

Pediatric Surgical Training: An Historic Perspective, a Formula for Change

By Moritz M. Ziegler
Denver, Colorado

Background/Purpose: American pediatric surgical education has more than a 65-year history of formalizing the organization and the curriculum of the training process. However, never before have so many simultaneous internal and external forces appeared on the horizon that have the collective potential of influencing the quality of future pediatric surgeons. It is the purpose of this study to identify and detail these opportunities, compare them with the historical past, and propose the beginnings of a strategy to control the destiny. The ultimate goal should be to continue to assure that pediatric surgeons are of the highest attainable quality that will optimize the surgical health of America's children.

Methods and Results: Using a current literature review, 7 specific influencing forces have been identified: a declining applicant pool, the generation-X factor, medical economics, early specialization of training, restricted residency work

hours, pediatric surgical manpower, and competency-based surgical education. An effective response to these forces is multifactorial, but a first need might be consideration of a new educational oversight organizational structure for pediatric surgery. Thereafter, specific curricular reform is needed to match the strengths of the candidates as well as the training programs. Finally, as a specialty field we must assert the leadership needed to define optimal educational outcomes.

Conclusions: This report defines the educational history and the contemporary influencing forces, and it proposes a strategy to assure that pediatric surgical education exceeds the needs of America's children into the future.

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"It is our very success that requires us to change!"

—Toyota Automobile Company of Japan

PEDIATRIC SURGERY as a specialty has come of age. We have more than a 75-year American history of defining pediatric surgery as a specialty, and the last 65 years have formalized education and training curricula. There has been oversight of our resident training provided by the Association of Pediatric Surgery Training Program Directors (APSTPD). Board certification and recertification as an assessment of continued competence along with a formal In-Training Examination process are products of a very close working relationship between pediatric surgery and the American Board of Surgery (ABS) and the new Pediatric Surgery Board of the ABS (the PSB-ABS). There are national organizations and their annual meetings (most importantly the American Pediatric Surgical Association [APSA], the American Academy of Pediatrics' Surgical Section [AAP-SS], and the American College of Surgeons' Clinical Congress [ACS]), textbooks, specialty journals, and electronic media to disseminate new information and foster continuing education. There have been remarkable discoveries in both clinical and basic research that have further advanced our fund of knowledge. Individual pediatric surgeons have achieved scholarly recognition with their election to the Institute of Medicine, their selection to lead surgical departments,

and their election to leadership positions in or recognition by prestigious surgical organizations such as the Association for Academic Surgery, the Society of University Surgeons, the American Surgical Association, the Residency Review Committee of Surgery (RRC), and the ABS. These educational achievements along with an understanding of our pediatric surgical manpower requirements have placed our specialty in an enviable position. Most importantly, pediatric surgeons have achieved recognition, respect, and collegiality with our peers in both pediatrics and surgery.

Because of these apparent successes, there is a prevailing level of comfort among many pediatric surgeons that fosters the premise that "if our specialty isn't broken, why fix it." In contrast, there are others among us who speak to the certain doom of American surgery, includ-

From The Children's Hospital, Denver, Denver, CO.

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Address reprint requests to Moritz M. Ziegler, MD, Surgeon-in-Chief, The Children's Hospital, Denver, 1056 East 19th Ave, B-323, Denver, CO 80218-1088.

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ing pediatric surgery. We often place medical economics—the uninsured, declining reimbursement, increased bureaucratic business requirements, escalating costs of pharmaceuticals, and technology—at the heart of this storm. Though such issues are of critical importance, a more fundamental concern for the future of pediatric surgery may instead be education! This subject has attracted great concern and a great volume of literature from our colleagues in general medicine and surgery.^{1,2} In contrast, little has been written about the education of the pediatric surgical trainee. Furthermore, we currently lack a longitudinal record that could detail the outcomes of our training process, a record that could answer with objective data the subjective assertion that we continue to train the highest quality personnel. We should all share a concern as to how we stimulate the best and brightest to pursue our specialty. How do we train pediatric surgeons; how do we assure that our “product” meets the needs of our patients and their families in clinical competence, education, research, and advocacy skills; and, perhaps most critically, how do we assure the continued optimization of the health of America’s children? Achieving such lofty and idealistic goals seems readily attainable; yet, standing in the way are a series of powerful forces that must be addressed. These include a declining applicant pool for medicine in general but general surgery in particular (with a secondary impact on pediatric surgery); a proposed early specialization option that would reduce the length of training in general surgery by at least a year; a defined limitation of work hours by house officers in training that has the potential to limit core knowledge and operative case volumes; the current “Generation X” persona disconnect from what has historically been held as the traits of a surgeon; conflicting interpretations of current pediatric surgical manpower needs; the need for competency-based training and the continued assessment of the competence of the practicing pediatric surgeon; and the need for our field to train individuals not only competent in clinical care but those that will lead educational as well as clinical and basic research programs.

This report reviews briefly “where we have been,” the history of American pediatric surgical training. It then defines “where are we today,” outlining candidate selection and the current training curriculum. Finally, and most importantly, this report outlines “where are we going,” detailing the internal and external forces that might have a profound contemporary effect on pediatric surgical education and training. The optimal education and training direction for our future is difficult to define. A new stratified training curriculum and a new organizational hierarchy for pediatric surgical education may be one hypothesis to test. It is my intent to convey urgency to the need to systematically address these

issues. This will assure an outcome that will allow pediatric surgery to dictate its future rather than be forced to react to a direction imposed by others who are less invested in the health and welfare of America’s children.

Where Have We Been?

AN ABBREVIATED HISTORY OF PEDIATRIC SURGICAL TRAINING

At the beginning of the 20th century, the Halstedian structured method of surgical training was being adopted nationwide.³ This method defined a fixed period of time for training, it provided a structured educational content, it assured actual patient experience with an escalating responsibility for patient care both in the operating room and at the bedside, and it recommended a period of supervised practice after the completion of formal training. Competency assessment was the responsibility of the training director. Products of such a training experience included the founding fathers of pediatric surgery, namely, William E. Ladd, Herbert E. Coe, and Oswald S. Wyatt. It was Ladd, appointed as Surgeon-in-Chief, Children’s Hospital Boston in 1927, who 10 years later began the first formal training program for pediatric surgeons. In the 8 years that followed before his retirement in 1945, Ladd trained such notable pediatric surgeons as Gross, Lozoya-Solis, Swenson, and Bill. Perhaps Ladd’s training of Robert E. Gross was his greatest educational legacy, because it was Gross, who over the next 23 years, trained 69 pediatric surgeons, many of whom founded training programs in medical centers throughout the United States. Gross defined the format of training to be a 3-year pyramid for residents with previous training. To assure continuity, Gross staggered the start of the residents that included a first-year junior residency, a second-year senior residency, and a following year as chief resident. The senior residents progressed through a 2-year program of 6-month rotations on general surgery, outpatient and emergency department, plastic surgery, and cardiac surgery. Judah Folkman succeeded Gross in 1968 and implemented the then more conventional 2-year curriculum.⁴

After the “Boston School” of Ladd and Gross had disseminated pediatric surgical leaders throughout America’s university and children’s hospitals, the opportunity for additional training programs, around 1950, became “self-declared.” They were approved by the Conference Committee on Graduate Training in Surgery, sponsored jointly by the American Medical Association (AMA) and the ABS. Over the next 30 years, this review group underwent changes in both name and constituency: Conference Committee on Graduate Education in Surgery (1950), Liason Committee on Graduate Medical

Education (1974), and the Accreditation Council on Graduate Medical Education (ACGME) in 1981, the latter which sponsored the RRC.⁴ The early training programs varied in both length (from 1 to 4 years) and in training emphasis (on neonatal surgery, urology, and cardiac surgery). In 1952, Herbert E. Coe, Chairman of the Surgical Section, AAP, appointed a Review Committee to oversee the approved programs. In 1966, the AAP published a booklet listing 18 United States and 2 Canadian “fellowships” plus 17 United States and 4 Canadian “residency” positions in pediatric surgery. A Surgical Section Committee on Postgraduate Education and Residency Training was appointed to develop standards, and H. William Clatworthy, Jr was appointed committee chairman. In 1967, this committee published the “Special Requirements for Training in General Pediatric Surgery,” and after study by the American Board of Medical Specialties, a revised “Essentials” was formatted and sent on to the AMA’s Council on Medical Education. By 1970, the “Clatworthy Committee” had completed 25 program site surveys, and they recommended approval of 12 United States programs, provisional approval of 4 Canadian training programs, and nonapproval of 8 programs; 1 program was “tabled.” Over the next 2 years, the Committee integrated the concept of “index cases” into the training curriculum, and a new document entitled “Special Requirements for Training in General Pediatric Surgery” was written.⁴

With the founding of APSA, the Education Committee of the new organization assumed residency program oversight chaired by Judson Randolph. This committee, through 1977, continued to provide training program evaluation and recommended approval. However, after the first examination to award the “Certificate of Special Competence in Pediatric Surgery” from the ABS, there was a lack of clarity between the roles of the ABS and RRC regarding the process of training program approval. Therefore, in 1976, the ACGME issued an invitation to training directors of the existing programs to reapply for approval. By 1977, the RRC assumed control of the approval process, it developed the “Essentials” to be met to gain approval, and the approved programs were reported in the Directory of Graduate Medical Education published by the AMA. Figure 1 depicts the growth in the numbers of approved US training programs in pediatric surgery over the last 25 years. An additional 6 Canadian training programs are currently approved.

Also in the mid-1970s, the selection process for trainees in pediatric surgery moved from the apprentice model of random interviews and selection to a formalized matching process organized within pediatric surgery by the APSA Education Committee.⁵ In the early 1980s the APSTPD was founded to develop a structured training curriculum for pediatric surgical trainees as well as to

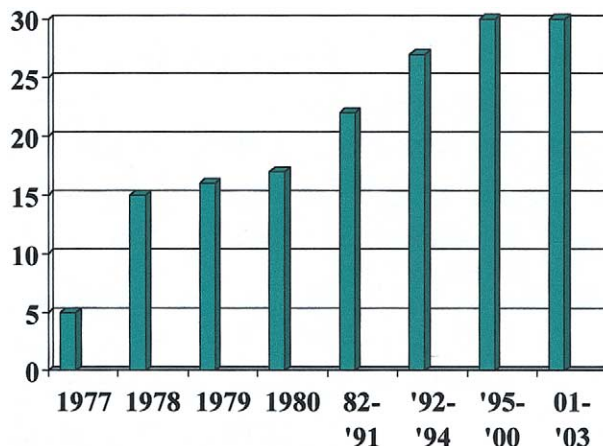


Fig 1. Growth of the number of pediatric surgery training programs in the United States. In addition to the 30 American programs in 2003, there are 6 approved Canadian programs.

oversee the selection process. Under the leadership of J.L. Grosfeld and D.R. Cooney, this group was incorporated in 1989, and, in 1992, it turned over the matching function to the National Resident Matching Program (NRMP). In the last 10 years this Association has continued to refine the training program curriculum, quantifying preferred minimal case types for trainees, and with the ABS, it has participated in developing a standardized in-training examination for pediatric surgical residents. The APSTPD also began a close liaison with the PSB-ABS in 2000, when the latter defined more clearly its own role in the process of qualification, certification, recertification, and continued competency assessment of pediatric surgeons.

Where Are We Now?

PEDIATRIC SURGICAL TRAINING: THE CURRENT STATE

The Candidates

The pediatric surgical trainee match has been under the control of NRMP since 1992. There has been broad participation by the approved training programs, but there has also been a persistent practice of “opting out” of the match process in any given year by 1 or more programs. This latter program behavior has many apparent honorable justifications, most commonly reflecting a program’s commitment to an internal candidate, thus declaring that other candidates need not apply nor visit, sparing them unnecessary expense. Comprehensive data analyzing the pediatric surgical match has not been published since the match was placed under the aegis of the NRMP.^{6,7} Participating programs in the past have received reports that are designed to protect the anonymity of the other training programs but that identify their own matched candidate along with an analysis of the

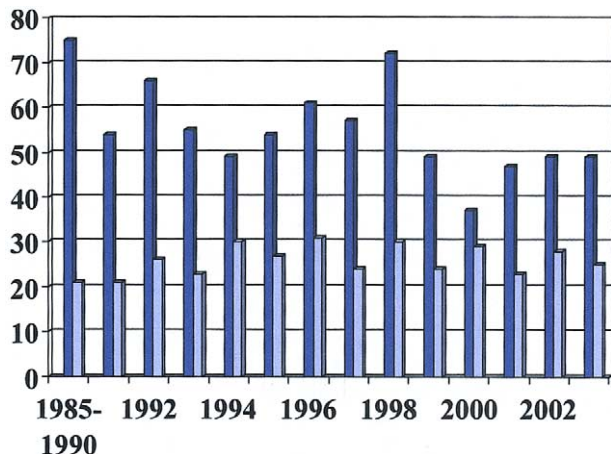


Fig 2. Number of training programs and the number of applicants for training positions in pediatric surgery participating in the matching process, 1985-2003. Data from 1992-2003 courtesy of the National Residency Matching Program. Dark bars, applicant no.; light bars, matched.

candidate pool's assessment of the program in terms of how many ranked it first, second, and third. Several observations can be made. The gender of the pediatric surgical resident applicant replicates the approximately 20% of women that currently constitute general surgery resident positions. The success of men and women in the pediatric surgical match has not been studied. Data depicting the rank success of programs suggests that many match their first choice candidate; however, several of the programs "match down" on their rank lists, matching a candidate never lower than 10th on their rank selection list. In the end, the success of a US program to match a candidate has remained at 100%. The data depicting the match success of the candidates is more striking. Although most candidates match to one of their top 5 choices, each year there have been candidates who have matched as low as their 20th choice. This suggests that there may be a consensus among candidates as to program stratification into a top, middle, and less desirable group by criteria that remain undefined, and the collective rank lists are so structured. When the top and middle group programs are filled, "matching down" occurs to the less desired programs. Figure 2 depicts the match success of candidates over the 12 years of the NRMP match process. The variation is influenced annually by the overall trend for fewer applicants against a background of variable numbers of programs participating in the match, both because of the "opting out" behavior and, more importantly, by the cycle of programs approved for 1 resident each year and those approved for 1 every 2 years.

Candidate selection criteria have been analyzed in the past,^{6,7} but these survey studies are dated and were not done in a prospective fashion in which longitudinal

outcomes-based follow-up was done. Objective assessment criteria of candidates are listed on their common application and include educational and training institutions, scholarly performance, board scores and ABSITE performance, and a listing of awards that may recognize educational or research productivity or acumen. An almost universal feature of the applicant pool over the last 10 to 20 years is the extra-added value trait, that is, a 1 to 3-year interval of extra training. Typically, this has come during their general surgery residency, and most often it has been in the arena of bench research, less frequently clinical research, and still less frequently as a unique clinical experience such as trauma, surgical critical care, transplantation, or advanced minimally invasive surgery, among others. These experiences and their resultant scholarly activity have proved to be a candidate attribute that has been associated with matching success.^{6,7} However, what is less clear is whether this added training contributes to the scholarly development of the candidate once their pediatric surgical training is complete. Finally, there is the mandatory, but most subjective of the analytical methods, namely, the personal interview. No program has negated this step, and the only variable has been the individual versus the group interview process. This latter very popular concept has been designed to assure faculty availability on the day that candidates visit, to often take advantage of weekend travel rates, to coordinate a regional interview process with other nearby programs, and in selected circumstances to permit group hotel rates or even host program housing payment to further minimize candidate expense.

The Training Curriculum

The RRC for surgery has standardized approval criteria for training programs in pediatric surgery, and of today's 30 approved programs in the United States, 25 are approved to train a new resident for a 2-year time interval each year, whereas the remaining 5 select a new resident every other year. The curriculum includes a minimum case volume of 900 cases done by the general pediatric surgical service annually.⁸ Further volume stratification requires that the chief resident experience should be broad and varied and that the resident should be responsible for at least 250 pediatric surgical operations under supervision during that year. Specific preferred "index case volumes" have been defined by the APSTPD. They serve as guidelines only, and the RRC for surgery neither specifically defines these numbers nor does it strictly enforce compliance based solely on such quantitative criteria. In Marc Rowe's 1999 APSA presidential address, his analysis showed a striking variability in resident operative case experience across training programs. There was as much as a 100% case volume difference across the training programs, and the data also

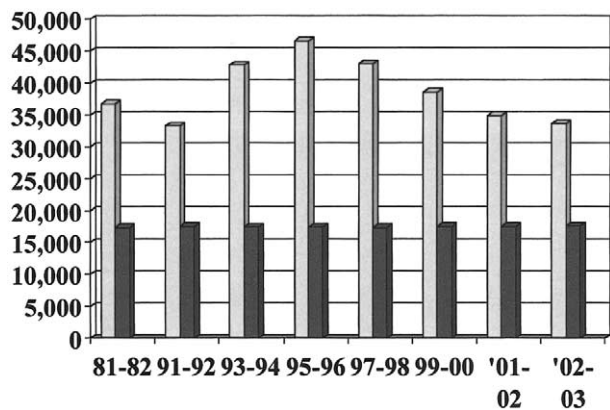


Fig 3. Medical school total applicants and the numbers that were accepted 1981 through 1982 and 1991 through 2003. Light bars, total; dark bars, accepted. Data adapted from Barzansky B, Etzel SI: Educational programs in U.S. medical schools, 2002-2003. JAMA 290: 1190-1196, 2003.

included the fact that some residents had completed their training having done only 1 or even none of selected index case types that conventionally have defined our field (Rowe MI, unpublished data). Programs are also expected to define mechanisms of graded responsibility for its trainees, assure faculty supervision and physical presence; assure longitudinal diagnosis, treatment, and follow-up of the cared-for patient population; and include a curriculum of didactic training conferences that teach tumor management, general pediatric surgery, and a core curriculum of basic science relevant to our discipline.⁸

This time- and volume-driven curriculum has not to date used competency-based advancement in a formalized fashion except for an assessment of the fund of knowledge analyzed by resident participation in the annual In-Training Examination for Pediatric Surgery, an examination developed under the umbrella of the PSB-ABS. This examination assesses core knowledge, and each candidate and program receives a report that details specific question category deficiencies to facilitate subsequent self-study. Candidates are analyzed by training year, and their respective performance scores are compared with their national peer group. There is no other

Table 1. Categorical General Surgical Match

Match Year	Available Positions	Total Matched	Percent Success	US Seniors Matched	Percent Success
1997	1,009	1,003	99.4%	883	87.5
1998	1,024	1,000	97.7%	853	83.3
1999	1,009	971	96.2%	840	83.2
2000	1,023	1,008	98.5%	874	85.4
2001	1,041	973	93.5%	820	78.8
2002	1,039	981	94.4%	782	75.3
2003	1,049	1,038	99.0%	867	82.7

NOTE. Data adapted from NRMP match statistics from www.NRMP.org

competency-based assessment in use that determines advancement in, or completion of, a given training program. After 2 years and successful completion, a candidate will submit a case list, cosigned by the training program director, to the ABS for eligibility consideration for the Qualifying Examination in Pediatric Surgery, an assessment currently offered on an every-2-year cycle. Once successfully completed, the candidate becomes eligible for the Certifying Examination. Recertification currently is required every 10 years; pediatric surgery was among the first specialties to issue time-limited certificates.

Where Are We Going?

THE IMPACTING FORCES

The Applicant Pool

Recent published and unpublished data describe a declining applicant pool for medical school (Fig 3) as well as for trainees in both general surgery (Table 1) and pediatric surgery (Fig 2). The decline in the appeal of a surgical career for medical students has been striking. Twenty years ago, 12.5% of US medical school graduates chose a general surgical residency, a number that fell to 8% 10 years ago, 6% in 2001, 6% in 2003, and had been projected to fall to 4.8% in 2005.² Figure 4 illustrates the increase in unmatched categorical general surgery resident positions, a trend that apparently was reversed in the most recent 2003 match. There are many who project that this turn around is a benefit of resident work hour limitations, and, as such, it represents a trend reversal that will be sustained for many years to come. However, the even more striking increase in non-US medical student graduates who are filling general surgical residency positions has continued.⁹

The interpretation of these data for pediatric surgery

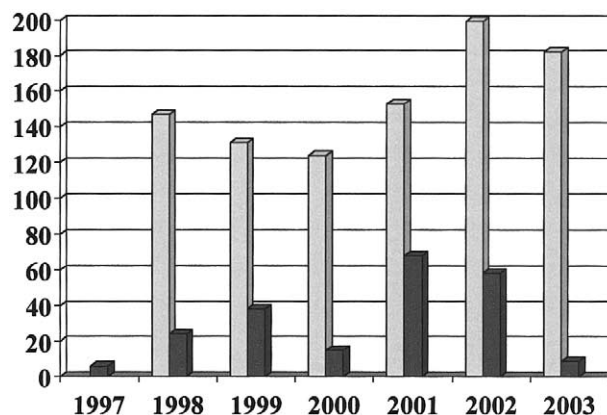


Fig 4. Unfilled categorical general surgery residency positions. The graph depicts those that were unfilled (dark bars) and those that were filled by non-US-trained medical students (light bars). Data adapted from the Report of the NRMP Matching Plan, 1997-2003, www.NRMP.org.

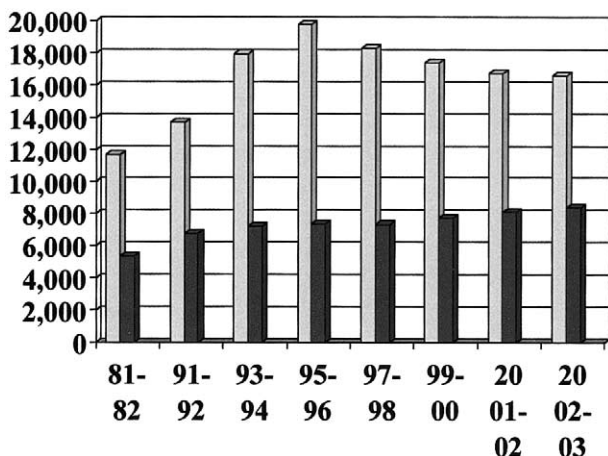


Fig 5. Total women applicants (light bars) and those in the entering medical school class (dark bars), 1981 through 1982 and 1991 through 2003. Data adapted from Barzansky B, Etzel SI: Educational programs in U.S. medical schools, 2002-2003. *JAMA* 290: 1190-1196, 2003.

reveals that since 1999, there have been only 2 applicants for every matched position compared with as many as 3 in the era before that time. Importantly, there remains an impression among the majority of training program directors that the quality of these fewer applicants remains very high. However, the declining applicant numbers coupled with the expanded number of training opportunities (Fig 1), suggests that it is possible that individuals selected for training today may not have qualified for selection by the process in place a decade ago. An alternate hypothesis suggests that qualified candidates in the past were turned away from pediatric surgical training. These facts beg the difficult and discomfiting question of whether we are training the best and the brightest. Fortunately, there are published data addressing this question in the field of general surgery,^{10,11} although there are no studies that have addressed this question for pediatric surgery. The data report that general surgical applicants have maintained their scholarly potential, but there has been a decided trend for programs to go deeper into their matching lists to fill their categorical general surgery positions, an observation that may be true for the pediatric surgical match as well.⁹ It does not require much foresight to recognize that a potential shortage of general surgeons in the next 10 to 20 years will have a trickle-down impact on pediatric surgery. Figure 2 shows the fewer applicants for pediatric surgery over the last 5 years. This decline precedes by almost a decade the putative impact that fewer numbers of matched categorical general surgery positions will be expected to have on both the pool of graduating general surgeons and those eligible for specialty training beginning in 2005. Therefore, if the more favorable general surgery match outcome of 2003 is not sustained, it is not

inconceivable that soon there may be unfilled pediatric surgical training program positions, unused pediatric surgical operating room time owing to a lack of surgeons and not anesthesiologists or nurses, and an underserved population of children with surgical illness.

Recent data have also shown that almost 50% of graduates of American medical schools are women (Fig 5); yet, general surgery is not attracting comparable proportions, where women approximate 20% of current general surgery residents. Figure 6 summarizes data that depict the gender distribution of applicants in pediatric surgery in the last 4 years as well as the gender distribution of members of APSA and the APSTPD. These data are subject to varying interpretations. Pediatric surgery applicants reflect the approximately 20% of women finishing annually in general surgery, and the APSA membership demographic should “catch-up” to this percentage over the next several decades. However, the greater problem seems to be how to first attract women to a career in surgery, how to afford them opportunities for career growth and advancement, and how to include them in faculty or practice positions in which they can mentor future trainees. To assure such progress will require a strategy for both the recognition and diffusion of obstacles that currently stand in the way of such a change.^{12,13}

The Generation-X Factor

An American cultural revolution also influences our current medical students and surgical trainees. Surgeons of past generations frequently possessed a variety of common attributes. As an example, the Web page of the ACS lists a line item entitled “So You Want to be a Surgeon” where the following “surgical” characteristics

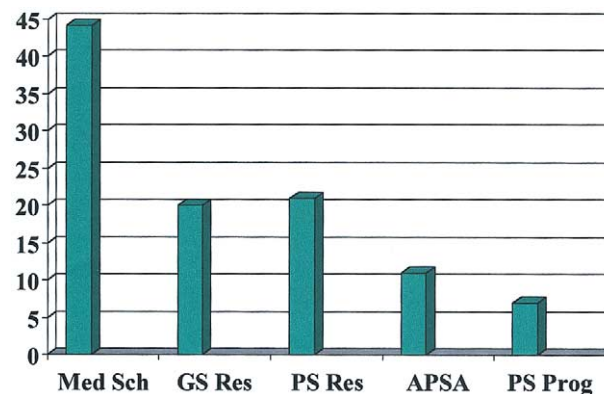


Fig 6. Approximate percentages of women graduates of US medical schools, residencies in general surgery, and residencies in pediatric surgery. Percentages also depict the current women membership of the American Pediatric Surgical Association and the Pediatric Surgery Training Program Directors in the United States (there are no women program directors among the 6 approved Canadian training programs).

are listed: “conservative, committed to total access and availability to patients, never a part-time doctor, intellectually results-oriented problem solvers, an ability to make decisions with incomplete data, impatience, less contemplative, flexibility in regards to the unexpected and inconvenient, and good to excellent manual spatial orientation.”¹⁴ Surgeons often have been described as individualistic, and despite the requirement for absolute team play in an operating room, the surgical analogy in athletics is that surgeons are baseball players, not basketball players. Furthermore, when surgeons are assembled to address a common mission or task, leading surgeons is akin to “herding cats.”

Whether these attributes influence why medical students select surgery as a career choice is speculative, and there are limited data that have been reported.¹⁶⁻¹⁷

Interestingly, lifestyle, time commitment, call schedules, and length of residency were characteristics that did not appear to discourage those considering a career in surgery. However, in contrast, positive reinforcement and motivation to pursue surgery occurred from both surgical role models as well as perceived career and academic opportunities. These motivating traits may be consistent with so-called “generation-X” individuals born between 1961 and 1981 who at least for the next 1 1/2 decades will represent our applicant pool in pediatric surgery no matter how our training curriculum is structured.¹⁸ Such individuals experienced a vastly changing society in their formative years that included parents working outside of the home, many 2-profession parents, many single-parent families, and a resultant “latch-key kid” experience. Families were more mobile; parental job security was less; and, economically, society was burdened with soaring debt and more limited economic prospects. To be sure, this generation has a work ethic and value system that differs from previous generations, particularly from those of the baby boomer generation. A variety of seemingly negative or at least unique behavioral attributes have been ascribed to this generation: self-absorbed and self-oriented; materialistic; slow to commit to long-term relationships; lacking basic skills in reading, mathematics, and communication; cynical and pessimistic; and possessed by an unrealistic expectation for the “quick fix.” These traits contrast with the salutary behaviors of independence, industriousness, resourcefulness, creativity, and decisiveness when problem solving. They also are flexible, adaptable and comfortable with change, voracious learners capable of parallel thinking and multitasking, and innovative risk takers, compatible with an entrepreneurial spirit. Generation-X individuals value fun and a balance of personal life and work. In short, generation-X individuals are empowered, technocompetent, self-directed, flexible, quick learners, and fearless when assessing their own abilities. Such traits in

part might explain why the same number of Harvard Medical School graduates in the 2001 class chose to pursue a career in general surgery as chose a career path in finance and consulting. It may also explain a surgical resident attrition rate that reportedly approaches 20%. Recognizing these distinctive traits is imperative, but how we structure appropriate and effective training for this generation may not optimally rest on past methodologies.

When specifically queried, medical students describe their concerns about surgical training to include a lack of autonomy, a brutal lifestyle, an unacceptable length of training, inadequate debt compensation mechanisms, and their perception that career financial compensation is modest, at best. They cite both a perceived lack of satisfaction by their surgical attending physicians and a related lack of surgical mentors or role models. They also list as a concern the intrusion on general surgery of other specialties including interventional radiology, interventional cardiology, and gastroenterology.¹⁵ Resident work hour limitation may address some of these concerns, but alone it is insufficient to address all of these issues.

Medical Economics

There are a variety of direct and indirect economic factors that influence the training of pediatric surgeons among which are federal funding for graduate medical education (GME), debt-service of our current and future trainees related to their university and medical school education, the distinction between training and service during the residency, faculty supervisory guidelines for resident training, malpractice premiums for faculty and trainees, and medical patient care reimbursement in general.

The first federal government support for resident training began with the 1983 DRG “adjustment factor” supplementation to teaching hospitals based on a resident-to-bed ratio. By the late 1990s, this resulted in a Medicare annual budget of more than \$6.8 billion dollars for direct and indirect medical education that translated into an average of \$76,000 per resident being awarded to teaching hospitals. An inequity arose in America’s free-standing Children’s Hospitals where little to no support for GME was received (about \$374 per resident when compared with the above \$76,000 per resident in a University Hospital) because few Medicare patients were cared for by such institutions. Yet, these hospitals were responsible for a majority of pediatric medical and surgical resident training. With lobbying and new legislation, the GME budget for independent Children’s Hospitals rose from \$2 million in 1999 to \$57 million in 2000, \$235 million in 2001, \$287 million in 2002, and a projected amount for 2003 in excess of \$300 million. However, because budget neutrality is mandated, this

windfall for children's hospital-based GME means that another aspect of training has lost a portion of its federal support. Furthermore, whether this level of support will continue into the future is speculative, and it will require ongoing vigilance and further legislation. At least the training program directors in the current 30 approved American pediatric surgical training programs, the majority of which are in such independent children's hospitals, now have the opportunity to justifiably argue for their portion of GME support for their pediatric surgical residents. This may alleviate some of the pressure imposed by the Health Care Finance Administration (HCFA) that had committed to funding resident trainees to either their first certificate or for 5 years, whichever is sooner.

Economic issues of critical importance that have not been satisfactorily addressed include the remarkable debt being faced by the majority of current medical school graduates, debt in excess of \$100,000 being the rule rather than the exception.² The median debt of medical school graduates has doubled in the last 15 years. The successful recruitment of students to residencies, or residents to their first post residency position, will depend in part on innovative scholarship, debt relief, or signing bonus packages that are designed to ease this substantial financial burden. Whether governmental relief will occur in the future remains speculative, but incentives might include debt relief in exchange for a period of national service in caring for the underserved. There currently is a debt relief opportunity for a selected group of individuals willing to commit to a federally funded research program.

Perhaps the greatest economic challenge facing those charged with training pediatric surgeons is the recognition that the declining clinical reimbursement dollar can no longer be used to support resident training. Reimbursement rates of \$0.40 or less on each dollar billed are inadequate to develop clinical, educational, and research programs and to recruit and retain a robust and diverse faculty that creates the optimal milieu for pediatric surgical training. The federal GME support noted above should facilitate resident salary support, but clinical and bench research programs and innovative educational programs are heavily dependent on extramural support from hospitals, industry, foundations, and the federal government. Multiple surgical organizations support residents and faculty in research. The Society of University Surgeons has endorsed a federally supported debt-relief program directed at young physicians pursuing research opportunities in academic medicine or surgery. The APSA Foundation has successfully accomplished such support by an annual competitive "pilot research" award to a junior faculty person. An analysis of this support suggests that these individuals have subsequently had

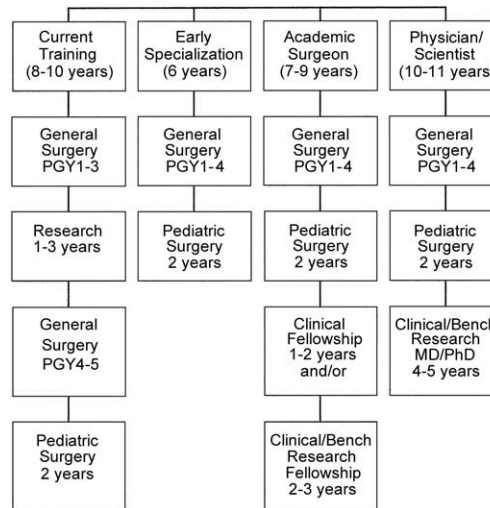


Fig 7. Pediatric surgery training paradigms. The figure depicts the current training paradigm with its characteristic period of research within general surgery residency training. Also shown is the theoretical early specialization program. Furthermore, if training programs are stratified to accommodate both their strengths and the strengths and wishes of the trainees, then 2 additional paradigms could be formally activated, namely, that for an academic surgeon and that for a surgeon physician/scientist.

great success in receiving federal extramural support. However, the size of such awards is small. A considerably enhanced future effort might take advantage of support such as the APSA–National Institutes of Health (NIH) grant for collaborative clinical research, or a new research fellow partnership with the NIH might be developed for pediatric surgery as has been done successfully in vascular surgery.

Early Specialization of Training

A series of striking data are the following: 93% of general surgery residents plan specialty residencies or fellowship training; 68% of such residents feel that 5 years of general surgery training is too much, and 71% of residents would be willing to short track their residency experience.¹⁹ Motivated by these factors as well as a perceived declining manpower in general surgery, a diluted case experience for general surgery trainees, and a strong push by several specialties—plastic surgery, cardiothoracic surgery, and vascular surgery—to limit length of “generalist” training in deference to specialty training, the ABS and a portion of the Association of Program Directors in Surgery (APDS) are recommending for implementation and study an early specialization training program. This new training paradigm—the 4-(1)-1 or 2 construct (Fig 7)—would include a 48-month postgraduate basic curriculum in general surgery where the PGY-4 resident would serve as chief-of-service, and the content of that year would be entirely the primary components of general surgery. This curriculum

proposal would require a radical curricular restructuring in the early years of training. It would eliminate the nonprimary components of urology, neurosurgery, otolaryngology, and orthopedic surgery, and it would propose that ACGME-approved program specialty training in a discipline already certified by the ABS would begin after the PGY-4 year. Furthermore, a PGY-5 year would be needed to complete general surgery training. Inherent in this model is the ability to count the first “specialty” year as a qualifier for the certification examination in general surgery. The timing of the qualifying and certifying examinations in general surgery would likely remain unchanged, although a proposal exists that would permit all surgical trainees to take the qualifying examination in general surgery at the end of the first 4 years of residency.

The modeling of contracted training for other surgical disciplines differs from these recommendations. Thoracic surgery is piloting a 3-year core and 3-year thoracic surgery curriculum for certification by the American Board of Thoracic Surgery (ABTS). Plastic surgery, under the aegis of the American Board of Plastic Surgery, continues to explore the 3-year core plus 3-year plastic surgery model in parallel with its historic training in which 2 years of plastic surgery residency follows traditional general surgery training.

Based on the criteria defined above, the participants in this contracted general surgery training might include pediatric surgery, vascular surgery, surgical critical care, and hand surgery. After further discussion, only vascular surgery will be the likely “test” specialty.

As one of the proposed pilot specialties, the response of pediatric surgery to this early specialization initiative had been measured at best. Of 25 training program directors responding to an initial informal poll, 2 indicated a willingness to participate in such a pilot, 2 indicated a willingness to explore the issue, and 21 expressed no interest in the initiative. Like their colleagues in surgical oncology and transplantation, the pediatric surgical training directors expressed a preference that general surgery trainees have a 5-year residency. In another published poll, 88% of pediatric surgery training program directors stated that they wanted their pediatric surgical residents to have such a 5-year training program.¹⁹ Another expressed concern was the requirement that the general surgery and pediatric surgery training be completed within the same university program so that curricular alterations could more likely satisfy core qualitative and quantitative requirements for each of the relevant board certificates. The impact of this requirement on the integrity of the matching plan has not been evaluated. It was projected that after a study trial, if early specialization proved successful, then future participating residents would not need their general surgery

and specialty residency to be restricted to the same university training program. The concept of a match for pediatric surgery could continue. After indicating an initial willingness to permit “volunteer programs” to participate in the pilot, the APSTPD recently reversed this position and instead filed a request with the ABS to withdraw pediatric surgical specialty training from this early specialization training paradigm trial, at least for the near future. Realistically, to measure the impact of this strategy for vascular surgery will require close outcomes monitoring over a 10- to 20-year interval.

Residency Work Hours

The issue of limiting residency work hours is very complex as witnessed by the multiple impacted groups with variable interests: federal and state governments, the consumer public, medical students, training directors, and the residents themselves. In addition to work hours, there are many additional cultural factors that have increased resident stress including the complexity of inpatient illness, the financial pressures on hospitals, departments and their faculty, shortages of nurses and a concomitant shift of even greater “scut work” to the resident and student, student/resident debt, and family and spousal obligations. The origin of limiting work hours began with the Libby Zion case in New York City in 1984 that culminated in the New York State Bell Commission Regulations of 1989 and the Health Reform Act of 2000.^{20,21} The 2000 Institute of Medicine report *To Err is Human: Building a Safer Health System* linked physician workload, work hours, and stress with patient safety, and it suggested that medical errors could be reduced if work hours were limited.²² In 2001, a petition was filed with the Occupational Safety and Health Administration (OSHA) calling for a national resident work hour limit modeled after those in New York State. Subsequently, federal legislation appeared in both 2001 and 2002, The Patient and Physician Safety and Protection Act, that described a similar model of work hour limitation with a defined mechanism for monitoring and whistle-blower protection. In response to these initiatives and in an effort to maintain control of physician training within the medical community, the ACGME guidelines on resident work hours were revealed in June 2002, and they were implemented with RRC oversight in July 2003.²³ In short, they restrict resident duty hours to no more than 80 hours in any week, duty not to exceed 24 consecutive hours, continuous duty in high-intensity settings not to exceed 12 hours, duty-free intervals between on-call periods to be at least 8 hours, and overnight, on-call duty frequency not to be more than 1 night in 3. The guidelines are to be applied with the flexibility that assures proper exchange of patient information during the “hand-off” process, and the guidelines in surgery

permit programs to petition for a 10% added weekly work-hour allotment if appropriate conditions can be met that assure resident rest or nonpatient activity. The RRC has recommended further guideline modification, requesting state Boards of Health to be flexible in regulating implementation. They recommend the separation of education from patient care service in which conference time would be subtracted from the 80-hour limitation, on-call sleep hours would likewise be subtracted, residents would be permitted to stay on the day after their call until 3:00 to 4:00 PM, and importantly, they pushed for an elimination of resident-performed menial tasks.²⁴

What data exist to support these recommendations? To date, the majority of the reports actually suggest that creating hand-off situations in hospital patient care reduces patient satisfaction and increases medical error. Operative technical errors may double after operating room case hand-offs to another resident.²⁵ The effects of more limited work hours on residency training has had limited study; however, there is evidence that such strategies improve the perceived quality of life of residents, and junior residents have achieved a significant increase in scores on in-training examinations.²⁶ The adverse impact of such regulations is a perceived negative impact on continuity of patient care. The data on operative case experience is conflicting: some reports have demonstrated case volume increases,²⁶ whereas other program directors project either no change or even a per resident case-volume experience decrease. If such latter projections hold true in pediatric surgery, it suggests that several "marginal volume" pediatric surgical training programs may no longer qualify to provide the minimum threshold case numbers for their pediatric surgical trainees. Fortunately, several prospective studies utilizing computerized resident self-reporting of data in general surgery will be collected after program implementation in July 2003. To date, no data have been published assessing this impact on pediatric surgery resident training.

Pediatric Surgical Manpower

There has been a rigorous and ongoing study of pediatric surgical manpower since the early 1970s.²⁷ The accumulated data have been utilized to project the need for pediatric surgeons based on the projected growth of the pediatric (0- to 15-year) population over the next 30 to 40 years. The trends in population growth through 2025 and the number of projected pediatric surgeons through 2020 have been calculated, depicting the potential number of trainees produced annually based on a varying number of training programs. Table 2 depicts projected data for the next 30 years, relating the annual growth of the 0- to 15-year population to the number of pediatric surgeons that vary with the annual number of

Table 2. Growth Rates—Pediatric Surgeons (PS) Versus the Population

Category	Growth Rate (% Per Year)
Population, 0-15 years	0.52
Training, 20 PS/yr	0.55
Training, 25 PS/yr	1.43
Training, 30 PS/yr	2.31
Training, 35 PS/yr	3.19

Adapted from O'Neill et al.²⁷

trainees produced. These current projections clearly demonstrate that growth in the numbers of pediatric surgeons is outdistancing population growth significantly, by as much as 3.5-fold.

There are many challenges to these data, not the least of which is the continued availability of multiple job opportunities in the field.^{28,29} The impact of disease control versus disease epidemic and new technology on such estimates is speculative. The definition of a clinical full-time equivalent (FTE) in an academic health center that includes education and bench and clinical research among its activities must differ from such a definition in a clinical practice situation. Data in general surgery suggest that a woman frequently accounts for less than one FTE, and, as more women enter pediatric surgery, this factor will also require study.¹⁰ Finally, the manpower data presume that all training programs will continue to fill their training positions, a reality that may be challenged if the number of general surgery trainees and pediatric surgical applicants were to decline.

Maintenance of Certification/Competency-Based Surgical Education

Stimulated by the need to assure patient safety as well as the continued competency of physicians nationwide, the American Board of Medical Specialties (ABMS) is developing its program to require all specialty boards to address the assessment of its physicians in 3 distinct areas: professional standing, lifelong learning and self-assessment, and cognitive assessment.³⁰ These were modifications of the original 6 competencies defined by the ACGME; namely, patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice.³¹ To assure professional standing, the certification and maintenance of certification process requires that a physician hold an unrestricted license to practice medicine in at least one jurisdiction in the United States, its territories, or Canada. Any restriction on a license for the licensure process shall impede the professional standing of that physician until the restriction is removed. Currently, this review as well as letters of recommendation from the Chief of Surgery and the

Chair of the Credentials Committee where the surgeon works is done as a part of the every 10 year recertification process. In the new proposed scheme of maintenance of certification (MOC), the frequency of this assessment would need to be accelerated to an every 2- to 3-year cycle.

Lifelong learning is intended to permit a physician to constantly expand and renew knowledge, skills, competence, and performance for the purpose of improving the quality of patient care. To date, this activity has fallen into the arena of Continuing Medical Education (CME) where typically 60 hours of category I CME have been required of the applicant in the 2-year interval before application for recertification. Each specialty has such a core set of competencies and content, and mechanisms must be developed to permit self-assessment and a comparison of such an evaluation against peer activity norms. An example in surgery would be to participate in the *Surgical Self-Assessment Program (SESAP)*, coupling the review of knowledge with the enclosed self-examination that can be scored to allow comparison with peer performance norms.³² In pediatric surgery this could be accomplished by the development of a de novo self-assessment examination process or by the potential accumulation of an appropriate collection of currently existing *SESAP* questions into a pediatric-specific examination. In addition, the PSB-ABS has developed a set of clinical self-assessment care guidelines for the diagnoses of appendicitis, esophageal atresia, and gastroschisis that would permit the pediatric surgeon to enter their own patient parameters and assess their personal outcomes relative to the performance of their peer group nationwide. Over time, these parameters could be expanded, or even rotated, to other disease entities that would allow a practicing surgeon to collect his or her own data and document continuing self-assessment and performance improvement in selected specialty-specific areas.

Cognitive assessment typically has been done in surgery and its specialties by the administration of an every 10-year secure recertification examination. Some additional nonsurgical boards have administered an open book or an at-home examination that could be applied every 2 to 3 years. The use of a *SESAP* process would again be useful. The completion of such a self-assessment tool along with its scoring and comparison of performance against a peer group norm would serve to qualify the candidate for as many as 60 category I CME hours, and it would assure a continued expansion of cognitive knowledge.³²

Competency-based training will be an expectation in the future, and such training will facilitate the entire MOC process. Importantly, early studies in procedural specialties have not only demonstrated the feasibility of such a training methodology, but they have also demon-

strated the potential to significantly shorten the training interval for some residents, although for others the training period may be prolonged.³ Most importantly, it becomes critical in such training to marry both procedural skills and knowledge in a program that assures the most appropriate care and outcome for each patient. What must be developed for pediatric surgery is a competency-based training curriculum along with an evaluative mechanism that will assure that each trainee will have achieved a specified level of competency before his or her training is considered complete.

CONCLUSION: A CALL FOR ACTION

Organizational Strategy

This essay has outlined multiple, simultaneous, and far-reaching forces, both internal and external, that will have a substantial impact on the very perpetuation of our specialty, namely, those who are selected, trained, and then practice, educate, or pursue new knowledge in pediatric surgery. It will be critically important that we develop an integrated and representative response that transcends any one organization or contingency in pediatric surgery. Persistent, bold, aggressive and proactive leadership that has characterized our past becomes a mandate, and the beneficiaries will not only be ourselves, but, importantly, will include our patients and their families.

Our educational opportunities are made more difficult because as a specialty we are small, and our educational organization is diffuse. Put in perspective, annually, there are approximately 15,000 US medical school graduates, 6,500 US and non-US foreign medical student graduates, 1,300 osteopaths, and 100 Canadians who account for the 23,000 physicians who enter the graduate medical education workforce.³³ Our 28 pediatric surgical graduates make up but 0.1% of that number. There are just over 1,000 PGY-1 categorical general surgical positions in 250 American training programs, and our 28 selected trainees make up but 2.8% of that group. These numbers may account for the feeling that we are being "pulled" into some of these changes rather than proactively responding to the challenge.

Currently, the educational activity within pediatric surgery has multiple defined and tacitly assumed origins. The Surgical Section, AAP provides CME for its members, a resident research award sponsored by the Jens Rosenkrantz Fund, interactive continuing medical education for other pediatric surgical specialists plus the pediatric primary care and specialty community, and sponsorship of the award that recognizes mentorship (Salzberg Award); it also serves as the host locale for the separate entity termed *the pediatric surgical resident's conference* (financially supported equally by the AAP,

APSA, APSTPD, and the host training program institution). The APSA annual meeting also provides CME credits, and its Education Committee has served to focus CME for pediatric surgeons as well as to define a curriculum for general surgery residents training in pediatric surgery. APSTPD has assumed the responsibility of defining a curriculum of case quality and quantity for pediatric surgical trainees, and it defines a sponsoring program for the annual Pediatric Surgical Residents Conference. The new PSB-ABS has expanded its role from in-training, qualifying, and certification examination construction, supervision, and evaluation along with an expanded scope that includes the program of MOC. Unfortunately, no group meets more frequently than twice annually, our “institutional memory” is marginal because of a lack of a defined archival system, no database except periodic survey instruments exist within pediatric surgery to define the longitudinal objective/subjective educational outcomes of our trainees, training programs or our membership at large, and no central management function exists. Instead, we are characterized by having a series of meeting and membership managers that supplement the extensive volunteerism that has been the backbone of administering our specialty and its multiple membership organizations. There is little wonder that communication and coordination of educational activity and purpose between the groups is hindered by this structure.

A long-term solution may be the development of an Executive Office of Pediatric Surgery with a variety of subset entities that would include a Division of Education. However, based on the size of our specialty and the projected costs that would accompany such a “full-time administration,” a more logical approach would be the reconfiguration of our educational efforts to include an oversight or coordinating body that would assure a timely proactive evaluation and response to initiatives and forces such as those that are defined above. This responsibility could be assumed by one of our existing organizations, for example, the PSB-ABS. However, to avoid a potential conflict of interest, that organization responsible for certification assessment might best not be the body responsible for curricular development. As an alternative, pediatric surgery might define a new structure, an example being a “Educational Council of Pediatric Surgery,” with representatives from each of our organizations—AAP, APSA, PSB-ABS, and APSTPD, along with representatives from the trainees themselves and the practice community. A similar entity has recently been forged for general surgery. An annual budget would need to be allocated to this group to assure that they could meet at a frequency to complete an annual mission driven strategic agenda. This would address the current limited meeting times that frequently are a product of the

attempt to combine educational group meetings with other already existing meeting schedules.

Curricular Reform

Our current pediatric surgical training curriculum has emphasized an expected uniformity within training programs based on minimum numbers of operative cases and a defined component exposure. It has tacitly endorsed candidate evaluation and selection based on educational performance measures that include both a cognitive and a “productivity” assessment such as scholarly performance and years and success in research. In addition, the interview process permits an assessment of the intangible interpersonal skill and style that seem to “click” with a given program’s faculty and personality. There are fundamental shortcomings with this strategy: we do not take into account the candidate’s own career development desires, molding him or her into a community practitioner versus an academic health center specialist interested in either educational or clinical/basic research activity; we do not consider the unique strengths of selected training programs and their faculty either in clinical or research areas; nor do we take into account that the time of training may need to vary for each candidate to assure the satisfactory completion of those training milestones that we deem important, that is, competency-based training. As a specialty, we also have not embraced the new evolving educational technologies, such as the application of simulators, into a formalized training curriculum.

Competency-based training can be done; it is being done in selected surgical specialties,³ and, when adopted, it would set a training standard that would carry over into a practitioner’s career where assessment and reporting of competencies is mandated by licensing and certifying bodies. Whereas some trainees would require longer than the current 2-year curriculum, it is clear that others would have the period foreshortened; in the end, there is no real change in a given program’s manpower.

Curricular reform as outlined in Table 3 and Fig 7 might require the stratification of training programs to permit career “tracking.”³⁴ This becomes especially attractive if, in response to a current sentiment, “surgical research” is moved out of the general surgery training period to a point in career development that more closely approximates completion of residency training. There would be programs that would concentrate on training the practitioner who desires a private or “community practice” career, and when such an individual is deemed competent they would be capable of entering such a career position. There may be that trainee who has a desire to be part of an academic health center after clinical training, whether developing a focused clinical expertise (critical care, transplantation, advanced mini-

Table 3. Pediatric Surgery Training: A Proposed New Paradigm

Postgraduate Year	Clinical Practice	Academic Surgery*	Physician/Scientist†
1	General surgery	General surgery	General surgery
2	General surgery	General surgery	General surgery
3	General surgery	General surgery	General surgery
4	General surgery	General surgery	General surgery
5	General surgery chief	General surgery chief	General surgery chief
6	Pediatric surgery	Pediatric surgery	Pediatric surgery
7	Pediatric surgery chief	Pediatric surgery chief	Pediatric surgery chief
8		Fellowship/scholar	PhD training
9		Fellowship/scholar	PhD training
10		Fellowship/scholar	PhD training
11			PhD training

*For the academic surgery track, after completion of clinical training the individual could develop a bench or clinical research expertise that might include an advanced degree. Clinical specialization might also be pursued in trauma, critical care, transplantation, robotic surgery, etc.

†For those desiring a career as a physician-scientist, a combined MD/PhD degree is recommended.

mally invasive or image-guided surgery) or an expertise in surgical clinical or bench research. As such a trainee completes general and pediatric surgery training, the program will be postured to offer the depth and breadth of faculty and training opportunity to integrate the individual into a specific 1 to 3 years of additional training that will fulfill the candidate's career needs. Because such "clinical scholars" or "research scholars" will be in the certifying process for pediatric surgery having completed their clinical training, they will be eligible for "junior faculty" status and may fulfill important manpower requirements within a given institution. Finally, there are a few programs that can also train the physician-scientists of our future. Those individuals typically will achieve dual MD and PhD degree status, and after the completion of their clinical training, they will integrate into a milieu that will offer them the opportunity, if not already done so, to focus their effort on that training required to achieve Ph.D. status.

Response to the External and Internal Forces

The issues outlined above are each complex with a potential significant impact on training in pediatric surgery. Listing the multiple strategies that might be applied to each force or opportunity is beyond the scope of this report. In regard to the declining applicant pool, we must do our part in enhancing our specialty as an attractive sought after field of endeavor. There are multiple strategies to address this issue including interposing ourselves into the early years of medical student education and serving as mentors and role models for future doctors and surgeons. We could extol a further description of our field and the salutary traits of pediatric surgeons on a national Web page, and we could uniformly define best practice generation X and quality of life issues for our trainees as well as our faculty. The area of medical

economics is immensely complex, and the ongoing efforts to enhance reimbursement for services delivered will need to be an aggressive strategy for the foreseeable future. However, other challenges will continue to be debt relief for our trainees, and there must be an ongoing effort by pediatric surgery as a whole to seek philanthropic, industrial, and governmental extramural support for research and education initiatives that will define our future. The pediatric surgical manpower ongoing study has been a strength of our field, but the development of a longitudinal outcomes database of those entering pediatric surgery would prove invaluable. It would also increase the precision of actual manpower analyses. The issues of work hours as well as early specialization strategies are both linked and separate. Certainly, until both have been tested, their respective impact on resident operative experience and nonoperative surgical leadership and judgement skill is in question. If we are proactive, we will be able to define how the best practice programs deal with work hours. As we observe and assess the outcomes of the early specialization program for vascular surgery, we can revisit whether nonparticipation in this endeavor is a wise strategy for pediatric surgery. Finally, the maintenance of certification initiative of the PSB-ABS will soon begin and we will need to refine that program as it is implemented. The development of a competency-based curriculum will be a greater challenge, but, once defined, it will benefit not only trainees but those who continue to practice the surgical care of children as well. Finally, we will need to be postured to both lead and follow the application of new technologies for our entire educational process.

Where do we start? I would suggest that the governing organizations of pediatric surgery debate and modify these recommendations. However, with some urgency, it is imperative that representatives from

each of our contingencies convene to define a functional structure, a strategy, and a working plan. A business-as-usual current structure and strategy is neither flexible enough nor rapid enough in its respon-

siveness to address these many seemingly concurrent challenges. The clock is ticking, the issues are large with significant long-term implication, and the ball is in our court!

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