

Perioperative Spending on Spinal Fusion for Scoliosis for Children With Medical Complexity

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abstract

BACKGROUND: Global payment is used with surgeries to optimize health, lower costs, and improve quality. We assessed perioperative spending on spinal fusion for scoliosis to inform how this might apply to children.

METHODS: Retrospective analysis of 1249 children using Medicaid and aged ≥ 5 years with a complex chronic condition undergoing spinal fusion in 2013 from 12 states. From perioperative health services measured 6 months before and 3 months after spinal fusion, we simulated a spending reallocation with increased preoperative care and decreased hospital care.

RESULTS: Perioperative spending was \$112 353 per patient, with 77.9% for hospitalization, 12.3% for preoperative care, and 9.8% for postdischarge care. Primary care accounted for 0.2% of total spending; 15.4% and 49.2% of children had no primary care visit before and after spinal fusion, respectively. Compared with having no preoperative primary care visit, 1 to 2 visits were associated with a 12% lower surgery hospitalization cost ($P = .05$) and a 9% shorter length of stay (LOS) ($P = .1$); ≥ 3 visits were associated with a 21% lower hospitalization cost ($P < .001$) and a 14% shorter LOS ($P = .01$). Having ≥ 3 preoperative primary care visits for all children would increase total perioperative spending by 0.07%. This increased cost could be underwritten by a 0.1% reduction in hospital LOS or a 1.0% reduction in 90-day hospital readmissions.

CONCLUSIONS: Hospital care accounted for most perioperative spending in children undergoing spinal fusion. Multiple preoperative primary care visits were associated with lower hospital costs and shorter hospitalizations. Modestly less hospital resource use could underwrite substantial increases in children's preoperative primary care.

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WHAT'S KNOWN ON THIS SUBJECT: The use of global payments for pediatric surgeries is increasing. General pediatricians are becoming more involved in perioperative care, especially for complex patients. Little is known about perioperative health resource use and spending for children.

WHAT THIS STUDY ADDS: Hospital care accounted for most perioperative spending in children undergoing spinal fusion. Multiple preoperative primary care visits were associated with lower hospital costs and shorter hospitalizations. Modest reductions in hospital spending could underwrite substantial increases in children's preoperative health services.

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Spinal fusion for scoliosis in children with medical complexity (CMC) is a high-cost procedure that is associated with a high rate of surgery-related complications,¹ other adverse events,²⁻⁷ prolonged recovery,^{8,9} and hospital readmission. It is believed that children's high prevalence of multiple comorbid conditions and their corresponding fragile health status are, together, primarily responsible for many of these consequences.¹⁰ Although national efforts to control the comorbid conditions and optimize the health of CMC undergoing spinal fusion are underway,¹¹ no evidence-based, validated, standardized, widely used guidelines exist on how to do that.

To help achieve the triple aim of increased patient satisfaction, improved quality of care, and decreased cost,¹² elective orthopedic operations (such as spinal fusion for scoliosis) are increasingly included in alternative payment initiatives, such as global payment by payors for the entire episode of perioperative care.^{13,14} The impetus behind these initiatives is to encourage care integration among clinicians across the CMC's care continuum (eg, surgeons, anesthesiologists, primary care providers, and specialists) as well as allocation of resources to health services that are most likely to benefit the patients.¹⁵ It is presupposed that better care integration might result in enhanced pre- and postoperative care that will improve the health of the patients ahead of the operation, thereby minimizing their likelihood of postoperative complications and excessive hospital use. Preoperatively, this enhanced care might include comprehensive health assessments and plans performed by general pediatricians as well as referrals to specialty care. Postoperatively, this care might include increased follow-up visits

and the use of postacute facility care for rehabilitation.

Despite this ideology, little is known about perioperative resource use and spending on behalf of CMC undergoing elective orthopedic procedures, such as spinal fusion. Transparency regarding the health service resource use and spending before, during, and after the surgical hospitalization could help guide the way perioperative clinicians integrate and determine the best approaches to optimizing the health, safety, and health care spending for their patients. Understanding the allocation of spending across health services (eg, hospital care versus preoperative primary care visits) might help identify opportunities for simultaneous improvements in care delivery and cost containment.

Therefore, the objectives of this study were (1) to assess health care resource use and spending on behalf of CMC undergoing spinal fusion and (2) to simulate a global payment reallocation with increased use of primary care followed by decreased hospital use.

METHODS

Study Design and Setting

This is a retrospective cohort analysis of the Truven MarketScan Medicaid Multistate Database (Truven Health Analytics Inc, Ann Arbor, MI) from 2013. The MarketScan Medicaid Database was used for health care claims across the care continuum of child Medicaid enrollees from 12 contributors, including 7 state contributors and 5 Medicaid health plans from multiple, geographically dispersed states. Because this study did not involve the collection, use, or transmittal of protected health information, Boston Children's Hospital Institutional Review Board review was waived.

Study Population

The study population was children aged 5 years or older with an underlying neuromuscular or genetic complex chronic condition (CCC) undergoing spinal fusion. Children with 1 of these CCCs were identified from *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnosis codes contained in Feudtner's set of CCCs (v2).¹⁶ Hospitalizations for spinal fusion were identified with a primary ICD-9-CM procedure code for primary spinal fusion (81.0).

Main Outcome Measures

The main outcome measures were perioperative health service use and spending occurring during the period 6 months before and 3 months after the spinal fusion hospitalization. This timing was informed by the Centers for Medicare and Medicaid Services's Bundled Payments for Care Improvement initiative¹⁵ as well as our clinical experiences regarding the time needed for CMC to prepare for and recover from spinal fusion. Outcomes were assessed in 2 ways.

First, we assessed outcomes overall (ie, total across all health services) and by specific health services, including durable medical equipment, emergency department, home health, inpatient, primary care, specialty care, and therapy (including physical, occupational, and all outpatient therapies). Spending was reported as the Medicaid payment for each health service. Use was described as the proportion of patients using a specific health service and the frequency of use for the service.

Second, we focused further on spinal fusion hospitalization, including hospital length of stay (LOS); spending; and 30-day, unplanned, and all-cause hospital readmissions. LOS was measured in days. All-cause hospital readmissions were measured within 90 days of discharge from the spinal fusion

admission by using criteria endorsed by the National Quality Forum.¹⁷ Reasons for readmission were described by using All Patient Refined Diagnosis Related Groups (3M Health Information Systems, St Paul, MN).

Demographic and Clinical Characteristics

We assessed patient demographic characteristics that might correlate with outcomes after spinal fusion for children in the cohort. Demographic characteristics included sex, age at admission (in years), reason for Medicaid enrollment (eg, income versus disability), and race and/or ethnicity (Hispanic, non-Hispanic African American, non-Hispanic white, and other). To assess the clinical characteristics including the presence and number of comorbid conditions experienced by the children, we used the Agency for Healthcare Research and Quality's Chronic Condition Indicator system, which categorizes >14 000 ICD-9-CM diagnosis codes into chronic versus nonchronic conditions.^{18,19} The system contains all the comorbid conditions known to affect children, including asthma, chronic respiratory insufficiency, constipation, dysphagia, epilepsy, gastroesophageal reflux, etc.

Statistical Analysis

We began our analyses with a focus on resource use for the spinal fusion hospitalization. We used Wilcoxon rank, Kruskal-Wallis, and χ^2 tests (for hospital readmission) to assess the relationship of spinal fusion hospitalization resource use with patients' clinical and demographic characteristics. We then explored the relationships between hospital resource use and preoperative health services, including primary care visits (χ^2), specialty visits (χ^2), and laboratory and radiographic testing (Wilcoxon rank).

Based on the findings from these relationships, we explored a net-neutral reallocation of spending for the total episode of perioperative care (6 months before and 3 months after spinal fusion) with increased spending for preoperative health services. We then estimated how reductions in hospital use could underwrite those health services. All analyses were performed by using SAS v.9.4 (SAS Institute Inc, Cary, NC), and *P* values <.05 were considered statistically significant.

RESULTS

Study Population

There were 1249 children with a complex neuromuscular, congenital, and/or genetic CCC who underwent spinal fusion in 2013. Among the most common complex conditions in the cohort were cerebral palsy (49.8%) and congenital brain malformation (22.8%) (Table 1). The median (interquartile range [IQR]) age at admission was 13 (11–16) years. Most children were non-Hispanic white (43.2%) and girls (52.9%). Most children (63.7%) had ≥ 9 vertebrae fused during the spinal fusion (Table 1).

Multiple chronic conditions were prevalent among the children; 53.5% of children had 10 or more chronic conditions in addition to the scoliosis that led to the indication for spinal fusion (Table 1). Among the most common chronic conditions were epilepsy (35.9%), asthma (33.3%), gastroesophageal reflux disease (29.4%), and genitourinary dysfunction (eg, neurogenic bladder) (23.4%). Forty-one percent of children were assisted with medical technology. Among the most common technologies were related to the digestive system (18.1%) (eg, gastrostomy), nervous system (7.1%) (eg, cerebrospinal fluid ventricular

shunts), and respiratory system (4.7%) (eg, tracheostomy) (Table 1).

Perioperative Health Resource Use and Spending

Total perioperative spending for all 1249 children in the cohort was \$140.3 million (US dollars), with 77.9% for the spinal fusion hospitalization, 12.3% for preoperative health services up to 6 months before admission, and 9.8% for postdischarge health services up to 3 months after hospital discharge (Fig 1). Details of perioperative spending are reported below in temporal order (before, during, and after spinal fusion).

Preoperative Health Services

The 3 most commonly used preoperative health services were laboratory and radiographic testing (97.3%), specialty care (85.9%), and primary care (84.6%) (Table 2). With a median spending of \$675 (IQR \$258–\$1552), preoperative laboratory and radiographic testing accounted for 8.1% (\$1.4 million) of preoperative health spending and 1.0% of total perioperative spending (Fig 1, Table 2). With a median spending of \$942 (IQR \$260–\$4008), outpatient specialty visits accounted for the largest percentage (43.1%; \$7.4 million) of preoperative health care spending. Preoperative outpatient specialty care accounted for 5.3% of total perioperative spending. Of the children with a specialty care visit (85.9%), the median number of specialty visits was 7 (IQR 3–18). With a median spending of \$239 (IQR \$134–395), primary care accounted for 1.8% of preoperative spending and 0.2% of total perioperative spending (Fig 1, Table 2).

Spinal Fusion Hospitalization

Median hospital LOS and spending for spinal fusion was 5 days (IQR 4–7 days) and \$69 106 (IQR \$41 642–\$101 424), respectively (Table 1). In

TABLE 1 Characteristics of and Hospital Resource Use by Children in Medicaid Undergoing Spinal Fusion

Characteristics	N (%)	Hospital Resource Use		
		LOS (Median [IQR]), Days	Spending (Median [IQR]), Dollars	90-d Readmission Rate (%)
Overall cohort	1249	5 (4–7)	69 106 (41 642–101 424)	12.3
Demographic characteristics				
Age at admission, y				
5–10	235 (18.8)	5 (3–7)	59 140 (34 238–92 459)	13.6
11–15	675 (54.0)	5 (4–7)	71 038 (44 810–102 101)	12.7
16–20	316 (25.3)	5 (4–7)	77 812 (45 815–104 081)	10.4
≥21	23 (1.8)	4 (3–7)	60 420 (29 666–86 889)	13.0
Sex				
Male	588 (47.1)	5 (4–7)	68 997 (41 175–101 342)	14.6
Female	661 (52.9)	5 (4–7)	71 144 (42 984–102 101)	10.3
Race and/or ethnicity				
White	539 (43.2)	5 (4–7)	72 446 (41 987–103 605)	12.2
African American	260 (20.8)	5 (4–7)	69 088 (43 831–99 543)	8.5
Hispanic	55 (4.4)	6 (4–8)	78 276 (47 636–103 562)	9.1
Other	395 (31.6)	5 (4–7)	67 013 (40 841–101 313)	15.4
Medicaid enrollment				
Disability	703 (56.3)	5 (4–7)	71 144 (44 498–102 713)	14.2
Other	546 (43.7)	5 (3–7)	68 910 (38 790–101 313)	9.9
Medicaid type				
Fee for service	784 (62.8)	5 (4–7)	72 408 (45 670–103 605)	13.3
Managed care	465 (37.2)	5 (3–6)	68 156 (33 771–96 975)	10.8
Clinical characteristics				
Number of comorbid chronic conditions				
1–3	124 (9.9)	4 (3–5)	67 744 (39 337–90 264)	5.6
4–6	213 (17.1)	5 (3–6)	62 077 (38 790–93 932)	8.9
7–9	238 (19.1)	5 (3–7)	71 715 (41 175–100 520)	8.0
10–14	327 (26.2)	5 (4–7)	69 070 (41 175–108 626)	13.1
≥15	341 (27.3)	6 (4–8)	77 597 (45 670–109 239)	19.4
Technology assistance				
Any	508 (40.7)	6 (4–8)	74 762 (47 143–115 788)	16.5
Digestive	226 (18.1)	6 (5–9)	79 117 (49 284–117 273)	19.0
Respiratory	59 (4.7)	6 (4–9)	74 762 (49 284–119 832)	20.3
Nervous	89 (7.1)	6 (4–8)	85 594 (44 786–109 239)	13.3
Renal	5 (0.4)	5 (4–7)	68 156 (57 926–85 594)	20.0
Cardiovascular	15 (1.2)	6 (4–8)	85 594 (44 786–109 239)	13.3
Other	28 (2.2)	5 (4–7)	68 736 (49 262–94 436)	7.1
Neuromuscular CCC				
Any	935 (74.9)	5 (4–7)	72 446 (44 465–103 605)	14.2
Cerebral palsy	622 (49.8)	6 (4–8)	72 873 (44 465–109 239)	15.1
Brain, spinal	285 (22.8)	5 (4–7)	69 106 (44 014–102 713)	13.7
CNS degeneration	160 (12.8)	6 (4–8)	72 873 (44 239–116 276)	18.1
Muscular dystrophy	110 (8.8)	5 (4–8)	61 975 (39 337–101 313)	19.1
Spina bifida	119 (9.5)	5 (4–7)	60 299 (38 947–103 354)	19.3
Congenital or genetic CCC				
Any	562 (45.0)	5 (3–7)	68 476 (38 790–100 520)	10.0
Bone, joint	404 (32.3)	4 (3–6)	62 997 (33 932–92 349)	9.2
Chromosomal	121 (9.7)	5 (4–8)	74 684 (39 976–109 239)	11.6
Other	144 (11.5)	5 (4–7)	68 953 (42 828–100 520)	10.4
Number of vertebrae fused				
2–3	175 (14.0)	4 (3–5)	42 984 (29 113–74 684)	10.3
4–8	145 (11.6)	4 (3–6)	68 156 (39 427–96 975)	9.0
≥9	796 (63.7)	5 (4–7)	74 723 (48 683–103 605)	13.6
Not specified	133 (10.6)	6 (3–9)	75 998 (39 427–138 140)	11.3

bivariable analyses, as the number of chronic conditions increased, spinal fusion LOS and cost increased significantly ($P < .001$). For example,

as the number of chronic conditions increased from 1 to 3 to ≥15, median LOS increased 50% from 4 days (IQR 3–5) to 6 days (IQR 4–8); median

hospital spending increased 15% from \$67 744 (IQR \$39 337–\$90 264) to \$77 597 (IQR \$45 670–\$109 239) (Table 1).

Postdischarge Health Services

Hospital readmissions accounted for the majority (59.4%; \$8 154 402) of postdischarge health spending and 5.8% of total perioperative spending. (Fig 1) The 90-day, all-cause readmission rate was

12.3% (Table 1). The median cost of each readmission was \$23 502 (IQR \$8915–\$56 530) (Table 2). In bivariable analyses, as the number of chronic conditions increased, the 90-day readmission rate increased significantly ($P < .001$). For example, as the number of chronic conditions

increased from 1 to 3 to ≥ 15 , 30-day readmission rates increased nearly 4 times, from 5.6% to 19.4% ($P < .001$) (Table 1).

Postdischarge, outpatient specialty visits accounted for the next-largest percentage (26.5%, \$3 640 096) of postdischarge spending (Fig 1). For children experiencing a specialty visit (70.6%), the median number of postoperative specialty visits was 5 (IQR 2–14) (Table 2). Of the children experiencing postdischarge primary care (50.8%), the median spending on primary care was \$114 (IQR \$67–\$201) (Table 2). Primary care accounted for 0.7% of postdischarge spending and 0.1% of total perioperative spending (Fig 1).

Preoperative Health Services and Hospital Resource Use

The number of preoperative primary care visits correlated significantly with hospital LOS and Medicaid spending for spinal fusion (Table 3). Compared with having no preoperative primary care visits (13.4%), having 1 or 2 preoperative visits (29.8%) was associated with 12% lower surgery hospitalization spending ($-\$12 429$; 95% confidence interval [CI], \$834 to \$22 711; $P = .05$) and 9% shorter LOS (-0.6 days; 95% CI, 0.4 to 0.7; $P = .1$); having

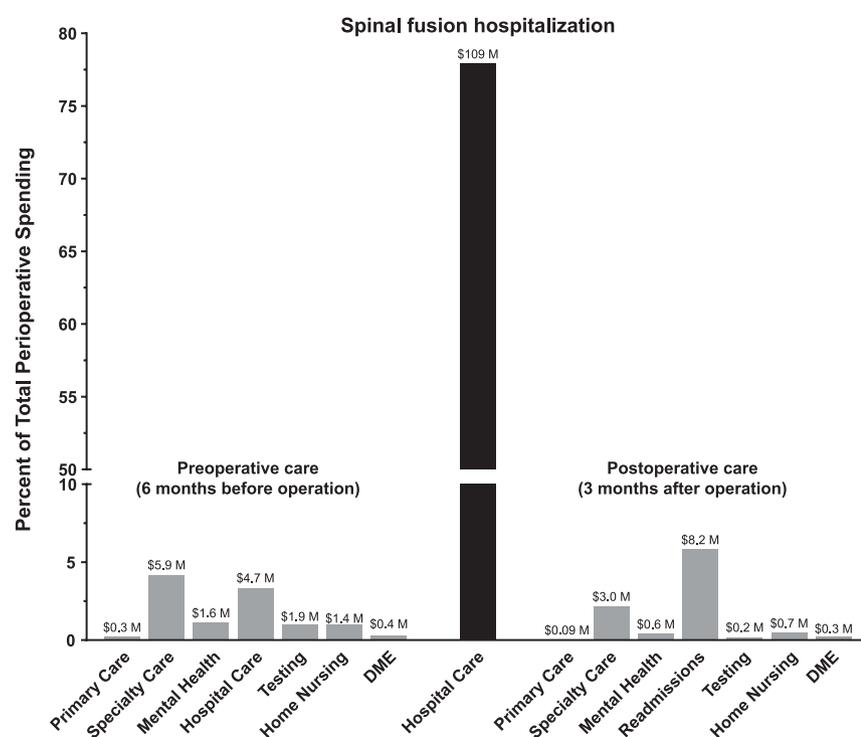


FIGURE 1

Allocation of perioperative health care spending for children in Medicaid undergoing spinal fusion. Each bar shows the percent of total health care spending attributable to the particular health service. The spending for each health service is presented in US millions of dollars on the top of the respective bar. DME, durable medical equipment.

TABLE 2 Use of and Payment for Pre- and Postoperative Health Services for Children in Medicaid Undergoing Spinal Fusion

Health Service	Preoperative Use (6 mo Before)			Postoperative Use (3 mo After)		
	Use, % ^a	Median (IQR) Number of Visits ^b	Median (IQR) Spent on Visits ^b in Dollars	Use, % ^a	Median (IQR) Number of Visits ^b	Median (IQR) Spent on Visits ^b in Dollars
Testing ^c	97.3	4 (2–5)	675 (258–1552)	86.6	2 (1–3)	102 (67–194)
Specialty care	85.9	7 (3–18)	942 (260–4008)	70.6	5 (2–14)	901 (232–3047)
Primary care	84.6	3 (2–5)	239 (134–395)	50.8	1 (1–2)	114 (67–201)
Therapy ^d	57.1	3 (1–13)	1297 (333–2690)	41.3	3 (1–7)	415 (166–1052)
Mental health	41.2	8 (3–25)	817 (301–2471)	33.1	4 (2–10)	421 (156–1202)
DME	35.6	2 (1–6)	512 (240–1259)	42.6	3 (1–4)	372 (205–819)
Drugs, injections	23.1	1 (1–2)	107 (61–216)	10.6	1 (1–2)	114 (54–256)
Emergency care	23.0	1 (1–2)	471 (270–816)	18.3	1 (1–1)	348 (216–604)
Hospital care	12.4	1 (1–1)	13 348 (6858–31 541)	12.3	1 (1–1)	23 502 (8915–56 530)
Home nursing	12.3	19 (5–86)	4817 (803–13 622)	14.5	8 (3–32)	1882 (507–5198)

DME, durable medical equipment.

^a The percentage of children with receipt of the specific health service.

^b The median (IQR) only for children receiving the specific health service.

^c Includes laboratory and radiographic testing.

^d Includes physical, occupational, and speech therapies.

3 or more preoperative primary care visits (54.9%) was associated with 21% lower hospitalization spending (−\$21 635; 95% CI, \$11 682 to \$30 506; $P < .001$) and 14% shorter LOS (−0.8 days; 95% CI, 0.6 to 1.0; $P = .01$). No statistically significant correlations with hospital resource use were associated with preoperative specialty visits ($P = .8$ for hospital spending; $P = .2$ for LOS) or laboratory or radiographic testing ($P = .1$ for hospital spending; $P = .4$ for LOS) (Table 3).

Simulation of Reallocated Perioperative Care Resource Use and Spending

Actual total perioperative spending (including care 6 months before and 3 months after spinal fusion) was \$112 353 per patient. An additional \$77 per patient would be required for each child to receive at least 3 preoperative primary care visits, resulting in a 0.07% increase in total perioperative spending to \$112 431. Net-neutral perioperative spending would occur if these visits contributed to a 0.1% reduction in hospital LOS (median 5.0–4.9 days) or a 1% reduction in 90-day readmission rates (median 12.3%–12.2%).

DISCUSSION

The findings from the current study reveal new information regarding perioperative health care use and spending for CMC during their episodes of spinal fusion care. Hospitalization for the children's spinal fusion and subsequent hospital readmissions within 90 days were responsible for nearly \$8 of every \$10 spent on perioperative care. Primary care health services accounted for a negligible amount of spending, with some children not receiving primary care before or after spinal fusion. Multiple preoperative primary care visits were associated with lower spinal

TABLE 3 Preoperative Primary Care Visits and Hospital Resource Use for Children in Medicaid Undergoing Spinal Fusion

No. of Preoperative Primary Care Visits	% of Patients	Hospital Resource Use			
		LOS, d		Spending (in Dollars)	
		Mean (95% CI)	<i>P</i>	Mean (95% CI)	<i>P</i>
None	13.4	Reference		Reference	
1–2	29.8	−0.6 (−0.4 to −0.7)	.1	−12 429 (−834 to −22 711)	.05
≥3	54.9	−0.8 (−0.6 to −1.0)	.01	−21 635 (−11 682 to −30 506)	.001

fusion hospitalization LOS and spending. Modest reductions in spinal fusion hospital resource use could underwrite major increases in the children's preoperative primary care health services.

The allocation of perioperative spending observed in the current study on children is comparable with previous studies. For example, the percentage (78%) of spending attributable to hospital care for spinal fusion surgery in the current study is similar to the percentage (75%) reported in previous studies of spinal surgery in adult patients,²⁰ suggesting that hospital care is the predominate cost driver during an episode of surgical care. The finding of much lower spending for pre- and postoperative outpatient care when compared with hospital care is also consistent with previous cross-sectional studies of CMC in Medicaid.^{21–23} This substantial difference in outpatient versus hospital spending suggests that opportunities might exist to decrease hospital resource use and spending by bolstering relatively inexpensive preoperative aspects of outpatient care, which could help optimize the children's health ahead of surgery.

Although we observed a correlation between increased preoperative primary care visits and fewer hospital resources and less spending for spinal fusion in children, the current study is not positioned to determine the correlation's causality. The American Academy of

Pediatrics recommends pediatrician involvement to help optimize the health and safety of all children undergoing surgery.²⁴ Previous studies report that enhanced general pediatrics involvement in preoperative spinal fusion care often results in increased attention to and recommendations for managing the children's comorbid conditions, including epilepsy and digestive dysmotility.²⁵ These clinical actions might result in fewer postoperative days in the hospital needed to stabilize the children's comorbidities (eg, returning to baseline digestive functioning).²⁶ Further investigation of the role of primary care in perioperative care (especially multiple visits) for CMC undergoing spinal fusion is needed to assess its value and potential impact on cost savings.

There may be several other ways to approach cost containment of hospital care for spinal fusion in CMC. Previous studies report that postoperative comanagement between surgeons and hospitalists has been associated with a reduction in spinal fusion LOS by ~1 day,^{27,28} which translates into decreased hospital costs. Suspected reasons for this finding include better availability of the hospitalists to promptly address acute, postoperative health issues (including pain) and assist with discharge planning.²⁹ These aspects of inpatient care might also apply favorably to cases of outliers with a long projected LOS. Medicare

demonstration projects of bundled payments for orthopedic surgeries for adult patients report cost savings from the negotiation of better prices for implantable orthopedic devices.¹⁵ The Medicare projects also associate cost saving from the increased use of postacute care for health recovery.¹⁵ Postacute care for rehabilitation after surgery is rarely used in children³⁰ but is under consideration for increased use in CMC.³¹

Although we did not observe a correlation between preoperative laboratory and other diagnostic testing with cost savings, more investigation is needed to assess the utility and value of this testing. For healthy, adult individuals, practice advisories from the American Society of Anesthesiologists recommend against routine preoperative laboratory testing in the absence of clinical indications.³² Clinicians often perform these tests out of habit or litigation concerns, and little benefit and a high false-positive rate of abnormal results is known to occur.³² However, given the high number of comorbidities affecting CMC undergoing spinal fusion in the current study (ie, more than half of the children had ≥ 10 comorbidities) as well as the significant impact of the comorbidities on LOS for spinal

fusion, different findings regarding preoperative testing may occur for these children.

This study has several limitations in addition to those described above. The reported health care spending information (ie, payments made from Medicaid for health services) may not reflect the true cost of the children's health care delivery. In some states, Medicaid payment is less than that cost. There may be variation in the categorization of Medicaid spending across states or in the use of resources by state, local area, or institution.³³ The accuracy of the reported spending and use by specific subtype of health service (eg, specialty care and primary care) is dependent on Truven's pre-established categorizations of those health services. The data usage agreement precludes the identification of US states included in the Truven database; specific attributes of a state's Medicaid program (eg, expansion under the Affordable Care Act) cannot be determined. Absent nationally representative Medicaid data, the generalizability of the results to all child Medicaid users is unknown. The findings may not generalize to children with private insurance or children with less-continuous enrollment in Medicaid. None of the patients in the current study died; researchers in future studies should

assess the impact of mortality on perioperative health services and cost.

Despite these limitations, we hope the findings from the current study will catalyze communication and integration among surgeons, anesthesiologists, primary and specialty care providers, and others involved in the care of CMC to (1) advance their knowledge of perioperative health resource use and spending in anticipation of alternative payment arrangements (eg, global payment) that could be employed and (2) consider opportunities to work together to optimize the value of their perioperative care for these children while containing their health care spending.

ABBREVIATIONS

CCC: complex chronic condition
CI: confidence interval
CMC: children with medical complexity
ICD-9-CM: *International Classification of Diseases, Ninth Revision, Clinical Modification*
IQR: interquartile range
LOS: length of stay

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