# Compensation and Advancement of Women in Academic Medicine: Is There Equity?

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Background: **Women have been entering academic medicine in numbers at least equal to their male colleagues for several decades. Most studies have found that women do not advance in academic rank as fast as men and that their salaries are not as great. These studies, however, have typically not had the data to examine equity, that is, do women receive similar rewards for similar achievement?**

Objective: **To examine equity in promotion and salary for female versus male medical school faculty nationally.**

Design: **Mailed survey questionnaire.**

Setting: **24 randomly selected medical schools in the contiguous United States.**

Participants: **1814 full-time U.S. medical school faculty in 1995–1996, stratified by sex, specialty, and graduation cohort.**

Measurements: **Promotion and compensation of academic medical faculty.**

Results: **Among the 1814 faculty respondents (response rate, 60%), female faculty were less likely to be full professors than were men with similar professional roles and achievement. For example, 66% of men but only 47% of women ($P < 0.01$) with 15 to 19 years of seniority were full professors. Large deficits in rank for senior faculty women were confirmed in logistic models that accounted for a wide range of other professional characteristics and achievements, including total career publications, years of seniority, hours worked per week, department type, minority status, medical versus nonmedical final degree, and school. Similar multivariable modeling also confirmed gender inequity in compensation. Although base salaries of nonphysician faculty are gender comparable, female physician faculty have a noticeable deficit (−$11 691; $P = 0.01$). Furthermore, both physician and nonphysician women with greater seniority have larger salary deficits (−$485 per year of seniority; $P = 0.01$).**

Limitations: **This is a cross-sectional study of a longitudinal phenomenon. No data are available for faculty who are no longer working full-time in academic medicine, and all data are self-reported.**

Conclusions: **Female medical school faculty neither advance as rapidly nor are compensated as well as professionally similar male colleagues. Deficits for female physicians are greater than those for nonphysician female faculty, and for both physicians and nonphysicians, women's deficits are greater for faculty with more seniority.**

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**See editorial comment on pp 238-240.**

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Female medical school faculty have not advanced to senior academic ranks and positions in proportion to their numbers in academic medicine (1). Reports from many specialties and institutions have documented this situation (2–8). Certain specialties have actually reported a decline between 1995 and 2000 in the percentage of full professors who are women (for example, from 11% to 6% in emergency medicine and from 2% to 1% in orthopedic surgery). In 2000, only 8% of medical school chairs were women, and just 8 of 125 U.S. medical school deans were female (4 of them were interim) (9). Nonnemaker (10), using data on all U.S. medical schools and all U.S. medical school graduates from 1979 to 1993, found that women had continuing slower advancement to senior rank and that the proportion of female physicians entering academic medicine declined (10). However, that study had no job descriptors or measures of faculty performance and thus could not address the equity of these differences.

Female physicians also receive lower financial compensation, both in academic centers and in private practice (3, 8, 11); Baker, however, in examining salaries for young physicians in all settings (those with 2 to 9 years of experience in 1990) did not find the 41% greater salaries of men to be inequitable. In his model, differences in self-reported hours worked "explained" most of the observed salary difference, and differences in job characteristics, principally specialty and practice setting, accounted for the rest (11).

No large, detailed study in a nationally representative sample of institutions conducted across all medical school departments (including the basic sciences) has explored gender equity of faculty in advancement and compensation in academic medicine. Our study examines rich data from more than 1800 male and female academic faculty in all medical school departments at 24 randomly selected schools.

## METHODS

### Study Design

In 1995–1996, we conducted a national mailed survey (12) to examine the status of female, minority, and generalist academic medicine faculty. In the first stage of a 2-stage sampling plan, we sought 24 U.S. medical schools. Of the 126 medical schools listed by the Association of American Medical Colleges (AAMC) in 1995, we excluded 6 schools outside the contiguous United States because the AAMC considered them to be substantially different from the mainland schools. In addition, to obtain reasonable numbers of female and minority faculty from each institu-

 

tion, we excluded 14 schools that had fewer than 200 faculty, 50 female faculty, or 10 ethnic or racial minority faculty. Our 24 medical schools were randomly selected from the remaining 106 eligible medical schools. The resulting sample of schools was balanced across the AAMC's 4 regions of the United States and between public and private institutions.

In the second sampling stage, we selected full-time salaried faculty members from the 24 schools by using the 1995 AAMC Faculty Roster. The AAMC listed 17 434 faculty at the 24 schools; 720 faculty were excluded because they were in unique departments not found at other medical schools. Of the remaining 16 714 faculty, 4156 were women, 929 belonged to a racial or ethnic minority, and 869 were generalists. For each institution, sampling was stratified by the following: 4 areas of medical specialization (primary care, medical specialty, surgical specialty, and basic science), 3 graduation cohorts (received doctoral degree before 1970, between 1970 and 1980, and after 1980), and sex. We randomly sampled 6 faculty in each cell (school × medical specialty × graduation cohort × sex). The most senior graduation cohort cells were filled first. When a cell contained fewer than 6 people, we finished filling it with faculty who were from the same school, specialty, and sex but who were more junior. To obtain sufficient numbers of minority, generalist, and senior female faculty, we added all such faculty to the sample.

### Data Collection and Survey Instrument

Our inclusion criteria required faculty to be full-time and currently employed at their AAMC-listed institution. We mailed 4405 surveys to sampled faculty, of which 1073 were ineligible because they had left their institution ($n$ = 512), were not full-time ($n$ = 510), had died ($n$ = 11), or had participated in the pilot study ($n$ = 9). The remainder ($n$ = 31) were ineligible for other reasons. Nonrespondents among the eligible 3332 faculty received reminder postcards, follow-up telephone calls, and survey remailing, as necessary. Because of confidentiality concerns of the AAMC, we do not have further information on nonrespondents.

The self-administered questionnaire asked 177 questions about faculty demographic characteristics, current academic environment and support, academic productivity, rank, and faculty compensation. The survey was pretested by 45 medical school faculty at 3 institutions to ensure that respondents understood the meaning of the questions and could answer them appropriately. The Boston University School of Medicine Institutional Review Board approved the study.

### Definitions of Analytic Variables

All reported data are from responses to survey questions. Career "seniority" was calculated as the number of years from first full-time faculty appointment (not necessarily at the current institution) until 1996. When the appointment year was missing, year of graduation from medical school + 4 was used in its place. For example, seniority equal to 25 years indicates either a first appointment in the 1970–1971 academic year or completion of schooling in 1967. We categorized race by using the AAMC classifications of white, majority, and 2 classes of minorities (13). Underrepresented minorities included black persons and most Hispanic persons, and nonunderrepresented minorities included Asian and Cuban persons. Missing race was imputed as white. Publications were specified as the career total number of any-authored articles in refereed journals; faculty who skipped this question were assigned a zero. To limit the influence of large outliers (for example, faculty reporting >500 publications or 120 hours of work per week), we coded publications in categories (0 to 9, 10 to 19, 20 to 39, 40 to 59, and ≥60) and top-coded "hours worked per week" at 80. "Chair or chief" is a marker for being a department chair or a division chief in 1996. "Physician" indicates faculty with a physician's degree (for example, MD or DO). Faculty responses to a request to divide 100% of their time into 4 categories (clinical, administrative, research, and teaching) yielded (continuous) "percent time in . . ." variables. Faculty with missing salaries (3%) were dropped from salary analyses, and those with missing rank (2.5%) were dropped from promotion studies.

We used the survey data to classify respondents' departments into the 4 prospectively identified types. "Primary care" includes general internal medicine and general pediatrics, family medicine, and geriatrics; "medical specialty" includes internal medicine and pediatric subspecialties, neurology, physical medicine, radiology, emergency medicine, anesthesia, and psychiatry; "surgical specialty" includes general surgery and its subspecialties, as well as obstetrics and gynecology; and "basic science" includes preclinical biological science.

Our outcomes were "salary" and "promotion." We used the term *salary* to refer to all pretax 1995–1996 academic-year faculty compensation, including clinical payments for the academic year (excluding fringe benefits, moonlighting, and consulting) and rounded to the nearest thousand. We defined the term *promotion* as having attained the rank of full professor by 1996.

### Statistical Analysis

We used frequency distributions, means, and standard deviations to separately describe female and male respondents. We used linear regression to analyze salary and logistic regression to examine promotion. In each model, we adjusted standard errors using "school" as a clustering variable. The following additional predictors were used in both models: physician status, department type, minority status, chair or chief, school, seniority (either coded as a continuous variable or in 5-year categories to a maximum of ≥30), hours worked per week, and number of career publications (coded in categories [0 to 9, 10 to 19, 20 to 39, 40 to 59, ≥60]). In modeling compensation, we also adjusted

for current percentage of time in research and teaching. However, we did not use these time-allocation variables to predict promotion because we did not know their values historically. Because being a chair or chief is an outcome whose use as a predictor is controversial, we also examined the effect of dropping this predictor.

For each outcome, we constructed models based on both male and female faculty data and interpreted the size and statistical significance of sex-related coefficients of the model as measures of and tests for sex differences. This model directly answers questions such as "do women who are more senior experience larger deficits than less senior ones, and, if so, how much additional deficit per additional year of seniority?" We summarized the deficits in promotion for women within a faculty cohort such as "those with a first faculty appointment between 1975 and 1979" as follows. First, we suppressed the information as to which faculty were women and used the previously developed model to calculate, for each faculty, the probability of being a full professor (effectively assuming that all faculty were promoted "as if they were men"). We then compared the difference—the actual percentage of professors minus the predicted number—for women versus men in the cohort. If the women are underpromoted compared with men, their difference will be negative, whereas the men's difference will probably be close to, although not exactly, zero. Finally, we reported the risk-adjusted women's promotion deficit in the cohort as the women's difference minus the men's difference. We tested for the significance of this difference by using a 2-sample *t*-test. The risk-adjusted women's salary deficit was calculated and tested analogously.

Because we believed that salary structures might differ for physician and nonphysician faculty, as well as for male and female faculty and across department types (for example, basic science vs. surgery), we tested selected interactions among these variables for their potential importance as predictors. Specifically, we evaluated interactions of women by physician status, seniority, career publications, rank, and chair or chief, and interactions of physician status by seniority; underrepresented minority; department; career publications; rank; chair or chief; hours worked per week; and percentage of time in research, administration, and teaching. We retained such interactions when they were statistically significant at a *P* value less than 0.05. We believed that full professorship would rarely be attained in fewer than 10 years but that such promotion would be steadily attained during the subsequent 10 to 15 years for most persons who ever attain it. Thus, in our analysis, we restricted our modeling to faculty with 10 or more years of seniority, included an interaction between being female and seniority, and, to capture the expected leveling off, added a "long-term" marker for faculty with at least 25 years of seniority. Finally, because Baker's study (11) could be interpreted as finding that gender equity in promotion problems was solely a phenomenon of the prefeminist past, we tested a female × long-term interaction for its independent value in predicting full professor status. If, in fact, women and men hired since 1970 have been promoted comparably—even though the older cohort of female faculty did not fare so well—this interaction term would be significant, and its inclusion would cause the female × seniority interaction to lose its explanatory power. The test for whether sex affects the probability of being a full professor for faculty with at least 10 years of seniority is based on the significance of the indicator for female, whereas the test for a larger deficit for women of greater seniority is based on the joint significance of the female × seniority and female × long-term variables. We present the odds ratios, CIs, and *P* values for the resulting model in **Appendix Table 1** (available at www.annals.org).

Salary models were also used to test coefficients for their size and significance and to examine differences between expected and actual salaries for cohorts of women. The test for a gender difference in salary for nonphysician faculty in the first year is based on the significance of the female indicator; the test for a difference in salary for a female versus a male physician in the first year is based on the significance of the female physician interaction. The test for an increasing gender difference in salary is based on the significance of the female × seniority interaction. We report the salary model, its coefficients, CIs, and *P* values in **Appendix Table 2** (available at www.annals.org). We used Stata software, version 7 (Stata Corp., College Station, Texas), for all analyses.

### Role of the Funding Sources

The Robert Wood Johnson Foundation funded the study but had no role in its design, conduct, or reporting or in the decision to submit the manuscript for publication.

## RESULTS

### Characteristics of the Faculty Sample

The 1814 respondents represent a response rate of approximately 60% for both male and female faculty (**Table 1**). Because of the stratified sampling, male and female respondents were similarly distributed by department, region of the country, and public–private status of their school. However, although we oversampled women who were senior faculty, female respondents were somewhat younger (mean age, 45 years vs. 47 years), more junior (only 31% of women vs. 38% of men had at least 15 years of career seniority), and less likely to be full professors (22% vs. 35%). Racial distributions were similar for men and women.

### Advancement to Full Professorship

In unadjusted analyses, female faculty were less likely to be full professors than men of similar credentials (**Table 2**). For example, 66% of men with 15 to 19 years of seniority (that is, those first hired between 1976 and 1980) but only

*Table 1.* **Demographic and Professional Characteristics of Respondents***

| Variable | Women (*n* = 873 [48%]) | Men (*n* = 941 [52%]) |
|---|---|---|
| **Mean age ± SD, *y*** | 45 ± 9 | 47 ± 9 |
| **Race or ethnicity, *n (%)*** | | |
| White | 715 (82) | 753 (80) |
| Underrepresented minority | 71 (8) | 114 (12) |
| Nonunderrepresented minority | 87 (10) | 74 (8) |
| **Physician status, *n (%)*** | 537 (61) | 663 (70) |
| **Region, *n (%)*** | | |
| Northeast | 342 (39) | 327 (35) |
| South | 184 (21) | 219 (24) |
| Midwest | 159 (18) | 197 (22) |
| West | 183 (21) | 182 (20) |
| **Institution, *n (%)*** | | |
| Private | 419 (48) | 429 (46) |
| Public | 450 (52) | 504 (54) |
| **Department category, *n (%)*** | | |
| Basic science | 221 (26) | 213 (23) |
| Medical specialty | 164 (19) | 159 (17) |
| Surgical specialty | 142 (17) | 176 (19) |
| Primary care | 327 (38) | 380 (40) |
| **Career years of seniority, *n (%)*** | | |
| 0–10 | 499 (57) | 474 (50) |
| 11–14 | 103 (12) | 111 (12) |
| ≥15 | 271 (31) | 356 (38) |
| **Career publications, *n (%)*** | | |
| 0–9 | 392 (45) | 332 (35) |
| 10–19 | 144 (16) | 119 (13) |
| 20–39 | 163 (19) | 186 (20) |
| 40–59 | 90 (10) | 120 (13) |
| ≥60 | 84 (10) | 184 (19) |
| **Mean hours of work/wk ± SD** | 56 ± 11 | 58 ± 10 |
| **Mean time in research ± SD, %** | 29 ± 29 | 28 ± 29 |
| **Mean time in teaching ± SD, %** | 21 ± 15 | 19 ± 14 |
| **Chief or chair, *n (%)*** | 115 (13) | 194 (21) |
| **Rank, *n (%)*** | | |
| Full professor | 190 (22) | 322 (35) |
| Associate professor | 226 (27) | 237 (27) |
| Assistant professor | 384 (45) | 322 (35) |
| Instructor | 48 (6) | 40 (4) |
| **Mean 1995 salary ± SD (in thousands), *$*** | 98 ± 45 | 125 ± 66 |

* Faculty with missing values of individual variables were dropped from percentage and mean calculations. Because sampling was stratified by school, sex, seniority, and department and was augmented to enhance numbers of senior faculty women and minority faculty, respondent percentages do not reflect national distributions of these characteristics for academic medical faculty.

47% of such women were full professors. **Table 2** also reveals that within each seniority cohort, female faculty were less likely than male faculty to have at least 40 publications; this finding emphasizes the importance of adjusting for such differences when examining equity. However, multivariable analysis also found substantial inequities in advancement for senior faculty women.

In the analysis for advancement (**Appendix Table 1**, available at www.annals.org), the only significant interaction was female × seniority (odds ratio, 0.90; $P = 0.003$), which suggests that each additional year of seniority was of substantially less value to women than to men in improving the chance of being a full professor. Underrepresented minority faculty were also less likely to have been promoted. In contrast, each of the following made full professorship more likely: being in a basic science department, having more career publications, being chair of a department or chief of an academic division, and working more hours. Three variations on this model yielded very similar odds ratio estimates (0.88 to 0.90) for the female × seniority interaction: 1) retaining only those 435 faculty with 10 to 20 years seniority; 2) adding a female × long-term marker (≥25 years), which was not significant ($P > 0.2$); and 3) dropping "chair or chief" as a predictor.

The cohort analysis (shown in the rightmost columns of **Table 2**) show the largest deficits in advancement for women among faculty hired before 1965 (44%), but notable deficits (22%) also persist for those hired as recently as 1970 to 1974.

### Compensation

In the compensation analysis, the professional predictors of salary were having seniority (nearly $11 000 in annual compensation for each 10 years of seniority); having publications (for example, 40 publications added about $20 000 and 60 publications added >$30 000); being a physician (worth $43 000) and, especially, a physician in a medical or surgical specialty (worth, respectively, >$20 000 and >$50 000 more than the salary of nonphysicians in any department or physicians in primary care or basic sciences); being a chair or chief (worth $22 000); and working more hours (an 80-hour work week yielded almost $22 000 more than a 40-hour work week). In addition, each 10% of time spent in research was associated with a $3000 reduction in compensation for nonphysicians and a $7000 reduction for physicians, and each 10% of time spent in teaching (as opposed to clinical or administrative work) was associated with an almost $4000 reduction in compensation. Some differences were not based on profession: Female physicians received nearly $12 000 less than male physicians; women received almost $5000 less additional salary than men for each 10 years of seniority; and nonunderrepresented minority faculty received $7000 less than majority faculty. The model predicts, for example, that a white male primary care physician faculty with fewer than 10 publications will earn $96 214 in his first year; if he were a medical specialist, he would earn $116 003. A similarly situated female in either scenario will earn $11 691 less. With 10 years' seniority, the gender deficit increases by $4850 to $16 541. The female × seniority deficit shrinks (from $485 to $410 per year) in a sensitivity analysis that excluded faculty with 30 or more years of seniority (50 men and 25 women), and dropping "chair"

*Table 2.* **Attainment of Full Professor Rank and Publications by Sex and Seniority***

| Seniority, *y* | Year of First Appointment | Faculty, *n* | | Full Professor Rank, % | | ≥40 Publications, % | | Risk-Adjusted Female Deficit† | *P* Value‡ |
|---|---|---|---|---|---|---|---|---|---|
| | | Women | Men | Women | Men | Women | Men | | |
| 0–4 | 1990–1995 | 241 | 220 | 1.2 | 3.6 | 1.2 | 5.4 | NA | |
| 5–9 | 1985–1989 | 219 | 211 | 4.6 | 4.3 | 6.4 | 14.2 | NA | |
| 10–14 | 1980–1984 | 129 | 148 | 20.2 | 24.3 | 23.5 | 35.3 | 4.8 | >0.2 |
| 15–19 | 1975–1979 | 88 | 122 | 46.6 | 66.4 | 33.3 | 48.8 | −5.7 | >0.2 |
| 20–24 | 1970–1974 | 86 | 100 | 68.6 | 81.0 | 45.1 | 46.5 | −22.4 | <0.001 |
| 25–29 | 1965–1969 | 60 | 72 | 63.3 | 86.1 | 45.2 | 60.3 | −21.7 | <0.001 |
| ≥30 | Pre–1965 | 25 | 48 | 52.0 | 93.8 | 36.0 | 66.7 | −44.0 | <0.001 |
| Total | | 848 | 921 | 22.4 | 35.0 | 19.9 | 32.3 | −11.0 | <0.001 |

* NA = not available.
† Sex difference in observed minus expected percentage who are full professors (absolute percentage points). All expected differences are based on the probability of being a full professor among male faculty, as predicted by the model in Appendix Table 1 (available at www.annals.org).
‡ Each *P* value results from a *t*-test of $H_0$: women's (observed − expected) = men's (observed − expected) based on the total number of male and female faculty within the specified cohort.

as a predictor increases the magnitude of the female × seniority and female × physician estimated deficits (to −$568 and −$13 738, respectively).

The cohort analysis (**Table 3**) also suggests that the women's deficit is larger for women of more senior faculty rank, especially those hired before 1975. However, it also finds female salary deficits in every cohort, including a particularly large one among faculty hired since 1990. An analogous analysis found the salaries of female chairs and chiefs to be $17 800 less than those of male peers ($P < 0.001$).

## Discussion

Our study confirms earlier findings that women in academic medicine have not reached senior academic ranks in proportion to their representation in medical school faculties. By considering and accounting for important professional characteristics (including number of career peer-reviewed publications) that independently affect faculty advancement, we have shown that women are significantly less likely to be full professors than comparably credentialed men. This is more than a pipeline phenomenon. Although ample numbers of women have entered academic medicine for at least the past 2 decades, the representation of women among full professors was only slightly higher in 1998 than in 1978 (10.5% vs. 7%) (14).

Our study found substantial deficits in academic rank for women, notably within cohorts whose first full-time appointment occurred between 1970 and 1985 and for women who became faculty before 1970. Although a few institutions have documented progress (15), most studies of women in academic medicine continue to find gender disparity in academic rank (1, 3, 16). Nonnemaker found female deficits in advancement in 15 consecutive national cohorts of academic faculty from 1979 to 1993; however, she did not have data on academic productivity, job characteristics, and performance to examine equity (10). Studies that have had such data have often been limited to 1 department or to 1 medical school (3–6, 15). Tesch and colleagues (16) conducted a national study and adjusted for important variables. In their study, 400 faculty hired in the 1980s from across the United States revealed issues with promotion similar to those found in our study, but they did not evaluate salary. We were able to examine faculty in all major medical school academic departments (basic science and clinical) and to account for important independent predictors of advancement, including numbers of peer-reviewed publications, hours worked per week,

*Table 3.* **Compensation by Sex and Seniority**

| Seniority, *y* | Faculty, *n* | | Year of First Appointment | Mean Salary ± SD (in thousands), $ | | Risk-Adjusted Female Deficit (in thousands)*, $ | *P* Value† |
|---|---|---|---|---|---|---|---|
| | Women | Men | | Women | Men | | |
| 0–4 | 241 | 217 | 1990–1995 | 85 ± 35 | 108 ± 61 | −13.0 | <0.001 |
| 5–9 | 217 | 204 | 1985–1989 | 94 ± 45 | 115 ± 61 | −9.2 | <0.001 |
| 10–14 | 126 | 147 | 1980–1984 | 105 ± 52 | 122 ± 62 | −9.0 | 0.011 |
| 15–19 | 90 | 121 | 1975–1979 | 105 ± 48 | 134 ± 54 | −10.4 | 0.005 |
| 20–24 | 88 | 99 | 1970–1974 | 113 ± 39 | 156 ± 78 | −19.8 | <0.001 |
| ≥25 | 86 | 123 | Pre–1970 | 110 ± 51 | 140 ± 75 | −24.0 | <0.001 |
| Total | 848 | 911 | | 98 ± 45 | 125 ± 66 | −13.0 | <0.001 |

* Sex difference in observed minus expected (thousands of) dollars in annual compensation. All expected differences are based on predicted salaries for male faculty by using the model in Appendix Table 2 (available at www.annals.org).
† Each *P* value results from a *t*-test of $H_0$: women's (observed − expected) = men's (observed − expected) based on the total number of male and female faculty within the specified cohort.

time spent in research and in teaching, and status as a chair or chief. Even after adjustment for these potential confounders, a concerning lack of equity in promotion to full professorship by sex remained.

Usual explanations for the scarcity of female full professors, other than simple discrimination, include women's lower motivation (17–19), their lack of mentorship (1, 20–23), sexual harassment (24–26), greater family responsibilities (20, 27, 28), less institutional support (6, 7), and the cumulative burden of many microinequities (29). However, most of these alternative explanations are not viable here. We found women to have similar motivation (30) and similar mentoring (31) as male faculty, and we did not find that gender bias or sexual harassment had noticeably affected academic productivity (12). Family responsibilities, however, did differentially weigh on female faculty, affect their academic productivity, and contribute to greater time to attaining senior rank (32). However, productivity differences do not fully explain the advancement deficit for women; at all levels of productivity, women are less likely to be full professors than are their male peers.

Equity in compensation has been equally problematic for female medical school faculty (3, 8), although 1 study (11) purported to show equity in compensation among recent graduates. However, as that cohort has aged, our study found increasing deficits. We found greater deficits for all female faculty with increasing years of seniority. For female physician faculty, in contrast to nonphysician faculty, we found a large additional deficit (−$11 691; $P = 0.01$). Others have found that the overall earnings differential between male and female physician faculty narrowed in the 1970s and 1980s (24% in 1972 [33], 19% in 1977 [34], and 15% in 1982 [35]) but did not disappear. Differences in specialty and practice style explain some of the salary deficits for women, as do differences in seniority, hours worked, and numbers of peer-reviewed publications (36). However, after adjustment for these and other faculty characteristics, female physician faculty are paid less than their male peers, and both physician and nonphysician female faculty experience greater deficits with greater seniority. We also found a significant salary deficit for non-underrepresented minority faculty.

We note that including a "chief or chair" indicator in models accepts women's lesser representation in leadership positions (13% vs. 21%) as a legitimate explanation for women's lower rank or salary. However, being passed over for a leadership position may be part of the same process that leads a woman to advance more slowly and be paid less than her male peers. The discrimination literature views variables that capture real differences in responsibility but may reflect discriminatory allocations as "tainted" (37). Dropping this variable had minimal effect on the promotion analysis but increased the estimated size of the salary deficit for women by about 17%. In addition, we found that female chairs and chiefs received $14 000 less than expected; this finding was based on the relations between professional characteristics and salary identified for their male peers.

Salary equity by sex or race is a legal as well as an ethical issue for employers. Pay discrepancies, typically associated with lower initial placement and slower promotions, have been found in successful gender discrimination lawsuits at universities (38). After accounting for the major professional factors that affect salary and advancement, substantial deficits for women and minorities remain; it is not obvious that additional legitimate factors, rather than discrimination, can account for these discrepancies. The gender deficits in both advancement and compensation are greater for women in more senior faculty positions.

Our findings in both advancement and salary parallel those of other studies in business, law, and academia (39). Starting salaries by sex for persons with an MBA, if experience is taken into account, tend to be approximately equal, but advancement for women is slower and salaries become increasingly disparate (39). In the profession of law, whether in private firms, corporations, or the judiciary, women are overrepresented in junior positions, are underrepresented in senior positions, and have lower salaries (39). Others have found the picture in academia to be the same and similar to our findings for academic medical faculty. The most recent female graduates start with salaries similar to those of their male colleagues, but by 3 to 8 years after a degree is earned, salary disparities appear and then increase with greater seniority. Gender differences in salary in science and engineering are greater than in the humanities. Overall, salary data for universities and colleges show almost no reduction of gender disparities between 1980 and 1996 (39).

The issues for women in science rather than medical academia are somewhat different; the "leaky pipeline" phenomenon is more potent here than in medical schools. Although nearly half (47%) of bachelor degrees in the sciences are awarded to women, only 38% of enrollees in graduate school in the sciences are women, and just 31% of PhDs in 1995 were awarded to women (40). In medicine, 40% of graduates are women, and, until recently, women have entered academia in higher proportion than their male colleagues (10). The cause of this decline in women entering medical academia over the past several years is unknown but could reflect resident and fellow awareness of the obstacles faced by female faculty.

Our work has limitations. Overall quality of academic performance is not fully captured by even our extensive data. However, there is no particular reason to believe that between 2 faculty of opposite sex with, for example, 50 publications each, legitimate "unmeasured factors," rather than gender-biased judgments, systematically favor the man. Although we have detailed data on many factors that may be associated with promotion, such as seniority and specialty, these data are self-reported; however, no evidence shows that any biases would be gender specific. Clearly,

number of peer-reviewed publications does not capture quality; however, promotion criteria are often (either formally or informally) linked to numerical "quotas." In addition, we have accounted for many other important factors that might affect rank, such as allocation of professional time, hours worked per week, seniority, and specialty.

Our information on compensation is also by self-report. However, we have no reason to suspect systematic differences by sex or other faculty descriptors in reporting professional income. One limitation is that significant differences in income can arise for faculty in the same surgical specialty if some faculty do fewer procedures. We have no data that speak to the existence, magnitude, or direction of such a difference by sex.

Our study is cross-sectional; thus, we know nothing about former faculty and whether men and women may have left in different numbers or for different reasons. Moreover, such data do not allow us to distinguish seniority from cohort effects. For example, we cannot say that the faculty hired since 1980, for whom no gender differences in promotion were apparent in 1996, are still subject to the same forces that led women hired in 1970 to experience a promotion deficit by 1996. A definitive answer to this question will not be available until after 2006. However, the fact that Baker (11) found gender equity in 1990 salaries for faculty hired within the preceding 10 years combined with our finding of salary inequities in 1996 for that cohort 6 years later suggests that gender inequities accrue over the course of a career. In the absence of corrective action, the gender inequities will probably continue to widen for current faculty as they become more senior. We do not know the level of academic productivity before promotion or productivity at the time of promotion, but we do know which faculty had not yet been promoted even though they had produced the number of publications reported.

Although 60% is a respectable response rate for a lengthy questionnaire administered to a nationally dispersed sample of academic physicians, nonresponders are sufficiently numerous that response bias could affect findings. Finally, our data are not as recent as we would wish (1995–1996); however, similarly rich, more recent data do not exist and data from the AAMC suggest that the gender gap in salaries persists. Thus, we believe that this study provides the best available data to address a very important issue.

Our work has many strengths. To our knowledge, it is the first study across all medical school departments, including clinical and basic science departments, in a national sample of medical schools to examine many key factors that affect academic advancement and compensation for men and women. Despite an adequate pipeline in academic medicine and sufficient years for women to achieve full professor rank, we found less advancement to full professor rank and lower salaries for women. Particularly in view of the decline in the numbers and proportion of women entering academic medicine (10), as well as the greater decrease in interest in an academic career for women compared with men during residency (41), medical schools should closely examine their environment for gender equity in promotion and compensation.

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*Appendix Table 1.* **Model To Predict Full Professor Status***

| Variable | Odds Ratio (95% CI) | *P* Value |
|---|---|---|
| Sex | | |
| Male | Reference† | |
| Female | 1.28 (0.57–2.86) | >0.2 |
| Seniority‡ | 1.35 (1.25–1.45) | <0.001 |
| Female × seniority | 0.90 (0.84–0.96) | 0.003 |
| Seniority of ≥25 y | 0.19 (0.19–0.40) | <0.001 |
| Race or ethnicity | | |
| White | Reference† | |
| Underrepresented minority | 0.42 (0.21–0.82) | 0.01 |
| Nonunderrepresented minority | 0.61 (0.30–1.26) | 0.18 |
| Department category | | |
| Primary care | Reference† | |
| Medical specialty | 1.62 (0.95–2.75) | 0.08 |
| Surgical specialty | 1.10 (0.61–1.99) | >0.2 |
| Basic science | 1.75 (1.21–2.53) | 0.003 |
| Career publications | | |
| 0–9 | Reference† | |
| 10–19 | 1.47 (0.69–3.13) | >0.2 |
| 20–39 | 2.74 (1.16–6.45) | 0.02 |
| 40–59 | 13.40 (6.03–29.76) | <0.001 |
| ≥60 | 22.92 (9.36–56.12) | <0.001 |
| Chair or chief | 3.51 (2.31–5.33) | <0.001 |
| Hours of work/wk§ | 1.39 (1.05–1.60) | <0.001 |

* The data pertain to all 482 male and 382 female respondents with at least 10 years of seniority.
† The reference group consists of white males who are in a primary care department, who have 0 to 9 publications, and who are not a chair or chief.
‡ Years beyond 10 since first full-time faculty appointment.
§ Hours of work/wk = each additional 10 hours over 40 worked/wk to a maximum of 80.

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*Appendix Table 2.* **Model To Predict 1996 Compensation***

| Variable | Compensation (95% CI), $ | *P* Value |
|---|---|---|
| Intercept† | 96 214 (81 160 to 111 269) | <0.001 |
| Female | −332 (−8148 to 7473) | >0.2 |
| Nonphysician | −43 131 (−55 493 to −30 768) | <0.001 |
| Female × physician | −11 691 (−20 735 to −2647) | 0.01 |
| Seniority‡ | 1097 (642 to 1552) | <0.001 |
| Female × seniority | −485 (−856 to −113) | 0.01 |
| Race or ethnicity | | |
| White | Reference§ | |
| Underrepresented minority | −1843 (−8990 to 5303) | >0.2 |
| Nonunderrepresented minority | −6798 (−12 316 to −1280) | 0.2 |
| Department category | | |
| Primary care | Reference§ | |
| Basic science | 1433 (−4618 to 7484) | >0.2 |
| Medical specialty | 3352 (−5868 to 12 572) | >0.2 |
| Surgical specialty | 7317 (−7692 to 22 326) | >0.2 |
| Physician × department | | |
| MD × medical specialty | 19 789 (8096 to 31 482) | 0.001 |
| MD × surgical specialty | 48 531 (27 182 to 69 881) | <0.001 |
| Career publications | | |
| 0–9 | Reference§ | |
| 10–19 | 9113 (4689 to 13 536) | <0.001 |
| 20–39 | 13 489 (6506 to 20 472) | 0.001 |
| 40–59 | 20 466 (11 180 to 29 752) | <0.001 |
| ≥60 | 31 493 (24 078 to 38 908) | <0.001 |
| Chair or chief | 22 078 (14 879 to 29 277) | <0.001 |
| Hours of work/wk‖ | 540 (308 to 773) | <0.001 |
| Percentage of time in research¶ | −297 (−463 to −131) | 0.001 |
| Physician × percentage of time in research | −375 (−563 to −188) | <0.001 |
| Percentage of time in teaching¶ | −375 (−568 to −183) | 0.001 |

* Data pertain to all 848 female and 911 male respondents with no missing salary and other predictor information.
† The expected 1996 salary for a starting white male physician faculty member who is in primary care, who has <10 publications, who is neither a chair nor chief, and who works 40 h/wk (none of it in research or teaching). Expected salaries for other faculty are obtained by adding pertinent characteristics to $96 214.
‡ Years since first full-time faculty appointment.
§ The reference group consists of white men who are in a primary care department, have 0 to 9 publications, and are not a chair or chief.
‖ Hours of work/wk = each additional hour worked/wk beyond 40 to a maximum of 80.
¶ Percentage time = each 1% of time spent as indicated (vs. clinical and administrative activities).