The future of the pediatric workforce has been the subject of significant dialogue in the pediatric community and generated much discussion in the academic literature. There are significant concerns regarding the ability of pediatricians to meet the growing demands of our pediatric population. Over the past 5 years, there has been a decline in the percentage of doctor of osteopathic medicine students who pursue a career in pediatrics but an equally important increase in the number of pediatric positions that are filled by doctor of osteopathic medicine students and international medical graduates. Although there has been an increase in the number of pediatric positions offered in the National Resident Matching Program, the last 4 years have seen a significant increase in the number of unfilled pediatric positions. A number of pediatric subspecialties struggle to fill their training positions, and those with low match rates may have 20% to 40% fewer applicants than positions. The pediatric vision for the future must include a commitment to a comprehensive strategic planning process with the many organizations involved across the multiple stages of the educational continuum. It is time to elucidate and address the questions raised by the workforce data. Developing solutions to these questions will require a careful planning process and a thoughtful analysis of the pediatric workforce data. Establishing this as an important priority will require a major collaborative effort between pediatric academic and professional organizations, but the future benefit to the nation’s children will be significant.

The future of the pediatric workforce has been the subject of significant dialogue in the pediatric community and generated much discussion in the academic literature. Both the Academy of Pediatrics (AAP) and the Federation of Pediatric Organizations have described the complex challenges that need to be addressed to provide care to our nation’s children. A key component of the future of pediatric care will be the development of a workforce that is responsive to the changing landscape of our communities while remaining focused on the goal of providing comprehensive and high-quality services required to deliver optimal child health.

Despite these organizational recommendations, there continue to be significant concerns regarding our ability to meet the growing demands of the population, especially in the pediatric medical subspecialties. Current estimates suggest that by the year 2032, there will be major workforce shortages in the primary care disciplines as well as in many specialty disciplines. Functional shortages in the pediatric workforce have been described by the Children’s Hospital Association in...
which data reveal long wait times for subspecialty services. Almost 50% of children’s hospitals reported vacancies in developmental and behavioral pediatrics and adolescent and child psychiatry, and >30% of children’s hospitals reported vacancies in child neurology and genetics. A 2015 survey of almost 10,000 US pediatric subspecialists found that subspecialists devote less time in direct patient care compared with data from the 1998 Future of Pediatric Education Project. Concerns have been raised that the needs of children living in rural areas are not being met and that the current workforce does not reflect the diversity of our patients.

In response to expected shortages in the workforce, there have been recommendations to increase the number of residency positions, especially as components of the pediatric workforce approach the age of retirement. The increasing numbers of generalist and subspecialty pediatricians working part-time may also exacerbate workforce shortages. Many of the pediatric subspecialties have also raised concerns about workforce shortages. With the recognition that pediatric physician scientists have been the cornerstone for advances in genomics, precision medicine, and biomedical research, the decline in the physician-scientist workforce adds further vulnerability. Physician scientists represent only 1.5% of the workforce, and understanding factors that impact the career decisions of trainees. It is imperative to undertake a comprehensive review of the pediatric workforce to meet the clinical, research, and public health goals we have established as an academic community. The current and future generations of trainees provide the foundation for our discipline, and the ultimate trajectory of their career paths into general and pediatric subspecialties will establish the degree to which we meet our most important mission, namely, the care required by our nation’s children.

To advance a discussion of the pediatric workforce, the author reviewed multiple data sources, including the annual data provided by the National Resident Matching Program (NRMP) (also referred to as “the Match”), the American Board of Pediatrics (ABP) physician tracking system, and data obtained from the Association of American Medical Colleges (AAMC). The goal of this article is to provide a comprehensive review of workforce data and highlight recent trends in the pediatric training workforce. These data can be used to stimulate discussion within pediatric organizations, refine strategies to enhance the pediatric workforce, and offer guidance on future areas of investigation.

**METHODS**

Data were extracted from the 2010–2020 NRMP annual data reports for both the Main Residency Match and the Fellowship Match. The NRMP provides discipline-specific data, including the total number of positions in the Match, overall match rate, breakdown of applicants by categories, and annual changes in each category. The NRMP uses discrete definitions to track trainees, thus allowing for comparison of year-to-year variations. An MD senior is a fourth-year medical student in a US MD medical school, accredited by the Liaison Committee on Medical Education with a graduation date after July 1 in the year before the Match. An MD graduate is a graduate of an Liaison Committee on Medical Education accredited US MD medical school with a graduation date before July 1 in the year before the Match. A DO senior is a fourth-year medical student in a US DO medical school, accredited by the Commission on Osteopathic College Accreditation with a graduation date after July 1 in the year before the Match. A DO graduate is a graduate of a Commission on Osteopathic College Accreditation accredited US DO medical school with a graduation date before July 1 in the year before the Match. When the number of DO graduates is small compared with the number of DO seniors, the 2 groups have been combined in this article into a single group referred to as DO medical students. International medical graduates (IMGs) are assigned to 1 of 2 categories. A US IMG is a US citizen who attended an international medical school, and a non-US IMG is a non-US citizen who attended an international medical school.

Additional data were obtained by reviewing the interactive ABP Workforce Data System. This data system tracks the general pediatrics residency and subspecialty fellow workforce and provides annual trends of the number of trainees in residency and fellowship training programs. The ABP data collection begins in the first year of residency training by using data submitted annually at the time of the General Pediatrics In-Training Examination. Trainees who enter subspecialty training programs continue to be tracked by using data provided to...
the ABP by their subspecialty fellowship training program directors.28

To understand trends in the career trajectory of graduates of MD medical schools, the AAMC provided an annual summary of the percentage of MD medical students who entered pediatric training each year from 2008 to 2018.

RESULTS

The 2020 Main Residency Match had 44,959 registrants, the highest number recorded by the NRMP. Since 2015, the number of applicants in the Match continues to grow, with the majority of growth limited to MD seniors (7% growth) and DO medical students (143%). Since 2015, there has been a 3% growth in the number of US IMGs but a 6% decline in the number of non-US IMGs. The 2020 match rate for MD seniors was 93.7%, a percentage consistent with the usual match rate for MD seniors. The match rate for DO seniors was 90.7%, the highest rate recorded for DO seniors. The match rates for US IMGs (61%) and non-US IMGs (61.1%) were the highest recorded by the NRMP since 1991 and 1990, respectively.

In 2020, there were 2864 first-year categorical pediatric positions in the Match, the highest number of positions ever offered and an increase of 17 positions compared with the 2019 Match. The 2020 Match represented a 7% increase from the number of categorical pediatric positions offered in 2015. During this same period, other disciplines had significant increases in the number of positions offered in the Match, including emergency medicine (46%), family medicine (46%), and internal medicine (28%) (Table 1).

Data obtained from the AAMC reveal a decline in the percentage of graduates of MD-granting medical schools pursuing pediatric training. In 2010, 9.7% of graduating US MD medical students entered residency training in pediatrics, but with the graduating class of 2018, the percentage decreased to 8.2% (Fig 1). The NRMP data confirm the decline in the number of MD seniors pursuing pediatrics. With the 2020 Match, the absolute number of MD seniors is 8% lower than the number matched in 2015. Over the same 5-year period, other disciplines have increased the number of matched MD seniors, including emergency medicine (19%), family medicine (10%), internal medicine (5%), obstetrics and gynecology (9%), psychiatry (47%), and surgery (6%) (Table 2).

The number of applicants who matched into categorical pediatric positions has increased each year as more programs and positions are added to the Match. In 2020, pediatrics had an absolute increase of 158 matched applicants into categorical pediatric programs compared with 2015. However, the growth in pediatrics leaves behind other disciplines. During this same period, remarkable growth in filled first-year positions occurred in internal medicine (1626 positions), family medicine (1274 positions), emergency medicine (839 positions), psychiatry (499 positions), surgery (309 positions), and obstetrics and gynecology (185 positions). The 2020 match rate for family medicine was 92.5% and for internal medicine was 95.7%. Pediatrics had a match rate of 98.2%, whereas emergency medicine, psychiatry, surgery, and obstetrics and gynecology had match rates ≥98.9%. Thus, not only have other disciplines significantly expanded the number of training positions, but they have also continued to fill the majority of these additional positions in the Match.

The number of pediatric positions that have been filled by DO medical students as well as US and non-US IMGs is at an all-time high. Although the number of MD seniors who have matched into pediatrics has decreased by 158 since 2015, the number of DO medical students who have matched into pediatrics has increased by 185 and the number of IMGs (both foreign and US born) has increased by 134 (Table 3). Since 2015, there have been dramatic increases in the number of DO medical students who match into first-year training programs. In 2015, DO medical students filled 8.9% of first-year training positions in the Main Residency Match, and by 2020, that number had increased to 19.2% of first-year training positions.

Although there has been an increase in the number of pediatric positions offered in the Match, the last 4 years has witnessed a significant increase in the number of unfilled pediatric positions. From 2017 to 2020, there was a total of 223 categorical first-year pediatric positions that were not filled in the Main Residency Match, with the 2019 Match representing the highest number of unfilled positions in a decade. In the 4 previous years (2013–2016), there were only 51 unfilled categorical pediatric positions (Table 4).

In 2020, a total of 1658 pediatric subspecialty positions were listed in the NRMP Fellowship Match. Of these, 1390 were filled for an overall match rate of 84%, similar to the overall match rate of 86% in 2015. The majority of positions (65%) were filled by graduates of US MD medical schools. The remaining positions were filled by non-US IMGs (13%), graduates of US DO medical schools (13%), and US
IMGs (8%) (Table 5). Although there are minor differences between subspecialties, each pediatric subspecialty had a first-year match consisting of 50% to 75% US MD graduates, 10% to 20% US DO graduates, and 15% to 25% IMGs, most of whom are non-US IMGs.26 In 2020, a number of pediatric subspecialties filled #70% of available positions, including child abuse, developmental and behavioral pediatrics, endocrinology, infectious disease, nephrology, and pulmonology, and rheumatology. This pattern, which has been consistent since 2015, is in stark contrast to the majority of pediatric subspecialties that fill $80% of positions each year. The subspecialties that fill $80% of their subspecialty positions often have $1 applicant per available position. In 2020, developmental and behavioral pediatrics, endocrinology, infectious disease, nephrology, and pulmonology had $0.7 applicants per available position (Table 6).

Similar to the differences between the NRMP and the ABP tracking of first-year categorical pediatrics residents, there are also differences between the number of first-year subspecialty positions filled in the Match and the number of first-year subspecialty fellows tracked by the ABP. Comparing data from 2018, the ABP tracks 82 first-year fellows in pediatric endocrinology, whereas the NRMP data listed 64 first-year positions as being filled in the Match. Similar discrepancies are seen for the majority of pediatric subspecialties, with the ABP tracking more first-year fellows than are reported to have matched by the NRMP.30

DISCUSSION

In their most recent workforce policy statement, the AAP concluded that “to achieve optimal health and well-being for all infants, children, adolescents, and young adults, sufficient numbers of appropriately trained primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists... must be available to provide care.” To ensure that children receive the clinical care, scientific advances, research, and advocacy that is required for optimal child health, it is imperative that pediatric leaders use workforce data to guide strategic planning and visioning for the future.

The past decade has witnessed an unprecedented growth in postgraduate training opportunities in a variety of disciplines. The growth in the number of candidates pursuing training and the availability of postgraduate year–1 positions are at an all-time high. The expansion of training positions is in response to many factors, including the increased complexity of clinical services within academic medical centers, the regulatory requirements limiting work hours, the development of new residency programs, and the recently completed single accreditation system for MD and DO medical students. The growth in internal medicine and family medicine over the past 2 years must be interpreted with caution because the single accreditation system has been a major factor in expanding the number of training positions in these disciplines. However, in the 5 years (2020–2015) before the development of the single accreditation system, the growth in family medicine (23%) and internal medicine (35%) still exceeded the growth in pediatrics (10%).

The overall expansion of the workforce raises many important questions for pediatrics. The disproportionate growth of many clinical disciplines in comparison...
with pediatrics should advance the ongoing dialogue about whether pediatrics is “right sized” to meet the needs of our nation’s children. Although the 7% increase in number of first-year categorical pediatric positions offered in the Match between 2015 and 2020 is encouraging, we must contrast this to the dramatic growth in other clinical disciplines. Over the past 10 years, the pediatric footprint in the Match has diminished as growth in other disciplines has far exceeded the growth in pediatrics. The expansion of adult-focused disciplines is aligned with the health care demands of a country that is expected to have more adults than children for the first time in US history by the year 2034. However, despite a falling birth rate, pediatrics must prepare for increases in the number of children living in the United States and the increased survival of children with complex medical conditions. Our workforce demands are further exacerbated by the demand for general and subspecialty pediatric care in many rural areas of the country and a growing commitment to the global community.

As we respond to the changing demographics of our population, we can no longer focus on the absolute numbers of trainees as a predictor of workforce stability and must consider factors that impact the functional capacity of our workforce. The increasing administrative demands on physician time has led to a decrease in the percentage of time subspecialists devote to direct patient care, a finding consistent with AAP data that identified a downward trend in the number of hours worked by primary care pediatricians. The functional capacity of the workforce is impacted by the number of clinicians working part-time. Although the number of pediatricians who work part-time appears to have leveled off, almost 30% of graduating residents seek part-time work at the end of their training. The gender disparities that have been described in the literature must also be addressed to support the growing number of women in the pediatric workforce.

To enhance our discussion of the functional capacity of the pediatric workforce, we must understand the important contributions to the care of children made by family medicine physicians and advanced practice providers. It is estimated that family medicine physicians provide ~20% of the physician visits for US children. However, a recent cross-sectional survey of family medicine physicians reveals that the number of family physicians providing care to children is decreasing. This trend is noteworthy because the geographic maldistribution of pediatricians in many rural areas of the country has been offset by the presence of family medicine physicians. Equally concerning is a recent analysis of all-payer claims data from Vermont in which researchers found that an increasing rural location of a child was associated with decreasing odds of receiving care in a family medicine practice. Any hope that pediatric advanced practice providers will augment the pediatric and family medicine workforce is challenged by an impending critical shortage of the pediatric nurse practitioners. Of the >270 000 licensed nurse practitioners, only 5% are certified in pediatrics. Certification data from the National Commission on the Certification of Physician Assistants reveal only 1.9% of the physician assistant workforce focus their practice on the care of children.

The functional capacity of the pediatric workforce must be viewed from the perspective of the patient and must address the geographic maldistribution of the pediatric workforce. In a study of general pediatricians and family physicians, Shipman et al identified significant disparities in access to primary care physicians for children. Almost 15 million children living in areas with a low penetration of physicians serving children were 6 times less likely to have access to primary care physicians compared with those
TABLE 4 Number of Pediatric Programs, Unfilled Programs, and Unfilled Pediatric Positions

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</thead>
<tbody>
<tr>
<td>Total No. programs</td>
<td>191</td>
<td>194</td>
<td>196</td>
<td>199</td>
<td>204</td>
<td>211</td>
<td>220</td>
<td>222</td>
</tr>
<tr>
<td>No. programs unfilled</td>
<td>6</td>
<td>4</td>
<td>7</td>
<td>8</td>
<td>13</td>
<td>23</td>
<td>29</td>
<td>24</td>
</tr>
<tr>
<td>Total No. available positions</td>
<td>2616</td>
<td>2640</td>
<td>2668</td>
<td>2689</td>
<td>2738</td>
<td>2788</td>
<td>2847</td>
<td>2864</td>
</tr>
<tr>
<td>Total No. filled positions</td>
<td>2606</td>
<td>2627</td>
<td>2654</td>
<td>2675</td>
<td>2683</td>
<td>2711</td>
<td>2778</td>
<td>2812</td>
</tr>
<tr>
<td>No. unfilled positions</td>
<td>10</td>
<td>13</td>
<td>14</td>
<td>14</td>
<td>45</td>
<td>57</td>
<td>68</td>
<td>52</td>
</tr>
</tbody>
</table>

children living in areas with a high penetration of physicians serving children, and almost 1 million children lived in areas without access to primary care physicians for children. Although there have been recent improvements in access to pediatric subspecialty care, there continue to be significant gaps for many of the pediatric subspecialties.45 With a recent study describing a higher degree of medical complexity for rural children admitted to children’s hospitals in comparison with urban children, our workforce discussions must consider strategies to reach children in rural areas of our country.46

Another important question to include in our workforce discussion is alignment with and recognition of the important workforce contributions of graduates of DO medical schools. Until the recent growth in osteopathic medical schools, pediatrics and most other disciplines relied on graduates of MD medical schools to populate their training programs. The recent decline in graduates of MD medical schools pursuing pediatrics has occurred during the time in which the AAMC reports a 1.5% annual increase in the number of graduates of US medical schools and overall reports a 31% increase in the number of graduates since 2002.47 Approximately 25% of our nation’s medical students are enrolled in osteopathic medical schools, and the annual growth in DO medical students is increasing well beyond the growth of MD medical students. In 2018, first-year enrollment in US DO medical schools increased by 5.7% compared with the previous year, significantly higher than the 1.3% increase in first-year enrollment in US MD medical schools.47,48 DO medical students make important contributions to the pediatric workforce, and survey data from DO medical schools for the 2019–2020 entering class reveal that 3% (n = 219) will pursue general pediatrics and an additional 6% (n = 423) will pursue a career in a pediatric subspecialty.49 The pathway of DO pediatric residents into the pediatric specialties will be important to monitor as current data suggest little 5-year change in the percentage of pediatric subspecialty positions filled by graduates of DO medical schools (Table 5). The practice pattern of DO medical students has the potential to impact the geographic maldistribution of pediatric care because 50% of entering DO medical students plan to practice in an underserved area, almost equally split between urban and rural areas of the country.49 The important contributions of DO medical students to the pediatric workforce will require a much deeper partnership with pediatric leaders at DO medical schools.

IMGs, both US and foreign born, constitute another important component of the pediatric workforce, with data suggesting that 25% of all practicing pediatricians are IMGs.50 American Medical Association data reveal that 62% of IMGs are primary care physicians, a rate much higher than graduates of MD medical schools. IMGs fill an important gap in the rural workforce and add significant diversity to our discipline.51–54 One large residency program has noted their success with recruiting IMGs, a goal that they have now achieved for almost 20 years.55 Recently, Chakraborty et al56 have discussed the important role of IMGs in our workforce and called for programs to address known challenges in preparing non–US-born IMGs for residency training.

Given the important contributions of the many individuals who comprise the pediatric workforce, it will be crucial to understand the process by which career decisions are made by trainees.57 The factors that impact career decisions of trainees may change throughout their educational journey. A recent qualitative study of medical students who entered medical school with an interest in pediatrics highlighted the interaction of intrinsic factors, such as perceived personal happiness with a career in pediatrics, and extrinsic factors, such as exposures to pediatrics both before and during their clerkship training, as contributing to the complex process of making decisions regarding future career plans.58 As training

TABLE 5 Who is Filling Pediatric Subspecialty Positions?

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. positions in the NRMP Match, N</td>
<td>1417</td>
<td>1658</td>
</tr>
<tr>
<td>Total No. positions filled in the subspecialty Match, N (%)</td>
<td>1214 (86)</td>
<td>1390 (84)</td>
</tr>
<tr>
<td>US MD graduates, n (%)</td>
<td>786 (65)</td>
<td>909 (65)</td>
</tr>
<tr>
<td>US DO graduates, n (%)</td>
<td>129 (11)</td>
<td>185 (13)</td>
</tr>
<tr>
<td>US IMG, n (%)</td>
<td>111 (9)</td>
<td>108 (8)</td>
</tr>
<tr>
<td>Non-US IMG, n (%)</td>
<td>187 (15)</td>
<td>187 (13)</td>
</tr>
<tr>
<td>Canadian graduate, n</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Understanding this decision-making process may offer potential insights for addressing concerns that have led to the dichotomy between subspecialty programs that easily fill their training positions and an equally important group of specialties that struggle to fill their training positions. Solutions to the administrative burdens and regulatory requirements that further compromise the goal of delivering clinical care and advancing the research agenda of the pediatric subspecialty workforce must be elucidated.5,15,66,67

Finally, it is our moral imperative to strengthen representation and diversity of the pediatric workforce. We must go beyond acknowledging the importance of workforce diversity and move to action-oriented strategies that enhance the diversification of pediatrics and demonstrate our clear commitment to this work as a core framework within pediatrics. Successful models must be reviewed, discussed, and disseminated widely.7,8,68,69 Leaders from these areas must be included in our workforce discussions.

**CONCLUSIONS**

Reviewing workforce data is a complicated undertaking, but as highlighted in this review, it is imperative to understand the changing composition of the pediatric workforce. Our vision for the future can best be achieved by a commitment to a comprehensive strategic planning process with the many organizations involved across the multiple stages of the educational continuum. There are many important considerations to include in this dialogue. The decline in MD medical students pursuing pediatric training requires a careful review of medical school curricula and a concerted effort to augment the pediatric experiences within our medical schools. The important contributions of DO medical students to our workforce must lead to a deeper partnership with leaders in osteopathic medicine. We must enhance the role of IMGs by identifying strategies that augment their training experiences.

Understanding the factors that impact the career decisions of trainees may highlight areas for potential interventions. Emphasizing and improving workforce diversity must be a core foundation of our work. The important contributions of pediatricians in clinical care, scientific discovery, education, and public health must be celebrated so that trainees understand the impact and advantages of pediatric careers. It is time to focus our efforts and address the myriad of challenges in the pediatric workforce. Establishing this as one of our highest priorities will require a major collaborative effort between our academic and professional organizations, but the future benefit to the nation’s children will be substantial.
REFERENCES


64. Frintner MP, Mulvey HJ, Pletcher BA, Olson LM. Pediatric resident debt and career intentions. *Pediatrics.* 2013;131(2):312–318


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