

A Comparative Study on the Impact of Big Data on the Quality of Life (QoL) and Daily Living of Long-Term Care Patients: Relationship Between Beneficiaries and Non-Beneficiaries

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Abstract: South Korea has rapidly transitioned to a super-aged society, intensifying the demand for long-term care (LTC) services for older adults. The LTC insurance system was introduced to improve the quality of life (QoL) and reduce family caregiving burdens; however, empirical evidence regarding its overall effectiveness on multidimensional QoL remains limited. Therefore, this study aimed to examine the effects of LTC service utilization on the physical and mental QoL among older adults and to explore sex-specific differences. This retrospective cohort study used data from the National Health Insurance Service Senior Cohort Database. In total, 3,470 older adults, comprising 1,735 LTC service users and 1,735 non-users, were included after propensity score matching. QoL was assessed across physical (daily living activities, falls, and voiding dysfunction) and mental (depression and cognitive decline) domains. Multiple logistic regression analyses were performed to examine the association between LTC service utilization and QoL, adjusting for sociodemographic and health-related covariates. Furthermore, sex-stratified analyses were performed. Compared with non-users, LTC service users exhibited a significantly poorer QoL across all domains. Users exhibited lower independence in daily living activities (adjusted odds ratio [aOR] = 0.15, 95% confidence interval [CI] 0.11–0.22), higher risks of falls (aOR = 3.22, 95% CI 2.62–3.95) and voiding dysfunction (aOR = 2.50, 95% CI 2.11–2.97), and increased risks of depression (aOR = 2.30, 95% CI 1.97–2.68) and cognitive decline (aOR = 2.50, 95% CI 2.12–2.96). Sex-stratified analyses revealed that male users exhibited a markedly higher risk of falls, whereas female users exhibited a higher risk of depression and voiding dysfunction. The utilization of LTC services is associated with poorer physical and mental QoL among older adults, reflecting the substantial health vulnerabilities of service users. The observed sex-specific patterns highlight the limitations of uniform care approaches and underscore the need for customized, multidimensional LTC interventions that address sex-specific health risks and psychosocial needs.

Keywords: Long-term Care Service, Beneficiaries and Non-Beneficiaries, Quality of Life, Big Data, Older Adults.

Introduction

Owing to the acceleration of population aging, a growing interest in the health and welfare of older adults is evident. Particularly, an increasing number of older adults live alone, without families to care for them, even while experiencing difficulties in daily living owing to old age, geriatric disease, and cognitive decline, making this an important social issue (Lee and Kim, 2020). To solve this generational and social problem, the South Korean government introduced a long-term care insurance (LTCI) system for older adults. This system provides support for physical activities, household chores, and nursing for older adults (≥65 years old) or individuals with geriatric diseases, who experience difficulties in daily living, to alleviate older adults' long-term care (LTC) and family burden, and to improve their quality of life (QoL) (National Health Insurance Service (NHIS), 2024). LTCI for older adults is a social benefit system that offers stability during old age. Therefore, individuals recognized as experiencing difficulty in independently performing daily living tasks for at least six months are provided support for physical activities, household chores, nursing or similar services, or money given in lieu of these services (Korea Ministry of Government Legislation, 2025). The LTCI system categorizes patients in five levels, according to their physical and cognitive functions, and provides benefits accordingly. Patients with dementia are assigned a separate grade (Korea Ministry of Government Legislation, 2024). The number of beneficiaries has been gradually increasing, reaching

1,019,130 by 2022, accounting for approximately 11% of the total older adult population (National Health Insurance Service (NHIS), 2024).

Various factors affect QoL, including health and social relationships' stability. During old age, health status and use of care services can have important effects on QoL (Kim et al., 2023; Youn et al., 2022). Life satisfaction among older adults is defined as satisfaction with one's own life, compared with others, by participating in activities for healthy aging and possessing the basic resources to fulfill the needs and desires of older adults (Shin and Johnson, 1978). Previous studies found that poor ability in daily living was negatively correlated with QoL among LTC beneficiaries (Byun, 2020), and that the living and labor costs of LTC were important factors affecting physical and psychological QoL (Lee and Hoe, 2020). Therefore, a combination of health and mental factors affects QoL (Kim et al., 2010). Among older adults, QoL is affected by chronic disease, living environment, and use of healthcare (Kim et al., 2010; Park, 2012; Do and Kim, 2022); however, whether the use of LTC benefits can improve older adults' QoL remains unclear.

Previous studies in Europe examined the effects of LTC usage on older adults' QoL. For example, the impact of community-based LTC services on QoL was analyzed, and the relationship between the level of service use and QoL was examined (Forder et al., 2018), which was subsequently reflected in policy. In addition, a comparative study demonstrated differences in the QoL and service quality between facility-based and home-based LTC services for patients with dementia, emphasizing the importance of dementia and social support among older adults, which are becoming prominent global issues (Beerens et al., 2014). The QoL among LTC service users has recently been measured in Japan. Previous studies examined the relationship between LTC services and QoL, analyzing various factors, including the level of care required according to sex and age, and presented aspects of care services that could be improved (Hara et al., 2022).

Thus, several domestic and international studies only reviewed some aspects of the effects of older adult LTC benefits or focused on user satisfaction (Lee, 2019; Jeon, 2017; Kang et al., 2023; Shin and Lee, 2018). However, relatively few studies empirically analyzed the effects of LTC benefits on all aspects of QoL among older adults or compared them with non-beneficiaries.

The LTCI system improves QoL by providing care services to older adults with physical or mental difficulties. Given that the use of LTC benefits among older adults may lead to differences in their QoL, it was surmised that it would be valuable to examine the factors affecting this relationship.

This study aimed to analyze LTC benefits' effect on older adults' QoL and to compare beneficiaries and non-beneficiaries. Consequently, the Senior Cohort DB, a retrospective cohort database provided by the National Health Insurance Service, was used to measure QoL among beneficiaries and non-beneficiaries, differences between the two groups were reviewed, and the contributing factors were elucidated. The research hypotheses were as follows:

First, differences are observed in the general characteristics of older adult LTC beneficiaries and non-beneficiaries.

Second, differences are observed in the QoL between older adult LTC beneficiaries and non-beneficiaries.

Third, the use of LTC benefits affects older adults' QoL.

Materials and Methods

Data

This study used data from the Senior Cohort DB provided by the National Health Insurance Service. This cohort comprised individuals between 60 and 80 years in January 2008 who subscribed to health insurance and qualified for healthcare benefits. This study's participants were extracted from this database using stratified stochastic sampling, based on sex, age, income (insurance fee quartile), and region, excluding individuals who died in 2008. The data included in the final analysis comprised standardized long-term follow-up data from 511,953 individuals, comprising 8% of the total cohort. After submitting the study plan and receiving approval from the National Health Insurance Review Board, a small usage fee was paid, and the data were analyzed using the remote virtualized system.

Participants

Of the 511,953 participants, 320,350 were excluded because the year of their age-matched health examination and the year of their insurance qualification were inconsistent, or because they did not receive a health examination. Subsequently, an additional 8,581 individuals who underwent a health examination before qualifying for LTC insurance and 866 individuals who had missing values for key variables (e.g., place of residence, smoking history, drinking history, or physical activity) were excluded.

Finally, propensity score matching was performed to minimize selection bias, depending on whether the participants subscribed to LTC insurance for older adults. After excluding 178,666 unmatched individuals, 3,470 individuals were included in the final analysis, with 1,735 LTC insurance subscribers and 1,735 non-subscribers. The mean ages of the subscribers and non-subscribers were 66.01 (SD = 0.07) years and 66.00 (SD = 0.05) years, respectively (age range: 66–67 years for both).

Research variables

Independent variables

The primary independent variable was LTC insurance for older adults. Based on the National Health Insurance Qualifications DB, the group who had received an LTC grade and was defined using benefits were defined as “LTC users” and those who had not received an LTC grade were defined as “LTC non-users.” This variable was processed as a categorical (binary) variable.

Dependent variables

This study’s dependent variables represented QoL and were divided into physical and mental factors. The questionnaires used to assess physical and mental QoL were derived from the standardized NHIS National Health Screening program, which has been validated for representing the functional health of the Korean elderly population (Kim et al., 2019).

First, physical QoL was measured based on the ability to perform activities of daily living (ADLs), history of falls, and voiding dysfunction. ADLs were assessed using six items adopted from the NHIS assessment tool: bathing, dressing, eating, toileting, meal preparation, and going out. Each item was scored on a binary scale (0 = independent, 1 = dependent), and individuals requiring assistance in one or more items were categorized as having ADL impairment. Falls and voiding dysfunction were defined according to the clinical criteria set by the National Health Screening protocol: falls were defined as tripping or falling within the last six months, and voiding dysfunction was defined as having impairment affecting urination or incontinence symptoms.

Second, mental QoL was assessed based on depression and cognitive decline. Depression was measured using four items: everyday mood, decreased appetite, depressed mood, and persistent sadness. Participants responded to each item, and those reporting symptoms in at least one area were classified as having depressive moods. Cognitive decline was assessed using the Korean Dementia Screening Questionnaire (KDSQ) (Yang et al., 2002). This tool is a validated instrument used nationwide in Korea for early dementia screening. Subjective cognitive decline was examined using five items: memory impairment (compared with peers and compared with one year ago), difficulties in performing important tasks, recognition of others, and difficulty in performing everyday tasks.

Control variables

To examine the independent effects of LTC insurance usage on QoL, this study categorized the potential confounding factors into sociodemographic characteristics and health-related characteristics.

Sociodemographic characteristics included sex, area of residence (urban or rural), health insurance status (workplace health insurance, regional health insurance, or medical aid), income level (high, middle, or low), and disability severity (none, mild, or severe).

Health-related characteristics included smoking status, drinking frequency, body mass index (BMI), exercise frequency, and the number of underlying diseases (comorbidities). Smoking status was categorized as non-smoker, past smoker, or current smoker, and drinking and exercise frequency were categorized into five levels, based on weekly frequency: non-drinker (non-exerciser), 1–2 times per week, 3–4 times per week, 5–6 times per week, and daily (7 times per week). BMI was calculated in kg/m² and categorized into five groups: underweight, normal, overweight, obese, and severely obese. Regarding underlying diseases (comorbidities), tuberculosis, hepatitis, liver disease, hypertension, heart disease, stroke, diabetes, cancer, and other diseases were counted, and participants were categorized as having 0,

1, 2, or ≥ 3 underlying diseases

Analysis method

This study employed the following analytical methods: First, a frequency analysis was used to ascertain the participants' sociodemographic and health-related characteristics. Second, to compare differences in general characteristics and major variables between LTC users and non-users, chi-squared tests were performed for categorical variables and t-tests were performed for continuous variables. Third, logistic regression analysis was performed to analyze the effects of LTC insurance usage on QoL (physical and mental) while controlling for potential confounding variables, such as sociodemographic factors and health behaviors. The logistic regression results were presented as adjusted odds ratios (aOR) and 95% confidence intervals (CI). All statistical analyses were conducted using SAS ver 9.4 (SAS Institute Inc., Cary, NC, USA), and the statistical significance level was $p < .05$.

Results

Sociodemographic characteristics

The participants' general characteristics are presented in Table 1. Of the 3,470 participants, the sample comprised slightly more females (53.3%) than males (46.7%). Additionally, more participants resided in rural areas (60.3%) than in urban areas (39.7%). Regarding healthcare insurance status, workplace-based subscribers were the most common (48.9%), followed by medical aid recipients (28.9%) and regional-based subscribers (22.2%). Approximately half of the participants were in the low-income bracket (48.3%), followed by the high-income bracket (27.4%) and the middle-income bracket (842, 24.3%). Moreover, the most frequent disability level was severe (53.0%), accounting for more than half of the participants, followed by no disability (27.5%) and mild disability (19.5%).

Table 1. Participants' general characteristics (n=3,470)

Categorized	Characteristic	Total	
		N	(%)
Sociodemographic characteristics	Sex		
	Male	1,621	(46.7)
	Female	1,849	(53.3)
	Region		
	Urban	1,376	(39.7)
	Rural	2,094	(60.3)
	Health insurance status		
	National Health Insurance (Region)	771	(22.2)
	National Health Insurance (Workplace)	1,697	(48.9)
	Medical aid	1,002	(28.9)
	Income level		
	Low	1,677	(48.3)
	Middle	842	(24.3)
	High	951	(27.4)
	Disability		
	No	955	(27.5)
	Mild	677	(19.5)
	Severe	1,838	(53.0)
Health-related characteristics	Underlying diseases		
	0	1,748	(50.4)
	1	664	(19.1)
	2	611	(17.6)
	≥ 3	447	(12.9)
	Smoke Status		
	Non-smoker	2,455	(70.7)
	Past smoker	583	(16.8)
	Current Smoker	432	(12.4)
	Alcohol Status		
	Non-drinker	3,080	(88.8)

	1–2 times	242	(7.0)
	3–4 times	92	(2.7)
	5–6 times	27	(0.8)
	7 times	29	(0.8)
	Body Mass Index		
	Underweight	244	(7.0)
	Normal	1,132	(32.6)
	Overweight	785	(22.6)
	Obese	1,077	(31.0)
	Severe obesity	232	(6.7)
	Exercise		
	Non-exerciser	2,754	(79.4)
	1–2 times	318	(9.2)
	3–4 times	191	(5.5)
	5–6 times	114	(3.3)
	7 times	93	(2.7)
	Long-Term Care		
	No	1,735	(50.0)
	Yes	1,735	(50.0)

Regarding health-related characteristics, the most frequent number of underlying diseases was zero (50.4%), followed by one (19.1%), two (17.6%), and three or more (12.9%). Concerning smoking status, most of the participants were non-smokers (70.7%), which was similar to drinking status where most of the participants were non-drinkers (88.8%). Furthermore, a similar number of participants had normal BMI (32.6%) or were obese (31.0%); however, when overweight (22.6%) and severely obese (6.7%) participants were included, more than 60% of the participants were considered overweight or heavier. The rate of physical activity was very low, and 2,754 individuals (79.4%) performed no exercise.

Comparison of the QoL depending on the use of LTC services

The physical and mental QoL were analyzed among the LTC user and non-user groups, and the results are presented in Figure1.

Among the physical QoL factors, the percentage of participants with ADL independence was lower among the user group (88.5%) than among the non-user group (98.0%) ($p<.001$). Similarly, the percentage of participants who experienced falls was 2.7 times higher among the user group (23.1%) than among the non-user group (8.5%; $p<.001$), and the prevalence of voiding dysfunction was more than twice as high among the user group (30.3%) than among the non-user group (14.7%; $p<.001$).

Similar trends were observed concerning mental QoL. The percentage of participants complaining of depression was significantly higher among the user group (36.7%) than among the non-user group (20.2%; $p<.001$), and the percentage of participants with cognitive decline was twice as high among the user group (32.0%) than among the non-user group (15.7%; $p<.001$).

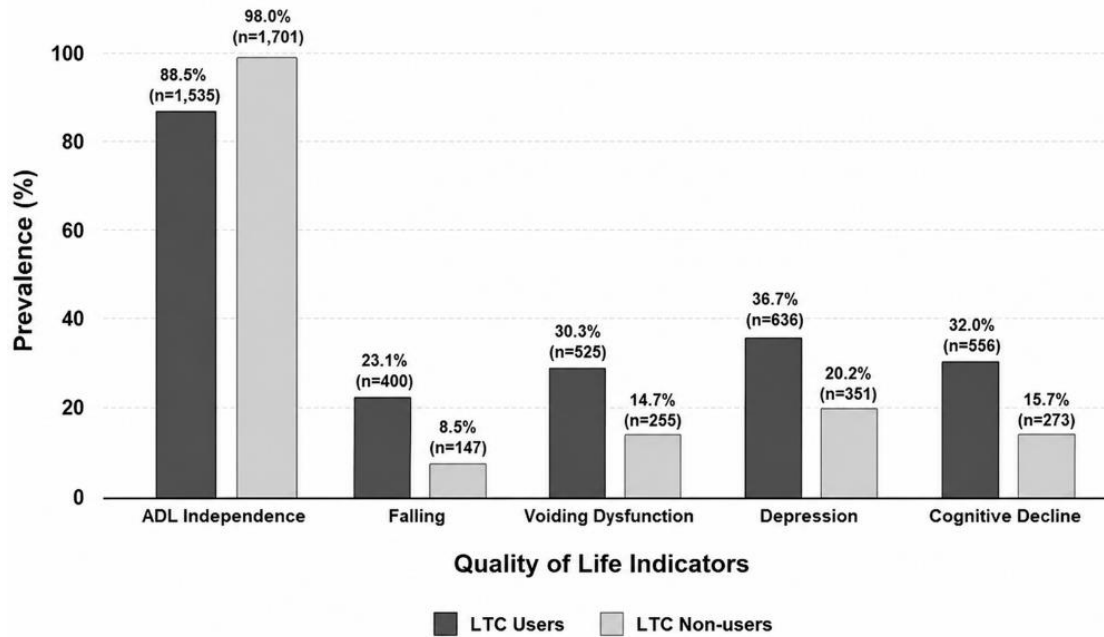


Fig 1. Comparison of physical and mental QoL indicators between LTC users and non-users

Note: Values are presented as percentages (%). The number of cases (N) is displayed above each bar. QoL = quality of life; LTC = long-term care; ADLs = activities of daily living. Differences between groups were highly significant across all indicators ($p < .0001$).

Relationship between LTC service utilization and physical and mental QoL

Table 2 presents the multiple logistic and linear regression analyses results concerning the relationships between LTC service utilization and physical and mental QoL.

Table 2. Long-term care service utilization and physical and mental QoL among older adults

Variables	ADLs			Falling			Voiding dysfunction			Depression			Cognitive decline		
	aO R	95% CI	p-value	aO R	95% CI	p-value	aO R	95% CI	p-value	aO R	95% CI	p-value	aO R	95% CI	p-value
Long-Term Care															
No	1.00			1.00			1.00			1.00			1.00		
Yes	0.15	(0.11 - 0.22)	<.0001	3.22	(2.62 - 3.95)	<.0001	2.50	(2.11 - 2.97)	<.0001	2.30	(1.97 - 2.68)	<.0001	2.50	(2.12 - 2.96)	<.0001
Sex															
Male	1.00			1.00			1.00			1.00			1.00		
Female	0.97	(0.69 - 1.35)	0.857	1.55	(1.21 - 1.98)	<.0001	0.88	(0.71 - 1.08)	0.221	1.41	(1.16 - 1.71)	.0001	1.22	(0.99 - 1.49)	0.059
Region															
Urban	1.00			1.00			1.00			1.00			1.00		
Rural	1.02	(0.76 - 1.36)	0.893	0.77	(0.64 - 0.93)	0.007	0.88	(0.74 - 1.04)	0.134	0.82	(0.70 - 0.95)	0.011	0.80	(0.68 - 0.94)	0.005
Health Insurance Status															
National Health Insurance(Region)	1.00			1.00			1.00			1.00			1.00		
National Health Insurance(Workplace)	0.78	(0.54 - 1.12)	0.178	0.93	(0.73 - 1.18)	0.550	0.96	(0.77 - 1.18)	0.698	0.91	(0.75 - 1.10)	0.337	1.02	(0.83 - 1.26)	0.849
Medical Aid	1.02	(0.64 - 1.64)	0.935	0.99	(0.72 - 1.37)	0.952	1.05	(0.80 - 1.40)	0.740	0.89	(0.69 - 1.14)	0.351	1.16	(0.88 - 1.52)	0.296
Income Level															
Low	0.82	(0.54 - 1.52)	0.356	0.83	(0.62 - 1.11)	0.209	0.80	(0.63 - 1.03)	0.072	0.98	(0.78 - 1.22)	0.827	0.84	(0.66 - 1.07)	0.157

Middle	0.8 2	(0.56 - 1.22)	0.32 8	0.9 5	(0.73 - 1.22)	0.68 8	0.9 2	(0.73 - 1.16)	0.47 7	0.8 8	(0.71 - 1.09)	0.25 1	0.9 5	(0.76 - 1.19)	0.66 5
High	1.0 0			1.0 0			1.0 0			1.0 0			1.0 0		
Disability															
No	1.0 0			1.0 0			1.0 0			1.0 0			1.0 0		
Mild	1.4 3	(0.86 - 2.39)	0.17 2	1.5 7	(1.18 - 2.08)	0.00 2	1.0 6	(0.82 - 1.36)	0.65 1	0.9 7	(0.77 - 1.22)	0.78 1	1.0 4	(0.82 - 1.32)	0.74 2
Severe	0.5 5	(0.39 - 0.78)	0.00 1	1.5 0	(1.18 - 1.90)	0.00 1	1.3 2	(1.08 - 1.61)	0.00 5	1.1 2	(0.94 - 1.35)	0.20 8	0.9 7	(0.80 - 1.18)	0.76 4
Underlying Diseases															
0	1.0 0			1.0 0			1.0 0			1.0 0			1.0 0		
1	0.7 4	(0.51 - 1.08)	0.11 9	1.1 1	(0.85 - 1.45)	0.44 4	1.1 0	(0.87 - 1.39)	0.39 0	1.5 9	(1.29 - 1.98)	<.00 01	1.4 5	(1.16 - 1.82)	0.00 1
2	1.1 5	(0.75 - 1.78)	0.53 1	0.9 1	(0.68 - 1.21)	0.51 7	1.0 5	(0.82 - 1.35)	0.69 4	1.4 4	(1.15 - 1.80)	0.00 2	1.2 2	(0.96 - 1.55)	0.10 4
≥3	1.0 1	(0.64 - 1.59)	0.96 6	1.2 2	(0.91 - 1.64)	0.18 8	1.4 6	(1.13 - 1.89)	0.00 4	1.9 4	(1.53 - 2.47)	<.00 01	1.4 3	(1.11 - 1.85)	0.00 7
Smoke Status															
Non-smoker	1.0 0			1.0 0			1.0 0			1.0 0			1.0 0		
Past smoker	0.9 7	(0.63 - 1.48)	0.88 8	1.4 5	(1.07 - 1.95)	0.01 4	1.7 1	(1.34 - 2.18)	<.00 01	1.5 2	(1.19 - 1.93)	0.00 1	1.2 8	(1.00 - 1.65)	0.04 2
Current Smoker	1.9 5	(1.06 - 3.59)	0.03 2	1.0 8	(0.76 - 1.52)	0.65 9	1.0 7	(0.81 - 1.43)	0.61 3	1.3 5	(1.03 - 1.76)	0.02 8	1.1 0	(0.83 - 1.46)	0.50 3
Alcohol Status															
Non-drinker	1.0 0			1.0 0			1.0 0			1.0 0			1.0 0		
1-2 times	5.3 3	(1.65 - 17.1 7)	0.00 5	1.1 3	(0.76 - 1.69)	0.55 2	0.8 9	(0.63 - 1.25)	0.50 7	1.1 0	(0.80 - 1.50)	0.56 4	0.8 2	(0.58 - 1.16)	0.26 3
3-4 times	3.3 1	(0.78 - 14.0 7)	0.13 4	1.6 6	(0.97 - 2.86)	0.09 5	1.2 3	(0.75 - 1.99)	0.41 5	0.8 4	(0.51 - 1.39)	0.49 4	0.9 5	(0.57 - 1.58)	0.84 3
5-6 times	0.4 2	(0.13 - 1.38)	0.11 1	1.4 5	(0.52 - 4.02)	0.09 5	1.8 3	(0.80 - 4.20)	0.15 4	1.1 6	(0.49 - 2.76)	0.73 6	1.3 8	(0.58 - 3.28)	0.45 9
7 times	0.4 9	(0.16 - 1.55)	0.37 7	1.7 1	(0.66 - 4.41)	0.37 7	0.7 3	(0.29 - 1.87)	0.50 9	1.0 2	(0.43 - 2.38)	0.97 1	0.9 1	(0.36 - 2.30)	0.83 9
Body Mass Index															
Underweight	0.4 6	(0.29 - 0.71)	0.00 1	0.9 8	(0.65 - 1.46)	0.92 1	0.9 0	(0.64 - 1.27)	0.55 1	0.8 6	(0.62 - 1.18)	0.34 9	0.9 4	(0.67 - 1.32)	0.72 1
Normal	1.0 0			1.0 0			1.0 0			1.0 0			1.0 0		
Overweight	1.1 2	(0.77 - 1.64)	0.56 0	0.9 4	(0.72 - 1.22)	0.64 2	0.8 2	(0.65 - 1.03)	0.09 0	0.7 9	(0.64 - 0.97)	0.02 7	0.8 4	(0.67 - 1.05)	0.12 6
Obese	1.6 3	(1.12 - 2.37)	0.01 1	1.1 2	(0.88 - 1.43)	0.36 3	0.9 2	(0.74 - 1.13)	0.38 8	0.9 2	(0.76 - 1.11)	0.37 3	1.0 3	(0.84 - 1.26)	0.77 4
Severe obesity	1.8 3	(0.91 - 3.67)	0.08 9	1.5 0	(1.03 - 2.17)	0.03 1	1.2 7	(0.91 - 1.79)	0.15 3	0.9 9	(0.72 - 1.37)	0.95 9	1.0 0	(0.72 - 1.41)	0.98 7
Exercise															
Non-exerciser	0.3 8	(0.12 - 1.25)	0.11 1	0.7 8	(0.45 - 1.35)	0.37 5	1.4 6	(0.84 - 2.52)	0.17 6	1.3 7	(0.83 - 2.26)	0.22 1	1.0 7	(0.65 - 1.77)	0.79 2
1-2 times	0.4 4	(0.12 - 1.59)	0.21 0	0.8 4	(0.45 - 1.55)	0.57 7	1.3 4	(0.73 - 2.45)	0.34 0	1.0 7	(0.61 - 1.88)	0.80 4	1.1 6	(0.66 - 2.02)	0.60 0
3-4 times	5.7 8	(0.58 - 57.3 7)	0.13 4	0.5 5	(0.27 - 1.11)	0.09 5	1.2 9	(0.67 - 2.47)	0.45 3	1.3 4	(0.75 - 2.42)	0.32 6	0.9 1	(0.50 - 1.67)	0.76 1

5-6 times	0.5 2	(0.12 - 2.22)	0.37 7	0.9 6	(0.47 - 1.97)	0.91 1	1.4 4	(0.72 - 2.91)	0.30 9	1.0 3	(0.53 - 2.00)	0.92 3	0.8 4	(0.43 - 1.65)	0.61 3
7 times	1.0 0			1.0 0			1.0 0			1.0 0			1.0 0		

aOR = adjusted odds ratio; CI = confidence interval; ADLs = activities of daily living; QoL = quality of life.

* Multiple logistic regression analysis was performed for ADLs, falls, voiding dysfunction, depression, and cognitive decline.

** Models were adjusted for age, sex, region, health insurance status, income level, disability, comorbidities, smoking status, alcohol consumption, body mass index and exercise.

The utilization of LTC benefits among older adults was significantly related to all QoL indices. LTC users were significantly less likely to perform ADLs independently compared with non-users (aOR = 0.15, 95% CI 0.11–0.22, $p < .0001$), indicating substantially greater functional dependence. Additionally, fall risks were 3.22 times higher (95% CI 2.62–3.95, $p < .0001$) and risk of voiding dysfunction was 2.50 times higher (95% CI 2.11–2.97, $p < .0001$) among the LTC group than among the non-user group. Regarding mental health, LTC users exhibited 2.30 times higher risk of depressive moods (95% CI 1.97–2.68, $p < .0001$) and 2.50 times higher risk of cognitive decline (95% CI 2.12–2.96, $p < .0001$) than the non-users.

Regarding demographic characteristics, compared with males, females exhibited higher risks of depression (aOR = 1.41, 95% CI 1.16–1.71, $p = .0001$) and falls (aOR = 1.55, 95% CI 1.21–1.98, $p < .0001$). Compared with urban residents, rural residents exhibited a lower risk of falls (aOR = 0.77, 95% CI 0.64–0.93, $p = .007$), depression (aOR = 0.82, 95% CI 0.70–0.95, $p = .011$) and cognitive decline (aOR = 0.80, 95% CI 0.68–0.94, $p = .005$). Moreover, participants with more severe disabilities exhibited an increased frequency of ADL impairment and falls, participants with more underlying diseases or smokers had a higher risk of depression, and severely obese participants had a significantly higher risk of falls than participants with normal body weight (aOR = 1.50, 95% CI 1.03–2.17, $p = .031$).

Relationship between LTC service utilization and QoL depending on sex

Figure 2 presents the relationship between LTC service utilization and QoL after stratifying participants by sex. Both males and females exhibited a poorer QoL among LTC users than among non-users. Compared with non-users, users exhibited significantly poorer ADL function and significantly higher risk of falls, voiding dysfunction, depression, and cognitive decline.

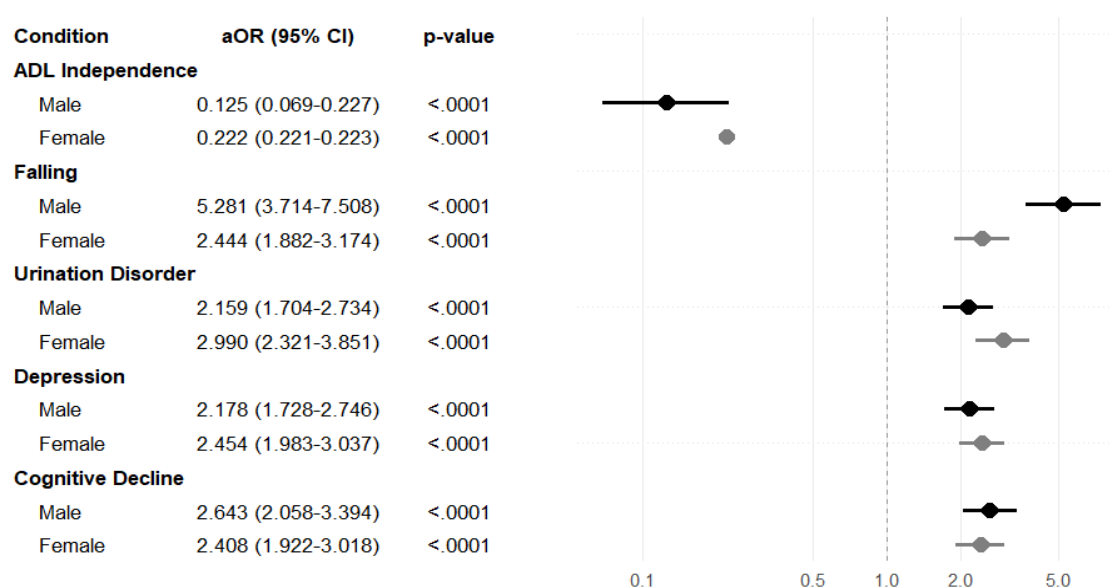


Fig 1. Forest plot of sex-stratified associations between long-term care service utilization and quality of life

Notes: aOR = adjusted odds ratio; CI = confidence interval; ADLs = activities of daily living. Models were adjusted for age, region, health insurance status, income level, disability, underlying diseases, smoking status, alcohol status, body mass index, and exercise. The reference group was non-beneficiaries.

Particularly, fall risk was more than twice as high among male LTC users (aOR = 5.281, 95% CI 3.714–7.508) than among female LTC users (aOR = 2.444, 95% CI 1.882–3.174). Conversely, females exhibited a slightly higher risk than males for voiding dysfunction (male aOR = 2.159, 95% CI 1.704–2.734; female aOR = 2.990, 95% CI 2.321–3.851) and depression (male aOR = 2.178, 95% CI 1.728–2.746; female aOR = 2.454, 95% CI 1.983–3.037). Therefore, differences were observed between males and females concerning QoL indices ($p < .001$).

Discussion

This study aimed to elucidate LTCI's effect on older adults' physical and mental QoL, and to analyze the differences by sex. Compared to LTC non-users, users not only exhibited considerable ADL impairment but also a significantly higher risk of falls, voiding dysfunction, depression, and cognitive decline, which demonstrated worse QoL across all factors. Particularly, in the multivariate analysis, controlling for sociodemographic characteristics and health behaviors, utilization of LTCI was an independent predictor of decreased QoL, and in a sex-stratified analysis, different patterns were observed by group, such as an even greater risk of falls for male LTC users than female users. This suggested that LTC beneficiaries have complex health problems and that they require more than simple care; they require multifaceted interventions to improve their QoL (Forder et al., 2018).

Regarding physical QoL, compared with LTC non-users, users exhibited considerably worse ADL function and, specifically, a higher fall risk. Rather than suggesting that the use of LTC services results in greater dependence in ADLs or a reduced ability to perform ADLs, this can be interpreted as showing that the beneficiaries of LTC among older adults have worse health statuses (Kim and Hwang, 2019). Although the extant system aims to maintain or improve function, the fall risk for LTC users was very high, which indicates that fall programs for users do not work sufficiently in home-based or facility-based services. Rather than simply focusing on care, a paradigm shift is required toward services focusing on functional recovery and improving the patient's environment.

Regarding mental QoL, compared with LTC non-users, users exhibited a much higher risk of depression and cognitive decline. The aforementioned ADL impairment or voiding dysfunction may have acted as a mediating factor, exacerbating depression by lowering self-esteem among older adults and causing withdrawal from social activities (Sahin-Onat et al., 2014; Wang et al., 2025). This suggests that LTC benefits are skewed toward physical care and that a relative shortage of emotional support and cognitive rehabilitation programs may exist (Wu et al., 2025; Cui et al., 2022; Hong et al., 2022). This emphasizes the need for introducing strategies that make referrals to psychological support services mandatory, strengthening screening for depression during nursing visits, and managing depression when identified.

Regarding sex differences, male older adults exhibited a higher risk of falls than female older adults, whereas females exhibited a higher risk of depression and voiding dysfunction than males. Male older adults are believed to exhibit a higher fall risk owing to an overdependence on muscle strength or a tendency to be more active, resulting in them attempting more risky movements than female older adults. Another cause might be the lack of male caregivers or male-friendly fall prevention education (Suh et al., 2023). Additionally, among females, stronger relationship-oriented tendencies than males may make them more susceptible to loneliness owing to physical impairment, or a longer expected lifespan may lead to depression (Jung, 2022; Girgus et al., 2017). These results strongly suggest the need for customized interventions that consider sex-specific characteristics rather than uniform services.

Although this study provided significant results, it has several limitations. First, this study used only long-term care (LTC) utilization as a single independent variable and did not differentiate between specific service types, such as home-based and facility-based services. Although physical and environmental factors' effects on quality of life (QoL) may differ between older adults living in the community and those admitted to facilities (Pigłowska et al., 2023), these subgroups were not differentiated in the current analysis. Second, as the analysis is based on the 2008 cohort—the inaugural year of the Korean Long-Term Care Insurance (LTCI) system—there may be institutional and environmental differences compared to the present policy landscape. Nevertheless, this study provides critical baseline data for understanding the foundational sex-specific vulnerability patterns of older adults during the system's early implementation. Third, the variables comprising QoL, including depression and fall experience, depended on self-reports by the participants and were susceptible to recall bias. Fourth, while QoL is affected by various factors such as family support and care burden (Hong, 2016), the limitations of the administrative

data meant that not all social and environmental factors could be fully controlled. Additionally, this study did not account for the cumulative duration of LTC service utilization as a continuous variable, which may influence the extent of its impact on health outcomes.

However, follow-up studies should be conducted based on these findings. First, a basis for the design of customized benefits should be provided by distinguishing between home- and facility-based LTC services and elucidating their differential effects on QoL. Future research incorporating the length of service exposure would provide a more comprehensive understanding of the insurance system's long-term effectiveness. Furthermore, considering the structural distinctions between LTC hospitals (under National Health Insurance) and LTC facilities (under LTCI), future research should aim to separate these two populations more explicitly to further refine the assessment of LTCI-specific outcomes. Such investigations will help clarify the unique role of each system in addressing the diverse medical and care needs of the elderly.

Finally, in addition to developing and validating intervention programs optimized for participants' characteristics—such as fall prevention for older males or emotional support for older females—qualitative studies, including focus group interviews, should be conducted to thoroughly review the subjective experiences and service satisfaction of older adults.

Conclusion

This study analyzed LTCI's effects on the physical and mental QoL of older adults in South Korea from multiple perspectives and examined differences depending on sex and sociodemographic characteristics.

Compared with LTC non-users, users exhibited considerable ADL impairment and a significantly higher risk of falls, voiding dysfunction, depression, and cognitive decline, demonstrating much worse QoL, even after receiving benefits. Particularly, in the sex-stratified analysis, male LTC users exhibited a higher risk of falls, whereas female LTC users exhibited a higher risk of depression and voiding dysfunction, demonstrating sex-dependent differences in health vulnerabilities.

These results suggest that the current LTC systems are skewed toward physical care-based services, resulting in limitations in maintaining users' existing functions, preventing falls, and promoting psychological and emotional stability. Therefore, future LTC policies should expand upon simple care provision to provide comprehensive services that reflect the multidimensional needs of users, including environmental improvement, rehabilitation for fall prevention, and psychological counseling for depression alleviation. Moreover, an urgent need is evident for developing customized intervention programs that account for sex-specific characteristics such as improving physical safety among males and providing emotional support among females, and for constructing an integrated medical-LTC management system. This study provides the basic empirical data to support these objectives.

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Ethical Considerations

This study obtained ethical approval from the Institutional Review Board (IRB) of Eulji University to ensure research ethics and participant confidentiality (Approval No.: EUIRB-2025-311).

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