The Right Child/Right Surgeon Initiative: A Position Statement on Pediatric Surgical Training, Sub-specialization, and Continuous Certification from the American Pediatric Surgical Association

Samuel M. Alaish[1], David M. Powell[2], John H. T. Waldhausen[3] and Stephen P. Dunn[4]

[1]Department of Surgery, School of Medicine, Johns Hopkins University, Baltimore, MD

[2]Department of Surgery, School of Medicine, Stanford University, Stanford, CA

[3]Department of Surgery, School of Medicine, University of Washington, Seattle, WA

[4]Department of Surgery, School of Medicine, Jefferson University, Philadelphia, PA

Corresponding author:

Samuel M. Alaish, M.D.

Associate Professor of Surgery

Johns Hopkins University School of Medicine

1800 Orleans Street, Room 7337

Baltimore, MD 21287

410-955-6256 (O)

443-769-1287 (F)

Salaish1@jhmi.edu

Abstract

The past 50 years have witnessed profound changes in the specialty of pediatric surgery in North America. There has been a marked increase in the number of both pediatric surgical training programs and practicing pediatric general and thoracic surgeons. Some pediatric surgeons have become “super specialists”, concentrating their practices in oncology or colorectal surgery. Despite this trend, the population of children in the US and the birth rate have recently remained relatively flat. This has the potential to result in a dilution of experience for both pediatric surgical trainees and practicing pediatric surgeons, thus limiting their ability to acquire and maintain expertise, respectively. Coincident with this, there has been a relative paradigm shift in recognition that “quality of life” is based more on maintaining a creative balance in lifestyle and is not “all about work”. There has been a parallel growth in the number of practicing pediatric general and thoracic surgeons in urban settings, but we have not appreciated as much growth in rural and underserved areas, where access to pediatric surgical care remains limited and fewer pediatric general and thoracic surgeons practice. This is a complex issue, as some underserved areas are economically depressed and geographically sparse, but others are just underserved with adult providers taking care of children in settings that are often under resourced for pediatric surgical care. This problem may extend beyond the boundaries of pediatric general and thoracic surgery to other specialties. As the premier association representing all pediatric surgeons in the United States, the American Pediatric Surgical Association (APSA) has concluded that the quality of pediatric surgical care will likely decline should the status quo be allowed to continue. Therefore, APSA has initiated a Right Child/Right Surgeon initiative to consider these issues and propose some potential solutions. What follows is a brief statement of intent.

Introduction

Founded in 1970, the American Pediatric Surgical Association (APSA) now includes more than 1300 pediatric general and thoracic surgeons. The charter members of APSA established core values that embodied the principles of specialization, access to pediatric surgeon and pediatric surgical care, access to quality education for our discipline (both printed and in an appropriate forum for discussion), encouragement of research and scientific progress, and speaking in a common voice for socioeconomic policy development affecting children's interests[1]. The current mission of APSA is to ensure optimal pediatric surgical care of patients and their families, to promote excellence in the field, and to foster a vibrant and viable community of pediatric surgeons. Deficiencies in individual surgeon training, practice volume, hospital volume and hospital resources for children have led to less optimal outcomes for some children undergoing surgery in North America[2]. A child's surgeon, whether a general surgeon or a fully-trained pediatric general and thoracic surgeon, may not have sufficient training or on-going experience to perform a particular operation or take care of children below a certain age or both, or that surgeon may be capable but lack the appropriate resources at their hospital. All of these issues require recognition and innovative solutions to ensure the appropriate care of the child. APSA must recognize the needed changes in surgical training, health care delivery and workforce distribution. Of paramount importance should be the pediatric surgeon's focus on provision of the optimal care of the individual child.

While APSA recognizes that there are many factors influencing how and where and by whom a child's surgical care is provided, we must continually advocate for the best delivery of pediatric surgical care possible. Our mission should include making sure that the providers who render this care, no matter where the child lives, receive adequate education to understand their own capabilities and limitations. This demands a certain level of "pediatric readiness" throughout the continuum of care of a patient's experience for not only medical issues, but also for surgical care and traumatic injuries; this

includes the emergency medical services provider, emergency department staff and any hospital inpatient services that exist to benefit children. It also includes a network of communication to give advice about local scene care, and transfer and transport guidelines. This may include telehealth services. All of these resources that are currently at least partially nonexistent or inadequate in many parts of the country need input from our specialty. By nature of the gaps in care, this conceptually presupposes the need for different training models.

In response to these challenges, APSA has created the Right Child/Right Surgeon Initiative. This initiative is consistent with the early origins of pediatric surgery when Willis Potts said that more appropriately-trained (men and women) surgeons and adequate facilities are needed to meet the surgical demands of children[3]. APSA is distinguished as a community of providers who add value to each one of their patients. We should extend this value to those that we cannot directly serve by understanding the gaps in care and how we might begin to close these gaps by "training for need".

There are key principles which drive this initiative. First, pediatric surgery should maintain the highest standards in training, certification and continuous certification for its own fellowship trainees and practicing surgeons. Second, we should recognize that different patients and practice environments require different levels of expertise. Third, practice and knowledge gaps exist within environments, as well as among surgeons currently caring for many children – especially those in underserved areas. Passively allowing political or market forces to effect change will be detrimental to patients and their caregivers. Fourth, we should be the driving force to understand and begin to close the gaps that exist.

Momentum for this initiative has been building for decades[4] but has become more focused on this particular issue recently. Dr. Keith Oldham envisioned the Children's Surgery Verification Program (CSV) with basic, advanced and comprehensive tiers to optimize children's care at a hospital level[2]. In his APSA Presidential Address, Dr. Michael Klein proposed that avoidance of a decline in pediatric surgical expertise would require a reorganization in pediatric surgical training and practice to align with

optimal resources for children's surgery (CSV) and the companion evolution of contemporary training in general surgery[5]. Data and expert opinion overwhelmingly demonstrate that systems of care designed for children provide better outcomes[5]. Dr. Mary Fallat proposed a paradigm shift in training of pediatric surgeons[6], envisioning a tiered-approach training model that produces three kinds of children's surgeons: a traditionally trained pediatric surgeon, an acute care pediatric surgeon to include trauma expertise, and a general surgeon with some pediatric expertise. This model would enable more surgeons to be capable in aspects of children's surgical care where they choose to practice and begin to provide optimal general surgical care for more children in the United States. In this position statement, we capsulize the pertinent data illustrating the current obstacles that prevent the optimal delivery of pediatric surgical care to all children and outline proposals to be considered in order to effect improvement.

Current Obstacles

1. **For children's surgery, less optimal outcomes are seen with surgeons lacking pediatric surgical training, who have lower case volumes and who perform their operations in hospitals without appropriate children's resources.** Today in North America, much of children's surgery is done in a nonspecialized environment (hospital, surgeon or both). This has been true for over a decade. Using the 2009 Kids' Inpatient Database (KID), Ziegler et al. found that 29% of 9668 infants received surgical care in general hospitals in the United States[7]. Similarly, using the same 2009 KID dataset, Chen et al. demonstrated that approximately 20% of all surgical neonates were definitively treated in freestanding children's hospitals, more than one-third were cared for in children's units within a general hospital and 45% of surgical neonates receive care in unspecialized general hospitals[2]. Acknowledging the age of this data, a deeper dive still yields valuable information about specific types of cases and surgical specialties. In fact, 15% of complex cases, such as esophageal atresia repair, congenital diaphragmatic hernia (CDH) repair, Ladd procedure, pull-through procedures for

Hirschsprung disease and lung biopsies, were performed in general hospitals in a study published as recently as 2013[7]. These data are concerning because CDH[8] and other complex pediatric surgical conditions, including congenital heart disease[9], biliary atresia[10] and trauma[11], have been shown to be associated with better outcomes when done in specialized environments. This specialized experience also extends to more common cases, including operations for intussusception[12] and pyloromyotomy[13], where morbidity tends to be higher in less resourced environments or when done by general surgeons rather than pediatric surgeons, as in the case of inguinal hernia repair[14], pyloromyotomy[15-17] and appendectomy[7,18,19]. However, there is also emerging data showing similar or improved outcomes by general or acute care surgeons in children, particularly those over 12 years of age, requiring appendectomy[20] or cholecystectomy[21]. This supports the long-held belief that proper training and experience are also a part of value-based care. Specialized pediatric anesthesia and critical care expertise have been shown to be critical for safe contemporary children's surgery[22] and pediatric trauma patients[23], emphasizing the need for partnership among disciplines caring for children. There is a strong survival benefit for very low birth weight infants with both medical and surgical diagnoses when care is provided in a Level 3 NICU vs a lower resource level NICU[24].

2. **Pediatric surgical training in general surgery residency and pediatric surgical fellowship may not be meeting the needs of future trainees.** The Accreditation Council of Graduate Medical Education (ACGME) approves programs and the American Board of Surgery (ABS) certifies surgeons. Although they work in concert and complement each other, the ACGME is not directly involved in workforce discussions that are unrelated to the quality of the programs they approve. Driven by concerns of quality and safety, compliance with supervision regulations, work-hour restrictions and societal expectations, independence in diagnostic and operative experience has been markedly diminished in general surgery training and further perpetuated during pediatric surgical fellowship[25]. Only 20

pediatric cases are required by the ACGME during General Surgery Residency. Many are done at a junior level early in training when it may be difficult to gain expertise. Overall case load for general surgery residents in pediatric surgery has simultaneously decreased[26]. The resulting diminution in autonomy carries over into pediatric surgery fellowship training, as evidenced by the fact that teaching cases performed by fellows have decreased 56%[27]. Research time usually performed after the second or third year of residency, while beneficial to the overall education of the trainee, is often obsolete by the time fellowship is completed. It is encouraging that pediatric surgical trainees now record more total cases and more minimally invasive surgery cases than ever before[28]. Regrettably, a subset of this increase comes from trainees performing cases previously assigned to general surgery residents.[27] There was a recent increase in the American Board of Surgery (ABS) Pediatric Surgery Certifying Exam failure rate, approaching 20% in 2018 (Figure 1) , although the most recent exam failure rates have improved. Whether this is due to the exponential rise in biomedical information and the requisite increased fund of knowledge required of all physicians, or to ineffective training program curricula or to any of the other factors mentioned previously is unclear. All may play a role. The ACGME implemented minimum case numbers by case type as a requirement for programs to monitor for dilution of training experience. Recently, the pediatric surgery case log has started to delineate common vs. complex cases to distinguish cases that only a pediatric surgeon should be qualified to perform with adequate training Numbers alone may not indicate competence. In addition to operative experience, an overall understanding of core surgical principles is necessary for a trainee to be ready for autonomous practice[29,30].

3. **The practicing pediatric general and thoracic surgeon is performing fewer index cases across a smaller breadth of children's surgery than in years past.** Many previous reports have indicated that individual surgeon volume once in practice is a strong predictor of patient outcomes, hospital length of stay and cost[13,14,31]. McAteer showed that hospital volumes

correlated with improved outcomes for high complexity procedures[32]. Surgeons must perform a sufficient number of operations during their training to develop skill, and a sufficient volume must be maintained over time in practice to ensure quality of care and avoid errors[33,34]. In 2010, Fonkalsrud et al. found that pediatric surgeons were performing an average of 9.5 index procedures per surgeon per year, which was a marked decrease from an estimated average of 18.0 in 1970[35]. Accomplished surgeons are not accumulating or maintaining experiences in key areas of practice, such as congenital anomalies or cancer. Abdullah et al.[36] performed a review of five years of pediatric surgery certification renewal applications submitted to the Pediatric Surgical Board (PSB) between 2009 and 2013. Overall, in 6 of 10 "rare" pediatric surgery cases, the mean number of procedures performed in the previous year was less than 2.0 (Figure 2). A retrospective review of surgical case volumes at 36 freestanding children's hospitals between 2004 and 2103 using the Pediatric Health Information System (PHIS) database showed a significant downward trend in index cases and a significant upward trend in routine cases, such as appendectomy and abscess drainage[37]. Routine cases increased by 33%, and index cases decreased by 18%[37]. The experience of junior pediatric general and thoracic surgical attendings was evaluated by examining APSA membership applicant case logs from 2006-2016. Case types that showed a declining trend included pyloromyotomies, omphalocele, gastroschisis, inguinal hernia, anti-reflux surgery, chest wall deformity, and PDA ligation[38]. On the other hand, laparoscopic appendectomy increased significantly[38]. Also troubling was the observation that total cases decreased from a median of 584 to 398.[35] Several of the cases a practicing pediatric surgeon is most likely to perform, such as appendectomy, central line and gastrostomy tube placement, are threatened by outside forces, including antibiotic treatment for appendicitis and interventional radiology placement of central lines and gastrostomy tubes. Analysis of the

PHIS database between 2005 and 2014 revealed a downward trend in the proportion of otolaryngologic (61.7 to 35.1) and urologic (49.2% to 30.8%) cases performed by pediatric surgeons[39]. During this same time period, pediatric otolaryngology training programs increased 133% and pediatric urology training programs increased 27%[40]. This trend is forecast to continue. The FutureDocs model predicts a very rapid growth of the supply of all types of pediatric surgeons by 2030, including an increase of 34% for general pediatric surgeons barring no change in number of programs and pediatric subspecialty surgeons, which far outpaces the estimated pediatric population 9% growth rate[41]. Accurately estimating the future balance of supply and need for any one specialty cannot be done without understanding what will happen to other specialties with overlapping cases[41].

4. **The current distribution of pediatric surgeons does not meet the needs of children; rather, it heavily favors metropolitan areas with poor penetration into underserved populations (e.g. smaller cities, rural areas).** Many recent graduates have joined academic institutions that contract their services to community general hospitals. The vast case experience at these hospitals involves care for children that used to be provided by general surgeons, including appendectomies, cholecystectomies, abscesses, etc. With this type of coverage comes "windshield time", the time required to travel to another hospital, which has resulted in an unexpected career obstacle, further reducing time for academic pursuits such as teaching and research. The most granular geographic level for which basic demographic data are available is the Census block[42]. At the time of the 2010 Decennial Census, almost 60 million people lived in rural America, defined as open countryside and any municipality with less than 2500 people[43]. Rural Americans occupied 80% of the total US landmass, but they only constituted 20% of the population[43]. Nearly a quarter of those living in rural areas as of 2016 were children under 18 years[43]. In a study by McEvoy et al.[44], the median distance in miles of all rural blocks to the closest pediatric surgeon was 44.43 compared to 11.11 for all urban blocks. While this distance

has decreased in some locations, it still remains significant for much of the country. More than 10 million children live more than 60 miles from care[44]. Increasing the number of classic fellowship programs has been unsuccessful in distributing fully trained pediatric surgeons to underserved areas of the US and is not a worthwhile strategy to pursue. Although it is more difficult to find positions consistent with their investment in training, exceedingly few elect for positions in underserved areas, despite the continued dilution of experience among practicing pediatric surgeons in better served areas. One of the most glaring needs in underserved areas is the presence of a provider with pediatric trauma expertise. Regrettably, 42% of practicing pediatric surgeons don't take care of trauma patients at all[6]. They have the skill set, but many do not have the desire or resources to care for injured children[6].

5. **Pediatric surgical sub-specialization is commonly undertaken at the wrong time. Other barriers result in few pediatric surgeons entering formal additional subspecialty training programs.** There is no efficient pathway for pediatric surgeons to expand their expertise. An increasing number of surgeons are subspecializing to meet the needs of the most complex patients. When and how this is done remains haphazard and often counterintuitive. Many sub-specialty fellowships are filled by general surgery residents who have not yet matched let alone entered their pediatric surgery specialty fellowship; they lack training in the core principles of pediatric surgery. If these surgeons do not subsequently match in an approved pediatric fellowship, their subspecialty training may be wasted time, because they will not be able to use it in what will likely be a non-pediatric surgical practice. For those who must complete additional training after pediatric surgery fellowship in order to meet subspecialty-training requirements, successful matching into these programs and the additional length of training are formidable barriers. Positions for these highly trained individuals are scarce. The overall effect is that other subspecialties have become providers of pediatric specialty care, as exemplified by the workforce in transplant surgery.

Recommendations:

1. **Training and ongoing certification in pediatric surgery require careful study by those organizations that are most able to effect changes.** These changes must continue to promote the excellence in training and certification of the pediatric surgeon of the future. This may require strategies that are difficult to conceive and implement, and may ultimately include more than one training model, but eventually will prove to be in the best interests of the populace that we serve. We need to redefine what it is to be a pediatric surgeon, considering three categories: *basic, fundamental and advanced* pediatric surgeons. The Workforce and Practice committees should define the positions to fill these categories.
    - Every child should have nearby access to *basic* pediatric surgical expertise (including the initial resuscitation and stabilization of all children and the management of straightforward disorders and injuries). This *basic* category includes two of Dr. Fallat's proposed positions: an acute care pediatric surgeon to include trauma expertise, and a general surgeon with some pediatric expertise.
    - Those children who require it should have manageable access to *fundamental* pediatric surgical expertise (to additionally include the management of more complex disorders such as congenital anomalies, cancer and those requiring critical care). This *fundamental* category includes Dr. Fallat's third position: the traditionally-trained pediatric surgeon.
    - Those few children who require it should have access to *advanced* subspecialized pediatric surgical expertise, such as with the treatment of Stage IV neuroblastoma or cloacal exstrophy. This *advanced* category was not previously described by Dr. Fallat. It is being proposed to offset the diluted experience in the workforce associated with rare, complex conditions. A specific strategy to implement this

recommendation may be as simple as inclusion of a senior partner. On the other hand, transfer to a more specialized center may be necessary. At the present time, both strategies occur daily throughout parts of the country. Other innovative solutions should be discussed and considered.

The APSA Education Committee should work with the ABS and Fellowship Council, a body that accredits programs outside of the ACGME, to determine what is required to certify surgeons in each of the defined categories, who should do it and then determine how. APSA should create memberships categories to foster relationships with those who might train outside of a traditional pediatric surgery fellowship in order to establish and support educational opportunities for each of the defined surgical categories.

2. **Pediatric surgeons should be the propelling force behind the creation of the curriculum and training involved in any training model and these models will ideally be incorporated into the framework of existing residency and fellowship training.** Finishing 5th year general surgery residents do not have the same breadth of experience in pediatric surgery as their predecessors[45]. An increase in the time spent on pediatric surgery is recommended during more senior years of training by those who will incorporate some children's care into their practice. An integrated 4/3 residency program is one solution and will be piloted in the near future. Experience with early specialization in Cardiac and Vascular Surgery have been associated with increased ABS Board Examination passage rates compared to the more traditional "5 plus 2" training. A third year in pediatric surgical training would allow more time for exposure and instruction in critical care, trauma and oncology, the domains currently most challenging for fellowship graduates on their board exams. Other recommended educational initiatives include the increased use of Flexibility in Surgical Training (FIST) as already approved by the ABS. This allows trainees and program directors to tailor residencies to accommodate those interested in specific areas of surgery.

Flexibility in training will be a key initiative and opportunity as more of our trainees come from the millennial generation and have greater needs for personalized attention and training regimens[47]. In addition, the use of structured processes to increase autonomy, such as the Zwisch App[48] , the SIMPL App[49], the Competency-Based Training championed by the University of Michigan or structured operative autonomy used at the Massachusetts General Hospital[50] are promising approaches. Promoting the role of the teaching assistant should be encouraged as well as the use of realistic simulators to enable trainees to perform "deliberate practice" on the most difficult parts of complex operations, as championed by Dr. Hirschl[51]. Surgical trainees participating in simulation-based education have already been shown to demonstrate improvements in operative time, technical skills and patient-centered outcomes[36,52-58].

3. **APSA should continue to support the work of the ACS-CVS to optimize the hospital infrastructure component of the environment of children's surgical practice, study its return on investment, and help guide centers achieve this goal.** This will increase the reach of the capability and capacity for children's surgical care.
4. **APSA should begin to study and provide guidance on which children could be cared for in rural and underserved environments, help define scope of practice to meet the need, and recommend/develop the curriculum and educational process to meet this need. APSA should likewise help define those children who need to be referred and to develop the network of care that facilitates this.**
5. **APSA should work with the American Academy of Pediatrics (AAP) and other surgical subspecialty organizations with the goal of engaging our surgical and anesthesia counterparts in a similar gap analysis of their workforce in rural and underserved areas. APSA should encourage a communal effort in improving access to care, training, and networking along the continuum.**

6. **There should be more focused training of general and rural surgeons to perform basic (non-index) pediatric surgery cases and care for pediatric trauma patients where pediatric surgeons are not practicing.** Potential avenues to impart this training include additional pediatric surgery rotational experience at a senior resident level as part of current ACGME-approved rural general surgery or general surgery residency programs, the American College of Surgeons (ACS) Mastery of Surgery Program, and working with the American Association for the Surgery of Trauma (AAST) to incorporate more pediatric exposure in the existing Acute Care Surgery fellowship. New models of training are also possible and might include combining one year of pediatric critical care or trauma training with one year of pediatric general surgery training to create an "Acute Care Pediatric Surgeon". These various levels of training must necessarily be linked in the future to scope of practice and credentialing at a local level to avoid professional creep beyond training[7].
7. **The incorporation of additional pediatric trauma training into courses, such as the Rural Trauma Team Development Course (RTTDC)[59,60], could be explored with the American College of Surgeons or APSA could develop its own rural pediatric trauma course.**
8. **There should be enhanced effort to develop remote based education and patient consultations using telehealth services.** The Project ECHO model, as adapted by the University of Wisconsin, is an example of telehealth services with the potential to extend the reach of tertiary subspecialty surgical and trauma care for children in rural and underserved areas[43]. Telemedicine can be used for education, protocol sharing and administrative oversight[43] as well as for home management of surgical conditions[61,62]. Telemedicine support has reduced the need to transfer up to 85% of potential patients and shortened the time to definitive transfer of more critical patients[63.64]. Improved ICU outcomes with decreased mortality and shorter length of stay

were reported following telemedicine neonatal and pediatric ICU support[65,66]. Teleradiology has been shown to decrease repeat imaging, cost, delays in care and radiation exposure[67].

9. **Although these resources are described in the context of the United States, the principles are applicable to meeting global pediatric surgery needs, including in the military.**

Conclusions

The workforce blueprint in pediatric surgery will require deliberate study and strategic reform to maintain the highest standards of care that are and always have been the hallmark of our specialty. The issues surrounding pediatric surgical training, sub-specialization and continuous certification are complex and involve multiple challenges and stakeholders, including the Association of Pediatric Surgery Training Program Directors, the Review Committee-Surgery, the ACGME, the Pediatric Surgery Board of the American Board of Surgery and APSA. These stakeholders have diverse responsibilities, agendas and priorities. In order to move forward with the recommendations outlined in this white paper, APSA should sponsor a Pediatric Surgery Summit comprised of leaders from each of the major stakeholders (Review Committee-Surgery, American Board of Surgery, Association of Pediatric Surgery Training Program Directors, Section of Surgery American Academy of Pediatrics, APSA Workforce and Practice Committees, American Society of Program Directors, ACS Advisory Council for Pediatric Surgery and other key specialties, such as Pediatric Anesthesia) with the purpose of discussing how best to fill the practice gaps in the surgical care of children. This meeting is urgently needed with the requisite momentum and decisional authority to positively impact the future of children's surgical care.

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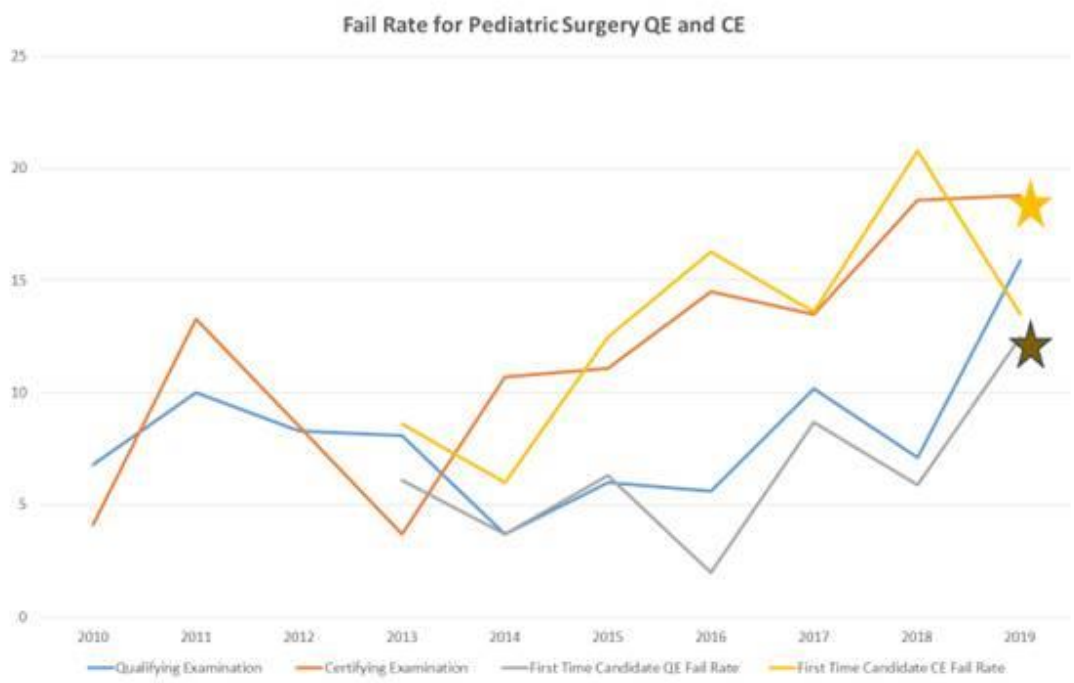
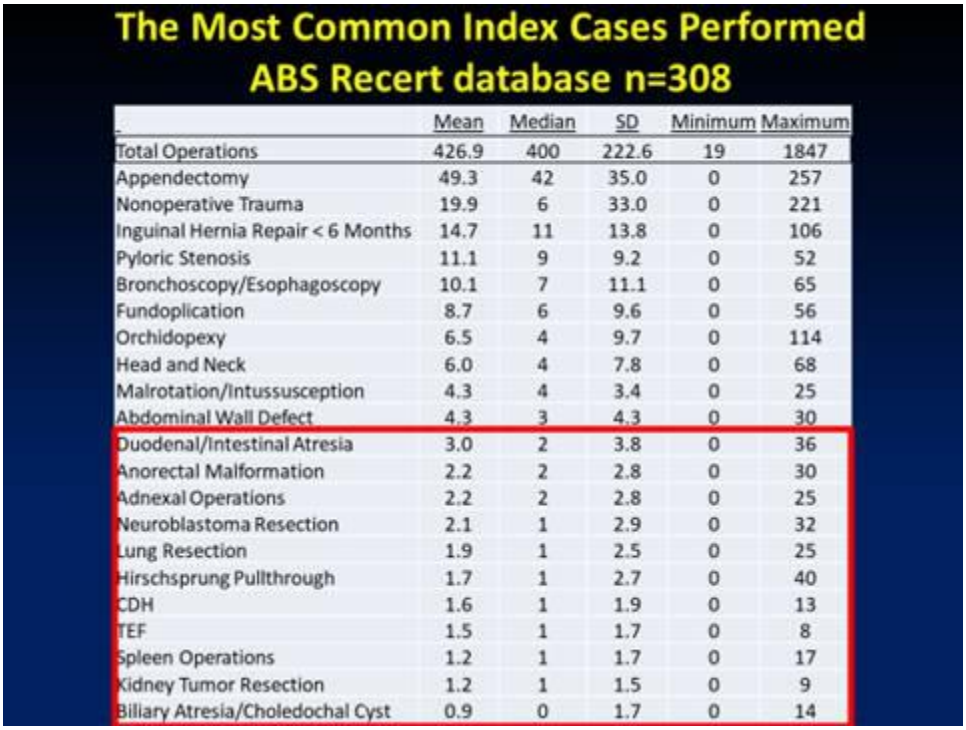


Figure 1. Failure rates for the ABS Pediatric Surgery Qualifying Examination (QE) and Certifying Examination (CE) from 2010 to 2019.



	Mean	Median	SD	Minimum	Maximum
Total Operations	426.9	400	222.6	19	1847
Appendectomy	49.3	42	35.0	0	257
Nonoperative Trauma	19.9	6	33.0	0	221
Inguinal Hernia Repair < 6 Months	14.7	11	13.8	0	106
Pyloric Stenosis	11.1	9	9.2	0	52
Bronchoscopy/Esophagoscopy	10.1	7	11.1	0	65
Fundoplication	8.7	6	9.6	0	56
Orchidopexy	6.5	4	9.7	0	114
Head and Neck	6.0	4	7.8	0	68
Malrotation/Intussusception	4.3	4	3.4	0	25
Abdominal Wall Defect	4.3	3	4.3	0	30
Duodenal/Intestinal Atresia	3.0	2	3.8	0	36
Anorectal Malformation	2.2	2	2.8	0	30
Adnexal Operations	2.2	2	2.8	0	25
Neuroblastoma Resection	2.1	1	2.9	0	32
Lung Resection	1.9	1	2.5	0	25
Hirschsprung Pullthrough	1.7	1	2.7	0	40
CDH	1.6	1	1.9	0	13
TEF	1.5	1	1.7	0	8
Spleen Operations	1.2	1	1.7	0	17
Kidney Tumor Resection	1.2	1	1.5	0	9
Biliary Atresia/Choledochal Cyst	0.9	0	1.7	0	14

Figure 2. Pediatric Surgery Board key operative cases from 2009 to 2013 as reported by practicing pediatric surgeons on applications for the ABS Recertifying Examination in Pediatric Surgery.