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Case report

Trends of the neurosurgical economy in the United States

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ABSTRACT

Background: The objective of this study was to identify the neurosurgical MS-DRGs highest national bills and to analyze economic, demographic, and patient outcome trends.

Methods: This retrospective cohort study used the Nationwide Inpatient Sample (NIS) database to achieve the results. All MS-DRG codes for the years 2014 were ranked based on total aggregate charges. The highest ranked relevant to neurosurgery were identified and retrospectively reviewed to 2008. The data was analyzed by Z-test.

Results: In 2014, NIS reported the MS-DRG with the highest national bill of \$22,894,340,928 was “Spinal Fusion Except Cervical without MCC,” which also had the largest rise over the cohort period, increasing from \$15,853,679,222 in 2008 ($p < .001$). It was also the MS-DRG with the highest incidence, totaling 1,443,112 discharges and increasing from 190,692 in 2008 to 214,100 in 2014 ($p < .10$). “Craniotomy with major Device Implant/Acute Complex CNS Procedure w/MCC or Chemo Implant” had the longest length of stay (LOS) with a mean patient stay of 12.9 days. This MS-DRG also had the oldest patient population mean age of 57.5 years old. “Craniotomy & Endovascular Intracranial Procedures with MCC” had the most in-hospital deaths totaling 28,707 increasing significantly from 3602 in 2008 to 4410 in 2014 ($p < .05$).
Conclusions: “Spinal fusion except cervical without MCC,” had the highest national bill in the USA over the period of the cohort. Healthcare organizations can benefit from awareness of this information by using it to establish the most efficient healthcare investments and preparing a health-care roadmap for the following decades.

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1. Introduction

In the ever-changing economic climate of health-care, understanding the economic trends of patient care is invaluable for all fields of medicine, including neurosurgery. Analysis of these trends is crucial to recognizing changes in supply and demand of health-care resources and the costs associated with those changes. Healthcare organizations can benefit from this type of economic information to prepare a plan for future decades by using it to identify potential areas of over or under spending or utilization of certain services and pursue the most efficient investments in their respective areas.

Previous studies have focused on specific neurosurgical procedures [1,3,4,7,8,10,13,14] or have analyzed multiple neurosurgical procedures [6]. However, a more global analysis of neurosurgical economic trends is lacking in the literature. We hope that by extracting data of the most expensive Neurosurgical MS-DRGs from the years recently available, it can open a window for the future of investment in this field.

Using a robust database, we sought to identify the most expensive neurosurgical procedures and the trends of their respective financial outcomes.

2. Methods

This study examined the neurosurgical procedure data from the National Inpatient Sample (NIS), Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality. The NIS is the largest publicly available all-payer inpatient health care database in the United States, representing a 20% random stratified sample of all discharges from U.S. community hospitals, excluding rehabilitation and long-term acute care hospitals and yielding

Abbreviations: CC, complication or comorbidity; DRG, diagnosis related group; HCUP, Healthcare Cost and Utilization Project; LOS, length of stay; MCC, major complication or comorbidity; MS-DRG, Medicare Severity-Diagnosis Related Group; NIS, National Inpatient Sample.

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national estimates of hospital inpatient stays [11]. We reviewed the MS-DRGs from 2008 to 2014 in United States. Diagnosis related groups (DRGs) comprise a patient classification system that categorizes patients into groups that are clinically coherent and homogenous with respect to resource use [5]. Each hospital stay has one DRG assigned to it [2]. Beginning in 2008, the DRG system underwent a major change with the addition and redefinition or numerous DRGs. This DRG version adopted the Medicare Severity-Diagnosis Related Group (MS-DRG) system to refine the

DRG system to better recognize severity of illness among patients [5].

To determine the MS-DRGs that would be used in this study, all existing MS-DRGs were ranked by total aggregate charges for the year 2014, which is the latest available NIS data. The first 10 MS-DRGs in the rank order that pertain to neurosurgery were chosen to be retrospectively analyzed till 2008 (Table 1). For these 10 MS-DRGs, the HCUPnet tool was used to extract data from 2008 to 2014 on total number of discharges, patient age, sex, hospital

Table 1
10 Neurosurgical MS-DRGs with the highest national bills.

Ranking of Neurosurgical MS-DRGs	Ranking of all MS-DRGs	DRG #, Principal Procedure Category:	National Bill
1	6	#460 Spinal Fusion Except Cervical without MCC	\$22,894,340,928
2	33	#25 Craniotomy & Endovascular Intracranial Procedures with MCC	\$8,752,916,660
3	47	#473 Cervical Spinal Fusion without CC/MCC	\$7,156,328,561
4	91	#27 Craniotomy & Endovascular Intracranial Procedures without CC/MCC	\$3,930,059,855
5	94	#23 Craniotomy with Major Device Implant/Acute Complex CNS Procedure w/MCC or Chemo Implant	\$3,801,400,645
6	104	#26 Craniotomy & Endovascular Intracranial Procedures with CC	\$3,554,744,821
7	122	#472 Cervical Spinal Fusion with CC	\$3,112,830,557
8	128	#454 Combined Anterior/Posterior Spinal Fusion with CC	\$3,063,774,302
9	140	#455 Combined Anterior/Posterior Spinal Fusion without CC/MCC	\$2,663,034,709
10	142	#457 Spinal Fusion Except Cervical with Spinal Curvature/Malignancy/Infection or 9+ Fusion with CC	\$2,629,259,947

Table 2
Cohort demographics.

DRG #, Principal Procedure Category:	Total Number	Gender		Age						Region			
		Male	Female	<1	1–17	18–44	45–64	65–84	85+	Northwest	Midwest	South	West
#460 Spinal Fusion Except Cervical without MCC	1,443,112	641,622	801,151	*	6,844	268,159	656,606	496,609	14,701	221,568	341,367	606,390	273,787
#25 Craniotomy & Endovascular Intracranial Procedures with MCC	306,427	168,531	137,867	4,427	17,349	51,150	107,970	107,637	17,781	50,067	65,594	113,826	68,546
#473 Cervical Spinal Fusion without CC/MCC	830,314	398,158	431,974	*	1,839	184,415	479,793	161,002	3,169	134,251	172,435	366,346	157,282
#27 Craniotomy & Endovascular Intracranial Procedures without CC/MCC	358,484	165,857	190,010	3,391	29,197	87,970	140,659	89,026	7,207	65,304	76,234	129,252	87,694
#23 Craniotomy with Major Device Implant/Acute Complex CNS Procedure w/MCC or Chemo Implant	109,786	61,729	48,027	215	3,155	15,431	44,376	41,165	5,283	18,298	23,559	40,652	27,276
#26 Craniotomy & Endovascular Intracranial Procedures with CC	245,543	118,987	126,364	2,999	24,773	48,856	85,891	71,597	11,297	45,254	56,060	83,971	60,257
#472 Cervical Spinal Fusion with CC	222,221	106,526	115,664	*	964	35,376	119,051	63,576	3,212	33,943	49,457	91,400	47,421
#454 Combined Anterior/Posterior Spinal Fusion with CC	87,201	36,760	50,436	*	821	14,429	44,183	27,121	142	12,061	13,524	30,135	25,172
#455 Combined Anterior/Posterior Spinal Fusion without CC/MCC	105,668	50,690	54,957	*	1,012	26,342	55,244	22,668	91	15,174	17,374	41,142	28,012
#457 Spinal Fusion Except Cervical with Spinal Curvature/Malignancy/Infection or 9+ Fusion with CC	76,850	26,758	50,061	*	17,862	7,863	22,517	27,732	745	11,258	17,550	28,589	17,862

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