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CLINICAL RESEARCH ARTICLE

Assessing the pediatric subspecialty pipeline: it is all about the data source

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BACKGROUND: National Resident Match Program (NRMP) data are often used to identify the pediatric subspecialty pipeline. Other data sources may provide greater accuracy.
METHODS: Analysis of data from the NRMP and the American Board of Pediatrics (ABP) for 14 pediatric subspecialties from 2008 to 2020. We calculated, within each subspecialty, the annual number of first-year fellowship positions offered, the NRMP match rate, the actual number of fellows entering training (ABP data) relative to the number of positions in the match (fill rate), and the actual number of matriculating first-year fellows each year.
RESULTS: For all subspecialties and years, the fill rate was greater than the match rate. All subspecialties had an increase in the relative and absolute number of first-year fellows, with the largest increases seen in emergency medicine (73.3%) and critical care (68.9%). Except for adolescent medicine, all subspecialties had an absolute increase in the number of positions offered, with the largest increase in pulmonology (32.1%).
CONCLUSIONS: NRMP data underestimate the actual number of first-year fellows entering subspecialty training. For all subspecialties, the number of first-year fellows has increased over time, indicating continued expansion in the pipeline for most. However, there remains great variation across subspecialties.

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IMPACT:

- Perceptions of the pipeline for the pediatric subspecialty workforce vary depending on the data source.
- The use of NMRP match data alone underestimates the number of matriculating trainees.
- The number of unmatched fellowship positions has created a perception of a diminishing number of pediatric subspecialty fellows.
- This study uses multiple data sources to better understand the actual number of fellows entering pediatric subspecialty training and demonstrates that the NRMP match rate alone underestimates the pipeline of the pediatric subspecialty workforce.

INTRODUCTION

Concern has been expressed by leaders of the pediatric community regarding the adequacy of the pediatric subspecialty workforce.[1–4] These concerns have focused on the belief of both current shortages of subspecialists as well the potential for a diminishing workforce in the future.[2,3,5] Some advocates point to studies demonstrating increased waiting times for subspecialty care,[6] the number of open positions in Children's Hospitals and distances needed for patients to travel as evidence of such shortages.[7] Others have opined that a substantial part of the perceived subspecialty shortages may be due to structural issues with the clinical capacity of the existing workforce.[8–11]

Previous investigators have tracked the fellowship match rates provided by the National Resident Matching Program (NRMP) and expressed concern regarding both the proportion and absolute number of unmatched positions for many subspecialties believed to be in short supply.[2,3] These studies have been used to advocate for policies to increase the number of applicants to subspeciality fellowship programs to fill these vacant positions including loan repayment programs.[2,12–14] Other work has suggested caution in the interpretation of match rates due to the year-to-year variability in available positions.[11] In years where there is an increase in the total number of available positions, decreases in the proportion of filled positions may occur despite growth in the actual number of trainees matriculating into a specific subspeciality.[11]

An alternative, and potentially valuable perspective in the assessment of trends in the subspeciality workforce pipeline, may be provided by a data source other than the NRMP. The NRMP data used to determine match rates of available subspecialty training positions is determined precisely at the time of the subspecialty match. This occurs in November/December of the calendar year preceding the initiation of training.[15] However, this timing is more than six months prior to the actual time of matriculation of subspecialty fellows into their training programs.

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Table 1. Number of first-year fellowship positions offered by subspecialty reported by the NRMP[a].

Subspecialty	Number of first-year fellowship positions offered													
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Adolescent medicine	N/A	N/A	N/A	N/A	N/A	32	35	36	31	32	31	36	30	30
Cardiology	108	108	118	124	127	134	141	141	139	142	145	154	158	157
Child abuse	N/A	N/A	N/A	N/A	N/A	N/A	19	20	19	26	27	20	22	24
Critical care	116	141	139	150	152	162	169	168	175	187	184	191	198	189
Developmental and behavioral	N/A	N/A	N/A	32	32	37	38	41	48	44	49	48	46	42
Emergency medicine	112	118	134	136	151	159	163	162	177	180	180	196	199	200
Endocrinology	N/A	N/A	N/A	N/A	N/A	81	84	85	83	88	96	99	108	103
Gastroenterology	56	60	63	72	74	80	84	85	93	92	104	101	102	109
Hematology/oncology	129	142	146	152	158	164	157	162	164	166	170	176	174	176
Infectious diseases	N/A	N/A	N/A	N/A	N/A	53	64	66	70	77	72	79	73	77
Neonatal-perinatal	N/A	208	221	223	222	226	241	242	252	254	263	270	265	273
Nephrology	N/A	N/A	50	51	47	51	61	58	62	59	58	65	64	69
Pulmonology	N/A	N/A	54	56	63	65	56	61	66	67	69	74	74	76
Rheumatology	16	22	24	27	27	36	38	40	37	40	41	39	42	34

[a]NRMP match data and reports archive (https://www.nrmp.org/match-data-analytics/archives/).

As such, the number of individuals who actually enter subspecialty training cannot be determined until several months after the match when definite matriculation occurs (usually June/July of the following year). In contrast to the NRMP match data, the American Board of Pediatrics (ABP) collects data from subspecialty training programs on the actual number of trainees who enter their fellowships, heretofore termed the "fill rate" of available positions.[16] These data provide an alternative, and perhaps more useful, perspective than match rates alone.

To provide a clearer understanding of the actual pipeline for pediatric subspecialties, we examine over time the differences in trends for "match rates" and "fill rates", and the actual number of new fellows entering training in each pediatric subspecialty each year using both of these data sources.

METHODS

Data sources

Data were obtained from the NRMP[17] and the ABP.[18] The NRMP publishes data from the fellowship match each year including (1) the number of available positions for fellowship training for each American Council of Graduate Medical Education (ACGME) recognized pediatric subspeciality and (2) the number of individuals matched into each subspecialty for training. Fellowship match data are publicly available from 2008 onwards but some pediatric subspecialties did not participate in the match until later years or were only recognized as an ACGME accredited subspecialty after 2008.

The ABP publishes data regarding the absolute number of fellows that enter pediatric subspecialty training in July of each year, including both those who participated in the NRMP match as well as those who enter outside of the match. Data for Canadian programs were excluded. We utilized data from 2008 and all subsequent years to provide comparisons with the NRMP data.

We collected data regarding the following subspecialties: adolescent medicine, cardiology, child abuse, critical care, developmental and behavioral, emergency medicine, endocrinology, gastroenterology, hematology and oncology, infectious diseases, neonatal-perinatal, nephrology, pulmonology, and rheumatology.

Data analysis

Using the NRMP data, we calculated the "match rate" for each subspecialty for the years 2008–2020. The match rate is defined as the ratio of fellows that were reported as matched into a subspecialty fellowship relative to the number of first-year fellowship positions available for that year. The NRMP data were used to determine the number of available positions for each pediatric subspecialty each year.

"Fill rates" were calculated using the ABP data to determine the actual number of fellows entering training in each subspecialty relative to the number of first-year fellowship positions offered as reflected by the NRMP data. This "fill rate" represents the actual proportion of the NRMP available fellowship positions filled, including those who matriculate above and beyond the NRMP matching process.

RESULTS

Table 1 shows the number of first-year fellowship positions offered in the NRMP match each year for each of the pediatric subspecialties. For all subspecialties, except adolescent medicine, there has been an increase in the number of available first-year fellowship positions offered. In general, there were larger increases in the absolute number of positions offered among the larger subspecialties (i.e., those with >100 first-year fellow positions in the first year for which data were available). These were cardiology, critical care, emergency medicine, hematology/oncology, and neonatal-perinatal. Smaller absolute increases in the number of available fellowship positions were noted for those with <50 fellowship positions offered (i.e., child abuse, developmental and behavioral, and rheumatology). Emergency medicine had the largest absolute total increase in number of positions offered ($N = 87$) from 112 in 2008 to 199 positions offered in 2020.

Table 2. Fellowship match rates from NRMP data and fellowship fill rates using ABP data[a,b].

	Year																									
	2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		2018		2019		2020	
Subspecialty	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP
Adolescent medicine											50.0%	84.4%	60.0%	102.9%	77.8%	105.6%	83.9%	122.6%	81.3%	109.4%	67.7%	109.7%	75.0%	108.3%	96.7%	126.7%
Cardiology	93.5%	125.0%	96.3%	125.0%	99.2%	128.8%	99.2%	117.7%	92.9%	118.9%	94.8%	114.2%	94.3%	107.8%	97.2%	114.9%	96.4%	115.8%	97.9%	112.7%	96.6%	112.4%	98.1%	111.7%	92.4%	107.0%
Child abuse													63.2%	73.7%	65.0%	85.0%	26.3%	36.8%	46.2%	53.8%	51.9%	63.0%	65.0%	80.0%	54.5%	63.6%
Critical care	74.1%	125.0%	78.0%	118.4%	75.5%	115.1%	77.3%	121.3%	86.8%	113.2%	92.6%	109.9%	92.3%	118.3%	95.2%	111.9%	93.7%	108.6%	95.7%	104.8%	96.2%	114.1%	99.0%	118.3%	98.5%	109.6%
Developmental and behavioral							78.1%	103.1%	65.6%	106.3%	78.4%	110.8%	68.4%	100.0%	73.2%	117.1%	54.2%	68.8%	70.5%	102.3%	67.3%	81.6%	62.5%	87.5%	52.2%	76.1%
Emergency medicine	98.2%	117.9%	92.4%	128.0%	89.6%	123.9%	92.6%	123.5%	94.0%	116.6%	96.2%	121.4%	96.3%	116.0%	98.1%	112.3%	100.0%	116.4%	98.3%	115.0%	98.9%	115.0%	100.0%	113.3%	98.0%	111.6%
Endocrinology											75.3%	109.9%	73.8%	102.4%	76.5%	111.8%	65.1%	103.6%	68.2%	96.6%	66.7%	94.8%	50.5%	82.8%	62.0%	81.5%
Gastroenterology	92.9%	162.5%	93.3%	156.7%	88.9%	157.1%	94.4%	138.9%	98.6%	137.8%	85.0%	127.5%	92.9%	117.9%	96.5%	136.5%	92.5%	118.3%	93.5%	117.4%	93.3%	116.3%	92.1%	119.8%	95.1%	120.6%
Hematology/ oncology	91.5%	119.4%	86.6%	116.2%	90.4%	121.9%	87.5%	113.8%	90.5%	112.0%	93.9%	110.4%	96.2%	117.8%	94.4%	119.8%	97.0%	110.4%	98.2%	114.5%	90.0%	106.5%	89.8%	106.3%	82.8%	98.9%
Infectious diseases											67.9%	117.0%	68.8%	115.6%	45.5%	81.8%	64.3%	92.9%	62.3%	84.4%	55.6%	93.1%	46.8%	73.4%	63.0%	98.6%
Neonatal-perinatal			76.9%	120.7%	76.5%	120.8%	83.4%	122.4%	85.6%	119.8%	93.4%	123.5%	95.0%	127.0%	98.3%	124.4%	90.5%	117.9%	92.1%	114.6%	87.1%	119.4%	86.7%	116.7%	87.2%	110.9%
Nephrology					62.0%	110.0%	56.9%	103.9%	66.0%	108.5%	49.0%	86.3%	54.1%	75.4%	36.2%	70.7%	43.5%	66.1%	54.2%	78.0%	62.1%	96.6%	41.5%	63.1%	59.4%	92.2%
Pulmonology					75.9%	116.7%	60.7%	107.1%	66.7%	103.2%	64.6%	90.8%	51.8%	117.9%	49.2%	100.0%	65.2%	97.0%	70.1%	82.1%	68.1%	101.4%	54.1%	93.2%	66.2%	85.1%
Rheumatology	75.0%	206.3%	77.3%	145.5%	54.2%	116.7%	51.9%	107.4%	55.6%	100.0%	50.0%	75.0%	68.4%	81.6%	55.0%	72.5%	67.6%	89.2%	72.5%	102.5%	53.7%	82.9%	48.7%	79.5%	69.0%	95.2%

[a]NRMP match data and reports archive (https://www.nrmp.org/match-data-analytics/archives/).
[b]ABP pediatric subspecialty first-year fellows by demographics and program characteristics since 2005 (https://www.abp.org/content/yearly-growth-pediatric-fellows-subspecialty-demographics-and-program-characteristics).

Child abuse had the smallest total increase in number of positions offered ($N = 5$) from 19 in 2014 to 22 in 2020. Adolescent Medicine had a decrease in the number of positions offered from 32 in 2013 to 30 in 2020.

Using data from the NRMP, Table 2 shows the match rates of the fellowship positions each year for each pediatric subspecialty and the fill rates using actual matriculation data from the ABP. The subspecialties with the highest match rates were cardiology, critical care, emergency medicine, gastroenterology, hematology/oncology, and neonatal-perinatal, all of which had match rates >75% for most years. The specialties with the consistently lowest match rates were child abuse, developmental and behavioral, infectious diseases, nephrology, and rheumatology.

The fill rates (ABP data) in Table 2 represent the actual number of fellows entering subspecialty training each year, including those entering outside of the formal NRMP match. Across all years and all subspecialties, the fill rates are the same or higher than those reported by the NRMP match. There are many subspecialties (i.e., cardiology, critical care, emergency medicine, gastroenterology, hematology/oncology, and neonatal-perinatal) where the fill rate using ABP data often exceeds 100%, indicating that the actual number of first-year fellows entering that field is larger than the number of fellowship positions reported to be offered in the NRMP match process.

Using data from both the NRMP and the ABP, Table 3 compares the actual number of first-year trainees entering fellowships for each subspecialty each year. The NRMP data of first-year fellows matched for each subspeciality are consistently lower than reported by the ABP across all subspecialties and years. The greatest absolute difference between the NRMP and ABP data is seen in neonatal-perinatal medicine, ranging from an additional 21–61 first-year fellows entering training each year not accounted for in the NRMP match. The smallest absolute difference between the NRMP and ABP data was seen in child abuse.

The actual number and percent change in first-year fellowship positions offered in the NRMP match (NRMP data) and the actual number and percent change in first-year fellows entering training (ABP data) from the year 2008 to the year 2020 are found in Table 4. All subspecialties had an increase in the actual number of fellows entering training programs. The most substantial changes were seen in emergency medicine where there was a 73.3% increase, and critical care where there was a 68.9% increase. The smallest increase was in endocrinology (1.2%). As data for all subspecialties regarding the number of positions offered in the NRMP match were only available from 2014, the table presents a comparison of these data from the year 2014 to the year 2020. The greatest increase in the number of first-year fellowship positions offered was seen in developmental and behavioral, emergency medicine, endocrinology, and pulmonology. Each of these subspecialties had >20% increase in the number of first-year fellowship positions offered in the NRMP match. Adolescent medicine was the only subspecialty to have a decrease in the number of first-year fellowship positions offered. Despite this decrease in positions offered, there was a 25% increase in the actual number of adolescent fellows entering training.

DISCUSSION

The most important finding from this study is the marked and consistent undercounting of the actual "fill rates" for subspecialty trainees relative to the match rates when using the NRMP data versus the ABP data. The singular use of the NRMP data results in an artificially low impression of the number of matriculating subspecialty fellowship program trainees and a distorted perception regarding the number of unfilled positions for purposes of workforce assessment, training capacity and policy planning.

Our findings demonstrate that for all pediatric subspecialties the actual number of persons entering each subspecialty has not

Table 3. Number entering fellowship training each year using NRMP and ABP data[a,b].

	Year																									
	2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		2018		2019		2020	
Subspecialty	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP	NRMP	ABP
Adolescent medicine		28		23		35		25		36	16	27	21	36	28	38	26	38	26	35	21	34	27	39	29	38
Cardiology	101	135	104	135	117	152	123	146	118	151	127	153	133	152	137	162	134	161	139	160	140	163	151	172	146	169
Child abuse		12		11		12		12		11		13	12	14	13	17	5	7	12	14	14	17	13	16	12	14
Critical care	86	145	110	167	105	160	116	182	132	172	150	178	156	200	160	188	164	190	179	196	177	210	189	226	195	217
Developmental and behavioral		40		29		40	25	33	21	34	29	41	26	38	30	48	26	33	31	45	33	40	30	42	24	35
Emergency medicine	110	132	109	151	120	166	126	168	142	176	153	193	157	189	159	182	177	206	177	207	178	207	196	222	195	222
Endocrinology		87		83		96		94		93	61	89	62	86	65	95	54	86	60	85	64	91	50	82	67	88
Gastroenterology	52	91	56	94	56	99	68	100	73	102	68	102	78	99	82	116	86	110	86	108	97	121	93	121	97	123
Hematology/oncology	118	154	123	165	132	178	133	173	143	177	154	181	151	185	153	194	159	181	163	190	153	181	158	187	144	172
Infectious diseases		75		63		67		67		72	36	62	44	74	30	54	45	65	48	65	40	67	37	58	46	72
Neonatal-perinatal		268	160	251	169	267	186	273	190	266	211	279	229	306	238	301	228	297	234	291	229	314	234	315	231	294
Nephrology		54		56	31	55	29	53	31	51	25	44	33	46	21	41	27	41	32	46	36	56	27	41	38	59
Pulmonology		52		57	41	63	34	60	42	65	42	59	29	66	30	61	43	64	47	55	47	70	40	69	49	63
Rheumatology	12	33	17	32	13	28	14	29	15	27	18	27	26	31	22	29	25	33	29	41	22	34	19	31	29	40

[a]NRMP match data and reports archive (https://www.nrmp.org/match-data-analytics/archives/).
[b]ABP pediatric subspecialty first-year fellows by demographics and program characteristics since 2005 (https://www.abp.org/content/yearly-growth-pediatric-fellows-subspecialty-demographics-and-program-characteristics).

fallen since 2008, and for most, a steady growth has taken place. This finding should provide some reassurance to those who have expressed the greatest concern regarding a current crisis in the trends for the future subspecialty workforce. However, it does suggest that additional focused energy for at least the three subspecialties with the smallest increases (i.e., endocrinology, infectious disease and developmental/behavioral) is likely warranted.

Nevertheless, it is important to note that despite the increased numbers of subspecialty trainees, there remains significant variation in the number of fellows entering each of the pediatric subspecialties. This may be due to a variety of factors including the relative attractiveness of each subspecialty to potential applicants, the density of the child population in different parts of the country, or the epidemiology of the diseases and conditions treated by a specific subspecialty.[19,20] For the non-procedural subspecialties, several open positions remain each year. A greater understanding of why trainees choose a specific subspecialty career is needed. Such studies should be conducted longitudinally at multiple points along the training pathway to see if different issues have different weight at different times, and if any are associated with the final decision made by trainees to pursue a specific subspecialty.

For some subspecialties, the unfilled positions likely are a direct result of the recent creation of increasing numbers of available positions and the growth of training opportunities over the past several years. Less clear is whether the growth in available positions has taken place predominantly in existing programs or if it represents the creation of new training programs. Regardless, this mismatch raises the question as to whether there is an oversupply of positions or an undersupply of applicants and how those engaged in workforce policy might know the difference. As seen specifically for endocrinology, it also suggests that simply creating more positions does not necessarily increase demand for them.

There is no national or regional feedback mechanism in place to assess problems in the availability of specific subspecialty clinical services and ties that availability to the number of training positions or the actual number of trainees. As such, the number of available positions in subspecialty training cannot be viewed as a reflection of the societal needs for a subspecialist of a specific type. Rather, open fellowship positions are a combined function of available resources at a site to pay trainee salaries and the clinical service needs of a given institution. As physicians are more likely to practice in areas where they have trained,[21] any expansions in the number of subspecialty training positions should likely occur in areas where concern exists regarding the distribution of those same subspecialists, not in already large training programs in a few geographic areas.

The differences seen in the match rate and fill rate are not due to inherent inaccuracy on the part of either the NRMP or the ABP, but rather simply to the different points in time at which the data are collected. The NRMP data are a snapshot taken at the time match results are announced, usually in November or December of the year preceding matriculation into subspecialty training. Both the available positions declared by the training programs and the number of applicants matched are current as of that time. In contrast, the ABP data include all trainees entering fellowship programs, whether or not the available position or the individual trainee was included in the NRMP match. These data include trainees admitted "outside" or after the match, as well as instances where a training program may increase the number of available positions after the official match has taken place.[22] This may occur due to several factors including increases in available funding at a specific program, changes in immigration status or policy, and/or the desire to accommodate an exceptional candidate. Thus, for some subspecialties, the actual number of physicians entering fellowship training will exceed the number of positions thought to be available in the match when using NRMP data.

Table 4. Percent change in the number of first year fellow positions offered and number of first year fellows from the year 2008 to the year 2020[a,b].

	Number of first-year fellow positions			Number of first-year fellows		
Subspecialty	**2014**	**2020**	**% change**	**2008**	**2020**	**% change**
Adolescent medicine	35	30	−14.3	28	35	25.0
Cardiology	141	158	12.1	127	161	26.8
Child abuse	19	22	15.8	12	14	16.7
Critical care	169	198	17.2	122	206	68.9
Developmental and behavioral	38	46	21.1	34	35	2.9
Emergency medicine	163	199	22.1	116	201	73.3
Endocrinology	84	108	28.6	83	84	1.2
Gastroenterology	84	102	21.4	81	111	37.0
Hematology/oncology	157	174	10.8	137	158	15.3
Infectious diseases	64	73	14.1	62	67	8.1
Neonatal-perinatal	241	265	10.0	233	261	12.0
Nephrology	61	64	4.9	39	44	12.8
Pulmonology	56	74	32.1	46	60	30.4
Rheumatology	38	42	10.5	26	35	34.6

[a]NRMP match data and reports archive (https://www.nrmp.org/match-data-analytics/archives/).
[b]ABP pediatric subspecialty first-year fellows by demographics and program characteristics since 2005 (https://www.abp.org/content/yearly-growth-pediatric-fellows-subspecialty-demographics-and-program-characteristics).

The actual determination of whether there is a shortage of pediatric subspecialists of a given type and/or a decrease in the number of persons entering specific fields has occasionally taken a back seat to advocacy efforts to address this issue. In some cases, flawed methodologic approaches have been used to support hypotheses of specific subspecialist shortages, especially distance from subspecialty care, and to advance the notion that the simple provision of additional funding specifically targeted to increase available fellowship positions will address the matter.[7,23–25]

Currently, there is no certainty or consensus on the actual, or even approximate, number of providers in each pediatric subspeciality needed by our nation. Such a determination would be complex and require a more granular assessment of subspecialty supply regarding actual clinical capacity and the most efficient use of that capacity. For example, some have previously opined that simply increasing the number of physicians may not have an appreciable impact on waiting times or other measures of clinical availability.[11] This is because only a variable fraction of the professional time of subspecialists is allocated to clinical care. It is possible that a new National Academy of Medicine study will shed light on this issue.[26]

The fraction of professional time devoted to clinical care by subspecialists is influenced by a number of considerations. Many of these factors may decrease clinical time allocation for individual subspecialists.[9–11] Importantly, apart from neonatology, most pediatric subspecialists are employed in academic medical centers.[27] These same centers have created a paradigm where a common goal (explicit or implicit) for faculty members is to "buy out" or otherwise diminish their clinical time. This paradigm is the product of the notion that perceived or actual success in academic environments is rarely, if ever, a function of the volume or excellence in clinical care provided by a subspecialist faculty member. Rather, the path to recognition and reward comes through research, administration, education or, more recently, quality improvement efforts.[28,29] This reality means that departments must often hire several full-time equivalent positions to achieve marginal increases in a clinical capacity for subspecialties they may posit to be in short supply. Initiatives to increase the prestige and value of clinical care may help to somewhat offset current clinical capacity concerns.

There are additional factors that may negatively impact the current clinical capacity of the existing subspecialty workforce. Attempting to address these factors may provide a significant expansion of clinical availability from those already in their respective fields. One such factor is the variation in the periodicity of return visits for children with chronic illness. Variation in care is known to occur both within and across institutions.[30,31] Rigorous evaluation and subsequent development of guidelines regarding the most appropriate duration between visits has the potential to increase outpatient clinical capacity significantly. Similarly, increased efforts by subspecialists to return some patients back to their primary care physician following consultation for either shared care or discharge from their clinics could potentially increase clinical capacity by a magnitude that would otherwise require several new clinicians to provide.

Another facet of the perception of pediatric workforce adequacy centers on concerns regarding the number of subspecialists engaged in research as a central focus of their professional careers.[32–34] These concerns have focused in a number of areas including the attractiveness of research careers, changing economic pressures on researchers and overall extramural funding available or awarded for children's issues, and culminate in a perception of a diminishing supply of pediatric scientists. However, the only recent study to assess changes in the number of either younger (<50 years of age) or older (>50 years of age) pediatric scientists devoting either >25% or >50% of their professional time to research over recent decades has failed to demonstrate true actual change.[8] As such, the actual basis for such concerns of recent change is unclear.

An important complicating factor in designing workforce policy initiatives is a lack of consensus as to how one would determine whether the supply of pediatric subspecialists in a given field is adequate. In other words, how will we know if or when we have enough? Without a goal, or even the methods to define a goal, it is unclear how to determine the most beneficial policy recommendations for the subspecialty care of children.

Workforce policy initiatives are best when reliant on objective data to guide their development. Resource allocation for children's issues is scarce, even in the best of financial times. As such, we must ensure that advocates for children have the best possible

information on which to base their efforts. Workforce policy is no exception.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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AUTHOR CONTRIBUTIONS

G.L.F. conceptualized and designed the study, coordinated and supervised data collection, drafted the initial manuscript, and critically reviewed and revised the manuscript for important intellectual content. K.L.W. collected data, carried out the initial analyses, and reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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