

The Changing Phenotype of Academic Nephrology— A Future at Risk?

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Background and objectives: Academic nephrology faces increasing challenges in faculty hiring and development. However, it is unknown how these pressures have affected the number and demographics of academic nephrologists.

Design, setting, participants, & measurements: Using the Association of American Medical Colleges Faculty Roster database, changes were analyzed in MD nephrology, as well as other internal medicine subspecialty, faculty from 1998 to 2008.

Results: There were 1315 full-time MD nephrology faculty in 2008; this fell by 4.9% over the past decade. There were fewer junior, and more senior, faculty over this period. This was associated with 12.4% fewer tenured, 22.3% fewer tenure track, and an 11.5% increase in nontenure track, academic nephrologists. Academic nephrologists who are U.S. medical school graduates declined by 11.9%, while those who were international medical school graduates increased by 13.2%; nephrology has a greater percentage of international medical school graduates than any other internal medicine subspecialty. Female nephrology faculty increased by 14.3%, while male faculty fell by 9.5%. Asian nephrology faculty increased by 41.3%, while Caucasians declined by 15.2%. Similar changes in all the above parameters were seen for most other internal medicine subspecialties. The nephrology research programs at the top 20 research institutions, as compared with all other nephrology programs, had a greater decline in total MD, male, tenure track, and junior faculty.

Conclusions: These data suggest that the future of academic nephrology is at risk. The decline in nephrology faculty provides incentive for leaders in academic nephrology to improve recruiting and retention practices.

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Many challenges exist with recruiting and retaining academic nephrologists. These include federally mandated caps on Medicare-funded graduate medical education programs, insecurity about research funding, increased training time necessary for success as a researcher, generational differences in career and lifestyle attitudes, increasing administrative burdens, reduced clinical revenues, changing public attitudes toward medicine, increased medical school debt, the challenges in achieving effective mentoring, and others (1–4). These issues are clearly on the minds of leaders in nephrology; a recent issue of the *Clinical Journal of the American Society of Nephrology* was partly devoted to current issues and challenges in academic nephrology (1,2,5–8). However, despite such obvious perception of the need to recognize and address these issues, how academic nephrology has, in fact, been affected by the various challenges has never been systematically addressed. In essence, we have no idea of what our academic nephrology workforce actually is, or if its characteristics have changed. Indeed, while several clinical nephrology workforce studies have been conducted (including the Nephrology Workforce Study cosponsored by the major U.S. nephrology and transplant societies), there has never been published comprehensive quantitative data on the nephrology MD

faculty workforce. The only relevant study that attempted such quantitation was a report on academic nephrology faculty number that was based on responses to a questionnaire distributed to divisions or departments doing renal research over 30 yr ago (9). Consequently, we investigated current nephrology, and to some extent other internal medicine subspecialties (for purposes of comparison to nephrology), faculty numbers, and demographics. In addition, we examined how these numbers and demographics have changed over the past decade.

Materials and Methods

Data were obtained from the Association of American Medical Colleges (AAMC) Faculty Roster, the only national database on the employment, training, and demographic backgrounds of individual U.S. medical school faculty. Only MD or MD/PhD faculty were included in our analysis since the database does not contain complete information on PhD faculty working in nephrology divisions. Faculty included in our analysis were those who were identified as having an active, full-time appointment at a U.S. medical school as of December 31 of each year from 1998 through 2008 and who were appointed to a nephrology division and/or were board certified in nephrology (primary *versus* secondary appointments were not distinguished). Data analyzed were total faculty number, gender, race, tenure status, academic rank, and medical school location (United States *versus* international). Data were also obtained for cardiology, endocrinology, gastroenterology, hematology/oncology, infectious diseases, pulmonary/critical care, and rheumatology divisions yearly from 1998 through 2008. All data received from the AAMC were de-identified and reported in aggregate, so individual faculty could not be ascertained (University of Utah Institutional Review Board approval was obtained).

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AAMC analyses of Faculty Roster data have shown that at the national level, the Faculty Roster counts of full-time faculty are within a few percentage points of full-time faculty counts reported to the Liaison Committee for Medical Education (LCME) (the committee that accredits all U.S. medical schools).

In addition to composite analysis of all U.S. medical school faculty, the data were sorted according to whether or not the individuals were in the 20 medical schools with the highest amounts of expenditures for federal research grants and contracts on the FY2008 LCME Part I-A Annual Financial Questionnaire (AFQ). The AFQ is submitted annually by each LCME-accredited medical school and is required for ongoing accreditation. The top 20 medical schools were Baylor, Case Western, University of Colorado, Columbia, Duke, Emory, Harvard, Johns Hopkins, University of Michigan, Mount Sinai, University of Pennsylvania, University of Pittsburgh, Stanford, University of Washington, University of California San Diego, University of California San Francisco, University of California Los Angeles-Geffen, Vanderbilt, Washington University in St. Louis, and Yale. For purpose of simplicity, these programs are referred to as the top 20 research programs; this designation is not intended to imply anything about research quality or productivity.

Results

Total Academic Faculty

In 1998, there were 1383 full-time academic nephrologists in the United States. The decade from 1998 to 2008 showed a decline (4.9%) in the total number of full-time academic nephrologists (Figure 1). This trend is not unique to nephrology in that seven other internal medicine subspecialties, with the exception of pulmonary/critical care, showed a 2.8% decrease in numbers of full-time faculty over the past decade (Table 1 and Figure 2). The greatest percent decline in faculty, whether nephrology or other subspecialties, occurred within the top 20 research programs (Table 2).

Academic Rank

The number of instructors in nephrology, while relatively small compared with other academic ranks, fell by 54.8% be-

tween 1998 and 2008 (Figure 3 and Table 1). This decline was similar to that for other internal medicine subspecialties (−56%). The number of nephrology assistant professors also fell over this period (−8.3%). The pattern of decreased assistant professors was even more evident for the other seven internal medicine specialties combined (−21.4%). The number of nephrology associate professors fell by 10.9%; this was associated with an 8.4% increase in nephrology full professors. The other seven internal medicine subspecialties had a small (4.5%) increase in the number of associate professors and a 15.8% increase in the number of full professors.

Marked differences were evident in academic rank based on research status; these were not unique to nephrology (Table 2). The percent fall in instructors and assistant professors was predominantly due to a decrease within the top 20 research institutions. In contrast, the number of professors increased more among the top 20 research institutions.

Tenure Status

There was a fall in the number of tenured faculty over the past decade (12.4% decrease in nephrology and 6.1% decrease in the other seven internal medicine subspecialties) (Figure 4 and Table 1). In addition, there was a 22.3% decrease in tenure track nephrology faculty and an 11.5% increase in nontenure track nephrology faculty from 1998 to 2008 (similar changes were seen for the other seven internal medicine subspecialties). These changes in tenure track status have resulted in approximately 50% of nephrology faculty (for whom tenure status was available) being nontenure track in 2008 as compared with about 43% in 1998.

The decrease in tenured faculty occurred exclusively in the non-top 20 research institutions (Table 2). In contrast, the number of tenure track faculty fell more among the top 20 research institutions, while the rise in nontenure track faculty was entirely due to changes in the non-top 20 research institutions.

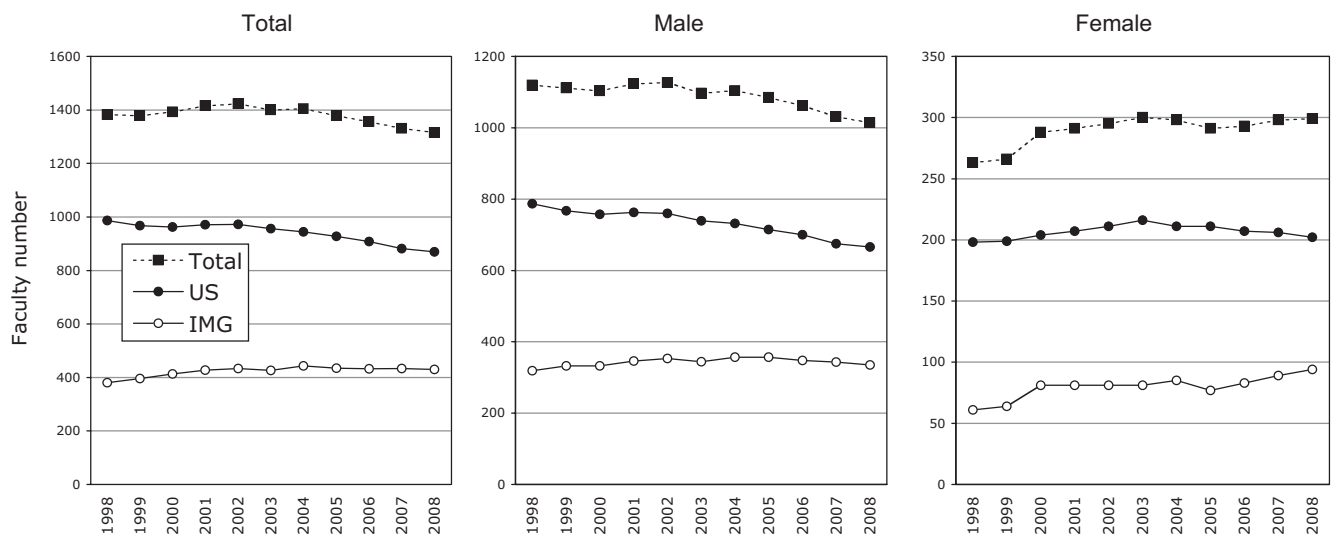


Figure 1. Number of total, U.S. medical graduate (US) and international medical graduate (IMG) full-time nephrology MD faculty in the United States from 1998 to 2008. Data are individually shown as total number, male gender, or female gender.

Table 1. Percent change in nephrology and other internal medicine subspecialty MD faculty number from 1998 to 2008

	Nephrology (% of 1998)	Other IM Subspecialties (% of 1998)
Total MD	−4.9	−2.8
USMG	−11.9	−8.5
IMG	+13.2	+22.4
Female gender	+14.3	+18.2
USMG female gender	+2.0	+9.7
IMG female gender	+54.1	+56.7
Male gender	−9.5	−7.9
USMG male gender	−15.4	−13.0
IMG male gender	+5.0	+14.7
Instructor	−54.8	−56.0
Assistant professor	−8.3	−21.4
Associate professor	−10.9	+4.5
Professor	+8.4	+15.8
Tenured	−12.4	−6.1
Tenure track	−22.3	−17.1
Not on tenure track	+11.5	+12.3
Tenure not available	+6.5	+8.0
Asian	+41.3	+36.0
African American	−4.5	−8.8
Hispanic/Latino	0.0	+24.9
Caucasian	−15.2	−10.1

The subspecialties included are cardiology, endocrinology, gastroenterology, hematology/oncology, infectious diseases, pulmonary/critical care, and rheumatology.

IM, internal medicine; USMG, United States medical graduates; IMG, international medical students.

These patterns were similar between nephrology and the other internal medicine subspecialties.

Location of Medical School

International medical graduates (IMG) have constituted a greater fraction of academic faculty in nephrology from 1998 to 2008 than in the seven other reported internal medicine subspecialties (Figure 2). As shown in Figure 1 and Table 1, nephrology faculty U.S. medical school graduates (USMG) have decreased (by 11.9%) and IMG have increased (by 13.2%) from 1998 to 2008. While nephrology has relatively more IMG, this general trend toward more IMG and fewer USMG faculty is apparent throughout internal medicine subspecialties, wherein USMG have decreased by 8.5% and IMG have increased by 22.4% over the past 10 yr. The increasing entry of IMGs, relative to USMGs, into academic nephrology is reflected in the academic ranks these individuals occupy (Figure 3). The numbers of USMG instructors, assistant professors, and associate professors in nephrology have dropped by over 20% from 1998 to 2008; in contrast, the numbers of IMG assistant and associate professors in nephrology have increased by over 20% during this time. While the number of USMG full professors in ne-

phrology increased from 1998 to 2001, there has been no appreciable change since 2001. Similarly, IMG full professors in nephrology have not changed over this time period. In addition, the number of tenured and tenure-track USMG nephrology faculty have decreased by about 20% between 1998 and 2008, while the number of IMG tenured and tenure-track nephrology faculty have not changed (Figure 4).

The increase in IMGs was most evident in the non-top 20 research institutions (Table 2). In fact, IMG nephrology faculty in the top 20 research institutions barely changed, while there was an 18.8% increase in the non-top 20 research institutions.

Gender

The number of female nephrology faculty has increased by 14.3% from 1998 to 2008 and currently represents about 23% of total academic nephrologists (Figure 1 and Table 1). This compares to an 18.2% increase in women in the other seven academic internal medicine subspecialties over the past decade; the percent of women currently in academic nephrology is about average for internal medicine faculty (Figure 2 and Table 1). The increase in female nephrology faculty is most evident in IMGs (54.1% increase) as compared with USMGs (2.0% increase); a similar trend was present for the other seven internal medicine subspecialties. Notably, the increase in female nephrology faculty was most evident in female associate and full professors, with relatively little change in female assistant professors and a decline in instructors since 2000 (Figure 3). Despite this increase in more senior faculty, there was only a small increase in the number of tenured female nephrology faculty, with the major increase being due to an increase in nontenure track women (Figure 4).

While male faculty predominate in academic nephrology, this is in the face of a modest decline in their levels over the past decade (Figure 1 and Table 1). This decrease was entirely due to a fall in USMG (15.4% decrease) since IMG male nephrology faculty increased by 5.0% from 1998 to 2008. This trend was also evident for the other seven internal medicine subspecialties wherein total males faculty fell by 7.9%, USMG male medical school graduates decreased by 13.0%, and IMG male graduates increased by 14.7%. The decrease in male nephrology faculty was largely due to a fall in the number of those at all ranks other than full professor (Figure 3); this was associated with a decrease in the number of tenured male faculty (Figure 4).

The percent increases in female nephrology faculty were greatest in the non-top 20 institutions (+25.5%), although nephrology female faculty increased in the top 20 institutions as well (+13.9%) (Table 2). Male nephrology faculty fell relatively more among the top 20 research institutions; this was associated with a decrease in IMG male nephrology faculty in the top 20 research institutions, while IMG male faculty actually increased in the non-top 20 institutions.

Race and Ethnicity

African Americans and Latino/Hispanics constituted only 1 to 5% of U.S. nephrology faculty (Figures 5 and 6, Table 1);

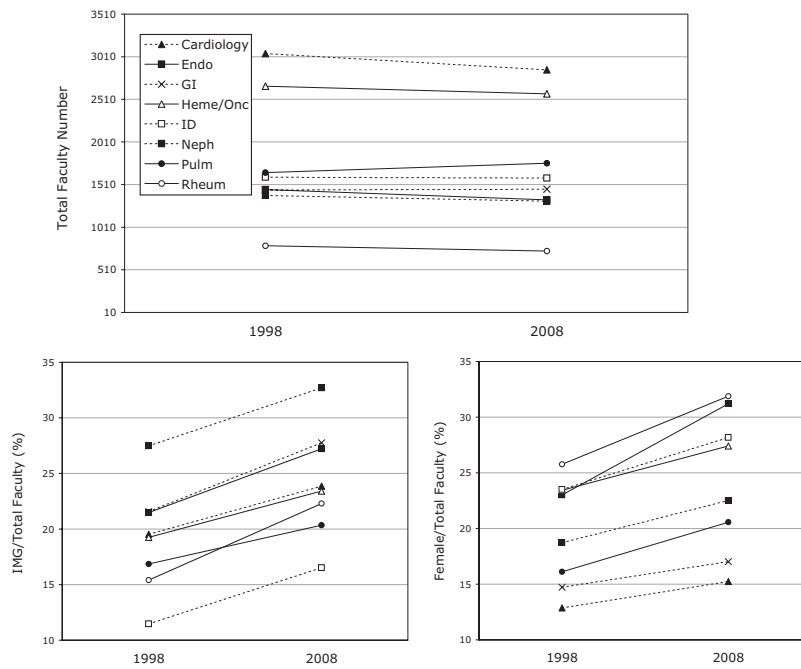


Figure 2. Demographics of full-time MD faculty in eight internal medicine subspecialties in 1998 and 2008. Data are reported as total faculty number, ratio of international medical graduates to total faculty, or ratio of female gender to total faculty. Endo, endocrinology; GI, gastroenterology; Heme/Onc, hematology/oncology; ID, infectious diseases; Neph, nephrology; Pulm, pulmonary/critical care; Rheum, rheumatology.

Table 2. Percent change in nephrology and other internal medicine subspecialty MD faculty number from 1998 to 2008, subdivided according to whether or not the faculty was a member of one of the 20 institutions with the highest research expenditures

Research Programs	Top 20		Not in Top 20	
	Nephrology (% of 1998)	Other IM Specialties (% of 1998)	Nephrology (% of 1998)	Other IM Specialties (% of 1998)
Total MD	-9.8	-6.8	-3.2	-0.8
USMG	-12.0	-9.5	-11.3	-17.9
IMG	+1.2	+9.9	+18.8	+30.6
Female gender	+13.9	+13.3	+25.5	+34.8
USMG female gender	+3.7	+5.9	+0	+12.9
IMG Female gender	+28.6	+35.5	+66.7	+73.0
Male gender	-12.9	-8.6	-3.0	-2.4
USMG male gender	-18.1	-13.5	-14.3	-12.8
IMG male gender	-4.3	+4.5	+9.1	+21.3
Instructor	-51.2	-63.7	-11.3	+8.2
Assistant professor	-25.0	-33.6	+9.7	-5.4
Associate professor	-6.7	+12.5	-10.8	+5.2
Professor	+15.5	+28.4	+8.4	+13.0
Tenured	+4.3	+17.4	-16.7	-14.1
Tenure track	-28.0	-29.3	-13.8	-5.0
Not on tenure track	-3.0	+0.8	+33.7	+30.7
Tenure not available	NA	NA	+11.5	+19.0
Asian	+44.1	+33.3	+53.2	+33.3
African American	-21.1	-14.1	+8.5	-3.6
Hispanic/Latino	+0	+10.4	+4.0	+34.9
Caucasian	-15.3	-9.8	-10.9	-6.6

NA, numbers were too small to be useful. The nonnephrology subspecialties are itemized in Table 1.

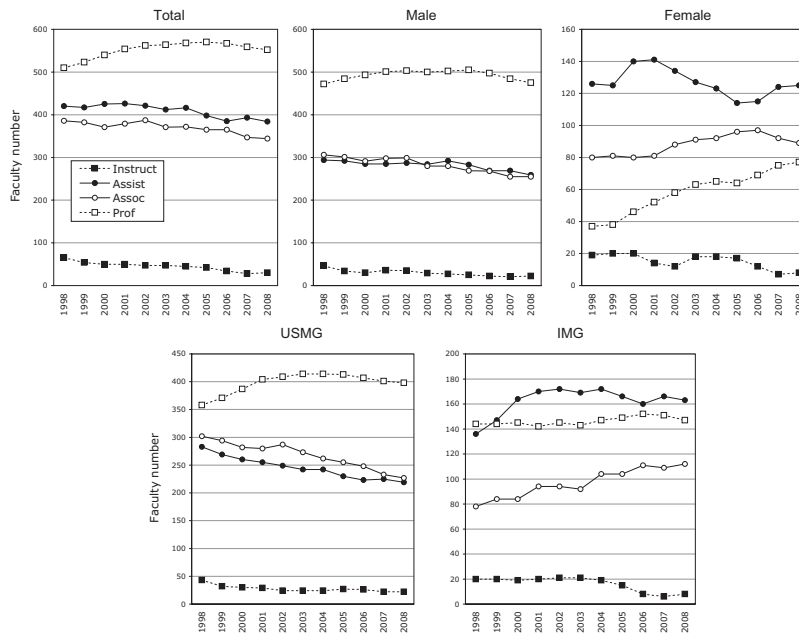


Figure 3. Academic rank of full-time MD nephrology faculty in the United States from 1998 to 2008. Data are individually shown as total number, male gender, female gender, and U.S. or international medical graduates.

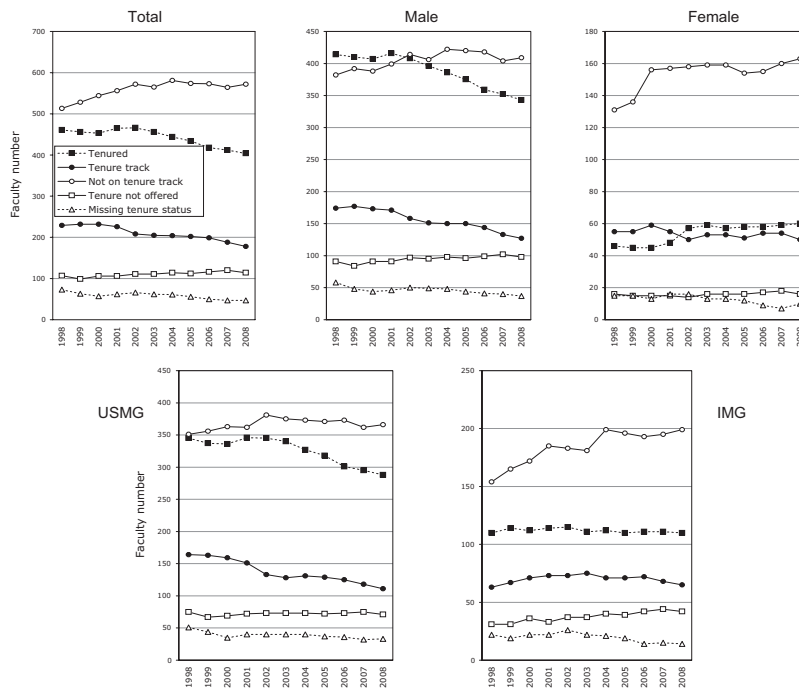


Figure 4. Tenure status of full-time MD nephrology faculty in the United States from 1998 to 2008. Data are individually shown as total number, male gender, female gender, and U.S. or international medical graduates.

over the past decade, African American nephrology faculty have declined by 4.5%, while Latino/Hispanic nephrology faculty have not changed (a similar trend occurred with African Americans in the other seven internal medicine specialties; however, Latino/Hispanics increased by 24.9%). Asian nephrology faculty markedly increased (41.3%) from 1998 to 2008 and this was apparent for men and women as

well as all academic ranks except instructors (other internal medicine subspecialty Asian faculty increased by 36.0%). Notably, Caucasian nephrology faculty decreased by 15.2% over the past decade; this decrease was entirely attributable to a fall in Caucasian men (by about 20%). These decreases were evident at all academic ranks except full professor, indicating that the pipeline of Caucasian men (which largely

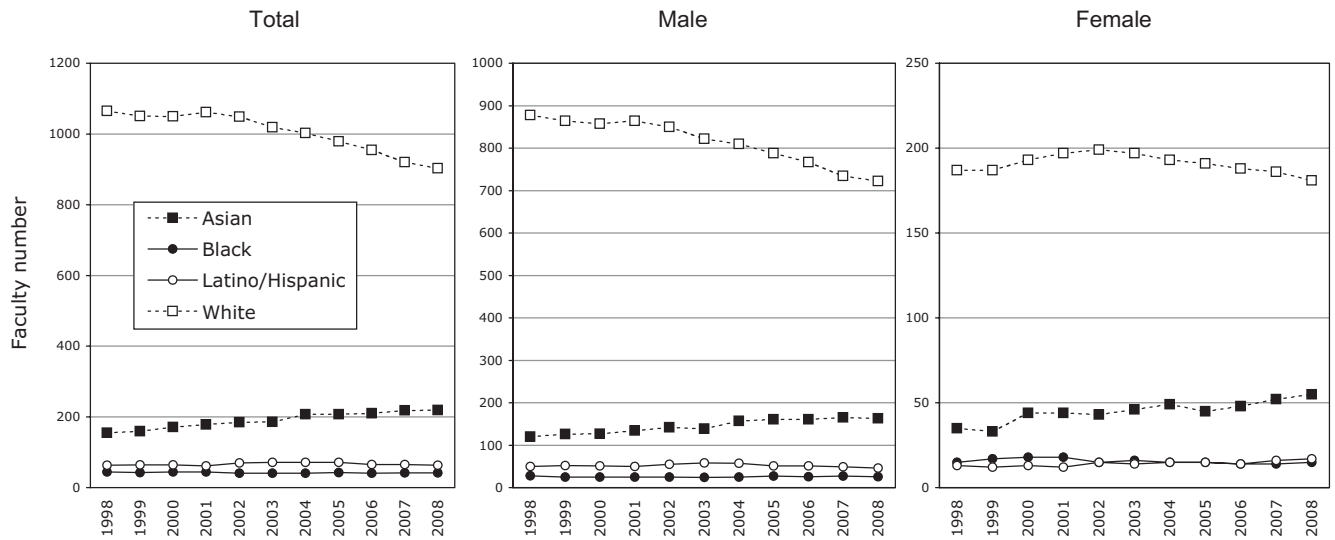


Figure 5. Racial demographics of full-time MD nephrology faculty in the United States from 1998 to 2008. Data are individually shown as total number, male gender, or female gender.

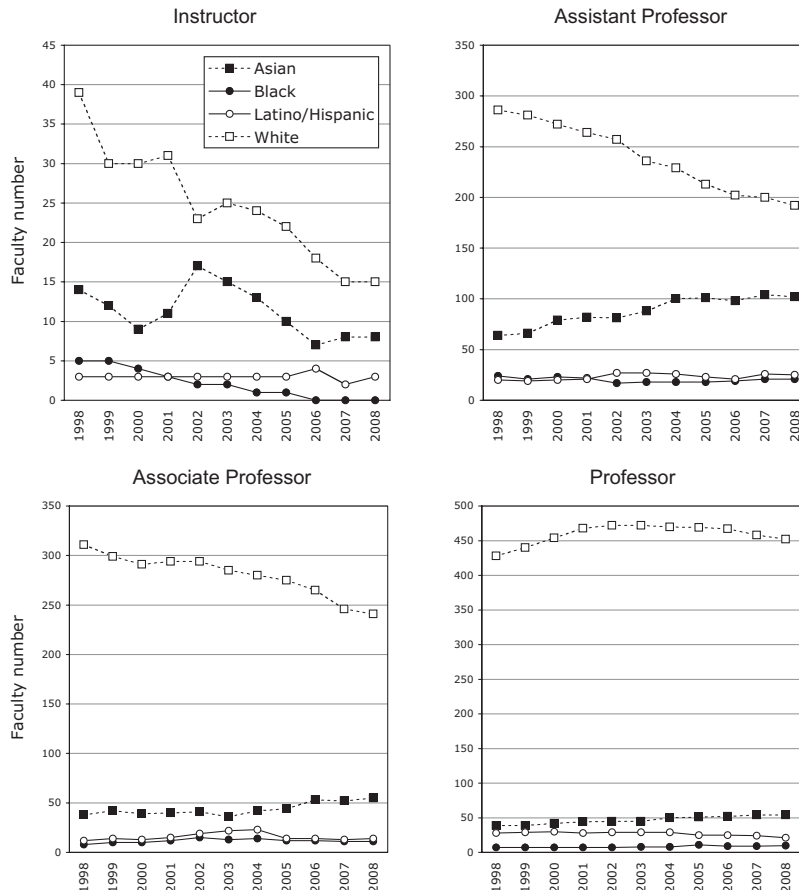


Figure 6. Racial demographics of full-time MD nephrology faculty in the United States from 1998 to 2008. Data are individually shown according to academic rank.

reflects USMGs) is becoming increasingly stented. This problem is not unique to nephrology in that the other seven internal medicine subspecialties combined saw a 10.1% fall in Caucasian male faculty.

The changes in Caucasian and Asian faculty were not substantially related to research status (Table 2). There was a shift in African American and Hispanic/Latino faculty toward non-top 20 research institutions.

Discussion

In 1980, Jamison *et al.*, based on a survey completed by 80% of nephrology divisions, reported that nephrology faculty numbered 242 from 1968 to 1972, 371.5 from 1972 to 1975, and 520.5 from 1976 to 1978; this represented a 115% increase over the 10-yr period. Furthermore, 253 nephrology faculty vacancies, largely based on anticipated expansion, were projected over the ensuing 5 yr (9). Nephrology faculty number was substantially greater in 1998 (almost 1400); however, the last decade has witnessed a fall in this number (as have faculty in other internal medicine subspecialties). The decrease in nephrology faculty number is not due to reduced nephrology fellow training; the number of first-year and total nephrology fellows increased by 33% and 27%, respectively, between 1998 and 2007 (<http://www.abim.org/about/examInfo/data-fellow/chart-04.aspx>). Similar increases were seen in fellows training in most other internal medicine subspecialties. During 1995 and 2004, there was a 41% increase in practicing nephrologists in the United States (<http://www.ama-aasn.org>) and a 29% increase in individuals receiving nephrology board certification between 1998 and 2007 (<http://www.abim.org>). These data indicate that the reduction in the number of nephrology faculty over the past decade is due to relatively fewer nephrology fellows choosing academic nephrology as a career and/or a greater faculty dropout rate.

Our data show a shift toward fewer junior and more senior faculty in nephrology as well as in most internal medicine subspecialties. Such a trend may be due to an increased junior faculty dropout rate, but is likely attributable, at least in part, to fewer fellows choosing a career in academic nephrology; a more careful analysis of the responsible factors, including determination of dropout *versus* entry rate, would be of considerable interest. In addition, despite the relative increase in senior faculty, there were fewer tenured faculty over the past decade, with an increase in nontenure track positions. It is tempting to speculate that the decrease in the availability of tenure, either due to reduced availability of funds or changes in institutional policies, has adversely affected the attractiveness of a career in academic nephrology.

IMG are a critically important component of academic nephrology. IMG have constituted a greater percentage of trainees and active physicians for nephrology than any other internal medicine subspecialty. This pattern is also apparent in academic nephrology faculty; further, the trend has increased over the past decade. Nephrology has greatly benefited by a talented pool of IMG; however, the decreasing numbers of USMG choosing a career in academic nephrology raises concerns. As discussed earlier, the challenges in recruiting and retaining academicians, and particularly those interested in research, are being increasingly understood. The findings in our analysis should heighten concerns and represent a call to immediate action. In this regard, solutions to attracting researchers were recently outlined in a consensus conference held by the Association of Professors of Medicine (APM) that involved thought leaders throughout the medical research communities (10). This group recommended focusing attention on a smaller group of highly promising trainees, formalization of the mentoring process involving faculty training and multidisciplinary/multigenerational mentoring teams, and coordinated efforts to identify and prepare future physician-scientists. In our opinion, there is no more important goal for academic nephrologists than realizing these recommendations.

Another key recommendation that came out of the 2007 APM conference was the recruitment and retention of minorities in academic medicine (11). Female nephrology faculty (particularly those at more senior academic ranks) have increased, but currently constitute less than one-quarter of academic nephrologists. Thus, efforts need to be maintained to encourage women to choose a career in academic nephrology. Similarly, academic nephrology must increase efforts to attract and retain African American and Latino/Hispanic faculty.

All our data were analyzed according to whether programs were or were not at the top 20 institutions with the greatest reported research expenditures. This analysis revealed that the percent fall over the past 10 yr in total nephrology, male, junior, tenure track, and nontenure track faculty was actually greater among this top 20 group. Thus, the concerns raised in the above discussions pertain to the majority of nephrology programs, regardless of their research emphasis or reputation.

Overall, our analysis shows that U.S. nephrology faculty have undergone substantial changes in the past decade. The total number of academic nephrologists has decreased, while there have been increases in female gender, IMG, and Asians; this was associated with decreases in male gender, USMG, African Americans, and Caucasians. These trends are mirrored by the other major internal medicine subspecialties, indicating that the responsible factors are not unique to nephrology. Indeed, studies have shown flagging interest in careers in academic medicine in general (12). IMG constitute a very important part of academic nephrology, representing a substantial percentage of faculty in all internal medicine subspecialties. While the U.S. renal academic community benefits from such international participation, it increases our reliance on factors that may be beyond our control.

Academic nephrology must improve its approach to recruiting and retaining quality faculty members. Multidisciplinary and multigenerational efforts are needed that involve identification of highly qualified trainees, enhanced mentoring at the trainee and faculty levels, and targeted resource allocation. We must work together, not only within our own specialty but within the institutional and national communities, to achieve effective change. Barring this, we risk our future as academic nephrologists.

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Disclosures

None.

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