Lessons Learned from the ASN Renal Educator Listserv and Survey

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Summary

Nephrology ranks next to last in career choices among US medical school graduates. The American Society of Nephrology established a Workforce Committee to help address this issue. Surveys of US medical students indicate that experiences during kidney pathophysiology courses in the preclerkship years may impact their decision to consider a career in nephrology. In October of 2011, preclinical kidney physiology and pathophysiology course directors at US medical schools were surveyed about teaching methods, curricular content, resources, and institutional support for teaching to identify what worked well and what impairs their teaching efforts. A Listserv of these educators, the American Society of Nephrology Renal Educators Listserv, was used to electronically administer the survey. Course leaders from 62 of 114 (54.4%) surveyed medical schools responded. Most of these educators are nephrologists, but physiologists and other clinicians also lead courses; 60% of course directors noted that lectures are videotaped, resulting in decreased attendance. A range of resources is used: 68% use audience response systems, 16% use the simulation center, and none of the educators indicated use of social media (such as Twitter or Facebook); 50% of respondents receive no remuneration, and 68% receive no full-time equivalent for their efforts. Audience response systems, virtual microscopy, and flash animations were identified as valuable teaching tools. Course directors, during subsequent dialogue on the American Society of Nephrology Renal Educators Listserv, have cited incorporation of case scenarios and integration of clinical exposure during preclinical years as methods that inspired interest. Hopefully, adoption of such approaches will ultimately serve to stimulate interest in nephrology.

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Introduction

There has been mounting concern in the nephrology community over the mismatch between the growing numbers of patients with kidney disease compared with the falling number of graduates of US medical schools interested in pursuing a career in nephrology. Earlier surveys of medical students identified issues in the preclinical years that might deter students from pursuing internal medicine and subsequently, nephrology (1). In addition, surveys of fourth-year medical students and internal medicine residents have revealed several areas of concern (2). These respondents note multiple reasons for their disinterest, including negative experiences during the preclinical years, when their exposure to kidney pathophysiology was felt to be too complex, failed to stimulate interest, or seemed irrelevant.

The American Society of Nephrology (ASN) established a Workforce Committee and has defined several targets for intervention (3). One target is to improve students' experience during kidney physiology and pathophysiology courses in preclinical years. This effort requires the creation of a community of educators and the ability to share resources, mentorship, and support. Because medical education is changing rapidly, this community is uniquely positioned to influence students.

As a first step, the Workforce Committee created a traditional listserv, the ASN Renal Educators Listserv, for preclinical course leaders in kidney physiology and pathophysiology. The listserv was used to distribute a survey of course leaders to determine demographics and professional background of educators, course structure and format, teaching tools and methodology, curricular content, and institutional support for faculty.

Next, dialogue on the Renal Educators Listserv was initiated among this community of educators to share best practices and provide mentorship. For example, the participants shared models of teaching strategies that stimulated interest among students in nephrology.

Methods

We identified 157 leaders of kidney physiology or pathophysiology courses taught during preclinical years from 114 of 134 medical schools listed by the American Association of Medical Colleges. Course leaders were contacted with the help of medical school websites, nephrology fellowship training program directors, local contacts, and phone calls. We were not able to identify appropriate individuals for 20 medical schools. Several of these medical schools are newly accredited or do not have individual course directors for kidney physiology and pathophysiology, because these materials are taught as part of a larger curriculum.

Next, a survey instrument was developed by the authors M.P.H. and G.A.H., who are both course

leaders in kidney pathophysiology. Content was validated by a subgroup of the ASN Workforce Committee as well as analysis of a similar survey conducted by the American Society of Hematology (4). At the authors' institutions, the survey was determined to be exempt from additional review, and a waiver for consent was granted from the institutional review board (G.A.H.) or considered exempt as a quality improvement project (M.P.H.).

The survey consisted of questions in four domains: educators' background and responsibilities, teaching methods, resources and content, and finally, feedback and compensation. Designation of race and ethnicity used the federal standards for classifications issued by the Office of Management and Budget (Directive No. 15). Multiple-choice questions were designed to best characterize the experience and challenges of educators. Open-ended questions were also included to allow individuals the opportunity to describe specific activities or innovations of which they are proud or outline issues that pose concerns.

The survey instrument was piloted by members of the ASN Workforce Committee. After validation and revision, the final product was distributed to kidney physiology and pathophysiology course leaders electronically using the listserv (Supplemental Appendix 1).

Since implementation, the ASN Renal Educators Listserv has been used by course leaders to share best teaching practices. Examples of teaching methods that course directors found were more likely to stimulate interest, as indicted on the Renal Educators Listserv, are delineated.

Survey Results

Sixty-nine kidney physiology and pathophysiology course directors representing 62 of 114 US medical schools included on the listserv responded to the survey (54% survey response rate; 46% of 134 US medical schools represented).

Faculty Demographics

Respondents were from a wide geographic area, representing both private and public institutions (Figure 1 and Supplemental Appendix 2). There were no individuals who identified themselves as black, African American, Native American, Hawaiian, or Pacific Islander; 4% identified themselves as Hispanic or Latino, and 15% identified themselves as Asian. Fourteen of the respondents (20%) were women; 60% of the course leaders were nephrologists, 28% were physiologists, and 12% were physicians but not nephrologists.

Faculty Experience

A broad range of experience existed among course directors: 33% indicated that they have taught their course for more than 10 years, 20% taught their course for 6–10 years, 21% taught their course for 3–5 years, and 26% taught their course for less than 3 years. The majority of respondents taught both kidney physiology and pathophysiology, whereas 63% of course leaders also taught in the clinical arena; teaching involved medical students, residents, and nephrology fellows.

Course Structure and Content

Most schools offer discrete kidney physiology and pathophysiology courses. Many schools, however, incorporate nephrology into courses that last for an entire semester or year. The average class size is 140 students; however, some are as large as 220 students, and some are as small as 25 students. Courses also vary in length; some are as short as a few lectures in a single week, and some are longer and span 16 weeks as part of a multidisciplinary longitudinal course (Figure 2). Changes in curricular time devoted to kidney physiology and pathophysiology over the past 10 years varied, with 42% indicating no change, 41% indicating increased time, and 17% indicating decreased time; 80% of courses integrate nephropathology, 72% of courses integrate urology, 50% of courses integrate

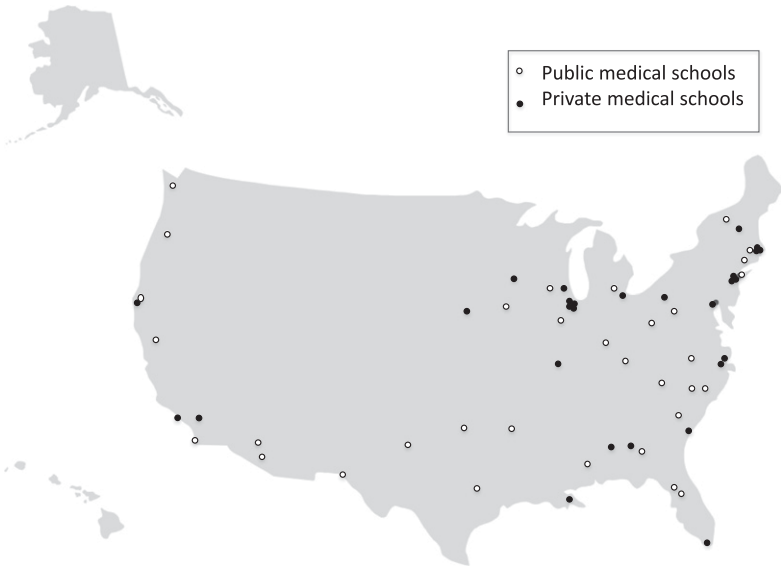

Figure 1. | Geographic location of US medical schools responding to the survey.

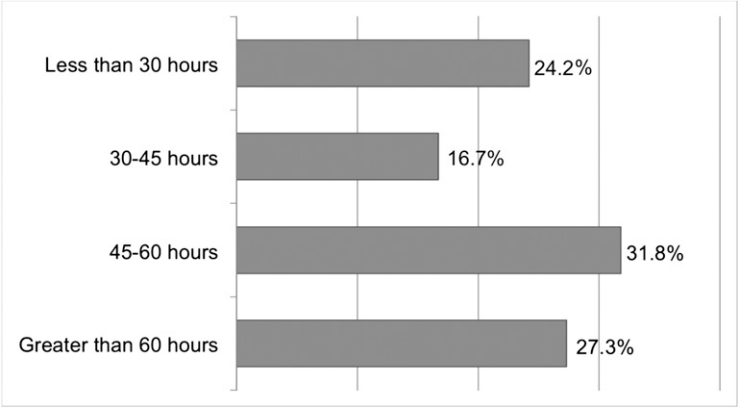

Figure 2. | **Curricular time devoted to renal pathophysiology courses.**

pediatric issues, 31.5% of courses integrate embryology, 29.6% of courses integrate ethics, 22.2% of courses integrate pregnancy-related issues, and 18.5% of courses integrate cultural competency.

Teaching Methods

Nearly all courses use large-group teaching for portions of their course, with a median of 25 hours devoted to lecture; 92% of the courses include small-group sessions led by diverse faculty, including nephrology (86%), pathology (45%), physiology (23%), nephrology fellows (38%), residents (9%), and more senior medical students (9%). The most common teaching method used in small groups was problem-based learning, with some courses now incorporating simulation and team-based learning.

In many instances, educators translated their passion for teaching into innovation. One educator "created flash animations and clearance worksheets that create a unique avatar patient for each student to study common problem-solving strategies." Others converted materials to online syllabi, added clinicopathologic conferences, revamped small groups, or coordinated horizontal and vertical integration.

Teaching Tools and Resources

Figure 3 shows teaching tools used by course directors who completed the survey. The majority (60%) noted that lectures are now captured or videotaped, resulting in decreased attendance. A range of resources is used: 68% use audience response systems, 55% use chalkboard talks, 37% use virtual microscopy, 22% use patient videotapes or visits, 20% use Smartboards, 16% have a chat room or blog, and 16% use a simulation center. None of the educators indicated use of social media, despite the increasing popularity of the social media favorites Facebook and Twitter outside the classroom; 49% require a textbook, and most recommend one or several textbooks for their course (Table 1).

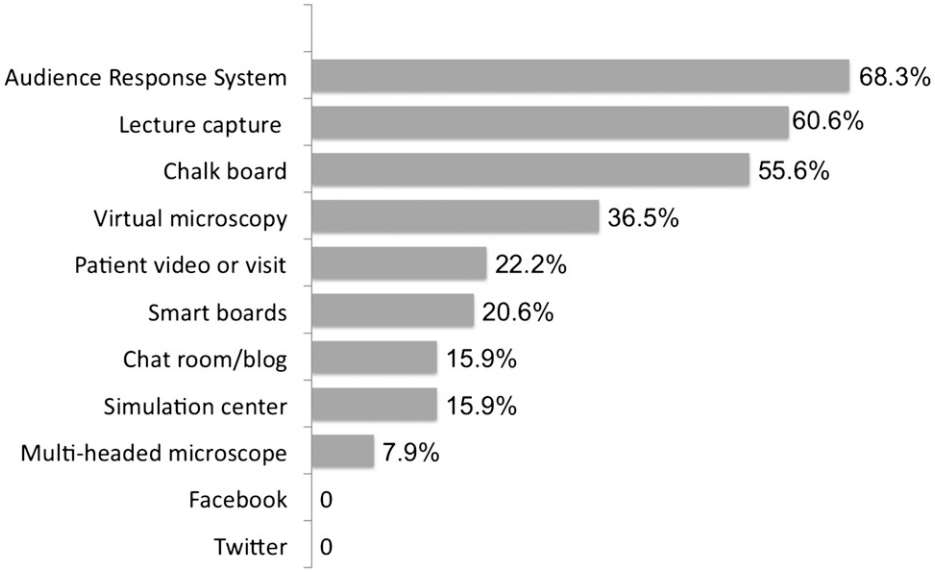

Figure 3. | **Teaching tools used by renal course directors.**

Institutional Support

Compensation for Teaching. Fifty percent of respondents receive no remuneration; 68% receive no consideration to the full-time equivalent for their efforts as course leaders, but some individuals received more than $15,000 to salary support. Some faculty indicated that promotion at their institution was often based more on publication and grants rather than achievement in teaching.

Faculty Recruitment for Teaching. Fifty-two percent of course leaders indicated that recruiting faculty is challenging and attributed this finding primarily to scheduling conflicts. However, 58% also perceived lack of support for teaching from their division or institution.

Faculty Development. Sixty-two percent of institutions offered opportunities for faculty development in teaching. Instruction was provided in team-based learning, process-oriented guided inquiry learning, evaluation methods, and large-group teaching strategies. Some course directors indicated that clinical responsibilities often impede their ability to attend these seminars.

Teaching Challenges

Fifty-six percent expressed concern over poor student attendance in lecture; 48% noted dissatisfaction over reduced time allocation, and 32% were worried about the distraction of preparation for the Step I United States Medical Licensing Examination. Kidney educators indicated that students found several topics difficult: sodium and water homeostasis (71%), acid–base disorders (55%), and glomerular diseases (48%).

Educators noted that "compressed schedules left little time for students to absorb the material" or "it is difficult to find the best balance of web-based content and live learning exercises." In addition, several voiced frustration over the pressure to provide content versus the need to foster critical thinking skills.

Satisfaction with Teaching Role

Ninety-three percent felt that students value their efforts; 71% felt that the medical school values their efforts, and 60% receive recognition from their institution. Despite the aforementioned challenges, most educators noted that they love teaching kidney physiology. "Watching medical students finally grasp some of the concepts that we teach is the most rewarding. It is a perpetual challenge but a real joy."

Teaching Methods Advocated on the Renal Educators Listserv

Course directors have indicated a number of strategies that have been successful in eliciting interest in nephrology among preclinical medical students. Examples from the Renal Educators Listserv are shown in Table 2.

Discussion

The survey indicates that, although nephrologists comprise the majority of course directors for preclinical kidney physiology and pathophysiology, 40% are physiologists, non-nephrology physicians, or pathologists. Non-nephrologists are less likely to have a vested interest in influencing students to consider nephrology, and it is, therefore, incumbent on nephrologists to play an active role in such courses whenever possible.

The survey suggests low representation of minorities among kidney physiology and pathophysiology course leaders. The limited response rate of the survey, however, could account for this finding. There may also be greater representation of minorities among the entire teaching faculty compared with course leaders. If minority students are more likely to identify with educators of similar racial or ethnic background, then increased minority representation among educators may be important. Students' career choices

Table 1. Textbooks used in preclinical nephrology courses

Reference	Title (Authors)	Number Recommended (Required)
(5)	*Renal Pathophysiology: The Essentials* (Rennke and Denker)	14 (7)
(6)	*Pathologic Basis of Disease* (Cotran, Kumar, and Robbins)	9 (3)
(7)	*Vander's Renal Physiology* (Eaton and Pooler)	8 (4)
(8)	*Primer on Kidney Diseases* (Greenberg)	8 (1)
(9)	*Berne and Levy Physiology* (Koeppen and Stanton)	7 (5)
(10)	*Medical Physiology* (Boron and Boulpaep)	4 (1)
(11)	*Guyton and Hall Textbook of Medical Physiology* (Hall)	3 (3)
(12)	*Physiology* (Costanzo)	3 (2)
(13)	*Renal: An Integrated Approach to Disease* (Schmitz)	3 (2)
(14)	*Clinical Physiology of Acid–Base and Electrolyte Disorders* (Rose)	3 (0)
(15)	*Andreoli and Carpenter's Cecil Essentials of Medicine* (Cecil, Benjamin, Griggs, Wing, and Andreoli)	2 (2)
(16)	*Pathophysiology of Disease: An Introduction to Clinical Medicine* (McPhee and Hammer)	2 (2)
(17)	*Rubin's Pathology: Clinicopathologic Foundations of Medicine* (Rubin, Strayer, and Rubin)	2 (2)
(18)	*Current Medical Diagnosis and Treatment 2013* (Papadakis, McPhee, and Rabow)	1 (1)
(19)	*Acid–Base and Electrolytes Made Ridiculously Simple* (Preston)	1 (1)
(20)	*Pathophysiology of Kidney Disease and Hypertension* (Moorthy)	1 (1)
(21)	*Harrison's Principles of Internal Medicine* (Longo, Fauci, Kasper, and Hauser)	1 (0)

Table 2. Examples of teaching methods advocated on the American Society of Nephrology Renal Educators Listserv

Educational Strategy	Comments
Active learning using audience response system in small groups	Each group is given six to eight electrolyte problems about 1 week after hearing a lecture on that topic. The questions are framed in a clinical context and become progressively more difficult. There are multiple-choice answers for each question. During the small group, the students are given clickers, and they can click in their answers. One faculty member in each group helps moderate the discussion and talk through the correct answers (going more quickly through those questions that most of the class gets correct). This strategy has worked great for students who want to ask questions in a smaller-group setting. However, it requires four faculty members who are willing to teach, not to mention the technical resources and an extra 90 minutes to fit into your classroom time (22).
Case simulation in large-group setting	I tried a case presentation to try to get the students to see how clinicians actually use the step-by-step process that we teach them when solving real, complex, and interesting cases. I presented a case to one of my colleagues, beginning with just a one liner, and giving little bits of data as the case unfolds. The discussant went through why each piece of data mattered in figuring out the pathophysiology of the problem. I think it was helpful for the students to hear a clinician's thought process and see how this information is all relevant. It was refreshing to hear, "Ooooh, so that's why urine osmolality matters!" (22).
Team-based learning in large classroom setting	One hundred fifty students in a large lecture hall are assigned to groups of 5 or 6 students who sit together to facilitate discussion. PowerPoint is used with TurningPoint software to incorporate audience response (23,24).
Integration of clinical experience with traditional preclinical curriculum	We started organizing rotations on the clinical service as part of the preclinical curriculum. Students each rotate the consult service in groups of five or six for 1 day, or we have the fellows take students to one to two interesting patients in the hospital. This rotation provides context for the classroom teaching; suddenly, the students see the electrolyte/acid–base material as information that is directly pertinent to patient care and not as esoteric. The rotations have been very successful and popular. I find that the students have much more respect for the material and try much harder at learning. I hear a lot less complaining about the difficulty of the course. It takes more effort to organize the rotations, but it is well worth it (25).
Evoking emotion by incorporating a newsworthy dramatic case	Fatal hyponatremia resulting from an ill-advised radio contest. The news report is shared with the students. There are some stunning aspects of the video, and it really grabs the students' attention with regard to the real-life importance of some water and electrolyte disruptions (26,27).

involve complex factors that include interactions with role models, and although there is no data that links the influence of the ethnicity of role models to students' subsequent career choice, the mismatch in the diversity of learners compared with the diversity of educators might be an opportunity lost.

One of four course leaders specified fewer than 3 years of experience teaching, underscoring the need for mentorship and opportunities for professional development. ASN can play an important role in this process by sponsoring symposia for faculty to develop teaching skills. The ASN Renal Educators Listserv provides additional opportunity for mentoring new course leaders.

Kidney physiology and pathophysiology courses are principally taught by a combination of traditional lecture supplemented by problem-based learning cases in small-group formats. Based on student feedback, course leaders indicated that methods incorporating case scenarios, simulation, or direct contact with patients were more likely to inspire interest in nephrology. These methods are more likely to evoke emotion, bringing added life and context to the curriculum. There is a growing body of evidence that shows that application of similar approaches yield improved interest and learning (28–32). Although it remains unclear whether such interest during medical school truly translates into students choosing nephrology, a recent survey of nephrology fellows indicates that nearly one fourth developed an interest in nephrology during medical school (33). Interest in nephrology during medical school is likely to be sustained when nephrologists take the initiative to attend on inpatient medicine or nephrology ward services, thus providing additional opportunities to mentor students during internal medicine clerkships.

Although the widespread use of lecture capture has led to decreased lecture attendance and faculty frustration, it also offers opportunity for innovation. Prober and Heath (34) recently proposed a model of the "flipped classroom," in which videotaped or captured lectures are reviewed

outside of the classroom, leaving increased time for clinical applications or simulations under the guidance of faculty during time traditionally allocated to lecture.

A significant percentage of course directors noted insufficient institutional support for teaching. Educators in other specialties have noted similar findings. In a survey of hematology course leaders performed by the American Society of Hematology, 45% noted difficulty recruiting faculty to teach, and many voiced frustration regarding the lack of academic reward for teaching (4). Two potential sources of bias, however, may have led to underestimation of compensation in the present survey. First, faculty who perceived adequate compensation may have been less likely to respond to the survey. Second, some course directors may not have known their level of salary support for teaching.

This survey has several limitations. The principle limitation is the response rate at just over 50% of medical schools contacted, representing 46% of US medical schools. This response rate, however, is equivalent to the rate of a comparable survey of hematology course directors in the United States (4). Surveys mailed to health professionals have been shown to have a median response rate of 54%, with a range of 9%–94%, consistent with the response rate of the present survey (35). Electronically administered surveys of health professionals have been shown to have slightly lower response rates (45% electronic versus 58% mail) (36). Although the survey represents responses from just 46% of US medical schools, both public and private institutions representing a wide geographic distribution are included.

Additional limitations of the survey instrument include the influence of wording as well as the absence of free text responses for some items. Increased use of open-ended questions could have generated additional information from survey items pertaining to issues such as concepts perceived by students as most challenging or other obstacles encountered in the recruitment of teaching faculty.

The online dialogue created with the Renal Educator Listserv began with this survey on common practices and challenges, and now, it serves two additional purposes. First, the listserv creates a community for educators often isolated in their academic setting. Such a community can provide support, resources, and mentorship. Second, this resource can help ASN connect to educators and through them, connect to students. This link will allow ASN to alert educators and students of opportunities, such as grants to attend ASN Kidney Week, and opportunities for professional development in teaching. These efforts will complement a proposed link for medical students on the ASN website, which could provide students easy access to information about careers in nephrology, available ASN grants, and peer-reviewed curricular resources.

This survey and subsequent dialogue on the Renal Educators Listserv highlight the successes and challenges of those individuals who teach in the preclinical years, often for little remuneration or recognition. Kidney physiology and pathophysiology course leaders repeatedly noted that they find teaching rewarding and pride themselves on positive reviews from students and the joys of watching students learn and steadily integrate material. This group of motivated individuals is uniquely situated to capture the interests of medical students and promote careers in nephrology.

The Kidney Educators Listserv will hopefully continue to serve as a forum for sharing best practices and resources as well as a means to provide mentorship for educators who share a passion for teaching. Application of teaching methods that incorporate clinical scenarios, patient contact, or simulation is recommended as a means to stimulate student interest. By doing so, educators can breathe more life into teaching, hopefully resuscitating interest in nephrology among US medical students.

Individuals interested in the Renal Educators Listserv should contact M.P.H.

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Disclosures

None.

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Supplemental Appendix 1: Survey

Part 1. Educator's Background and Responsibilities

1. Which category best describes your background:
    - Nephrologist
        - (*If yes then the survey should offer:* besides teaching, is your primary activity
            - In the clinical arena
            - In the research arena
    - Physiologist
        - Are you involved in research?
            - Is your research in nephrology
            - Other? _____
            - Do you also teach other aspects of physiology to medical students
    - Physician non nephrologist
        - What is your primary specialty?
2. What is your ethnicity? Please choose one answer.
    a. Not Hispanic or Latino
    b. Hispanic or Latino

3. What race do you consider yourself to be? Choose <u>all</u> that apply.

    a. White
    b. Black or African American
    c. American Indian or Native American
    d. Asian
    e. Native Hawaiian or other Pacific Islander

4. Please describe the number of years that you have served as Course Director
    a. <3
    b. 3-5
    c. 6-10
    d. >10 years

5. Do you teach in the (check all that apply)
    a. First year of medical school
    b. Second year of medical school
6. Do you teach (check all that apply)
    a. Renal physiology
    b. Renal pathophysiology
    c. Combined physiology and pathophysiology
    d. Renal pathology
7. Do you also teach in the clinical arena (check all that apply)
    a. Medical students on the wards
    b. Medical students in the ambulatory setting
    c. House staff on the wards
    d. House staff in the ambulatory setting
    e. Nephrology fellows

Part II. Course Format and Participants:

8. Approximately how many medical students participate in your course each year

9. Are there additional students in your course
    a. Dental students
    b. Allied medical fields such as psychologists
    c. PhD candidates
10. Your course is taught over: _____Weeks

11. Approximately how many total hours is your course:
    a. <30 hours
    b. 30-45
    c. 45-60
    d. >60 hours
12. Approximately how many hours of lecture are included in your course _____

13. In the past ten years, has the time devoted to your course
    a. Increased
    b. Decreased
    c. Unchanged
14. Are lectures videotaped?
    a. Yes-*if yes, does this decrease attendance* Y N
    b. No
15. Lectures are given by
    a. 1-3 individuals
    b. >3 individuals
16. The total number of faculty in the course is _____

17. Small group sessions are lead by (check all the apply)
    a. More senior medical students
    b. Graduate students
    c. Physiology faculty
    d. House staff
    e. Fellows
    f. Nephrology faculty
    g. Pathology faculty

18. Recruiting faculty for small group sessions is
    a. Relatively easy, if *so why? (Check all that apply)*
        i. Popularity
        ii. Commitment and interest of faculty in teaching
        iii. Leadership within the Division and/or Institution
    b. Challenging (check all that apply)
        i. Lack of interest
        ii. Scheduling conflicts
        iii. Lack of Division/Institution support for teaching.

19. Your course is taught in the (check all that apply)
    a. Lecture hall
    b. Tutorial rooms (<10 students)
    c. Small groups (10-30 students)
    d. Moderate sized groups/seminar (30-50)
    e. Simulation center
    f. Laboratory
20. Is there a final examination at the end of your course
    a. Yes (if yes, check all that apply)
        i. Multiple choice
        ii. Short answer
    b. No, a combined examination with other disciplines

Part III Course Resources and Content

21. Do you use: (check all that apply)
    a. Multi-headed microscopes
    b. Virtual microscopy
    c. Smart boards
    d. Audience response system (ARS)
    e. Chat room or blog
    f. Social media such as Facebook
    g. Twitter
    h. Chalk board
    i. Problem based learning cases in small groups
    j. Simulation center
    k. Patient videotapes or visits

22. Do you provide a comprehensive syllabus (i.e. no additional textbook is necessary)
    a. Yes
    b. No

23. Do you have a required textbook? _

a. Yes-
    i. Renal pathophysiology: the Essentials (Rennke and Denker)
    ii. Nephrology in 30 Days (Reilly and Perazella)
    iii. Primer on Kidney Diseases (Greenberg)
    iv. Renal System at a Glance (O'Callaghan)
    v. Vander's Renal Physiology
    vi. Other_____
b. No

24. There is an increasing trend for students to utilize a Board Review textbook as their primary source. Do the majority of your students utilize such a book for your course?

a. Yes (*if yes then the survey should offer the following question* have you reviewed the material in this book? Are you satisfied with the coverage of the material?)
b. No

25. The course content includes (check all that apply)

a. Renal pathology (if yes, approximately _____hours)
b. Urology (if yes, approximately _____hours)
c. Physiologic changes in pregnancy and obstetric complications
d. Kidney stones
e. Cultural competencies
f. Ethics
g. Pediatric issues
h. Embryology

26. In your role as Course Director, you utilize which of the following resources:
    a. The journal, Academic Medicine
    b. The Journal of the American Physiologic Society and/or their educational resources
    c. The Journals of the American Society of Nephrology and/or their website
    d. American Journal of Kidney diseases and /or their website
    e. Other (if yes, list)

27. The Internet is quickly changing the educational landscape. How do you utilize the Internet? (Check all that apply)
    a. You have your own website
    b. The institution has a website which allows you to post materials
    c. You recommend several popular websites

PART III Feedback and Compensation

28. For your efforts as course director, there is faculty compensation:
    a. Yes, if yes:
        i. <$2,5000
        ii. 2,500-5,000
        iii. 5,000-7,500
        iv. 7,500-10,000
        v. 10,000-15,000
        vi. >15,000
    b. No
29. For your efforts as course director, your department or division has allotted a percentage of your time:
    a. No allocation of time is specifically recognized
    b. 0.1 FTE (full time equivalent, i.e. Half day weekly)
    c. 0.2 FTE (i.e. One full day weekly)
    d. 0.3-0.4

30. In your role as course director, you receive feedback from your institution (check all that apply)
    a. On your course as a whole
    b. On your lectures
    c. On your materials
    d. Small group teaching
31. In your role as course director, there are opportunities for faculty development:
    a. Yes (if yes, describe)
    b. No
32. Do you feel that your efforts are valued by the (check all that apply)
    a. Students
    b. Medical school
    c. Your division
    d. Hospital (if applicable)
33. There are opportunities for "horizontal" integration of material with other courses (respiratory, hematology, etc)
    a. Yes
    b. No
34. There are opportunities for "vertical" integration of materials with other courses (first and second year course or the clinical years)
    a. Yes
    b. No
35. Do you know the names of the individuals who run an elective in nephrology for your students in the clinical years?
    a. Yes
    b. No
36. The topic that your students find most difficult is:
    a. Sodium and water homeostasis
    b. Acid base disorders
    c. Acute kidney injury
    d. Glomerular diseases

37. As a course leader, the issues that you find most frustrating include: (check all that apply)
    a. Reduced time allotted to the course
    b. The combination of physiology and pathophysiology in one course
    c. Negative student reviews
    d. Students' preparation for the NBME
    e. Lack of student attendance at lectures
    f. Difficulty recruiting faculty
    g. Other (describe)

38. As course leader, the activity or innovation for which you are most proud_____

39. Are there additional thoughts that you would like to share?

Thank you for participating in this survey. When results are available, we will share these with the participants.

Supplemental Appendix 2: Participating Institutions, Alphabetized by State

University of Alabama School of Medicine
University of Arizona School of Medicine
University of Arkansas for Medical Sciences College of Medicine
Keck School of Medicine of the University of Southern California
Loma Linda University School of Medicine
Stanford University School of Medicine
University of California Davis, School of Medicine
University of California, San Diego School of Medicine
University of San Francisco, School of Medicine
University of Connecticut School of Medicine
Georgetown University School of Medicine
University of Central Florida College of Medicine
University of Florida College of medicine
University of Miami Leonard M Miller School of Medicine
Emory University School of Medicine
Medical College of Georgia at Georgia Health Sciences University
Loyal University Chicago Stritch School of Medicine
Rush Medical College of Rush University Medical Center
University of Chicago Division of the Biological Science of The Pritzker School of Medicine
University of Illinois college of Medicine at Urbana
Indiana University School of Medicine
University of Iowa Roy and Lucille Carver College of Medicine
University of Kentucky College of Medicine
Northwestern University The Feinberg School of Medicine
Tulane University School of Medicine
Boston University School of Medicine
Harvard medical School
Tufts University School of Medicine
University of Massachusetts Medical School
University of Michigan Medical School
Wayne State University School of Medicine
Mayo Medical School
Washington University in St. Louis School of Medicine
Creighton University School of Medicine
Dartmouth Medical School
Albert Einstein College of Medicine of Yeshiva University
Columbia University College of Physicians and Surgeons
Hofstra North Shore LIJ School of Medicine
New York University School of Medicine
The School of Medicine at Stony Brook University Medical Center
The Brody School of Medicine at East Carolina University
University of North Carolina at Chapel Hill School

University of Oklahoma College of Medicine
Oregon Health & Science University School of Medicine
Pennsylvania State University College of Medicine
Raymond and Ruth Perelman School of Medicine at the University of Pennsylvania
Temple University School of Medicine
University of Pittsburgh School of Medicine
Medical University of South Carolina College of Medicine
University of South Carolina School of Medicine
East Tennessee State University James Quillen college of Medicine
Texas A&M Health Science Center College of Medicine
Texas Tech University Health Sciences Center Paul Foster School of Medicine
Texas Tech University Health Sciences Center School of Medicine
University of Vermont College of Medicine
University of Virginia School of Medicine
Virginia Commonwealth University School of Medicine
University of Washington School of Medicine
Marshall University Joan Edwards School of Medicine
Medical College of Wisconsin
University of Wisconsin School of Medicine and Public Health