Changes in Length of Stay for Neurological Geriatric Diseases in Korea between 2003 and 2007

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Introduction

Elderly people aged ≥65 years comprised 7.2% of the Korean population in 2000; this figure had increased to 10.3% in 2008. It is expected that Korea will become an aged society in 2018 and a post-aged society in 2026. The incidence of geriatric diseases is rising as the elderly population increases, and the incidence of stroke is thought to be 1,000-2,000 per 100,000 people aged ≥65 years. In the early 2000s, the annual incidence of stroke was reported to be approximately 100,000, and the prevalence was thought to be approximately 400,000. Based on a review of medical records, the prevalence of Parkinson’s disease was reported to be 27.83 per 100,000 people of all age groups in the early 2000s, and 165.9 per 100,000 people aged ≥60 years. The prevalence of dementia was reported to be approximately 8.5% of elderly people (aged ≥65 years) in 2005, corresponding to a total of 360,000 people. The number of patients who were hospitalized or received outpatient treatment for 19 geriatric diseases that were covered by
the Long-term Care Insurance Law for the Elderly increased 1.9-fold from 2002 (n=499,000) to 2008 (n=952,000), during which their associated medical expenses increased 3.8-fold, from KRW 581.3 billion to KRW 2,198.3 billion. The proportion of cost related to geriatric diseases in the National Health Insurance (NHI) scheme increased during this time from 4.25% to 8.33%.

Quantitative aspects of medical resources, such as length of stay (LOS), should be considered along with the incidence and prevalence of diseases and associated medical expenses. LOS is an index of the quantity of medical services whose perspective differs from that of medical expenses. That is, the same LOS can result in differences in medical expenses according to disease severity, and the LOS can differ for the same medical expenses, depending on the type of disease. With the recent increase in the number of long-term-care hospitals, it is expected that LOS will lengthen due to a higher prevalence of geriatric diseases. Studies have examined the factors that affect LOS, the effects of LOS on healthcare administration, and LOS associated with specific diseases or specific patient classes in Korea.

Using the health insurance claim data that were collected during 2003-2007, we calculated the LOS for neurological geriatric diseases in patients aged ≥40 years, and compared the LOS among healthcare institutions.

Methods

Study data
We selected 19 neurological geriatric diseases and related variables, based on the primary disease code among the health insurance claim data for which a review and an assessment were completed by the Health Insurance Review and Assessment Service (HIRA) during the 5-year period from 2003 to 2007. In Korea, the NHI is a social insurance scheme; all Koreans join an insurance scheme as a form of health insurance or public medical aid. All healthcare institutions have been appointed as medical insurance hospitals. After providing treatment for diseases that are covered by the NHI scheme, a hospital will submit an insurance claim to HIRA. Then, following a review and assessment of this claim, HIRA makes a payment to the healthcare institution.

Measures and variables
LOS is the total sum of days of hospital stay per year. LOS was compared based on variables such as gender, age, insurance type, disease group, and type of healthcare institution. Considering the characteristics of geriatric diseases, the study population was divided into two age groups: 40-64 years and ≥65 years. The types of insurance were classified into health insurance, public medical aid, and others. Using the International Classification of Diseases codes, 19 neurological geriatric diseases were classified into four groups: cerebral infarction, cerebral hemorrhage, Parkinson’s disease, and dementia. The following codes (for neurological geriatric diseases) were assigned to the cerebral infarction group: I63 (cerebral infarction), I64 (stroke, not specified as hemorrhage or infarction), I65 (occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction), I66 (occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction), I67 (other cerebrovascular diseases), I68 (cerebrovascular disorders in diseases classified elsewhere), and I69 (sequela of cerebrovascular disease). The following were classified into the cerebral hemorrhage group: I60 (subarachnoid hemorrhage), I61 (intracerebral hemorrhage), and I62 (other nontraumatic intracranial hemorrhage). The dementia group comprised F00 (dementia in Alzheimer’s disease), F01 (vascular dementia), F02 (dementia in other disease classified elsewhere), F03 (unspecified dementia), and G30 (Alzheimer’s disease), and the Parkinson’s disease group comprised G20 (Parkinson’s disease), G21 (secondary Parkinsonism), G22 (Parkinsonism in diseases classified elsewhere), and G23 (other degenerative diseases of the basal ganglia).

Healthcare institutions were classified into six groups: tertiary hospitals, general hospitals, hospitals, long-term-care hospitals, private clinics, and public health centers.

Data analysis
Statistical analyses were performed using SAS software (version 9.1). The mean, standard deviation, median, 25th percentile (Q1), and 75th percentile (Q3) were calculated. The parameters associated with LOS were compared using the t-test and ANOVA, with the level of statistical significance set at p<0.05. Poisson regression with a generalized estimating equation and a log link was used to assess the relationship between predictors and LOS. This method accounts for the potential correlation of repeated admissions for the same patient; we assumed that the correlation from multiple admissions was exchangeable. Standard errors were adjusted for patient clustering with the robust sandwich estimator.

Results

Comparison of LOS according to NHI and geriatric disease
In patients aged ≥40 years, LOS due to neurological geriatric diseases was found to total 5,550,193 days in 2003, which accounted for 10.8% of LOS in the total NHI admission days. In 2007 it was found to be 14,749,671 days, accounting for 19.7% of LOS in the total NHI admission days.

In 2003 and 2007, LOS was longest in the cerebral infarction group. This was followed by the dementia, cerebral hemorrhage, and Parkinson’s disease groups. For geriatric diseases, LOS
was prolonged from 25.4% in 2003 to 36.4% in 2007 in the dementia group, and from 2.6% in 2003 to 4.0% in 2007 in the Parkinson’s disease group. However, in the cerebral infarction and cerebral hemorrhage groups LOS was shortened from 50.5% and 21.5% to 47.5% and 12.1%, respectively (Table 1).

**LOS for neurological geriatric diseases**

The parameters associated with LOS are compared in Table 2. In 2003, the mean LOS due to geriatric diseases was 40.8 days (median: 14 days). In 2007, it was 71.2 days (median: 22 days). That is, the mean and median LOSs had lengthened by 1.75 and 1.57 times, respectively ($p<0.01$).

In 2007, the mean LOS for female patients was 79.4 days (median: 26 days). This was significantly longer than the 60.5 days (median: 18 days) for male patients ($p<0.01$). In both groups, the mean and median LOSs were longer in 2007 than in 2003.

In 2007, the mean LOS in the dementia group was 118.2 days (median: 71 days), and this was the longest among the groups. This was followed by the Parkinson’s disease group (mean: 62.1 days; median: 22 days), cerebral hemorrhage group (mean: 57.3 days; median: 25 days), and cerebral infarction group (mean: 51.7 days; median: 15 days). In 2003, the mean LOS was longest in the dementia group, followed in order by the cerebral hemorrhage, Parkinson’s disease, and cerebral infarction groups. The mean and median LOSs in these four groups were longer in 2007 than in 2003.

In 2007, the mean LOS in long-term-care hospitals was 128 days (median: 86 days), and this was the longest among the groups. This was followed in order by private clinics (mean: 69 days; median: 24 days), tertiary hospitals (mean: 16.7 days; median: 9 days), and general hospitals (mean: 25.7 days; median: 12 days). Compared with 2003, the mean LOS was longer in the long-term-care hospitals and private clinics, but shorter in the tertiary hospitals, general hospitals, hospitals, and public healthcare centers.

**LOS in healthcare institutions stratified by geriatric disease subgroup**

The LOS in each type of healthcare institution after stratification by disease group is given in Table 3. In 2003, the primary healthcare institutions for the treatment of the four disease groups included the tertiary hospitals, general hospitals, and hospitals, which accounted for 57-80% of the total LOS. However, in 2007 that proportion decreased to 30-60%, and that for long-term-care hospitals was 39.2-72.8%.

Compared with 2003, the mean LOS in each type of healthcare institution was similar or slightly longer in the tertiary hospitals, general hospitals, and hospitals in the cerebral infarction, cerebral hemorrhage, and Parkinson’s disease groups in 2007. However, in the long-term-care hospitals the mean LOS was longer, by 1.43 times (81.7-116.6 days), 1.35 times (85.6-115.2 days), and 1.28 times (82.7-105.7 days), respectively. In private clinics, it was longer by 1.79 times (25.7-45.9 days), 1.81 times (31.4-56.8 days), and 1.46 times (33.6-49.2 days), respectively. In the dementia group, the mean LOS was 1.30-fold longer (88.1-114.1 days) only in the private clinics.

**Table 1. Comparison of LOS and numbers of patient according to National health insurance and geriatric disease from 2003 to 2007**

|                  | 2003   | 2004   | 2005   | 2006   | 2007   |
|------------------|--------|--------|--------|--------|--------|
| Total LOS        | 51,423,637 | 53,374,553 | 56,538,690 | 62,735,518 | 74,979,885 |
| Geriatric disease| 5,550,193 | 5,814,485 | 10.9  | 8,469,032 | 10.9  |
| Cerebral infarction | 2,801,328 | 3,112,338 | 53.5  | 4,395,391 | 51.9  |
| Cerebral hemorrhage | 1,195,384 | 1,248,007 | 21.5  | 1,465,852 | 17.3  |
| Parkinson disease | 144,073  | 178,426  | 3.1   | 284,435  | 3.4   |
| Dementia         | 1,409,408 | 1,275,714 | 21.9  | 2,323,354 | 27.4  |
| Number of patients | 3,756,783 | 3,870,213 | 3,986,453 | 4,315,691 | 4,756,645 |
| Geriatric disease | 135,998 | 145,768 | 3.6   | 161,516 | 4.1   |
| Cerebral infarction | 93,683  | 102,910  | 68.9  | 112,167 | 70.6  |
| Cerebral hemorrhage | 30,604  | 30,278  | 22.5  | 30,576  | 20.8  |
| Parkinson disease | 4,080  | 4,792  | 3.6   | 6,191  | 3.8   |
| Dementia         | 13,093  | 14,060  | 9.6   | 20,695  | 12.8  |

LOS: length of stay.
Table 2. Comparison of LOS and numbers of patient according to the related-parameters in 2003 and 2007

|                  | 2003               |                  | 2007               |                  |
|------------------|--------------------|------------------|--------------------|------------------|
|                  | No     | %           | No     | %           | No     | %           | No     | %           |
| LOS Patients     |         |             |         |             |         |             |         |             |
| Mean          | SD     | Median     | 25%    | 75%        | Mean          | SD     | Median     | 25%    | 75%        |
| Total amount   | 5,550,193 | 100      | 135,998 | 100        | 40.8 | 70.1 | 14 | 7 | 36 | 14,749,671 | 100      | 207,079 | 100       | 71.2 | 100.7 | 22 | 8 | 89 |
| Gender          |         |             |         |             |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Male            | 2,292,574 | 41.3      | 62,587  | 46.0        | 36.6 | 63.3 | 13 | 7 | 33 | 5,393,176 | 36.6      | 89,185   | 43.1       | 60.5 | 90.8 | 18 | 8 | 65 |
| Female          | 3,257,619 | 58.7      | 73,411  | 54.0        | 44.4 | 75.2 | 15 | 7 | 40 | 9,356,495 | 63.4      | 117,894  | 56.9       | 79.4 | 106.9 | 26 | 9 | 106 |
| Age             |         |             |         |             |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 40-64           | 1,805,312 | 32.5      | 52,814  | 38.8        | 34.2 | 59.9 | 13 | 6 | 31 | 3,191,298 | 21.6      | 61,271   | 29.6       | 52.1 | 84.8 | 16 | 7 | 49 |
| 65-             | 3,744,881 | 67.5      | 83,463  | 61.4        | 44.9 | 75.2 | 15 | 7 | 41 | 11,558,373 | 78.4      | 146,621  | 70.8       | 78.8 | 105.0 | 27 | 9 | 105 |
| Type of insurance|       |             |         |             |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Health insurance| 4,055,804 | 73.1      | 115,035 | 84.6        | 35.3 | 62.1 | 13 | 6 | 32 | 10,317,953 | 70.0      | 164,728  | 79.5       | 62.6 | 93.8 | 19 | 8 | 69 |
| Public medical aid| 1,494,389 | 26.9      | 22,092  | 16.2        | 67.6 | 94.3 | 25 | 9 | 80 | 4,428,137 | 30.0      | 44,931   | 21.7       | 98.6 | 114.3 | 43 | 13 | 151 |
| Others          |         |             |         |             |     |     |     |     |     |     |     |     |     |     |     |     |     |
|                 | 3,581   | 0.0        | 108     | 0.1         |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type of disease |         |             |         |             |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Cerebral infarction | 2,801,328 | 50.5    | 93,683  | 68.9        | 29.9 | 54.7 | 11 | 6 | 26 | 7,005,935 | 47.5      | 135,398  | 65.4       | 51.7 | 84.3 | 15 | 7 | 50 |
| Cerebral hemorrhage | 1,195,384 | 21.5    | 30,604  | 22.5        | 39.1 | 55.4 | 20 | 9 | 42 | 1,791,928 | 12.1      | 31,264   | 15.1       | 57.3 | 80.3 | 25 | 11 | 63 |
| Parkinson disease| 144,073  | 2.6       | 4,080   | 3.0         | 35.3 | 59.2 | 13 | 7 | 34 | 584,613  | 4.0       | 9,413    | 4.5         | 62.1 | 88.9 | 22 | 8 | 73 |
| Dementia        | 1,409,408 | 25.4     | 13,093  | 9.6         | 107.6 | 115.0 | 58 | 18 | 170 | 5,367,195 | 36.4      | 45,415   | 21.9       | 118.2 | 115.1 | 71 | 27 | 184 |
| Type of medical institution |       |             |         |             |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Tertiary hospital | 679,085  | 12.2      | 36,347  | 26.7        | 18.7 | 27.8 | 10 | 5 | 21 | 684,013  | 4.6       | 40,979   | 19.8       | 16.7 | 25.2 | 9 | 5 | 19 |
| General hospital | 1,714,693 | 30.9     | 63,896  | 47.0        | 26.8 | 45.2 | 12 | 6 | 27 | 1,912,704 | 13.0      | 74,287   | 35.9       | 25.7 | 41.4 | 12 | 6 | 27 |
| Hospital        | 1,785,940 | 32.2     | 32,688  | 24.0        | 54.6 | 85.9 | 17 | 7 | 57 | 2,638,998 | 17.9      | 43,820   | 21.2       | 60.2 | 86.8 | 22 | 8 | 70 |
| Long-term care hospital | 1,157,103 | 20.8 | 11,302  | 8.3        | 102.4 | 108.8 | 56 | 20 | 153 | 9,051,988 | 61.4      | 70,293   | 33.9       | 128.8 | 119.4 | 86 | 30 | 212 |
| Private clinic  | 209,815  | 3.8       | 5,553   | 4.1         | 37.8 | 65.4 | 13 | 6 | 34 | 459,759  | 3.1       | 6,668    | 3.2         | 69.0 | 96.0 | 24 | 9 | 87 |
| Public health center | 3,557    | 0.1       | 161     | 0.1         | 22.1 | 33.7 | 10 | 3 | 21 | 2,209    | 0.0       | 145      | 0.1         | 15.2 | 18.0 | 11 | 4 | 19 |

LOS: length of stay.
Table 3. Comparison of LOS and numbers of patient according to healthcare institutions, stratified by geriatric disease subgroup in 2003 and 2007

| Disease          | 2003          | 2007          |
|------------------|---------------|---------------|
|                  | LOS Patients  | LOS Patients  |
|                  | No | %   | No | %   | No | %   | No | %   |
|                  | Mean | SD | Median | 25 | 75 | Mean | SD | Median | 25 | 75 |
| Cerebral infarction |     |     |        |    |    |      |    |        |    |    |
| Tertiary hospital | 352,791 | 12.6 | 23,943 | 23.7 | 14.7 | 21.6 | 9 | 5 | 16 | 385,715 | 5.5 | 28,795 | 19.0 | 13.4 | 19.3 | 8 | 4 | 15 |
| General hospital  | 995,153 | 35.5 | 45,418 | 44.9 | 21.9 | 37.1 | 10 | 6 | 21 | 1,214,878 | 17.3 | 55,549 | 36.6 | 21.9 | 35.6 | 11 | 6 | 22 |
| Hospital          | 852,650 | 30.4 | 21,714 | 21.5 | 39.3 | 68.3 | 13 | 6 | 36 | 1,173,815 | 16.8 | 28,522 | 18.8 | 41.2 | 65.7 | 15 | 7 | 43 |
| Long-term care hospital | 497,501 | 17.8 | 6,091 | 6.0 | 81.7 | 94.5 | 40 | 16 | 109 | 4,049,662 | 57.8 | 34,742 | 22.9 | 116.6 | 114.6 | 69 | 27 | 182 |
| Private clinic    | 100,519 | 3.6 | 3,916 | 3.9 | 25.7 | 47.2 | 10 | 5 | 23 | 180,288 | 2.6 | 3,929 | 2.6 | 45.9 | 75.7 | 15 | 7 | 42 |
| Public health center | 2,714 | 0.1 | 122 | 0.1 | 22.2 | 34.7 | 11 | 3 | 22 | 1,577 | 0.0 | 105 | 0.1 | 15.0 | 17.3 | 11 | 4 | 19 |
| Cerebral hemorrhage |     |     |        |    |    |      |    |        |    |    |
| Tertiary hospital | 292,144 | 24.4 | 10,759 | 31.4 | 27.2 | 35.7 | 17 | 7 | 32 | 251,437 | 14.0 | 9,542 | 26.2 | 26.4 | 34.9 | 17 | 8 | 30 |
| General hospital  | 567,518 | 47.5 | 16,427 | 47.9 | 34.5 | 49.2 | 18 | 8 | 38 | 528,413 | 29.5 | 15,091 | 41.4 | 35.0 | 47.2 | 20 | 8 | 40 |
| Hospital          | 217,623 | 18.2 | 5,313 | 15.5 | 41.0 | 60.2 | 19 | 7 | 44 | 279,219 | 15.6 | 5,170 | 14.2 | 54.0 | 72.2 | 27 | 8 | 68 |
| Long-term care hospital | 97,896 | 8.2 | 1,144 | 3.3 | 85.6 | 92.9 | 48 | 20 | 120 | 703,245 | 39.2 | 6,106 | 16.8 | 115.2 | 110.8 | 72.5 | 28 | 179 |
| Private clinic    | 19,682 | 1.6 | 626 | 1.8 | 31.4 | 44.3 | 17 | 8 | 34 | 29,212 | 1.6 | 514 | 1.4 | 56.8 | 75.5 | 29 | 12 | 69 |
| Public health center | 521 | 0.0 | 29 | 0.1 | 18.0 | 25.4 | 60 | 58 | 104 | 402 | 0.0 | 20 | 0.1 | 20.1 | 25.1 | 11 | 5 | 15 |
| Parkinson disease |     |     |        |    |    |      |    |        |    |    |
| Tertiary hospital | 22,079 | 15.3 | 1,447 | 33.9 | 15.3 | 21.1 | 10 | 6 | 16 | 32,402 | 5.5 | 2,883 | 22.2 | 14.2 | 20.5 | 9 | 5 | 16 |
| General hospital  | 33,593 | 23.3 | 1,443 | 33.8 | 23.3 | 35.1 | 11 | 6 | 23 | 67,619 | 11.6 | 2,491 | 24.3 | 27.1 | 44.9 | 13 | 6 | 28 |
| Hospital          | 37,987 | 26.4 | 687 | 16.1 | 55.3 | 77.0 | 22 | 8 | 65 | 80,096 | 13.7 | 1,542 | 15.0 | 51.9 | 72.3 | 25 | 9 | 61 |
| Long-term care hospital | 45,499 | 31.6 | 550 | 12.9 | 82.7 | 92.9 | 47 | 23 | 106 | 393,534 | 67.3 | 3,724 | 36.3 | 105.7 | 106.3 | 61 | 26 | 153 |
| Private clinic    | 4,677 | 3.2 | 139 | 3.3 | 33.6 | 52.7 | 175 | 82 | 286 | 10,925 | 1.9 | 222 | 2.2 | 49.2 | 75.2 | 18 | 7 | 58 |
| Public health center | 238 | 0.2 | 4 | 0.1 | 59.5 | 49.5 | 51 | 18.5 | 100.5 | 37 | 0.0 | 7 | 0.1 | 5.3 | 3.5 | 11 | 11 |
| Dementia          |     |     |        |    |    |      |    |        |    |    |
| Tertiary hospital | 12,071 | 0.9 | 590 | 4.3 | 20.5 | 32.2 | 10 | 5 | 22 | 14,459 | 0.3 | 856 | 1.8 | 16.0 | 26.9 | 9 | 4 | 19 |
| General hospital  | 118,429 | 8.4 | 1,686 | 12.3 | 70.2 | 98.4 | 24 | 8 | 90 | 101,794 | 1.9 | 2,529 | 5.3 | 40.3 | 61.8 | 15 | 6 | 44 |
| Hospital          | 677,680 | 48.1 | 6,121 | 44.7 | 110.7 | 115.0 | 61 | 22 | 176 | 1,105,868 | 20.6 | 10,544 | 21.9 | 104.9 | 110.7 | 59 | 22 | 153 |
| Long-term care hospital | 516,207 | 36.6 | 4,325 | 31.6 | 119.4 | 115.3 | 74 | 28 | 188 | 3,905,547 | 72.8 | 32,062 | 66.7 | 121.8 | 114.3 | 79 | 30 | 190 |
| Private clinic    | 84,937 | 6.0 | 964 | 7.0 | 88.1 | 100.6 | 44.5 | 15 | 121.5 | 239,334 | 4.5 | 2,097 | 4.4 | 114.1 | 113.3 | 68 | 23 | 177 |
| Public health center | 84 | 0.0 | 7 | 0.1 | 12.0 | 7.2 | 27 | 27 | 27 | 193 | 0.0 | 14.0 | 0.0 | 13.8 | 13.5 | 11.5 | 4 | 18 |

LOS: length of stay.
Application of a poisson regression model to LOS

The results of univariate and multivariate Poisson regression analysis presented as the relative risk (RR) are given in Table 4. The RR of males (compared with females) in 2007 was 0.987 and was significantly lower than 1 (0.992) in 2003; an RR of 0.987 and more (compared with 40-64) in 2007 was 1.019, and was significantly higher than 1 (1.005) in 2003.

The RRs of public medical aid (compared with health insurance), cerebral hemorrhage, Parkinson’s disease, and dementia (compared with cerebral infarction) in 2007 were 1.089, 1.196, 1.061, and 1.138, respectively, which were lower than those recorded for 2003. However, the RRs of general hospitals, hospitals, long-term-care hospitals, and private clinics (compared with tertiary hospitals) in 2007 were 1.250, 1.440, 1.706, and 1.476, respectively, and were higher than those recorded for 2003.

Discussion

The findings of this study show that the mean LOS due to geriatric diseases has lengthened every year from 2003 to 2007, although with some variability. In both 2003 and 2007 there were more female patients than male patients, and the mean LOS was longer for female than for male patients. This difference might be because the present study enrolled only geriatric cases. It was thus expected that the number of female patients with geriatric diseases would increase.

Compared with 2003, the mean LOS and number of patients aged ≥65 years had increased in 2007, by 3.11 times and 1.77 times, respectively. These results suggest that the number of patients with geriatric diseases and the use of medical services have increased due to the increased number of elderly people. Moreover, the mean LOS and number of patients increased by 1.84 and 1.18 times, respectively, in the 40-64 years age group. These results suggest that preventive measures should be taken against geriatric diseases before the age of 40 years.

While public medical aid accounted for 30.5% and 20.4% of the mean LOS and the number of patients with geriatric diseases, respectively, in 2007, only 3.7% of the NHI scheme was covered by public medical aid. This indicates that public medical aid patients commonly have geriatric diseases and they frequently use medical services. People who are covered by public medical aid or Industrial Accident Compensation Insurance are less burdened by paying their own medical expenses than are those who are covered by health insurance. Thus, the former group, when in need of hospitalization, tend to receive continuous assistance from healthcare professionals, even though their treatment has been completed, and they might be subjected to long-term hospitalization. In addition, improvements in access to medical services in the public medical aid group might also contribute to the increased use of medical services.

 LOS: length of stay.

**Table 4. Application of a poisson regression model on LOS in 2003 and 2007**

| Variables (reference) | 2003 |  |  | 2007 |  |  |
|-----------------------|------|---|---|------|---|---|
|                       | Univariate analysis | Multivariate analysis | 95% Confidence interval | Univariate analysis | Multivariate analysis | 95% Confidence interval |
| Gender (female) Male | 0.961* | 0.992 | 0.983-1.002 | 0.923* | 0.987 | 0.983-0.992 |
| Age (40-64) 65- | 1.025* | 1.005 | 0.994-1.015 | 1.133* | 1.019 | 1.013-1.025 |
| Type of insurance (health insurance) Public medical aid | 1.300* | 1.216 | 1.203-1.231 | 1.189* | 1.089 | 1.084-1.094 |
| Others | - | - | - | 1.066 | 1.164 | 1.017-1.333 |
| Type of disease (cerebral infarction) Cerebral hemorrhage | 1.378* | 1.416 | 1.399-1.434 | 1.136* | 1.196 | 1.188-1.205 |
| Parkinson disease | 1.112* | 1.098 | 1.067-1.130 | 1.108* | 1.061 | 1.050-1.072 |
| Dementia | 1.420* | 1.270 | 1.257-1.284 | 1.297* | 1.138 | 1.133-1.143 |
| Type of medical institution (tertiary hospital) General hospital | 1.166* | 1.145 | 1.129-1.162 | 1.262* | 1.250 | 1.236-1.265 |
| Hospital | 1.297* | 1.238 | 1.219-1.257 | 1.497* | 1.440 | 1.424-1.457 |
| Long-term care hospital | 1.465* | 1.373 | 1.352-1.395 | 1.790* | 1.706 | 1.688-1.724 |
| Private clinic | 1.046* | 1.055 | 1.029-1.081 | 1.513* | 1.476 | 1.453-1.499 |
| Public health center | 1.193 | 1.176 | 0.951-1.455 | 1.019 | 0.991 | 0.848-1.159 |

*p<0.001.

LOS: length of stay.
The number of patients hospitalized therein and the lengthened LOS indicate that the demands of customers (patients or their caregivers) are on care rather than medical services per se.

More studies on LOS due to geriatric diseases have been conducted in overseas countries compared with Korea. In an Australian study of patients aged ≥65 years, the mean LOS was 20.6 days among those with dementia, compared with 9.6 days among other patients. In a study from Thailand, the mean LOS for acute stroke patients was 7 days, and the most influential factor for LOS was stroke severity at admission. According to a study from the United States regarding patient burden with medical expenses for the treatment of Parkinson’s disease, the mean LOS was 5.3 days. Due to differences in medical systems, the status of geriatric disease, and access to medical institutions between countries, a simple comparison of LOS would not be useful. However, the present study has revealed that LOS in tertiary and general hospitals is longer in Korea than in other countries.

This study was based on medical insurance claims data. Special attention should thus be paid to the interpretation of this study because there are basic limitations in using such data. First, it is possible that diagnoses on claims data can be overestimated. That is, disease codes for dementia might be included in patients with mild cognitive impairment or those for stroke might be included for brain magnetic resonance imaging evaluation. Second, the diagnostic accuracy might vary with the physicians’ clinical experience and diagnostic instruments. Third, the current study dealt only with the primary disease codes. It is thus likely that some data were missing because they were not claimed as the primary disease codes. However, because this study was conducted exclusively using the primary disease codes, it is highly likely that major reasons for hospitalization were the geriatric diseases in question. Furthermore, because this study examined LOS data that were collected from all healthcare institutions, it would be appropriate to compare the LOS based on spatiotemporal changes due to geriatric diseases. That is, this study could overcome the limitations due to the validity of data collected through a patient survey or LOS studies conducted at some healthcare institutions, or those due to the generalization of study results.

This study showed that the LOS due to geriatric diseases has lengthened markedly due to the increased number of hospitalized patients and mean LOS. With regard to the healthcare institutions, the number of patients and mean LOS were particularly markedly increased in long-term-care hospitals. At this time, consideration should be given to examining whether long-term-care hospitals are increasing their size while being faithful to their own purposes, and providing medical treatment and care for appropriate patients, or whether they are increasing their size, being simple service providers responding to an increased demand.
Conflicts of Interest

The authors have no financial conflicts of interest.

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