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Invited Commentaries

Development of Paediatric Nephrology Training

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Abstract We shall bring into focus the history of training and board certification in paediatric nephrology in the USA. In the three decades since 1974, the American Board of Pediatrics certified over 700 paediatric nephrologists with the current active workforce of 631, giving a manpower national average of 0.6 paediatric nephrologists per 100,000 populations under 18 years of age. The workforce entry and exit is in parallel with population growth, at least for the foreseeable future. Paediatric nephrology training in other parts of the world is extraordinary diverse. No one single system or approach fits all because of dissimilar local conditions. Different emphasis arises due to distinctive local conditions and priorities. Everywhere, paediatric nephrologists are concentrated at big cities, accentuating the tension between urban and rural concerns. Finally, we would like to kindle a conversation about future training in this subspecialty, in a complex world of expanding science and contracting resources.

Key words Certification; Examination; Paediatric nephrology; Training; Workforce

Introduction

We aim to bring into focus the development of paediatric nephrology in the USA,[1,2] simply because this has the longest history of training, certification and tracking.[3-6] Then, we shall briefly touch on a survey of training in some other countries. Lastly, we shall bring up the question regarding what conversations we should be having about future training.

American Board of Pediatrics (ABP)

Let us start with the basic requirements of the ABP.[3] In order to enter nephrology training, a physician holding the MD or equivalent degree must have completed three years of paediatric residency. Nephrology training requires 3 additional years: consisting of one clinical year and two research years. Throughout the research years in most programs, clinical training continues with one month per year of in-patient service and one day a week of outpatient renal clinics. In this way, continuity and long-term care becomes an integral part of the training.

Accredication Council of Graduate Medical Education (ACGME)

Thirty-five training programs are approved by the ACGME. The ACGME, established in 1981 (has been in operation since 1972 under the name of Liaison Committee of Graduate Medical Education) is a private, independent national accreditation organisation for all post-MD training. The ACGME approves all training in specialties and subspecialties. Its member organisations are the American Board Medical Specialties (to which the ABP is included); American Hospital Association; American Medical Association; American Association of Medical Colleges (AAMC); Council of Medical Specialties Societies (to

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which the ASPN is included). Each member organisation appoints four members to the ACGME Board of Directors. Through their respective member organisations, the ABP and the ASPN are represented on the ACGME Board.

The ACGME requirements for graduate medical education in paediatric nephrology are as follows: During the clinical year, the trainee, under supervision of at least two board certified faculty, gains competence in treating patients in the renal clinics, including dialysis/transplant clinics; in-patient nephrology service and evening/weekend calls. The trainee gains competence in kidney biopsies, dialysis procedures, pre- and post-transplant care under the supervision of the faculty. Out of recognition that care for children with kidney disease, especially end-stage kidney failure, requires a multidisciplinary approach, the following faculty must be available in addition to the minimum of 2 paediatric nephrologists: paediatric surgeon, urologist, transplant surgeon, pathologist, radiologist, and psychiatrist/psychologist. In addition, the following resources must be available: fully staffed space for outpatient and inpatient services, dialysis/transplant service and kidney biopsies; laboratory and diagnostic imaging services; nutritional, social services, and psychiatry/psychology support personnel.

The ACGME does not specify as to what constitute enough volume of patients. But most accredited programs usually have more than 10 kidney transplants; more than 10 chronic dialysis patients; and more than 10 acute dialysis cases over a 3-year period. If the program director judges that the trainee can benefit from more experience in any procedures beyond the first clinical year, additional training in procedures available in the subsequent two years can be arranged for the trainee, without losing out in research time.

For the research years, the trainee chooses a preceptor.[1,3] They have informal daily interactions to discuss research development. During both the research as well as the clinical years, formal periodic evaluations are conducted by a review committee, usually consisting of the program director, the preceptor and other faculty members.

Training is augmented by course work in molecular biology, genetics and statistics; advanced training in laboratory and clinical trial methods. There are basic science and research conferences, where the trainees participate and hone their presentation skills. Finally, they receive training in writing of abstracts, manuscripts and grants. This heavy emphasis on research training is in recognition that paediatric nephrology is an academic profession. Private practice paediatric nephrology is not economically feasible, because of the small patient volume. This is in contrast to internal medicine nephrologists serving a large enough adult patient population, in private dialysis centers.

History of the American Board of Pediatrics (ABP) and the American Society of Pediatric Nephrology (ASPN)

In 1933, the ABP was founded.[3] In 1968 the ASPN was founded.[5] By a milestone Act of Congress, access to dialysis/transplantation treatment, as a basic right of every citizen, became law in 1972. Henceforth, only board certified subspecialists bill for such Medicare services. Accordingly, in 1974 the first certification examination in paediatric nephrology was given by the ABP.[3] Currently, the examinations are given at 2-year intervals. Finally, re-certification examinations are given every 10 years to promote ongoing lifelong learning and self-assessment. This takes the form of a closed book, secure examination as a component of Maintenance of Certification process.

The number of trainees in the recent 7 years (Table 1),

Table 1 Number and other data on paediatric nephrology trainees from the American Board of Pediatrics[3]

Year	Total n	Male/Female %	American Medical Graduate/ International Medical Graduate %
2001-2002	74	46/54	50/50
2002-2003	86	42/58	64/36
2003-2004	115	40/60	64/37
2004-2005	116	34/66	66/35
2005-2006	110	39/61	66/34
2006-2007	124	32/68	60/40
2007-2008	125	34/66	51/49

almost doubled, which is a good sign that paediatric nephrology continues to be attractive as a career choice. It is also noted that in the same period of time (Table 1), there is a progressive increase of female trainees from 54% to the current majority of 66%. This is a reflection of the general trend that paediatrics continues to be favored by female medical graduates. The last column shows the % of American medical graduates (AMG) to international medical graduates (IMG). For 2008, the most recent year with completed data, trainees were equally divided between AMG and IMG. No data are available concerning how many IMG return to their home-countries and how many stay in the USA. Even if half of the IMG choose not to stay, the manpower supply will still keep pace with the growth of the paediatric population, for the foreseeable future.

Table 2 shows the passing rate of the nephrology certification examination for first time examination takers, which stays at 82% in the recent 2 cycles. This compares with those who take the 2008 general paediatrics examination (78%) or the neonatology (83%) or cardiology (78%) subspecialty examinations with a larger number of trainees or with the pulmonary subspecialty examination (77%), closer in size of trainees as nephrology.

Table 3 shows that more than 700 individuals have been certified as paediatric nephrologists since the beginning of certification in 1974, and 631 are still active as of December 2008.[2] The median age is currently 55.7 years.[2] The national average stands at 0.6 paediatric nephrologists per 100,000 populations under 18 years of age. But distribution of the workforce is uneven throughout the country. The highest ratio is in Washington DC (Table 3). This could be a reflection of the higher number of paediatric nephrologists in administrative positions in the federal government and include many who are working in the National Institutes of Health. Five states are without board certified paediatric nephrologists. It is possible that these are primarily rural states. So the tension between rural and urban priorities is palpable even here.

Table 2 The American Board of Pediatrics. Passing rate of first time examination takers[3]

	2005/2006		2008	
	#	%	#	%
General paediatrics	2850	77	2916	78
Neonatology	309	79	357	83
Cardiology	162	77	209	78
Pulmonology	74	72	83	77
Nephrology	39	82	62	82

NIH Support for Training

The revenues of support for training come from faculty practice, hospital and NIH grants. The category of NIH grants entitled T32 training grants are awarded by competitive, peer review to institutions, to support the research years of the trainees and include not only salary but also support for the trainee's attending or presenting at local, national or international research conferences. Trainees, especially those at top-ranked research universities, are encouraged to apply for NIH individual research awards to support their research years, using the results of their first year of a T32 grant as a springboard.[5,7,8] Both categories of training grants stipulate that the trainee has at least 75% time devoted to research, free of clinical duties. Such NIH training awards lead to another category of grants entitled the Mentored Research awards for a number of years, until the trainee matures into an independent investigator, with successful investigator initiated (RO1) research grants. Aside from salary support, additional funds are made available to sustain the recipients'

Table 3 Specifics on ABP-certified paediatric nephrologist

727 diplomats since the beginning of certification in 1974.

631 paediatric nephrologists are active as of 2008. Median age: 55.7 years.

Workforce national average: 0.6 paediatric nephrologists per 100,000 populations under 18 years of age.

Uneven distribution of paediatric nephrologists throughout the country

- Washington DC has the highest ratio: 4.4 paediatric nephrologists per 100,000 children.
- Six states with paediatric nephrologists: child ratio equal to or exceeding 1:100,000: Maine, Maryland, Massachusetts, Ohio, Rhode Island, and Washington State.
- Five states with no ABP certified paediatric nephrologists: Hawaii, Montana, North Dakota, South Dakota, and Wyoming.

support personnel. Finally, aside from these "Direct Costs" to the trainee/investigators, the NIH provides "Indirect Costs" to the sponsoring university for grant administration and maintenance of the facilities in connection with the research efforts. Depending on locale, the "Indirect Costs" of most RO1 grants come to an additional 50% to 90% of the "Direct Costs." The "Indirect Costs" are usually divided between the university, the medicine dean's office and the department sponsoring the investigator. In this myriad method, seeding for innovative research is born.

Paediatric Nephrology Training in Other Parts of the World

An informal survey was conducted with input from contacts in the 5 regions (in brackets) of the world: (Africa) Egypt; (Americas) Argentina, Brazil, Canada, Chile, Mexico; (Asia-Pacific) Australia, China, Hong Kong, India, Japan, South Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand; (Europe) France, Germany, Greece, Russia, Spain, Switzerland, United Kingdom; (Middle East) Israel, Saudi Arabia, Turkey.

Out of the 5 regions, 19 countries have national certification examination with training varying from 12 months to 3 years or more. Quite a few have long histories of certification.[9] Eighteen countries have no national certification, with training varying from a few months or more. The workforce data per country are extraordinarily diverse, varying from 10 to 1100 physicians with interest in paediatric nephrology. Finally, in examining this workforce data equalised to the paediatric population in each country, we found 0.3 to 3.0 paediatric nephrologists per 100,000 populations less than 14 years of age.

To what extent the available resources, priorities and local conditions drive this workforce diversity and the direction of training, remain open for discussion.[10,11] In regions with inadequate workforce, innovative ways may need to be implemented to re-train academic faculty to fill this gap.[12]

Strengths and Weaknesses

A few of the central specifics concerning paediatric nephrology in the USA are summarised in Table 3. The strengths of the US system are the uniformity and outstanding training available at each of the accredited programs, which are located in different regions of the country. Out of the 131 AAMC accredited US medical schools, it is generally recognised that the 35 paediatric nephrology training programs, accredited by ACGME, are situated in top-ranked universities with strong research environments.

The on-going, periodic re-accreditation of these training programs and the certification examinations are vigorous processes to insure high quality of the graduate medical education. The tracking of ABP diplomats is invaluable in analysis of outcomes and policy decisions. The operating expenses are high, because the ACGME and the ABP are non-government organisations, financed primarily by the fees levied on the institutional and individual applicants under review. The documentation and administrative support on the part of the sponsoring medical school paediatric department, incurs a great deal of effort and capital which cannot be recouped. Some departments regard training programs as almost unsustainable. Thus, these are simultaneously strengths and weaknesses in the system.

This paradox of simultaneous strength and weakness extends to the length of the training. By the time the subspecialty training is completed, the trainee would have been at least 10 years after graduation from college, counting the 4 years of medical school, 3 years of paediatric residency and 3 years of paediatric nephrology fellowship training. The stress on the trainee and the trainee's family, the move to a different city each step of the way for most trainees and the adjustment to a new environment every 3 to 4 years are demanding, not to mention the limited salary of the trainee, a decade beyond college and the education loan repayments constantly on the horizon. On the one hand, despite these limitations, it has been an assured process to produce superbly trained paediatric nephrologists. On the other hand, research training of only 2 years may be insufficient for the trainee to be truly competitive for NIH grants.

In recognition of these issues, the NIH has instituted a new educational "loan forgiveness program" as well as the innovative mentored research grants to support junior investigators for a number of years after completion of subspecialty training, before they are fully competitive for RO1 grants.[1,6] In addition, the American Society of Nephrology, the ASPN, the National Kidney Foundation and other public interest groups have grant opportunities to support career development of young investigators.

Finally, the resources, accountability and openness of the NIH and its peer review structure are the crowning jewels of the American system, which continues to lead and innovate.

Conclusions

With these diverse data as backdrop, we should keep an open mind as we can learn from each other. At least we can begin open discussions and collaborations. At these critical times of global recession, we have to conserve our limited resources and think innovatively about ways and means to fulfill our mission of providing the best training to care for children with kidney disease, in a rapidly changing world.

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