Increasing Medical Student Interest in Nephrology

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Keywords

Nephrology workforce · Medical school · Specialty choice · Medical education

Abstract

Background: Interest in nephrology careers is declining, possibly due to perceptions of the field and/or training aspects. Understanding practices of medical schools successfully instilling nephrology interest could inform efforts to attract leading candidates to the specialty. **Methods:** The American Society of Nephrology Workforce Committee's Best Practices Project was one of several initiatives to increase nephrology career interest. Board-certified nephrologists graduating medical school between 2002 and 2009 were identified in the American Medical Association Masterfile and their medical schools ranked by production. Renal educators from the top 10 producing institutions participated in directed focus groups inquiring about key factors in creating nephrology career interest, including aspects of

their renal courses, clinical rotations, research activities, and faculty interactions. Thematic content analysis of the transcripts (with inductive reasoning implementing grounded theory) was performed to identify factors contributing to their programs' success. **Results:** The 10 schools identified were geographically representative, with similar proportions of graduates choosing internal medicine (mean 26%) as the national graduating class (26% in the 2017 residency Match). Eighteen educators from 9 of these 10 institutions participated. Four major themes were identified contributing to these schools' success: (1) nephrology faculty interaction with medical students; (2) clinical exposure to nephrology and clinical relevance of renal pathophysiology materials; (3) use of novel educational modalities; and (4) exposure, in particular early exposure, to the breadth of nephrology practice. **Conclusion:** Early and consistent exposure to a range of clinical nephrology experiences and nephrology faculty contact with medical students are important to help generate interest in the specialty.

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Introduction

Interest in nephrology careers among internal medicine (IM) residents is waning. Applicant totals have steadily decreased since nephrology rejoined the National Resident Matching Program's Medical Specialties Matching Program in 2009, dropping below available fellowship positions in appointment year 2014 [1]. Among the top reasons for not choosing nephrology are perceptions that the care of patients with end-stage renal disease is too complicated, a lack of mentors, and the insufficient number of procedures in nephrology [2]. Prevailing perceptions, and misperceptions, of the specialty have accelerated this decline [3, 4]. For example, the belief that nephrology is a poorly remunerated specialty with a soft job market, despite recent reports showing nephrology in the middle tertile of base compensation among medical and surgical specialties [5]. Such perceptions are important given that lifestyle factors – including time off, schedule control, and financial compensation – weigh heavily in medical students' career choices [6].

Efforts to reverse the decline have been focused at the training program level, including redesigning preclinical [7] and clinical educational approaches [8], and implementing and adapting new pedagogical methods [9, 10] that accommodate the current generation's learning needs. Yet, identifying and understanding practices of institutions successfully generating nephrology career interest are needed. To address this, the American Society of Nephrology (ASN) Workforce Committee developed the "Best Practices Project" to isolate translatable methods from the top nephrologist-producing institutions—both medical schools and IM residencies—that could be disseminated and implemented to reverse the declining nephrology interest.

Methods

Board-certified nephrologists who graduated medical school between 2002 and 2009 were identified in the American Medical Association's Masterfile. The medical schools of these future nephrologists were tabulated, and the top 10 medical schools ranked by total graduates included in this study. Institutional characteristics were collated from publicly available data and participant survey responses (online Supplemental Material; for all online suppl. material, see www.karger.com/doi/10.1159/000501058). Directed focus group questions were developed by the Best Practices Subcommittee (chaired by the first author [S.M.S.]) covering aspects of fostering student interest in nephrology and specific elements of their educational environment (e.g., clerkships, mentorship, and training strategies). Multiple stakeholders at each institution, including renal educators, training program directors (TPDs), and

a department of medicine chair, participated in the focus groups facilitated by the first author (S.M.S.). In order to have familiarity with the medical school program, participants were either directly involved in teaching renal pathophysiology courses at their institution, developing curricula, or directly overseeing teaching faculty in addition to their other roles in the academic institution.

Deidentified focus group transcripts were analyzed for distinct themes by 2 reviewers (S.M.S. and K.A.P.). Thematic content analysis identified key attitudes and approaches facilitating recruitment into nephrology. Codes and major themes were identified over the course of 2 subsequent rounds of review by 2 researchers (S.M.S. and K.A.P.) and interrater reliability assessed using the Krippendorff's alpha statistic [11] ($\alpha = 0.66$). Networks of themes with linkages were generated to form a conceptual model.

This study was approved by the Johns Hopkins School of Medicine Institutional Review Board (IRB00081315). All participants gave oral consent at the start of their focus group. Data were analyzed using ATLAS.ti 7 (Berlin, Germany).

Results

The top 10 medical schools graduating future nephrologists were located in the Northeast (3 institutions), Midwest (3), and South (4) census regions. Median class size was 185 students; 26% of graduates entered IM. Focus groups were conducted with 18 physicians from 9 of the institutions who were directly involved in the renal components of the medical students' training.

Four major themes were identified that contributed to these schools' success in creating nephrology career interest: (1) nephrology faculty interaction with medical students; (2) clinical exposure to nephrology and clinical relevance of renal pathophysiology materials; (3) use of novel educational modalities; and (4) exposure, in particular early exposure, to the breadth of nephrology practice. Translatable approaches distilled from these themes are presented with representative quotes in Table 1 (online Supplemental Material for program characteristics and additional themes and quotes).

The impact of nephrology faculty on medical students was commonly reported by renal educators, who described faculty presence in multiple aspects of a student's experience. This includes the renal course, overall medical school curriculum, and residency program. One renal educator stated, "[W]e're... visible and approachable, not only when the students are rotating on nephrology...[but] our involvement in the general IM curriculum both pre-clinical and clinical is...apparent..." Another renal educator stated, "It's about... faculty [having] a big presence in the medical school and even in the residency program. It's about providing good teaching and forming relationships with students, mentoring relationships with them."

Table 1. Themes, translatable approaches, and representative quotations

Theme	Translatable approach	Exemplar quotation
Nephrology faculty interaction with medical students	Mentoring programs pairing students with nephrology faculty	It's about ... faculty [having] a big presence in the medical school and even in the residency program. It's about providing good teaching and forming relationships with students, mentoring relationships with them
	ASN's TREKS Program	It's really exposure; being present, ...participating in morning reports. You know giving residents, lectures for students also present. And just being very approachable
Clinical exposure to nephrology and clinical relevance of renal pathophysiology materials	Increasing faculty presence on wards, Grand rounds presentations, and participation in conferences and didactic sessions	The other thing is that we're trying to take students also into clinic and outpatient dialysis rounding. So basically, round the students up, put them in a car, go to the outpatient unit rounds on a monthly round or regular visit with dialysis patients and also have them sit in CKD clinic. And I think showing the variety of nephrology, I think that's something that might spark interest
	Offering range of clinical nephrology experiences to medical students in preclinical and clinical years	I think it's the patient care because these are students that are relatively new to seeing patients and applying to put the pathophysiology that they've learned in their former 2 years. [S]o you kind of see how excited they get when they actually see patients and then they go back and then they say, "Oh, this is because of this happening" and this is what we were talking about when we were talking about the great (gray) abstract idea in pathophysiology back, you know, last year
Use of novel educational modalities	Expanded use of interactive, case-based educational offerings	We were one of the first sections in the internal medicine curriculum to do [activity-based] learning where we do ...clinical case scenarios. We have our lectures online so students listen to lectures as an online recording and then come to class where we do clinical cases and use a lot of TurningPoint polling technology. So, we have the class actively engaged and we received very positive feedback
		We have revised our curriculum, so now at least 50% of the sessions have to be [activity-based] learning. We've used the (flip) classroom approach. We've done team-based learnings sessions which is sort of a (flip) classroom approach for our assets-based session. It generally gets good reviews, again just having the students more actively engaged, we've moved away from the path of lecture format
Exposure, in particular early exposure, to the breadth of nephrology practice	Summer research programs matching students with nephrology faculty investigators	[The] relationships with the faculty that are very important. I think the key is just getting those relationship[s] started earlier and earlier. And research is a good way to do it
	minority health and translational research programs	[Research is performed] in the summer of first year and first-year students are eligible, they actually get a stipend ... for an eight-week program. [T]he students who participated in the [program] and did some research in renal went on to pick renal as their specialty later on
		What we have been trying to do is to expose med students to the whole spectrum of nephrology, and that means inpatient nephrology and it's one-on-one with the attending so there's no fellow in between or resident
TREKS, Tutored Research and Education for Kidney Students.		

Beyond faculty presence, the close relationship between nephrology faculty and students seemed particularly poignant. One TPD stated, "...one of the things that drives them in is just the faculty, and I think that faculty and ...responsiveness of faculty to-and interest in faculty in-developing the medical students and giving them good experiences is ...key of this whole thing." "[F]or a student to see themselves as a ... nephrologist, ... they have to feel as if they could see themselves as a faculty person," a renal educator noted. "So, they have to connect to the specialty but more importantly, the faculty member."

Finally, faculty enthusiasm, both in their overall presence and teaching, was readily apparent. One renal educator stated, "[H]aving faculty that are eager and excited to teach and approachable I think is the key [to success]." Another renal educator stated, "[A] big factor in attracting students and residents to the field of nephrology has been just providing really good teaching from likeable individuals. And I just get a sense that when students try to master the topic that's when their interest develop."

Clinical exposure to nephrology was identified as essential to successfully generating interest in nephrology, both in the inpatient and outpatient rotations. "[W]e actually have the third and 4 years in renal, that's when they get their exposure to the renal cases. They see the patients, they present like an intern." Involvement in this clinical curriculum is further enhanced by active engagement for students. One renal educator described that, "in our med student rotation, we actually have every student in their month of rotation present a case and it's a formal presentation, PowerPoint. And based on the feedback that I have received, it sparked certainly a lot of interest in nephrology, reading and preparing a case." Finally, this engagement can continue into other parts of the clinical curriculum, including case presentations and conferences. One renal educator noted, "[O]ur students go to clinic every week, and then they also do the inpatient consult service. And they attend the [3 h of] nephrology didactic conferences every week."

Programs successfully generating medical student interest in nephrology tended to focus on novel educational modalities, including small group learning, moderated physiology lectures, flipped classrooms (where students absorb the material asynchronously before apply it practically in the classroom/lab), and application of pathophysiology to patients. Teaching sessions are typically smaller, with one TPD stating their approach "was case-based but it was in small groups [of] 15–20 and not more to facilitate learning. And I think that ...close interaction with the nephrologist is beneficial." Another TPD high-

lighted the novel and active curriculum, "We were one of the first sections in the IM curriculum [at our institution] to do [activity-based] learning where we do-basically in class, we do clinical case scenarios. We have our lectures online so students listen to lectures as an online recording and then come to class where we do clinical cases and use a lot of TurningPoint polling technology [on mobile phones or clickers]. So we have the class actively engaged and we received very positive feedback."

Finally, successful programs included exposure to multiple aspects of what the field can offer, such as clinical care, research, education, and leadership. This theme depends on the previously mentioned themes above including clinical exposure, but is distinct in that students see what the field and the faculty have to offer. One TPD stated, "I ... think that as a division that we have a lot of good role models for all sorts of different types of faculty.... [W]e've got scientists. We've got ... educators that are involved in the medical school. We've got physician administrators... [M]ost of our faculty are also involved in some aspect of leadership and I think that ... is also helpful to students ... just to have role models in all different aspects of academic medicine." Another added, "I think it's good for the medical students to be exposed to sort of everybody on the renal division. I think that some of the more clinical faculty have more exposure to people on the wards and some other people, you know, have more exposure during the basic science time. But I think it's important to...expose everybody because everybody has a slightly different career."

A variety of clinical cases and settings, whether electrolyte disorders or outpatient dialysis, while emphasizing the primacy of the physician-patient relationship was reported across institutions. One renal educator described this as, "conveying the variability of nephrology that nephrology offers. I mean, as I think is such a wide range of conditions and physiology and I think bringing that across ... takes ... time and passion versus just dialyzing patients left and right." Another TPD stated, "I think making sure that students get exposed to the whole spectrum and the more fun parts of nephrology other than really sick returning end-stage renal disease patient is very important."

Discussion

Several factors can play a role when choosing medical careers. This includes how a subject and career path is taught and presented to prospective medical students.

Faculty influence on career choice and specialty interest has been well described in the literature [3, 6, 12–14]. Educational experiences, the nature of patient care, and lifestyle factors during clerkship were the leading influences on fourth-year medical students' career choice regarding IM [13]. Shah et al. [3] found a majority of nephrology fellows surveyed (65.2%) cited mentorship and role modeling for choosing the specialty. In proposing a redesigned nephrology rotation for residency, Jhaveri et al. [15] emphasized the importance of broadening faculty exposure to provide "...access to as many faculty members as possible." Horn et al. [16] specifically recommended that "...faculty in specialties with declining interest could attempt to ensure they are visible, available and approachable to residents seeking guidance with their careers."

Early clinical experiences for medical students have been recommended by McMahon et al. [17] to increase nephrology exposure in the preclinical years. Using case-based approaches [7] can synthesize the clinical relevance of the material and motivate students to understand the complexity of renal pathophysiology, a common challenge – and negative influencing factor for choosing the specialty – among medical students.

In silico case studies, simulated patients, 3D visualizations [7], as well as active learning approaches utilizing small groups and interactive polling technology [18] can help a range of different learners appreciate the complexities of renal pathophysiology.

Allowing students to see the full scope of nephrology was often closely tied with faculty providing early clinical experiences in the outpatient setting. Innovative nephrology elective curricula designed to broaden students and IM resident's views of the specialty through an increased variety of clinical settings, educational activities, and faculty engagement have been described [8, 14, 19]. Lane and Brown [20] notes "... exposure to general nephrology clinics (including rural-based practices) ... and subspecialty areas of interest ... should contribute to providing a more rewarding and balanced training experience." McMahon et al. [17] pointed to developing "nephrology curricula that are broad and relevant while emphasizing the diversity of opportunities that exist in a nephrology career, including interventional nephrology, transplantation, recent advances in the understanding of the pathophysiology of renal disease, and improvements in the delivery of dialysis."

While exposure to the breadth of the specialty was consistently noted among participants, mention of nephrology procedures, specifically kidney biopsy, dialysis access management and/or line placement, ultrasonography,

and transplantation, was not identified by focus group participants. This is an important finding given the potential primacy of procedures as an influencing factor in career choice [2] and perception of nephrology as a specialty with few procedures. While nephrology procedures are performed at academic medical centers (our study population), the lack of a response about procedures may be an artifact of the focus group question script, which was designed to elicit broad discussion driven by participants and lacked a specific prompt specific for procedures.

Our study is limited by the narrow timeline for schools graduating board-certified nephrologists (2002–2009). Although these programs' training structure may have subsequently changed, the timespan was chosen to allow for students to choose and complete residency (3 years) and fellowship (2–3 years). No institutions were in the West census region, our selection into the study was based on absolute number of graduates rather than percentages, and not all participants shared similar faculty positions and/or roles in their respective institutions; these perspectives may have introduced some variance. While the lack of heterogeneity potentially introduces selection bias, the distillation of themes is still likely translatable to other programs. We also designed and moderated the focus group script to generate broad insights into programmatic issues. Like any focus group, this format may stimulate ideas, but also has the potential to have expectancy bias no matter how much we attempted to minimize this bias. Another limitation is that our study focused solely on medical schools and did not examine aspects of residency, which is the focus of the project's next phase. The results of the current study may have been even stronger if the analysis was restricted to faculty/schools from medical school graduates who clearly had an interest in nephrology at the time of medical school graduation (as a way to control for the effect of GME training); however, this is not available. In addition to the educators' perspective, it would be helpful to survey medical students and residents to better determine what educators can do to improve the understanding of renal medicine. This is an open area for the next research study. Finally, our study only examined US medical graduates, who since 2007 comprise a minority of current trainees.

Translatable approaches to increase student exposure to nephrology faculty and the full range of the specialty include utilizing summer research programs matching students with nephrology faculty investigators. Typically offered between years medical school 1 (M1) and M2, and often with a mentoring component, these programs give students a chance to develop early connections with ne-

phrology investigators and, sometimes, present work at national meetings. Beyond basic and clinical research, several institutions focused on minority health and translational research. Studies demonstrate the importance of research to exposing medical students to nephrology [3, 17].

Mentoring programs pairing students with nephrology faculty were commonly leveraged to increase faculty availability and interaction. Although most institutions have such programs, encouraging nephrology faculty to participate could have a lasting effect in increasing medical student interest.

Another option is ASN's Tutored Research and Education for Kidney Students Program, which pairs an intensive renal physiology experience with longitudinal mentoring [21].

Increasing faculty presence on wards, presentations at grand rounds, and participation in conferences and didactic sessions are all important opportunities for enhancing medical students' exposure to nephrology. These could lead to clinical and mentorship opportunities for preclinical students, a key factor among surveyed programs. Offered either on a formal basis or ad hoc, this allows faculty the flexibility to expand students' perspectives of the specialty through outpatient and other settings. In addition, providing medical students with clinical elective experiences in nephrology during M3 or M4 can increase both the exposure to clinical cases and to faculty in nephrology. However, we recognize faculty face numerous competing interests—from clinical service to

academic output—that may prevent faculty from engaging in these activities. Implementation is predicated on support from the division and administration.

Finally, expanded use of interactive, case-based educational offerings can help facilitate comprehension and immediate utility of complex physiology among learners whose digital fluency and learning styles may differ from previous generations [10].

Conclusion

Early and consistent clinical nephrology experiences and contact with nephrology faculty are key factors in generating medical student interest in nephrology. Translatable approaches include offering summer nephrology research opportunities; leveraging existing nephrology mentoring programs; expanding nephrology faculty participation in grand rounds, morning reports, and conferences; offering a broad range of clinical nephrology experiences to medical students in their preclinical and clinical years; and implementing interactive case-based approaches and other novel modalities in renal pathophysiology curricula.

Disclosures Statement

K.A.P. and K.L. are ASN employees. The results presented have not been published previously, except in abstract format.

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