementia, some countries have installed special units (for example. dementia special care unit, specialized living unit) in nursing homes since the 1980s, to provide customized services to patients with dementia.[5-7)]

Dementia-specialized care units (D-SCUs) in nursing homes

are of various types and have heterogeneous structures in each country, with no international consensus on their definition.[8-10] However, most D-SCUs apply patient admission and discharge criteria; appropriate standards of physical environment design; hire, train, place, and supervise personnel suitable for the care of residents with dementia; conduct special activity programs for patients with dementia; and allow family participation.[6]

Since the introduction of long-term care insurance (LTCI), which has been operating in the national social insurance system since July 2008, various policy measures for dementia beneficiaries have been applied in South Korea. For example, workers caring for beneficiaries with dementia receive additional training to provide patients with cognitive enhancement programs. From July 2016, the D-SCU was included in the Korean LTCI benefit and its facility, and staffing standards and details of the program were legislated into law. The reimbursed costs on a pay-per-day basis and copayment for services provided in D-SCU are higher than those of general nursing home services.

Previous studies reported that D-SCUs positively affected the social interactions of patients with dementia,[11] and improved their daily living ability,[6,7,12] cognitive function,[13] and quality of life,[5] compared to traditional nursing homes. However, a systematic review of the literature indicated that the results of these studies were inconsistent and that the studies had different numbers of patients assigned to the experimental and control groups.[9] Therefore, the present study aimed to compare changes in the functional status of Korean LTCI beneficiaries with dementia between the D-SCU and general nursing homes over 1 year and to examine the associations between LTCI service type and health outcomes.

MATERIALS AND METHODS

Data Sources

This study used the LTCI dataset, a national-level data source from the National Health Insurance Service (NHIS), a public insurer, between July 2015 and September 2018. More specifically, this study used data from the long-term care (LTC) needs assessment and claims databases from the LTCI dataset. All applicants for LTCI benefit eligibility were evaluated using the LTC needs assessment checklist, which consists of 52 items, including information on the presence of diseases, physical function, cognitive function, behavioral problems, nursing needs, and environmental conditions.[14] LTCI applicants are categorized into six groups (grades 1–5 and grade cognition assistance) based on the severity of the beneficiary's care needs. Grade 1 includes those with the highest level of care needs, while grade 5 includes those with the lowest care needs.[15] Grade cognition assistance is assigned to applicants with mild dementia and relatively good physical functioning. A mandatory LTC needs assessment must be conducted every 12 months, except for individuals with an initial high score[16] for LTCI beneficiaries. The LTCI claims data include the type of benefits provided to beneficiaries by the LTC institution, the date of the provision, and the frequency of provision. These data are used to determine whether dementia beneficiaries receive care in a D-SCU or a general nursing home.

Overview of D-SCUs under LTCI in Korea

The basic directive of the D-SCU is to target dementia recipients who can perform daily life activities and live together to maintain and improve the physical and cognitive functions of older adults with dementia. Accordingly, grade 1 was excluded; among beneficiaries of grades 2–5, those with dementia listed in the doctor's note or with a medical treatment history for dementia were considered. Compared to the general nursing home unit, the D-SCU has a reinforced manpower standard; thus, with one care provider assigned per 2.5 residents in the general unit of a nursing home, the D-SCU has one provider per two residents. Additionally, in the D-SCU, caregivers and managers directly providing services to residents with dementia are required to complete separate specialized training. The D-SCU provides tailored programs that consider the functional status and characteristics of residents to maintain and improve physical and cognitive functions; reality awareness training and exercise therapy, family education and family participation programs, and cognitive stimulation activities group programs such as music and music activities are also provided. Moreover, the bedroom or common space areas of the D-SCU are wider than those of the general unit of the nursing home, making it easier to perform individual care and cognitive reinforcement programs.

Study Sample

While D-SCUs were introduced in July 2016, the actual service was provided in January 2017. Among the 466 LTC beneficiaries who used D-SCU benefits for > 1 year between January 2017 and September 2018, 182 people who used LTC services for < 12 months between July 2015 and December 2016 were excluded. The final treatment group consisted of 284 individuals. A total of 72,299 LTC beneficiaries who used general LTC units for > 1 year between January 2017 and September 2018 were included in the control group in the first step. Among these, 9,124 LTC beneficiaries were excluded if they did not use general LTC units for > 1 year between July 2015 and December 2016. We applied propensity score matching (PSM) to minimize the effects of potential confounding factors. After PSM (1:1 nearest-neighbor matching), two new groups were obtained, each with 284 patients.

Outcome Variables

The outcome variables in this study were changes in physical function, cognitive function, and problematic behaviors. The activities of daily living (ADL) subscale measuring physical function consisted of changing clothes, face washing, brushing teeth, bathing, eating, changing positions, sitting up, transferring to a different seat, exiting a room, using a toilet, controlling the bowel and bladder, and washing hair, with a possible score ranging from 13 to 39. Each item was assessed as totally independent, partially dependent, or totally dependent. The cognitive function subscale consists of 10 items to measure short-term memory loss; disorientation to time, place, age, and people; and inability to understand one's daily schedule/work. Each item was scored as either 1 or 0 to indicate whether the beneficiary had the symptom. The problematic behavior subscale consists of 16 items (delusions, hallucinations, sadness/crying, sleep disturbance/confusing day and night, resistance to assistance, wandering/restlessness, getting lost, verbal aggression/threatening actions, attempting to leave, destroying property, inappropriate or meaningless behaviors, hiding money/things, inappropriate dressing, poor hygiene, inability to manage fire hazards, and separation anxiety). Each ADL item and problem behavior were assessed as yes or no. In this study, we converted the total score of each scale to a perfect score of 100 points, the validity of which was demonstrated previously.[17-19]

Ethical Approval

This study was approved by the Sangji University Institutional Review Board (IRB No. 1040782-181120-HR-19-38). Also, this study complied the ethical guidelines for authorship and publishing in the *Annals of Geriatric Medicine and Research*.[20]

Statistical Analysis

We used a quasi-experimental approach that mixed PSM with difference-in-differences (DID) to measure the effect of D-SCU. The purpose of matching was to identify individuals with characteristics similar to those of the intervention participants, except for the intervention status.[19] We matched LTC beneficiaries in the D-SCU with those in general units using the PSM method (1:1 nearest-neighbor matching) to minimize selection bias. Based on a literature review of potentially explainable variables[16,21-25] related to changes in physical function, cognitive function, and problematic behavior of nursing home residents, demographic factors, LTC need factors, and utilization of LTC benefit were the factors used for PSM. The demographic factors included sex and age. The indicators of LTC need included LTC grade (2, 3, 4, and 5), subjective vision condition (having problems seeing), subjective hearing status (having problems hearing), and diseases other than dementia (yes or no). The utilization of LTC benefit factors included facility type (nursing home or small-group home) and total duration of LTC benefit use. We defined the period before the intervention as the baseline period (July 2015 to December 2016). Logistic regression models were used to calculate the propensity scores. Differences between the treatment and control groups were compared using the χ^2 test for categorical variables and the t-test for continuous variables after PSM.

In this study, the primary statistical model used was the DID analysis. DID analysis is the most frequently used and informative study design to examine the effects of interventions.[25] DID assumes that the intervention and comparison groups would have shown the same trends without any intervention in pre-post assessments.[26] Because nursing home residents with dementia have a continuous decline in functional status, this study applied DID analysis to determine whether the D-SCU slowed this decline compared to the general unit. The change in scores of physical function, cognitive function, and problematic behaviors in the treatment group before the introduction of the D-SCU and after utilization of the D-SCU minus the corresponding change in the control group were assessed. Analyses were performed using SAS Enterprise Guide 7.1 (SAS Institute Inc., Cary, NC, USA). All tests were two-tailed, and a p-value < 0.05 was considered statistically significant.

RESULTS

Study Population Characteristics

The general characteristics of the participants are shown in Table 1. The proportions of LTCI grades 2–5 at baseline was 38.4% (n = 218), followed by 37.9% (n = 215), 18.5% (n = 105), and 5.3% (n = 30). The number of female participants exceeded that of male participants by 437. Subjective vision conditions were 66.2% (n = 376), compared to 33.8% (n = 192) in the group with no vision problems. Subjective hearing conditions accounted for 51.1% (n = 290) of the cases with problems, similar to the proportion of participants without problems. Moreover, 37.1% (n = 211) participants were affected by diseases other than dementia, whereas 62.9% (n = 357) were affected by dementia alone. Regarding facility types, 67.1% (n = 381) used LTC facilities, compared to 32.9% (n = 1,887) users of state and night care facilities. The average age of the participants and duration of utilization was 81.72 ± 7.72 years and 18.40 ± 3.07 months, respectively. The distributions of these general characteristics did not differ between the experimental and control groups.

Table 1. General characteristics of subjects after matching

Variable	Treatment group (n = 284)	Control group (n = 284)	Total (n = 568)	p-value[a]
LTC grade				0.983
2	16 (5.6)	14 (4.9)	30 (5.3)	
3	107 (37.7)	108 (38.0)	215 (37.9)	
4	108 (38.0)	110 (38.7)	218 (38.4)	
5	53 (18.7)	52 (18.3)	105 (18.5)	
Sex				0.370
Female	223 (78.5)	214 (75.4)	437 (76.9)	
Male	61 (21.5)	70 (24.6)	131 (23.1)	
Subjective visual status				0.859
No problem	97 (34.2)	95 (33.5)	192 (33.8)	
Problem	187 (65.8)	189 (66.5)	376 (66.2)	
Subjective hearing status				0.502
No problem	135 (47.5)	143 (50.4)	278 (48.9)	
Problem	149 (52.5)	141 (49.6)	290 (51.1)	
Diseases other than dementia				0.543
No	175 (61.6)	182 (64.1)	357 (62.9)	
Yes	109 (38.4)	102 (35.9)	211 (37.1)	
Age (yr)	81.48 ± 7.58	81.97 ± 7.86	81.72 ± 7.72	0.448
Duration of utilization (mo)	18.38 ± 3.03	18.43 ± 3.11	18.40 ± 3.07	0.838

Values are presented as number (%) or mean±standard deviation.
[a]Using the χ^2 test for categorical variables and the t-test for continuous variables after propensity score matching.

Functioning and Problematic Behavior Scores Pre- and Post-intervention in the Treatment and Control Groups

During the use of the D-SCU service, physical function scores increased in both groups, from 33.42 to 36.63 points in the experimental group and from 33.00 to 41.21 points in the control group. The cognitive function scores showed that cognitive ability increased in the experimental group by 3.13 points, from 56.16 to 59.29 points, and by 4.64 points in the control group, from 57.04 points to 61.68 points. Regarding problem behavior scores, the score in the experimental group decreased by 1.80 points from 19.73 to 17.93 points, while that in the control group decreased by 1.61 points from 19.77 to 18.16 points, showing improvement in both groups (Table 2).

Table 3 shows the results of the DID analysis for functioning and problematic behaviors. A multiple regression analysis controlling for the control variables to determine the effects of dementia-premeditated LTC facility services showed that the physical function scores increased by 8.21 points depending on the time effect ($p < 0.001$). The physical functional score of the control group increased by 5.01 points more than that of the LTC service provider because of the significant interaction term of the service type, indicating the effectiveness of the pure policy ($p < 0.001$). Similar to the results of the simple double-difference analysis, recipients using the dementia-preferred service had lower deterioration in physical function compared to recipients using the care-type service.

Table 2. Pre- and post-score of physical function, cognitive function, and problematic behavior in treatment and control group

Variable	Score	
	Pre	Post
Physical functioning		
Treatment group	33.42 ± 10.88	36.63 ± 11.75
Control group	33.00 ± 10.69	41.21 ± 17.63
Cognitive functioning		
Treatment group	56.16 ± 16.04	59.29 ± 18.88
Control group	57.04 ± 16.60	61.68 ± 18.47
Problematic behavior		
Treatment group	19.73 ± 14.24	17.93 ± 13.96
Control group	19.77 ± 13.91	18.16 ± 13.91

Values are presented as mean±standard deviation.

Cognitive function scores increased by 4.64 points ($p < 0.01$) depending on the time effect ($p < 0.01$), and dementia-premeditated LTC systems did not affect cognitive performance scores due to the lack of significant interaction terms of the pure policy.

Regression analysis of problem behavior scores did not significantly affect users' behavioral change scores, nor did the statistical significance of the interaction between time and group indicate the effects of pure policies, indicating that dementia counseling services did not significantly affect the change in recipients' problem behavior scores (Table 3).

Table 3. Effects of D-SCU on the functioning and problematic behavior

Variable	Physical functioning		Cognitive functioning		Problematic behavior	
	β	SE	β	SE	β	SE
Intercept	30.443	4.054	67.463	6.557	36.239	5.536
Time	8.21*	0.830	4.64*	1.343	-1.61	1.134
Groups	0.19	0.832	-1.18	1.346	-0.06	1.136
Time × Groups	-5.01*	1.175	-1.51	1.900	-0.19	1.604

D-SCU, dementia-specialized care unit; SE, standard error.
*p<0.001.

DISCUSSION

The results of this study indicated that the D-SCU was effective in maintaining residual physical function and preventing the deterioration of physical functions. These results are consistent with those of previous studies.[5,12,27] In contrast, the D-SCU did not affect changes in cognitive function, also similar to results reported previously.[5,12] In addition, the behavioral change scores decreased in both the experimental and control groups. However, the effects of time or D-SCU service on the behavioral change score were not significant in the DID analysis. Thus, the D-SCU service did not affect changes in behavioral change scores, which is consistent with the findings of a previous study.[5] Therefore, the effects of the D-SCU were limited and did not contribute to preventing cognitive decline in nursing home residents with dementia.

There are several possible explanations for these results. First, while the D-SCU services were ineffective in preventing the deterioration of cognitive function, they were more effective than services in general LTC facilities in preventing a decline in daily activities. Dementia reduces the ability to perform daily activities, making independent life difficult and subsequently reducing the quality of life of people afflicted with dementia.[28] Impairment in performing daily activities is common in individuals with dementia and has been reported to rapidly decline with the progression of dementia.[29] Therefore, preventing a decline in the ability to perform daily activities in the early stages of dementia can contribute to improving the quality of life of individuals with dementia. In this respect, it is significant that the results of this study revealed that the D-SCU was effective in preventing the deterioration of daily life performance. Prior research has reported the effectiveness of ADL training, physical rehabilitation therapy, and exercise therapy as non-pharmacological interventions to improve daily life performance in people with dementia.[28,30] Because such content was included in the D-SCU program, the D-SCU likely prevented the decline in daily life performance.

Second, the results of the present study showed that the D-SCU did not have a significant effect in preventing cognitive decline compared to general LTC services. The change in cognitive function score in the experimental group was 2.38 points lower than that in the control group after the implementation of the D-SCU. However, the difference was only 1.51 points when considering the change between pre- and post-implementation. Two interpretations are possible for these results; first, the current D-SCU services are qualitatively insufficient to prevent cognitive decline in service recipients. Although it is currently intended to arrange facilities and personnel as stipulated by the law and implement customized programs for patients with dementia, the provision of level-specific programs or customized programs for individuals is practically difficult.[31] Accordingly, for D-SCU services to contribute to the prevention of cognitive decline, discussions are needed regarding qualitative improvements beyond the current level of service delivery. Second, although the degree of decline in cognitive function varies according to the severity of dementia, we could not perform subgroup analysis of dementia severity could not be performed due to the limited sample size. Subsequently, it was impossible to identify potential differences according to the severity.

Third, problem behavior scores showed nearly no difference or a slight decrease in both D-SCU and general LTC facility users after receiving the services. Therefore, the services provided under LTCI were associated with a reduction in problem behaviors among patients with dementia. However, the results of the DID analysis indicated no statistically significant effect of D-SCU services in reducing problem behaviors compared to general LTC services. Several studies on D-SCUs have reported improvements in both the quantity and quality of social interactions between patients with dementia or between patients with dementia and their caregivers[5,11,32] and a decrease in problem behaviors.[7,25,33] However, we observed no significant difference compared to general LTC facilities. The clinical aspects of D-SCU services in Korea do not include interventions related to drug intake. However, nursing home residents with dementia take multiple medicines and require medication management that includes prescribing, dispensing, and adherence to medication review.[34] In addition, the results of the current study indicated that the difference in these results

stems from the fact that the service provider personnel and service content of D-SCUs that showed effectiveness in prior studies differ from those in the Korean D-SCU services. A previous study reporting the effect of D-SCU on social interaction in patients with dementia proposed that, unlike traditional nursing homes, dementia-specialized units were staffed with additional personnel for recreation and activities to work three shifts from 08:00 to 21:00, and such staffing had an effect on improved social interaction.[32] The results of these prior studies are considered to have significant implications for South Korea's policy. Since the introduction of D-SCU services in July 2016, the number of providers has increased from 25 in 2016 to 175 in 2019, and the Ministry of Health and Welfare has relaxed provider-entry requirements, such as facility and staffing standards, to increase the number of facilities. However, a previous study on the relaxation of such standards argued that although service differentiation is key to improving D-SCU effectiveness, further examination is needed to determine whether this can be achieved with relaxed standards.[35] Furthermore, service fees may increase if facility staffing standards are tightened and out-of-pocket costs for beneficiaries may rise, creating unmet needs that prevent access to necessary services due to cost burdens. Therefore, policies must be formulated to differentiate between general LTC facilities and simultaneously reduce the recipients' cost burdens.

The present study has several limitations. First, although the sample size of the target analysis was sufficient, the period of data collection was < 3 years after the introduction of the D-SCU system and there was a limit to securing a large number of subjects for the analysis because the level of participation at the beginning of the implementation of the new system was low. In the future, more accurate evaluation will be possible if the follow-up period is further extended and continuous research is conducted on a larger number of subjects to suggest sophisticated directions for institutional development.

Second, the current study used secondary data extracted from the NHIS's LTCI database. Therefore, we couldn't have analyzed a wide range of variables, such as social support, nutritional status, and dementia type and severity, which can affect physical and cognitive functions as well as changes in problem behaviors.

Third, the LTC needs checklist used for outcome measures in this study was not developed for research but rather was developed to administratively select LTC beneficiaries. Therefore, we did not rigorously test its validity. In addition, under Korean circumstances, it is highly likely that the evaluators assessing the LTC needs checklist in patients with dementia residing in nursing homes differ before and after LTC. While evaluators who are NHIS staff receive sufficient training for the evaluation of the LTC checklist, differences may occur between evaluators.

Fourth, this study did not consider variables concerning providers of services to patients with dementia. In other words, although LTC facilities dedicated to dementia care arrange service personnel and the environment according to the relevant laws and regulations, staffing and environments differ among facilities; these variables cannot be controlled due to data restrictions. Therefore, further research using sophisticated research designs is necessary.

ACKNOWLEDGMENTS

CONFLICT OF INTEREST

The researchers claim no conflicts of interest.

FUNDING

None.

AUTHOR CONTRIBUTIONS

Conceptualization, IS; Data curation, IS; Investigation, IS, HS; Methodology, IS, HS; Project administration, IS, HS; Supervision, HS; Writing–original draft, IS, HS; Writing–review and editing, HS.

REFERENCES

1. GBD 2019 Dementia Forecasting Collaborators. Estimation of the global prevalence of dementia in 2019 and forecasted prevalence in 2050: an analysis for the Global Burden of Disease Study 2019. Lancet Public Health 2022;7:e105-e125.
2. Kim KW, Kwak GP, Kim BS, Kim BC, Kim JR, Kim TH, et al. Nationwide survey on the dementia epidemiology of Korea. Sejong, Korea: Ministry Health and Welfare; 2017.
3. Yaffe K, Fox P, Newcomer R, Sands L, Lindquist K, Dane K, et al. Patient and caregiver characteristics and nursing home placement in patients with dementia. JAMA 2002;287:2090-7.
4. Cadigan RO, Grabowski DC, Givens JL, Mitchell SL. The quality of advanced dementia care in the nursing home: the role of special care units. Med Care 2012;50:856-62.
5. te Boekhorst S, Depla MF, de Lange J, Pot AM, Eefsting JA. The effects of group living homes on older people with dementia: a comparison with traditional nursing home care. Int J Geriatr Psychiatry 2009;24:970-8.
6. Nobili A, Piana I, Balossi L, Pasina L, Matucci M, Tarantola M, et al. Alzheimer special care units compared with traditional nursing home for dementia care: are there differences at admission and in clinical outcomes? Alzheimer Dis Assoc Disord 2008;22:352-61.

7. Weyerer S, Schaufele M, Hendlmeier I. Evaluation of special and traditional dementia care in nursing homes: results from a cross-sectional study in Germany. Int J Geriatr Psychiatry 2010; 25:1159-67.
8. Palm R, Bartholomeyczik S, Roes M, Holle B. Structural characteristics of specialised living units for people with dementia: a cross-sectional study in German nursing homes. Int J Ment Health Syst 2014;8:39.
9. Kok JS, Berg IJ, Scherder EJ. Special care units and traditional care in dementia: relationship with behavior, cognition, functional status and quality of life: a review. Dement Geriatr Cogn Dis Extra 2013;3:360-75.
10. Holmes D, Ory MG, Teresi J. Dementia special care: overview of research policy and practice. Alzheimer Dis Assoc Disord 1994;8 Suppl 1:S5-13.
11. De Rooij AH, Luijkx K, Schaafsma J, Emmerink P, Schols JM, Declercq A. Functional status, behaviour and social interaction of residents with dementia living in small-scale and traditional long-term care settings in the Netherlands and Belgium. J Alzheimers Dis Parkinsonism 2012;2:1000106.
12. Reimer MA, Slaughter S, Donaldson C, Currie G, Eliasziw M. Special care facility compared with traditional environments for dementia care: a longitudinal study of quality of life. J Am Geriatr Soc 2004;52:1085-92.
13. Volicer L, Collard A, Hurley A, Bishop C, Kern D, Karon S. Impact of special care unit for patients with advanced Alzheimer's disease on patients' discomfort and costs. J Am Geriatr Soc 1994;42:597-603.
14. Ga H. Long-term care system in Korea. Ann Geriatr Med Res 2020;24:181-6.
15. Kim H, Kwon S. A decade of public long-term care insurance in South Korea: policy lessons for aging countries. Health Policy 2021;125:22-6.
16. Lee TW, Yim E, Cho E, Chung J. Cognitive function, behavioral problems, and physical function in long-term care insurance beneficiaries with dementia in South Korea: comparison of home care and institutional care services. J Am Geriatr Soc 2014;62:1467-75.
17. Han EJ, Lee JS, Kim DG, Ka IO. A recommending system for care plan (Res-CP) in long-term care insurance system. Korean J Appl Stat 2009;22:1229-37.
18. Han EJ, Kwak MJ, Kan IO. A determining system for the category of need in long-term care insurance system using decision tree model. Korean J Appl Stat 2011;24:145-59.
19. Kim HS. Item analysis of an eligibility scale for long-term care in South Korea. J Korean Acad Health Welf Elder 2010;1:39-51.
20. Noh JH, Jung HW, Ga H, Lim JY. Ethical guidelines for publishing in the Annals of Geriatric Medicine and Research. Ann Geriatr Med Res 2022;26:1-3.
21. Sari N, Osman M. The effects of patient education programs on medication use among asthma and COPD patients: a propensity score matching with a difference-in-difference regression approach. BMC Health Serv Res 2015;15:332.
22. Caljouw MA, Cools HJ, Gussekloo J. Natural course of care dependency in residents of long-term care facilities: prospective follow-up study. BMC Geriatr 2014;14:67.
23. Wysocki M, Luo X, Schmeidler J, Dahlman K, Lesser GT, Grossman H, et al. Hypertension is associated with cognitive decline in elderly people at high risk for dementia. Am J Geriatr Psychiatry 2012;20:179-87.
24. Freeman S, Spirgiene L, Martin-Khan M, Hirdes JP. Relationship between restraint use, engagement in social activity, and decline in cognitive status among residents newly admitted to long-term care facilities. Geriatr Gerontol Int 2017;17:246-55.
25. Choi Y, Kim JH, Yoo KB, Cho KH, Choi JW, Lee TH, et al. The effect of cost-sharing in private health insurance on the utilization of health care services between private insurance purchasers and non-purchasers: a study of the Korean health panel survey (2008-2012). BMC Health Serv Res 2015;15:489.
26. Dimick JB, Ryan AM. Methods for evaluating changes in health care policy: the difference-in-differences approach. JAMA 2014; 312:2401-2.
27. de Rooij AH, Luijkx KG, Schaafsma J, Declercq AG, Emmerink PM, Schols JM. Quality of life of residents with dementia in traditional versus small-scale long-term care settings: a quasi-experimental study. Int J Nurs Stud 2012;49:931-40.
28. Bossers WJ, van der Woude LH, Boersma F, Hortobagyi T, Scherder EJ, van Heuvelen MJ. Comparison of effect of two exercise programs on activities of daily living in individuals with dementia: a 9-week randomized, controlled trial. J Am Geriatr Soc 2016;64:1258-66.
29. Feldman H, Gauthier S, Hecker J, Vellas B, Emir B, Mastey V, et al. Efficacy of donepezil on maintenance of activities of daily living in patients with moderate to severe Alzheimer's disease and the effect on caregiver burden. J Am Geriatr Soc 2003;51:737-44.
30. Folkerts AK, Roheger M, Franklin J, Middelstädt J, Kalbe E. Cognitive interventions in patients with dementia living in long-term care facilities: systematic review and meta-analysis. Arch Gerontol Geriatr 2017;73:204-21.
31. Song MK, Kim JH, Han EJ. Features exploration and service provision strategies for long-term care beneficiaries with dementia. J Korea Gerontol Soc 2021;41:887-98.
32. Abbott KM, Sefcik JS, Van Haitsma K. Measuring social integra-

tion among residents in a dementia special care unit versus traditional nursing home: a pilot study. Dementia (London) 2017;16:388-403.
33. Selbaek G, Kirkevold O, Engedal K. Psychiatric and behavioural symptoms and the use of psychotropic medication in special care units and regular units in Norwegian nursing homes. Scand J Caring Sci 2008;22:568-73.
34. McGrattan M, Ryan C, Barry HE, Hughes CM. Interventions to improve medicines management for people with dementia: a systematic review. Drugs Aging 2017;34:907-16.
35. Kim IG, Seo SW, Jung SH, Gong CT, Lee DH, Lee JG, et al. Evaluation of health program for older people. Seoul, Korea: National Assembly Budget Office; 2019.