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The impact of removing global periods on pediatric surgeon reimbursement☆

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ABSTRACT

Purpose: CMS has proposed removing postoperative care from the global periods for surgical procedures and instead requiring surgeons to bill for postoperative visits using evaluation & management (E&M) codes. This policy may alter reimbursement to pediatric surgeons.
Methods: To assess the impact of this policy, NSQIP-pediatric data were used to calculate median LOS for high-volume procedures with 10 or 90 day global periods. We then merged these data with CMS physician work time and RVU files. A CMS LOS variable was created by counting the number of hospital-based E&M codes built into the global period based on the fact that if global periods are removed, surgeons may only bill one E&M code per postoperative day. We then compared the CMS and NSQIP LOS values.
Results: The dataset included 201 CPT codes with NSQIP LOS estimates derived from a median of 137 operations. Twenty-nine procedures (14.4%) had higher, 24 (16.9%) had the same, and 138 (68.7%) had lower NSQIP median LOS than current CMS values. On average, NSQIP values were 40.0% (95% confidence interval [95CI] −50.0, −29.9%) lower than CMS values. Based on a daily average work RVU per postoperative E&M code of 1.09 (95% CI 1.05, 1.12), and $35.78 per RVU (2017 rate), surgeons in this sample would experience a cumulative annual reduction in reimbursement of approximately $3.4 M following the policy change.
Conclusions: Most pediatric surgical procedures have RVU valuations that include more hospital-based E&M codes than the current median number of postoperative days. Holding all else equal, the removal of global periods would therefore reduce reimbursement for pediatric surgeons. The downstream effects of this policy change, such as the impact on the quality of clinical care, are uncertain and warrant further investigation.
Type of study: Clinical research paper.
Level of evidence: Level II.

The relative value unit (RVU) scale was created in 1992 by what is now known as the Centers for Medicare and Medicaid Services (CMS) in response to significant and unsustainable variations in physician reimbursement [1–5]. RVUs are used to measure value for individual procedures or operations in order to standardize the calculation of physician reimbursement [3]. The total RVU assigned to a current procedural terminology (CPT) code is comprised of three components (1): the "work RVU", which encompasses the physician's effort in caring for the patient including the overall complexity of the service (2); nonphysician expenses such as supplies and clinical staff time and (3) the liability cost of malpractice insurance [1–3,5].

The work RVU is the largest component of the total RVU and has historically been the most controversial and challenging portion to quantify and standardize. It consists of the physician time and the intensity of pre, intra, and postoperative patient care [2]. For major surgical procedures, there are an assumed number of postoperative visits (evaluation and management [E&M] codes), both in the hospital and in the clinic, built into the work RVU valuation. These visits compose the so-called "global period", which extends to either 10 or 90 days following the procedure.

Concerns about the accuracy of bundled E&M codes in the global period led CMS to propose eliminating global periods and instead requiring physicians to bill each postoperative E&M code separately [6]. Initially planned for 2017/2018, this transition was put on hold in the Medicare Access and CHIP Reauthorization Act in favor of further study. Initial studies in the adult population suggested that this policy may lead to large reductions in surgeon compensation [7,8]. While the proposed policy is primarily aimed at Medicare providers, work RVUs are also used by private insurers and Medicaid and will also affect pediatric providers [9,10]. Our study assesses the impact of eliminating global periods on pediatric surgeons by analyzing data from the National Surgical Quality

☆ *How this paper will improve care: Removal of the global period would lead to a substantial decrease in surgeon reimbursement. We instead propose an RVU system redesign, advocating for more frequent RVU updating and the use of objective data in the updating process.*

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Improvement Program (NSQIP)-Pediatric database. Specifically, we compared median postoperative length of stay (LOS) days derived from the NSQIP for common pediatric procedures to the number of postoperative visit days included in the global period for the same procedure, hypothesizing that there would be a significant difference between the two values.

1. Methods

Because all data were deidentified, this study did not meet the definition of human subjects research and a waiver was obtained from the institutional review board prior to initiating this study. Two primary data sources were used: the 2017 NSQIP-Pediatric Participant Use File (PUF) and 2017 RVU files from CMS. The NSQIP-Pediatric database was created by the American College of Surgeons and is a large national conglomeration of patient-level information from more than 700 participating hospitals [10]. Patient information is collected prospectively by trained healthcare professionals, is risk adjusted and nationally validated, and includes preoperative risk factors, operation details and postoperative variables through 30 days [11,12]. The PUF consists of data presented in a deidentified format and can be used for research and quality improvement purposes [13]. CMS files were used to extract data underlying the RVU valuation for individual CPT codes, including the 2017 work RVU valuation, the number of inpatient E&M codes assumed in this valuation and the year the procedure was last reviewed by the Relative Value Scale Update Committee (RUC), the committee tasked with maintaining RVU valuations [14].

Using the 2017 NSQIP-Pediatric PUF, we identified standalone pediatric procedures (i.e. procedures with only one billed CPT code) performed ≥50 times and calculated the median postoperative LOS for these procedures. We then compared this to the expected postoperative LOS that underlies the RVU valuation for procedures with 10 or 90 day global periods. To calculate the expected postoperative LOS, we summed the number of hospital-based E&M codes built into the global period (CPT 99,231–99,233, 99,238–99,239, and 99,291), as only one E&M code can be billed per patient per day. We then compared the LOS derived from NSQIP to the number of inpatient days included in the CMS global period for each procedure. For example, for a laparoscopic appendectomy (CPT 44,970), the current CMS valuation is based on the assumption of one postoperative day and one discharge day, for a total LOS of 2 days. This was compared to NSQIP which had a median postoperative LOS of 1 day (Appendix).

Finally, we assessed the financial impact of removing global periods and requiring pediatric surgeons to bill each postoperative day separately. This analysis relied on two primary assumptions. First, we assumed, as noted above, that only one E&M code could be billed per patient per day as per current CMS policy [15]. Second, we assumed that the overall mix of E&M codes (e.g., level II hospital visit) billed after the policy change would be similar to the mix of E&M codes currently built into the RVU valuation. All data were analyzed using STATA v 15.1 with statistical significance determined using two-sided tests and an alpha of 0.05.

2. Results

The final sample included 201 distinct CPT codes. NSQIP LOS estimates were generated from a median of 137 patient-level observations (range 50–13,869). A weighted scatterplot comparing the presumed number of visits based on the global period to the actual median LOS in NSQIP is presented in Fig. 1. Twenty-nine procedures (14.4%) had NSQIP LOS estimates higher than CMS values, 34 (16.9%) had the same values, and 138 (68.7%) had lower estimates. On average, NSQIP LOS estimates were 40.0% (95% CI −50.0% to −29.9%) lower than CMS values. If global periods were removed and surgeons continued to bill one E&M code for each postoperative day, surgeons in this sample would effectively increase billing for 13,891 E&M visits and decrease billing for 108,094 E&M visits. With a daily average work RVU per E&M code of 1.09 (95% CI 1.05–1.12), and $35.78 per RVU (Medicare's 2017 rate), this translates to a reduction in reimbursement of approximately $3.4 M by surgeons in this sample. When looking at the date of the most recent RUC review, almost half (39.8%) of the procedures in the sample had not had their work RVU updated since their initial valuation in 1992 (Table 1). Among those that had been reviewed (n = 121), 35.5% were last updated prior to 2000 and 57.0% prior to 2010 (Table 1).

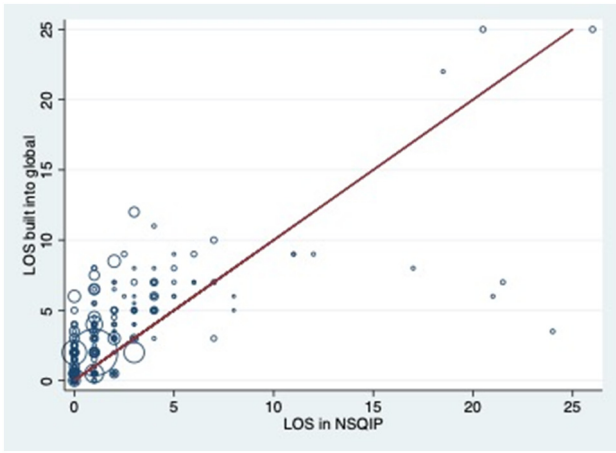

Fig. 1. Comparison of LOS assumed into the RVU valuation and median LOS derived from NSQIP. Each circle represents a procedure (i.e. CPT code) with the size of the circle based on the number of observations included in NSQIP. The red line is a "45-degree line" and therefore a circle along this line would represent LOS values that are the same in the global period (i.e. CMS value) and in NSQIP. A circle above the line would indicate a longer LOS built into the global period as compared to the NSQIP value and a circle below the line would indicate the opposite. LOS = length of stay, NSQIP = National Surgical Quality Improvement Program.

3. Discussion

Our results indicate that common pediatric surgical procedures have work RVU valuations that include more hospital-based E&M codes than the current median postoperative LOS. In part, this reflects the fact that work RVUs for pediatric procedures are rarely updated. Based on these findings and holding all else equal, the removal of global periods would reduce reimbursement for pediatric surgeons.

There is a paucity of research on this topic in pediatric surgery. The studies that have been published to date focus on reimbursement and value of surgeon time and effort [16–18], rather than implications of policy change on the field. For example, one such study noted that RVU valuations do not correlate well with and tend to undervalue pediatric surgeon's time in the operating room [16]. The other studies focused on clarifying components of the often complex surgeon reimbursement process [17,18]. However, similar studies performed in the adult population have yielded results consistent with our study and additionally, models have been created to adjust the global period to increase its accuracy — suggesting that current RVU valuations include more postoperative care than actually occurs [7,15,18,19].

The downstream effects of this policy change on patients and providers should be considered. If surgeon reimbursements were substantially cut,

Table 1
Time period when the work RVUs included in the study sample were last reviewed and updated by the RUC.

Years of most recent RVU review by the RUC	
Year of last RUC review	Number of CPT codes, n = 201 (%)
Never reviewed	80 (39.8)
1992–1999	43 (21.4)
2000–2009	69 (34.3)
2010–2017	9 (4.5)

CPT = Current Procedural Terminology, RVU = relative value unit, RUC = Relative Value Scale Update Committee.

adverse incentives could arise. For example, surgeons could recuperate losses by keeping patients in the hospital longer, increasing coding severity, shifting focus to outpatient operations or increasing office visits [15]. It is unclear if any of these shifts would improve patient care. It is reasonable to assume that nonsurgeon practitioners would be in favor of this policy effort. Because Medicare's budget is based on budget neutrality [20], if surgeons do not substantially change postoperative billing practices, nonsurgeons should expect increased payments from this policy shift.

Several steps should be considered moving forward. A move towards using objective data in the RVU update process is needed and would generate a reimbursement system that is accurate, reproducible and equitable. The current process of updating RVU valuations relies on results from surveys sent to physicians to assess the time and labor required to perform their duties. The results of these surveys are then used by specialty societies to advocate to the RUC for new and updated RVU valuations. Because there are more than 7000 CPT codes, the RUC does not have the capacity to update even a small fraction of these codes in any given year and there are concerns that the process is biased [20,21]. A move towards using objective data, which are now readily available and published in near real time, would help streamline this process. Rather than updating procedures once a decade, they could be updated every few years. Objective data would also increase the granularity with which physicians could be compensated. For example, many of the CPT codes used for pediatric patients are not specific to children, such as the laparoscopic Nissen fundoplication (CPT code 43,280). Performing a fundoplication in a premature newborn residing in the ICU is not equal in effort or required level of expertise to performing an elective procedure in an otherwise healthy adult. Using objective data, rather than surveys, would facilitate identification of stratifying variables that are related to physician effort. If, indeed, complexity, operative time and LOS are higher for certain procedures in children than they are for adults, this should be included as a separate CPT code or as a modifier.

Moving to an objective data system will take time. An intermediate and more rapid step to enact would be to increase the influence of pediatric surgery providers in the RUC. While the RUC is composed of 31 representatives from various medical and surgical subspecialties [22], pediatric surgery does not have a permanent representative [23]. Adding this voice would help emphasize the nuances in caring for pediatric patients and may help identify those CPT codes that require updating with a greater urgency. Finally, relying on objective data would improve equity across medical and surgical specialties. Much of the existing literature has focused only on surgical specialties and inaccuracies in their RVU valuations. It is likely that many nonsurgical RVU valuations are also inaccurate and would benefit from updates using objective data. It would be inappropriate for global periods to be removed on the basis of inaccuracy, without also addressing inaccuracies in the valuations of all CPT codes. In a system that relies primarily on objective data, pediatric surgeons may actually have higher reimbursement than in the current system.

There are several limitations to this study. First, the observations in NSQIP are only a fraction of the total procedures performed on children in the United States and thus the overall economic effect would likely be larger than we estimated. Second, LOS estimates in NSQIP, which are primarily derived from large academic facilities, may be biased and not generalizable to smaller community hospitals. Lastly, we did not have access to postoperative clinic visits that are also included in 10 and 90-day bundles; if CMS currently underestimates these visits, surgeons may fare better than expected if bundles are removed, although there is research in the adult population suggesting this would not be the case [22].

4. Conclusion

It is likely that removing global periods will reduce reimbursement for pediatric surgeons. What remains unknown is how surgeons would respond to such a change and how it will affect patient care. A move towards using objective data in the RVU update process is desperately needed.

Appendix A. Appendix table

CPT code	CPT description	Global period (days)	NSQIP median LOS (days)	Presumed LOS in RVU valuation (days)	Year of last review
11,400	Excision, benign lesion including margins, except skin tag (unless listed elsewhere), trunk, arms or legs; excised diameter 0.5 cm or less	10	0	0	2005
11,401	Excision, benign lesion including margins, except skin tag (unless listed elsewhere), trunk, arms or legs; excised diameter 0.6 to 1.0 cm	10	0	0	2005
11,402	Excision, benign lesion including margins, except skin tag (unless listed elsewhere), trunk, arms or legs; excised diameter 1.1 to 2.0 cm	10	0	0	2005
11,403	Excision, benign lesion including margins, except skin tag (unless listed elsewhere), trunk, arms or legs; excised diameter 2.1 to 3.0 cm	10	0	0	2005
11,404	Excision, benign lesion including margins, except skin tag (unless listed elsewhere), trunk, arms or legs; excised diameter 3.1 to 4.0 cm	10	0	0	2005
11,406	Excision, benign lesion including margins, except skin tag (unless listed elsewhere), trunk, arms or legs; excised diameter over 4.0 cm	10	0	0	2005
11,420	Excision, benign lesion including margins, except skin tag (unless listed elsewhere), scalp, neck, hands, feet, genitalia; excised diameter 0.5 cm or less	10	0	0	2005
11,421	Excision, benign lesion including margins, except skin tag (unless listed elsewhere), scalp, neck, hands, feet, genitalia; excised diameter 0.6 to 1.0 cm	10	0	0	2005
11,422	Excision, benign lesion including margins, except skin tag (unless listed elsewhere), scalp, neck, hands, feet, genitalia; excised diameter 1.1 to 2.0 cm	10	0	0	2005
11,423	Excision, benign lesion including margins, except skin tag (unless listed elsewhere), scalp, neck, hands, feet, genitalia; excised diameter 2.1 to 3.0 cm	10	0	0	2005
11,426	Excision, benign lesion including margins, except skin tag (unless listed elsewhere), scalp, neck, hands, feet, genitalia; excised diameter over 4.0 cm	10	0	0	2005
11,440	Excision, other benign lesion including margins, except skin tag (unless listed	10	0	0	2005

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CPT code	CPT description	Global period (days)	NSQIP median LOS (days)	Presumed LOS in RVU valuation (days)	Year of last review
	elsewhere), face, ears, eyelids, nose, lips, mucous membrane; excised diameter 0.5 cm or less				
11,441	Excision, other benign lesion including margins, except skin tag (unless listed elsewhere), face, ears, eyelids, nose, lips, mucous membrane; excised diameter 0.6 to 1.0 cm	10	0	0	2005
11,442	Excision, other benign lesion including margins, except skin tag (unless listed elsewhere), face, ears, eyelids, nose, lips, mucous membrane; excised diameter 1.1 to 2.0 cm	10	0	0	2005
11,443	Excision, other benign lesion including margins, except skin tag (unless listed elsewhere), face, ears, eyelids, nose, lips, mucous membrane; excised diameter 2.1 to 3.0 cm	10	0	0	2005
11,450	Excision of skin and subcutaneous tissue for hidradenitis, axillary; with simple or intermediate repair	90	0	0	
14,040	Adjacent tissue transfer or rearrangement, forehead, cheeks, chin, mouth, neck, axillae, genitalia, hands and/or feet; defect 10 sq. cm or less	90	0	0	2005
19,300	Mastectomy for gynecomastia	90	0	0.5	
19,318	Reduction mammaplasty	90	0	0.5	1995
21,501	Incision and drainage, deep abscess or hematoma, soft tissues of neck or thorax	90	2	0.5	
21,740	Reconstructive repair of pectus excavatum or carinatum; open	90	4	3	2002
22,800	Arthrodesis, posterior, for spinal deformity, with or without cast; up to 6 vertebral segments	90	3	8	1995
22,802	Arthrodesis, posterior, for spinal deformity, with or without cast; 7 or 12 vertebral segments	90	4	5	1995
22,804	Arthrodesis, posterior, for spinal deformity, with or without cast; 13 or more vertebral segments	90	4	6	1995
22,849	Reinsertion of spinal fixation device	90	1	5.5	
24,538	Percutaneous skeletal fixation of supracondylar or transcondylar humeral fracture, with or without intercondylar extension	90	0	2	
24,579	Open treatment of humeral condylar fracture, medial or lateral, includes internal fixation, when performed	90	0	2	2007
26,055	Tendon sheath incision (eg, for trigger finger)	90	0	0.5	2005
26,561	Repair of syndactyly (web finger) each web space; with skin flaps and grafts	90	0	1	
26,587	Reconstruction of polydactylous digit, soft tissue and bone	90	0	0	2001
27,030	Arthrotomy, hip, with drainage (eg, infection)	90	4	5	
27,146	Osteotomy, iliac, acetabular or innominate bone	90	3	3	1995
27,147	Osteotomy, iliac, acetabular or innominate bone; with open reduction of hip	90	2	3	1995
27,151	Osteotomy, iliac, acetabular or innominate bone; with femoral osteotomy	90	3	4	1995
27,156	Osteotomy, iliac, acetabular or innominate bone; with femoral osteotomy and with open reduction of hip	90	3	4	1995
27,165	Osteotomy, intertrochanteric or subtrochanteric including internal or external fixation and/or cast	90	2.5	9	
27,176	Treatment of slipped femoral epiphysis; by single or multiple pinning, in situ	90	1	6.5	
27,258	Open treatment of spontaneous hip dislocation (developmental, including congenital or pathological), replacement of femoral head in acetabulum (including tenotomy, etc);	90	1	5.5	
27,310	Arthrotomy, knee, with exploration, drainage, or removal of foreign body (eg, infection)	90	3	5.5	
27,355	Excision or curettage of bone cyst or benign tumor of femur	90	0	2.5	
27,395	Lengthening of hamstring tendon; multiple tendons, bilateral	90	1	3.5	
27,422	Reconstruction of dislocating patella; with extensor realignment and/or muscle advancement or release (eg, Campbell, Goldwaite type procedure)	90	0	3	
27,450	Osteotomy, femur, shaft or supracondylar; with fixation	90	2	4.5	
27,454	Osteotomy, multiple, with realignment on intramedullary rod, femoral shaft (eg, Sofield type procedure)	90	2	4	1995
27,466	Osteoplasty, femur; lengthening	90	2	7	
27,475	Arrest, epiphyseal, any method (eg, epiphysiodesis); distal femur	90	0	2	
27,477	Arrest, epiphyseal, any method (eg, epiphysiodesis); tibia and fibula, proximal	90	0	2	
27,479	Arrest, epiphyseal, any method (eg, epiphysiodesis); combined distal femur, proximal tibia and fibula	90	0	2.5	
27,485	Arrest, hemiepiphyseal, distal femur or proximal tibia or fibula (eg, genu varus or valgus)	90	0	2	
27,506	Open treatment of femoral shaft fracture, with or without external fixation, with insertion of	90	1	7.5	

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CPT code	CPT description	Global period (days)	NSQIP median LOS (days)	Presumed LOS in RVU valuation (days)	Year of last review
	intramedullary implant, with or without cerclage and/or locking screws				
27,507	Open treatment of femoral shaft fracture with plate/screws, with or without cerclage	90	1	4	1992
27,511	Open treatment of femoral supracondylar or transcondylar fracture without intercondylar extension, includes internal fixation, when performed	90	1	4	2007
27,635	Excision or curettage of bone cyst or benign tumor, tibia or fibula	90	0	1.5	
27,685	Lengthening or shortening of tendon, leg or ankle; single tendon (separate procedure)	90	0	0.5	
27,687	Gastrocnemius recession (eg, Strayer procedure)	90	0	0.5	
27,690	Transfer or transplant of single tendon (with muscle redirection or rerouting); superficial (eg, anterior tibial extensors into midfoot)	90	0	0.5	2008
27,691	Transfer or transplant of single tendon (with muscle redirection or rerouting); deep (eg, anterior tibial or posterior tibial through interosseous space, flexor digitorum longus, flexor hallucis longus, or peroneal tendon to midfoot or hindfoot)	90	0	1	2008
27,705	Osteotomy; tibia	90	1	3.5	
27,709	Osteotomy; tibia & fibula	90	1	3	2005
27,758	Open treatment of tibial shaft fracture (with or without fibular fracture), with plate/screws, with or without cerclage	90	1	6.5	
27,759	Treatment of tibial shaft fracture (with or without fibular fracture) by intramedullary implant, with or without interlocking screws and/or cerclage	90	1	3	1992
28,116	Ostectomy, excision of tarsal coalition	90	0	2	1995
28,262	Capsulotomy, midfoot; extensive, including posterior talotibial capsulotomy and tendon(s) lengthening (eg, resistant clubfoot deformity)	90	1	2	1995
28,300	Osteotomy; calcaneus (eg, Dwyer or Chambers type procedure), with or without internal fixation	90	1	0.5	
30,124	Excision dermoid cyst, nose; simple, skin, subcutaneous	90	0	0	
30,460	Rhinoplasty for nasal deformity secondary to congenital cleft lip and/or palate, including columellar lengthening; tip only	90	0	0	1992
30,540	Repair choanal atresia; intranasal	90	1	0.5	
32,480	Removal of lung, other than pneumonectomy; single lobe (lobectomy)	90	4	7	2000
32,651	Thoracoscopy, surgical; with partial pulmonary decortication	90	6	7	2005
32,652	Thoracoscopy, surgical; with total pulmonary decortication, including intrapleural pneumonolysis	90	6	7	2005
32,655	Thoracoscopy, surgical; with resection–plication of bullae, includes any pleural procedure when performed	90	3	5	2005
32,662	Thoracoscopy, surgical; with excision of mediastinal cyst, tumor, or mass	90	2	2	2005
32,663	Thoracoscopy, surgical; with lobectomy (single lobe)	90	3	5	2011
32,666	Thoracoscopy, surgical; with therapeutic wedge resection (eg, mass, nodule), initial unilateral	90	2	3	2011
38,120	Laparoscopy, surgical, splenectomy	90	2	5	1998
38,510	Biopsy or excision of lymph node(s); open, deep cervical node(s)	10	0	0.5	2000
38,724	Cervical lymphadenectomy (modified radical neck dissection)	90	1	4	2005
39,503	Repair, neonatal diaphragmatic hernia, with or without chest tube insertion and with or without creation of ventral hernia	90	20.5	31	2000
40,700	Plastic repair of cleft lip/nasal deformity; primary, partial or complete, unilateral	90	1	2	
40,701	Plastic repair of cleft lip/nasal deformity; secondary, by recreation of defect and reclosure	90	1	2	
40,720	Plastic repair of cleft lip/nasal deformity; secondary, by recreation of defect and reclosure, bilateral	90	0	1.5	
42,200	Palatoplasty for cleft palate, soft and/or hard palate only	90	1	2	1995
42,210	Palatoplasty for cleft palate, with closure of alveolar ridge; with bone graft to alveolar ridge (includes obtaining graft)	90	1	2	1995
42,215	Palatoplasty for cleft palate; major revision	90	1	1	
42,220	Palatoplasty for cleft palate; secondary lengthening procedure	90	1	1	
42,225	Palatoplasty for cleft palate; attachment pharyngeal flap	90	1	1.5	
42,226	Lengthening of palate, and pharyngeal flap	90	1	2.5	
42,415	Excision of parotid tumor or parotid gland; lateral lobe, with dissection and preservation of facial nerve	90	1	0.5	2011
42,440	Excision of submandibular (submaxillary) gland	90	1	0.5	2008
42,700	Incision and drainage abscess; peritonsillar	10	1	0	
42,720	Incision and drainage abscess; retropharyngeal or parapharyngeal, intraoral	10	2	5	1995

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CPT code	CPT description	Global period (days)	NSQIP median LOS (days)	Presumed LOS in RVU valuation (days)	Year of last review
	approach				
42,810	Excision branchial cleft cyst or vestige, confined to skin and subcutaneous tissues	90	0	0	
42,815	Excision branchial cleft cyst, vestige, or fistula, extending beneath subcutaneous tissues and/or into pharynx	90	0	2	
42,950	Pharyngoplasty (plastic or reconstructive operation on pharynx)	90	1	1	
43,280	Laparoscopy, surgical, esophagogastric fundoplasty (eg, Nissen, Toupet procedures)	90	3	3	1997
43,281	Laparoscopy, surgical, repair of paraesophageal hernia, includes fundoplasty, when performed; without implantation of mesh	90	2	3	2009
43,314	Esophagoplasty for congenital defect (plastic repair or reconstruction), thoracic approach; with repair of congenital tracheoesophageal fistula	90	21	6	2001
43,520	Pyloromyotomy, cutting of pyloric muscle (Fredet–Ramstedt type operation)	90	1	4	2000
43,653	Laparoscopy, surgical; gastrostomy, without construction of gastric tube (eg, Stamm procedure) (separate procedure)	90	3	2	1997
43,830	Gastrostomy, open; without construction of gastric tube (eg, Stamm procedure) (separate procedure)	90	4	5	2000
43,870	Closure of gastrostomy, surgical	90	0	6	2000
44,005	Enterolysis (freeing of intestinal adhesion) (separate procedure)	90	7	7	2000
44,050	Reduction of volvulus, intussusception, internal hernia, by laparotomy	90	2	7	2000
44,055	Correction of malrotation by lysis of duodenal bands and/or reduction of midgut volvulus (eg, Ladd procedure)	90	6	10	2000
44,120	Enterectomy, resection of small intestine; single resection and anastomosis	90	7	10	2005
44,125	Enterectomy, resection of small intestine; with enterostomy	90	21.5	7	2000
44,126	Enterectomy, resection of small intestine for congenital atresia, single resection and anastomosis of proximal segment of intestine; without tapering	90	18.5	22	2001
44,130	Enteroenterostomy, anastomosis of intestine, with or without cutaneous enterostomy (separate procedure)	90	17	8	2005
44,140	Colectomy, partial; with anastomosis	90	6	7	2005
44,144	Colectomy, partial; with resection, with colostomy or ileostomy and creation of mucofistula	90	11	9	2006
44,160	Colectomy, partial, with removal of terminal ileum with ileocolostomy	90	5	7	2000
44,180	Laparoscopy, surgical, enterolysis (freeing of intestinal adhesion) (separate procedure)	90	3	5	
44,188	Laparoscopy, surgical, colostomy or skin level cecostomy	90	2	4	2005
44,202	Laparoscopy, surgical; enterectomy, resection of small intestine, single resection and anastomosis	90	4	5	1997
44,205	Laparoscopy, surgical; colectomy, partial, with removal of terminal ileum with ileocolostomy	90	4	6	2001
44,210	Laparoscopy, surgical; colectomy, total, abdominal, without proctectomy, with ileostomy or ileoproctostomy	90	5	6	2002
44,310	Ileostomy or jejunostomy, nontube	90	8	6	2000
44,320	Colostomy or skin level cecostomy;	90	7	7	2000
44,620	Closure of enterostomy, large or small intestine	90	4	7	2000
44,625	Closure of enterostomy, large or small intestine; with resection and anastomosis other than colorectal	90	4	7	2000
44,626	Closure of enterostomy, large or small intestine; with resection and colorectal anastomosis (eg, closure of Hartmann type procedure)	90	4	8	2000
44,800	Excision of Meckel's diverticulum (diverticulectomy) or omphalomesenteric duct	90	2	6.5	
44,950	Appendectomy	90	1	3	2000
44,960	Appendectomy; for ruptured appendix with abscess or generalized peritonitis	90	4	6	2000
44,970	Laparoscopy, surgical, appendectomy	90	1	2	1996
45,120	Proctectomy, complete (for congenital megacolon), abdominal and perineal approach; with pull-through procedure and anastomosis (eg, Swenson, Duhamel, or Soave type operation)	90	4	11	
45,397	Laparoscopy, surgical; proctectomy, combined abdominoperineal pull-through procedure (eg, coloanal anastomosis), with creation of colonic reservoir (eg, J-pouch), with diverting enterostomy, when performed	90	5	6	2005
46,715	Repair of low imperforate anus; with anoperineal fistula (cut-back procedure)	90	2	3.5	
46,716	Repair of low imperforate anus; with transposition of anoperineal or anovestibular fistula	90	3	3	2000
46,740	Repair of high imperforate	90	3	5	2000

(continued)

CPT code	CPT description	Global period (days)	NSQIP median LOS (days)	Presumed LOS in RVU valuation (days)	Year of last review
	anus with rectourethral or rectovaginal fistula; perineal or sacroperineal approach				
47,562	Laparoscopy, surgical; cholecystectomy	90	1	0.5	2005
47,563	Laparoscopy, surgical; cholecystectomy with cholangiography	90	1	0.5	2010
49,000	Exploratory laparotomy, exploratory celiotomy with or without biopsy(s) (separate procedure)	90	7	3	2005
49,320	Laparoscopy, abdomen, peritoneum, and omentum, diagnostic, with or without collection of specimen(s) by brushing or washing (separate procedure)	10	0	0.5	1996
49,321	Laparoscopy, surgical; with biopsy (single or multiple)	10	1	2	1996
49,322	Laparoscopy, surgical; with aspiration of cavity or cyst (eg, ovarian cyst) (single or multiple)	10	1	0	1997
49,324	Laparoscopy, surgical; with insertion of tunneled intraperitoneal catheter	10	2	0.5	2006
49,600	Repair of small omphalocele, with primary closure	90	8	5	
49,605	Repair of large omphalocele or gastroschisis; with or without prosthesis	90	26	27	2000
49,606	Repair of large omphalocele or gastroschisis; with removal of prosthesis, final reduction and closure, in operating room	90	24	3.5	
50,220	Nephrectomy, including partial ureterectomy, any open approach including rib resection;	90	2.5	6	1995
50,230	Nephrectomy, including partial ureterectomy, any open approach including rib resection; radical, with regional lymphadenectomy and/or vena caval thrombectomy	90	5	9	
50,400	Pyeloplasty (Foley Y-pyeloplasty), plastic operation on renal pelvis, with or without plastic operation on ureter, nephropexy, nephrostomy, pyelostomy, or ureteral splinting; simple	90	1	8	
50,405	Pyeloplasty (Foley Y-pyeloplasty), plastic operation on renal pelvis, with or without plastic operation on ureter, nephropexy, nephrostomy, pyelostomy, or ureteral splinting; complicated (congenital kidney abnormality, secondary pyeloplasty, solitary kidney, calycoplasty)	90	1	8	
50,544	Laparoscopy, surgical; pyeloplasty	90	1	4	1999
50,546	Laparoscopy, surgical; nephrectomy, including partial ureterectomy	90	1	4	1999
50,590	Lithotripsy, extracorporeal shock wave	90	0	0.5	2012
50,780	Ureteroneocystostomy; anastomosis of single ureter to bladder	90	1	6.5	
50,782	Ureteroneocystostomy; anastomosis of duplicated ureter to bladder	90	1	3	1992
50,783	Ureteroneocystostomy; with extensive ureteral tailoring	90	2	3	1992
50,845	Cutaneous appendicovesicostomy	90	3	6	1993
51,500	Excision of urachal cyst or sinus, with or without umbilical hernia repair	90	0	2	
51,980	Cutaneous vesicostomy	90	1	4.5	
53,450	Urethromeatoplasty, with mucosal advancement	90	0	1	
54,322	1-stage distal hypospadias repair (with or without chordee or circumcision); with simple meatal advancement (eg, Magpi, V-flap)	90	0	2.5	
54,324	1-stage distal hypospadias repair (with or without chordee or circumcision); with urethroplasty by local skin flaps (eg, flip–flap, prepucial flap)	90	0	3.5	
54,326	1-stage distal hypospadias repair (with or without chordee or circumcision); with urethroplasty by local skin flaps and mobilization of urethra	90	0	4	
54,328	1-stage distal hypospadias repair (with or without chordee or circumcision); with extensive dissection to correct chordee and urethroplasty with local skin flaps, skin graft patch, and/or island flap	90	0	3.5	
54,332	1-stage proximal penile or penoscrotal hypospadias repair requiring extensive dissection to correct chordee and urethroplasty by use of skin graft tube and/or island flap	90	0	4	
54,340	Repair of hypospadias complications (ie, fistula, stricture, diverticula); by closure, incision, or excision, simple	90	0	0.5	
54,344	Repair of hypospadias complications (ie, fistula, stricture, diverticula); requiring mobilization of skin flaps and urethroplasty with flap or patch graft	90	0	2.5	
54,650	Orchiopexy, abdominal approach, for intraabdominal testis (eg, Fowler–Stephens)	90	0	0	1993
54,692	Laparoscopy, surgical; orchiopexy for intraabdominal testis	90	0	3	1999
55,530	Excision of varicocele or ligation of spermatic veins for varicocele; (separate procedure)	90	0	0.5	
55,550	Laparoscopy, surgical, with ligation of spermatic veins for	90	0	0	1992

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CPT code	CPT description	Global period (days)	NSQIP median LOS (days)	Presumed LOS in RVU valuation (days)	Year of last review
	varicocele				
58,661	Laparoscopy, surgical; with removal of adnexal structures (partial or total oophorectomy and/or salpingectomy)	10	1	0.5	1995
58,925	Ovarian cystectomy, unilateral or bilateral	90	1	3	1995
58,940	Oophorectomy, partial or total, unilateral or bilateral;	90	2	3.5	
60,220	Total thyroid lobectomy, unilateral; with or without isthmusectomy	90	1	0.5	2010
60,240	Thyroidectomy, total or complete	90	1	0.5	2010
60,280	Excision of thyroglossal duct cyst or sinus	90	1	2	
61,343	Craniectomy, suboccipital with cervical laminectomy for decompression of medulla and spinal cord, with or without dural graft (eg, Arnold–Chiari malformation)	90	3	12	
61,500	Craniectomy; with excision of tumor or other bone lesion of skull	90	0	5	
61,510	Craniectomy, trephination, bone flap craniotomy; for excision of brain tumor, supratentorial, except meningioma	90	3	7	1995
61,518	Craniectomy for excision of brain tumor, infratentorial or posterior fossa; except meningioma, cerebellopontine angle tumor, or midline tumor at base of skull	90	5	8	1995
61,550	Craniectomy for craniosynostosis; single cranial suture	90	2	0.5	
61,559	Extensive craniectomy for multiple cranial suture craniosynostosis (eg, cloverleaf skull); recontouring with multiple osteotomies and bone autografts (eg, barrel-stave procedure) (includes obtaining grafts)	90	3	5	1994
61,885	Insertion or replacement of cranial neurostimulator pulse generator or receiver, direct or inductive coupling; with connection to a single electrode array	90	0	0.5	2010
62,161	Neuroendoscopy, intracranial; with dissection of adhesions, fenestration of septum pellucidum or intraventricular cysts (including placement, replacement, or removal of ventricular catheter)	90	2	4	2002
62,201	Ventriculocisternostomy, third ventricle; stereotactic, neuroendoscopic method	90	2	3	1995
62,223	Creation of shunt; ventriculoperitoneal, -pleural, other terminus	90	2	3	1995
62,225	Replacement or irrigation, ventricular catheter	90	1	3.5	
62,230	Replacement or revision of cerebrospinal fluid shunt, obstructed valve, or distal catheter in shunt system	90	1	4.5	
62,258	Removal of complete cerebrospinal fluid shunt system; with replacement by similar or other shunt at same operation	90	2	5	
62,350	Implantation, revision or repositioning of tunneled intrathecal or epidural catheter, for long-term medication administration via an external pump or implantable reservoir/infusion pump; without laminectomy	10	2	0.5	2008
62,362	Implantation or replacement of device for intrathecal or epidural drug infusion; programmable pump, including preparation of pump, with or without programming	10	1	0.5	2008
63,200	Laminectomy, with release of tethered spinal cord, lumbar	90	2	8.5	
63,704	Repair of myelomeningocele; less than 5 cm diameter	90	12	9	1993
63,706	Repair of myelomeningocele; larger than 5 cm diameter	90	11	9	1993
64,568	Incision for implantation of cranial nerve (eg, vagus nerve) neurostimulator electrode array and pulse generator	90	0	2	2010
69,610	Tympanic membrane repair, with or without site preparation or perforation for closure, with or without patch	10	0	0	
69,620	Myringoplasty (surgery confined to drumhead and donor area)	90	0	0	
69,631	Tympanoplasty without mastoidectomy (including canalplasty, atticotomy and/or middle ear surgery), initial or revision; without ossicular chain reconstruction	90	0	0.5	
69,633	Tympanoplasty without mastoidectomy (including canalplasty, atticotomy and/or middle ear surgery), initial or revision; with ossicular chain reconstruction and synthetic prosthesis (eg, partial ossicular replacement prosthesis [PORP], total ossicular replacement prosthesis [TORP])	90	0	0.5	
69,635	Tympanoplasty with antrotomy or mastoidotomy (including canalplasty, atticotomy, middle ear surgery, and/or tympanic membrane repair); without ossicular chain reconstruction	90	0	0.5	
69,641	Tympanoplasty with mastoidectomy (including canalplasty, middle ear surgery, tympanic membrane	90	0	1	

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CPT code	CPT description	Global period (days)	NSQIP median LOS (days)	Presumed LOS in RVU valuation (days)	Year of last review
	repair); without ossicular chain reconstruction				
69,642	Tympanoplasty with mastoidectomy (including canalplasty, middle ear surgery, tympanic membrane repair); with ossicular chain reconstruction	90	0	1	
69,643	Tympanoplasty with mastoidectomy (including canalplasty, middle ear surgery, tympanic membrane repair); with intact or reconstructed wall, without ossicular chain reconstruction	90	0	1.5	
69,644	Tympanoplasty with mastoidectomy (including canalplasty, middle ear surgery, tympanic membrane repair); with intact or reconstructed canal wall, with ossicular chain reconstruction	90	0	1.5	
69,645	Tympanoplasty with mastoidectomy (including canalplasty, middle ear surgery, tympanic membrane repair); radical or complete, without ossicular chain reconstruction	90	0	2	
69,930	Cochlear device implantation, with or without mastoidectomy	90	0	0.5	2008

Appendix: Description of each CPT code included in the analysis with the LOS assumed in the global period; median postoperative LOS derived from NSQIP and date of last RUC review. A missing date indicates that the code has not yet undergone RUC review and therefore the work RVU valuation is based on the original 1992 value.
CPT = Current Procedural Terminology, LOS = length of stay, RUC = Relative Value Scale Update Committee.

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpedsurg.2020.09.051.

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