

## WOMEN PHYSICIANS IN ACADEMIC MEDICINE

## New Insights from Cohort Studies

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**ABSTRACT**

**Background** I conducted a study to determine whether women who graduate from medical schools are more or less likely than their male counterparts to pursue full-time careers in academic medicine and to advance to the senior ranks of medical school faculties.

**Methods** The rates of advancement to the ranks of assistant, associate, and full professor for all U.S. medical school graduates from 1979 through 1993 and for all members of U.S. medical school faculties from 1979 through 1997 were studied. Cohorts were defined on the basis of the year of graduation from medical school, track (tenure or nontenure), and academic department. Within each cohort, the number of women who advanced to a senior rank was compared with the number that would be expected on the basis of parity between men and women, and 95 percent confidence intervals were calculated.

**Results** Women were significantly more likely than men to pursue an academic career. During the study period, 634 more women became faculty members than expected. The numbers were higher in the older cohorts than in the younger cohorts. The numbers of women who advanced to the ranks of associate and full professor were significantly lower than the expected numbers. This was true for both tenure and nontenure tracks, even after adjustment for the department. A total of 334 fewer women advanced to associate professor than expected, and 44 fewer women advanced to full professor than expected.

**Conclusions** Disparities persist in the advancement of men and women on medical school faculties. However, the numbers of women physicians at all levels of academic medicine are increasing. (N Engl J Med 2000;342:399-405.)

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**T**HE proportion of medical school graduates who are women has risen over the past two decades, from 23 percent in 1979 to more than 41 percent in 1997.<sup>1</sup> The representation of women on medical school faculties has also increased steadily during this period.<sup>2,3</sup> The faculties of medical schools, however, continue to have substantially fewer women than their student bodies, and studies of the distribution of faculty members among ranks suggest that women are primarily in the low-

er ranks, whereas men are more equally distributed among the lower and higher ranks.<sup>4-6</sup>

Studies of differences in promotion according to sex have had mixed results. Some studies have found that the promotion of women takes longer than that of men.<sup>7-10</sup> Others have found that within academic departments, women and men advance at the same rates or that sex differences in promotion rates disappear in younger cohorts.<sup>7,11,12</sup> These studies have two limitations. First, most of them have focused on the timing of promotion, ignoring the broader question of whether women have the same likelihood of ultimately reaching senior ranks as their male counterparts. Second, the studies have looked at a single department, school, specialty, or cohort, thereby limiting the generalizability of the findings.<sup>7-12</sup>

This study represents an attempt to fill the gaps in the current understanding of sex differences in the attainment of higher ranks among medical school faculties. The study was designed to answer the following question: Are women physicians in academic medicine as likely as their male counterparts to advance beyond the junior faculty ranks?

This study extends previous work in several ways. First, I looked at the achievement of an academic rank regardless of when it occurred, allowing for differences in timing that may mask larger trends in advancement to senior ranks. Second, I used data on all U.S. medical schools and all U.S. medical school graduates during a 15-year period, from 1979 through 1993. Finally, I identified cohorts of faculty members on the basis of their year of graduation from medical school and compared men and women only within a particular cohort, thereby focusing the analysis.

**METHODS**

The data for this study were taken from several data bases maintained by the Association of American Medical Colleges (AAMC). Cohorts of medical school graduates were identified from the AAMC's system for tracking medical students. This system con-

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tains records on all graduates of U.S. medical schools. Information on faculty appointments was obtained from the AAMC's faculty-roster system, which contains information on new appointments and promotions of medical school faculty members. The rate of underreporting in the faculty-roster system is estimated to be 10 percent.<sup>1</sup> For purposes of this study, it was assumed that men and women were equally likely to be affected by underreporting.

Cohorts of medical school graduates were identified on the basis of the year of graduation, as reported to the AAMC by the medical schools. Fifteen cohorts were created, one for each year from 1979 through 1993. (Academic years were defined as July 1 through June 30.) For the analysis of advancement to senior ranks, the cohorts were restricted to graduates in a given year who held a full-time appointment as assistant professor (for the analysis of advancement to associate professor) or associate professor (for the analysis of advancement to full professor) at some point between the year of graduation and 1997. Separate analyses were conducted for tenure and nontenure tracks and for each academic department. The results were summarized for tenure and nontenure tracks. Each of these analyses was performed separately for each cohort of medical school graduates, in order to distinguish differences among groups at any one point in time from changes that occurred over time in all groups. Grouping cohorts by the year of graduation from medical school permitted a comparison of the experiences of male graduates in any one year with the experiences of female graduates in that same year. The focus of the analysis was advancement from assistant to associate professor or from associate to full professor, regardless of whether the advancement was a result of an internal promotion or a move to another institution.

A faculty appointment was recorded if the faculty-roster system reported a full-time faculty position at the level of assistant, associate, or full professor. For the analyses of advancement to senior ranks, one additional refinement was made. Only persons who had held an appointment at a junior level for more than two years were included. Those who left academic medicine during the first two years of the appointment were excluded, because they could

not reasonably expect to be promoted. Similar proportions of men and women were excluded from the analysis on this basis (27.7 percent of men and 28.2 percent of women).

Data from these sources were merged into a single file containing information on all persons who graduated from U.S. medical schools from 1979 through 1993. The file contained records on a total of 235,776 graduates, of whom 21,940 held faculty appointments between the year of graduation and 1997. On average, 9.2 percent of graduates in any given year held a faculty appointment at some point. Men accounted for 69.7 percent of graduates and 69.6 percent of faculty members; women accounted for 30.3 percent of graduates and 30.4 percent of faculty members. Tenure-track faculty members accounted for 46.5 percent of persons included in the analyses according to track.

The actual and expected numbers of women in various faculty groups were compared. The actual number was simply the number of women who achieved a given rank. The expected number was the number of women who would have achieved a given rank under conditions of parity between women and men and on the basis of their representation in the cohort. The difference between these two numbers was calculated, along with the 95 percent confidence interval for the difference.

Analysis of differences is similar to regression analysis but has distinct advantages that make it ideally suited to this study. Unlike regression analysis, analysis of differences makes no assumptions about similarities in experiences from one year to the next. Moreover, although regression analysis provides a measure of the statistical significance of one or more factors in a model, it does not provide the actual numbers and can therefore be difficult to interpret. Analysis of differences has the advantage of showing the actual numbers in different groups.

## RESULTS

Table 1 shows the results of analyses comparing the expected and actual numbers of women physicians

**TABLE 1. ACTUAL AND EXPECTED NUMBERS OF WOMEN ON MEDICAL SCHOOL FACULTIES BETWEEN 1979 AND 1997, ACCORDING TO THE YEAR OF GRADUATION FROM MEDICAL SCHOOL.**

YEAR OF GRADUATION	TOTAL		WOMEN			
	GRADUATES	FACULTY	GRADUATES	FACULTY		
				actual	expected	difference (95% CI)*
	no. of men and women		no. of women			
1979	14,874	2,421	3,458	637	563	74 (37 to 111)
1980	15,136	2,399	3,531	655	560	95 (58 to 132)
1981	15,715	2,503	3,915	703	624	79 (40 to 118)
1982	16,072	2,389	4,019	678	597	81 (42 to 118)
1983	15,840	2,325	4,245	676	623	53 (14 to 90)
1984	16,384	2,257	4,644	654	640	14 (-25 to 53)
1985	16,380	2,035	4,915	686	611	75 (37 to 113)
1986	16,186	1,759	4,982	586	541	45 (9 to 81)
1987	15,884	1,473	5,122	490	475	15 (-11 to 41)
1988	15,966	1,115	5,225	407	365	42 (12 to 72)
1989	15,659	712	5,226	275	238	37 (14 to 61)
1990	15,413	336	5,231	125	114	11 (-7 to 27)
1991	15,427	149	5,546	63	54	9 (-2 to 20)
1992	15,369	46	5,550	23	17	6 (0 to 12)
1993	15,471	21	5,886	6	8	-2 (-6 to 2)
Overall	235,776	21,940	71,495	6664	6030	634 (515 to 757)

\*CI denotes confidence interval.

**TABLE 2.** ACTUAL AND EXPECTED NUMBERS OF WOMEN WHO ADVANCED TO THE RANK OF ASSOCIATE OR FULL PROFESSOR BETWEEN 1979 AND 1993.\*

YEAR OF GRADUATION	ASSOCIATE PROFESSOR				FULL PROFESSOR			
	TOTAL NO. OF MEN AND WOMEN	NO. OF WOMEN			TOTAL NO. OF MEN AND WOMEN	NO. OF WOMEN		
		actual	expected	difference (95% CI)		actual	expected	difference (95% CI)
1979	998	213	254	-41 (-60 to -22)	197	19	42	-23 (-33 to -13)
1980	933	190	255	-65 (-85 to -45)	134	15	26	-11 (-19 to -3)
1981	831	173	231	-58 (-78 to -38)	83	14	18	-4 (-11 to 3)
1982	720	147	196	-49 (-67 to -30)	53	5	10	-5 (-10 to 0)
1983	585	110	165	-55 (-73 to -37)	27	2	5	-3 (-9 to -1)
1984	423	92	120	-28 (-44 to -12)	14	3	3	0 (-6 to 0)
1985	241	49	78	-29 (-42 to -16)	7	1	1	0
1986	117	25	38	-13 (-23 to -3)	2	0	0	0
1987	63	11	20	-9 (-16 to -2)	2	0	0	0
1988	27	4	9	-5 (0 to 10)	0	0	0	0
1989	9	3	4	-1 (-4 to 2)	0	0	0	0
1990	8	0	3	-3 (0 to 6)	0	0	0	0
1991	3	1	1	0	0	0	0	0
1992	0	0	0	0	0	0	0	0
1993	1	1	0	1 (0 to 1)	0	0	0	0
Overall	4959	1019	1374	-355 (-407 to -307)	519	59	105	-46 (-64 to -30)

\*CI denotes confidence interval.

on medical school faculties. Women were significantly more likely than men to hold a faculty position at some point after graduation. Among physicians who graduated from medical school between 1979 and 1993, 6664 women held a faculty position at some point between the year of graduation and 1997. On the basis of the representation of women in the pool of graduates, a total of 6030 women would have been expected to hold faculty positions between 1979 and 1997. A total of 634 additional women therefore entered the faculty ranks during this period, or approximately 10 percent more women than would be expected with proportional representation of men and women. The analyses of individual cohorts showed that in 9 of 15 years, women were significantly over-represented among medical school graduates holding faculty appointments. During the 1980s, the proportion of women entering academic medicine was significantly greater than that of men; no cohort in the 1990s had such an imbalance.

The finding that women join the ranks of academic medicine at higher rates than men leads to the question of whether, once there, women advance from junior to senior ranks. During the study period, the proportion of women who advanced from assistant to associate professor was significantly smaller than the proportion of men who advanced (Table 2); the disparity was present in both tenure and nontenure tracks (data not shown). A total of 4959 assistant professors became associate professors; 1019 of them

were women. On the basis of their representation in the pool of assistant professors, the number of women who would have been expected to reach the rank of associate professor was 1374, a difference of 355, or 14 SD. In all but two cohorts, women were significantly less likely than expected to achieve the rank of associate professor; in no cohort were they significantly more likely than expected to achieve that rank. In the tenure track, 205 fewer women than expected — almost one third of those eligible — advanced to the rank of associate professor; in the nontenure track, 151 fewer women than expected became associate professors.

Similarly, women who had appointments as associate professors were less likely to attain the rank of full professor than their male counterparts (Table 2), and this difference was observed in both tenure and nontenure tracks (data not shown). Overall, 519 associate professors attained the rank of full professor; 59 were women. The number of women who would have been expected to reach the rank of full professor on the basis of their representation in the pool of associate professors was 105, a difference of 46, or more than 5 SD. In one non-tenure-track cohort and three tenure-track cohorts, women were significantly less likely than men to move from associate to full professor, whereas in the other cohorts, women and men reached the highest rank in about the same proportions. The numbers of persons in six cohorts were too small for meaningful comparisons to be made. Al-

**TABLE 3.** ACTUAL AND EXPECTED NUMBERS OF WOMEN WHO ADVANCED TO THE RANK OF ASSOCIATE OR FULL PROFESSOR, ACCORDING TO THE DEPARTMENT.\*

DEPARTMENT	ASSOCIATE PROFESSOR				FULL PROFESSOR			
	TOTAL NO. OF MEN AND WOMEN	NO. OF WOMEN			TOTAL NO. OF MEN AND WOMEN	NO. OF WOMEN		
		actual	expected	difference (95% CI)		actual	expected	difference (95% CI)
<b>Basic science</b>								
Anatomy	13	5	5	0	1	0	1	-1 (-2 to 0)
Biochemistry	11	2	2	0	7	1	1	0 (-1 to 1)
Microbiology	17	3	3	0	8	0	2	-2 (0 to 4)
Pathology (basic)	199	51	66	-15 (-25 to -5)	32	4	9	-5 (-9 to -1)
Pharmacology	12	2	1	1 (-1 to 3)	4	0	1	-1 (-2 to 0)
Physiology	10	0	1	-1 (-2 to 0)	4	0	0	0
Other basic sciences	10	2	3	-1 (-3 to 1)	1	0	0	0
<b>Clinical</b>								
Anesthesiology	305	58	79	-21 (-34 to -8)	30	4	6	-2 (-6 to 2)
Dermatology	49	10	20	-10 (-15 to -5)	7	0	2	-2 (-4 to 0)
Family medicine	168	40	53	-13 (-23 to -3)	18	1	5	-4 (-7 to -1)
Internal medicine	1473	295	387	-92 (-118 to -66)	141	19	28	-9 (-16 to 0)
Neurology	192	28	43	-15 (-24 to -6)	15	1	2	-1 (-3 to 1)
Obstetrics-gynecology	240	81	97	-16 (-28 to -4)	19	2	6	-4 (-8 to 0)
Ophthalmology	144	23	30	-7 (-14 to 0)	22	3	4	-1 (-4 to 2)
Orthopedic surgery	109	6	9	-3 (-8 to 2)	11	0	0	0 (-1 to 1)
Otolaryngology	73	9	9	0	7	2	1	1 (-1 to 3)
Pathology (clinical)	83	16	22	-6 (-11 to -1)	13	0	2	-2 (-4 to 0)
Pediatrics	564	181	237	-56 (-74 to -38)	34	3	11	-8 (-13 to -3)
Physical medicine and rehabilitation	46	12	16	-4 (-9 to 1)	3	1	1	0 (-1 to 1)
Psychiatry	232	51	79	-28 (-40 to -16)	29	2	6	-4 (-6 to 0)
Public health	32	7	10	-3 (-7 to 1)	3	0	0	0 (-1 to 1)
Radiology	336	84	104	-20 (-34 to -6)	44	12	10	2 (-3 to 7)
Surgery	608	45	64	-19 (-31 to -7)	65	4	5	-1 (-5 to 3)
Other	33	8	13	-5 (-9 to -1)	1	0	0	
<b>Overall</b>	<b>4959</b>	<b>1019</b>	<b>1353</b>	<b>-334 (-380 to 284)</b>	<b>519</b>	<b>59</b>	<b>103</b>	<b>-44 (-58 to -26)</b>

\*CI denotes confidence interval.

though the underrepresentation of women was significant in both tracks, it was greater in the tenure track.

Table 3 shows the proportions of men and women who advanced to the rank of associate or full professor according to the academic department. After adjustment for the department, the proportion of women who advanced to the rank of associate professor was significantly lower than that of men. Although there were significant differences in both tracks, the disparity was greater in the tenure track (data not shown).

The results were similar, if less dramatic, for advancement to the rank of full professor (Table 3). Women remained less likely than men to advance to full professor after adjustment for the academic department. The disparity between the actual and expected numbers of women who became full professors was greater for tenure-track faculty members

than for non-tenure-track faculty members (data not shown).

## DISCUSSION

The main finding of this study was that the proportion of women who advanced to the senior ranks of academic medicine was lower than that of their male colleagues. Although the results presented here are consistent with the findings of other studies of promotion in academic medicine, this study has the methodologic advantage of including data on all graduates of U.S. medical schools over a period of almost two decades. In addition, the cohort analysis allowed for longitudinal tracking of not only the numbers of women who advanced but also the total numbers of women at each academic rank.

Current research on the advancement of women in academic medicine tends to concentrate on two fac-

tors: net changes in the distribution of men and women on medical school faculties and differences in the timing of promotion for men and women. Net changes in the sex distribution of medical school faculties tell two different stories. On the one hand, the distribution of women across ranks has not changed substantially over the past two decades (Fig. 1). Between 1979 and 1997, the proportion of male faculty members who were full professors remained approximately 34 percent, and the proportion of female faculty members who were full professors remained approximately 12 percent. These data suggest that women remain assistant professors rather than advancing to senior ranks.<sup>13-16</sup> On the other hand, the proportions of associate and full professors who were women increased during the same period (Fig. 2). In 1979, just 5 percent of full professors were women; in 1997, more than 10 percent were women. In 1979, 647 women were full professors, as compared with 2335 women who were full professors in 1997, a net increase of more than 260 percent. The overall increase in the proportion of full professors during the period was 82 percent (from 12,237 to 22,255). At the same time, the proportion of associate professors who were women increased from 13 percent in 1979 to 22 percent in 1997, representing a net increase of 216 percent. Analyzed in this way, the data suggest that women are progressing through the ranks of academic medicine.

How can these two conflicting findings be reconciled? Taken together, the trends shown by these figures suggest that the numbers of women at every level of academic medicine are increasing as the numbers of women graduating from medical school increase. In part, the persistently uneven distribution of women among the lower and higher ranks is a result of the steady growth in the numbers of women entering academic medicine as assistant professors. At the same time, the steady increase in the numbers of women in the junior ranks has led to the advancement of larger numbers of women to senior ranks than were already there, even when the rate of advancement was low. Net changes in the sex composition of faculties ignores the gross (as opposed to net) flow of men and women into and out of the ranks.<sup>17</sup> Even if the rate of advancement for women were similar to the rate for men in the more recent cohorts, it would take many years to overcome decades of disparities in the numbers of women and men promoted to senior ranks.<sup>18,19</sup> However, neither of the trends shown in Figures 1 and 2 addresses the question of whether women advance to senior ranks at the same rate as men. The cohort analysis presented here is necessary to compare the experiences of similarly situated men and women over time.

Previous studies have also looked at sex differences in the timing of advancement to senior ranks. These studies have had mixed results. Several found that

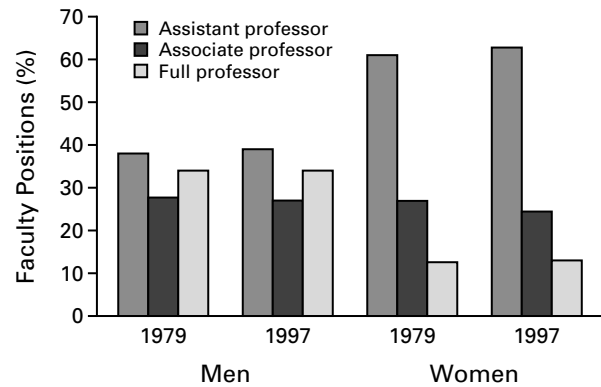


Figure 1. Distribution of Men and Women in Full-Time Faculty Positions in 1979 and 1997, According to Rank.

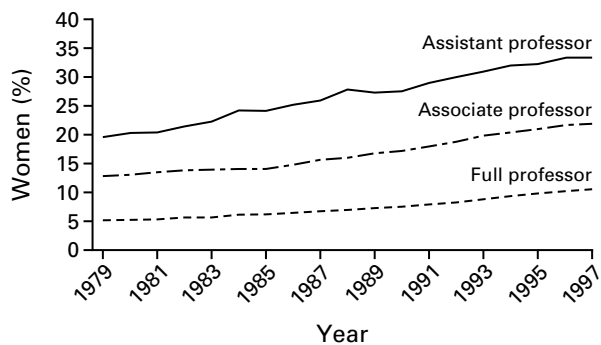


Figure 2. Proportion of Full-Time Faculty Appointments Held by Women from 1979 through 1997, According to Rank.

women were less likely to be promoted within a specified period of time than men.<sup>7-10</sup> Others found no difference in the rates of promotion for men and women, particularly when specialty or department was taken into account.<sup>7,11,12</sup> The generalizability of these findings is limited, however, because they represent only a single cohort, specialty, department, or institution.

What explains the fact that women are less likely than men to advance to the senior ranks of academic medicine? Possible explanations considered by previous researchers include lower productivity, as measured by numbers of publications or external grants,<sup>20</sup> fewer hours devoted to their work, and fewer resources (e.g., administrative support or laboratory space) provided by the school.<sup>7,13</sup> Another possible explanation is that women are more likely than men to join departments in which the overall probability of promotion is low. If women tend to join such departments, they may have a lower overall likelihood of promotion than men, even if they have a higher likelihood of promotion within other departments. A 1990 study found wide variations among academic

departments in the proportions of men and women who advanced to senior ranks.<sup>2</sup> The data used here confirm that women are not represented equally in all departments. During the study period, women accounted for only 9 percent of assistant professors in orthopedic surgery but for 46 percent of assistant professors in pediatrics. The data in Table 3, however, show that even when such differences are taken into account, women remain less likely to advance.

This study confirms previous research showing that women who graduate from U.S. medical schools enter academic medicine at higher rates than their male counterparts.<sup>2,14,16,18</sup> However, the current study shows that women are no longer more likely than men to enter full-time faculty positions. One possible explanation is that women are finding more opportunities outside academic medicine, either because of an increased demand for women physicians or because of increased opportunities for employment that is conducive to their personal and professional goals. An alternative explanation is that women take longer to enter academic medicine; over time, the sex differences seen in the older cohorts may become apparent in the younger cohorts. The data reported here do not confirm or disprove either explanation.

This change threatens even the limited gains in the representation of women in academic medicine. Although a reduction in the number of women entering academic medicine may improve their distribution among ranks, it may also have the effect of slowing the overall increase in the proportion of women on medical school faculties. As alternative career paths become more appealing to women, medical schools may have to work harder to attract and retain talented women.

This study has several limitations. First, it includes only faculty members who received an M.D. degree from a U.S. medical school. The results cannot be extended to faculty members with other degrees. Since only physicians with M.D. degrees were included in the analysis, the results apply mainly to clinical departments. Differences in sex distribution, promotion criteria, and overall trends in promotion may result in very different experiences for women in basic-science departments. Future research should examine the degree of equity between the sexes among faculty members with degrees other than the M.D. degree.

In addition, this study does not address important questions about the timing of women's progression through the ranks of academic medicine. It does not consider the many questions concerning equal treatment at each step of the academic hierarchy, such as the question of whether women are as likely as men to receive tenure, or whether the salaries of men and women are similar at each rank.

This study does not account for possible differences in productivity that may affect the likelihood of promotion. Definitions of productivity are open

to interpretation and reevaluation, as are expectations of behavior or motivation. Despite the increasing numbers of women in academic medicine, they may still encounter barriers, including lower pay,<sup>10,21</sup> lack of access to leadership positions,<sup>22</sup> and difficulties in balancing their professional and personal lives.<sup>6</sup> According to an AAMC data base on medical school deans, from 1970 through 1996, only 4.1 percent of all the deans of U.S. medical schools were women. As this study shows, the goal of proportional representation of women and men in academic medicine remains an elusive one.

## CONCLUSIONS

This report has two main messages. The first is that the numbers of women at all levels of academic medicine are increasing. As more women graduate from medical school, the pool of women joining academic faculties as assistant professors is increasing. The growth of this pool, in turn, has led to growth in the absolute numbers of women at each rank. The second message is that, despite these increases, when the experiences of women and men at similar stages of their careers and under similar circumstances are compared, women are significantly less likely to have reached the senior ranks of academic medicine.

The results highlight the continued need to ensure equal opportunity for women in academic appointments and promotions. In addition, they demonstrate the need for a better balance of male and female role models for purposes of education, research, and service. The large disparity between the proportion of women enrolled as students in medical schools and the proportion of women who hold senior faculty positions may discourage women from pursuing academic careers in the future.

These results tell only part of the story of women in academic medicine. They show the cumulative effects of many individual careers, decisions about promotion, and institutional experiences. One cannot conclude from this study that every institution has failed to provide opportunities for women in academic medicine or even that any one institution has failed. When even the best efforts to provide equal opportunities fall short of their goal, however, they contribute to the overall imbalance between women and men in the senior ranks of medical school faculties.

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