

## **Perspective**

### **Increasing Medical Student Interest in Nephrology**

#### **SUPPLEMENTAL MATERIAL**

#### **PART 1: Demographic Survey and Focus Group Questions**

##### **Demographic Survey:**

1. What is the approximate size of a medical school class at your institution?
2. What is the mean percentage of graduates entering an internal medicine residency?
3. What is the size of your catchment area?
4. Does your institution offer additional training beyond internal medicine/pediatrics (i.e., subspecialty fellowships)?

##### **Focus Group Questions:**

1. What factors have made your program successful at producing medical graduates that choose nephrology careers?
2. In your experience, what seems to get students interested or excited about nephrology?
3. How involved are the nephrology faculty in student programs at your institution?
4. How does your institution approach teaching the principles of renal physiology and pathophysiology?
5. Are your students exposed to nephrology cases during rotations in internal medicine? If so, please describe.

6. Do students have the opportunity to choose nephrology as an interest area for 4th-year rotations? If so, please describe the structure of the rotation.
7. Do students have the opportunity to choose nephrology as a research area? If so, please describe.
8. Does your institution have any kind of mentorship program in place for medical students? If so, please describe.

## PART 2: TABLES

**Table 1: Characteristics of Participating Institutions**

<b>Medical School</b>	<b>Location</b>	<b>Total Enrollment (2017)</b>	<b>Institution Type</b>	<b>NIH Research Rank by \$ (2017)</b>	<b>US News &amp; World Report Rank (2019)</b>
Albert Einstein College of Medicine at Yeshiva University	Bronx, NY	826	Private	695	39
Northwestern University, Feinberg School of Medicine	Chicago, IL	761	Private	22	20
University of Illinois College of Medicine	Chicago, IL	1393	Public	62	52
SUNY Downstate Medical College	Brooklyn, NY	843	Public	187	Unranked
Temple University School of Medicine	Philadelphia, PA	882	Private	80	57
Loyola University of Chicago Stritch School of Medicine	Maywood, IL	675	Private	237	Unranked
George Washington University School Medicine & Health Sciences	Washington, DC	726	Private	69	62
Medical College of Georgia School of Medicine	Augusta, GA	962	Public	109	84

Eastern Virginia Medical School of Hampton Roads	Norfolk, VA	609	Public/Private	446	89
University of South Alabama College of Medicine	Mobile, AL	302	Public	309	Unranked

**Table 2: Quotes Identified for the Theme: Nephrology Faculty Interaction, Availability, and Teaching (Theme 1)**

<b>Exemplar Quote No.</b>	<b>Source</b>	<b>Exemplar Quotation</b>
1	Renal Educator	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.
2	Renal Educator	It's really exposure; being present, ...participating in morning reports. You know giving residents, lectures for students also present. And just being very approachable.
3	Renal Educator	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.
4	Renal Educator	[Presence] is really important because even without the distinct curriculum, a lot of my great teachers at my sites are nephrologists. So, I think that part of it is having the faculty out there and the students seeing that these are really good doctors who care and who are interesting and who are accessible to the students while they're learning.
5	Renal Educator	I would just reiterate [that] in terms of the kind of face-to-face things that happen on the wards during third and fourth years I still think are really important.
6	Renal Educator	[T]here is accessibility in the preclinical years and...as a faculty. We're just generally pretty accessible people but then in the clinical years, the nephrology faculty is also involved in

		<p>medicine conferences, so general internal medicine conferences. We're in the wards quite a bit because we have a busy service.</p> <p>[W]e're... visible and approachable, not only when the students are rotating on nephrology or nephrology clinic but we are big, you know, our involvement in the general internal medicine curriculum both preclinical and clinical is...apparent...</p>
7	Renal Educator	[H]aving faculty that are eager and excited to teach and approachable I think is the key [to success].
8	Renal Educator	[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.
9	Renal Educator	[F]or a student to see themselves as a pulmonologist, nephrologist, rheumatologist, whatever it is, they have to feel as if they could see themselves as a faculty person, right? So, they have to connect to the specialty but more importantly, the faculty member and so I think the faculty is the most important thing—most important reason why the students are interested in nephrology.
10	TPD	[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.
11	TPD	I just wanted to say that I think that one of the things that drives them in is just the faculty, and I think that faculty and sort of responsiveness of faculty to—and interest in faculty in—

		developing the medical students and giving them good experiences is sort of key of this whole thing.
M3 = third-year medical student; M4 = fourth-year medical student; TPD = training program director.		

**Table 3: Quotes Identified for the Theme: Clinical Exposure to Nephrology and Clinical Relevance  
(Theme 2)**

<b>Exemplar Quote No.</b>	<b>Source</b>	<b>Exemplar Quotation</b>
1	Renal Educator	<p>[W]e actually have the third and four years in renal, that's when they get their exposure to the renal cases. They see the patients, they present like an intern, and I have to say sometime the fourth-year students do a great job.</p> <p>And oftentimes when they have a patient they're particular in, all the previous students that went on the nephrology actually they had a great case that got them enrolled in nephrology. And so, they eventually went on presenting that case and case reports there, and then choosing nephrology.</p>
2	Renal Educator	[O]ur students go to clinic every week, and then they also do the inpatient consult service. And they attend the nephrology didactic conferences every week as well, there's usually three hours of those per week.
3	Renal Educator	Depending on the month we have at least three to four medical students, sometimes third year, who are rotating renal consult service. And it's difficult to cater to the needs of the third year on a busy consult service, so that's why we came up with the monthly lecture series so that we have that one-on-one interaction.
4	Renal Educator	...we make them take the history and physical [and] present it to the fellow. And then during rounds [the medical student] presents [the] case..., not the resident.



5	Renal Educator	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.
6	TPD	<p>I think some of our philosophy is that if they have some practical exposure to nephrology in terms of how they can actually do procedures, we train them on blood pressure, measurements, accurate blood pressure measured in the clinic either in microscopy that's for all medical students. And then we also in the rotations go through hemodialysis. And if we have a chance, peritoneal dialysis.</p> <p>I think that's also attractive to a number of the students and residents. Certainly pathophysiology attracts people, but I think some of these hands-on approaches also are helpful for young trainees.</p>
7	TPD	We also do a lot of outpatient experience, the medical students rotate throughout outpatient clinics so they see both the inpatient side and the outpatient side of things so we get the positive feedback from that variety.

CKD = chronic kidney disease; TPD = training program director.

**Table 4: Quotes Identified for the Theme: Educational Modalities and Approaches (Theme 3)**

<b>Exemplar Quote No.</b>	<b>Source</b>	<b>Exemplar Quotation</b>
1	Renal Educator	I've talked to a lot of students who then went on to pick nephrology.  And they said the fact that the physiology lecture in the second year of medical school [used] small groups case discussion where nephrologists are involved. And that's what triggered their interest in nephrology.
2	Renal Educator	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 two 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.
3	Renal Educator	[S]tudents who ... went on to pick nephrology ... said the fact that ... the physiology lecture in the second year of medical school [are] small groups case discussion where nephrologist are [involved] triggered their interest in nephrology.
4	Renal Educator	These are very interactive conferences, these are more than conferences... three out of the five hours are interactive. Meaning, they are presenting as an interactive workshop, they're learning things, they're arguing about things, they're asking questions.  It's a small group and usually, there's one or two faculty there and the rest are people in training whether they are fellows, residents,

		students. So you go through pathophysiology questions, cases, teaching points...
5	Renal Educator	But I also think that we have interesting cases. You know, we present quite a few cases in general medicine conference. We've got weekly conference just on fluids and electrolytes where [we're] just presenting interesting fluid and electrolyte cases. So, there is sort of the combination of – it's the faculty but it's also, you know, their cool cases that come in that we try to highlight for [the] medical students that are rotating on just general medicine.
6	TPD	[Our renal physiology is] case-based but it was in small groups. So the faculty divided ...the medical students into smaller groups of hopefully 15 to 20 and not more to facilitate learning. And I think that interaction, that close interaction, with the nephrologist is beneficial.
7	TPD	We were one of the first sections in the internal medicine curriculum to do [activity-based] learning where we do, basically in class, ...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.
8	TPD	We've also focused on, and not just the pathophysiology and talking about that, but doing some hands-on things with the students and residents. And that's essentially going through urine microscopy with them. We have facilities for the images on microscopy to be projected on a screen.
9	TPD	[The nephrology] faculty started case-based learning in the nephrology introduction of clinical medicine [and we] were really the only medical

		division that did the case-based learning rather – in small groups learning rather than just straight lectures.
10	TPD	We have those case-based learning for our second-year medical students, but I think 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.
11	TPD	I think one of things that has helped certainly the case-based learning makes it more clinically relevant for these concepts and nephrology can be a bit daunting and maybe bland if not tied to cases. And the same thing goes with the experiences, the clinical experience of the students.
12	TPD	<p>We have revised our curriculum, so now at least 50 percent 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.</p> <p>Again, our lectures are all online. It's sort of a prep material before the patients come to—or before the students rather come to class, they listen to the online prep material, and then they come to class for active learning sessions. Either team-based learning or we do this (flipped) classroom or they do it on the TurningPoint polling technology.</p>
AKI = acute kidney injury; TPD = training program director.		

**Table 5: Quotes Identified for the Theme: Nephrology Exposure (Theme 4)**

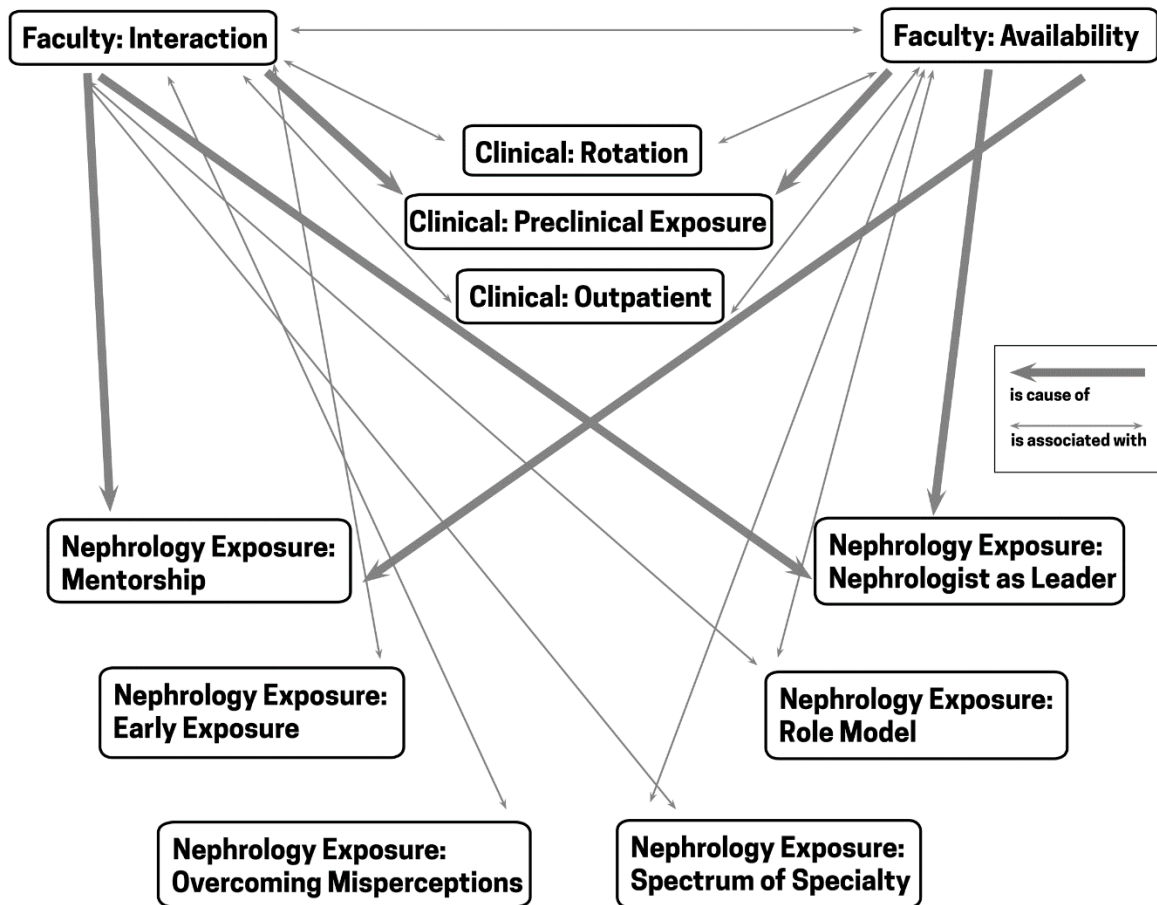
<b>Exemplar Quote No.</b>	<b>Source</b>	<b>Exemplar Quotation</b>
1	Renal Educator	[I]t's done in the summer of first year and first-year students are eligible, they actually get a stipend of \$2700 for an eight-week program. And same experiences... [T]he students who participated in the [program] and did some research in renal went on to pick renal as their specialty later on.
2	Renal Educator	<p>[I]t's the culture that's being fostered at any institution. And it's a combination of ... faculty that [are] engaged in research and teaching and ... nurturing that in a way. I mean, at the end of the day, it's a culture, it's the people who are being part of the division or being recruited towards the division, having a passion about teaching.</p> <p>Basically 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 is—takes, you know, time and passion versus just dialyzing patients left and right. If it's a very busy institution with limited faculty, then, you know, then you will have less of that. So I think it's a little bit the culture and the setup of the division that might be from the top to bottom, you know, but I think that's the only thing I can think of, the culture.</p>
3	Renal Educator	[E]xciting students about the different aspects and all just to offer and showing that, that it matters. I mean, that basically measuring all these electrolytes and, you know, calculation actually do matter and can translate in better care.
4	Renal Educator	Having nephrologist be part of the medical school curriculum being available or medical students do rotate through nephrology, both

		<p>inpatient as well as in the outpatient clinics, even early on in their third-year rotation. So it does expose them to nephrology in various aspects. And you know, I think just again having the faculty accessible and just, you know, involved in educational activities I think makes a big difference.</p>
5	TPD	<p>I think this is the—even some of us do, you know, see much more of really sick ESRD patients rather than, what 95 percent of nephrologists seeing outpatient ESRD, which is much more rewarding, and also in the physician-patient relationship. I think making sure that students get exposed to the whole spectrum and the more fun parts of nephrology other than [the] really sick returning ESRD patient is very important.</p>
6	TPD	<p>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.</p> <p>But I think it's important to sort of expose everybody because everybody has a slightly different career. And I think the other thing [at our institution] that's really nice is that we have a lot of women sort of in positions of, you know, higher on the academic ladder, which I think is a good role model for, you know, at least the female medical students who are coming up.</p>
7	TPD	<p>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.</p>
8	TPD	<p>I also think that as a division that we have a lot of good role models for all sorts of different types of faculty. So, you know, we've got</p>

		<p>scientists. We've got, you know, educators that are involved in the medical school. We've got physician administrators. We've got people that are—most of our faculty are also involved in some aspect of leadership and I think that, you know, is also helpful to students to, you know, just to have role models in all different aspects of academic medicine.</p>
<p>ESRD= end-stage renal disease; TPD = training program director.</p>		

PART 3:

Figure 1: Network of Themes Contributing to Successfully Instilling Nephrology Interest.





**Figure 2: Network of Themes Contributing to Successfully Instilling Nephrology Interest—Faculty Teaching**

