

Adult Nephrology Fellowship Training in the United States: Trends and Issues

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This article reviews trends and issues related to adult nephrology fellowship education in the United States. The number of nephrology fellowship programs and trainees has continued to increase slowly despite limitations in funding of graduate medical education. The use of the Electronic Residency Application System has provided information for the first time on the number, demographics, and behavior of applicants that can be used as baseline data for tracking trends in fellowship applications and for formulating training policies. Issues that nephrology training programs face are discussed in this review: (1) A more stringent graduate medical education regulatory environment, (2) the use of the National Resident Matching Program to enhance the nephrology fellowship applicant selection process, (3) future nephrology workforce shortages, and (4) the continued subspecialization of nephrology. By working together, nephrology fellowship programs can overcome barriers that are raised by these issues and improve the fellowship training experience.

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The objective of this article is to provide a summary of the trends and issues in adult nephrology fellowship education in the United States. Future decisions on education and policy issues require accurate information regarding the demographics of nephrology trainees and programs. These data are available from several national sources and are reviewed. With the use of an electronic application system, data are now available for the first time about the number and demographics of applicants for nephrology training. As the specialty of nephrology evolves and the training environment changes, fellowship programs will have to deal with a number of important matters. This article discusses issues that are related to accreditation, a formal match in nephrology, workforce needs, and further subspecialization. These issues are complex and often controversial but are raised to foster constructive dialogue among the relevant constituencies.

Trends in Nephrology Fellowship Education *Demographics of Nephrology Fellows and Programs*

Demographic data were obtained from the National Graduate Medical Education Census obtained through Graduate Medical Education (GME) Track. This is an Internet-based system of the Association of American Medical Colleges (AAMC) that is jointly sponsored by the American Medical Association and the AAMC (<http://www.aamc.org/programs/gmetrack/start.htm>). Information from the GME Track survey is published

in the annual medical education issue of the *Journal of the American Medical Association* (1–7). The most recent data are for the 2005 to 2006 academic year and included 135 Accreditation Council for Graduate Medical Education (ACGME)-approved adult nephrology fellowship programs (7). There were a total of 822 nephrology fellows with 372 first-year fellows. The demographics of the fellows are shown in Table 1. The majority of fellows were either white (43.1%) or Asian (40.9%), with a relatively small number of black or Hispanic fellows. The number of fellows who completed training in 2005 to 06 was 366.

Trends in fellowship training are displayed in Figure 1 for the academic years 1998 thru 2005. During this time, the number of ACGME-approved fellowship programs increased from 127 to 135, and the number of fellows increased from 635 to 822. The majority of this growth has occurred since 2002. Because Medicare caps for GME have remained frozen at 1996 levels, the sources of funding for this growth in fellowship numbers remains unclear. The percentage of international medical graduates (IMG) who are enrolled in nephrology fellowship programs has decreased from 1998 levels but has remained constant during the past few years (Figure 2).

Graduates of nephrology fellowship programs must take the American Board of Internal Medicine (ABIM) subspecialty certification examination in nephrology to become board certified. Table 2 displays the number of first-time takers of this examination along with pass rates. As can be seen, pass rates were high and relatively stable during the past 3 yr.

Applications to Nephrology Fellowship Programs

The Electronic Residency Application System (ERAS) was used for the first time by adult nephrology fellowship programs for applicants who were applying to start training on July 1, 2007. The transition to ERAS was voluntary, but the majority of nephrology programs participated. The main rea-

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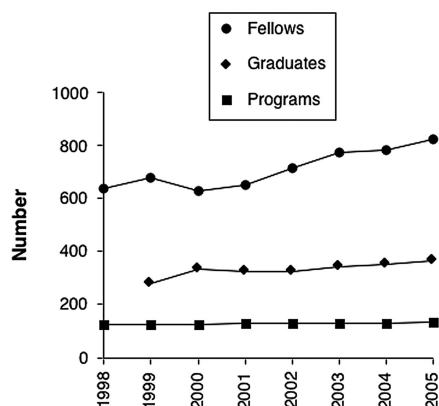
Although the author served as chair of the Training Program Directors Executive Committee of the American Society of Nephrology (ASN) from 2003 to 2006, the views expressed in this article are those of the author and not of the ASN or the members of the Executive Committee.

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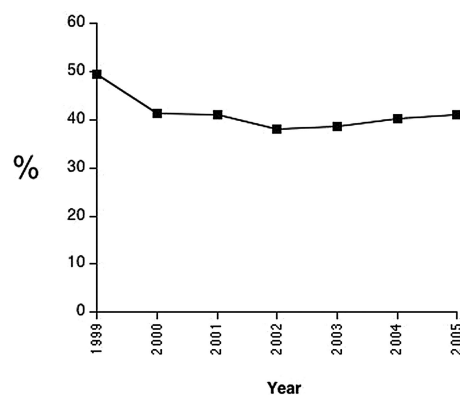
Table 1. Demographics of adult nephrology training in the United States, 2005 (7)^a

Category	Value
Total fellows	822
First-year fellows	372
Women (%)	30.3
USMG (%)	52.7
IMG (%)	41
Canadian medical graduates (%)	0.9
Osteopathic medical graduates (%)	5.4
Race	
white	354
black	45
Asian	336
American Indian/Alaskan native	1
Hispanic	47
Native Hawaiian/Pacific Islander	17
other/unknown	69

^aIMG, international medical graduates; USMG, US medical graduates.

**Figure 1.** Trends in adult nephrology fellowship training in the United States for 1998 to 2005. The total number of fellowship programs, fellows, and fellows who graduated from training programs are displayed.

sions for using ERAS were to make the application process more standardized and to allow residents more time to make appropriate career decisions. In the past before ERAS, interviews for nephrology fellowships usually took place 2 yr before starting a fellowship. With ERAS, programs received applications December 1, 2005, for the start date of July 1, 2007. There was no uniform offer date or match, leaving many programs and applicants a short window of time to interview and make selection decisions. Operationally, the application process using ERAS offered a number of advantages. All applicant documents were provided from one source, all application data were automatically stored for comparison in one database, and tools were available to programs to facilitate review and evaluation of application material. The use of ERAS allowed inter-

**Figure 2.** The percentage of international medical graduates for each academic year is displayed.**Table 2.** Pass rates for first-time takers of the ABIM subspecialty certification examination in nephrology^a

Year	Total No. of First-Time Takers	% Passed
2005	395	92
2004	377	91
2003	396	95
2002	367	89
2001	312	88

^aData are from <http://www.abim.org/resources/statcert.shtm>. ABIM, American Board of Internal Medicine.

ested candidates to apply electronically to multiple programs with a single application.

There is no cost to nephrology fellowship programs for using ERAS. In fact, there is potential cost savings in the decreased administrative work that is involved in the handling of paper applications. The cost to applicants is based on the number of programs to which they apply. The cost for applying to up to 10 programs was \$100; for 11 to 20 programs, the cost was \$10 per program; for 21 to 30 programs, \$15 each; and for 31 or more programs, \$25 each.

The use of ERAS provided for the first time national statistics regarding the number, demographics, and behavior of applicants. These data are useful for future historical trending, analysis of workforce issues, and individual program comparison with national statistics. As can be seen in Table 3, there were a total of 757 applicants to nephrology, with US medical graduates (USMG) comprising 29.6% of applicants and IMG 70.4%. IMG applied to a greater number of programs compared with USMG (35.9 *versus* 16.9 programs per applicant), which is reflected in the total number of applications received by each program. There were an estimated 372 first-year positions available, giving a ratio of 2.03 applicants per fellowship position. The number of IMG who enrolled in fellowship programs has remained at approximately 40% (Figure 2). If this trend continues, then >70% of IMG who apply to nephrology fellowship programs may not be successful in obtaining a fellowship

Table 3. ERAS applications to nephrology fellowship programs for academic year 2007^a

Category	Value
Total applicants	757
USMG	224 (29.6%)
IMG	533 (70.4%)
Average applications per person, USMG	16.9
Average applications per person, IMG	35.9
Average applications per program, USMG	28.0
Average applications per program, IMG	153
No. of programs	135
No. of first-year positions	372
Applicants per position	2.03

^aData are from <http://www.aamc.org/audienceeras.htm>. ERAS, Electronic Residency Application System.

position. Nephrology application data are compared with that of other specialty programs in Table 4. As can be seen, nephrology ranked behind cardiology and hematology and oncology in the total number of applications and was fourth in the number of applications from USMG. No data were available for gastroenterology which did not participate in ERAS but started using ERAS in December 2006.

For the July 1, 2008, start date, 129 programs were listed as participating in ERAS (<http://www.aamc.org/audienceeras.htm>). Excluding military programs and programs in Puerto Rico, only three programs did not participate, for a participation rate of 97.7%. The ERAS Web site opened to applicants on July 1, 2006, to allow them to begin working on their applications. On November 15, 2006, applicants could start selecting and applying to specific programs. Applications became available to training programs on December 1, 2006. ERAS is an application system and does not mandate a uniform offer date to candidates or a match. After much discussion, nephrology training programs have committed to the principle of a uniform interview season that extends

Table 4. ERAS applications to all specialty fellowship programs for academic year 2007^a

Fellowship Program	USMG	IMG	Total
Cardiovascular disease	714	870	1584
Hematology and oncology	353	507	860
Nephrology	224	533	757
Pulmonary disease and critical care	278	437	715
Endocrinology, diabetes, and metabolism	197	342	539
Oncology	193	294	487
Infectious disease	199	214	413
Rheumatology	145	221	366
Hematology	75	114	189
Pulmonary disease	18	157	175
Critical care medicine	31	139	170

^aData are from <http://www.aamc.org/audienceeras.htm>. Gastroenterology did not participate in ERAS.

through January 31, 2007. During this time, programs can make offers to applicants but cannot demand a commitment until February 1, 2007.

Issues in Nephrology Fellowship Education

Accreditation Issues

Several new requirements that were instituted by the ACGME will be challenging for fellowship training programs, departments of internal medicine, and sponsoring institutions. Funding for the effort of the program director and key faculty is one challenge (8). The ACGME requires that the program director dedicate an average of 20 h/wk of his or her professional effort to the subspecialty program, with sufficient time for administration of the program. The program director must “receive institutional support for that administrative time.” Because this institutional support is being mandated by the ACGME, it is critical that fellowship programs work with their internal medicine departments and institutions to secure this funding.

In addition to the program director, each program must have key clinical faculty (KCF) who on average dedicate 10 h/wk throughout the year to the training program. For programs with more than five fellows, a ratio of KCF to fellows of at least 1:1.5 must be maintained. The availability and funding for this time for the program director and KCF is problematic, particularly for smaller programs. In addition, the ACGME work-hour limitations on fellows has led to the transfer of care of some patients from fellows with faculty supervision to faculty only requiring a greater financial commitment to cover this additional faculty time.

A second challenge pertains to evaluating fellows on the six general competencies that now are required in residency and fellowship programs (patient care, medical knowledge, practice-based learning and improvement, interpersonal communication skills, professionalism, and systems-based practice). Starting in July 2006, a single evaluation method is no longer sufficient to assess the competence of a trainee. Programs must demonstrate at least two methods of evaluation for each of the competencies. The ACGME recommends development of a structured portfolio for each trainee that includes foundational evaluations, direct observations, practice and data-based learning, and multisource evaluations (9). The use of an outcomes-based evaluation system will enhance the feedback that fellows receive about their performance. However, the development of valid and reliable tools by individual programs and the training of faculty in these evaluation techniques are challenging to individual programs. These challenges can be met in a number of different ways. The ACGME and the GME community need to determine whether these more stringent competency requirements affect such outcomes as quality of trainees or patient care. Existing evaluation tools need to be shared among training programs, with the ACGME taking the lead in offering their vision of “best tools” to training programs. New methods for assessing the six competencies need to be developed and assessed for their effectiveness. Finally, a plan to share existing evaluation tools and methods on a central Web site is being

developed by the American Society of Nephrology (ASN) training program directors.

In-Training Examination in Nephrology

The Association of Specialty Professors (ASP) has launched an initiative to have all fellowship programs implement formal in-training examinations no later than the year 2010, as is currently done for internal medicine and other residency programs. An in-training examination would be used to evaluate formally the knowledge of trainees and can serve as an independent predictor of performance on the ABIM examination for board certification. The examination can also be used by programs to identify deficiencies in training. Having such a tool will help in the assessment of the core competencies of medical knowledge and patient care and can provide an opportunity to survey all trainees on issues such as recruitment, career choice, and practice plans.

Although some specialty fellowship programs have already developed an in-training examination, the majority of programs have only begun the process or have not yet taken the necessary steps. There are financial advantages of bringing subspecialties together when programs use a standardized set of services and uniform processes. More important, common pools of questions can be developed to assess areas of common interest, such as end-of-life care, ethics, and continuous quality improvement. The ASP interviewed a number of different vendors before recommending the National Board of Medical Examiners (NBME) as the vendor of choice for the development, administration, and scoring services for the subspecialty in-training examinations. NBME is a not-for-profit institution whose mission is to provide high-quality testing and research services to organizations that are involved in the licensure and certification of health care professionals. The NBME is most notable for its role in developing and administering the US Medical Licensing Examination and for administering the internal medicine in-training examination.

The ASP and NBME hosted a meeting with representatives from subspecialties that were interested in discussing fellowship in-training examinations on May 30, 2006. Nephrology, with the support of the ASN and its Training Program Directors Committee, agreed to move ahead with the development of an in-training examination. The next steps are to host a question (item)-writing workshop to develop a pool of questions and to select an In-Training Examination Committee of interested volunteers to move this initiative forward. The tentative date for the first examination in nephrology is the spring 2009. This will allow sufficient time to develop a high-quality examination. The working model for the examination is for it to be Web based and consist of approximately 250 questions. The cost for the examination is projected to be \$200 to \$220 dollars per fellow per year.

Nephrology Match

The National Resident Matching Program (NRMP) is a private, not-for-profit corporation that was established to provide a uniform date of appointment to positions in GME in the United States. The Specialties Matching Service of the NRMP

conducts matches for advanced residency or fellowship positions. For matching services to be provided, each specialty must verify that at least 75% of programs with available positions in a given year are registered for the match, encourage programs to participate actively by submitting a rank-order list, and have at least 75% of the available positions within the specialty registered with the NRMP. Not all programs and not all positions in any one program must be in the match.

Medical specialties that participate in the match and the year they joined the match are as follows: Cardiovascular disease (1986), gastroenterology (1986 to 1999; rejoined in 2006), hematology (2006), hematology/oncology (2006), infectious disease (1986 to 1990; rejoined in 1994), oncology (2006), pulmonary and critical medicine (1986), and rheumatology (2005). The medical specialties that are not participating in the match at the present time are nephrology, endocrinology, diabetes and metabolism, sleep medicine, and geriatric medicine.

To assess the interest level for a match, a Web-based survey was conducted by the ASN in February 2006 and targeted all adult training program directors in nephrology. In response to the question, "Should there be a match for nephrology?" 61.8% of nephrology training program directors said yes and 38.2% said no ($n = 102$). Potential disadvantages of the match are discussed next and were cited in the survey as reasons for not wanting to participate in the match. When internal medicine residents were surveyed in 2001, 69% of the respondents believed that the fellowship application process for all programs occurred too early for them to make an informed decision (10). A similar percentage of residents surveyed preferred a uniform starting date for offering appointments.

Disadvantages for nephrology participation in the match include the following:

- The current system for selecting fellows is familiar and is working well for many programs. Changing the selection system would raise the level of uncertainty beyond a threshold that would be comfortable for some programs.
- The match would decrease flexibility particularly for programs that very specifically match a given candidate with a specific laboratory. Also, for some programs, the decision about positions is an iterative process and therefore dependent on which candidates accept the initial offers. This flexibility would be decreased with the match.
- Programs would have to interview more candidates to generate their match list. This would be expensive and time-consuming.
- A match requires widespread support of all training programs to ensure compliance. Many program directors recalled the failure of a previous nephrology match that was held more than 20 yr ago during which many programs offered positions outside the match, disadvantaging those who participated. Currently, the rules are stricter and the applicant pool is larger.
- The match creates a level of uncertainty regarding which candidates will match with a given program, potentially leading to unsatisfied candidates and/or programs.

Advantages for nephrology participation in the match include the following:

- The match provides applicants and programs with the time and the opportunity to make an informed decision. For programs that are participating in the match for the 2007 academic year (start date July 1, 2007), the dates for submitting rank-order lists for applicants and programs began April 12, 2006, and ended June 7, 2006. Match Day was June 21, 2006. This timeline allows programs and applicants a longer interview season. Applicants no longer have to make career choices during their internship year before they have had the chance to do electives, perform research, or establish the necessary contacts for letters of reference.
- The match would provide order to what has been a chaotic application process. The interview season would become more standardized, creating an even playing field for nephrology fellowship programs to compete.
- Absence of a match places undue pressure on applicants. A frequent complaint of applicants was that after interviewing at a specific program, they were told to decide within a short time frame whether they were interested in the program. Many had future interviews scheduled and had to decide between accepting the current early offer or continuing with these interviews.
- The longer interview season would prevent the disruptive consequences of applicants accepting an early offer and then resigning the offer after choosing a program that they preferred but had a later interview date.
- There is greater potential for applicants to choose programs other than their own when there is a more uniform interview season including a match. This has been seen with the Gastroenterology Match (11,12). Such cross-fertilization has many advantages to programs and applicants, including diversity of ideas and experiences.
- The match offers programs flexibility in deciding how many tracks the program offers and how these tracks are filled. There can be separate tracks for research and clinical positions within a participating program. For example, research tracks in the Gastroenterology Match are further subdivided into basic science and clinical research (11). There is also flexibility for positions to be moved between tracks at the time of the actual match. If a nephrology program has three positions and wants to fill two positions in a clinical track and one in a research track, then the program would submit separate rank-order lists for each track. If the research position did not fill, then the program could elect to revert the position to its clinical track and the matching algorithm would attempt to fill the research position from the clinical track's rank-order list. The program can determine the order in which the different tracks for a program are filled. Also, applicants can apply for one or more tracks within a given program. Therefore, programs can customize the matching process.
- The number of applicant interviews that a program conducts is likely to increase with participation in the match. However, this can be a positive consequence because it allows

programs and applicants to consider all options before making decisions and removes the pressure on programs to accept reasonable applicants before completing all interviews.

- Without a match, nephrology is potentially falling behind other specialties that participate in the match. When the career plans of internal medicine residents who took the 2005 Internal Medicine In-Training Examination were examined ($n = 17,258$), 5.5% ($n = 949$) were interested in nephrology (13). This number of potential applicants is more than the actual number who applied for 2007 ($n = 757$; Table 2), although the populations are likely different. Of the group surveyed, 12.3% were undecided, 12.9% were going into cardiology, and 8.5% were going to gastroenterology. The lack of a uniform application and acceptance process is a potential barrier for choosing nephrology for undecided but high-quality applicants.
- After the match, information is available to the training program regarding the choice of ranked applicants who did not match with their program. This information can be valuable to programs for improving their recruitment strategies in the future.

The advantages and disadvantages of the match have to be carefully assessed by programs as they decide whether to participate in the match. In my opinion, the current application and acceptance process is chaotic, disadvantages the candidates, and could potentially impair our ability to recruit high-quality candidates into nephrology. A match in nephrology would build trust and good faith between our specialty and the applicants, as well as between training programs.

Workforce Needs

According to the AAMC Physician Specialty Data report (<http://www.aamc.org>) that used the American Medical Association Physician Masterfile (January 2006), 6891 nephrologists were listed as active physicians. This translates to 43,300 people per nephrologist in the United States compared with 3000 for general internal medicine, 7900 for psychiatry, and 26,000 for gastroenterology. Approximately 30% of nephrologists were aged 55 or older. The number of nephrologists increased by 1804 between 1995 and 2004. The production rate of nephrologists, defined as the ratio of first-year fellows in ACGME-accredited nephrology training program to active nephrologists, is approximately 5%, a rate that is similar to that of internal medicine. For comparison, the production rate for internal medicine subspecialties varies from a high of 44% for interventional cardiology to a low of approximately 4% for gastroenterology.

A comprehensive report on workforce and training requirements for nephrology was conducted by the ASN and its sister societies, the National Kidney Foundation (NKF), the Renal Physicians Association, the American Society of Transplant Physicians, and the American Society of Pediatric Nephrology, and was published in 1997 (14,15). At the time of the survey, 235 nephrology trainees graduated from nephrology training programs, acquiring specialty certificates. The report con-

cluded that nephrology has not been training new nephrologists beyond anticipated need and that training programs would need to expand. In fact, the number of trainees would have had to increase by 200 trainees for each year between the years 1996 and 2010 to meet conservative workforce estimates. The number of actual graduates is plotted in Figure 1. In 2005, the number of new graduates was 366, the highest number in recent years, but the growth is well short of projected needs. Similar projected workforce shortages in nephrology have been reported by others (16–18).

Lack of funding is the major limitation to expanding the number of nephrology trainees. The Balanced Budget Act of 1997 capped the number of Medicare-funded GME positions (19,20). Despite this lack of funding, the number of nephrology fellowship graduates has increased (Figure 1), reflecting the use of alternative funding sources or redistribution of training positions within institutions. No data are available regarding which of these possibilities has occurred more often or the source of additional funds. In addition, it has been increasingly difficult to pay for the research training that is needed for both the mandatory scholarly activity that is required of all trainees by the ACGME and the more extensive research training of fellows who plan to have an academic research career. Growth is further hampered by the growing uncompensated effort that is required to train fellows given the ACGME requirements for hours devoted to training by program directors and key faculty (8). Finally, not all graduates of US training programs will join the clinical workforce. For example, 40% of graduates are IMG, some of who return to their home countries to practice (Figure 2).

Solutions to the projected workforce shortage in nephrology are either to decrease demand for nephrologists or to increase supply. The demand for nephrologists is unlikely to decrease given the rising incidence of ESRD (although this may be stabilizing) and the growing involvement of nephrology in the management of the early stages of chronic kidney disease. On the supply side, new strategies for funding nephrology training have to be developed. The case needs to be clearly made regarding projected workforce shortages in nephrology. Nephrology should join forces with other subspecialties under the leadership of organizations such as the ASP and the Association of Professors of Medicine to address the future of funding for GME. An issue that nephrology can specifically address relates to the fact that hospitals receive only half of the financial support (payment for indirect medical education) for fellows in subspecialty training compared with residents in “primary care” specialties. The case should be made to designate nephrology a “primary care” specialty that serves a defined chronic disease population. Doing so would qualify hospitals for a higher level of reimbursement and should have advantageous downstream effects for nephrology training programs. New and existing partners need to be approached to fund additional clinical nephrology fellowship positions. Examples of new partnerships include affiliated hospitals, nephrology practices, or even large health plans along the lines of an “all-payer” fund. Organizations that currently fund nephrology research, such as the National Institutes of Health, ASN, NKF,

American Heart Association, and Juvenile Diabetes Foundation, should also be approached with new ideas to enhance the funding of nephrology research training.

Subspecialization in Nephrology

The ABIM is the US specialty board that “sets the standards and certifies the knowledge, skills, and attitudes of physicians who practice in internal medicine and its subspecialties.” A single examination and certification for nephrology is available. As part of the new uniform recognition of all subspecialties, the ABIM offers certification of newer subspecialties in other fields, including adolescent medicine, clinical cardiac electrophysiology, critical care medicine, geriatric medicine, interventional cardiology, sleep medicine, sports medicine, and transplant hepatology, under the designation “subsidiaries of internal medicine.”

As with other internal medicine specialties, nephrology is becoming more subspecialized, with additional training available for transplant and interventional nephrology. An additional year of training in transplant nephrology is available through programs that are accredited by the American Society of Transplantation and the ASN to provide subspecialty training to nephrologists, qualifying them to head United Network for Organ Sharing–approved renal transplant programs. There are 42 accredited renal transplant training programs in the United States (http://www.a-s-t.org/accreditation/AST-ASN_accredited.htm).

The American Society of Diagnostic and Interventional Nephrology has defined criteria for the certification of interventional nephrologists and the accreditation of programs in ultrasonography, insertion of peritoneal dialysis catheters, endovascular procedures on arteriovenous fistulas and grafts, and placement of chronic venous catheters for hemodialysis (<http://www.asdin.org/>) (21). Neither transplant nephrology nor diagnostic and interventional nephrology is ACGME accredited or recognized as a subspecialty by the ABIM.

In the future, there will be growing pressure to recognize formally these subspecialties in nephrology. Such recognition has important implications for the general discipline of nephrology and for training programs in particular. On the positive side, these subspecialties have a distinct and unique body of knowledge and skill sets that should be recognized. Formal recognition of these programs could potentially open up funding sources for training that are limited in most institutions to ACGME-approved programs. On the negative side, dividing nephrology into distinct subspecialties has the potential to fragment the specialty. Aspects of transplant and interventional nephrology are part of the training of all nephrologists. Subspecialization may place limitations on the practice of general nephrology. This could lead to heterogeneity of care such that a dialysis patient would need to be referred to a transplant nephrologist once that patient undergoes a kidney transplant.

Options for dealing with subspecialization in nephrology include not doing anything to keep nephrology as a single specialty. Alternatively, transplant nephrology or interventional nephrology could apply to the ABIM for designation as a separate subspecialty in internal medicine, similar to what

was done for transplant hepatology. More moderate options would be to work with the ABIM to develop either special certifications for the areas of transplant nephrology and/or interventional nephrology or request “focused recognition” within the structure of the maintenance of certification program. Subspecialization will continue to be a challenge and should be approached with a careful and thoughtful review of these and other issues to allow for the harmonious integration of all aspects of nephrology.

Conclusion

The number of nephrology fellowship programs and trainees in the United States has continued to increase slowly despite funding limitations. This growth is not large enough to meet previously estimated workforce needs. Also, there is a pronounced shortage of minority nephrologists (18). Training programs have to face a more stringent regulatory environment and increased demands on faculty time. Additional training is available in transplant nephrology and diagnostic and interventional nephrology. The integration of these subspecialties into the overall training and certification of nephrologists remains an open issue. Despite these challenges, there are many ways in which training programs can come together to enhance the nephrology fellowship experience and ultimately the care of nephrology patients. Lobbying for greater funding of fellowship programs should be done on a local and national level. Evaluation tools can be developed and shared among programs, including the proposed in-training examination. Programs can cooperate to ensure the future diversification of the nephrology workforce to reflect better the patient population served. The application and selection process for trainees should evolve to reinforce the principles of professionalism and fairness that exist in our discipline. Training our future workforce remains one of the most important responsibilities in nephrology and needs to be approached with intensity, innovation, and integrity.

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Disclosures

None.

References

- Appendix: II. Graduate Medical Education. *JAMA* 284: 1159–1172, 2000
- Graduate medical education. *JAMA* 286: 1095–1107, 2001
- Graduate medical education. *JAMA* 288: 1151–1164, 2002
- Graduate medical education. *JAMA* 290: 1234–1238, 2003
- Graduate medical education. *JAMA* 292: 1099–1113, 2004
- Graduate medical education. *JAMA* 294: 1129–1143, 2005
- Graduate medical education. *JAMA* 296: 1154–1169, 2006
- Zeidel ML, Kroboth F, McDermot S, Mehalic M, Clayton CP, Rich EC, Kinsey MD: Estimating the cost to departments of medicine of training residents and fellows: A collaborative analysis. *Am J Med* 118: 557–564, 2005
- Holmboe ES, Rodak W, Mills G, McFarlane MJ, Schultz HJ: Outcomes-based evaluation in resident education: Creating systems and structured portfolios. *Am J Med* 119: 708–714, 2006
- Clayton CP, Battinelli DL, Ladenson PW: Halfway toward healing a broken system: Fellowship recruitment in internal medicine. *Am J Med* 117: 69–71, 2004
- Niederle M, Proctor DD, Roth AE: What will be needed for the new gastroenterology fellowship match to succeed? *Gastroenterology* 130: 218–224, 2006
- Niederle M, Roth AE: The gastroenterology fellowship match: How it failed and why it could succeed once again. *Gastroenterology* 127: 658–666, 2004
- Evolution of medicine. Career aspirations of residents. *Academic Internal Medicine Insight* 4: 9, 2006
- Estimating workforce and training requirements for nephrologists through the year 2010. Ad Hoc Committee on Nephrology Manpower Needs. *J Am Soc Nephrol* 8[Suppl 9]: S9–S13, i–xxii, 11–32 passim, 1997
- Neilson EG, Hull AR, Wish JB, Neylan JF, Sherman D, Suki WN: The Ad Hoc Committee report on estimating the future workforce and training requirements for nephrology. The Ad Hoc Committee on Nephrology Manpower Needs. *J Am Soc Nephrol* 8[Suppl 9]: S1–S4, 1997
- Hollomby DJ: Manpower issues outside the U.S. Canada looks at its supply of nephrologists. *Nephrol News Issues* 12: 15–17, 1998
- Kletke PR: The changing supply of renal physicians. *Am J Kidney Dis* 29: 781–792, 1997
- Pogue VA, Norris KC, Dillard MG: Kidney disease physician workforce: Where is the emerging pipeline? *J Natl Med Assoc* 94: 39S–44S, 2002
- Dunn MR, Miller RS, Richter TH: Graduate medical education, 1997–1998. *JAMA* 280: 809–812, 1998
- Miller RS, Dunn MR, Richter T: Graduate medical education, 1998–1999: A closer look. *JAMA* 282: 855–860, 1999
- Beathard GA, Trerotola SO, Vesely TM, Schimelman B, Zimmerman R, Himmelfarb J, Work J: What is the current and future status of interventional nephrology? *Semin Dial* 18: 370–379, 2005