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Changes in Spinal Injection Utilization in Korea: A Nationwide Comparative Study of Two Observation Periods (2008–2012 and 2018–2022)

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Objective: This study aimed to examine changes in spinal injection utilization in Korea between two observation periods, 2008–2012 and 2018–2022.
Methods: We analyzed records from the Korean National Health Insurance Service (NHIS) database, using procedure-specific treatment codes to identify spinal injections and classify them as cervicothoracic or lumbar. We assessed patient and procedure counts, along with patient demographic characteristics. Annual medical costs were calculated based on standardized NHIS fees, adjusted using sampling weights, and converted to U.S. dollars (USD).
Results: From 2008 to 2022, the number of patients receiving spinal injections increased from 432,795 to 3,743,410, while the annual number of procedures rose from 1,017,715 to 13,919,792. The average annual number of injections per patient increased from 2.35 to 3.72. Lumbar injections accounted for most procedures, with their share rising from 81.3% in 2008 to 89.8% in 2022. Annual medical costs increased more than 13-fold, from approximately 45.4 million USD in 2008 to 606.3 million USD in 2022.
Conclusion: Spinal injection utilization and associated medical costs in Korea increased substantially between the two observation periods in this nationwide study.

Keywords: Health care costs; Health services research; Injections, spinal; Republic of Korea

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INTRODUCTION

Spinal injections are frequently performed in patients with symptoms to reduce pain intensity, identify the source of discomfort, and potentially avoid surgical intervention[16]. This intervention has advanced with the development of computed tomography and magnetic resonance imaging, enabling greater precision and less invasive approaches. Nerve root blocks, facet joint injections, and injections targeting the sacroiliac joints have been used to treat pain in the cervical, thoracic, lumbosacral, and sacroiliac regions. As a result, these image-guided interventions have become reliable and widely accepted options for treating localized spinal pain and radiculopathy[7,24].

Nationwide studies are less susceptible to selection biases than case-series studies, thus they possess greater statistical power[20,21]. In Korea, a mandatory health insurance system is in place, and a single database holds all medical reimbursement records for the entire population, enabling comprehensive evaluation of healthcare utilization across the country[8,11].

Although the modalities and techniques for spinal injections have significantly advanced and broadened in scope, their overall utilization in Korea remains largely unknown. In this nationwide study, we aimed to investigate the changes in utilization and costs of spinal injections by comparing two five-year periods (2008–2012 and 2018–2022).

MATERIALS AND METHODS

1. Data Source

This study was a nationwide retrospective observational study using the Korean National Health Insurance Service (NHIS) database for the periods 2008–2012 and 2018–2022. NHIS database includes coverage up to 100% of the population including 97% health insurance and 3% medical aid in the Republic of Korea[22]. This database covers information regarding insurance eligibility, medical treatment, and medical care institution[18].

2. Patient Population

We extracted patient information and medical fee data related to spinal injection procedures. Specific National Health Insurance Electronic Data Interchange procedure codes were used to identify patients who underwent non-surgical spinal injection procedures. Spinal injections were defined as therapeutic or diagnostic non-surgical interventional procedures targeting the spine, including interlaminar/transforaminal steroid injections, nerve root blocks, and facet joint/medial branch injections.

The target procedure codes were categorized into cervicothoracic and lumbar injections. Cervicothoracic injections were identified using procedure codes including LA251 (epidural injection, cervicothoracic) and LA321 (selective nerve root block, cervicothoracic). Lumbar injections were extracted using corresponding lumbar-specific codes (e.g., LA252, LA322, LA35X/LA36X series) Patients below age 18 were excluded. In addition to the number of patients and number of injection procedures, demographic data including age and sex of patients were obtained.

3. Medical Cost Calculations

Annual medical costs for spinal injections were defined as the total direct medical expenditure reimbursed by the NHIS for the procedures. For each procedure, the annual medical cost was calculated by multiplying the annual number of procedures by the official procedure-specific NHIS standardized reimbursement fee (e.g., 35,790 KRW for LA251 and 72,870 KRW for LA321). To estimate nationwide figures, a sampling weight correction factor of 1.6667 was applied. Costs reported in KRW were converted to U.S. dollars (USD) based on a fixed exchange rate of 1,448 KRW per USD.

RESULTS

1. Characteristics of Patients

The number of patients who received spinal injections has increased markedly from 432,795 in 2008 to 3,743,410 in 2022 (Table 1, Fig. 1). Female patients predominated throughout the study period; however the proportion of male patients increased slightly from 39.8% in 2008 to 44.1% in 2022. The mean age of patients who received spinal injection showed a slight upward change, ranging from 56.9±14.7 years in 2008 to 58.7±14.4 years in 2022. Regarding the age distribution, the percentage of younger patients (<30 years) declined from 13.4% in 2008 to 11.3% in 2022. In contrast, the proportion of older patients increased, particularly in the 70–79 age group, which rose from 3.7% to 7.6%. Although patients aged 80 years or older remained a small fraction of the total, their proportion more than doubled from 0.2% in

Table 1. Characteristics of patients receiving spinal injections

Characteristics	2008	2009	2010	2011	2012	2018	2019	2020	2021	2022
Total number of patients	423,852	561,653	647,576	804,236	1,105,619	2,346,420	2,694,101	2,862,747	3,287,961	3,743,410
Sex										
Male	172,078 (39.8)	224,178 (39.9)	268,870 (39.9)	322,150 (40.1)	426,525 (40.4)	997,535 (42.5)	1,150,520 (42.7)	1,252,743 (43.8)	1,441,962 (43.9)	1,651,030 (44.1)
Female	260,717 (60.2)	337,475 (60.1)	405,706 (60.1)	482,086 (59.9)	629,094 (59.6)	1,348,885 (57.5)	1,543,581 (57.3)	1,610,004 (56.2)	1,845,999 (56.1)	2,092,380 (55.9)
Age at procedure										
Mean age (years)	56.9 ± 14.7	57.2 ± 14.8	57.1 ± 14.8	57.1 ± 14.8	56.8 ± 14.9	58.1 ± 14.7	58.4 ± 14.6	58.2 ± 14.6	56.8 ± 14.9	58.7 ± 14.4
<30 years	57,858 (13.4)	73,840 (13.1)	90,082 (13.4)	108,387 (13.5)	151,033 (14.3)	300,77 (12.8)	332,05 (12.3)	360,579 (12.6)	392,755 (11.9)	423,100 (11.3)
30–39 years	73,840 (17.1)	92,732 (16.5)	109,064 (16.2)	127,078 (15.8)	165,765 (15.7)	364,864 (15.5)	417,343 (15.5)	454,169 (15.9)	530,006 (16.1)	616,997 (16.5)
40–49 years	99,615 (23.0)	130,154 (23.2)	161,893 (24.0)	201,782 (25.1)	265,424 (25.1)	560,573 (23.9)	631,073 (23.4)	654,256 (22.9)	736,743 (22.4)	835,312 (22.3)
50–59 years	108,341 (25.0)	136,153 (24.2)	157,425 (23.3)	181,670 (22.6)	227,720 (21.6)	547,579 (23.3)	644,765 (23.9)	705,979 (24.7)	838,707 (25.5)	955,826 (25.5)
60–69 years	76,442 (17.7)	104,839 (18.7)	126,221 (18.7)	149,218 (18.6)	196,969 (18.7)	413,073 (17.6)	469,789 (17.4)	478,558 (16.7)	538,347 (16.4)	606,850 (16.2)
70–79 years	15,990 (3.7)	22,975 (4.1)	28,562 (4.2)	34,464 (4.3)	46,403 (4.4)	151,236 (6.4)	187,937 (7.0)	196,722 (6.9)	235,630 (7.2)	286,082 (7.6)
≥80 years	710 (0.2)	960 (0.2)	1,330 (0.2)	1,637 (0.2)	2,307 (0.2)	8,318 (0.4)	11,142 (0.4)	12,484 (0.4)	15,774 (0.5)	19,242 (0.5)

The data is presented as number (%) or mean ± standard deviation.

2008 to 0.5% in 2022.

2. Average Number of Spinal Injections

The number of spinal injection procedures conducted annually increased markedly from 1,017,715 in 2008 to 13,919,792 in 2022 (Table 2, Fig. 1). The average number of procedures per single patient within each year also increased from 2.35 in 2008 to 3.72 in 2022 (Table 2). In terms of the annual number of spinal injections classified by injection sites, lumbar injections were predominant compared to cervicothoracic injections (Fig. 2). The proportion of lumbar injections also showed increased use in observed period from 81.3% in 2008 to 89.8% in 2022.

3. Medical Cost for Spinal Injections

Annual medical costs for spinal injections were evaluated as total direct medical expenditures reimbursed by the NHIS. The total annual medical cost for spinal injections increased over 13-fold, from 45,384,789 USD in 2008 to 606,326,200 USD in 2022 (Table 3).

DISCUSSION

The number of spinal injections dramatically increased from 2008 to 2022. This result was consistent with the prior study in the U.S. which showed a 99% increase in frequencies per 10,000 from 2000 to 2014[13]. Demographic shifts towards elderly age can be a main reason for rising prevalence of chronic pain which lead to surge in utilization of spinal injections. In Korea, the population aged 65 years or older increased 1.9-fold, from 4,940,573 in 2008 to 9,267,290 in 2022[23]. Age and chronic back pain can have strong positive relationship reaching a peak in 70s[17]. However, there are concerns that this rapid increase in utilization may be driven by factors other than demographic changes, as an 8.7-fold increase in the number of patients who received spinal injections from 2008 to 2022 was far more drastic than population aging. While this marked increase may reflect improved healthcare access, broader application of image-guided techniques, and private insurance expansion, further clinical studies are required to determine whether this reflects medically appropriate care or potential overutilization. Changes in policies in health care insurances may have facilitated the increase in utilization of spinal injections. The private health insurance in Korea was firstly implemented

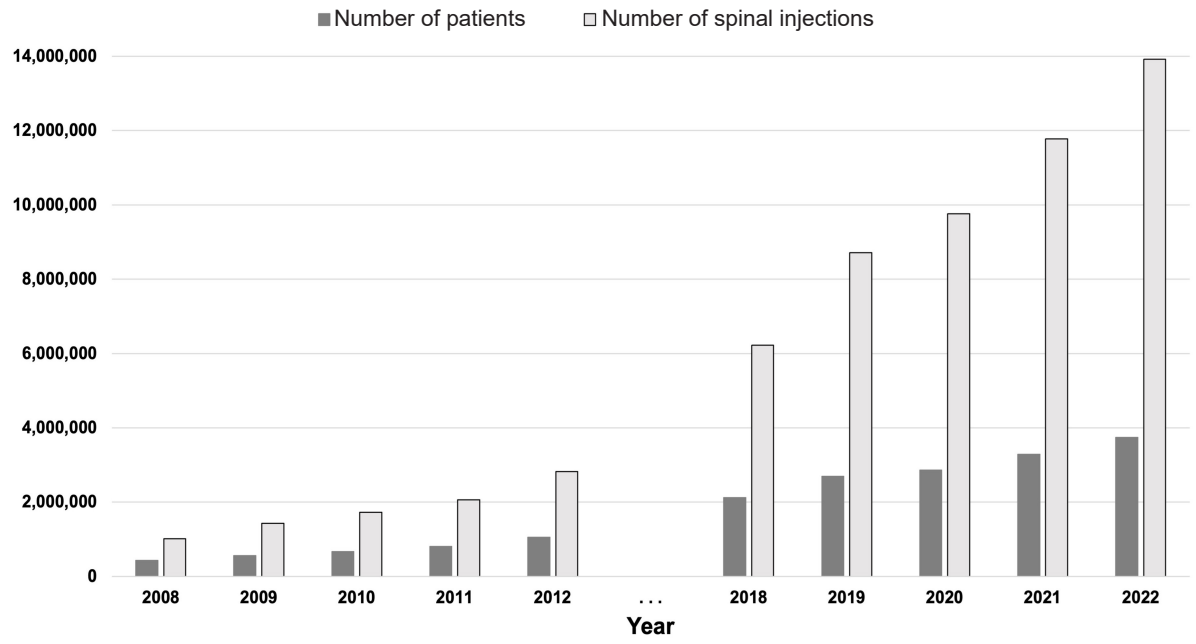


Fig. 1. Annual numbers of patients receiving spinal injections and spinal injection procedures.

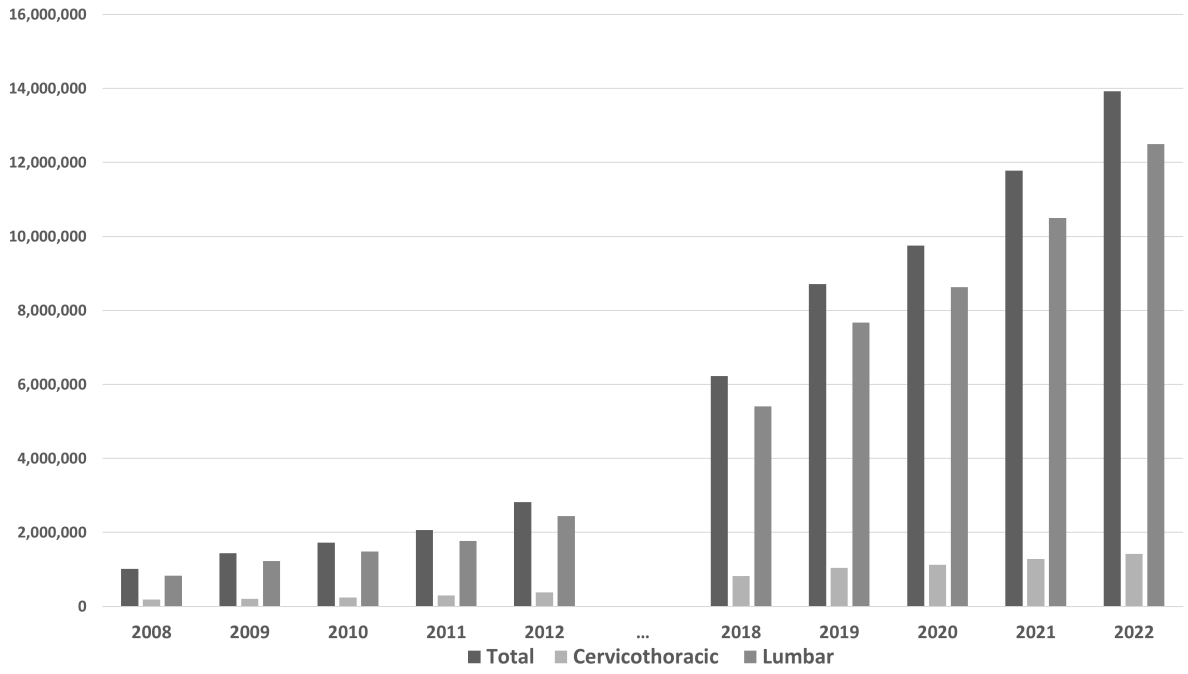


Fig. 2. Annual numbers of spinal injections by anatomical site.

in 2007 and insured rate reached up to 66.4% in 2022[5]. According to a study by Son and Jung, those covered by private health insurance in addition to national health insurance more likely to use health care than those who only had national health insurance[19,25].

Female patients received more spinal injections than male

Table 2. Annual number of spinal injections per patient

Variables	2008	2009	2010	2011	2012	2018	2019	2020	2021	2022
Number of patients	432,795	561,653	674,577	804,236	1,055,619	2,346,420	2,694,101	2,862,747	3,287,961	3,743,410
Number of procedures	1,017,715	1,435,215	1,726,670	2,063,480	2,822,191	7,285,536	8,710,971	9,755,995	11,778,354	13,919,792
Mean annual procedures per patient	2.35	2.56	2.56	2.57	2.67	3.10	3.23	3.41	3.58	3.72

Table 3. Estimated annual medical costs of spinal injections

Variable	2008	2009	2010	2011	2012	2018	2019	2020	2021	2022
Annual medical costs (USD)	45,384,789	62,106,125	74,831,126	89,677,435	121,717,738	322,908,486	386,232,658	432,600,500	521,289,747	606,326,200

patients and this was consistent with prior studies[4,6]. Women have a higher prevalence of chronic pain conditions including low back pain than men[2,17]. Another reason for this sex distribution might come from different health-seeking behavior in men and women, in which women tend to use more health care services than men[3].

The average number of spinal injections per patient within each year increased from 2.35 to 3.72 between 2008 and 2022, suggesting a recent increase in utilization of spinal injections in Korea. Notably, this figure is almost the same as the mean number of procedures per patient (3.75) performed by the top 20% of providers in the United States, who accounted for 57.6% of all spinal injections[1].

Classified by the injection sites, proportion of lumbar injections was greater than that of cervicothoracic injections and it was consistent with prior study in U.S.[13].

The annual medical cost for spinal injections increased more than 13-fold from 2008 to 2022. Although this covers a different timeframe and the magnitude of growth is not directly comparable, a study in U.S. similarly reported a 106.3% increase in medical costs for spinal injections between 1997 and 2006[12]. Despite rising medical costs, spinal injections remain a cost-effective modality to treat chronic spinal pains. Lewis et al.[9] presented a systematic review and economic model suggesting that spinal injections for sciatica are cost-effective. In a separate network meta-analysis, they also found that spinal injections are more cost-effective than other treatments, including traction, discectomy, and exercise therapy[10]. In addition to rising medical costs, various adverse events have been associated with the increased utilization of spinal injections. These range from mild effects such as facial flushing and weight gain to more serious complications like hemorrhage, spinal cord injury, and infectious spondylitis[4,6,22]. For these reasons, there have been efforts to reduce the use of spinal injections, considering them frequently used in the U.S. Various regulations, including the Stimulus Act, were introduced, and reimbursement structures were revised by bundling fluoroscopy into physician payments[15]. However, there have also been adverse effects from efforts to control the use of spinal injections. Manchikanti et al. identified an increase in opioid-related deaths as an unintended consequence of the underuse of spinal injections, illustrating a direct inverse relationship between the frequency of the procedures and the annual number of opioid deaths. Under these circumstances, the American Society of Interventional Pain Physicians has recommended renewed promotion of spinal injections to help curb opioid abuse[14]. In this complex context, managing the use of spinal injections requires careful consideration, as it has far-reaching implications that extend beyond clinical outcomes to include social and economic factors.

In this study, there are several limitations to consider. First, the observed periods of this study were not continuous. Due to the large volume of data to be extracted, the earlier and later observation periods were separated by a five-year interval. This approach was intended to highlight changes in the utilization of spinal injections over time. Second, spinal injection procedures were classified solely based on their injection sites. Different injection methods, such as interlaminar and transforaminal injections, may exhibit distinct utilization patterns over the observed period. Nevertheless, to the best of our knowledge, this is the first study to describe nationwide changes in the utilization of spinal injections using large-scale healthcare data in Korea.

CONCLUSION

The present nationwide study indicates that utilization of spinal injections has markedly increased between the two study periods (2008-2012 and 2018-2022).

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CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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