Gender Differences in the Salaries of Physician Researchers

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Context It is unclear whether male and female physician researchers who perform similar work are currently paid equally.

Objectives To determine whether salaries differ by gender in a relatively homogeneous cohort of physician researchers and, if so, to determine if these differences are explained by differences in specialization, productivity, or other factors.

Design and Setting A US nationwide postal survey was sent in 2009-2010 to assess the salary and other characteristics of a relatively homogeneous population of physicians. From all 1853 recipients of National Institutes of Health (NIH) K08 and K23 awards in 2000-2003, we contacted the 1729 who were alive and for whom we could identify a mailing address.

Participants The survey achieved a 71% response rate. Eligibility for the present analysis was limited to the 800 physicians who continued to practice at US academic institutions and reported their current annual salary.

Main Outcome Measures A linear regression model of self-reported current annual salary was constructed considering the following characteristics: gender, age, race, marital status, parental status, additional graduate degree, academic rank, leadership position, specialty, institution type, region, institution NIH funding rank, change of institution since K award, K award type, K award funding institute, years since K award, grant funding, publications, work hours, and time spent in research.

Results The mean salary within our cohort was $167 669 (95% CI, $158 417-$176 922) for women and $200 433 (95% CI, $194 249-$206 617) for men. Male gender was associated with higher salary (+$13 399; *P*=.001) even after adjustment in the final model for specialty, academic rank, leadership positions, publications, and research time. Peters-Belson analysis (use of coefficients derived from regression model for men applied to women) indicated that the expected mean salary for women, if they retained their other measured characteristics but their gender was male, would be $12 194 higher than observed.

Conclusion Gender differences in salary exist in this select, homogeneous cohort of mid-career academic physicians, even after adjustment for differences in specialty, institutional characteristics, academic productivity, academic rank, work hours, and other factors.

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STUDIES HAVE REVEALED GENDER differences in physicians' pay,[1-8] but experts continue to debate the magnitude and cause of these differences. Some evidence suggests that disparities in pay are explained by specialization, work hours, and productivity,[9] leading some to believe that they are justifiable outcomes of different choices made by men and women. Debate persists in part because most studies of physicians' pay have included relatively heterogeneous groups, are now dated, or are limited by lack of information on key factors such as specialty[10] or family characteristics.[11]

Given the lack of conclusive evidence to answer whether male and female physicians who do similar work are paid differently in the present day, we sought to determine whether there were gender differences in salary of a relatively homogeneous sample: physicians who were granted prestigious National Institutes of Health (NIH) K08 and K23 career development awards in 2000-2003 and who continued to work at academic institutions. We focused on this select population to minimize variability in aptitude or motivation as well as in seniority and content of work activities. Consequently, we expected to find little if any gender difference in salary and that any differences observed would be explained by specialty, productivity, or other measured factors.

METHODS

Data Collection

We identified all 1853 recipients of new K08 and K23 awards in 2000 through 2003 using the CRISP (Computer Retrieval of Information on Scientific Projects) database.[12] After approval by the

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University of Michigan Institutional Review Board to survey these individuals, with a waiver of explicit written informed consent (beyond completion of the questionnaire), we conducted Internet searches and telephone calls that identified addresses for 1729 recipients.

In fall 2009, we mailed survey questionnaires and $20 to 818 individuals who received awards in 2000-2001; we sent second questionnaires to nonrespondents. In fall 2010, we repeated this for the 911 individuals who received awards in 2002-2003.

We merged survey responses with data previously collected from CRISP.

Measures

We designed the questionnaire after review of the relevant literature, consideration of other instruments used to determine outcomes of academic careers,[11,12] and detailed cognitive pretesting.[13] The ultimate questionnaire included 39 items that assessed demographics, education, career outcomes, and compensation.

The principal dependent variable for the analysis was current annual salary, which was structured as a continuous variable rounded to the nearest thousand dollars. Several independent variables were also analyzed as continuous variables, including age, work hours, percentage of time spent in research, and total number of peer-reviewed publications.

We grouped specialties into 4 categories based on their nature, including a category for internal medicine and its subspecialties; a category for surgical specialties; a category for specialties related to the care of children, women, and families (family practice, obstetrics/gynecology, and pediatrics, including subspecialties); and a category of specialties that are hospital-based, such as emergency medicine, anesthesiology, pathology, and radiology, as described in greater detail in previous studies.[14] We also grouped specialties into 4 pay level categories based on Association of American Medical Colleges data on the median salary of an associate professor in that specialty in 2009, as follows: low-paying (<$175 000), moderate-paying ($175 000-$225 000), high-paying ($226 000-$300 000), and extremely high-paying (>$300 000).

We grouped institutions so that all hospitals affiliated with a single university were considered to be a single institution. We then grouped institutions into 4 tiers containing roughly equal numbers of K awardees, based on the amount of total NIH funding received,[15] as well as into categories for public or private. We grouped institution location into 4 categories based on region of the country (Northeast, South, Midwest, and West). We further noted whether individuals remained at their K-awarding institution.

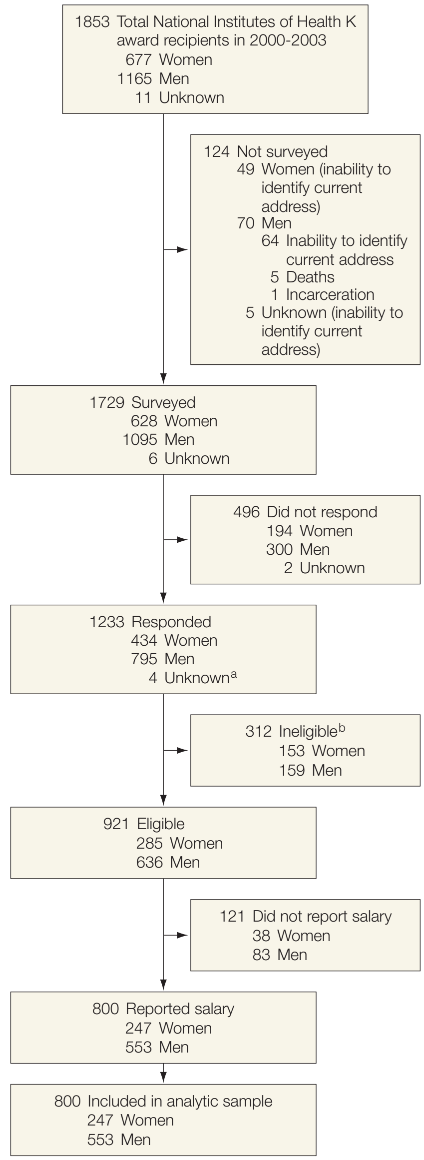
We grouped the NIH institutes that funded respondents' K awards into 3 tiers of funding activity, based on the total dollar amount of R01 awards granted in 2000.

Academic rank was grouped into 3 categories, years since K award into 3 categories, race (as self-reported in multiple-choice questions) into 4 categories, and marital status into 3 categories. K award type, parental status, attainment of an R01 grant or $1 million in other grant funding, attainment of a leadership position (dean, department chair, or division chief), and possession of a graduate degree other than MD were binary variables, as was gender (assessed by self-report; for the 4 cases missing self-reported gender, gender was determined based on first name and Internet search confirmation).

Data Analysis

We performed statistical analyses using the SAS system, version 9.2 (SAS Institute Inc). We compared respondents to the remainder of the initial target population for gender, K award type, K award year, institution, funding institute group, and CRISP-documented R01 attainment, reporting the mean estimate with 95% confidence intervals based on the binomial or normal distribution, given the nature of the characteristic. We tested for significant dif-

Figure. Development of Analytic Sample From Original Pool of All 1853 New K08 and K23 Award Recipients in 2000-2003, by Gender



Gender determination for the full group of 1853 reported herein was by consideration of first name and the results of Internet searches. Gender of respondents, as reported herein and used in the analyses, was determined via self-report (except for the 4 who failed to report gender, in whom we considered first name and results of Internet searches).

[a] All 4 respondents of initially unknown gender based on first name/Internet search self-reported themselves as women.

[b] Those who lacked an MD or equivalent degree (n=177), who had left the United States (n=13), or who were not practicing at an academic institution (n=154) were ineligible. Several individuals were ineligible for more than 1 reason; the total number was 312.

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Table 1. Characteristics of the Analytic Sample by Gender (N = 800)

Characteristics	No. (%) of Sample[a] Women	Men	P Value
Race			
White	189 (76.5)	415 (75.1)	.70
Asian/Pacific Islander	38 (15.4)	98 (17.7)	
Black/African American	4 (1.6)	5 (0.9)	
Other	16 (6.5)	33 (6.0)	
Unknown	0	2 (0.4)	
Age, mean (SD), y	45.3 (3.9)	45.0 (3.5)	.27
Children			
Yes	208 (84.2)	494 (89.3)	.03
No	39 (15.8)	57 (10.3)	
Unknown	0	2 (0.4)	
Marital status			
Married	215 (87.0)	503 (91.0)	.02
Divorced/widowed	13 (5.3)	34 (6.2)	
Single/never married	17 (6.9)	15 (2.7)	
Unknown	2 (0.8)	1 (0.2)	
Additional graduate degree			
Yes	120 (48.6)	272 (49.2)	.87
No	127 (51.4)	281 (50.8)	
Academic rank			
Assistant professor/instructor	78 (31.6)	150 (27.1)	.23
Associate professor	144 (58.3)	326 (59.0)	
Full professor	24 (9.7)	73 (13.2)	
Unknown	1 (0.4)	4 (0.7)	
Specialty nature			
Medical specialties	113 (45.8)	283 (51.2)	<.001
Clinical specialties for women, children, and families	88 (35.6)	106 (19.2)	
Hospital-based specialties	37 (15.0)	119 (21.5)	
Surgical specialties	6 (2.4)	43 (7.8)	
Unknown	3 (1.1)	2 (1.7)	
Specialty pay level			
Low-paying	83 (33.6)	124 (22.4)	<.001
Moderate-paying	128 (51.8)	300 (54.3)	
High-paying	29 (11.7)	67 (12.1)	
Extremely high-paying	7 (2.8)	62 (11.2)	
Current institution type			
Private	143 (57.9)	296 (53.5)	.27
Public	104 (42.1)	255 (46.1)	
Unknown	0	2 (0.4)	
Current institution National Institutes of Health funding rank group			
First	49 (19.8)	130 (23.5)	.41
Second	59 (23.9)	115 (20.8)	
Third	71 (28.7)	141 (25.5)	
Fourth	67 (27.1)	165 (29.8)	
Unknown	1 (0.4)	2 (0.4)	
Current institution region			
Northeast	111 (44.9)	209 (37.8)	.25
South	44 (17.8)	100 (18.1)	
Midwest	38 (15.4)	103 (18.6)	
West	54 (21.9)	141 (25.5)	
Still at K institution at time of survey			
Yes	183 (74.1)	369 (66.7)	.04
No	64 (25.9)	184 (33.3)	
K award type			
K08	115 (46.6)	347 (62.8)	<.001
K23	132 (53.4)	206 (37.2)	

(continued)

ferences using χ^2 or Fisher exact tests for categorical data and 2-sample *t* tests for continuous data. Consequently, in limited cases, confidence intervals overlapped between groups even when statistically significant differences existed.

We limited the analytic sample to individuals who held MD degrees, were still affiliated with US academic institutions, and reported their salary, after comparing those who reported salary with those who did not. We described characteristics of this sample by gender and then constructed multiple variable linear regression models for salary with the following respondent characteristics: gender, age, race, marital status, parental status, additional graduate degree, rank, leadership, specialty nature, specialty pay level, current institution type, current institution region, current institution NIH funding rank group, whether the respondent had changed institutions, K award type, years since K award, K award funding institute, receipt of R01 or greater than $1 million in grants, publications, work hours, and percentage of time spent in research. Most characteristics were categorical and modeled as indicator variables with a reference category. Continuous-variable characteristics were centered at their means.

We constructed both a full model using all covariates and a parsimonious model whereby we iteratively deleted variables from the model based on improvement in the Akaike information criterion, using both forward stepwise and backward elimination approaches. We explored pairwise interactions between gender and the other characteristics. We also used the Peters-Belson approach, in which a regression model is developed using all measured characteristics for men alone. The coefficients from that model are then applied to the characteristics for each woman to derive the expected salaries as if their gender were male in order to quantify the proportion of the observed gender difference unexplained by the measured characteristics.[16-20] For statistical inference, we conducted 2-tailed tests with $P \leq .05$ considered to be significant.

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RESULTS

We received 1233 completed questionnaires (71% of those to whom surveys were mailed and 67% of the initial target pool). Comparison of survey respondents with the remainder of the initial target population demonstrated statistically significant differences only by K award type (55% [95% CI, 52.4%-57.9%] of respondents vs 63% [95% CI, 58.9%-66.6%] of nonrespondents had K08 awards [$P=.002$]) and R01 attainment (40% [95% CI, 36.9%-42.4%] of respondents vs 27% [95% CI, 23.9%-30.9%] of nonrespondents had received an R01 by 2009 [$P<.001$]).

The FIGURE depicts the evolution of the initial cohort into the analytic sample. Of the 1233 respondents, 1056 held MD degrees, and of these, 921 remained at US academic institutions. Of these, 800 provided salary information. Those who reported salary were similar to those who did not in terms of gender, race, age, parental status, marital status, current institution characteristics, funding institute tier, work hours reported, and attaining an R01 grant. However, provision of salary information was more likely from those with an additional graduate degree (90% [95% CI, 87.3%-92.9%] vs 84% [95% CI, 80.7%-87.2%]; $P=.006$), lower academic rank (91% [95% CI, 87.3%-94.4%] of assistant professors, 87% [95% CI, 84.4%-89.9%] of associate professors, and 78% [95% CI, 71.0%-85.5%] of full professors; $P=.006$), K08 awards (89% [95% CI, 86.1%-91.6%] vs 84% [95% CI, 80.7%-87.9%]; $P=.05$), no leadership position (88% [95% CI, 85.5%-90.1%] vs 81% [95% CI, 75.0%-87.9%]; $P=.04$), and fewer publications (mean, 31 [95% CI, 29.5-33.0] vs 37 [95% CI, 32.0-43.0] publications; $P=.04$).

Characteristics of the 247 female and 553 male physicians analyzed are detailed in TABLE 1. Mean age of the sample was 45 years and 76% of respondents were white. Men in this cohort were more likely than women to be married (91% [95% CI, 88.8%-93.5%] vs 87% [95% CI, 83.7%-91.9%]; $P=.02$) and to have children

Table 1. Characteristics of the Analytic Sample by Gender (N = 800) (continued)

Characteristics	No. (%) of Sample[a] Women	Men	P Value
Years since K award			
7	63 (25.5)	160 (28.9)	.15
8	111 (44.9)	265 (47.9)	
9	73 (29.6)	128 (23.2)	
Funding institute tier			
First	61 (24.7)	171 (30.9)	.19
Second	110 (44.5)	231 (41.8)	
Third	76 (30.8)	151 (27.3)	
Attained R01 grant or >$1 million in grant funding			
Yes	102 (41.3)	257 (46.5)	.17
No	145 (58.7)	296 (53.5)	
No. of publications, mean (SD)	26.7 (21.3)	33.3 (25.6)	<.001
Leadership (dean, department chair, or division chief)			
Yes	24 (9.7)	90 (16.3)	.01
No	223 (90.3)	463 (83.7)	
Work hours, mean (SD)	58.1 (12.8)	63.2 (12.6)	<.001
Time spent doing research, mean (SD), %	57.0 (27.2)	58.0 (25.5)	.64

[a] Data are expressed as No. (%) of sample unless otherwise indicated.

Table 2. Bivariable Associations Between Salary and Measured Characteristics

Characteristics	Salary Estimate, $ (95% CI)	P Value
Gender		
Female	167 669 (158 417 to 176 922)	<.001
Male	200 433 (194 249 to 206 617)	
Race		
White	189 630 (183 578 to 195 682)	.91
Asian/Pacific Islander	191 650 (178 897 to 204 403)	
Black/African American	205 333 (155 758 to 204 403)	
Other	193 263 (172 016 to 214 510)	
Age, per 1-y increase	2337 (887 to 3787)	.002
Children		
Yes	192 525 (186 936 to 198 114)	.03
No	174 598 (159 485 to 189 711)	
Marital status		
Married	190 533 (184 983 to 196 083)	.87
Divorced/widowed	190 528 (168 836 to 212 220)	
Single/never married	183 484 (157 195 to 209 773)	
Additional graduate degree		
Yes	181 801 (174 350 to 189 251)	.002
No	198 500 (191 197 to 205 803)	
Academic rank		
Assistant professor/instructor	155 908 (147 063 to 164 753)	<.001
Associate professor	190 927 (184 764 to 197 084)	
Full professor	268 995 (255 435 to 282 555)	
Specialty nature		
Medical specialties	176 003 (170 005 to 182 001)	<.001
Clinical specialties for women, children, and families	173 732 (165 163 to 182 302)	
Hospital-based specialties	193 125 (183 569 to 202 681)	
Surgical specialties	363 939 (346 888 to 380 990)	
Specialty pay level		
Low-paying	156 897 (148 864 to 164 930)	<.001
Moderate-paying	177 185 (171 599 to 182 772)	
High-paying	217 565 (205 769 to 229 361)	
Extremely high-paying	331 319 (320 213 to 348 040)	
Current institution type		
Public	195 395 (187 568 to 203 223)	.09
Private	186 246 (179 167 to 193 324)	

(continued)

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Table 2. Bivariable Associations Between Salary and Measured Characteristics (continued)

Characteristics	Salary Estimate, $ (95% CI)	P Value
Current institution National Institutes of Health funding rank group		
First	177 590 (166 584 to 188 596)	<.001
Second	184 771 (173 608 to 195 934)	
Third	188 104 (177 991 to 198 217)	
Fourth	206 621 (196 953 to 216 288)	
Current institution region		
West	194 474 (183 876 to 205 073)	.09
Midwest	198 890 (186 426 to 211 354)	
South	194 439 (182 105 to 206 773)	
Northeast	192 152 (173 878 to 190 425)	
Still at K institution at time of survey		
Yes	186 985 (180 681 to 193 289)	.06
No	197 734 (188 330 to 207 139)	
K award type		
K08	192 786 (185 885 to 199 686)	.36
K23	186 943 (178 885 to 195 011)	
Years since K award		
7	184 672 (174 741 to 194 603)	.30
8	194 387 (186 740 to 202 035)	
9	188 966 (178 506 to 199 427)	
Funding institute tier		
First	201 873 (192 185 to 211 561)	<.001
Second	181 350 (173 359 to 189 341)	
Third	191 978 (182 184 to 201 771)	
Attained R01 grant or >$1 million in grant funding		
Yes	187 749 (180 670 to 194 828)	.35
No	193 440 (185 634 to 201 247)	
Publications, per 1-publication increase	871 (660 to 1081)	<.001
Leadership position		
Yes	255 726 (242 720 to 268 733)	<.001
No	179 448 (174 146 to 184 750)	
Work hours, per 1-h increase	1525 (1122 to 1927)	<.001
Research time, per 1% increase	−937 (−1128 to −746)	<.001

Table 3. Multivariable Model of Current Annual Salary of Respondents Who Received Initial K Award Funding in 2000-2003

	Initial Model[a]		Final Model[b]	
Characteristics	Salary Estimate, $	P Value	Salary Estimate, $	P Value
Intercept	136 064	<.001	166 094	<.001
Gender				
Female	Reference	.006	Reference	.001
Male	12 001		13 399	
Race				
White	Reference	.70		
Asian/Pacific Islander	−472			
Black/African American	19 422			
Other	2794			
Age, per 1-y increase	−381	.49		
Children				
Yes	Reference	.48		
No	−4789			
Marital status				
Married	Reference	.76		
Divorced/widowed	3663			
Single/never married	6585			

(continued)

(89% [95% CI, 87.1%-92.2%] vs 84% [95% CI, 79.7%-88.8%]; $P=.03$). Nearly half held an additional graduate degree, and the majority held the rank of associate professor, with no statistically significant differences by gender. Women tended to be in lower-paying specialties, with 34% (95% CI, 27.7%-39.5%) of women and 22% (95% CI, 19.0%-25.9%) of men in the lowest-paying category and 3% (95% CI, 0.1%-4.9%) of women and 11% (95% CI, 8.6%-13.8%) of men in the highest-paying category ($P<.001$). In this sample, nearly half had attained R01 grant funding, without statistically significant gender differences, and the mean percentage of time spent in research was more than 50% for both men and women. Men were more likely to be at a different academic institution than the one at which they received their K awards (33% [95% CI, 29.4%-37.2%] vs 26% [95% CI, 20.5%-31.4%]; $P=.04$). Women were more likely to have had K23 awards (53% [95% CI, 47.2%-59.7%] vs 37% [95% CI, 33.2%-41.3%]; $P<.001$). Women were less likely to hold administrative leadership positions (10% [95% CI, 6.0%-13.4%] vs 16% [95% CI, 13.2%-19.4%]; $P=.01$) and had fewer publications (mean, 27 [95% CI, 23.9-29.4] vs 33 [95% CI, 31.1-35.4] publications; $P<.001$) and work hours (mean, 58 [95% CI, 56.4-59.7] vs 63 [95% CI, 62.1-64.3] hours; $P<.001$).

Overall, mean salary was $167 669 (95% CI, $158 417-$176 922) for women and $200 433 (95% CI, $194 249-$206 617) for men in this sample. TABLE 2 presents correlates of salary in the bivariable analysis. These include gender, age, parental status, possession of additional graduate degree, academic rank, nature of specialty, specialty pay level, funding rank of current institution, funding institute tier, publications, administrative leadership positions, work hours, and percentage of research time. Further details of mean salaries of men and women after grouping by these covariates are provided in eTable 1 (available at http://www.jama.com).

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TABLE 3 presents a multivariable model of salary in this sample. In the final model, male gender was associated independently and significantly with higher salary (+$13 399; P=.001), along with specialty nature (clinical specialties for women, children, and families, −$1317; hospital-based specialties, −$10 190; and surgical specialties, +$60 379 compared with medical specialties; P<.001), specialty pay level (moderate-paying, +$19 070; high-paying, +$51 204; and extremely high-paying, +$100 734 compared with low-paying specialty pay level; P<.001), academic rank (associate professors, +$17 007 and full professors, +$48 205 compared with assistant professors or instructors; P<.001), leadership positions (+$31 232 for those holding leadership positions; P<.001), publications (+$393 for each additional publication >30; P<.001), and research time (−$361 for each additional percentage point increase in time spent in research >55%; P<.001). On exploration of all pairwise interactions with gender, statistically significant interactions were observed with research time (with women experiencing little effect on salary from an increase in research time but men experiencing a more pronounced decrease in pay with increased research time) as well as academic rank (with men receiving more of an increase in pay with higher rank than women received). Neither interaction remained significant in the final model.

The gender difference in salary observed in the overall cohort was $32 764 (95% CI, $21 635-$43 892) before adjustment for any covariates, $17 874 (95% CI, $9193-$26 555) after adjustment for the 2 specialty variables alone, and $12 001 (95% CI, $3427-$20 574) after adjustment for all covariates in the full model. Peters-Belson analysis indicated that the expected salary for women, estimated by their own other characteristics but as if their gender were male, was $12 194 higher than that observed. This unexplained disparity accounted for 37.4% of the total observed difference by gender.

Table 3. Multivariable Model of Current Annual Salary of Respondents Who Received Initial K Award Funding in 2000-2003 (continued)

	Initial Model[a]		Final Model[b]	
Characteristics	Salary Estimate, $	*P* Value	Salary Estimate, $	*P* Value
Additional graduate degree				
Yes	3313	.40		
No	Reference			
Academic rank				
Assistant professor/instructor	Reference	<.001	Reference	<.001
Associate professor	18 445		17 007	
Full professor	48 836		48 205	
Specialty nature				
Medical specialties	Reference	<.001	Reference	<.001
Clinical specialties for women, children, and families	−1601		−1317	
Hospital-based specialties	−8164		−10 190	
Surgical specialties	66 739		60 379	
Specialty pay level				
Low-paying	Reference	<.001	Reference	<.001
Moderate-paying	21 131		19 070	
High-paying	51 680		51 204	
Extremely high-paying	98 874		100 734	
Current institution type				
Public	Reference	.05		
Private	9336			
Current institution NIH funding rank group				
First	−19 374	.02		
Second	−12 956			
Third	−8048			
Fourth	Reference			
Current institution region				
West	7634	.006		
Midwest	−160			
South	−15 165			
Northeast	Reference			
Still at K institution at time of survey				
Yes	−2539	.55		
No	Reference			
K award type				
K08	1907	.65		
K23	Reference			
Years since K award				
7	−2540	.67		
8	Reference			
9	−4042			
Funding institute tier				
First	4796	.61		
Second	558			
Third	Reference			
R01 or 1 million in grant funding				
Yes	1973	.66		
No	Reference			
Publications, per 1-publication increase >30	387	<.001	393	<.001
Leadership position				
Yes	29 431	<.001	31 232	<.001
No	Reference		Reference	
Work hours, per 1-h increase >60	196	.23		
Research time, per 1% increase >55%	−408	<.001	−361	<.001

[a] Initial model included the main effects of all variables listed above.
[b] Final model derived by both forward stepwise and backward elimination algorithms based on improvement in Akaike information criterion.

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Sensitivity analyses in which data were weighted to adjust for differential nonreporting of salary yielded similar results. Male gender remained significantly associated with salary on weighted multivariable analysis in both the full (+$9300; *P*=.04) and reduced (+$11 766; *P*=.006) models. Further details of the sensitivity analysis results are provided in eTable 2.

COMMENT

In 1891, Webb noted that the "chief difficulty" that confronts studies of gender differences in compensation is "what seems to be the impossibility of discovering any but a very few instances in which men and women do precisely similar work, in the same place and at the same epoch."[21] This study, which considered a homogeneous population of physicians, demonstrates a substantial and significant gender difference in salary, one-third of which is unexplained by differences in specialty, productivity, or numerous other measured factors.

Much of the overall gender difference in salary observed in this study was explained by specialty. Women were far less likely to be represented in higher-paying interventional specialties than men, with the notable exception of obstetrics and gynecology. It may be important to consider the gender gap without adjustment for specialty if women do not choose but rather are encouraged to occupy lower-paid specialties or if those specialties pay less partly because they are predominated by women.[7]

Leadership positions and academic rank are other factors that may explain some of the overall gender difference. As Ash et al[1] note, "Including a 'chief or chair' indicator in models accepts women's lesser representation in leadership positions . . . as a legitimate explanation for women's lower rank or salary," but "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." Along the same line of reasoning, it is important to consider the implications of including academic rank in our model, especially because all individuals in this study began as a single cohort of K awardees, given concerns that women may not advance in academic medicine at the same rate as their male peers.[22]

Nevertheless, the gender difference in salary observed herein was not fully explained by measured differences in specialization, institution, academic advancement, or productivity. A number of other explanations are possible. Sex differences in compensation may be related to parental status, with mothers potentially more likely to sacrifice pay for unobserved job characteristics such as flexibility and fathers potentially more likely to wish to earn more to support their families. However, in contrast to some other studies,[23,24] we did not observe any interaction between gender and parental status; even women without children had lower pay than men. Thus, we found no evidence suggesting differential influence of parental status on priorities or values of the male vs female academic physicians in this sample.

Still, it remains possible that men and women in our sample did have different values or made different choices. It is possible that men prioritized compensation more than women did. Of note, we studied a select group of highly accomplished individuals who chose academic careers rather than more lucrative positions in the private sector, so pay in general is not expected to be a high priority. Yet perhaps these researchers still internalized to some degree society's gendered expectations of career success, with men more likely to value pay.[25] As a result, women may have made trade-offs in compensation to achieve nonmonetary benefits. For example, women may have been more likely to choose institutions that successfully offered lower salaries because of a location in or near a desirable community. The women in our sample were less likely to move to a new institution, and we controlled for this in our analysis, but it is possible that they were also less willing or able to make credible threats to leave their institutions, for which we did not control. Women have, in other studies, been shown to negotiate less aggressively regarding salary than men.[26] We do not have information on employment status of the respondents' spouses, so we cannot ascertain whether spousal employment may have mediated the salary difference observed.

Other potential explanations are gender bias and discrimination. Economists have described "statistical discrimination," in which employers make inferences based on the mean characteristics of a group rather than considering individual characteristics when setting salaries.[27] Numerous psychological studies suggest the existence of small yet meaningful gender biases, often unconscious, that may ultimately influence the outcomes of women's careers, including hiring, salaries, and promotions.[28] These biases have been demonstrated to be particularly likely to be mobilized when women are mothers.[29,30] Given that psychological research shows that women with identical accomplishments are viewed as less productive than men,[31] the observation that controlling for objective measures of academic productivity did not eliminate variation by gender is perhaps more understandable. Research has shown that observers have little difficulty rationalizing different outcomes for women and men with identical qualifications or performance.[32,33]

This study has a number of strengths, including its focus on a homogeneous population in whom gender differences are particularly unexpected and its consideration of a large array of measures of productivity and other factors to which gender differences might be attributed. The study has certain limitations, however. Like any survey study, it is vulnerable to selection bias. Although the response rate was high, it is nevertheless possible that respondents were not similar to the overall target population. Reassuringly, analyses comparing respondents with the overall cohort of K awardees from 2000-2003 suggested few systematic differences. Item nonresponse regarding salary was not negligible, and there were meaningful differences between those who chose to respond to the salary item and those who

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did not, but there were not differences by gender, and sensitivity analysis using weighted data produced similar findings. Finally, this study, like most studies of physician compensation, relies largely on self-report for its measures. Although the questions used were developed with standard techniques of survey design, including cognitive pretesting, and have high face validity, it is possible that recall or other biases influenced response. Nevertheless, there is little reason to suspect that such biases would affect the identification of gender differences.

Of note, some might consider the magnitude of the difference observed in this study to be modest in the absence of considering the cumulative effect.[10] If one conservatively assumes a static, unexplained annual gender difference in salary of the size we observed over a 30-year career, women in this group will end their careers having earned more than $350 000 less than similarly situated men, even without considering the compound interest on the investment of that extra income. Moreover, the cumulative difference would be even larger if one were persuaded that it is more appropriate to consider the gender gap without controlling for differences in specialty, leadership, and rank, as discussed above.

Ultimately, this study provides evidence that gender differences in compensation continue to exist in academic medicine, even among a select cohort of physician researchers whose job content is far more similar than in cohorts previously studied, and even after controlling extensively for specialization and productivity. Efforts to investigate the mechanisms by which these gender differences develop and ways to mitigate their effects[34] merit continued attention, as these differences have not been eliminated through the passage of time alone and are difficult to justify.

Author Contributions: Dr Jagsi and Mr Griffith had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Jagsi, Griffith, Stewart, Ubel.
Acquisition of data: Jagsi, Sambuco, DeCastro.
Analysis and interpretation of data: Jagsi, Griffith, Stewart.
Drafting of the manuscript: Jagsi, Griffith.
Critical revision of the manuscript for important intellectual content: Jagsi, Griffith, Stewart, Sambuco, DeCastro, Ubel.
Statistical analysis: Jagsi, Griffith.
Obtained funding: Jagsi, Ubel.
Administrative, technical, or material support: Jagsi, Stewart.
Study supervision: Jagsi.
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