



Changes in the Place of Death of Patients With Cancer After the Introduction of Insurance-Covered, Home-Based Hospice Care in Korea

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Abstract

IMPORTANCE Although hospice care has been covered by health insurance for the purpose of improving the quality of life of patients with terminal cancer as well as their caregivers, few studies have evaluated the outcomes of the policy to cover home-based hospice care services.

OBJECTIVE To investigate the changes in the place of death of patients with cancer after the introduction of insurance-covered, home-based hospice care services in Korea.

DESIGN, SETTING, AND PARTICIPANTS This cohort study used data from February 1, 2018, to December 31, 2021, from the Causes of Death Statistics database, released annually by Statistics Korea, which contains information on all deaths in the country. Individuals who died of cancer, a representative hospice-eligible disease, were assigned to the case group, and those who died of dementia, a non-hospice-eligible disease, were assigned to the control group. A total of 218 522 individuals constituted the study population.

EXPOSURE Because the Korean Health Insurance Service had begun covering home-based hospice care services on September 1, 2020, and the last follow-up date was December 31, 2021, the follow-up periods for before and after intervention were 31 months and 16 months, respectively (preintervention period: February 1, 2018, to August 31, 2020; postintervention period: September 1, 2020 to December 31, 2021).

MAIN OUTCOMES AND MEASURES The place of death was categorized as a binary variable according to whether it was the person's own home or not. Comparative interrupted time-series models with segmented regression were applied to analyze the time trend and its change in outcomes.

RESULTS Of the 218 522 deaths eligible for the analysis (mean [SD] age at death, 78.6 [8.8] years; 130 435 men [59.7%]), 207 459 were due to cancer, and 11 063 were due to dementia. Immediately after the introduction of home-based hospice care, the rate of home deaths was 24.5% higher for patients with cancer than for those with dementia (estimate, 1.245 [95% CI, 1.030-1.504]; $P = .02$). The difference in the level change between cancer deaths and dementia deaths, on intervention, was more pronounced for those living in rural areas (estimate, 1.320 [95% CI, 1.118-1.558]; $P = .001$). In addition, a higher educational level was associated with a larger difference in the immediate effect size due to home-based hospice care (low educational level: estimate, 1.205 [95% CI, 1.025-1.416]; $P = .02$; middle educational level: estimate, 1.307 [95% CI, 0.987-1.730], $P = .06$; high educational level: estimate, 1.716 [95% CI, 0.932-3.159]; $P = .08$).

CONCLUSIONS AND RELEVANCE In this cohort study exploring the changes in the place of death for patients with cancer after the insurance mandates for home-based hospice care in Korea, the probability of patients with cancer dying in their own homes increased after the intervention. This

(continued)

Key Points

Question Is health insurance coverage for home-based hospice care associated with changes in the place of death among Korean patients with cancer?

Findings This cohort study of 218 522 individuals identified that hospice-eligible patients with cancer were more likely than patients with dementia to die at home after home-based hospice care was covered by health insurance in Korea.

Meaning Considering that many patients with terminal illness want a dignified death at home with palliative care, this study suggests that home-based hospice care is associated with improved quality of life at the end of life.

+ Supplemental content

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Abstract (continued)

finding suggests the need to broaden the extent of home-based hospice care to honor the autonomy of individuals with terminal illness and improve their quality of death.

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Introduction

Over the past few decades, cancer has become the leading cause of death worldwide. As of 2020, approximately 10 million people died of cancer, representing approximately one-sixth of all deaths.¹ Despite advancements in cancer diagnosis and treatment that have resulted in longer lifespans for patients with cancer, many patients still receive a diagnosis at the terminal stage. Patients with advanced cancer may experience physical and psychological symptoms due to their disease, treatment, or other comorbidities.² Symptoms are often not addressed with conventional care, leading to a significant effect on the patients' quality of life and family relationships.³ Against this background, hospice and palliative care programs were introduced to improve the quality of life of patients with terminal illness and their caregivers by providing relief rather than a cure.

Hospice care and palliative care are essential aspects of integrated patient-focused health care. It is a global and ethical responsibility to alleviate severe health-related pain, be it physical, psychological, or spiritual.⁴ Hospice care services can be provided in a variety of settings, such as hospitals, nursing homes, and patients' own homes,⁵ depending on the health care system in each country. The World Health Organization has estimated that approximately 56.8 million individuals, including 25.7 million in the last year of life, require palliative care each year and that there is a growing need for hospice care services due to the aging population and the increase in the prevalence of chronic diseases, such as cancer, heart disease, and dementia.^{6,7} However, only approximately 14% of those in need of hospice care are currently receiving it.^{6,7} Similarly, discussions on dying well and the improvement of the right to self-determination at the end of life are being actively conducted in Korea owing to the rapid aging of the population. In Korea, 1 in 4 deaths is due to cancer, and approximately 23.2% of all cancer-related deaths involve hospice care services.⁸ However, most patients use hospital-based hospices, and only 4% of all hospice users used home-based hospices,⁸ which raises doubts about the effectiveness of the policy.

Several studies have previously evaluated the association of hospice use with medical applications and expenses before the death of patients with terminal cancer. They reported that providing hospice care at an earlier stage could potentially reduce unnecessary hospital admissions, use of health care services,⁹ and medical expenditures.¹⁰ Because it has been only 3 years since the insurance mandate for home-based hospice care in Korea, only a few studies have been conducted to evaluate its effectiveness. Patients who opt for home-based hospice care are provided with palliative care in their own homes and die in the comfort of their homes. However, to our knowledge, no study has yet evaluated whether the policy was implemented as intended.

Therefore, the present study aimed to explore the changes in the place of death of patients with cancer after the introduction of home-based hospice care in Korea. We hypothesized that the intervention would increase the likelihood of patients with cancer dying at home compared with patients with dementia.

Methods

Data and Study Population

This retrospective cohort study used data from the Causes of Death Statistics database released annually by Statistics Korea. This database includes information on the sociodemographic characteristics and mortality of all individuals who have died in Korea. The date, time, and place of

death of all the deceased individuals were recorded, and the cause of death was coded according to the clinically determined *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10)*. The study protocol was approved by the institutional review board of Severance Hospital, Yonsei University Health System, which waived the requirement for informed consent because the Causes of Death Statistics did not contain any identifiable information. Furthermore, ethical approval for the use of data was not required because Statistics Korea provides publicly accessible data. In conducting this observational study, we adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline designed for cohort studies.

The present study included data from February 1, 2018, when the Act on Hospice and Palliative Care and Decisions on Life-Sustaining Treatment for Patients at the End of Life was implemented in Korea, to December 31, 2021. Those who died of cancer were classified into the case group, those who died of dementia were classified into the control group, and those who died before the age of 65 years were excluded. A total of 218 522 individuals constituted the study population and were eligible for the analysis.

Variables

The main variable of interest was the time of the introduction of home-based hospice care in Korea, which divided the time span studied. Because the Korean Health Insurance Service began providing health insurance coverage for home-based hospice services from September 1, 2020, and the last follow-up date was December 31, 2021, we determined the follow-up periods for before and after intervention as 31 months and 16 months, respectively. The preintervention period was from February 1, 2018, to August 31, 2020, and the postintervention period was from September 1, 2020, to December 31, 2021. We set deaths due to cancer, which account for most hospice users, as the case group (*ICD-10* codes C00-D49) and deaths due to dementia (*ICD-10* codes F00-F03, G30, and G311),¹¹ which is not yet eligible for hospice care in Korea but is significantly prevalent and is a major cause of mortality,^{12,13} as the control group.

The outcome variable was the place of death, which was categorized as a binary variable (ie, whether it was the person's own home or not). As covariates, we included sociodemographic factors, such as sex (men and women), age at death (65-69, 70-74, 75-79, and ≥ 80 years), residential area (urban and rural), occupation (white collar [professional, managerial, or administrative workers], blue collar [manual or industrial workers], pink collar [service-oriented workers], and other), marital status (married and single), and educational level (low [elementary school graduation or lower], middle [high school graduation or lower], and high [college graduation or higher]).

Statistical Analysis

Descriptive statistics are presented as frequencies and percentages. Subsequently, to evaluate the association of the policy with the time trend and the change in outcomes, we applied comparative interrupted time-series (CITS) models. In a CITS design, the evaluation of policy associations involves comparing the degree of deviation from the baseline trend between the case and control groups to assess whether the deviation in the case group is greater.¹⁴ The CITS was modeled using a linear regression model that included 7 time-related variables. Because we used the log-link function in the generalized linear model to conduct the segmented regression, converting the model coefficient exponentials (exp) to show the trends and changes in outcomes on the original scale was necessary. Therefore, to interpret model coefficients, we had to convert $\log [E(Y_i)]$ into multiplicative interpretations for the original scale, which is represented as $E(Y_i) = \mu_i$:

$$\log(\mu_i) = \beta_0 + \beta_1 T + \beta_2 + \beta_3 XT + \beta_4 Z + \beta_5 ZT + \beta_6 ZX + \beta_7 ZXT + e.$$

In this regression equation, T represents time, shown on a monthly basis. X indicates whether the intervention had been introduced yet, and XT indicates the time after the intervention. Z is a binary variable that distinguishes the case group from the control group. ZT represents the time for the case group, ZX refers to the study phase for the case group, and ZXT represents the time after

interruption for the case group. Therefore, ZT , ZX , and ZXT were all assigned 0 for the control group. Regarding the regression coefficients in this model, intercept β_0 estimates the baseline level of the outcome; β_1 estimates the preintervention trend of the outcome for the control group; β_2 estimates the level change after the intervention for the control group, indicating the immediate effect size of the intervention for the control group; and β_3 estimates the slope change after the intervention for the control group. Intercept β_4 estimates the level difference between the case group and the control group before intervention, β_5 estimates the difference in slope between the case group and the control group before intervention, and β_6 estimates the difference in absolute level change between the case group and the control group after intervention. Finally, β_7 estimates the difference in slope change before and after the intervention between the case group and the control group.¹⁵

All statistical analyses were conducted using SAS software, version 9.4 (SAS Institute Inc). The results are presented as parameter estimates, SEs, 95% CIs, and *P* values, where statistical significance was determined by 2-sided tests and *P* < .05 considered significant.

Results

A total of 218 522 individuals (mean [SD] age at death, 78.6 [8.8] years; 130 435 men [59.7%] and 88 087 women [40.3%]) were eligible for the present analysis (144 506 before the introduction of the intervention and 74 016 after the introduction of the intervention). Men (130 435 [59.7%]), people who died at 80 years of age or older (100 225 [45.9%]), rural residents (130 581 [59.8%]), and those who were single (123 894 [56.7%]) were the most frequently reported among all participants (Table 1). Subsequently, 207 459 deaths were due to cancer (classified as the case group), and 11 063 deaths were due to dementia (classified as the control group) (Table 2). A total of 20 851 cancer deaths (10.1%) and 3246 dementia deaths (29.3%) occurred at home.

Table 1. Characteristics of the Study Population

| Variable | Patients receiving insurance-covered home-based hospice care, No. (%) | |
|-------------------|---|--|
| | Preintervention period (February 2018 to August 2020) (n = 144 506) | Postintervention period (September 2020 to December 2021) (n = 74 016) |
| Sex | | |
| Men | 85 850 (59.4) | 44 585 (60.2) |
| Women | 58 656 (40.6) | 29 431 (39.8) |
| Age of death, y | | |
| 65-69 | 20 387 (14.1) | 11 135 (15.0) |
| 70-74 | 24 623 (17.0) | 12 659 (17.1) |
| 75-79 | 33 789 (23.4) | 15 704 (21.2) |
| ≥80 | 65 707 (45.5) | 34 518 (46.6) |
| Residential area | | |
| Urban | 58 325 (40.4) | 29 616 (40.0) |
| Rural | 86 181 (59.6) | 44 400 (60.0) |
| Occupation | | |
| White collar | 7174 (5.0) | 4378 (5.9) |
| Blue collar | 32 743 (22.7) | 15 757 (21.3) |
| Pink collar | 4927 (3.4) | 2944 (4.0) |
| Other | 99 662 (69.0) | 50 937 (68.8) |
| Marital status | | |
| Married | 62 845 (43.5) | 31 783 (42.9) |
| Single | 81 661 (56.5) | 42 233 (57.1) |
| Educational level | | |
| Low | 75 965 (52.6) | 36 766 (49.7) |
| Middle | 51 933 (35.9) | 28 182 (38.1) |
| High | 16 608 (11.5) | 9068 (12.3) |

Table 3 presents the results of the segmented regression analysis used to assess the probability of death at home after adjusting for all covariates. The difference in level change between the case and control groups at the time of the intervention was estimated to be 1.245. In other words, immediately after the introduction of home-based hospice care, the rate of deaths at home was 1.245 times greater for cancer deaths than for dementia deaths ($\exp [\beta_6] = 1.245 [95\% \text{ CI}, 1.030\text{-}1.504]$; $P = .02$). However, no significant difference was observed between the case and control groups regarding the trend change after the intervention compared with that before the intervention.

Table 3 provides quantitative confirmation of the differences in level and trend changes through the calculation of parameter estimates. The **Figure** allows for the intuitive confirmation of the outcome trends after the intervention. During the preintervention period, the probability of death at home tended to increase for both patients with cancer and those without cancer. At the time of the introduction of the intervention, both groups showed noticeable interruptions and absolute level changes, especially in cancer-related deaths. After the intervention, the likelihood of dying at home

Table 2. Distribution of the Study Population

| Period | Death at home, No./total No. (%) (N = 218 522) | | | |
|---|--|------------------------|------------------------------|--------------------|
| | Cancer deaths (n = 207 459) | | Dementia deaths (n = 11 063) | |
| | Yes | No | Yes | No |
| Preintervention period (February 2018 to August 2020) | 11 837/136 390 (8.7) | 124 553/136 390 (91.3) | 2351/8116 (29.0) | 5765/8116 (71.0) |
| Postintervention period (September 2020 to December 2021) | 9014/71 069 (12.7) | 62 055/71 069 (87.3) | 895/2947 (30.4) | 2052/2947 (69.6) |
| Total | 20 851/207 459 (10.1) | 186 608/207 459 (89.9) | 3246/11 063 (29.3) | 7817/11 063 (70.7) |

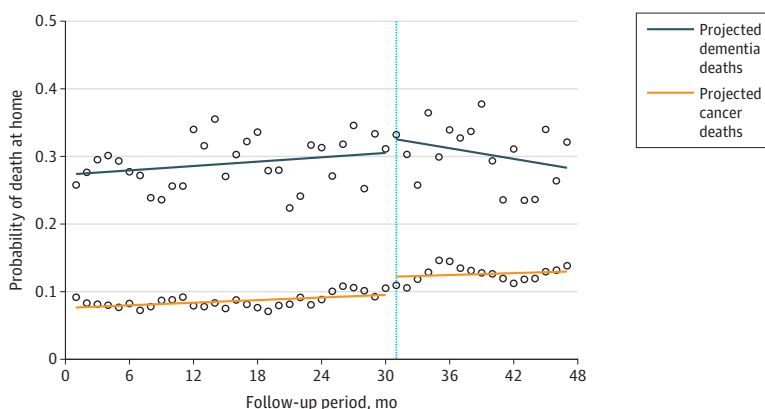
Table 3. Parameter Estimates, SEs, and P Values From the Segmented Regression Models Assessing the Probability of Death at Home

| Parameter | exp (β) ^a | exp (SE[β]) (95% CI) | P value |
|--|------------------------------|------------------------------|---------|
| Intercept (β_0) | 0.371 | 1.052 (0.336-0.410) | <.001 |
| Control pretrend (β_1) | 1.006 | 1.003 (1.001-1.012) | .03 |
| Control postlevel change (β_2) | 1.068 | 1.096 (0.893-1.279) | .47 |
| Control posttrend change (β_3) | 0.983 | 1.009 (0.965-1.000) | .05 |
| Case-control prelevel difference (β_4) | 0.220 | 1.057 (0.197-0.245) | <.001 |
| Case-control pretrend difference (β_5) | 1.003 | 1.003 (0.997-1.009) | .27 |
| Case-control postlevel change difference (β_6) | 1.245 | 1.101 (1.030-1.504) | .02 |
| Case-control trend change difference pretrend to posttrend (β_7) | 1.009 | 1.010 (0.990-1.028) | .35 |

Abbreviation: exp, exponential.

^a Calculated by statistically adjusting for all covariates.

Figure. Estimated Trends in Probability of Death at Home



The vertical dashed line indicates the start of the intervention on September 1, 2020. Circles indicate observed values.

due to dementia began to decrease, whereas the likelihood of dying at home due to cancer was estimated to remain steady or increase slightly.

We assumed that the preferred place of death would vary according to sociodemographic characteristics; therefore, we performed subgroup analyses stratified by residential area and educational level. As shown in **Table 4**, the difference in level change between cancer and dementia deaths, at intervention, was more pronounced for those living in rural areas (exp [β_6] = 1.320 [95% CI, 1.118-1.558]; $P = .001$). In addition, a higher educational level was associated with a larger difference in immediate effect size due to home-based hospice practice (low educational level: exp [β_6] = 1.205 [95% CI, 1.025-1.416]; $P = .02$; middle educational level: exp [β_6] = 1.307 [95% CI, 0.987-1.730]; $P = .06$; high educational level: exp [β_6] = 1.716 [95% CI, 0.932-3.159]; $P = .08$).

Discussion

Since February 2018, Korea has been enforcing the Act on Hospice and Palliative Care and Decisions on Life-Sustaining Treatment for Patients at the End of Life, aimed at respecting the right to self-determination and improving quality of life for individuals at the end of life. Recently, there have been active discussions regarding the decision to discontinue life-sustaining treatment and die well, and various types of hospice services have been institutionally established. Hospice care in Korea was introduced in the order of hospital-based, home-based, and consultation services; the Korean Health Insurance Service covers all 3 types of services through health insurance. Nevertheless, until recently, most patients with terminal cancer use hospital-based hospices, with home-based and consultation services used only as supplemental care.⁸

In this context, the present retrospective cohort study investigated how the place of death of patients with cancer changed after the introduction of home-based hospice care in Korea and explored whether this intervention was being successfully implemented. The key findings of this study were as follows: in September 2020, when home-based hospice services began to be covered by health insurance in Korea, the probability of patients with cancer (who accounted for most hospice users) dying at home, rather than in a medical institution, increased markedly. However, dementia is not yet recognized as a disease requiring hospice services in Korea, and the probability of patients with dementia dying at home increased in the preintervention period but decreased in the postintervention period. Overall, the association between place of death of patients and the policy immediately after implementation showed a significant difference between groups with diseases eligible for hospice and those with diseases noneligible for hospice.

Table 4. Results of Subgroup Analysis Stratified by Residential Area and Educational Level

| Variable | Death at home | | | | | | | |
|--------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | exp (β_0) | exp (β_1) | exp (β_2) | exp (β_3) | exp (β_4) | exp (β_5) | exp (β_6) | exp (β_7) |
| Residential area | | | | | | | | |
| Urban | 0.242 | 1.002 | 1.277 | 0.978 | 0.298 | 1.007 | 1.074 | 1.011 |
| P value | <.001 | .66 | .03 | .04 | <.001 | .10 | .55 | .36 |
| Rural | 0.285 | 1.006 | 0.936 | 0.996 | 0.273 | 1.002 | 1.320 | 0.999 |
| P value | <.001 | .01 | .40 | .61 | <.001 | .35 | .001 | .86 |
| Educational level | | | | | | | | |
| Low | 0.272 | 1.004 | 1.113 | 0.986 | 0.283 | 1.004 | 1.205 | 1.006 |
| P value | <.001 | .08 | .15 | .05 | <.001 | .11 | .02 | .45 |
| Middle | 0.269 | 1.006 | 0.936 | 0.987 | 0.271 | 1.003 | 1.307 | 1.004 |
| P value | <.001 | .17 | .63 | .35 | <.001 | .46 | .06 | .75 |
| High | 0.254 | 1.001 | 0.737 | 1.021 | 0.298 | 1.006 | 1.716 | 0.974 |
| P value | <.001 | .87 | .31 | .45 | <.001 | .53 | .08 | .36 |

Abbreviation: exp, exponential.

Most previous studies have examined the association of home-based hospice care with the economic burden on patients and their families. The studies revealed that home-based hospice services are effective in reducing medical expenses by preventing acute hospitalization, such as in an emergency department, and by managing symptoms competently at home.¹⁶⁻¹⁸ In addition, several studies have demonstrated that home-based hospice use improves both patient and caregiver satisfaction and quality of life.¹⁹⁻²¹ The studies suggested that home-based hospice care offers personalized and consistent care to patients and their families by providing the exclusive attention of a limited number of well-informed medical professionals. Several studies have investigated the determinants of the place of death for patients with terminal cancer receiving home hospice care,²²⁻²⁴ as well as the trends in their preferred and actual places of death.²⁵⁻²⁸ According to the findings reported, the presence of dedicated and capable caregivers, such as family members or trained hospice professionals, can be associated with the feasibility of home hospice care. Financial factors can also be associated with the place of death, and some patients may choose home hospice care because it is more cost-effective than inpatient care. Most patients with terminal illness have been found to prefer to die at home if given the choice; thus, home-based palliative care services that aim to provide patients with comprehensive medical, emotional, and practical support in their own homes are currently gaining popularity.

As such, interest in respecting the right to self-determination at the end of life and improving the quality of life of patients with terminal illness has increased. The extent and approach of hospice care coverage may differ from one country to another, and in certain countries, such as Korea, home-based hospice care services are covered by national health insurance. Although many patients with terminal illness wish to die comfortably with their families at home, to our knowledge, no study has evaluated whether the 2020 health insurance mandate for home-based hospice care services was associated with a change in the preferred place of death. Our results revealed that the probability of dying at home increased when home-based hospice care was covered by health insurance for patients with terminal cancer. The findings implied that, to enhance the quality of death of individuals with terminal illness and older adults, not only cancer and acute diseases but also more chronic and aging-related diseases, such as dementia and frailty, should be included as diseases eligible for home-based hospice care services.

Limitations and Strengths

This study has certain limitations. First, the Causes of Death Statistics data that we analyzed included sociodemographic and mortality information on the total number of deaths in Korea; however, only the underlying cause of death was recorded, and there was no information on the use of medical care before death. Therefore, the recorded underlying cause of death codes could not represent the actual disease status of the patients, and there is a concern of misclassification problems because we could not take into account other contributing causes of death. In addition, because it was not possible to identify whether the deceased used home-based hospice care, using these data, the case and control groups were divided based on whether the patient died due to a hospice-eligible disease. Second, we used *ICD-10* codes to identify the study participants; however, the *ICD-10* codes themselves have limitations.²⁹⁻³¹ The *ICD-10* codes are designed primarily for administrative purposes and may not provide comprehensive clinical details of patients. In addition, there is a concern of incomplete coding, which could result in the misclassification or underestimation of certain factors. Third, we had limited control over various additional nonofficial benefits and interventions provided to patients with terminal illness during the period in which the insurance coverage policy for home-based hospice care was implemented. Therefore, the associations could have possibly been overestimated. Fourth, although we attempted to adjust for potential confounders that could be associated with the change in the place of death, residual confounding effects from unmeasured variables could not be ruled out.

Nevertheless, the study has several strengths. The Causes of Death Statistics database that we analyzed contains very large-scale data, including the total number of deaths in Korea, which has

the advantage of being applicable to the evaluation of the associations of medical practices with policies. In addition, we used the CITS design to assess the longitudinal effects of the interventions.³² Prior studies relied on a difference-in-differences study design, which compares only 2 time points to examine the net policy impact on outcomes,³³ or a segmented regression with fewer than 10 time points.³⁴ However, these approaches have limitations, because they do not adequately capture the baseline trends and changes. In contrast, our study used 47 time points, which enabled us to capture and analyze the trend changes more accurately over time.

Conclusions

In this cohort study exploring the changes in the place of death of patients with terminal cancer after the insurance mandates went into effect for home-based hospice care in Korea, the probability of patients with cancer dying in their own homes increased after the intervention. To honor the autonomy of patients with terminal illness during the final stages of life and improve their quality of death, expansion of the coverage of home-based hospice care, including for other aging-related and chronic diseases, would be recommended.

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Acquisition, analysis, or interpretation of data: Yun, S.-I. Jang, Park.

Drafting of the manuscript: Yun.

Critical review of the manuscript for important intellectual content: S.-I. Jang, Park, S.-Y. Jang.

Statistical analysis: Yun, S.-I. Jang.

Administrative, technical, or material support: S.-I. Jang.

Supervision: Park, S.-Y. Jang.

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SUPPLEMENT.

Data Sharing Statement