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Original Research Article

Associations Between Regional Supply and Integration of Home and Community-Based Service Providers and Risk of Institutionalization: Evidence From South Korea

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Abstract

Background and Objectives. To examine whether the regional density of integrated home and community-based services (HCBS) providers affects long-term care (LTC) service utilization pattern and institutionalization risk in South Korea.

Research Design and Methods. This observational study utilized data from the National Health Insurance Service (NHIS) on individuals aged 65 and older who became newly eligible for LTC insurance benefits in 2018. The final sample excluded individuals admitted to long-term care hospitals during the previous year or those living away from home, resulting in a total of 91,302 individuals included in the study. We analyzed the impact of regional HCBS and integrated care provider density on 4 outcomes: choice of HCBS over LTC facilities (LTCF) as first LTC service, intensity and comprehensiveness of HCBS use, and risk of institutionalization within a year.

Results. Higher regional densities of integrated care providers are associated with increased odds of using HCBS as the first LTC service (odds ratio 1.066, model 1, $p < .01$). Increased density was also associated with higher odds of using multiple HCBS (Odds Ratio 1.108, model 1, $p < .01$). Additionally, higher density of integrated care providers was associated to decreased risk of institutionalization into LTC facilities (hazard ratio 0.98, model 1, $p < .01$).

Discussion and Implications: The density integrated care providers significantly reduce institutionalization rates, by increasing the possibility of choosing HCBS over LTCF as their first LTC service and using a more comprehensive combination of HCBS services. Further investment in integrated care models may enhance the effectiveness of LTC systems.

Keywords: Home and community-based services, Integrated care, Long-term care institutionalization, Regional differences

Translational significance: Integrated care is considered an innovative model to foster aging in place, but its impact on service utilization decisions remains unclear. Study results show that higher level regional density of integrated care organizations could delay the institutionalization of community-dwelling frail older people. This is possibly achieved by increasing the likelihood of choosing home and community-based care over facility care as their first service and by utilizing a more personalized combination of home and community-based care services. Understanding that increasing the supply of integrated care can have a positive influence on service utilization decisions could contribute to long-term care policy decisions.

Background and Objectives

Population aging is increasing the demand for long-term care (LTC) services. As this demand for LTC services is becoming difficult to meet through informal caregiving (Spillman et al., 2021) and as the market for private LTC insurance (LTCI) is difficult to grow on its own (Brown & Finklestein, 2007; Pauly, 1990), most high-income countries have some form of public LTC system to meet their population's needs (Colombo & Mercier, 2012; Gori et al., 2015). During the past decades, rebalancing LTC systems toward home- and community-based care services (HCBS) instead of LTC facilities (LTCF), such as nursing homes, has been pursued (Konetzka, 2014). This change is common worldwide (Gori & Luppi, 2022), under the notion that it is beneficial both in terms of user preferences and costs (Norton, 2016). Various studies have shown that more intensive investment in HCBS could delay LTCF entry (Hedrick et al., 1989; Muramatsu et al., 2007; Segelman et al., 2017); however, the question regarding the most effective and efficient model of HCBS delivery remains (Amelung et al., 2021).

Person-centered integrated care begins with the notion that whereas the person who needs LTC services is singular, their needs are complex, and the providers of services for each need are often fragmented. If there are insufficient

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mechanisms to drive cooperation between these fragmented providers, it could result in a mismatch between the needs of the person and the provision of services, owing to information asymmetry and conflicts of interest (Hofmarcher et al., 2007; OECD, 2011). Integrated care seeks to bridge these gaps by coordinating services across provider entities, ranging from highly unified organizations delivering a full spectrum of services to more loosely affiliated networks that coordinate but do not integrate service provision at an organizational level (Amelung et al., 2021; Lillrank, 2012). The Rainbow Model of Integrated Care (Valentijn et al., 2013) further specifies that "integrated care" involves a high degree of shared decision making and sustained collaboration, often formalized through mergers or long-term agreements, distinguishing it from other forms of cooperation such as coordination, linkage, or segregation. In this study, we adopt this interpretation and focus on integrated care as delivered by unified entities that provide a combination of LTC services. This approach allows us to examine the impact of organizational-level integration on service utilization patterns and the potential for reducing institutionalization.

The goal of this study was to discover whether the density of integrated care providers independently affects people's choice of LTC services even when the total amount of HCBS provision is controlled. This is important considering that the literature regarding the impact of integrated care on service utilization is inconsistent (Alderwick et al., 2021). Although several literatures reported that those who use integrated care could be better in terms of health than those who use other HCBS or LTCF (Martínez-González et al., 2014; Segelman et al., 2015; Wieland et al., 2010), whether the existence of such providers could increase the probability of choosing HCBS over LTCF or choosing a better combination of HCBS services is unclear. This could be a mechanism of the benefits of investment in integrated care. Considering that multiple medical diseases and functional limitations affect admission to nursing homes (Tate et al., 2022), more supply of integrated care providers may postpone nursing-home entrance not only through postselection utilization but also through the LTC service selection process itself.

We examined whether the regional-level density of HCBS and integrated care providers could independently affect the choice of LTC service combinations using a data set from South Korea by analyzing four different outcomes. First, we analyzed whether the regional-level density of HCBS and integrated care providers increases the probability of choosing HCBS over LTCF as their first LTC service using LTCI beneficiaries who have acquired their eligibility level for the first time. Second and third, we analyzed whether the regional-level density of HCBS and integrated care providers increases the intensity and comprehensiveness of HCBS utilization using samples who chose HCBS as their first LTC service. Finally, we analyzed whether the regional-level density of HCBS and integrated care providers decreases the risk of entering LTCF or LTC hospitals (LTCH) during the 1-year follow-up period.

Several key characteristics of the South Korean LTC system make the results of this study interesting. First, public universal LTCI was introduced in 2008 in South Korea, enabled us to study the potential effect of the regional-level density of HCBS and integrated care providers among those who are dually eligible to HCBS and LTCF services. In the South Korean context, those seeking LTC services should apply for a comprehensive needs assessment conducted by the National Health Insurance Service (NHIS), the public insurer, and an eligibility grade is determined based on the national eligibility criteria. The eligibility grade determines whether a person can use LTCF services without further approval (severest grades 1–2) and the amount of HCBS covered by the LTCI per month. As the eligibility for LTCF services among the less severe is generally approved based on their status regarding dementia or informal caregiving possibility, approximately two-thirds of LTCF users are less severe (grades 3–5) beneficiaries. The benefit packages of HCBS covered by the LTCI are categorized into three: personal care services (home-visit care and bathing), day and respite care services (day and night care and short-term respite care), and visiting nursing services. The monthly maximum benefits are set based on the eligibility grades and roughly 18–27 visits of 4-hr home-visit care services per month could be covered with the LTCI (Lee, 2018). Moreover, as the Korean National Health Insurance (NHI), which has universal population coverage, covers another type of facility service called LTCH, those with LTC eligibility can be considered dually eligible in Korea. Second, the South Korean HCBS reimbursement policy provides financial incentives for integrated care providers, which shares the spirit of capitated or bundled payments often used for integrated care (Stokes et al., 2018). Although capitated payment models are not used in the Korean LTC setting as each HCBS are purchased based on fee-for-service payments, the LTCI coverage for total HCBS services used is capped monthly (Kim & Kwon, 2021). Consequently, integrated care providers have an incentive to provide the most comprehensive and attractive composition of all three types of services to maximize their monthly HCBS reimbursement while also keeping people from leaving their services and entering LTCF/LTCH. This is different from the usually, fragmented single HCBS providers in the Korean context, where case management mechanisms are poor (Kim & Kwon, 2021), making each HCBS service provider compete to maximize their revenue.

The advantages of the South Korean setting for studying this topic are as follows: First, the demand for LTC for each individual could be well captured nationwide using data from the national-level, single public insurer, NHIS. As the South Korean LTCI is operated by a single insurer, the LTC benefit eligibility criteria based on needs assessments are uniform nationwide. As these needs assessments include various factors, including health and social needs, and as the contribution rate of the LTCI is proportionally set according to income, the NHIS holds key data on the demand for LTC services. Second, the supply of LTC services can be captured nationwide. As the private market for LTCI is negligible in Korea, most LTC providers rely on funds reimbursed through the public LTCI. These LTC providers are registered with the NHIS, as LTC providers willing to receive reimbursement through the public LTCI should meet the nationally uniform accreditation and compensation criteria set by legislation. Therefore, although the majority of LTC providers are operated by private organizations or individuals, the profiles of LTC providers nationwide are well monitored by the NHIS. Finally, the regional density of LTC providers could vary as the availability of services differs by region. The most important factor affecting availability is the possibility of recruiting care workforces. This is especially true considering that although the price level for LTC services is uniformly set at the national level, the regional cost of supplying LTC could differ. As the

current pricing of LTC services does not account for cost variation across the region, it amplifies the variation in regional LTC supply even after adopting the concept of density, using the number of older people (≥65) living in the region as the denominator. Further details on the South Korean LTC system can be found elsewhere (Kim & Kwon, 2021).

Research Design and Methods

Data Sample and Construction

To examine the association between regional supply of independent or integrated providers of HCBS and HCBS utilization or risk of institutionalization, we performed an observational study using NHI data; we analyzed the entire Korean national population of grades 1–5 older (age ≥ 65) LTCI beneficiaries who were newly eligible during 2018. Data from new users in 2018 were used because this is the most recent period for which we have a full year of follow-up data before 2020, when the coronavirus pandemic began. Individuals were excluded from the sample if they had been admitted to an LTCH in the year prior to the day of the eligibility assessment or if they reported living away from home at the time of the eligibility assessment, resulting in a final sample of 91,302 individuals. All samples were followed up a year from the day of their first LTC eligibility acquisition.

Six data sets were combined (Supplementary Figure 1 in Supplementary Material). Four NHIS data sets were used to identify the study samples and individual-level covariates. First, a dataset that included all LTCI eligibility assessments conducted by the NHIS in 2018 was used to identify the study sample and create baseline covariates. Second, a data set including claims records for all medical care utilization in the year prior to and one year after the date of initial LTCI benefit enrollment was used to generate health status and outcome variables. Third, a dataset that included claims records for all LTCI service use in the year following the date of initial enrollment for LTCI benefits was used to create variables related to LTCI utilization. Fourth, we combined data sets that contained basic information on an annual basis, including gender, age, type of health security coverage, and social insurance contribution level, which was defined based on income and assets, disability benefit eligibility, and region of residence. Two additional data sets, one from the NHI and the other from the Korea National Statistical Office, were combined to construct regional-level covariates. Taking advantage of all medical care and LTCI providers being enrolled in the NHIS, we created a regional-level variable measuring supply characteristics. Other regional variables were extracted from the Korea National Statistical Office dataset to control for regional differences.

Variables

Outcome variables

Four outcome variables were analyzed to understand the association between regional supply and integration of HCBS providers on LTC service utilization patterns. All variables were derived from LTCI and NHI claim records in the NHIS database. The first outcome variable, initial utilization of HCBS, examined whether LTC beneficiaries used HCBS as their first service after becoming eligible.

The second outcome, intensity of HCBS utilization, was assessed among individuals who selected HCBS as their first service. This measure represents the average daily cost of HCBS use, providing an indicator of resource intensity over the utilization period. The daily cost variable was log-transformed to address skewness, and all costs were standardized to 2018 price levels based on the NHIS national fee schedule.

The third outcome, comprehensiveness of HCBS utilization, was measured at the individual level adapting Herfindahl–Hirschman Index (HHI) to capture the degree of diversification across HCBS service types utilized by each person (Rhoades, 1993). Specifically, we calculated HHI based on the proportion of costs attributed to each of the three HCBS service types—personal care, day and respite care, and visiting nursing services—out of the total HCBS utilization for each individual over the follow-up period. As the HHI exhibited a left-skewed distribution with a high proportion of zero values, we used "1-HHI" to represent comprehensiveness, with higher values indicating a broader and more diversified use of services by individuals. This approach aligns with previous studies that have applied HHI to measure service diversity within health care contexts (Hall et al., 2009; Kim et al., 2015; Zwanziger et al., 1996). In this study, a higher 1-HHI value reflects greater diversity in service use for each individual, allowing us to examine whether a higher regional density of integrated HCBS providers is associated with a more comprehensive, person-centered pattern of service utilization at the individual level.

Finally, the fourth outcome variable, risk of institutionalization, was analyzed using a time-to-event approach. We measured the number of days until institutionalization in an LTCF or LTCH, with death treated as a competing event. This analysis used the Fine–Gray competing risks model (Fine & Gray, 1999), and hazard ratios were calculated to assess the relationship between HCBS integration density and institutionalization risk over a one-year follow-up period.

These outcome measures together provide a multidimensional view of HCBS utilization patterns and institutionalization risks, helping to illuminate the role of regional HCBS integration density in shaping long-term care experiences.

Explanatory variables

Our primary interest is to analyze the association between the regional-level density of HCBS and integrated care providers on the risk of LTC institutionalization. Measures of regional-level supply and integration of HCBS providers were constructed using the basic municipalities as the unit of measurement. Using NHIS data, we identified 13,054 HCBS providers who operated during the study period. Of the 13,054 HCBS providers, 10,897 (83.5 %) provided a single type of service. As only 98 providers offered all three types of services, we considered providers providing two or more service types as integrated care providers. To construct regional-level variables that reflect the overall HCBS provider density and the share of integrated providers, the following two combinations of variables were considered as separate models. First, we conducted an analysis using the total number of HCBS providers per 1,000 older adults (≥65) and the proportion of integrated providers that deliver two or more services (model 1). Second, analyses using the number of providers delivering each of the three types of services (personal care services, day and respite care services, and visiting nursing services) per 1,000 older adults (≥65) and the number of integrated providers that delivers two or more services per 1,000 older adults (≥65) as variables were conducted (model 2).

Various individual- and regional-level variables were selected based on a literature review and used as control variables (Gaugler et al., 2007; Tate et al., 2022). Regarding individual-level demand-side factors, such as sex, age, NHI, and LTCI contribution quintile (proxy of income level), health care coverage type, disability enrollment status, LTCI benefit grade, ADLs, IADLs, cognitive function status including dementia, CCI, outpatient, and inpatient utilization in the year prior to entering LTCI, living alone, and primary caregiver type, were controlled for. A wide range of medical and social need factors were adjusted to capture the complex needs of an individual. Regional-level factors, such as GrDP per capita, urban space area per capita, green space area per capita, traffic accidents per 1,000 older adults, practicing doctors per capita, hospital beds per capita, LTCH beds per 1,000 older adults, and LTCF beds per 1,000 older adults, were also controlled to reduce the confounding between regional-level supply characteristics and LTC utilization. All regional-level variables were standardized in the main analyses.

Statistical analysis

We first present the descriptive distributions of the characteristics of the study population and descriptive distributions of the HCBS supply characteristics of the regions. To examine the association between the regional supply of independent or integrated providers of HCBS and HCBS utilization or the risk of institutionalization, we applied multivariate regression models to control for a set of covariates that may have a high potential to confound the results. As four dependent variables were analyzed in this study, different models were used to estimate the association.

For the first three dependent variables, we used generalized estimating equations (GEE) to account for correlations within regional clusters (Liang & Zeger, 1986). First, to examine whether HCBS was the beneficiary's first LTC service, we used a binary distribution with a logit link and reported the odds ratios. Second, the average HCBS cost per day with log-transformation among those whose first LTC service was HCBS was analyzed under the assumption of a normal distribution and identity link, and the exponentiated coefficients were reported as the percentage change in costs. Third, for the concentration of HCBS utilization, measured by the 1-HHI variable, we applied a two-part hurdle model (Mullahy, 1986). This model accounted for the unique distributional characteristics of 1-HHI, which has a high proportion of zero values (85%>). The hurdle model was structured as follows: (a) a binary logistic model to estimate the likelihood of 1-HHI being greater than zero and (b) a gamma distribution with a log link for the 1-HHI values among those with nonzero observations. We report odds ratios with 95% confidence intervals for the binary logistic part and exponentiated coefficients as percentage changes for the gamma part of the hurdle model, respectively. This approach allowed us to better capture both the probability of diversified HCBS use and the degree of diversification among those using multiple HCBS types, as well as addressing the extreme distribution found in the data.

Finally, a time-to-event analysis was performed to analyze the days to first entering LTCH or LTCF as a dependent variable. Considering that death before entering LTCF or LTCH is a competing risk event that cannot be considered as random censoring, we conducted a competing risk analysis using the Fine–Gray model and reported the subdistribution hazard ratio (Fine & Gray, 1999). To account for clustering at the regional level, we applied cluster-robust standard errors in this competing risk model.

To account for the fact that local HCBS supply may fluctuate within the study period, we conducted a sensitivity analysis using the average supply levels of January 2018 and January 2019 as a measure of regional HCBS provider density and integration to check the robustness of the results. All analyses were performed using SAS Enterprise guide 7.4. This study was approved by the Seoul National University Institutional Review Board, IRB No. E2110/002-007.

Results

On average, 84.5% of community-dwelling older adults with newly acquired LTCI benefit eligibility used HCBS as their first LTC service. Table 1 describes the individual characteristics of the entire study sample who had newly acquired LTCI benefit eligibility (S1) and the subsample who used HCBS as their first LTC service (S2). Overall, no significant differences were observed between the two samples.

There was considerable geographic variation in the HCBS supply density in terms of both the total supply and the proportion of integrated providers (Table 2). In 2018, basic municipality level total HCBS providers per 1,000 older people (age ≥ 65) ranged from 0.30 (minimum) to 3.38 (maximum) with the mean of 1.64 (standardized deviation 0.49); proportion of integrated providers ranged from 0% (minimum) to 66.7% (maximum) with the mean of 18.1% (standardized deviation 10.4%). As provider density was measured using the number of provider entities enrolled in the NHIS in January 2018, we checked whether there were variations across time using the providers enrolled in the NHIS in January 2019 and found that the variation across time during this period was small (Supplementary Table 1).

The results of the regression analysis showed that a higher density of HCBS providers and a higher proportion of integrated care providers were both associated with an increased probability of using HCBS as the first LTC service (Table 3). An increase in the total density of HCBS providers and the proportion of integrated providers by one standardized deviation was associated with an odds ratio of 1.131 ($p < .01$) and 1.066 ($p < .01$), respectively, for using HCBS as the first LTC service, after adjusting individual- and regional-level covariates (model 1). Model 2 also yielded similar results. An increase in the density of personal care providers and that of integrated providers by one standardized deviation was associated with odds ratios of 1.09 ($p < .01$) and 1.131 ($p < .01$), respectively, for using HCBS as the first LTC service, accounting for the same covariates (Model 2). The full results of the regression are presented in Supplementary Table 2.

The first column of Table 4 presents the findings that a higher density of HCBS providers and proportion of integrated care providers are both associated with an increased intensity of HCBS use among HCBS users, but the size of the association was small or insignificant. A one standardized deviation increase in the total density of HCBS providers was associated with increased intensity of HCBS use by 2.6%, but the proportion of integrated care providers did not have a statistically significant association, accounting for individual- and regional-level covariates (Model 1). In Model 2, an increase in the density of personal and integrated care providers by one standardized deviation was associated

Table 1. Characteristics of Study Sample of Newly Eligible Grade 3–5 LTCI Beneficiaries Aged 65 and Older in 2018, South Korea

Variables	S1: Whole sample (n = 91,302)		S2: Sample using HCBS as their first LTC service (n = 77,122)	
	n (%)	Mean ± *SD*	n (%)	Mean ± *SD*
Age				
65–69	4,525 (5.0%)		3,913 (5.1%)	
70–74	7,968 (8.7%)		6,797 (8.8%)	
75–79	17,236 (18.9%)		14,684 (19.0%)	
80–84	26,489 (29.0%)		22,540 (29.2%)	
≥≥85	35,084 (38.4%)		29,188 (37.8%)	
Female	59,605 (65.3%)		51,120 (66.3%)	
Health care coverage (Medical aid = 1)	8,098 (8.9%)		7,110 (9.2%)	
NHI contribution quintile [a]				
1st (low income)	20,487 (22.4%)		17,496 (22.7%)	
2nd	8,268 (9.1%)		6,838 (8.9%)	
3rd	11,233 (12.3%)		9,302 (12.1%)	
4th	16,293 (17.8%)		13,571 (17.6%)	
5th (high income)	35,021 (38.4%)		29,915 (38.8%)	
Disability registration status (yes = 1)	25,330 (27.7%)		21,523 (27.9%)	
LTCI benefit grade (severity)				
Grade 1 (severest)	1,329 (1.5%)		804 (1.0%)	
Grade 2	5,378 (5.9%)		3,466 (4.5%)	
Grade 3	23,130 (25.3%)		18,487 (24.0%)	
Grade 4	45,747 (50.1%)		40,312 (52.3%)	
Grade 5	15,718 (17.2%)		14,053 (18.2%)	
ADLs (0–6)		3.1 ± 1.2		3.2 ± 1.1
IADLs (0–8)		3.1 ± 1.6		3.2 ± 1.6
Cognition level (0–10) [a]		4.2 ± 2.0		4.1 ± 1.9
Dementia diagnosed	3,213 (3.5%)		2,683 (3.5%)	
Charlson comorbidity index				
0	34,327 (37.6%)		28,932 (37.5%)	
1	31,895 (34.9%)		26,955 (35.0%)	
2 or higher	25,080 (27.5%)		21,235 (27.5%)	
Live alone	23,027 (25.2%)		20,605 (26.7%)	
Primary caregiver				
None	5,328 (5.8%)		4,786 (6.2%)	
Immediate family	81,078 (88.8%)		68,079 (88.3%)	
Other	4,896 (5.4%)		4,257 (5.5%)	

Notes: ADLs = activities of daily living; HCBS = home and community-based services; IADLs = instrumental activities of daily living; LTC = long-term care; LTCI = long-term care insurance; NHI = national health insurance; S1 & S2 = sample 1 & 2; *SD* = standard deviation.
[a]The NHI contribution quintile is used as a proxy for income level, with the first quintile (low-income group) including the population receiving medical aid.

with increased intensity of HCBS use by 1.8% and 2.1%, respectively, accounting for individual- and regional-level covariates. The complete regression results are presented in Supplementary Table 3a.

The second and third columns of Table 4 show the results from the two-part hurdle model, which examines the association between HCBS provider density and the likelihood of diversified HCBS utilization (1-HHI > 0) as well as the degree of diversification among those with nonzero 1-HHI values. In the first part of the model, both a higher density of HCBS providers and a greater proportion of integrated care providers were significantly associated with an increased likelihood of diversified HCBS use (1-HHI > 0). Specifically, an increase of one standardized deviation in the total density of HCBS providers and the proportion of integrated providers was associated with odds ratios of 1.175 ($p < .01$) and 1.108 ($p < .01$), respectively, for using multiple types of HCBS services, when accounting for individual- and regional-level covariates (Model 1). Model 2 also yielded similar results. This suggests that regions with higher HCBS integration density see a greater likelihood of beneficiaries utilizing a mix of services rather than a single service type. On the other hand, in the second part of the model, which estimates the extent of diversification among those with nonzero 1-HHI values, neither the overall density of HCBS providers nor the proportion of integrated providers showed a statistically significant relationship with the level of 1-HHI. This result indicates that although higher HCBS integration density increases the

Table 2. Mean and Percentile Distribution of Regional Level Measures of HCBS Supply and Integration in 2018, South Korea

Regional level measures	Mean	*SD*	Min	5th	25th	50th	75th	95th	Max
Total HCBS providers	1.64	0.49	0.30	0.92	1.33	1.63	1.98	2.39	3.38
Personal care providers	1.17	0.41	0.14	0.49	0.92	1.15	1.43	1.80	2.65
Day and respite care providers	0.17	0.13	0	0	0.06	0.15	0.24	0.42	0.67
Visiting nurse service providers	0.08	0.07	0	0	0.02	0.07	0.12	0.22	0.37
Integrated care providers	0.22	0.16	0	0.02	0.11	0.19	0.31	0.51	0.96
Proportion of Integrated care providers (%)	18.1	10.4	0	6.3	11.1	15.2	22.8	39.1	66.7

Notes: HCBS = home and community-based services; *SD* = standard deviation. A total of 250 basic municipalities in South Korea were considered. Due to the limitations of the data source, Ansan and Cheonan, which are generally divided into two municipalities respectively, were treated as one region each (reduced from 250 to 248 regions). Reported personal care providers, day and respite care providers, visiting nurse service providers are numbers of providers per 1,000 older people who provides single service type. Numbers of total day and respite care and total visiting nurse service providers including integrated care providers are separately reported. Reported integrated care providers are numbers of providers per 1,000 older people who provide two or more combinations of services.

Table 3. Associations Between Regional Supply and Integration of HCBS and Using HCBS as First LTC Service

Model	Regional HCBS supply measures [a]	Odds ratio (95% CI) On using HCBS as first LTC service [b]
Model 1	Total HCBS providers	1.131 (1.091, 1.173) **
	Proportion of Integrated care providers (%)	1.066 (1.024, 1.109) **
Model 2	Personal care providers	1.09 (1.057, 1.123) **
	Day and respite care providers	1.015 (0.979, 1.053)
	Visiting nurse service providers	1.003 (0.971, 1.036)
	Integrated care providers	1.131 (1.09, 1.174) **

Notes: ADLs = activities of daily living; CI = confidence interval; CCI = Charlson's comorbidity index; GrDP = gross regional domestic product; HCBS = home and community-based services; IADLs = instrumental activities of daily living; LTC = long-term care; LTCF = long-term care facility; LTCH = long-term care hospital; LTCI = long-term care insurance; NHI = national health insurance; *SD* = standard deviation. All models control for sex, age, NHI contribution quintile, health care coverage type, disability enrollment status, LTCI benefit grade, ADLs, IADLs, cognitive function status including dementia, CCI, outpatient and inpatient utilization in the prior year entering LTCI, living alone, primary caregiver type, GrDP per capita, urban space area per capita, green space area per capita, traffic incidents per older population, practicing doctors per capita, hospital beds per capita, LTCH beds per older population, and LTCF beds per older population. Generalized estimating equation was performed treating 248 basic municipalities as repeated subject.
[a]Total HCBS providers, personal care providers, day and respite care providers, visiting nurse service providers, integrated care providers are numbers of providers per 1,000 older people in the region. Proportion of IC providers (%) is the proportion of integrated care providers among total HCBS providers.
[b]Effects on using HCBS as first LTC service were estimated using the whole sample (S1), and binary distribution with logistic link function was assumed. Odds ratios are shown in the table with their significance. All values are standardized, and the effect of a one-unit increase can be interpreted as the effect of increasing the supply in a region by 1 *SD*.
$^{*}p < .05$. $^{**}p < .01$.

likelihood of diversified HCBS use, it does not significantly affect the degree of diversification among those already using multiple service types. The full regression results are presented in Supplementary Table 3b.

Finally, Table 5 shows that a higher density of HCBS providers and proportion of integrated care providers are both associated with a decreased subdistribution hazard of LTC institutionalization. An increase of total density of HCBS providers and the proportion of integrated providers by one standardized deviation was associated with decreased subdistribution hazards of LTC institutionalization by 0.94 times ($p < .01$) and 0.98 times ($p < .05$), respectively, accounting for individual- and regional-level covariates (Model 1). Model 2 yielded similar results. An increase of the density of personal care providers and the density of integrated providers by one standardized deviation was associated with decreased subdistribution hazards of LTC institutionalization by 0.96 times ($p < .01$) and 0.97 times ($p < .01$), respectively, accounting for individual- and regional-level covariates (Model 2). The complete results of the regression are presented in Supplementary Table 4.

Other sensitivity analyses constructing regional provider variables using the average values of the January 2018 and January 2019 supply levels also showed robust results throughout the results (Supplementary Table 5).

Discussion and Implications

In this study, we examined whether the regional-level density of total HCBS and integrated care providers is independently associated with the pattern of LTC service utilization among community-dwelling LTC eligible individuals in South Korea. Our findings suggest that both the total HCBS provider density and density of integrated care providers delivering a combination of different types of HCBS was associated with the pattern of LTC service utilization. More specifically, a higher density of total HCBS and integrated care providers was both independently associated with delayed LTC institutionalization, which could be explained by the higher association of using HCBS as the first LTC service and the higher association of using a more comprehensive combination of HCBS services. Considering that the participants of this study who newly acquired LTC benefit eligibility have the purchasing power to freely choose either HCBS or LTCF services, the results of this study show that the regional density of integrated care providers which has financial incentives

Table 4. Associations Between Regional Supply and Integration of HCBS and HCBS Service Utilization Pattern

Model	Regional HCBS supply measures [a]	Estimated effect on HCBS use percentage change Exp (coefficient) (95% CI)	Hurdle model on "1-HHI" [b]	
			Odds ratio (95% CI) on "1-HHI" being nonzero	Exp (coefficient) (95% CI) on "1-HHI" percentage change (among nonzero subjects)
Model 1	Total HCBS providers	1.026 (1.011, 1.041) **	1.175 (1.118, 1.234) **	0.999 (0.972, 1.026)
	Proportion of Integrated care providers (%)	1.013 (0.996, 1.03)	1.108 (1.046, 1.174) **	0.99 (0.964, 1.017)
Model 2	Personal care providers	1.018 (1.005, 1.032) **	1.082 (1.034, 1.132) **	1.003 (0.977, 1.031)
	Day and respite care providers	1.002 (0.989, 1.021)	1.02 (0.977, 1.067)	1.008 (0.985, 1.031)
	Visiting nurse service providers	1.002 (0.989, 1.016)	1.137 (1.093, 1.183) **	0.985 (0.961, 1.01)
	Integrated care providers	1.021 (1.004, 1.038) **	1.102 (1.041, 1.166) **	0.999 (0.97, 1.03)

Notes: ADLs = activities of daily living; CI = confidence interval; CCI = Charlson's comorbidity index; GrDP = gross regional domestic product; HCBS = home and community-based services; HHI = Herfindahl-Hirschman Index; IADLs = instrumental activities of daily living; LTC = long-term care; LTCF = long-term care facility; LTCH = long-term care hospital; LTCI = long-term care insurance; NHI = national health insurance; *SD* = standard deviation. All models control for sex, age, NHI contribution quintile, health care coverage type, disability enrollment status, LTCI benefit grade, ADLs, IADLs, cognitive function status including dementia, CCI, outpatient and inpatient utilization in the prior year entering LTCI, living alone, primary caregiver type, GrDP per capita, urban space area per capita, green space area per capita, traffic incidents per older population, practicing doctors per capita, hospital beds per capita, LTCH beds per older population, and LTCF beds per older population. Generalized estimating equation was performed treating 248 basic municipalities as repeated subject. Effects were estimated using the sample who used HCBS as their first LTC service (S2). HCBS use intensity was measured by using log-transformed value of average HCBS cost per day. Normal distribution with identity link function was assumed.
[a]Total HCBS providers, personal care providers, day and respite care providers, visiting nurse service providers, integrated care providers are numbers of providers per 1,000 older people in the region. Proportion of IC providers (%) is the proportion of integrated care providers among total HCBS providers. All values are standardized, and the effect of a one-unit increase can be interpreted as the effect of increasing the supply in a region by 1 *SD*.
[b]Estimation on HCBS concentration used "1-HHI," as HHI was left-skewed. 2-part Hurdle model was applied as following: (1) a binary model to estimate the likelihood of "1-HHI" being greater than zero across the entire sample and (2) a gamma distribution with a log link function to model the "1-HHI" values for individuals with nonzero values. Odds ratios and exponentiated coefficients as percentage changes reported, respectively.
$^{*}p < .05$. $^{**}p < .01$.

Table 5. Associations Between Regional Supply and Integration of HCBS and LTC Institutionalization

Model	Regional HCBS supply measures [a]	Estimated effect on risk of LTC institutionalization subdistribution hazard ratio (95% CI) [b]
Model 1	Total HCBS providers	0.95 (0.94, 0.97) **
	Proportion of integrated care providers (%)	0.98 (0.97, 0.99) *
Model 2	Personal care providers	0.96 (0.95, 0.98) **
	Day and respite care providers	1.00 (0.99, 1.02)
	Visiting nurse service providers	1.00 (0.98, 1.01)
	Integrated care providers	0.97 (0.95, 0.98) **

Notes: ADLs = activities of daily living; CI = confidence interval; CCI = Charlson's comorbidity index; GrDP = gross regional domestic product; HCBS = home and community-based services; IADLs = instrumental activities of daily living; IC = integrated care; LTC = long-term care; LTCF = long-term care facility; LTCH = long-term care hospital; LTCI = long-term care insurance; NHI = national health insurance; *SD* = standard deviation. All models control for sex, age, NHI contribution quintile, health care coverage type, disability enrollment status, LTCI benefit grade, ADLs, IADLs, cognitive function status including dementia, CCI, outpatient and inpatient utilization in the prior year entering LTCI, living alone, primary caregiver type, GrDP per capita, urban space area per capita, green space area per capita, traffic incidents per older population, practicing doctors per capita, hospital beds per capita, LTCH beds per older population, and LTCF beds per older population.
[a]Total HCBS providers, personal care providers, day and respite care providers, visiting nurse service providers, integrated care providers are numbers of providers per 1,000 older people in the region. Proportion of IC providers (%) is the proportion of integrated care providers among total HCBS providers. All values are standardized, and the effect of a one-unit increase can be interpreted as the effect of increasing the supply in a region by one standard deviation.
[b]Effects were estimated using the whole sample (S1). Competing risk analysis treating death as a competing event had been performed. Standard errors were clustered at the regional level. Hazard ratios are shown in the table with their significance.
$^{+}p < .1$.
$^{*}p < .05$. $^{**}p < .01$.

is associated with more comprehensive mix of HCBS delivery and a delay in LTCF entry. This association may reflect an influence of integrated care provider density on residents' LTC service utilization choices.

Literature shows that more investment toward HCBS could foster "aging in place" (AIP) of older adults, and integrated care is often considered as a way of more effectively achieving this (Amelung et al., 2021). The results of this study showed that the positive association of integrated care on AIP is consistent in the South Korean setting. One of the key findings of this study is that the regional density of integrated care providers is associated with an increased likelihood that residents choose HCBS over LTCF as their initial LTC service, thereby supporting AIP. This association addresses an area that has been underexplored in the literature. Additionally, by applying the hurdle model to 1-HHI,

we identified a more nuanced pattern in service diversification. Although a higher density of integrated care providers was associated with a greater likelihood of individuals moving beyond exclusive reliance on a single HCBS type, it did not significantly influence the specific degree of diversification among those already using multiple service types. This finding suggests that, although integrated care density may promote initial diversification in HCBS use, the particular combination of services utilized is likely driven more by individual needs than by the availability of integrated care providers. This result could support decisions on resource allocation and the expansion of integrated care models to foster more personalized and need-responsive service utilization, ultimately aiming to improve the quality and effectiveness of long-term care services.

The limitations of this study are as follows. First, the results of this study could not be interpreted as causal relations because we had to rely on controlling for observable variables. As the change in regional-level LTC supply characteristics was minimal during the 2015–2018 period where data were available, we decided not to add regional-level fixed effects to the model. Rather, we conducted sensitivity analyses by adding 3-years trends of regional LTCF utilization rates among the LTC benefit eligible individuals for the model and found robust results in general (Supplementary Table 6). Second, other characteristics, such as the quality or capacity of HCBS providers, were not considered. Owing to data limitations, we were unable to quantify the quality of the providers. However, we compared the capacity of each type of HCBS provider based on whether they were providing single services or multiple services and found that the difference between single service and integrated care providers was statistically insignificant or small (Supplementary Table 7). Capacity was defined based on the number of caregiving workers, legally authorized capacity per day, and number of nursing staff, respectively, for personal care, day and respite care, and visiting nursing services.

The results showed that greater investment by integrated care providers could benefit the LTC system by fostering AIP. The positive associations between integrated care provider density and choosing HCBS as the first LTC service, comprehensiveness of HCBS service utilization, and reduced hazard of LTCF entrance show a possible mechanism by which an increase in the integrated care provider supply could reduce LTC institutionalization. Based on pilot studies that began in 2016 (Yoo et al., 2020), South Korea plans to expand the supply of integrated care providers nationwide by 2027 (Ministry of Health and Welfare, South Korea, 2023). Although challenges in expanding integrated care providers, such as challenges in finding a workforces with the capacity and willingness to provide integrated care services, administrative and legislative barriers, and adequate mechanisms to support collaboration between the integrated care provider and the acute sector, may still remain (Gross et al., 2004; Hirth et al., 2009), this study could add insight into how more investment in integrated care could add value to the public long-term care system.

Supplementary Material

Supplementary data are available at *Innovation in Aging* online.

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Conflict of Interest

None.

Data Availability

Data were generated through the NHIS research data sharing website (https://nhiss.nhis.or.kr/). Codes supporting the findings of this study are available upon request. This study was not preregistered.

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