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Letter to the Editor

## Association of insurance status and spinal fusion usage in the United States during two decades

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## ABSTRACT

**Objective:** This study examined the distribution of spinal fusion usage among payer groups in the United States.

**Methods:** Using the National Inpatient Sample (NIS) database, total discharges, length of stay, and mean hospital charges of patients who underwent spinal fusion from 1997 to 2014 in the United States were determined and analyzed.

**Results:** 5,715,625 total discharges with spinal fusion were reported. Among them, 2,875,188 (50.3%) were covered by private insurance, 1,710,182 by Medicare (29.9%), 342,638 (6.0%) by Medicaid, and 91,990 (1.6%) were uninsured. A statistically significant increase in spinal fusion usage occurred within each payer group over the study period ( $P < 0.001$ ). For every year of the study period, private insurance patients had the most number and uninsured patients had the least number of total discharges with spinal fusion. Furthermore, annual growth in spinal fusion usage was greatest among private insurance patients, and smallest among uninsured patients.

**Conclusions:** Total discharges with spinal fusion increased significantly across all payer groups between 1997 and 2014, but not equally. Further inquiry is indicated to determine the etiology of spinal fusion usage discrepancies between payer groups.

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### 1. Introduction

Multiple studies have noted the significantly increased usage of spinal fusion over the past several decades in the United States [1–4]. Possible factors contributing to this trend include improved biomechanical understanding of the spine, improved diagnostic imaging techniques, increased availability of spinal fixation devices, and increased life expectancy of the general population [4]. The most common indications for spinal fusion surgery have also changed substantially. While initially employed to treat severe scoliosis, spinal tuberculosis, and fractures, the indications for spinal fusion have since expanded greatly; the majority of procedures are now performed for spondylosis, disk disorders, and spinal stenosis without deformity [5]. For each of these contemporary indications, more conservative treatment options exist through physical therapy and medical management. Healthcare providers are tasked with determining which patients will benefit

from surgery, and which would be better suited for non-operative management.

Though common and increasingly more frequently utilized, spinal fusion surgeries are expensive. In 2014, the mean hospital charges for such procedures were \$109,807 [6]. Furthermore, for most contemporary indications, spinal fusion surgery is performed on an elective basis. In light of these factors, we sought to examine the distribution of spinal fusion usage, length of stay, and hospital charges across different payer groups in American hospitals. Information on these trends is limited in the literature, particularly after the year 2010.

### 2. Materials and methods

Data for this study was sourced from the National Inpatient Sample (NIS) database, a component of the Healthcare Cost and Utilization Project (HCUP). The HCUP is a nationwide resource for patient data and is maintained by the Agency for Healthcare Research and Quality. They collect hospital discharge information from nonfederal, short-term, general, and specialty-specific hospitals [7]. The NIS approximates a 20% stratified sample of the

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hospitals represented in the HCUP database. These stratified data are weighted to generate nationally representative estimates. Individual records in the HCUP databases represent discrete hospital discharges and not necessarily discrete patients.

Using the NIS database, we identified patients who underwent spinal fusion surgery (CCS principal procedure category 158) from 1997 to 2014 in the United States [8]. Our institution exempted this analysis from full review by the Institutional Review Board. For each year of the study period, total discharges, mean length of stay, and mean charges of patients who received spinal fusion were determined. Additionally, the cohort was furcated by types of insurances, and analyzed using the Z-test statistic to compare each year with the first year of the study period and univariate regression to analyze the overall trends for the study period. Statistical software SPSS version 19 was used (IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp.).

### 3. Results

Over the 18 years of the study period, 5,715,625 total discharges with spinal fusion were reported by the NIS for all payers combined in the United States, with an annual mean of 317,534 (Table 1). This cohort was 53.7% female, and the age distribution was 2.9% 1–17, 24.6% 18–44, 46.8% 45–64, 24.8% 65–84, and 0.8% 85+ years old.

**Table 1**  
Cohort demographics for patients undergoing spinal fusion surgery in the United States from 1997 to 2014.

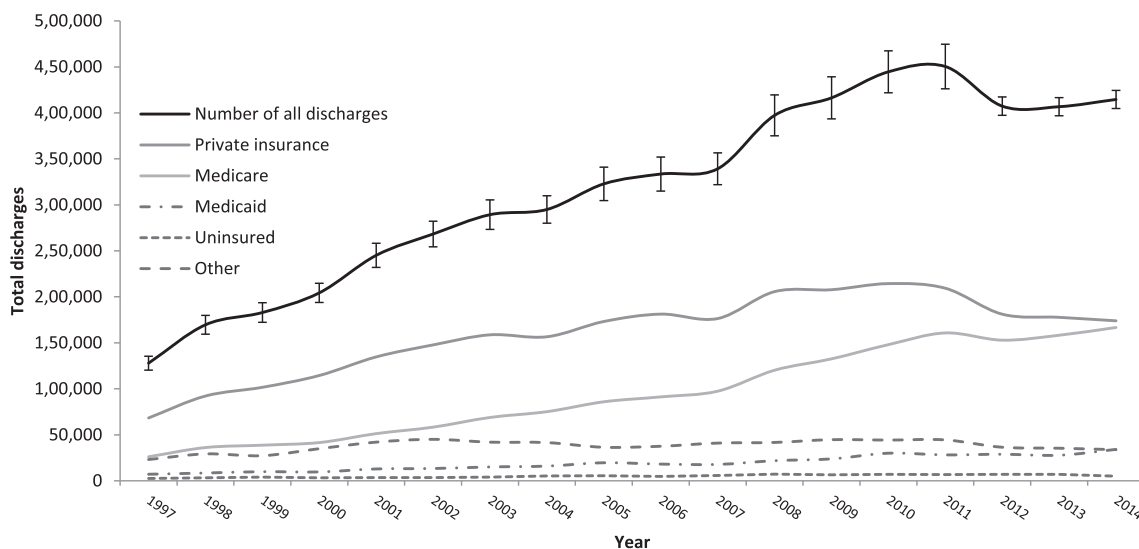
Total discharges		5,715,625
Insurance status	Private insurance	50.3%
	Medicare	29.9%
	Medicaid	6.0%
	Other insurance	11.9%
	Uninsured	1.6%
Gender	Male	46.3%
	Female	53.7%
Age	1–17	2.9%
	18–44	24.6%
	45–54	46.8%
	65–84	24.8%
	85+	0.8%

Among these discharges, 2,875,188 (50.3%) were covered by private insurance, 1,710,182 (29.9%) by Medicare, 342,638 (6.0%) by Medicaid, and 91,990 (1.6%) were uninsured. A statistically significant increase in spinal fusion usage occurred within each payer group over the study period (Fig. 1,  $P < 0.001$ ). Each of these four major payer groups had statistically significant annual average increases in total discharges over the study period (Table 2,  $P < 0.001$ ). The greatest annual average increase in total discharges was 9015 among Medicare patients, while the smallest annual average increase in total discharges was 254 among uninsured patients.

A statistically significant annual average decrease in mean length of stay for spinal fusion occurred among private insurance, Medicare, and Medicaid patients during the study period, with the greatest annual average decrease in mean length of stay occurring among the Medicare population (Fig. 2,  $P < 0.001$ ). However, a statistically significant annual average increase in mean length of stay occurred among uninsured patients ( $P < 0.05$ ). Mean charges for spinal fusion had statistically significant annual average increases in all four major payer groups (Fig. 3,  $P < 0.001$ ). The smallest annual average increase in mean charges was \$5380 among private insurance patients, while the greatest annual average increase in mean charges was \$6317 among uninsured patients.

### 4. Discussion

In this study, we found significantly increased total discharges of spinal fusion surgery in all payer groups combined and individually between 1997 and 2014. For every year of the study period, private insurance patients had the most number and uninsured patients had the least number of total discharges with spinal fusion. Furthermore, annual growth in spinal fusion usage was greatest among private insurance patients, and smallest among uninsured patients. The study period included a drop in spinal fusion utilization in 2011 among all payer groups, largely driven by privately insured and Medicare patients. In addition to the perpetually increasing cost of spinal fusion at the time, a well-publicized 2010 study concluded that Medicare patients were undergoing increasingly higher rates of unnecessary spinal fusion procedures, a trend that resulted in increased rates of major complications, 30-day mortality, and resource use [9]. Following the drop in 2011, however, spinal fusion usage steadily increased.



**Fig. 1.** Total discharges for spinal fusion surgery by type of insurance in the United States from 1997 to 2014.

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