Future Supply of Pediatric Surgeons

Analytical Study of the Current and Projected Supply of Pediatric Surgeons in the Context of a Rapidly Changing Process for Specialty and Subspecialty Training

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Objective: To describe the future supply and demand for pediatric surgeons using a physician supply model to determine what the future supply of pediatric surgeons will be over the next decade and a half and to compare that projected supply with potential indicators of demand and the growth of other subspecialties.

Background: Anticipating the supply of physicians and surgeons in the future has met with varying levels of success. However, there remains a need to anticipate supply given the rapid growth of specialty and subspecialty fellowships. This analysis is intended to support decision making on the size of future fellowships in pediatric surgery.

Methods: The model used in the study is an adaptation of the FutureDocs physician supply and need tool developed to anticipate future supply and need for all physician specialties. Data from national inventories of physicians by specialty, age, sex, activity, and location are combined with data from residency and fellowship programs and accrediting bodies in an agent-based or microsimulation projection model that considers movement into and among specialties. Exits from practice and the geographic distribution of physician and the patient population are also included in the model. Three scenarios for the annual entry into pediatric surgery fellowships (28, 34, and 56) are modeled and their effects on supply through 2030 are presented.

Results: The FutureDocs model predicts a very rapid growth of the supply of surgeons who treat pediatric patients—including general pediatric surgeon and focused subspecialties. The supply of all pediatric surgeons will grow relatively rapidly through 2030 under current conditions. That growth is much faster than the rate of growth of the pediatric population. The volume of complex surgical cases will likely match this population growth rate meaning there will be many more surgeons trained for those procedures. The current entry rate into pediatric surgery fellowships (34 per year) will result in a slowing of growth after 2025, a rate of 56 will generate a continued growth through 2030 with a likely plateau after 2035.

Conclusions: The rate of entry into pediatric surgery will continue to exceed population growth through 2030 under two likely scenarios. The very rapid anticipated growth in focused pediatric subspecialties will likely prove challenging to surgeons wishing to maintain their skills with complex cases as a larger and more diverse group of surgeons will also seek to care for many of the conditions and patients which the general pediatric surgeons and general surgeons now see. This means controlling the numbers of pediatric surgery fellowships in a way that recognizes problems with distribution, the volume of cases available to maintain proficiency, and the dynamics of retirement and shifts into other specialty practice.

Keywords: general surgery, pediatric surgery, physician supply, workforce

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Concern about the balance of the supply of pediatric surgeons with the necessity of maintaining surgical skills has been a characteristic of almost every discussion of the future of the subspecialty as it was organized.[1] Surgeons must perform a sufficient number of procedures as part of their training to develop skills and a sufficient volume must be maintained over time to ensure quality of care and avoid errors.[2] The number of pediatric surgeons completing fellowships has grown over recent years whereas the pediatric population has remained stable. This imbalance has stimulated the leadership of the specialty to examine the numbers of fellowship programs, the content of training of pediatric surgery fellowships, and the volume of complex cases that are required for a surgeon to maintain skills. This article describes our analysis and projection of the supply and economic demand—based on actual use—for pediatric surgeons. Our approach is adapted from the ''FutureDocs Forecasting Tool,'' (The Tool was developed under a grant from The Physicians Foundation, Inc. and is available at: https://www2.shepscenter.unc.edu/workforce/model.php.) but takes into account more finely grained data on the supply of pediatric surgeons. This is a unique approach to understanding the balance of supply of physicians to the demand for their care that uses a microsimulation modeling approach and considers not only the number of surgeons entering and leaving the specialty but also the potential for overlap of specialties caring for patients. The model also considers changes in the choice of specialty and switching among specialties in training and in practice.[3,4] We show three scenarios about how changes in the number of pediatric surgeons on fellowship will affect future supply.

METHODS

The numbers of actively practicing pediatric surgeons in the United States is not precisely known as not every surgeon who cares for children is a member of the American Pediatric Surgery Association or has completed a pediatric surgery fellowship. General surgeons often operate on children (in 2013, 55% of all surgeries on children under 18 years in North Carolina were done by general surgeons) and surgical subspecialists other than pediatric surgeons also care for younger patients including neonates and infants. An example of this overlap can be seen in data from North Carolina hospitals. In those data, general and pediatric surgeons accounted for the overwhelming majority of cases, 86.7% of 19,520 appendectomies performed on children less than 18 years of age in the 5-year period. The primary attending physicians in 13.7% of the cases were in 63 other specialties. The 13.7% of cases performed by other specialists creates a challenge when modeling the demand for pediatric and general surgeons as that proportion represents a significant caseload volume when extrapolated to regional or national levels. Likewise, North Carolina is a relatively populous state (ranks 10th) with an age profile that is close to the national; however, it is not fully representative of the nation. The FutureDocs model attempts to adjust for that "plasticity" in its projections,[5] and, in the case of supply estimations reported in this article, interjects another reason for caution when drawing assumptions.

Even for complex cases for which pediatric surgeons specifically train, other subspecialties may perform these procedures on children. Examining data from the North Carolina statewide discharge database, that includes 100% of all inpatient and outpatient surgical procedures, we see that there were 396 "pull-through procedure" surgeries for Hirschsprung's disease, inflammatory bowel disease, or polyposis during 2009 to 2013. Pediatric surgeons were the primary surgeon for 342 (86.6%) of these cases. (These were cases with a International Classification of Disease procedure code of 4841-4843, 4849, 4851, 4862, 4865, or 4892 with 751.3.) This procedure is one that is often included on lists of "index" cases for which pediatric surgeons should be trained to perform and maintain proficiency.[6] There are a limited number of such index cases and they must be shared among the 30 to 35 pediatric surgeons practicing in North Carolina either as fellows or in full, postfellowship practice. For example, general surgeons were listed as the primary or sole attending surgeon in 18 (4.5%) and pediatricians in 16 (4.0%) of the Hirschsprung cases where there was likely a pediatric surgeon involved but not attributed in the record. Other specialists were listed as the sole attending in 5 other cases including orthopedic surgery, pediatric hematology-oncology, pediatric gastroenterology, pediatric critical care, and colon-rectal surgery.

The number of physicians who do perform general and complex general surgery on children can be described by the sum total of general surgeons, pediatric surgeons, and surgeons whose initial surgery training is in a specialty other than pediatric surgery but who later focus their practice on children. The last group includes pediatric neurological surgery, pediatric otolaryngology, pediatric ophthalmology, pediatric minimally invasive surgery, and pediatric urology. These focused subspecialists generally begin their training in a residency track other than general surgery and restrict their surgical care to a limited number of specific procedures, conditions, and diseases in children. Four of these subspecialties have organized formal fellowship training programs focused on pediatric populations. They can be distinguished from other programs and concentrations based in general surgery such as pediatric vascular anomalies and subspecialties in colorectal, fetal surgery, and pediatric surgical critical care—these lead to certifications and contribute a smaller proportion of surgeons to the overall field. The focus of this analysis is on the supply of pediatric surgeons who completed a pediatric surgery fellowship after a residency in general surgery and do not restrict their practice to a specific subspecialty of pediatric surgery, for example, orthopedics, neurosurgery, otolaryngology, and so on.

Baseline Supply of Pediatric Surgeons

The complexity involved in determining each year's supply of pediatric surgeons and surgeons who primarily treat children is illustrated by this example using data from the 2013 American Medical Association (AMA) Masterfile. (The AMA Masterfile is the best available inventory of physicians. Its accuracy has been criticized, but it remains a continuously updated source of complete physician supply data. For further details see Kessler et al[7], Konrad et al[8], Staiger et al[9], McLafferty et al.[10]) In that year, there were 1023 actively practicing physicians under the age of 80 years who indicated their "first" specialty was pediatric surgery; 273 of those listed general surgery and 41 listed thoracic surgery as a second specialty but most did not indicate a secondary specialty. There were 87 physicians who identified a secondary specialty as pediatric surgery. Of those who self-identified as pediatric surgeons, 494 were not board certified in pediatric surgery whereas 616 were board certified. Thus, the number of pediatric surgeons can be described by the number with a self-designated specialty pediatric surgery or subspecialty, or board certification, or both. Table 1 summarizes the numbers of surgeons in the AMA Masterfile who designated or were assigned a first or second specialty in pediatric surgery or one of the children's surgery subspecialties for the years 2009 to 2013 (comparable data were not available for 2010). These numbers formed part of the input into estimating the baseline supply of pediatric surgery subspecialties and pediatric surgeons in 2012.

In comparison, in November 2015, the American Pediatric Surgical Association (APSA) membership directory identifies 749 regular members described as actively practicing pediatric surgeons, along with 287 senior members described as those over 70 years of age who may or may not be practicing. The APSA also has a candidate membership category with 124 surgeons who are enrolled in fellowships or within 5 years of completing fellowships, and an associate category of pediatric surgeons with nontraditional training backgrounds (n = 22). This total to 1058 members that compares with the AMA trend data (n=1113 in 2013).

TABLE 1. AMA Masterfile Number of Active Physicians Indicating Pediatric Surgery as "First or Second Specialty," US 2009–2013

First Specialty	2009	2011	2012	2013
Ophthalmology/pediatrics	202	194	234	218
Orthopedic pediatric surgery	405	425	501	537
Pediatric cardiothoracic surgery	47	53	62	54
Pediatric neurological surgery	34	33	40	38
Pediatric otolaryngology	165	201	240	285
Pediatric surgery	984	809	1080	1110
Pediatric urology	219	259	294	338
Total	2056	1974	2451	2577

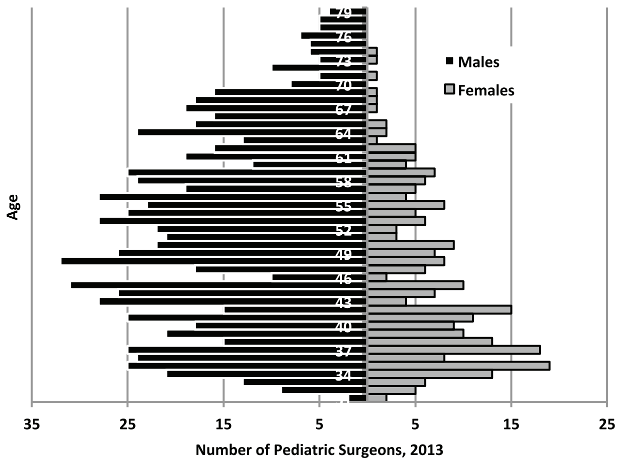

FIGURE 1. Population pyramid of pediatric surgeons, 2013.

Age and Sex

Any model predicting physician supply must consider the age of the individual and the likelihood of their retirement or death to anticipate future numbers. The FutureDocs forecasting model uses sex and age to calculate retirement rates that assume an increasing probability of retirement, death, or exit from practice that rapidly increases until 80 years where we assume all pediatric surgeons have left effective practice. We do, however, recognize that completion of a pediatric surgery fellowship may occur at different times and we have adjusted the entry cohorts to reflect the age distribution of entrants into fellowships that mirrors the current distribution. The projection distributes new entrants by age for an annual entry cohort of 56 years by age from 33 years (1 entrant) to 37 years (20 entrants) to 41 years (3 entrants), smaller entry cohorts are reduced proportionately by age for the projections.

To illustrate the current distribution of pediatric surgeons by age and sex, we can examine a population pyramid of the active, less than 80 years, pediatric surgeons in the 2013 Masterfile (Fig. 1). The data used to populate the FutureDocs tool were a combination of selfdesignation from the Masterfile and board certification data from the American Board of Medical Specialties (ABMS) for baseline estimates and from the Association of American Medical Colleges (AAMC) GME Track data for additions to the supply. This approach assumes that most input into the system will be from fellowship trained surgeons although we identified a small number of entrants who did not go through the ''normal'' GME Track but later selfdesignated as pediatric surgeons. In general, the current stock of actively practicing physician in any specialty in the model was derived from a data set of all physicians listed as actively working in medicine according to the AMA Masterfile, whether that was in direct patient care, administration, medical research, or teaching.

The overall pattern of the age-sex mix in illustrated Figure 1 suggests a current ''steady'' rate of production for those in the 45 to 79 years age cohorts but an increase among females in the less than 45 years age cohorts.

Training

Inputs into the pediatric surgery supply are measured by the numbers of surgeons completing their ABMS subspecialty fellowship in pediatric surgery. That trend is described in Table 2. The certifying board for pediatric surgery moved from a 2-year to an annual certification cycle in 2010.

The FutureDocs model and this analysis recognize that many residency graduates, particularly those who have completed internal medicine or general surgery, go on to further training to subspecialize. For example, rather than becoming general surgeons, over 70% of general surgery residency graduates move into fellowships and eventually practice in specialties such as surgical oncology, colorectal surgery, surgical critical care, and vascular surgery.[11] These patterns are documented in GME Track maintained by the AAMC and the FutureDocs model uses those data from GME Track to estimate the number of general surgery residency graduates that branch into other subspecialties or the orthopedists or otolaryngologists who go into pediatric fellowships. It also models residents who switch training pathways.

The AMA Masterfile and the ABMS data classify physicians into as many as 315 specialties. All surgical specialties where physicians initially go through a general surgery residency and who primarily treat adults are grouped under the ''surgery'' category in FutureDocs. Given the specific nature of their patient population, pediatric surgical specialties were clustered separately and that grouping included the 7 pediatric surgery subspecialties listed in Table 2. The model was subsequently adapted to separate the ''general'' pediatric surgeon from the children's surgical specialists; this analysis focuses on those ''general'' pediatric surgeons. The data reported here used 2012 as its starting year for the modeling using graduate medical education trend data from the GME Track data set and published data from the American Board of Medical Specialties and the Advisory Council on Graduate Medical Education (ACGME) from that year.

Retirements, Death, and Exits from Practice

Estimating when a physician will exit practice is a difficult process but represents a very important component of any predictive model.[12–15] There are few recent, comprehensive studies that have examined retirement by specialty in surgery.[16,17] There have been studies that try to anticipate retirements but they have been found to be unreliable and physicians in practice tend to over-anticipate their leaving practice.[18,19] The FutureDocs model adopted approaches from prior retirement studies,[3,20] including those described in a report issued by the Federal Bureau of Health Workforce.[12] The FutureDocs model also used data on practice exits derived from analysis of the AMA Masterfile over successive years and mortality data from the National Center for Health Statistics, Centers for Disease Control and Prevention. For the projection of pediatric surgeon supply, the probability of retiring or expiring at each year of life is shown in Figure 2. This estimate is not based on direct surveys of retirement and must, like all estimates of exit from

TABLE 2. Pediatric Surgery Subspecialty Certificates issued by ABMS Boards, 2004–2013

Specialty	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	10-year Total
Pediatric surgery	57	0	61	0	64	0	71	26	43	34	356
General surgery	1069	1026	1266	838	1133	738	927	879	991	1131	9998

American Board of Medical Specialties Annual Reports, 2005–2015

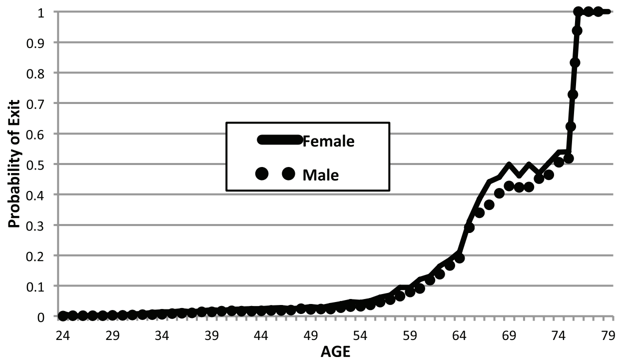

FIGURE 2. Probability of retirement or exit from practice, male and female physicians by age.

practice, be viewed with caution. There are slight differences in the exit patterns for female versus make pediatric surgeons and differences in overall activity reported as hours in active practice. We did not have comparison data on surgical volume for males and females. Physicians have a very small but nonzero probability of retiring that rises as they age and this analysis assumed that all physicians will effectively retire or expire by the age of 80 years. This is a higher retirement age than used in other studies; however, we assumed surgeons can be actively teaching or in administrative positions up to 80 years. These physicians also play an important role in the medical education and/or the organization and delivery of surgery care and include them in our projections; however, the older surgeons are not likely to be doing operations and cannot be counted in estimates of the balance of supply versus need or demand for surgery.

Adapting and Applying the Model

The FutureDocs model includes a category for "pediatric surgery specialties" in its modeling process that includes the 7 subspecialties included in (see: https://www2.shepscenter.unc.edu/workforce/about.php). That analysis had to be modified to estimate the general pediatric surgery component of the output. Determining how many pediatric surgeons are actually in practice requires an allocation based on primary and secondary self-designated AMA specialties and up to 4 ABMS certifications included in the data. A set of rules using board certification and self-designated specialty were developed to generate the baseline estimate of supply. That yielded a head count of 773 pediatric surgeons who were fellowship trained, active, less than 80 years of age and not practicing in a children's surgical subspecialty as the basis for a projection of future, pediatric surgeons.

Information on residency length by specialty, age, sex, and location of residents—and the number of residents who leave residency programs in a given year as provided by the AAMC GME Track—were used to estimate the number, distribution, and demographic composition of residents entering the physician workforce in each specialty group.

The model distributes new entrants into practice and physicians who change location into 271 "Tertiary Service Areas" (TSA). These are aggregations of counties based on the Dartmouth Atlas of Health Care's 306 Hospital Referral Regions.[21] The TSAs are essentially an overlay of county boundaries on the HRR areas that are constructed from ZIP code-based areas. (The Dartmouth Atlas project includes a "Pediatric Surgical Areas (PSAs) classification to identify the market for pediatric surgery in three New England states based on referral patterns for appendectomy and common otolaryngology (ENT) pro-cedures. see: http://www.dartmouthatlas.org/data/region/ (Accessed November 23, 2015.) The geographic "diffusion" of pediatric surgeons is very sensitive to regional shifts because of the relatively small number of surgeons in the specialty group. The FutureDocs model projects the supply by TSA for pediatric surgeons and subspecialty children's surgeons through 2030 and may be accessed at the Future Docs website (https://www2.shepscenter.unc.edu/workforce/index.php). The adapted model for pediatric surgeon supply was implemented as an Excel calculation using 2012 baseline data (n = 773). The 2012 FutureDocs model uses a pediatric population segment to calculate supply relative to demand and adjusts for some changes in GME pathways up to 2012. The supply and demand results are not reported here; see the online model for those estimates. This article uses data extracted from the updated model to develop estimates of supply for pediatric surgeons through 2030.

Analysis Results

The combined results of the estimation of supply through 2030 for pediatric surgeons using 3 options for growth using alternative GME entry scenarios is presented in Table 3 and Figure 3. The 3 options for growth of pediatric surgeons were chosen based on the historical highs of entry into pediatric surgery fellowships or 56; a low value of one half of the highest rate or 28, which compares to the entry of 26 in 2011, and a middle value of 34, the rate for 2013. Under the assumptions of the model, maintaining the middle level of entry of 34 per year would mean achieving a "steady state" of supply by 2028 to 2030 with a subsequent small decline. Increasing the output to 56 per year would generate a small but continuous growth trend for general pediatric surgeons likely to continue to add to the overall supply beyond 2030 but eventually level off. The modeled options generate estimates of growth in the supply of pediatric surgeons by 2030 of 21%, 24%, and 45%. All of these potential growth rates would be well above the 9 percent growth in the pediatric population estimated for 2030.

DISCUSSION

Whether or not the supply of pediatric surgeons will meet future demand remains an issue. The demand for pediatric surgery is

TABLE 3. Projections for Pediatric Surgeons, 2013–2030

	Pediatric Surgeons Head Count Forecasts		
Year	28 Entrants/Yr	34 Entrants/Yr	56 Entrants/Yr
2012	773	773	773
2013	791	791	791
2014	806	806	806
2015	825	831	831
2016	841	849	871
2017	859	869	900
2018	872	884	924
2019	887	901	950
2020	896	912	970
2021	905	923	990
2022	911	931	1007
2023	921	943	1028
2024	924	948	1042
2025	931	957	1060
2026	938	966	1078
2027	936	966	1087
2028	943	975	1105
2029	944	978	1117
2030	938	974	1122
Cumulative growth	21%	26%	45%

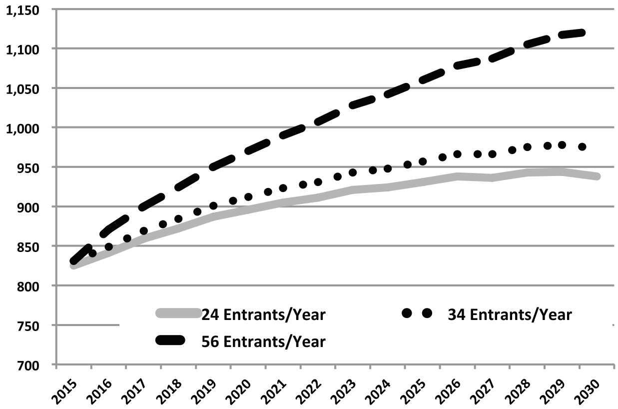

FIGURE 3. Projections of growth for pediatric surgeons, headcount, United States, 2011–2030.

heavily dependent on the size of the pediatric population and factors that are very difficult to anticipate including operative technology, alternative treatments, prevention, and interspecialty substitution. We know that the pediatric population will be growing slowly during the coming decades unless there are substantial changes in the makeup of the national population. Trends in the ‘‘head count’’ of pediatric surgeons and the growth rate of the pediatric population are not the only factors that determine future balance of demand and supply for pediatric surgeons. It is a reasonable assumption that closely related specialties will begin to overlap with the scope of the pediatric surgeon's practice, much in the way that the adult general surgeon has seen subspecialties take on procedures once solely performed by general surgeons. In this context of a very rapid anticipated growth in the children's surgery subspecialties, the FutureDocs model forecasts increases in supply of over 100%. Given this, the pediatric surgeon's caseload of complex procedures will likely decline and they will equally likely seek to care for many of the pediatric patients that general surgeons now see.

In comparing our work to prior studies, we find general agreement. James O'Neill et al[22–24] tracked the pediatric surgery workforce over the last three decades of the 20th century. That work examined the growth of the subspecialty and predicted that an oversupply of pediatric surgeons might appear before the year 2000.[25] The suggestion that there might be a surplus of pediatric surgeons was met with some skepticism in the. Multiple commenters noted that projections of demand developed by Richard Cooper[26] suggested that there might be a continuing rise in the effective utilization of physicians and surgeons because of changes in the economics of medical care and a continuing aging of the population. As the effects of population aging are clearly not applicable for the pediatric population, there will be a different pattern of effects for physicians caring for children: demand may not rise as fast.

In 2009, Nakayama et al[27] reported on a survey of pediatric and general surgeons and the availability of pediatric surgery services reported in the media or on the Internet. They opened their description of their work with a clear statement that there existed an overall shortage of physicians in the US citing the work of Richard Cooper[28,29] and George Sheldon.[30] This analysis was based upon perceptions of members of APSA of the numbers of new pediatric surgeons who were being recruited by their or other practices and was not verified by data. The authors concluded that there was sufficient demand for 280 additional pediatric surgeons over the period 2010 to 2012. More recently, a survey of Canadian pediatric surgeons in 2012 by Emil et al[31] found a ‘‘stable’’ pediatric surgery workforce with an equally stable volume of surgery. That group estimated a demand for approximately 20 new pediatric surgeons ‘‘over the next decade.’’ Data from the English NHS showed a steady increase in the number of pediatric surgeons from 100 in 2003 to 180 in 2014 (A. Knapton. SMAP, Winchester England, personal communication. December 1, 2015).

In contrast to these predictions of relative ‘‘shortages’’ and increasing demand, the volume of complex surgery for which pediatric surgeons are uniquely trained has remained very stable over time. Meanwhile, the number of pediatric surgeons has risen rapidly. Fonkalsrud et al[32] pointed this out in their 2013 American Journal of Surgery article where they ‘‘called into question’’ the ability of pediatric surgeons to maintain their skill levels given this lack of demand. Drake et al [33] and Drake et al[34], using ACGME case logs, found that general surgeons were performing fewer and fewer pediatric surgery case in their residencies and fellowships. Simultaneously, Fingaeret et al[35] noted a 42% increase in pediatric surgery residents between 2003 and 2010 as background to their analysis of case logs from ACGME certification records for pediatric surgery. They found little evidence of an increase in overall cases but ‘‘minimally invasive’’ case volume increased. They found an increasing ‘‘positive skew’’ of case volume over time suggests increasing variability of volume over time.

The annual growth rate of the pediatric population, based on birth trends and immigration, is expected to be on the order of one-half percent per year resulting in less than 18 years population that is 9% larger in 2030 than in 2013. A proportional growth of pediatric surgeons would likely meet the surgical demands of that population. The adapted FutureDocs model predicts a much higher growth rate of the number (‘‘head count’’) of practicing pediatric surgeons (Table 3, Fig. 3). This prediction is based on the number of surgeons trained in North America, their retirement patterns, their location, and changes in specialty choice. If the current number of pediatric surgery training programs generates a constant number of pediatric surgeons, which, at its current peak is 54 new surgeons per year (Hirschl, R. personal communication 2015. Data from Pediatric Surgery Board, American Board of Surgeons) and is maintained through 2030, then growth of the pediatric surgeon headcount would be 5 times greater than the pediatric population growth between 2013 and 2030. In comparison, if the training programs generated one half as many new pediatric surgeons each year, 24 surgeons per year, the growth rate would be just over twice the rate of population growth—a rate likely to allow for changes in practice, technology, and shifts in the content of surgery among other specialists but would likely plateau and decline after 2025. A third estimate, for 34 new entrants per year would result in a growth rate of 24%, a rate that might create an imbalance between supply and demand but would result in a decline in overall numbers after 2030. If the trend toward higher and higher numbers of pediatric surgeons in training continues, the supply of pediatric surgeons will steadily outstrip the growth of the pediatric population and the demand for pediatric surgeons and other subspecialists in children's surgery.

The FutureDocs model anticipates that the supply of general surgeons is anticipated to grow more slowly through 2030 than in previous years. It is not clear whether this will result in a greater number of pediatric procedures formerly performed by general surgeons will shift to a more rapidly growing number of pediatric surgeons.

The model that was used to generate these projections has multiple potential flaws inherent in predicting the future of surgery and the demand and/or need for surgery as well as problems derived from the lack of precise and contemporary data. For example, the model tends to be based more on actual use rates, most often termed ‘‘demand.’’ Need for surgery and surgeons, defined as the highest likelihood that surgery would produce benefits for the patient, is different from demand, which is the actual use of surgery, would likely produce different results. However, the model does attempt to overcome some of the problems encountered with prior models including unrealistic expectations for retirement, a lack of accurate data on who was actually practicing in the relevant specialties, and recognition that there is a dynamic flow across specialties that can affect supply in any given specialty. The aim of the analysis and modeling reported here was to provide answers to the question of what general trends could be anticipated given the current realities of the supply of pediatric surgeons and the current process of preparing them for practice and related trends among overlapping specialties. The core of this paper is the description of change in supply of pediatric surgeons, but in several instances we have noted that the practice and procedure boundaries across pediatric surgery and other surgical specialties are relatively open and generate a great deal of uncertainty in predictions of the future. Many who criticize projections of physician supply comment that we do not know what physicians and surgeons of the future will be doing. These comments in general refer to technology and clinical advances in care. What they fail to point out is that we can see that there are alternative physicians and surgeons who are willing to adopt and adapt to the care of patients once seen as the exclusive domain of one specialty.[5] We can anticipate that process to some degree and can model the growth in one particular specialty in parallel to those "complementary" or competing specialties and anticipate that there will be conflicts and competition among them. The important thing to consider in pediatric surgery is that the patient pool will remain relatively fixed over time.

CONCLUSIONS

The current emphasis on the relationship between volume (both institutional and individual surgeon) and quality raises several concerns as to the implications of the findings presented here. There is a trend for general surgeons to care for a smaller proportion of pediatric cases. This may be because of the recognition that they do not have enough volume to offer the best care. Pediatric surgeons are concerned that if there are enough general surgeons to do the routine cases, few of them will maintain expertise with the complex cases. It is unlikely that the latter can be dealt with by having the general surgeons do more pediatric cases, as the general surgeons have already demonstrated their disinclination to do so and there is a projected shortage of general surgeons. Several remedies have been proposed such as including routine pediatric cases in the curriculum of acute care surgery or developing two tracks in pediatric surgery based on whether the surgeon will practice in the community or at a center. Data such as that presented here will be crucial in the development of policy in this area.

Despite variations in predictions and the potential to confuse rather than guide policy making, one recommendation included in Thomas Holder's 1976 article reviewing pediatric workforce studies still holds: "The conclusions of the deliberations on manpower needs were ... that the pediatric surgical manpower needs of the nation must be reevaluated periodically."[1] This study points to a likely oversupply of general pediatric surgeons unless there are changes in the input to that supply. This means controlling the numbers of pediatric surgery fellowships in a way that recognizes problems with distribution and the dynamics of retirement and shifts into other specialty practice. This anticipated excess of supply is dependent on trends in other specialties, general surgery in particular. Although it may seem reasonable to reduce the volume of new trainees in pediatric surgery, it is also necessary to understand what other specialties and subspecialties are doing to adapt to changes in the patient population and the structure of medical care. That lesson should be heeded by all who make predictions and develop projections—accurately estimating the future balance of supply and need for any one specialty cannot be done without understanding what will happen in other specialties.

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