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Increased Trends of Spinal Injections in South Korea : A Nationwide Cohort Study

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Objective : This study aims to evaluate nationwide trends in spinal injections in South Korea and to analyze the demographic, provider-related, and sociocultural subgroups that may explain the continuous rise observed in clinical practice.

Methods : Using the National Health Insurance Sharing Service (NHISS) dataset, all spinal injection procedures were identified using Fee-for-Service codes. Annual utilization was expressed as total procedures and population-normalized rates per 100000 persons. Demographic characteristics, provider specialty distribution, and regional injection patterns were analyzed.

Results : The annual number of patients receiving spinal injections increased from 432795 in 2008 to 3743410 in 2022. Population-adjusted rates rose from 882.23 to 7244.77 per 100000 persons, reflecting an 8.21-fold increase. The mean patient age increased from 56.9 to 58.7 years, with the ≥70-year population accounting for the largest growth. All specialties demonstrated higher procedural volumes, particularly neurosurgery and other departments. After 2020, the Seoul capital area exceeded non-capital regions in procedure numbers.

Conclusion : The present nationwide study suggests that the number of patients and procedures regarding spinal injections increased significantly between 2008 and 2022 in Korea.

Key Words : Health care costs · Injections, spinal · Back pain · Nerve block.

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INTRODUCTION

Spinal pain has remained a major cause of disability for decades, and its impact is still apparent in everyday clinical encounters as well as on a broader healthcare level[4,14,35]. Conditions such as degenerative spine disease, radiculopathy, and various chronic musculoskeletal problems are now seen more often than in the past[5,15,30]. As these factors have accumulated, visits for spinal disorders and the use of interventional procedures have grown steadily across many countries, regardless of income level[8,9,31].

Within this wider clinical trend, spinal injections have taken a firm place in patient management. Epidural steroid injections, selective nerve root blocks, facet joint injections, and medial branch blocks are commonly used in daily practice[10,16,26]. Several reports from Western countries—spanning the United States, parts of Europe, and Australia—have shown that these procedures have continued to increase over long periods[3,11,27,29].

South Korea is undergoing one of the fastest demographic transitions toward a super-aged society, with adults aged 65 years or older now accounting for more than 19% of population[18]. Claims collected through the National Health Insurance Sharing Service (NHISS) include roughly 97% of the population[6,21,24]. Because of this wide coverage, national trends in procedure utilization can be examined.

Despite the clinical importance of spinal injections, long-term and population-standardized analyses are still limited in Asian countries. In Korea, previous studies have mainly focused on spine surgery[22,36,38] or the overall healthcare burden associated with spinal disorders[23,37].

In this study, we aim to evaluate nationwide trends in spinal injections of South Korea and to analyze the demographic, provider-related, and sociocultural subgroups that may explain the continuous rise observed in clinical practice.

MATERIALS AND METHODS

Ethics approval

This study was approved by the Institutional Review Board of CHA Bundang Medical Center, CHA University (IRB No. 2024-02-011).

Data source

Data were obtained from the Korean NHISS for the periods 2008–2012 and 2018–2022. The NHISS provides comprehensive coverage for approximately 97% of the South Korean population through the National Health Insurance program. The NHISS claims database contains detailed information on patient demographics, medical treatments, and procedures, classified according to 'Fee-for-Service' codes[6,21,24]. Access to the database is granted to researchers when their studies are approved by an official review committee.

Although the NHISS database provides annual nationwide claims data, access requires a structured application process and provision of customized datasets, which may limit large-scale continuous extraction. Therefore, two stable 5-year windows (2008–2012 and 2018–2022) were selected. During these periods, 1) procedural coding structures for spinal injections remained unchanged, 2) reimbursement policies did not undergo incentive-altering adjustments, and 3) NHISS population coverage (>97%) remained stable[19,24]. Trends within each window were internally consistent, supporting the validity of between-period comparisons.

Definition of spinal injections

In this study, spinal injection procedures were identified using standardized Fee-for-Service codes defined by the National Health Insurance (NHI) system. These included epidural steroid injections, selective nerve root blocks, facet joint injections, and medial branch nerve blocks. These codes remained unchanged across study periods, enabling reliable cross-year comparison[24].

Population-standardized utilization rates

To quantify true per-capita trends, annual spinal injection rates were calculated using the following formula : rate per 100000 persons = (annual number of patients receiving spinal injections) / (annual total Korean population) × 100000.

Annual population data were obtained from verified Statistics Korea demographic datasets[18].

Age-standardized rates were additionally calculated using direct standardization based on Korean population data from Statistics Korea (KOSIS, 2024)[20].

Medical cost calculations

Annual medical costs for spinal injections were calculated by multiplying number of lumbar and cervicothoracic spinal in-

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Table 1. Characteristics of spinal injection patients between 2008–2012 and 2018–2022

Characteristic	2008	2009	2010	2011	2012	2018	2019	2020	2021	2022
Total (n=18235721)	432795 (100.0)	561653 (100.0)	674577 (100.0)	804236 (100.0)	1055619 (100.0)	2118622 (100.0)	2694101 (100.0)	2862747 (100.0)	3287961 (100.0)	3743410 (100.0)
Gender										
Male	172078 (39.8)	224178 (39.9)	268870 (39.9)	322150 (40.1)	426525 (40.4)	892144 (42.1)	1150520 (42.7)	1252743 (43.8)	1441962 (43.9)	1651030 (44.1)
Female	260717 (60.2)	337475 (60.1)	405707 (60.1)	482086 (59.9)	629094 (59.6)	1226478 (57.9)	1543581 (57.3)	1610004 (56.2)	1845999 (56.1)	2092380 (55.9)
Age at diagnosis										
Mean (years)	56.9 (14.7)	57.2 (14.8)	57.1 (14.8)	57.1 (14.8)	56.8 (14.9)	58.6 (14.7)	58.4 (14.6)	58.2 (14.6)	56.8 (14.9)	58.7 (14.4)
<30 years	57858 (13.4)	73840 (13.1)	90082 (13.4)	108387 (13.5)	151033 (14.3)	258432 (12.2)	332052 (12.3)	360579 (12.6)	392755 (11.9)	423100 (11.3)
30–39 years	73840 (17.1)	92732 (16.5)	109064 (16.2)	127078 (15.8)	165765 (15.7)	319193 (15.1)	417343 (15.5)	454169 (15.9)	530006 (16.1)	616997 (16.5)
40–49 years	99615 (23.0)	130154 (23.2)	161893 (24.0)	201782 (25.1)	265424 (25.1)	499077 (23.6)	631073 (23.4)	654256 (22.9)	736743 (22.4)	835312 (22.3)
50–59 years	108341 (25.0)	136153 (24.2)	157425 (23.3)	181670 (22.6)	227720 (21.6)	498883 (23.5)	644765 (23.9)	705979 (24.7)	838707 (25.5)	955826 (25.5)
60–69 years	76441 (17.7)	104839 (18.7)	126221 (18.7)	149218 (18.6)	196969 (18.7)	387301 (18.3)	469789 (17.4)	478558 (16.7)	538347 (16.4)	606850 (16.2)
70–79 years	15990 (3.7)	22975 (4.1)	28562 (4.2)	34464 (4.3)	46403 (4.4)	146866 (6.9)	187937 (7.0)	196722 (6.9)	235630 (7.2)	286082 (7.6)
≥80 years	710 (0.2)	960 (0.2)	1330 (0.2)	1637 (0.2)	2305 (0.2)	8870 (0.4)	11142 (0.4)	12484 (0.4)	15774 (0.5)	19243 (0.5)
Health insurance income group										
0	33948 (7.8)	44011 (7.8)	48440 (7.2)	56063 (7.0)	69601 (6.6)	133149 (6.3)	156241 (5.8)	165747 (5.8)	188474 (5.7)	208267 (5.6)
1	63078 (14.6)	81905 (14.6)	111361 (16.5)	136008 (16.9)	176490 (16.7)	357480 (16.9)	494620 (18.4)	515450 (18.0)	572025 (17.4)	662078 (17.7)
2	55821 (12.9)	74466 (13.3)	89648 (13.3)	106972 (13.3)	146451 (13.9)	286661 (13.5)	341278 (12.7)	390511 (13.6)	467776 (14.2)	525737 (14.0)
3	70726 (16.3)	91894 (16.4)	109166 (16.2)	128684 (16.0)	172607 (16.4)	347434 (16.4)	449336 (16.7)	484810 (16.9)	555019 (16.9)	630644 (16.8)
4	91443 (21.1)	117672 (21.0)	138378 (20.5)	164927 (20.5)	215343 (20.4)	437110 (20.6)	548908 (20.4)	569815 (19.9)	657226 (20.0)	745430 (19.9)
5	117779 (27.2)	151705 (27.0)	177584 (26.3)	211582 (26.3)	275127 (26.1)	556788 (26.3)	703717 (26.1)	736415 (25.7)	847440 (25.8)	971254 (25.9)

Values are presented as number (%). Health insurance income groups are classified by the National Health Insurance Service (NHIS) of Korea based on insurance premium contributions as a proxy for household income. Types 1 through 5 represent progressively lower income levels, with type 5 corresponding to the lowest income group

jections conducted annually and cost of each procedure.

Demographic, provider, and regional variables

Patient variables included age, sex, and income quintile. Provider specialties were categorized as : neurosurgery (NS), orthopedic surgery (OS), anesthesiology & pain medicine (ANE), rehabilitation medicine (RM), radiology (RA), other departments (OD). OD encompasses general practitioners and specialists including internal medicine, neurology, psychiatry, general surgery, gynecology, pediatrics, otolaryngology-head and neck surgery, dermatology, nuclear medicine, laboratory medicine, and preventive medicine. Regions were classified into the Seoul capital area (SCA) and non-capital areas (NCA).

Statistical approach

Given the descriptive objective of this study, only descriptive statistics were applied. Trends were summarized using frequencies, proportions, and population-standardized rates without in-

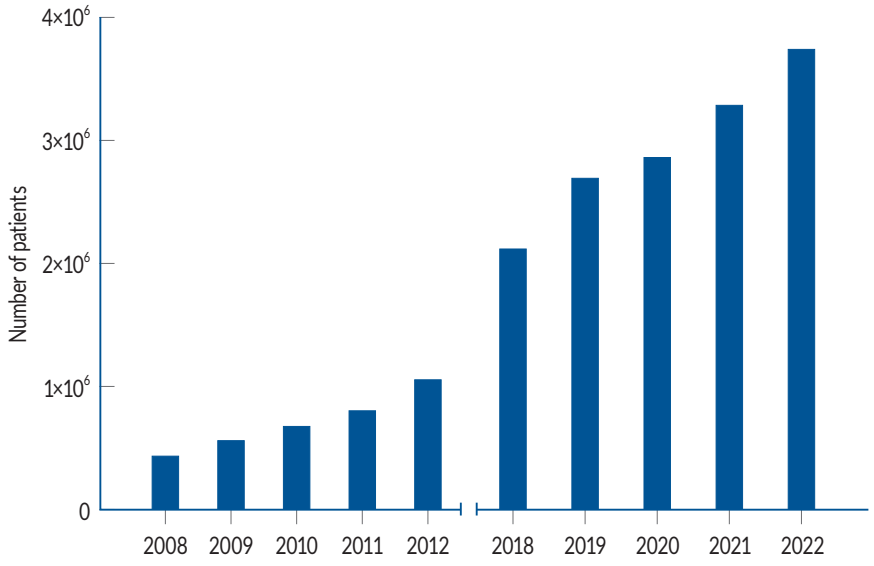


Fig. 1. Number of patients receiving spinal injections. The total number of patients receiving spinal injections increased significantly from 2008 to 2022.

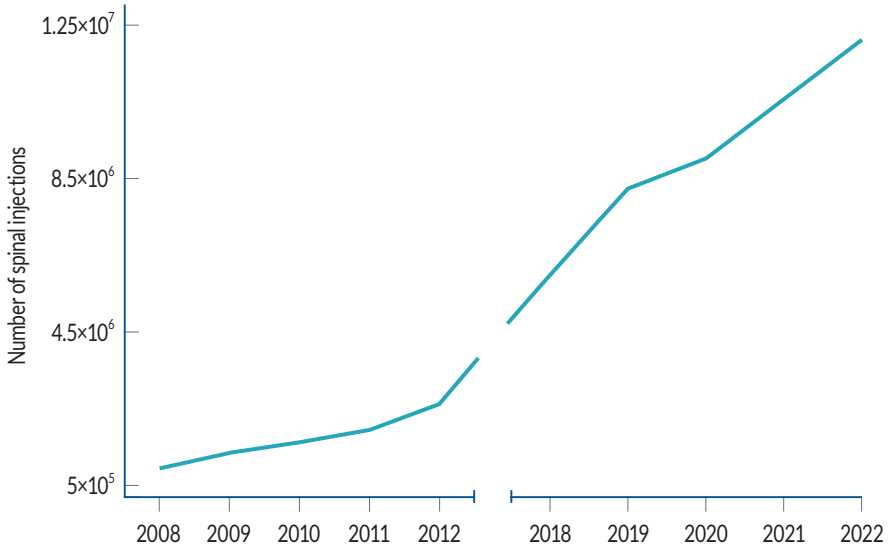


Fig. 2. Total number of spinal injections. Consistent with the trend shown in Fig. 1, the total number of spinal injections also increased significantly from 2008 to 2022.

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ferential hypothesis testing. This approach is consistent with prior large-scale NHISS-based descriptive epidemiologic studies[6,24].

RESULTS

Comparison of the spinal injection group between 2008–2012 and 2018–2022

There has been a significant increase in both the number of patients undergoing spinal injections and the total number of procedures performed annually since 2008. Additionally, the proportion of patients receiving multiple injections per year has risen. In 2008, 432795 patients underwent injections, which corresponds to 882.23 per 100000 persons, with female patients comprising 260717 of the patients (60.2%). By 2022, the total number of patients had increased to 3743410, corresponding to 7244.77 per 100000 persons, with 2092380 (55.9%) of the patients being female (Table 1 and Fig. 1). An average annual in-

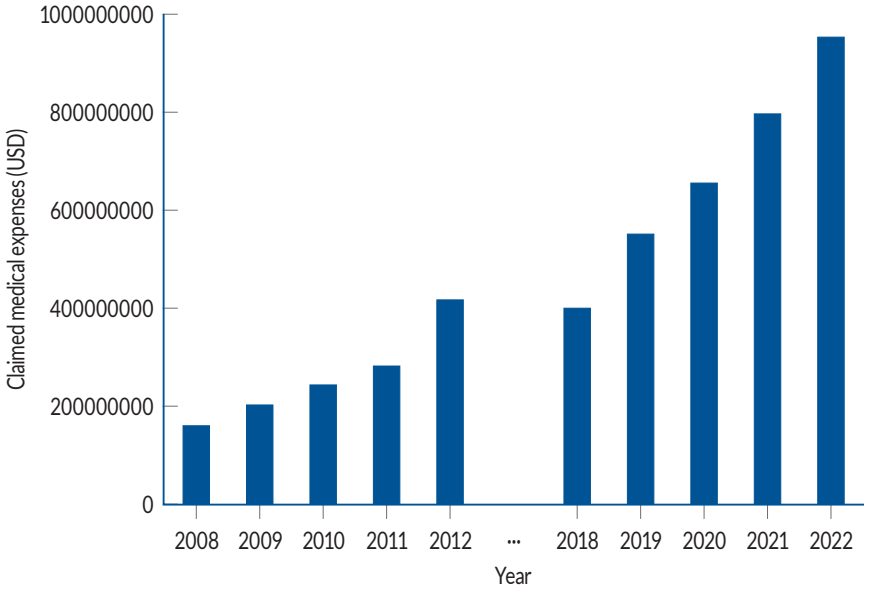


Fig. 3. The annual medical cost for spinal injections increased markedly from 2008 to 2022.

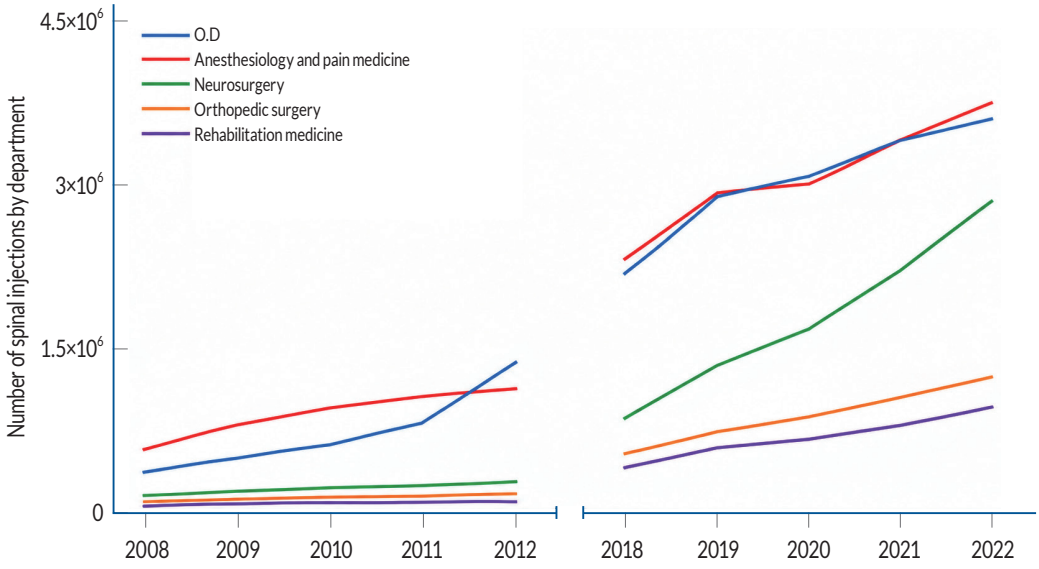


Fig. 4. Comparison of spinal injections performed by department. OD : other departments (all specialties other than neurosurgery, orthopedic surgery, anesthesiology and pain medicine, rehabilitation medicine, and radiology).

crease of approximately 227000 patients and 760000 procedures was observed. Notably, the proportion of male patients increased over time from 39.8% to 44.1% in 2022 (Table 1).

There has been a marked rise in the number of patients aged 70 years and older compared to previous years. As a result, the mean patient age has also increased from 56.9 years to 58.7 years (Table 1). The number of spinal injections also increased from a total of 432632 in 2008 to 3743387 in 2022, marking an 8.65-fold difference between the years. When standardized using verified national population statistics, the utilization rate rose from 882.23 per 100000 persons in 2008 to 7244.77 per 100,000 persons in 2022, corresponding to an 8.21-fold per-capita increase.

Year-by-year standardized rates demonstrated a continuous upward trajectory, increasing from 1138.68 in 2009, 1361.36 in 2010, 1610.55 in 2011, and 2102.65 in 2012, then escalating further during the second study window (4104.88 in 2018, 5203.47 in 2019, 5521.55 in 2020, 6366.20 in 2021) (Table 1 and Fig. 2).

To further evaluate the potential impact of population aging, age-standardized utilization rates were calculated using Korean population data from Statistics Korea (KOSIS, 2024)[20]. The age-standardized rate increased from 836.89 to 6552.92 per 100000 persons between 2008 and 2022, corresponding to a 7.83-fold increase. This pattern was comparable to that observed in crude rates, suggesting that population aging alone may not fully explain the observed rise in spinal injection utilization (Supplementary Table 1).

Furthermore, a significant increase in the utilization of these procedures among patients from higher income groups was observed. Income groups 1 and 2 displayed the greatest proportional increases, rising from 14.6% to 17.7% and from 12.9% to 14.0%, respectively (Table 1).

Comparison of annual medical costs for spinal injections from 2008 to 2022

Calculated annual medical cost for spinal injections had more than 12-fold increase from 30701316 USD in 2008 to 384320319 USD in 2022 (Fig. 3).

Comparison among different departments between 2008–2012 and 2018–2022

The distribution of spinal injections across medical specialties shifted considerably between 2008–2012 and 2018–2022. Each department demonstrated a significant increase in the

Table 2. Number of spinal injections by departments

Characteristic	2008	2009	2010	2011	2012	2018	2019	2020	2021	2022
Neurosurgery	83013	110884	126124	134354	165557	778819	1239696	1587022	2102739	2830177
Orthopedic surgery	60373	84142	98164	97317	107330	454291	652176	785377	961784	1137788
Radiology	98	287	38	413	353	2263	4185	4623	4883	4593
Anesthesiology and pain medicine	493045	712419	856780	976941	1030239	2242948	2933215	3026001	3406531	3712974
Rehabilitation medicine	42098	55224	64378	67586	59703	332983	498220	570770	702681	847590
Other departments	285526	392131	492828	683507	1277414	2184335	2927235	3062330	3417923	3596913
Total	964153	1355087	1638312	1960118	2640596	5995639	8254727	9036123	10596541	12130035

Table 3. Number of spinal injections by Seoul capital areas and non-capital areas

Province	2008 (n=432631)	2009 (n=561391)	2010 (n=674329)	2011 (n=803793)	2012 (n=1054957)	2018 (n=2118525)	2019 (n=2694071)	2020 (n=2862713)	2021 (n=3287930)	2022 (n=3743386)
Seoul capital areas	161308	212120	267868	331661	451275	1000890	1320216	1436462	1692107	1965459
Non-capital areas	271323	349271	406461	472132	472132	1373855	1373855	1426251	1595823	1777927

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number of spinal injections performed (Fig. 4). The largest increase was observed in the OD, where the number of spinal injections rose from 285526 in 2008 to 3596912 in 2022 marking a 12.60-fold increase. ANE also had a substantial increase from 493045 injections in 2008 to 3712974 in 2022 which is 6.5-fold increase, while NS experienced an even steeper rise from 83013 to 2830177. OS also showed a notable increase from 60373 to 1137788 injections. RM also showed an increase in injection numbers starting with 42098 in 2008 and rising to 847590 in 2022. While the ANE remained the leading contributor to spinal injections, the combined role of NS and OD has grown significantly over time (Table 2).

Comparison among SCA and NCA between 2008–2012 and 2018–2022

The growth in the number of spinal injections was observed in SCA and NCA. In 2008, NCA had 271323 injections while SCA had 161308. In 2022, NCA had 1777927 while SCA had 1965459 injections. The SCA overtook NCA in the number of injections in the year 2020, and the gap expanded thereafter. The most prominent increases were observed in Gyeonggi Province, consistent with its rapid population growth (Table 3 and Fig. 5).

DISCUSSION

Advancements in diagnostic imaging and interventional pain management techniques have led spinal injections to become an increasingly utilized modality for managing spinal pain worldwide[7,10]. Similar to global trends, our nationwide analysis demonstrates a substantial rise in spinal injections in South Korea between 2008 and 2022. Importantly, when standardized to verified national population statistics, utilization rates increased from 882.23 per 100000 persons in 2008 to 7244.77 per 100000 persons in 2022, representing an 8.21-fold per-capita increase. This finding shows that the observed growth is not merely due to population expansion but reflects a true change in clinical practice patterns, patient demand, and healthcare system behavior.

The absolute number of injections and the number of patients receiving them also climbed steadily through both study windows. Similar increases have been noted elsewhere as non-surgical treatment options become a larger part of the care for chronic pain[1,25].

Our study reveals that the mean patient age receiving spinal injections increased from 56.9 to 58.7 years, with a significant surge in patients aged 70 and above. The expansion of the aging population is closely associated with rising prevalence rates of chronic degenerative spinal conditions, which are targeted by

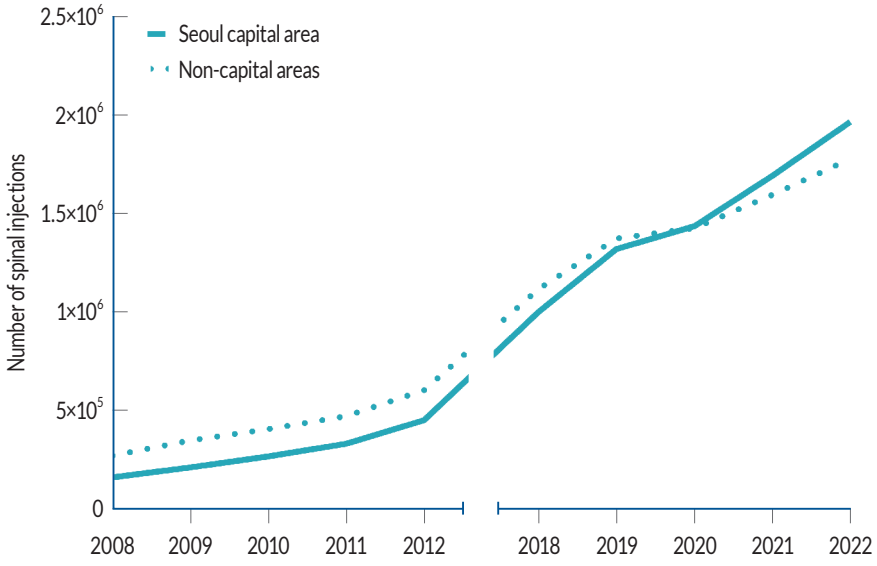


Fig. 5. Comparison of spinal injections conducted in the Seoul capital area versus non-capital areas. The number of injections performed in the two regions exhibited a notable reversal in trend. Prior to 2020, the non-capital areas had a higher volume of injections, but from 2020 onward, the number of spinal injections conducted in the Seoul capital area surpassed that of the non-capital areas.

spinal injections. Also, the proportion of male patients undergoing injections increased from 39.8% in 2008 to 44.1% in 2022, suggesting a narrowing gender gap. The increase in age can be inferred from the fact that the Korean population is becoming a 'Super-Aged Society.' Moreover, the life expectancy of men has increased more rapidly than that of women, which also helps explain the decreasing gender gap[40].

Significant regional differences were observed regarding spinal injections. We grouped the provinces of Korea into two regions, SCA and NCA. SCA includes Seoul, Gyeonggi and Incheon. NCA includes all the other provinces, which are generally considered more rural. NCA had more injections in 2008 whereas in 2020, SCA had overtaken NCA in the number of spinal injections. The gap between two regions is increasing. Looking into each region specifically, Gyeonggi Province exhibited the greatest increase from 76874 to 988758 injections. These differences may be attributed to variations in healthcare infrastructure, the availability of pain management clinics, and/or socioeconomic factors. The data provided by Health Insurance Review & Assessment Service about the number of ANE, NS, and OS clinics in Korea shows continuous increase from 2018 to 2022[17,19,33,42]. Thus, it could be assumed that Korea's healthcare is catered around SCA and the number of clinics offering spinal injections has increased. Further studies are warranted to investigate such differences among provinces. This urban-rural disparity mirrors trends observed in other countries, such as the United States, where specialized healthcare infrastructure is often concentrated in metropolitan areas[2,34]. This finding suggests a need for policy initiatives aimed at ensuring access to pain management services for rural and underserved populations. To further explore regional heterogeneity, a detailed analysis subdivided by province is presented in Supplementary Fig. 1.

At the provider level, ANE, OD and NS demonstrated the most substantial increases in procedural volume. While ANE consistently performed the highest number of injections, the OD, comprised largely of general practitioners, emerged as the second-largest contributor in 2022. The growth of spinal injections within OD may reflect a combination of supply- and demand-side factors. On the supply side, the fee-for-service reimbursement structure of the Korean NHI system may encourage the expansion of procedural services across specialties[23], while the availability of short-term training opportunities may lower barriers to adoption among non-specialist practitioners. On the demand side, the increasing prevalence of chronic spinal pain in an aging population, together with greater patient awareness of interventional options, may contribute to rising procedural demand in primary care settings[32].

The increase in spinal injections performed by surgical specialties may reflect a broader shift toward conservative and stepwise management of spinal conditions. Evidence from randomized trials suggests that nonoperative treatment can achieve outcomes comparable to surgery in selected patients[41]. In addition, practical considerations, including documentation of prior conservative management may influence clinical decision-making.

This rapid growth in injections performed outside of traditionally trained specialties raises important questions. The marked increase in spinal injections performed by non-traditional specialties represents a potential patient safety concern. Given that formal training in these procedures is concentrated within specific specialties, expansion into other provider groups may result in variability in procedural competency. As complications including epidural abscess and neurological injury are closely linked to operator technique, the absence of standardized training and credentialing frameworks warrants attention[12,13].

Formal training for advanced spinal interventions is typically integrated into residency and fellowship programs only for ANE, NS, OS, RM, and RA in Korea. The adequacy of training for general practitioners performing these procedures is less clear, highlighting the need for standardized educational guidelines to ensure quality of care[28].

Several limitations of the study should be noted. First, further prospective studies are needed to determine whether a relationship exists between increase in spinal injections and side effects[39]. Second, disparities in procedure frequency according to healthcare facility level (e.g., primary clinics vs. secondary or tertiary hospitals) could not be analyzed due to limitations of the NHISS dataset. Finally, the NHISS database only allows for limited study volume to be analyzed per project. Therefore, we could not obtain whole numbers from 2008 to 2022.

Despite these constraints, this is the largest and longest duration nationwide study in Korea to demonstrate changes in the trend of spinal injections.

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CONCLUSION

The present nationwide study demonstrates significant increases in both the number of patients receiving spinal injections and the total number of procedures performed in Korea between 2008 and 2022. When adjusted for population size, spinal injection utilization increased more than eightfold.

AUTHORS' DECLARATION

Conflicts of interest

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

Informed consent

This type of study does not require informed consent.

Author contributions

Conceptualization : SS, SH, MB; Data curation : SH, MB, HJY; Formal analysis : SH, MB, SP; Funding acquisition : SS, MB; Methodology : SS, SH, MB, IH, SHL; Project administration : SS, IH, MJC, SHS, JBH, CKC, DHY; Visualization : SS, IH, SH, MB; Writing - original draft : SH, MB, SS; Writing - review & editing : SH, MB, SS

Data sharing

This study used National Health Insurance Sharing Service (NHISS) data.

Preprint

None

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• **Supplementary materials**

The online-only data supplement is available with this article at https://doi.org/10.3340/jkns.2026.0096.

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