Special Article

SEX DIFFERENCES IN ACADEMIC ADVANCEMENT

Results of a National Study of Pediatricians

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ABSTRACT

Background Although the numbers of women in training and in entry-level academic positions in medicine have increased substantially in recent years, the proportion of women in senior faculty positions has not changed. We conducted a study to determine the contributions of background and training, academic productivity, distribution of work time, institutional support, career attitudes, and family responsibilities to sex differences in academic rank and salary among faculty members of academic pediatric departments.

Methods We conducted a cross-sectional survey of all salaried physicians in 126 academic departments of pediatrics in the United States in January 1992. Of the 6441 questionnaires distributed, 4285 (67 percent) were returned. The sample was representative of U.S. pediatric faculty members. Multivariate models were used to relate academic rank and salary to 16 independent variables.

Results Significantly fewer women than men achieved the rank of associate professor or higher. For both men and women, higher salaries and ranks were related to greater academic productivity (more publications and grants), more hours worked, more institutional support of research, greater overall career satisfaction, and fewer career problems. Less time spent in teaching and patient care was related to greater academic productivity for both sexes. Women in the low ranks were less academically productive and spent significantly more time in teaching and patient care than men in those ranks. Adjustment for all independent variables eliminated sex differences in academic rank but not in salary.

Conclusions Lower rates of academic productivity, more time spent in teaching and patient care and less time spent in research, less institutional support for research, and lower rates of specialization in highly paid subspecialties contributed to the lower ranks and salaries of female faculty members in pediatrics. (N Engl J Med 1996;335:1282-9.)

DESPITE an increase in the proportion of applicants to medical school who are women (26 percent in 1977 vs. 37 percent in 1987) and an increase in the representation of women among house officers and entry-level faculty, the proportion of women in the senior ranks of academic medicine has remained relatively constant over the past decade, at approximately 28 percent for associate professors and 15 percent for full professors.[1-13] Even in pediatrics, the specialty with the highest proportion of female residents and faculty members, few women are associate or full professors.[14]

Listed in descending level of empirical support, the following hypotheses have been proposed for the disparities in academic advancement and salaries between women and men: (1) women publish fewer papers and secure fewer grants[1,5,6,9,15-17]; (2) women work fewer hours and spend their time in teaching and patient care rather than in research[1,6,10,18-20]; (3) women have inadequate mentorship and lack female role models[3,6,7,9,16,21-26]; (4) women produce less because they shoulder the burden of family responsibilities (although multiple studies have failed to support this hypothesis)[2,27-30]; (5) women are demoralized and less productive because of subtle or overt sex discrimination or harassment (or both)[21,23,31,32]; (6) women have less motivation to achieve than men,[11,25] set lower career goals, and devalue the "pure research" thought necessary for traditional academic advancement; and (7) women have historically been underrepresented in entry-level positions, but with the increasing numbers of women in such positions, sex differences in the senior ranks will diminish.[33]

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Studies of sex differences in academic advancement have been compromised by small samples, failure to include both sexes, samples of trainees and house staff rather than senior faculty, use of measures with unknown psychometric properties, or consideration of only a few variables or institutions. Few studies of academia in general,[2,12,20] or of academic medicine[1,11,27,28] have attempted to explore several hypotheses simultaneously in a sample of men and women. No study has assessed the collective contribution of all the hypotheses listed above to academic achievement.

To address these conceptual and methodologic issues, we conducted a survey of all academic pediatricians on the faculties of all departments of pediatrics in the United States. We present here the results of the study, known as the Career Advancement in Academic Pediatrics (CAAP) Project.

METHODS

Study Design and Sample

The CAAP study was a cross-sectional survey of all physicians who were salaried faculty members of the 126 pediatric departments in the United States from November 1991 through January 1992. Of the 6441 self-administered questionnaires distributed by the offices of the department chairs, 4285 (67 percent) were returned; 1512 of the respondents (35.3 percent) were women, and 2773 (64.7 percent) were men. The proportions of male and female nonrespondents were similar. For this study, we restricted the sample to the 3999 respondents who were full-time faculty members. The mean (±SD) age of the sample was 44.3±9.01 years; 39.0 percent of the respondents were 40 years of age or younger, and 7.9 percent were 60 or older. Fifty percent of the sample had graduated from medical school after 1975. The majority of the respondents (88.3 percent) were white, 1.7 percent were black, 2.8 percent were Hispanic, 6.3 percent were Asian, and 0.9 percent were members of other races or ethnic groups.

A total of 25.9 percent of the respondents were full professors (82.9 percent were male and 17.1 percent were female), 27.4 percent were associate professors (70.6 percent male and 29.4 percent female), 40.2 percent were assistant professors (54.4 percent male and 45.6 percent female), and 6.6 percent were instructors (42.4 percent male and 57.6 percent female). With respect to geographic region, 33.2 percent of the respondents came from the Northeast, 25.1 percent from the Midwest or north-central region, 14.7 percent from the West, and 27.0 percent from the South. There were consistent parallels between the profiles for pediatrics of the Faculty Roster System of the Association of American Medical Colleges[34] and the survey respondents in terms of age, sex, race or ethnic group, rank, and region. We therefore concluded that any nonresponse bias was negligible.

To simplify the analyses, we divided the respondents into three groups according to specialty: neonatology, intensive care, or cardiology (28.6 percent), all other subspecialties (44.4 percent), and general pediatrics (28.8 percent).

Measures

We developed multi-item scales for each of the following variables: institutional support of research, distribution of work time, family responsibilities, and career attitudes and perceived barriers to advancement. Multi-item scales were created with the use of cluster scoring. Reliability coefficients for internal consistency were computed for these scales, all of which met or exceeded the standards for group comparisons (Cronbach's alpha, ≥ 0.70). Composite measures were transformed into scales ranging from 0 to 100 for ease of interpretation. We calculated the ratio of time spent in teaching and patient care to time spent in research, adjusted for the total number of hours worked each week. We also measured gratification from teaching, patient care, research, and administration, using five-point scales ranging from "extremely unrewarding" to "extremely rewarding." Because of multicollinearity, we created four summary scales of career attitudes and barriers. We used these summary scales in multivariate models.

We asked 10 questions about academic productivity, including the numbers of unsolicited articles for which the respondent was the first, last, or only author; solicited articles; book chapters; book reviews; named lectureships; and positions as principal investigator, co-principal investigator, or consultant on grants and contracts. Two productivity measures were derived from principal-components analysis with a varimax (orthogonal) rotation of these 10 items. Standardized composite-factor scores were developed and used in multivariate analyses.

Statistical Analysis

Descriptive statistics were used to assess sex differences for all independent variables and covariates. In separate multiple regression models for academic rank and salary, seven blocks of variables were entered: background and training, academic productivity, distribution of work time, institutional support of research, family responsibilities, career attitudes, and perceived barriers to advancement. Since academic rank was ordinal, both multiple linear regression and discriminant analysis were used. The results of the two analyses were similar; we report the multiple regression results. Because of substantive sex differences in all the modeled independent variables, separate models were developed for men and women for both academic rank and salary. Tolerances and variance-inflation factors were investigated to assess multicollinearity.[35] Mallow's C_p coefficients were analyzed for variable selection and overspecification in the multiple regression models.[35]

RESULTS

Academic Rank, Salary, and Background and Training

At every rank, except that of instructor, there were proportionately more men than women. This disparity was most pronounced in the senior ranks. Unadjusted mean annual salaries reported by male faculty members were substantially higher than those reported by female faculty members at each academic rank (e.g., $128,520 vs. $110,497 among full professors and $71,496 vs. $66,212 among instructors). For both male and female faculty members, salaries were higher in the Northeast than in all the other regions (for men, $134,152 vs. an average of $126,306 in all other regions; and for women, $113,137 vs. an average of $109,375 in all other regions).

The male respondents were older than the female respondents (45.4 vs. 42.1 years, $P<0.001$), a higher proportion of the men were white (89.6 percent, vs. 85.8 percent of the women; $P<0.001$), and a higher proportion were married (89.1 percent vs. 72.1 percent, $P<0.001$). More men than women specialized in intensive care, neonatology, or cardiology (28.8 percent vs. 23.4 percent, $P<0.001$), and more women than men were general pediatricians (35.9 percent vs. 24.8 percent, $P<0.001$). A significantly higher proportion of male respondents

TABLE 1. DISTRIBUTION OF WORK TIME, INSTITUTIONAL SUPPORT, FAMILY RESPONSIBILITIES, CAREER ATTITUDES, AND PERCEIVED BARRIERS TO ADVANCEMENT AMONG 3954 MALE AND FEMALE FACULTY MEMBERS IN PEDIATRICS.

CHARACTERISTIC	MEN (N=2661)	WOMEN (N=1293)	UNADJUSTED MEAN DIFFERENCE (95% CONFIDENCE INTERVAL)*	P VALUE†
Distribution of work time				
Ratio of teaching time to research time	1.18	1.32	−0.14 (−0.19 to −0.08)	<0.001
Ratio of time spent in patient care to research time	1.72	1.96	−0.24 (−0.32 to −0.16)	<0.001
Total work time per week (hr)	64.4	60.5	3.9 (3.1 to 4.8)	<0.001
Rating of institutional support‡				
Adequate mentorship quality	53.0	42.5	10.5 (9.2 to 11.8)	<0.001
Adequate institutional support of research	62.1	55.9	6.2 (4.5 to 7.9)	<0.001
Research time sponsored by institution	60.8	59.9	0.9 (−0.7 to 4.4)	NS
Family responsibilities				
Time off for birth or adoption of children (mo)	0.1	2.9	−2.8 (−3.0 to −2.6)	<0.001
Rating of career delays due to family§	74.5	70.3	4.2 (2.9 to 5.7)	<0.001
Career attitudes¶				
Overall achievement orientation‖	43.2	40.5	2.7 (2.0 to 3.4)	<0.001
Highest academic rank aspired to	5.6	5.0	0.6 (0.5 to 0.6)	<0.001
Achievability of aspiration	75.6	62.8	12.8 (11.1 to 14.4)	<0.001
Achievement orientation	46.1	41.0	5.1 (3.9 to 6.2)	<0.001
Overall satisfaction‖	65.6	56.4	9.2 (8.4 to 10.4)	<0.001
Absence of career delays	59.0	49.4	9.6 (8.3 to 10.8)	<0.001
Commitment to career path	78.0	75.4	2.6 (1.3 to 3.8)	<0.001
Satisfaction with career progress	62.7	56.8	5.9 (4.9 to 6.9)	<0.001
Perceived barriers to advancement**				
Discrimination‖	6.1	20.1	−14.0 (−14.8 to −13.2)	<0.001
Religious discrimination	7.4	5.7	1.7 (0.6 to 2.7)	<0.001
Age discrimination	7.1	14.8	−7.7 (−8.9 to −6.6)	<0.001
Sex discrimination	3.8	39.9	−36.1 (−37.2 to −34.8)	<0.001
Problems and frustrations‖	36.3	37.2	−0.9 (−1.5 to −0.4)	<0.001
Demoralization	61.0	56.4	4.6 (3.2 to 6.0)	<0.001
Problems in professional life	32.4	37.5	−5.1 (−6.3 to −3.8)	<0.001
Hindrance from colleagues	15.3	17.8	−2.5 (−3.5 to −1.4)	<0.001

*The reference value is the value for the men.

†NS denotes not significant.

‡Institutional support was scored on scales from 0 to 100, with higher scores indicating greater support.

§Perceived career delays due to family responsibilities were scored on a scale from 0 to 100, with higher scores indicating greater delays.

¶Career attitudes were scored on scales from 0 to 100, with higher scores indicating more favorable attitudes, except for highest academic rank aspired to, which was scored on a scale from 1 (instructor) to 7 (dean).

‖Composite measure with three components as indicated.

**Perceived barriers were scored on scales from 0 to 100, with higher scores indicating greater barriers (more discrimination, more demoralization, more problems in professional life, and more hindrance from colleagues).

had completed fellowships and received postgraduate degrees.

Work Time, Institutional Support, Family Responsibilities, and Career Attitudes

Male faculty members reported more hours worked per week than female faculty members (64.4 vs. 60.5 hours, $P<0.001$). Female respondents reported spending proportionately more time in teaching and patient care than male respondents (Table 1). This difference was most pronounced among instructors and assistant professors, with the men reporting significantly fewer hours per week in teaching and patient care than the women (34.9 vs. 40.1 hours, $P<0.001$) and more hours in research (20.4 vs. 15.0 hours, $P<0.001$). Since the men at these ranks reported working more total hours per week than the women (64.7 vs. 58.2 hours, $P<0.001$), these differences reflected a substantial disparity in the distribution of work time (Fig. 1).

Significantly more men than women reported adequate mentorship quality (Table 1). There were no significant differences between the men and the women in the proportion of research time sponsored by the institution. However, the adequacy of intramural research support was rated higher by men than by women.

Men took significantly less time off for the birth or adoption of children than did women (approximately 3 vs. 90 days), but men perceived significantly greater delays in their careers because of family responsibilities.

More male than female respondents aspired to the rank of division chief (28 percent vs. 17 percent) or

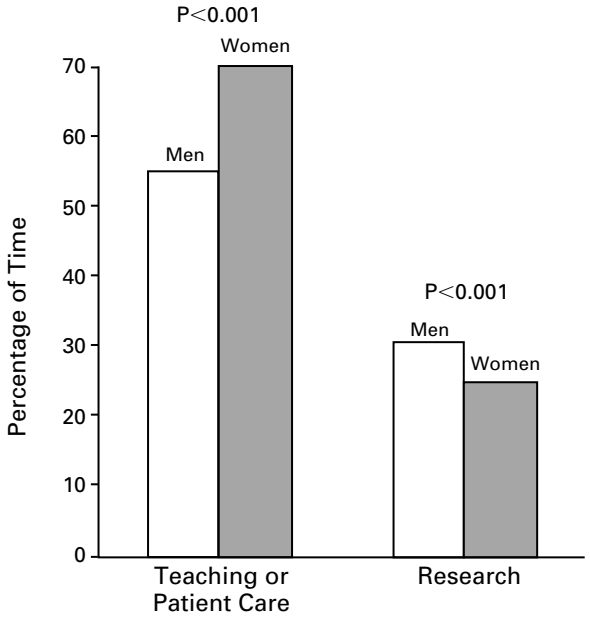

Figure 1. Distribution of Work Time among 3999 Entry-Level Faculty Members (Instructors or Assistant Professors) in Pediatrics.

department chair (13 percent vs. 3 percent). The highest rank that half the female faculty members aspired to was that of full professor. Men considered their career aspirations to be more achievable than did women. Men also reported significantly fewer career delays, higher achievement orientation, more commitment to their career paths, and greater satisfaction with the progress of their careers (Table 1). There were no statistically significant differences in the proportions of male and female respondents who found teaching and patient care "very rewarding" or "extremely rewarding"; however, a higher proportion of the men found research very or extremely rewarding (68.6 percent vs. 56.7 percent, $P<0.001$).

Male faculty members also reported significantly fewer barriers to advancement than female faculty members but were more demoralized about their careers. Women reported more sex and age discrimination, more problems in professional life (such as isolation from colleagues), and more negative interference from senior colleagues.

Academic Productivity

Male faculty members published significantly more articles (as first, last, or only author), book chapters, and book reviews and gave more named lectures than did female faculty members (Table 2). Male respondents reported twice as many positions as principal investigator, co-principal investigator, or consultant on research grants.

Variables Associated with Academic Rank and Salary

Variables significantly associated with academic rank were similar for male and female faculty members, with some important exceptions. Among respondents in the Northeast, among those specializing in neonatology, intensive care, or cardiology, and among those who had completed fellowships, men had higher academic positions than women. Academic productivity accounted for the most age-adjusted variation in academic rank for both male and female faculty members (Table 3). Neither the distribution of work time nor the amount of insti-

TABLE 2. ACADEMIC PRODUCTIVITY AMONG MALE AND FEMALE FACULTY MEMBERS.

ACADEMIC PRODUCTIVITY	MEN (N=2661)	WOMEN (N=1293)	UNADJUSTED MEAN DIFFERENCE (95% CONFIDENCE INTERVAL)	P VALUE
Publications and lectures (no.)				
Unsolicited article				
First author	10.2	5.6	4.6 (3.8–5.3)	<0.001
Last author	7.1	2.5	4.6 (3.8–5.5)	<0.001
Sole author	2.2	0.8	1.4 (1.1–1.7)	<0.001
Book chapter	6.0	3.0	3.0 (2.2–3.8)	<0.001
Book review	1.1	0.5	0.6 (0.4–0.9)	<0.001
Solicited article	2.7	1.2	1.5 (1.1–1.9)	<0.001
Named lecture	1.0	0.4	0.6 (0.4–0.9)	<0.001
Factor score for publications and lectures*	0.16	−0.25	0.41 (0.34–0.48)	<0.001
Grants (no.)				
Principal investigator	3.4	1.9	1.5 (1.2–1.9)	<0.001
Co-principal investigator	1.4	0.8	0.6 (0.4–0.8)	<0.001
Consultant	0.6	0.3	0.3 (0.2–0.4)	<0.001
Factor score for grants*	0.13	−0.19	0.32 (0.25–0.39)	<0.001

*Factor scores are aggregate scores that were calculated by summing scores on standardized-item components.

TABLE 3. VARIABLES SIGNIFICANTLY ASSOCIATED WITH ACADEMIC RANK AND SALARY, ACCORDING TO SEX.*

VARIABLES ASSOCIATED WITH RANK		VARIABLES ASSOCIATED WITH SALARY	
MEN	WOMEN	MEN	WOMEN
Publications	Publications	Publications	Publications
Grants	Grants	—	—
Perceived career delays due to family responsibilities	—	—	—
—	—	Ratio of time spent in patient care to research time	Ratio of time spent in patient care to research time
—	—	Total hours worked	Total hours worked
—	Adequacy of institutional support of research	Adequacy of institutional support of research	Adequacy of institutional support of research
Overall career satisfaction	Overall career satisfaction	Overall career satisfaction	Overall career satisfaction
Career problems and frustrations	Career problems and frustrations	Career problems and frustrations	—

*Direct-entry multiple regression analyses were performed separately for men and women and were adjusted for background and training. All associations were positive with the exception of perceived career delays due to family responsibilities. $P<0.01$ for associations.

tutional support accounted for the significant variation in academic rank among the men. Male faculty members who perceived few career delays due to family responsibilities and female faculty members who reported adequate institutional support of research were likely to have higher academic positions. Among both men and women, higher overall career satisfaction and more career problems and frustrations were associated with higher academic ranks.

There were no significant proportional differences in the salaries received by men and women according to geographic region. Intensivists and cardiologists of both sexes reported significantly higher salaries than generalists or other specialists. For both male and female respondents, more time spent in patient care than in research, more total hours worked, adequate institutional support of research, and higher overall career satisfaction were associated with higher annual salaries. For male faculty members only, more career problems and frustrations were also associated with higher salaries.

Sex Differences among the Most Academically Productive Respondents

We divided the sample into three equal groups on the basis of academic productivity. In the most productive group, there were similarities between male and female faculty members and significant differences between them and their less productive colleagues. As compared with the other two groups, the most productive male and female faculty members were in subspecialties other than neonatology, intensive care, and cardiology, had completed fellowships, spent less time in teaching and patient care than in research, worked more hours per week, reported a higher quality of mentorship, had a much greater proportion of institutional support for their research, reported higher overall career satisfaction, had a higher degree of achievement orientation, and reported greater discrimination and career problems and frustrations. Even in the advanced ranks, the ratio of time spent in teaching to time spent in research and the ratio of time spent in patient care to time spent in research were lower among the highly productive female faculty members (0.90 and 1.24, respectively) than among their less productive female colleagues (1.38 and 2.06, respectively).

In the most productive group, the men were older than the women, reported a higher quality of mentorship, received more institutional support for research, took less time off for the birth or adoption of children, reported fewer delays in their careers due to family responsibilities, expressed higher overall career satisfaction, and reported less discrimination and fewer career problems and frustrations (Table 4). At the rank of a midlevel associate professor, highly productive male faculty members earned an average annual salary of $122,172 in 1992 dollars, as compared with $102,189 for highly productive female faculty members ($P<0.001$).

Estimates of Expected Rank and Salary

To determine whether male and female faculty members with the same characteristics differed in rank and salary, we generated multivariate estimates of the expected mean salaries and ranks, using background and training characteristics as well as the variables listed in Tables 1 and 2. The probabilities of achieving the rank of full professor, along with 95 percent confidence intervals, are shown in Figure 2A. The probabilities did not differ for male and female faculty members with identical characteristics.

A similar analysis of expected academic salaries is shown in Figure 2B. For men and women with the

same characteristics, the models showed higher mean salaries for men with increasing age. For example, at the age of 45 years, the expected annual salary for women was $89,730 (95 percent confidence interval, $85,010 to $94,450), whereas the expected salary for men was $103,470 (95 percent confidence interval, $98,950 to $107,980).

DISCUSSION

The proportion of women in the senior academic ranks has not changed appreciably in the past 10 years.[2,8,10] To date, the hypothesized trend toward equalization in the representation of women at senior faculty levels as a result of the increasing numbers of women in training and entry-level faculty positions[8] has not materialized. We conducted a multivariate analysis of factors that have been hypothesized to contribute to sex differences in academic achievement. For virtually all the independent variables and covariates that we examined, there were statistically significant differences favoring male faculty members. Of all the variables examined, the only finding favoring female faculty was less career demoralization. With some notable exceptions, however, the analyses produced remarkably similar relationships for both male and female faculty.

Although age was the variable most closely correlated with both rank and salary, since this was a cross-sectional study, it was not possible to estimate the influence of time spent at each rank on academic advancement. Some people have suggested that lifting the time restrictions on promotions will eventually resolve sex differences in academic rank. Our data, however, suggest that such differences may reflect a complex process involving productivity and differential institutional support for and use of work time by male and female faculty members. If so, lifting time constraints on promotions may not resolve existing sex differences.

Female faculty members were less productive at all ranks than their male counterparts. Women accounted for less than 20 percent of the highly productive respondents, and these women did not differ from the highly productive men in terms of hours worked per week, ratio of time spent in teaching and patient care to time spent in research, institutional support for research, or achievement orientation. However, the highly productive women reported a poorer quality of mentorship, less-adequate institutional support of their research, more time taken off for the birth or adoption of children, and less overall career satisfaction than their male counterparts. The most productive female faculty members worked an average of six hours per week longer and spent proportionately more of their time in research than their less productive female colleagues.

According to our study and others, female faculty members, particularly those in the early phases of their careers, spend more time in teaching and patient care than their male colleagues.[1,6,10,18-20] Carr et al. reported that women preferred to spend more time in teaching but did not differ from their male colleagues in their preferences for how they spent the remainder of their time.[1] Although female faculty members found research less rewarding than male faculty members, this variable was not significantly related to productivity, rank, or salary.

Although even the most productive female faculty members reported a lower quality of mentorship, which is often cited as a barrier to academic advancement among women,[3,6,7,9,16,21-26] we found no empirical support for this hypothesis. Differences in

TABLE 4. CHARACTERISTICS OF HIGHLY PRODUCTIVE MALE AND FEMALE FACULTY MEMBERS.*

CHARACTERISTIC	HIGHLY PRODUCTIVE MEN (N=716)	HIGHLY PRODUCTIVE WOMEN (N=154)	P VALUE†
Age (yr)	51.7‡	49.9‡	<0.05
Training (% of respondents)			
Neonatology, intensive care, or cardiology	24‡	19	NS
Other subspecialty	53‡	54‡	NS
Fellowship	94‡	95‡	NS
Distribution of work time			
Ratio of teaching time to research time	0.99‡	0.90‡	NS
Ratio of time spent in patient care to research time	1.30‡	1.24‡	NS
Total work time per week (hr)	65.9‡	66.3‡	NS
Rating of institutional support§			
Adequate mentorship quality	58.7‡	44.3	<0.05
Adequate institutional support of research	66.5‡	57.4	<0.05
Research time sponsored by institution	69.5‡	73.6‡	NS
Family responsibilities			
Time off for birth or adoption of children (mo)	0.7‡	2.09‡	<0.05
Rating of career delays due to family¶	75.6	69.6	<0.05
Career attitudes‖			
Overall satisfaction	73.4‡	65.0‡	<0.05
Achievement orientation	47.5‡	47.0‡	NS
Perceived barriers to advancement**			
Discrimination	6.8	22.9‡	<0.05
Problems and frustrations	37.5‡	39.6‡	<0.05

*Highly productive male and female physicians were those in the highest thirds for both number of publications and number of grant-related activities.

†Statistically significant differences were based on two independent samples with t-tests and chi-square tests. NS denotes not significant.

‡$P<0.05$ for the comparison with less productive faculty members of the same sex.

§Institutional support was scored on scales from 0 to 100, with higher scores indicating greater support.

¶Perceived career delays due to family responsibilities were scored on a scale from 0 to 100, with higher scores indicating greater delays.

‖Career attitudes were scored on scales from 0 to 100, with higher scores indicating more favorable attitudes.

**Perceived barriers were scored on scales from 0 to 100, with higher scores indicating greater barriers.

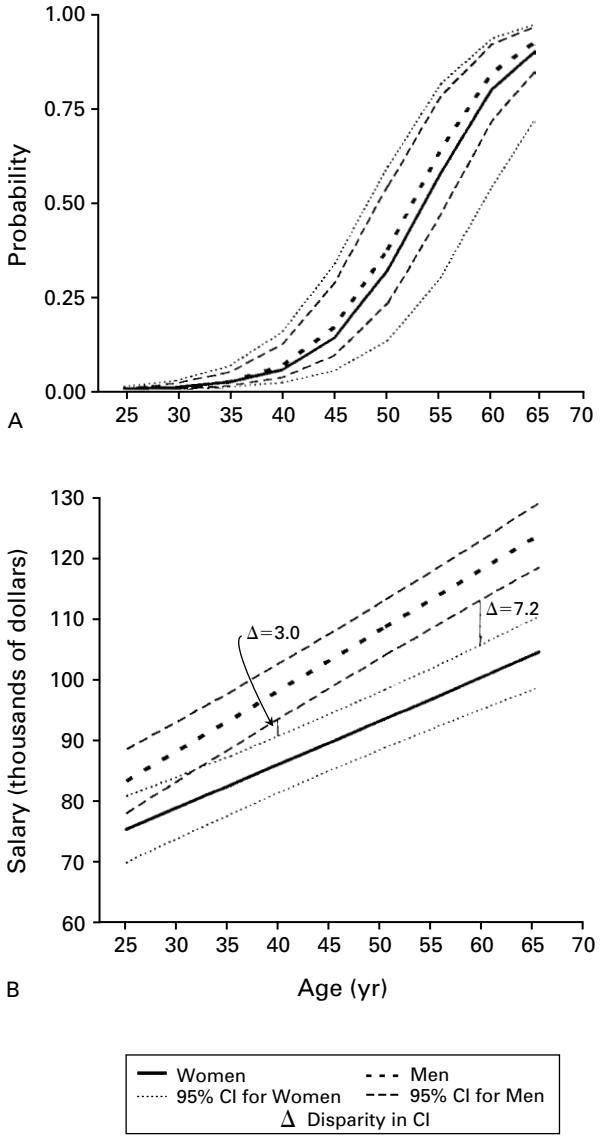

Figure 2. Probability of Achieving the Rank of Full Professor (Panel A) and Probable Mean Salary (Panel B) for Male and Female Faculty Members, According to Age.

The characteristics of the men and women were the same with respect to background and training, productivity, distribution of work time, institutional support, family responsibilities, and career attitudes. CI denotes confidence interval.

mentorship may operate more subtly to influence such factors as the distribution of work time and the allocation of institutional support for research. These subtle effects of mentorship, "protected time," and institutional support of research on academic advancement require further research.

The hypothesized inverse relation between family responsibilities and academic productivity,[2,27-30] although a popular explanation for sex differences in academic advancement,[16] was not supported by our findings or those of other studies.[36] Paradoxically, a larger proportion of men than women in our study reported career delays because of family responsibilities. It may be that women learn to accommodate family responsibilities in the context of their professional and other social roles.[37,38] Men may perceive the burden of these responsibilities as more directly in conflict with the demands of their professional roles. Whatever the underlying sociological differences, family responsibilities do not appear to account for sex differences in academic advancement in pediatrics.

Career attitudes, such as achievement orientation, have been hypothesized to explain sex differences in academic advancement,[11,25] but such attitudes did not explain sex differences in rank or salary in our study.

Finally, we found that after adjustment for all observed sex differences in academic productivity, distribution of work time, institutional support for research, family responsibilities, and career attitudes, male and female faculty members attained similar academic ranks, but women did not receive similar salaries. These findings support those of a recent study of 5057 faculty members at 310 universities, suggesting that even in fields where women are more prevalent than they are in medicine, female faculty members are paid less than their male colleagues.[17] These findings suggest a pervasive prejudice against women, despite similar scholarship, that is manifested throughout academia and is not unique to medicine.

The results of our study have three implications for policy making. First, time spent in teaching and patient care has a differentially negative effect on the academic productivity of female faculty members. Second, institutional support of research, in terms of protected time and access to research space, research assistants, and support staff, is substantially lower for women than for men. Finally, although work-site child care and other such arrangements have a high social value, these endeavors alone are unlikely to diminish the differences in academic advancement between male and female physicians.

Because our findings are based on associations between variables, we cannot establish causal relations. Longitudinal studies of the careers of physicians in pediatrics and other academic specialties, with the use of comprehensive measures to test multiple hypotheses, are needed. Our data do suggest, however, that greater representation of women in medical training and entry-level faculty positions will not eliminate sex differences in academic advancement over time. Female faculty members will remain at greater risk than their male colleagues for failing to meet their career aspirations and will continue to receive lower salaries. Further institutional efforts are required to eliminate the differences in rank and salary between women and men in academic medicine.

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REFERENCES

1. Carr P, Friedman RH, Moskowitz MA, Kazis LE, Weed HG. Research, academic rank, and compensation of women and men faculty in academic general internal medicine. J Gen Intern Med 1992;7:418-23.
2. Long JS, Allison PD, McGinnis R. Rank advancement in academic careers: sex differences and the effects of productivity. Am Sociol Rev 1993; 58:703-22.
3. The American College of Physicians. Promotion and tenure of women and minorities on medical school faculties. Ann Intern Med 1991;114:63-8.
4. AAMC faculty roster system: U.S. medical school faculty 1994. Washington, D.C.: Association of American Medical Colleges, 1994.
5. Levey BA, Gentile NO, Jolly HP, Beaty HN, Levey GS. Comparing research activities of women and men faculty in departments of internal medicine. Acad Med 1990;65:102-6.
6. Wilkinson CJ, Linde HW. Status of women in academic anesthesiology. Anesthesiology 1986;64:496-500.
7. Neumayer L, Konishi G, L'Archeveque D, et al. Female surgeons in the 1990s: academic role models. Arch Surg 1993;128:669-72.
8. Wallis LA, Gilder H, Thaler H. Advancement of men and women in medical academia: a pilot study. JAMA 1981;246:2350-3.
9. Bickel J. Women in medical education: a status report. N Engl J Med 1988;319:1579-84.
10. Dial TH, Bickel J, Lewicki AM. Sex differences in rank attainment among radiology and internal medicine faculty. Acad Med 1989;64:198-202.
11. Lorber J, Ecker M. Career development of female and male physicians. J Med Educ 1983;58:447-56.
12. Cole JR. Fair science: women in the scientific community. New York: Free Press, 1979.
13. Beaty HN, Babbott HO, Higgins EJ, Jolly P, Levey GS. Research activities on faculty in academic departments of medicine. Ann Intern Med 1986;104:90-7.
14. Schaller JG. Women and the future of academic pediatrics. J Pediatr 1991;118:314-21.
15. Whitley NO, Evens RG, Moody MA, Putman CE, Sackett JF, Vydareny KH. Advancement of women in academic radiology. Invest Radiol 1987;22:431-5.
16. Levinson W, Tolle SW, Lewis C. Women in academic medicine: combining career and family. N Engl J Med 1989;321:1511-7.
17. Bellas ML. Comparable worth in academia: the effects on faculty salaries of the sex composition and labor-market conditions of academic disciplines. Am Sociol Rev 1994;59:807-21.
18. Landau C, Hall S, Wartman SA, Macko MB. Stress in social and family relationships during the medical residency. J Med Educ 1986;61:654-60.
19. Ramos SM, Feiner CJ. Women surgeons: a national survey. J Am Med Wom Assoc 1989;44:21-5.
20. Calkins EV, Willoughby TL, Arnold LM. Women medical students' ratings of the required surgery clerkship: implications for career choice. JAMA 1992;47:58-60.
21. Komaromy M, Bindman AB, Haber RJ, Sande MA. Sexual harassment in medical training. N Engl J Med 1993;328:322-6.
22. Ochberg RL, Barton GM, West AN. Women physicians and their mentors. J Am Med Wom Assoc 1989;44:123-6.
23. Grant L. The gender climate of medical school: perspectives of women and men students. J Am Med Wom Assoc 1988;43:109-10, 115-9.
24. Flach DH, Smith MF, Smith WG, Glasser ML. Faculty mentors for medical students. J Med Educ 1982;57:514-20.
25. Roeske NA, Lake K. Role models for women medical students. J Med Educ 1977;52:459-66.
26. Schermerhorn GR, Colliver JA, Verhulst SJ, Schmidt EL. Factors that influence career patterns of women physicians. J Am Med Wom Assoc 1986;41:74-8.
27. Graves PL, Thomas CB. Correlates of midlife career achievement among women physicians. JAMA 1985;254:781-7.
28. Mandelbaum DR. Work, marriage, and motherhood: the career persistence of female physicians. New York: Praeger, 1981.
29. Relman AS. Here come the women. N Engl J Med 1980;302:1252-3.
30. Cole JR, Zuckerman H. Marriage, motherhood and research performance in science. Sci Am 1987;256:119-25.
31. Baldwin DC Jr, Daugherty SR, Eckenfels EJ. Student perceptions of mistreatment and harassment during medical school: a survey of ten United States schools. West J Med 1991;155:140-5.
32. Richman JA, Flaherty JA, Rospenda KM, Christensen ML. Mental health consequences and correlates of reported medical student abuse. JAMA 1992;267:692-4.
33. Nickerson KG, Bennett NM, Estes D, Shea S. The status of women at one academic medical center: breaking through the glass ceiling. JAMA 1990;264:1813-7.
34. AAMC faculty roster system: U.S. medical school faculty 1991. Washington, D.C.: Association of American Medical Colleges, 1991.
35. Kleinbaum DG, Kupper LL, Muller KE. Applied regression analysis and other multivariable methods. 2nd ed. Boston: PWS-Kent Publishing, 1988.
36. Tesch BJ, Wood HM, Helwig AL, Nattinger AB. Promotion of women physicians in academic medicine: glass ceiling or sticky floor? JAMA 1995; 273:1022-5.
37. Martin SC, Arnold RM, Parker RM. Gender and medical socialization. J Health Soc Behav 1988;29:333-43.
38. Koshland DE Jr. Women in science. Science 1988;239:1473.