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Current state and future direction of quality improvement in pediatric neurosurgery: a survey of pediatric neurosurgeons

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OBJECTIVE Quality improvement (QI) is a methodology used to implement sustainable, meaningful change to improve patient outcomes. Given the complex pathologies observed in pediatric neurosurgery, QI projects could potentially improve patient care. Overall, there is a need to characterize the degree of QI opportunities, training, and initiatives within the field of pediatric neurosurgery. Herein the authors aimed to define the current QI landscape in pediatric neurosurgery.

METHODS A cross-sectional survey was sent to all members of the American Association of Neurological Surgeons/Congress of Neurological Surgeons Joint Section on Pediatric Neurological Surgery via email. The responses were anonymized. Questions addressed several relatable QI topics including 1) training and participation in QI; 2) QI infrastructure; 3) QI program incentives; and 4) general opinions on the National Surgical Quality Improvement Program (NSQIP) database, various QI topics, and QI productivity.

RESULTS Responses were received from 129 participants (20% response rate). Most respondents practiced in an academic setting (59.8%) and at a free-standing pediatric hospital (65.4%). Participation in QI projects was high (81.7%), but only 23.8% of respondents had formal QI training. Only 36.5% of respondents had institutional requirements for QI work; the majority of those were only required to participate as a project team member. Nearly half of the respondents did not receive incentives or institutional support for QI. The majority agreed ("strongly" and "somewhat") that a QI course would be beneficial (75.5%), that QI projects should be considered for publication in neurosurgery journals (88.1%), and that there is a need for national quality metrics (81.4%). Over 88% have an interest in seeing QI project presentations at the annual Pediatric Joint Section meeting. Only 26.3% believed that the NSQIP was a useful QI guide. Respondents suggested further study of the following QI topics: overall rates of infection and their prevention, hydrocephalus, standardized treatment algorithms for common disorders, team communication, pediatric neurosurgery–specific database, access to care, and interprofessional education.

CONCLUSIONS Areas of opportunity include specialty-specific QI education, tactics for obtaining support to build the QI infrastructure, increased visibility of QI work within pediatric neurosurgery, and a review of available registries to provide readily available data relevant to this specialty.

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KEYWORDS quality improvement; pediatric neurosurgery; survey

In recent years, quality improvement (QI) has become an integral part of contemporary healthcare and has been increasingly adopted by surgical specialties. As confidence in the ability of the QI approach to advance care continues to increase, its use across institutions has grown. QI is now a requirement for neurosurgery residency training by the Accreditation Council for Graduate Medical Education. Despite the benefits of actively pursuing meaningful QI projects, there are barriers to carrying out these initiatives in clinical practice. Several factors are necessary to ensure the successful integration of these QI projects into patient care.[1] Recent research has shown that

ABBREVIATIONS AANS = American Association of Neurological Surgeons; CNS = Congress of Neurological Surgeons; IHI = Institute for Healthcare Improvement; NSQIP = National Surgical Quality Improvement Program; QI = quality improvement; VA = Veterans Affairs.

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TABLE 1. Institutional incentives and support for QI

Type of Incentive & Support for QI	No. of Responses (%)
Incentive for QI initiatives*	
Financial (e.g., annual bonus)	16 (12.8)
Academic (e.g., annual performance review)	23 (18.4)
Helps w/ academic promotion	34 (27.2)
Other	1 (0.8)
No incentive	72 (57.6)
Institutional support for QI†	
Funding available	16 (12.9)
Protected time	5 (4.0)
Support personnel (e.g., data analyst, QI consultant, assigned advanced practice provider to work on projects, etc.)	52 (41.9)
Other	4 (3.2)
No support	64 (51.6)

* Missing data in 4 responses.
† Missing data in 5 responses.

interventions must be adapted to new environments, patient and staff groups, available resources, and the personal preferences of healthcare providers in order to maintain efficacy.[1]

The best outcomes and safe equitable care for children are the missions of every pediatric neurosurgeon; as a result, pediatric neurosurgery as a field is showing interest in making QI a priority. In this survey study we sought to define the current QI landscape in pediatric neurosurgery. The goal of this study was to better understand the perceptions, strengths, and challenges related to QI in pediatric neurosurgery.

Methods

A cross-sectional questionnaire study targeting members of the American Association of Neurological Surgeons and Congress of Neurological Surgeons (AANS/CNS) Joint Section on Pediatric Neurological Surgery was performed. Twenty-one questions were formulated to address the following topics: 1) training and participation in QI; 2) QI infrastructure; 3) QI program incentives; and 4) general opinions on the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database, various QI topics, and QI productivity. A RedCap survey was sent to pediatric neurosurgeons through the AANS/CNS Joint Section on Pediatric Neurological Surgery members' email distribution list (n = 645). The survey and reminder emails were distributed by the AANS/CNS Joint Section on Pediatric Neurological Surgery communications committee cochair over the course of 6 weeks. Our institutional research ethics board waived review given the nature of the survey study and the lack of identifying factors in the survey. The results were collected and tabulated in a Microsoft Excel spreadsheet to perform descriptive analysis. Responses remained anonymous. Likert scales were used in the development of the survey questions assessing opinions, ranging from strongly agree, neutral, and strongly disagree. Regarding the question, "In your opinion, what are the most critical topics in pediatric neurosurgery that should be addressed in future patient quality and safety initiatives? Please list your top three topics," a language analysis of the free-text responses was performed. Responses were organized into groupings based on their natural relationship (affinity diagram process). The questionnaire is accessible in the Supplementary Appendix.

Results

We received responses from 129 individuals (20.0% return rate). Most respondents practiced in an academic setting (59.8%), with the remainder practicing in affiliated academic settings (30.7%), private settings (7.9%), and other (1.6%; missing data in 3 surveys). More than half of the respondents practiced in a free-standing pediatric hospital (65.4%). Approximately 82% had participated in a QI project, with 63.7% of those being involved in 1–2 projects. At the time of the survey, only 3.9% of respondents had been involved in more than 7 projects. Of the total respondents, 36.5% were required by their institution to work in QI. The majority were required to participate as a team member in at least 1 project per year.

A minority of the survey participants (23.8%) reported receiving formal QI training. Of those receiving formal training, 69.0% followed a set curriculum, which led to the conclusion of the project, whereas 31.0% followed an online self-taught course. The various QI methodologies taught in these courses were as follows: 62.1%, Institute for Healthcare Improvement (IHI); 13.8%, Six Sigma approach; 13.8%, various methodologies (Lean principles; Donabedian model; institution-specific process; and the define, measure, analyze, improve, control [DMAIC] approach); and 10.3%, uncertain.

Approximately half of the respondents did not receive incentives or institutional support for QI. Table 1 lists the types of institutional incentives and supports offered. Only 26.3% of the participants believed that the NSQIP has been a useful guide for QI work in pediatric neurosurgery at their institution ("strongly agree" and "somewhat agree").

Most participants agreed (33.3% strongly agree and 42.2% somewhat agree) that a QI course tailored to pediatric neurosurgeons would be beneficial to their practice. Forty-four percent strongly agreed and 44.1% somewhat agreed that they would be interested in seeing QI projects presented at the annual meeting of the AANS/CNS Joint Section on Pediatric Neurological Surgery. Just over 88% of the respondents agreed (51.5% strongly agree and 36.6% somewhat agree) that QI projects should be considered for publication in neurosurgery journals. The majority of respondents agreed (39.2% strongly agree and 42.2% somewhat agree) that there is a need for establishing national quality metric benchmarks in pediatric neurosurgery. Opinions were divided on the topic of pediatric neurosurgery groups being required to have a QI portfolio (21.6% strongly agree, 30.4% somewhat agree, 32.4% neutral, 10.8% somewhat disagree, and 4.9% strongly disagree).

TABLE 2. Critical topics in pediatric neurosurgery suggested for future QI initiatives

Topic Category	No. of Responses (% of total unique responses)
Total no. of unique responses	263
General management of neurosurgical disorder	
General spine	2
Tethered cord	6
Myelomeningocele/spinal lipoma	5
Vascular	2
Tumor	8
Craniofacial	3
Chiari malformation type I	3
Epilepsy	4
Periop care	6
Miscellaneous	4
Total	43 (16.3)
General postsurgical infection	
General infection management	17
Prevention	4
Antibiotics use	4
Implant/hardware infection	4
Total	29 (11.0)
General outcome & complication of neurosurgical disorders	
Readmission/length of stay	4
Disorder-specific complication	5
Disorder-specific outcome	4
Neurocognitive outcome & quality of life	3
Implant/hardware complication	2
Miscellaneous general outcome & complication	12
Total	30 (11.4)
Standard of care	
Management protocols & guidelines	12
Database/registry	7
QI culture & dissemination of benchmark outcomes	6
Total	25 (9.5)
Hydrocephalus	
Shunt infection	10
General management	20
Shunt malfunction	4
Hydrocephalus-specific outcome	7
Total	41 (15.6)
Trauma	
Nonaccidental trauma	5
Head injury	5
Spine injury	3
General neurosurgical trauma	8
Total	21 (8.0)
Patient & family resource	
Patient/family education	5
Academic support	2
Miscellaneous	3
Total	10 (3.8)
Healthcare resource	
Use of hospital resources & cost	11
Transition to adult care	4
Access to care	14
Appropriate use of surgery	2
Appropriate use of imaging	12
Total	43 (16.3)
Professionalism	
Communication (inter-/intradisciplinary)	11
Multidisciplinary education	6
Culture & team building	4
Total	21 (8.0)

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Participants also submitted free-text responses detailing a total of 263 suggestions for critical pediatric neurosurgery topics to be addressed in future patient quality and safety initiatives (Table 2). We organized the 263 unique responses into 9 groups based on their natural relationship using an affinity diagram process: 1) general management of neurosurgical disorders; 2) general postsurgical infections; 3) general outcomes and complications of neurosurgical disorders; 3) standards of care; 4) hydrocephalus; 5) trauma; 6) patient and family resources; 7) healthcare resources; and 8) professionalism. Other than the broad category of the general management of neurosurgical disorders, hydrocephalus (15.6%) and healthcare resources (16.3%) appeared to be the most relevant categories. The top 3 topics repeatedly mentioned were as follows: general management of hydrocephalus (7.6%), general postsurgical infection management (6.5%), and access to care (5.3%).

Discussion

The best outcomes and safe equitable care for children are every pediatric neurosurgeon's mission. For many years, members of the pediatric neurosurgery field have shown commitment to prioritizing patient care and identifying areas for improvement. Our survey was designed to evaluate the current QI landscape in pediatric neurosurgery. With it, we highlighted opportunities for future development of the field including initiating specialty-specific QI education, creating spaces to share resources and to advocate for QI support, increasing the visibility of QI work within this surgical subspecialty, and establish-

ing standards of care for pediatric neurosurgery disorders on a larger scale. Additionally, respondents of the survey proposed numerous critical topics to address in future QI initiatives. Of these, the top 3 categories included establishing standards of care for a variety of neurosurgical disorders, expanding on the use of healthcare resources (e.g., access to care), and making advancements in the care and outcomes of hydrocephalus patients.

The idea of using the QI methodology as a framework for growth involves implementing sustainable, meaningful change while improving patient outcomes. This idea can be observed in action and throughout history. The early 20th century efforts of Ernest Codman, one of the first physicians to highlight the importance of consistent hospital standards, established him as a pioneer in the use of data-driven strategies to improve healthcare outcomes.[2] His efforts continue to be translated to a multitude of fields, including neurosurgery. Medicine has a long history of utilizing critical thinking skills and experimentation in the pursuit of a healthier society. This drive is exemplified by the revolutionary discovery of the importance of hand hygiene and clean living conditions in limiting the spread of disease.[3] However, the growth of a field can be spurred by many influences beyond those within the profession itself. Late 20th century organizational improvement initiatives such as Motorola's Six Sigma method have inspired healthcare institutions, including the IHI, as well as individual providers to adapt their methods of self-evaluation.[2] We demonstrated in our own study that more than 80% of respondents have participated in a QI initiative. Despite this involvement, survey respondents still believe there is ample room for growth.

Although most of our survey participants have been involved in QI initiatives, only 23.8% have received formal or informal QI training. This may be secondary to a lack of access to these initiatives as well as a lack of incentives and opportunities to obtain formal training.[4] Currently, individuals can independently seek out QI resources such as Six Sigma and IHI modules.[5] Efforts to encourage QI participation beginning at the trainee level will lead to more practitioners performing QI projects at an earlier time in their career. Current initiatives exist to train medical students before they enter the workforce with the intent of increasing QI familiarity before practicing at the physician level.[5] A formal curriculum that outlines methods of facilitating trainee participation in QI activities has been described in the literature.[5] This formal training provides specific skills related to safety and quality, which are considered to represent core physician competencies (e.g., effective patient handover). It includes trainee participation in real-life QI initiatives as active or passive participants.[5] A study by Clarke et al. details the Mayo Clinic's neurosurgery residency program trial of a QI curriculum in conjunction with the Mayo Clinic Quality Academy.[4] The participants worked on a team QI project while taking 1-hour didactic courses weekly (for 10 weeks) and completed an online test. Although this course was subjectively labeled as a positive experience by participants, with more than 95% describing the training as valuable, they also identified important limitations to such an intensive QI program. These limitations include the need for participant buy-in, competing time demands, preestablished ideas on the definition of research, the time needed to see actual change, and the difficulty integrating QI into training in a durable fashion. Continued efforts are needed to make QI accessible and easy to integrate into neurosurgery training and practices. Our survey study results reinforced the need to address this gap and suggested that education through a QI course tailored to the pediatric neurosurgery community would be well received.

QI initiatives have the potential to lead to multiinstitutional consensus guidelines and spark future collaborations. The NSQIP was developed to assess the higher mortality rates recorded in Veterans Affairs (VA) hospitals compared to non-VA hospitals.[3] Efforts by this group led to the collection of data regarding both risks and outcomes, which were later confirmed to be generalizable to hospitals regardless of VA status.[3] The NSQIP now serves as a resource for surgeons to calculate risk tailored to specific patient scenarios, a hub for the most up-to-date quality and safety information, as well as a training and testing program.[3] Since its creation, the NSQIP has collected data from adult and pediatric patients across multiple surgical specialties. However, on a practical level, only 26.3% of our survey respondents believed that the NSQIP has been useful for QI work at their institution. This suggests the need for a specialty-specific initiative that is valued and relevant to pediatric neurosurgeons.[6]

Active participation in QI efforts specific to the field of neurosurgery has been displayed by the University of Minnesota Department of Neurosurgery through their creation of NeuroSafe,[7] a highly interactive yearly symposium in its fifth edition that facilitates conversations among experts about improving safety and quality across many neurosurgery practices at an individually applicable level. The symposium has created a unique national forum using case-based presentations and showcasing national experts who share their own strategies, studies, and ideas about improving neurosurgical quality and safety. It employs a multidisciplinary approach, allowing collaboration among neurosurgeons, researchers, administrators, and nursing professionals, each sharing their perspectives on advancing the quality of care they provide to their patients. This symposium is an example of organizational support focusing on improving quality care. It is remarkable that only 52% of our responders reported institutional support or incentives for QI efforts. Advocacy with philosophical and monetary support for QI infrastructure by national neurosurgical organizations, hospital-wide systems, and neurosurgical departments is crucial, and that finding should serve as a call to action to provide an environment for pediatric neurosurgeons to focus and have supported time and resources toward conducting QI projects.

It is important to note that the pediatric neurosurgery community has the ability and discipline to follow through when an opportunity for advancement becomes apparent. In the 1990s, a pediatric neurosurgery focus group identified the need for a centralized data bank to facilitate communication between organizations and offer the opportunity to analyze, document, and process data regarding the management of pediatric hydrocephalus.[6] Only a few years later, two databases were created regard-

ing hydrocephalus (Hydrocephalus Association Network for Discovery Science [HANDS] and Hydrocephalus Clinical Research Network [HCRN]).[8,9] These multiinstitutional registries have provided greater strength and generalizability of research results relevant to the specialty, and the HCRN has continually published key QI initiatives since their creation.[10–14] Despite this important work, as seen with the results of our survey, there is a critical need for developing initiatives on a cross-organizational level to allow for greater bandwidth of resource acquisition and continued progress.

The AANS/CNS Joint Section on Pediatric Neurological Surgery has responded positively to the ever-growing need for QI within this subspecialty field and has formed a QI committee with the potential to become a platform connecting members in academic and nonacademic pediatric neurosurgery. The new committee will be used as a specialty-specific resource for providers to learn about and engage in QI projects conducted by colleagues. The committee intends to serve as a central facilitator to support QI initiatives in pediatric neurosurgery. Educational resources and project ideas will be shared on the association's website to foster collaboration and inspire the pediatric neurosurgery community to improve patient care. In addition to providing education and mentorship to those interested in QI, the committee will continue to explore opportunities to establish national standards and benchmarks in the care of children with neurosurgical disorders. The results of this survey study will be extremely valuable in shaping the mission and goals of this committee. Support for such an endeavor will need to be garnered from individuals as well as systems. Experts within the field can be encouraged to show support by acting as advisors and educators.

Just as there are strengths, there are limitations to our cross-sectional questionnaire. Of 645 potential respondents, only 20% completed our survey. This response rate may be a byproduct of survey fatigue. A nonresponse bias and self-selection bias may also be present, as those who participate in QI initiatives may be more apt to complete the survey. The rate of response bias in physician-based surveys is known to be quite low. Our response rate of 20% is slightly lower than expected from specialty-based physicians.[15] In creating the survey, we considered best practices, such as survey length and nonresponder follow-up, to attain the highest response rate from potential survey participants.[16]

Conclusions

The implementation of QI in pediatric neurosurgery is currently in a state of goal-oriented growth. This study provides a better understanding of the perceptions, strengths, and challenges of QI in pediatric neurosurgery. Furthermore, the AANS/CNS Joint Section on Pediatric Neurological Surgery has created a QI committee with the goals of evaluating and reporting on the role of QI in pediatric neurosurgery, advocating for QI infrastructure, providing education on the science of improvement and safety for pediatric neurosurgery providers, establishing QI standards for pediatric neurosurgery, and encouraging multicenter collaboration. By enthusiastically directing efforts toward achieving these goals, pediatric neurosurgeons can ensure that patient care is continually improving in a manner consistent with their mission of achieving the best outcomes and safe equitable care for children.

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Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author Contributions

Conception and design: Pendola, Piatt, Kaufman, Sandoval-Garcia, Drapeau. Acquisition of data: Pendola, Sandoval-Garcia, Drapeau. Analysis and interpretation of data: Koutsouras, Pendola, Sandoval-Garcia, Drapeau. Drafting the article: Koutsouras, Pendola, Sandoval-Garcia, Drapeau. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Koutsouras. Statistical analysis: Drapeau.

Supplemental Information

Online-Only Content

Supplemental material is available with the online version of the article.

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