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Association between home-visit nursing utilization and all-cause hospitalization among long-term care insurance beneficiaries: A retrospective cohort study

Yeong Jun Ju[a,b], Hyo Jung Lee[a,b], Woorim Kim[a,b], Sang Ah Lee[a,b], Kyu-Tae Han[a,b], Eun-Cheol Park[b,c,*]

[a] Department of Public Health, Graduate School, Yonsei University, Seoul, Republic of Korea
[b] Institute of Health Services Research, Yonsei University, Seoul, Republic of Korea
[c] Department of Preventive Medicine, Yonsei University College of Medicine, Seoul, Republic of Korea

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ABSTRACT

Background: Ensuring and improving long-term care services that use limited healthcare resources more efficiently is a major concern for many aging societies.
Objectives: The aim of this study was to investigate the relationship between use of home-visit nursing services and all-cause hospitalization in a home-visit nursing-recommended group.
Design: A retrospective cohort study.
Setting: Population-based sample of long-term care insurance beneficiaries from the long-term care insurance 2002–2013 claims database in South Korea.
Participants: Long-term care insurance beneficiaries who need one or more types of nursing care were defined as the home-visit nursing −recommended group (n = 4173).
Measurements: The dependent variable in this study was all-cause hospitalization in the home-visit nursing-recommended population. Multivariate Cox proportional hazards regression analysis was used to identify the association between home-visit nursing service use and all-cause hospitalization.
Results: A total of 3.8% of the subjects used home-visit nursing services. When participants who used home-visit nursing services were set as the reference group, participants who did not use home-visit nursing services had a higher risk of hospitalization (hazard ratio [HR] = 1.25, 95% confidence interval [CI] = 1.07–1.47). Additionally, participants who did not use home-visit nursing services and who did not have a caregiver showed a marked increase in the risk of hospitalization (HR = 6.81, 95% CI = 1.17–39.66). Participants who did not use home-visit nursing services with greater comorbidity showed a considerable increase in risk of hospitalization (HR = 1.36, 95% CI = 1.09–1.70).
Conclusions: Non-use of home-visit nursing services was associated with an increased risk of all-cause hospitalization in the home-visit nursing-recommended population. The present results suggest that the use of home-visit nursing services reduced the risk of hospitalization. Moreover, home-visit nursing may play an essential role in reducing hospitalization risk in the absence of caregiver support.

What is already known about the topic?

- Home-visiting nursing programs covered by long-term care insurance can have favorable effects on many outcomes of the elderly.
- In studies of various programs, including nurse care coordination, health consultation programs, house-call visit plans, health promotions for frail elderly, and nurse home visiting interventions for older people with disability, the authors have found that home visits by nurses favorably affect health outcomes.

What this paper adds

- This secondary analysis of national claim data from a cohort of long-term care insurance beneficiaries demonstrates that home-visit nursing services non-use was associated with an increased risk of all-cause hospitalization among elderly who had the potential need for

* Corresponding author at: Department of Preventive Medicine and Institute of Health Services Research, Yonsei University College of Medicine, 50 Yonsei-ro, Seodaemun-gu, Seoul 120-752, Republic of Korea.
E-mail address: ecpark@yuhs.ac (E.-C. Park).

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home-visit nursing services.
- In particular, we suggested that in the absence of caregivers, home-visit nursing services may play an essential role in healthcare management.

1. Introduction

Healthcare systems in many countries have faced challenges resulting from rapidly aging populations. Those aged ≥60 years accounted for 524 million people or 8% of the world's population in 2010, and this figure is expected to exceed 20% by 2026 (National Institute on Aging, 2011). Moreover, medical expenses for senior citizens in developed countries have continued to rise quickly; a large part of these expenses stems from the cost of hospitalization (Centers for Disease Control Prevention, 2013). These concerns are particularly noteworthy in South Korea, which has one of the most rapidly aging populations in the world (Kwon et al., 2015). The medical expenses of the elderly population in South Korea increased from 12 billion USD in 2010 to 18 billion USD in 2015. Moreover, the medical expenses of the elderly population aged ≥65 years accounted for 35% of total annual medical expenses in 2015 (Statistics Korea, 2015). Ensuring and improving the long-term care services that use limited healthcare resources more efficiently is a major concern for many societies with aging populations and growing health expenses (OECD, 2013).

The long-term care insurance service was established to cope with these pressures and to support independence in the older population. Among in-home and community-based services based on long-term care insurance, home-visit nursing services provide educational support for clients, personal care, and medical treatment (Lim et al., 2014). Authors of studies on home-visit nursing covered by long-term care insurance have reported a reliable relationship between home-visit nursing use and favorable health and functional status, and use of hospitalization (Fortinsky et al., 2006; Oyama et al., 2013). Some authors also suggested that home-visiting nursing programs under in-home and community care can have favorable effects on many outcomes of the elderly (Markle-Reid et al., 2006a). In addition, home-based visiting-nurse programs that provide comprehensive nursing care for the purposes of promoting and maintaining health have been effective in reducing hospital utilization by elderly patients (Low et al., 2015; Oyama et al., 2013). Researchers in the United States of America (USA) and Europe have confirmed similar findings by focusing on specific subjects or evaluating the results through a diverse framework (Imhof et al., 2012; Liebel et al., 2009; Marek et al., 2006; Markle-Reid et al., 2006b; Mattke et al., 2015). However, there is little evidence on this topic from Asian countries.

Long-term care insurance was introduced in Asia relatively late. In 2000, Japan became the first Asian country to introduce compulsory long-term care insurance. In 2008, South Korea followed suit, becoming the second Asian nation to introduce universal long-term care insurance. In particular, the rate of home-visit nursing utilization is very low in these countries, regarding which there is a great deal of concern (Kang and Kim, 2014; Kashiwagi et al., 2013). For example, according to official long-term care insurance statistics, the home-visit nursing utilization rate in South Korea was 2.0% (National Health Insurance Service, 2015). In addition, only 13.1% of those who were recommended to use home-visit nursing services actually used it (Lee et al., 2008). Moreover, only a few studies of home-visit nursing services in South Korea have been reported. These studies focused mainly on reducing social costs and identifying the characteristics of users (Kang and Kim, 2014; Kim and Lee, 2015). Hence, there is a need for further study on the impact of home-visit nursing on healthcare service utilization including hospitalization. Thus, we examined the relationship between home-visit nursing service utilization and risk of hospitalization in the home-visit nursing-recommended group.

1.1. South Korean long-term care insurance scheme

As a form of social insurance, long-term care insurance aims at preserving and improving senior citizens' health and stable livelihoods as well as improving the quality of their lives by relieving the burden of care on family members.

1.1.1. Eligibility and assessment

Those aged ≥65 years who need care/support or persons <65 years who have geriatric diseases are eligible for benefits, depending on the extent of their care needs. The care needs of all applicants for long-term care insurance benefits are assessed using a national care need-assessment tool, which is a 52-item screening tool containing five domains of physical functions, cognition, behavioral problems, demand for nursing, and demand for rehabilitation (Supplementary Table 1). Subjects' care needs are categorized into five groups, ranging from grade 1 (very severe) to grade 5 (near to normal). Those whose care needs are from grade 1 to grade 3 (moderate) are entitled to the long-term care insurance benefit.

1.1.2. Benefits

The South Korean long-term care insurance scheme primarily provides three types of services: (i) *in-home and community-based care,* (ii) *institutional care services*, and (iii) *cash allowances* (Supplementary Table 2). Benefits are available with a monthly limit and are calculated according to the level of care needed and the type of services (Table 1). Beneficiaries are able to choose freely the type of service they wish to receive as well as service times, and they negotiate contracts directly with service providers without input from a helper, such as a care manager. No one helps with long-term care service planning in South Korea.

1.1.3. Financing

The South Korean long-term care insurance program is financed by monthly premiums from enrollees, government taxation, and copayments by the actual users of long-term care under the long-term care insurance. The majority of long-term care financing comes from insurance premiums, which are mandatory for all adults registered under the National Health Insurance. Actual users receiving in-home and community-based care services and institutional care services pay 15% and 20% of the total costs, respectively (Francesca et al., 2011; Kang et al., 2012; Kim et al., 2013, 2010; National Health Insurance Service, 2015).

1.2. Home-visit nursing-recommended group

The home-visit nursing-recommended group was categorized based on the methodology of the standard benefit model for long-term care services, which identifies elderly people who have a potential need for home-visit nursing services. Long-term care insurance beneficiaries who receive a diagnosis from a physician, according to the national care need-assessment tool, that one or more types of nursing care of the 9 nursing treatment items (tracheostomy care, suction, oxygen therapy, sore care, tube feeding, pain control, urine catheter care, colostomy care, dialysis care) are needed are defined as the home-visit nursing-recommended group. Previous studies have successfully used this method based on Korean long-term care insurance claim data (Kang and Kim, 2014; Kwon et al., 2011).

1.3. Home-visit nursing services

Home-visit nursing services are performed as in-home and community-based care services under long-term care insurance. The nurses visit beneficiaries' homes and provide services such as administration of medication and injections, skin care, pain management, and arrangement of laboratory examinations or dental hygiene services according

Table 1
Long-term care service benefits by levels of care.

Status	Grade 1 (very severe) Require help in all aspects of daily life	Grade 2 (severe) Require help in most areas of daily life	Grade 3 (moderate) Require help in some part of daily life
Possible service	• In-home and community based care services • Institutional care services (nursing home, and group home)	• In-home and community based care services • Institutional care services (nursing home, and group home)	• In-home and community based care services • Special permission: residential care†
Monthly limit ($)	• In-home and community based care services: $1102 • Institutional care services (nursing home): $1566 • Institutional care services (group home): $1398	• In-home and community based care services: $971 • Institutional care services (nursing home): $1454 • Institutional care services (group home): $1297	• In-home and community based care services: $918 • Institutional care services (nursing home): $1340 • Institutional care services (group home): $1195
Copayment	• In-home and community based care services: 15% • Institutional care services (nursing home, and group home): 20%		
Service fee of home-visit nursing (regardless of grade, per visit)	• Less than 30 min: $29 • 30 ~ 60 min: $37 • More than 60 min: $44		

Notes: † Special permission for nursing home care in Grade 3: (i) care from family is impossible; (ii) living conditions are very poor; (iii) behavioral problems. All figures are based on January 1, 2017

to a referral from a physician, doctor of oriental medicine, or dentist. Beneficiaries with grades 1–3 can use home-visit nursing services. The service fee is based on service hours per visit regardless of grade (Table 1) (Lim et al., 2014; National Health Insurance Service, 2015).

2. Methods

2.1. Data and study population

We used data from the long-term care insurance 2002–2013 claims database, which was collected by the National Health Insurance Service in South Korea. The long-term care insurance claims database is based on data collected from the long-term care insurance system and provides information about instrumental activities of daily living and service grades, in addition to information on health care utilization (Seong et al., 2016).

Our sample was restricted to individuals who were recommended for home-visit nursing services. Thus, participants who received institutional services and/or a cash allowance were excluded. In addition, because only beneficiaries with long-term care insurance grades 1–3 can use home-visit nursing services, we excluded those in long-term care insurance grades 4 or 5.

2.2. Measures

2.2.1. All-cause hospitalization

The dependent variable in this study was all-cause hospitalization in the home-visit nursing-recommended population. We identified the data for each subject's first inpatient visit during the study period. If the first hospitalization was recorded before home-visit nursing service use, it was not considered hospitalization. If the first hospitalization was recorded after home-visit nursing service use, it was considered hospitalization.

2.2.2. Home-visit nursing service use or non-use

The home-visit nursing service use group included individuals who were recommended for home-visit nursing services. In addition, this group received home-visit nursing services or both home-visit nursing services and home-visit care at least once.

The home-visit nursing service non-use group included individuals who were recommended for home-visit nursing services but did not receive them. This group received home-visit care and/or other in-home and community-based services, instead of home-visit nursing (Kang and Kim, 2014; Kwon et al., 2011).

2.2.3. Covariates

The covariates considered included age, sex, type of insurance coverage, grade of long-term care, Charlson comorbidity index, disease, depressive disorder, income, home-visit nursing centers per 10,000 elderly, division of medical institutions, and caregiver. Age was categorized as 60–69 years, 70–79 years, and ≥ 80 years. Income level of each individual was collected based on mean household income. Types of insurance coverage were categorized as beneficiaries of National Health Insurance (workplace insured, regionally insured, or medical aid). Grade of long-term care was assessed by the national care need-assessment tool (grades 1–3). We calculated the Charlson comorbidity index using a method published previously (Quan et al., 2005). Charlson comorbidity index is a weighted summary measure of clinically important concomitant disease (e.g. myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia liver disease, hemiplegia or paraplegia, and renal disease and malignancy) that has been adapted for use with ICD-10 coded administrative database (Charlson et al., 1987). This index is useful for retrospective studies, as well as for studies in the geriatric population (Buntinx et al., 2002). We divided the patients into four categories based on the index scores (0,1,2, and ≥3), with ≥3 being the most severe. Depressive disorder was assessed using the national care need-assessment tool.

2.3. Statistical analysis

We first examined the distribution of each categorical variable using the chi-square test to calculate the frequency and percentage of variables and to identify significant differences between groups. Next, a multivariate Cox proportional hazard regression analysis was used to estimate hazard ratios (HRs) for hospitalization. We examined the association between home-visit nursing and risk of hospitalization due to non-use of home-visit nursing in subjects who had been recommended for home-visit nursing services. The log-rank test was used after checking for the validity of the proportional hazards assumption. No violations of the proportional hazards assumption were detected. Subgroup analyses were carried out to evaluate possible associations between home-visit nursing and risk of hospitalization due to non-use of home-visit nursing in subjects for whom home-visit nursing services had been recommended by the presence of caregiver support, or Charlson comorbidity index. Statistical analyses were carried out using

Table 2
General characteristics of the study populations.

Variables	Total		All-cause hospitalization				*p*-value
			Yes		No		
	N	%	N	%	N	%	
Home-visit nursing							0.020
Non-use	4016	96.2	2614	65.1	1402	34.9	
Use	157	3.8	88	56.1	69	43.9	
Age							0.058
60–69	2180	52.2	1442	66.1	738	33.9	
70–79	1710	41.0	1091	63.8	619	36.2	
80+	283	6.8	169	59.7	114	40.3	
Sex							0.012
Male	1777	42.6	1189	66.9	588	33.1	
Female	2396	57.4	1513	63.1	883	36.9	
Types of insurance coverage							<0.001
Workplace insured	2317	42.7	1114	62.5	668	37.5	
Regionally insured	1782	55.5	1541	66.5	776	33.5	
Medical aid	74	1.8	47	63.5	27	36.5	
Grade of long-term care							<0.001
1	1077	25.8	763	70.8	314	29.2	
2	1369	32.8	930	67.9	439	32.1	
3	1727	41.4	1009	58.4	718	41.6	
Charlson comorbidity index							<0.001
0	687	16.5	269	39.2	418	60.8	
1	761	18.2	452	59.4	309	40.6	
2	678	16.2	437	64.5	241	35.5	
3+	2047	49.1	1544	75.4	503	24.6	
Disease							0.030
Cataract	453	10.9	289	63.8	164	36.2	
Cerebral infarction	251	6.0	180	71.7	71	28.3	
Hypertension	110	2.6	77	70.0	33	30.0	
Diabetes mellitus	107	2.6	77	72.0	30	28.0	
Gonarthrosis	100	2.4	57	57.0	43	43.0	
All others	3152	75.5	2022	64.1	1130	35.9	
Depressive disorder							0.474
Yes	34	0.8	24	70.6	10	29.4	
No	4139	99.2	2678	64.7	1461	35.3	
Income							0.172
Low	661	15.8	411	62.2	250	37.8	
Middle	2055	49.3	1325	64.5	730	35.5	
High	1457	34.9	966	66.3	491	33.7	
The number of home-visit nursing agencies per 10000 elderly by region							0.170
One or more region[a]	2309	55.3	1474	63.8	835	36.2	
Less than one region[b]	1864	44.7	1228	65.9	636	34.1	
Establishment type of medical institution							0.937
State and local government	641	15.4	419	65.4	222	34.6	
Corporation	2279	54.6	1474	64.7	805	35.3	
Individual	1253	30.0	809	64.6	444	35.4	
Caregiver support							<0.001
Yes	4114	98.6	2668	64.8	1446	35.2	
No	59	1.4	34	57.6	25	42.4	
Activities of daily living scores (Mean ± SD)	34.63	±	7.91	32.54	±	8.06	0.130
Total	4173	100.0	2702	64.7	1471	35.3	

[a] Seoul, Daegu, Incheon, Gwangju, Daejeon, Ulsan, Gyeonggi, Gangwon, Jeju.
[b] Gyeongnam, Gyeongbuk, Jeonnam, Jeonbuk, Chungnam, Chungbuk, Sejong.

the SAS package 9.4 (SAS Institute, Cary, NC, USA) and a *p*-value < 0.05 was considered significant.

3. Results

After excluding subjects with any missing values, a total of 4173 subjects remained in the study. Table 2 shows the characteristics of the study population according to all-cause hospitalization. Nearly two-thirds experienced all-cause hospitalization (64.7%). Only 3.8% (n = 157) utilized home-visit nursing. Cataract was the most common condition (10.9%), followed by cerebral infarction (6.0%). Caregiver support was noted in 4114 subjects (98.6%). In addition, >80% of the participants had one or more morbidity. The mean activities of daily living score was higher in individuals with all-cause admission (scores: 34.63 and 32.54). Although not listed in the table, the average number of home-visit nursing service use in the home-visit nursing use group was 5.18 ± 4.10.

Fig. 1 shows the Kaplan–Meier survival curves and log-rank test results of the study population. The average period to hospitalization was longer in patients who used home-visit nursing services (mean: 13.9 months, standard error [S.E.]: 15.6) than in those without home-visit nursing services (mean: 10.2 months, S.E.: 12.2, *p*-value: 0.002).

Table 3 shows the results of the Cox proportional hazard regression analysis of the association between home-visit nursing use and all-cause hospitalization after multivariate adjustment. Home-visit nursing use was significantly associated with risk for all-cause hospitalization. Subjects who did not use home-visit nursing services had a 1.25-fold higher risk of all-cause hospitalization (HR = 1.25, 95% confidence

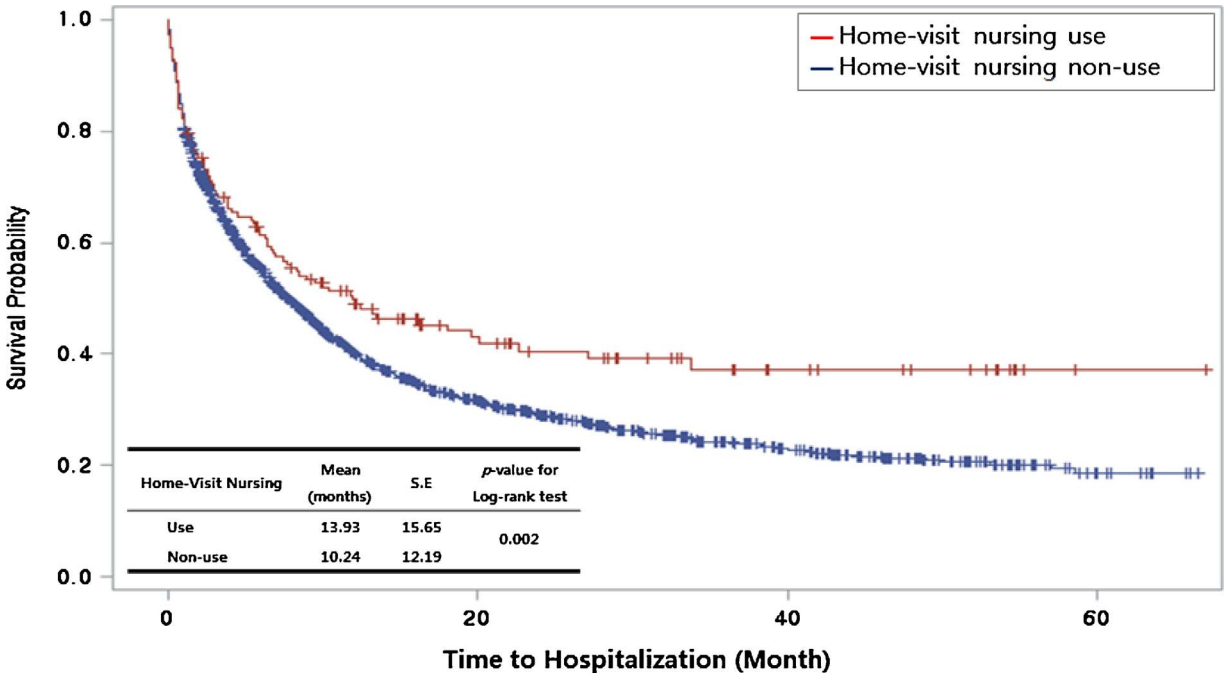

Fig. 1. Kaplan-Meier survival curves and log-rank test results comparing survival rates between subjects with home-visit nursing use (red line) or home-visit nursing non-use (blue line). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
The average period to hospitalization was longer in patient with home-visit nursing use than in those without home-visit nursing services in the home-visit nursing-recommended group.

interval [CI] = 1.06–1.47). In addition, using individuals without morbidity as a reference group, greater comorbidity (Charlson comorbidity index) was also associated with a significantly increased risk of all-cause hospitalization (1 comorbidity: HR = 1.29, 95% CI = 1.16–1.43; 2: HR = 1.40, 95% CI = 1.26–1.56; 3 or more: HR = 1.71, 95% CI = 1.56–1.87). Income level showed a tendency to be inversely correlated with the risk for hospitalization, but this did not reach significance.

The subgroup analysis results are shown in Table 4. Subgroup analyses were stratified by caregiver support or Charlson comorbidity index. Individuals who did not use home-visit nursing services and who were without caregiver support showed the most dramatic increase in risk of all-cause hospitalization (HR = 6.81, 95% CI = 1.17–39.66). Individuals who did not use home-visit nursing services with greater comorbidity showed the considerable increase in risk of all-cause hospitalization (HR = 1.36, 95% CI = 1.09–1.70).

4. Discussion

Home-visit nursing services include not only active medical care services among long-term care services but also community-based care under the South Korean long-term care insurance program, which has had a positive effect on the utilization of medical services (Kang and Kim, 2014; Kim and Lee, 2015; Lee et al., 2011). In our study, we found that home-visit nursing non-use in the home-visit nursing-recommended group was associated with increased risk of all-cause hospitalization. This finding is consistent with similar studies in other countries (Fortinsky et al., 2006; Oyama et al., 2013).

However, according to an official National Health Insurance report, despite these findings only 8613 individuals used home-visit nursing services under the long-term care insurance in 2015, which represented only 2.0% of the total in-home and community-based service users under long-term care insurance in South Korea (National Health Insurance Service, 2015). Although there is growing interest in home-visit nursing, little information is available on home-visit nursing services in South Korea. Hence, additional studies will help guide policy implications in South Korea by filling this research gap. As this study was carried out using nationally representative cohort data, the findings can be generalized to the South Korean elderly population and conceivably to other Asian populations sharing similar characteristics. In addition, for countries such as Thailand that are preparing to establish long-term-care insurance schemes, this study can provide a basis for the effectiveness of long-term care services that include home-visit nursing services.

We found that only 3.8% of the home-visit nursing-recommended group actually utilized home-visit nursing services, which was consistent with the official statistical yearbook in South Korea (National Health Insurance Service, 2013). Studies have pointed to several reasons why service utilization is low. First, there is no care management system in the South Korean long-term care insurance scheme. Hence, beneficiaries negotiate contracts directly with service providers without input from a helper, such as a care manager, which is complicated for the elderly (Lim et al., 2012). Second, there is a limit to provide appropriate type and amount of services to beneficiary, due to the lack of a systematic assessment of the need for home-visit nursing care of the beneficiary (Kang et al., 2012). In line with previous findings, discussions will be required regarding the efficient operation of home-visit nursing services, including simplifying procedures, and providing appropriate services. Prior to the introduction of long-term care insurance, Japan had already designated a roadmap for the future development of this system and is continuously and systematically managing it. Therefore, such efforts including a roadmap for future development will provide useful lessons to the Korean long-term care insurance systems (Campbell et al., 2009; Chon, 2013).

In addition, we found that the use of home-visit nursing services was associated with the risk for all-cause hospitalization. There is a reason for the observation of increased all-cause admission risk in the home-visit nursing non-use group. Under long-term care insurance, beneficiaries are typically > 65 years and have co-occurring health problems including comorbidities as well as functional disabilities. These health problems lead to a greater risk for mortality, hospitalization, and institutional health service use. Hence, long-term care insurance beneficiaries need support for both activities of daily living and healthcare management needs (Gill and Sharpe, 1999; Markle-Reid et al., 2006a).

Table 3
Results of the cox proportional hazard regression analyzing the effects of home-visit nursing services.

Variables	All-cause hospitalization	
	Adjusted-HR	95% CI
Home-visit nursing		
Use	Ref.	
Non-use	1.25	1.06–1.47
Age		
60–69	Ref.	
70–79	1.01	0.95–1.08
80+	1.01	0.89–1.15
Sex		
Male	Ref.	
Female	1.01	0.95–1.08
Types of insurance coverage		
Medical aid	Ref.	
Workplace insured	0.91	0.71–1.17
Regionally insured	0.87	0.68–1.11
Grade of long-term care		
3	Ref.	
2	1.02	0.90–1.14
1	1.00	0.85–1.18
Charlson comorbidity index		
0	Ref.	
1	1.29	1.16–1.43
2	1.40	1.26–1.56
3+	1.71	1.56–1.87
Disease		
All others	Ref.	
Cataract	1.00	0.90–1.10
Cerebral infarction	1.08	0.90–1.31
Hypertension	1.02	0.89–1.16
Diabetes mellitus	1.02	0.84–1.24
Gonarthrosis	0.91	0.75–1.12
Depressive disorder		
Yes	Ref.	
No	0.81	0.58–1.14
Income		
Low	Ref.	
Middle	1.00	0.91–1.10
High	1.04	0.94–1.14
The number of home-visit nursing agencies per 10000 elderly by region		
One or more region †	Ref.	
Less than one region ‡	1.03	0.96–1.09
Establishment type of medical institution		
Individual	Ref.	
State and local government	0.99	0.90–1.09
Corporation	0.98	0.91–1.05
Caregiver support		
Yes	Ref.	
No	1.01	0.78–1.31
Activities of daily living scores	1.01	1.00–1.02

In particular, given that our study population had been recommended to receive home-visit nursing services, the need for healthcare management is greater in this group than in other beneficiary groups.

Authors of previous studies have suggested that if home-visit nursing needs remain unmet, the elderly may be at a greater risk for a variety of adverse health outcomes (Branch, 2000; Liebel et al., 2009). Thus, home-visit nursing non-users have unmet healthcare management needs, which may lead to hospitalization. In line with previous reports, our finding is consistent with a growing body of evidence on home-visit nursing for elderly populations. Home care services provided by nurses are helpful in managing chronic diseases and prevent hospitalization via face-to-face communication between the user and a skilled healthcare provider (Kang and Kim, 2014; Naylor et al., 2011). In addition, because home-visit nursing services should encourage self-management of a patient's health status through in-person interaction, there can be favorable effects on health outcomes for the elderly (Markle-Reid et al., 2006a).

Table 4
Results of the cox proportional hazard regression analyzing the effects of home-visit nursing services and all-cause hospitalization by caregiver support or Charlson comorbidity index.

		All-cause hospitalization	
		Adjusted-HR[a]	95% CI
Caregiver support			
No	Home-visit nursing use	Ref.	
	Home-visit nursing non-use	6.81	1.17–39.66
Yes	Home-visit nursing use	Ref.	
	Home-visit nursing non-use	1.24	1.05–1.46
Charlson comorbidity index			
0	Home-visit nursing use	Ref.	
	Home-visit nursing non-use	1.10	0.71–1.71
1	Home-visit nursing use	Ref.	
	Home-visit nursing non-use	1.09	0.71–1.68
2	Home-visit nursing use	Ref.	
	Home-visit nursing non-use	1.14	0.77–1.67
3+	Home-visit nursing use	Ref.	
	Home-visit nursing non-use	1.36	1.09–1.70

[a] Adjusting for age, sex, types of insurance coverage, grade of long-term care, Charlson comorbidity index, disease, depressive disorder, income, the number of home-visit nursing agencies per 10000 elderly by region, establishment type of medical institution, and activities of daily living scores.

Based on results of our subgroup analysis, we also found that home-visit nursing non-use was associated with all-cause hospitalization among home-visit nursing-recommended individuals without caregiver support. Several studies offer potential explanations for this finding. Caregivers provide important support to elderly people in long-term and home-based care, which improves the functional ability and health of the care receiver, and thus reduces the need for institutionalization (Elliott and Pezent, 2008; Karlsson et al., 2008; Mittelman et al., 2006). If there is no assistance from a caregiver, healthcare management needs will remain unmet, which may result in adverse health outcomes. Thus, home-visit nursing non-users without caregivers may be more vulnerable to healthcare management needs compared with those with caregiver support, which could increase their risk of hospitalization.

Additionally, considering that the majority of beneficiaries had one or more chronic conditions (94.4%) and that greater comorbid condition was associated with healthcare utilization in the elderly population (Griffith et al., 2016; Kang et al., 2012), subgroup analysis was carried out to evaluate possible associations between home-visit nursing service utilization and risk of hospitalization in the home-visit nursing-recommended group by number of Charlson comorbidity index. We found that home-visit nursing non-use was associated with an increased risk of all-cause hospitalization among home-visit nursing-recommended individuals with greater comorbidity. In line with previous evidence, comorbidity can contribute to risks of hospitalization in the elderly population (Inouye et al., 2008).

South Korea has one of the fastest growing populations of the elderly in the world. The importance of home-visit nursing services in this country will increase in the future because the tradition of family care that previously played a dominant role is breaking down through rapid industrialization (Cook and Kim, 2010). In addition, the recent increase in the elderly population of South Korea has in turn increased concerns related to medical expenditures for their care. Thus, home-visit nursing services can be an alternative way of using limited medical resources efficiently and reducing soaring medical costs due to the aging population.

We suggest that efforts should be made to enhance home-visit nursing services through a systematic assessment to implement long-term care insurance successfully based on our findings. First, elderly individuals who were aware of home-visit nursing services in the past indicated a greater willingness to use them in the future (Lee and Kwak, 2016); thus, it is necessary to activate services by inducing potential users to use services by emphasizing the favorable effects on health

outcomes for the elderly. Second, there is no care management system in the South Korean long-term care insurance scheme. The absence of a care management system means that, although service beneficiaries are able to choose freely the kinds of service that they will receive, they must select the service providers and make their own contracts. This may result in the recipient not being able to utilize the necessary services comprehensively due to a lack of information, while preparing the care plan (Chon, 2013). Japan, which provides home-visit nursing services under a long-term care insurance system, like South Korea, provides integrated services to recipients using care management (Tsutsui and Muramatsu, 2007). We suggest the introduction of care management in the South Korean environment to revitalize long-term care services and provide integrated services (Kim, 2013).

This study has some strengths compared to previous studies. We used national sampling cohort data to identify the relationship between home-visit nursing use and the risk of all-cause hospitalization. Our findings from the national sampling cohort should be of significant benefit to healthcare system administrators. In particular, our positive findings about home-visit nursing will help guide policy decisions in the context of an aging society.

Although we obtained meaningful findings that should help improve South Korean home-visit nursing services in the future, there were several limitations. First, our study focused only on the home-visit nursing-recommended group. However, it would have yielded more meaningful findings if we had examined the relationship between home-visit nursing utilization and risk of hospitalization among specific subjects using a conceptual model or framework.

Second, long-term care insurance beneficiaries are vulnerable to hospital admissions or poor health outcomes, and prior research has demonstrated comparable rates of hospital admission or readmission among long-term care insurance beneficiaries because of the association with chronic conditions, disabilities, and physical and psychological problems. Accordingly, our findings might be reflective of broader cause, rather than simply home-visit nursing service use or non-use. In fact, we could not accurately determine whether hospitalization caused individuals not to use home-visit nursing services or whether there was another explanation. As a result, hospital admissions as measured in this study may not be directly related to home-visit nursing use.

Third, we did not measure some patient characteristics, such as job status, marital status, education level, health behaviors, and other factors that have been associated with hospital admissions among the elderly because this study was performed using a National Health Insurance sampling cohort in which data were collected based on the medical utilization of each patient. These possibly unobserved or unreported patient characteristics could have influenced the hospital admission rates. Finally, we did not investigate the reasons why individuals did not use home-visit nursing services because of limitations in the data.

5. Conclusion

Home-visit nursing non-use was significantly associated with increased risk for all-cause hospitalization in the home-visit nursing-recommended population. In particular, there was a significantly increased risk for all-cause hospitalization in the home-visit nursing-recommended population who did not use home-visit nursing services and had caregiver support.

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None

Ethical approval

As the LTCI 2002–2013 claims database does not contain private information and is openly available to researchers in de-identified format, we did not have to address ethical concerns regarding informed consent.

Conflict of interest

The authors have no conflicts. All authors declare no support from any organization for the submitted work, no financial relationship with any organization.

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The English in this document has been checked by at least two professional editors, both native speakers of English. For a certificate, please see: http://www.textcheck.com/certificate/GvR2fI.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.ijnurstu.2017.07.016.

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