JAMA Internal Medicine | Original Investigation

Sex Differences in Physician Salary in US Public Medical Schools

Anupam B. Jena, MD, PhD; Andrew R. Olenski, BS; Daniel M. Blumenthal, MD, MBA

IMPORTANCE Limited evidence exists on salary differences between male and female academic physicians, largely owing to difficulty obtaining data on salary and factors influencing salary. Existing studies have been limited by reliance on survey-based approaches to measuring sex differences in earnings, lack of contemporary data, small sample sizes, or limited geographic representation.

OBJECTIVE To analyze sex differences in earnings among US academic physicians.

DESIGN, SETTING, AND PARTICIPANTS Freedom of Information laws mandate release of salary information of public university employees in several states. In 12 states with salary information published online, salary data were extracted on 10 241 academic physicians at 24 public medical schools. These data were linked to a unique physician database with detailed information on sex, age, years of experience, faculty rank, specialty, scientific authorship, National Institutes of Health funding, clinical trial participation, and Medicare reimbursements (proxy for clinical revenue). Sex differences in salary were estimated after adjusting for these factors.

EXPOSURES Physician sex.

MAIN OUTCOMES AND MEASURES Annual salary.

RESULTS Among 10 241 physicians, female physicians (n = 3549) had lower mean (SD) unadjusted salaries than male physicians ($206 641 [$88 238] vs $257 957 [$137 202]; absolute difference, $51 315 [95% CI, $46 330-$56 301]). Sex differences persisted after multivariable adjustment ($227 783 [95% CI, $224 117-$231 448] vs $247 661 [95% CI, $245 065-$250 258] with an absolute difference of $19 878 [95% CI, $15 261-$24 495]). Sex differences in salary varied across specialties, institutions, and faculty ranks. For example, adjusted salaries of female full professors ($250 971 [95% CI, $242 307-$259 635]) were comparable to those of male associate professors ($247 212 [95% CI, $241 850-$252 575]). Among specialties, adjusted salaries were highest in orthopedic surgery ($358 093 [95% CI, $344 354-$371 831]), surgical subspecialties ($318 760 [95% CI, $311 030-$326 491]), and general surgery ($302 666 [95% CI, $294 060-$311 272]) and lowest in infectious disease, family medicine, and neurology (mean income, <$200 000). Years of experience, total publications, clinical trial participation, and Medicare payments were positively associated with salary.

CONCLUSIONS AND RELEVANCE Among physicians with faculty appointments at 24 US public medical schools, significant sex differences in salary exist even after accounting for age, experience, specialty, faculty rank, and measures of research productivity and clinical revenue.

JAMA Intern Med. 2016;176(9):1294-1304. doi:10.1001/jamainternmed.2016.3284
Published online July 11, 2016.

Invited Commentary page 1305

Supplemental content at jamainternalmedicine.com

Author Affiliations: Department of Health Care Policy, Harvard Medical School, Boston, Massachusetts (Jena, Olenski); Department of Medicine, Massachusetts General Hospital, Boston (Jena); National Bureau of Economic Research, Cambridge, Massachusetts (Jena); Cardiology Division, Massachusetts General Hospital, Boston (Blumenthal); Harvard Medical School, Boston, Massachusetts (Blumenthal).

Corresponding Author: Anupam B. Jena, MD, PhD, Department of Health Care Policy, Harvard Medical School, 180 Longwood Ave, Boston, MA 02115 (jena@hcp.med.harvard.edu).

The number of women in medicine has grown rapidly since 1970. Women now compose half of all US medical school graduates and hold 38% of faculty positions in US medical schools.[1,2] Nonetheless, significant sex differences in job achievement and compensation exist in medicine. Several studies[3-11] of US medical schools have documented sex differences in faculty rank. A recent analysis[12] of sex differences in faculty rank in 2014, which used a comprehensive cross-sectional database of 91 073 US physicians, found substantial sex differences in faculty rank after adjustment for physician age, years since residency completion, specialty, scientific authorship, National Institutes of Health (NIH) research funding, and clinical trial participation.

Less attention has been focused on differences in earnings between male and female physicians, largely owing to limited availability of earnings data and matching information on factors that may affect earnings, such as specialty, years of experience, clinical practice characteristics, and, within academic medicine, measures of research productivity. Still, among physicians overall, several surveys[13-16] have found that women earn substantially less than men after adjustment for specialty choice, hours worked, years of experience, and family structure. Within academic medicine, many studies[17-22] have found that women earn less than men after adjustment for factors such as age, race, marital status, years of experience, specialty, reported work hours, research productivity, and faculty rank. However, these studies have been limited by several factors, including reliance on survey-based approaches to measuring sex differences in physician earnings, lack of contemporary data, small sample sizes, and limited geographic representation.

We undertook an analysis of sex differences in academic physician salary that was designed to mitigate many of the limitations of previous studies on this topic. To achieve this end, we assembled a database of salary information of academic physicians employed in 24 public medical schools in 12 states, relying on the fact that several states have Freedom of Information laws mandating the release of government financial records that frequently include salary information on employees of public universities. We combined these data with information on clinical and research productivity of physicians to analyze sex differences in earnings.

Key Points

Question Do differences in salary exist between male and female academic physicians in US public medical schools?

Findings Relying on Freedom of Information laws that mandate release of salary information of public university employees in several states, this study analyzed sex differences in academic physician salary among 10 241 physicians in 24 public medical schools. Accounting for physician age, experience, faculty rank, specialty, scientific authorship, National Institutes of Health funding, clinical trial participation, and Medicare reimbursements, female physicians earned less than males.

Meaning Significant sex differences in salary exist in public medical schools after accounting for clinical and research productivity.

Methods

Salary Data

Government records frequently include public employee salary data, detailing the employee's full name, position title, institution name, and salary of all public employees in that state. We extracted salary information on all employees in 24 state medical schools in 12 states that had public employee data available online as of November 1, 2015. These schools included the University of California at Davis, Irvine, Los Angeles, San Diego, and San Francisco; University of Florida and South Florida; Southern Illinois University and University of Illinois; University of Kansas; University of Maryland; University of Michigan; East Carolina University and University of North Carolina; The Ohio State University; University of Tennessee; University of Texas at Houston, San Antonio, Medical Branch, and Southwestern, Texas Tech University, and MD Anderson Cancer Center; University of Washington; and University of Wisconsin. Year of salary ranged from 2011 to 2013 (eg, 2012 salaries for University of Texas Southwestern employees and 2013 salaries for University of California employees).

Data were approved for study by the human subjects review committee at Harvard Medical School. The need for consent was waived. With the design of the study, data were not deidentified.

We merged these individual-level salary data with those of a comprehensive database of US physicians obtained from a company that provides online networking services for US physicians (Doximity; https://www.doximity.com/). The purpose of the match was to identify physician faculty in each state employee salary database using a list of physician names and institutional affiliations from the Doximity database. The Doximity database draws on several sources to identify physicians, including the National Plan and Provider Enumeration System, National Provider Identifier Registry, self-registered members, and collaborating hospitals and medical schools that provide information to the company. Additional details on this database are described below.

Individuals in the 2 data sets were matched iteratively through various combinations of first and last name, middle initial, and university affiliation. University affiliation and associated faculty rank of physicians in the Doximity database had been obtained from the Association of American Medical Colleges faculty roster database. Because it is possible that a physician in a medical school may share the same first and last name as a nonphysician employee in that university, we excluded all nonunique names in the salary data sets.

We assessed the validity with which we were able to identify public medical school physician faculty in state employee databases in 2 ways. First, we sought to confirm that individuals who we identified in the salary data as being physician faculty were in fact physician faculty. For a random sample of 240 physicians (10 per school), we verified through online searches that each physician was affiliated with that medical school. Second, we sought to determine whether unmatched physicians (ie, those who were listed as faculty members at a given medical school in the Doximity database but were not matched to state employee salary records) failed to match for correct reasons. To accomplish this task, we manually confirmed that each unmatched physician who was listed by the Association of American Medical Colleges as a professor at a given medical school was not in the payroll data. Most of these physicians held titular positions at various medical schools but earned a majority, if not the entirety, of their salary through an affiliated private hospital and as such were not listed in the public employee payroll data.

Physician Characteristics

In addition to university affiliation and faculty rank, the Doximity database includes information on physician age, sex, specialty, and year of residency completion, which is obtained through partnerships with the American Board of Medical Specialties, state licensing boards, and collaborating hospitals and medical schools. The database also includes information on the number of authored scientific publications indexed in PubMed (first author, last author, and total publications); number of NIH grants for which the physician was a principal investigator, obtained from the NIH Research Portfolio Online Reporting Tools database (https://report.nih.gov/); and number of registered clinical trials in which the physician was a principal or subinvestigator, obtained from clinicaltrials.gov. Details of the database and validation of the accuracy of its data have been published elsewhere.[12]

In addition to these characteristics, we obtained information on the total amount a physician was reimbursed by Medicare in 2013 as reported in publicly available data published by the Centers for Medicare & Medicaid Services.[23] This figure was used as a proxy for clinical revenue and full-time vs part-time effort, which may influence a physician's salary.

Statistical Analysis

We estimated a physician-level, multivariable linear regression model of annual salary as a function of physician sex, age, years since residency completion, faculty rank (assistant, associate, or full professor), specialty, NIH funding (yes/no indicator for whether a physician was ever a principal investigator on an NIH grant), clinical trial participation (yes/no indicator), publication count (first or last authored and total), whether the medical school from which the physician graduated ranked among the top 20 in *US News and World Report* research rankings of medical schools in 2013 (yes/no indicator), and the total amount the physician billed to Medicare in 2013 (http://www.usnews.com/). Our model included medical school–level fixed effects, thereby identifying the sex difference in physician salary on the basis of comparisons of physicians within the same institution rather than across institutions.

We report the absolute adjusted difference in salary between male and female physicians overall, as well as in several prespecified subgroups (by specialty and faculty rank; for each of the 24 medical schools in our database; and for the 3 census regions in which schools are located: Midwest, South, and West).

Sensitivity Analysis

We conducted several sensitivity analyses. First, to address the potential impact of data inaccuracies in the measures of research productivity, we re-estimated the earnings model among registered physician members who provide information in their own Doximity profiles. Second, although we used Medicare reimbursements as a proxy for clinical revenue and effort, it is possible that physicians on different faculty tracks (eg, clinical vs research) or with varying work hours (eg, full-time vs part-time) may be compensated differently, which could confound sex differences in faculty rank.[24] We therefore analyzed sex differences in earnings among faculty with NIH funding who we assumed were more likely to be full-time researchers. Moreover, to further address this issue, we re-estimated our earnings model excluding the bottom 25% of earners in each specialty and institution to limit the sample to physicians more likely be in full-time rather than part-time positions. Third, we assessed the sensitivity of adjusted sex differences in earnings to models that included years since residency as a categorical variable (rather than continuous so as to allow for nonlinear effects of experience on earnings) and counts of NIH grants and clinical trials as opposed to binary indicators for each. Stata, version 13 (StataCorp) was used for analyses.

Results

Characteristics of Population

Population characteristics are presented in **Table 1**. The sample consisted of 10 241 physician faculty in 24 public medical schools in the United States (11.0% of 93 480 physicians with academic appointments). Of these, 3549 were women (34.7%) and 6692 were men (65.3%), a proportion comparable to that seen among physician faculty in the US medical schools not included in the study (55 754 of 83 239 [67.0%] men). In unadjusted analyses, women had lower mean (SD) salaries than men ($206 641 [$88 238] vs $257 957 [$137 202]; absolute difference $51 315 [95% CI, $46 330-$56 301]). Women were less likely than men to be full professors (717 [20.2%] vs 2543 [38.0%]; $P < .001$), were younger (mean [SD] age, 46.4 [9.2] vs 51.1 [10.8] years; $P < .001$), and completed residency more recently (14.6 [9.0] vs 19.4 [11.4] years; $P < .001$). A significantly greater percentage of women compared with men were specialized in internal medicine (11.3% vs 7.9%), obstetrics and gynecology (6.8% vs 2.7%), and pediatrics (17.6% vs 9.9%). Women had fewer total publications as well as first or last author publications (mean [SD] total, 13.5 [23.5] vs 26.1 [37.6]; mean first or last author publications, 8.6 [19.4] vs 17.1 [29.8]; $P < .001$ for both), were less likely to have had NIH funding (412 [11.6%] () vs 1076 [16.1%]; $P < .001$), and were less likely to have conducted a clinical trial (287 [8.1%] vs 773 [11.6%]; $P < .001$). Women were also less likely to have received payments from Medicare and, among physicians receiving payments, the mean amount received was lower for women ($38 409 [56 105] vs $52 320 [93 327]; $P < .001$). Women were equally likely to have graduated from a medical school ranked in the top 20 in terms of

Table 1. Characteristics of the Population

Characteristic	Faculty			P Value[a]
	All (N = 10 241)	Men (n = 6692)	Women (n = 3549)	
Salary, mean (SD), $	240 173 (124 877)	257 957 (137 202)	206 641 (88 238)	<.001
Salary category, $, No. (%)				
<100 000	421 (4.1)	277 (4.1)	144 (4.1)	<.001
100 000-149 999	1562 (15.3)	799 (11.9)	763 (21.5)	
150 000-199 999	2567 (25.1)	1448 (21.6)	1119 (31.5)	
200 000-249 999	2091 (20.4)	1403 (21.0)	688 (19.4)	
250 000-299 999	1326 (12.9)	951 (14.2)	375 (10.6)	
≥300 000	2274 (22.2)	1814 (27.1)	460 (13.0)	
Faculty rank, No. (%)				
Assistant professor	4479 (43.7)	2516 (37.6)	1963 (55.3)	<.001
Associate professor	2502 (24.4)	1633 (24.4)	869 (24.5)	.93
Full professor	3260 (31.8)	2543 (38.0)	717 (20.2)	<.001
Age, mean (SD), y	49.49 (10.5)	51.1 (10.8)	46.4 (9.2)	<.001
Age, y, No. (%)				
<40	1999 (20.4)	1065 (16.5)	934 (27.8)	<.001
40-44	1733 (17.7)	1037 (16.1)	696 (20.7)	
45-49	1559 (15.9)	1007 (15.6)	552 (16.4)	
50-54	1358 (13.8)	897 (13.9)	461 (13.7)	
55-59	1291 (13.2)	916 (14.2)	375 (11.1)	
60-64	955 (9.7)	718 (11.1)	237 (7.0)	
≥65	913 (9.3)	803 (12.5)	110 (3.3)	
Years since residency, mean (SD)	17.7 (10.9)	19.4 (11.4)	14.6 (9.0)	<.001
Specialty, No. (%)				
Anesthesiology	654 (6.4)	444 (6.6)	210 (5.9)	.16
Cardiology	369 (3.6)	294 (4.4)	75 (2.1)	<.001
Emergency medicine	361 (3.5)	261 (3.9)	100 (2.8)	.005
Family medicine	519 (5.1)	277 (4.1)	242 (6.8)	<.001
Gastroenterology	228 (2.2)	175 (2.6)	53 (1.5)	<.001
Hematology/oncology	419 (4.1)	288 (4.3)	131 (3.7)	.14
Infectious disease	237 (2.3)	143 (2.1)	94 (2.7)	.10
Internal medicine	927 (9.1)	527 (7.9)	400 (11.3)	<.001
Neurology	449 (4.4)	307 (4.6)	142 (4.0)	.17
Obstetrics/gynecology	418 (4.1)	178 (2.7)	240 (6.8)	<.001
Orthopedic surgery	233 (2.3)	199 (3.0)	34 (1.0)	<.001
Pathology	440 (4.3)	284 (4.2)	156 (4.4)	.72
Pediatrics	1285 (12.6)	661 (9.9)	624 (17.6)	<.001
Psychiatry	455 (4.4)	294 (4.4)	161 (4.5)	.74
Radiology	573 (5.6)	402 (6.0)	171 (4.8)	.01
Surgery	590 (5.8)	454 (6.8)	136 (3.8)	<.001
Surgery subspecialty	744 (7.3)	629 (9.4)	115 (3.2)	<.001
Other	1331 (13.0)	868 (13.0)	463 (13.1)	.91
Publications, mean (SD), No.				
Total	21.7 (33.9)	26.1 (37.6)	13.5 (23.5)	<.001
As first or last author	14.2 (26.9)	17.1 (29.8)	8.6 (19.4)	<.001
≥1 NIH grant				
No. (%)	1488 (14.5)	1076 (16.1)	412 (11.6)	<.001
Mean (SD)	6.1 (5.7)	6.7 (6.0)	4.5 (4.4)	<.001
≥1 Clinical trial				
No. (%)	1060 (10.4)	773 (11.6)	287 (8.1)	<.001
Mean (SD)	2.2 (2.4)	2.2 (2.5)	2.1 (2.0)	.50

(continued)

Table 1. Characteristics of the Population (continued)

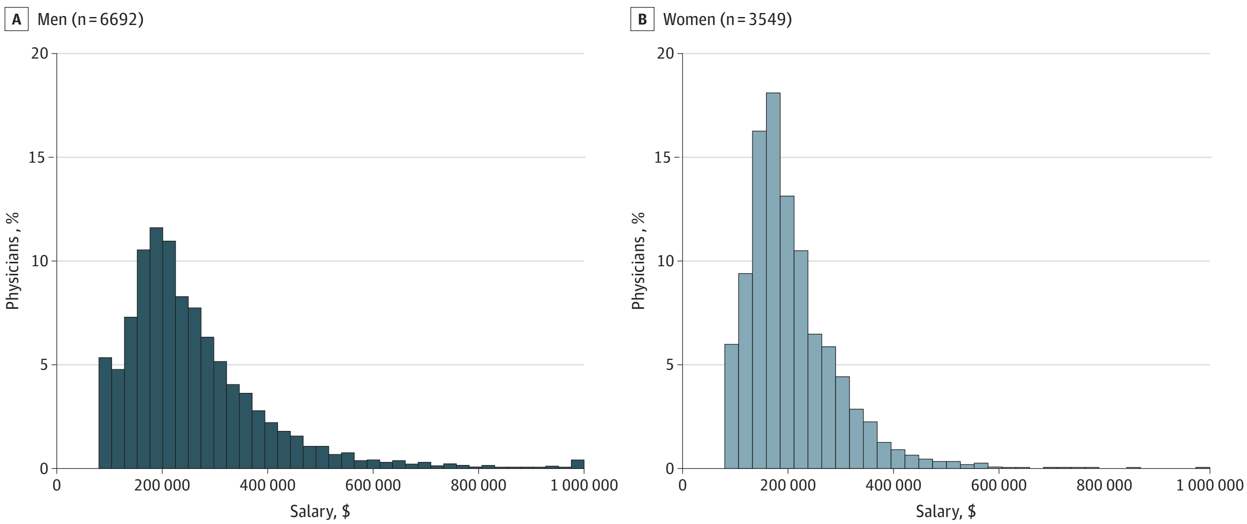
Characteristic	Faculty All (N = 10 241)	Faculty Men (n = 6692)	Faculty Women (n = 3549)	*P* Value[a]
Medicare payments				
No. (%)	7366 (71.9)	5017 (75.0)	2349 (66.2)	<.001
Mean (SD), $	47 884 (83 531)	52 320 (93 327)	38 409 (56 105)	<.001
Graduated from a top 20 US medical school, No. (%)[b]	2488 (25.9)	1667 (24.9)	821 (23.1)	.11
Census region				
Midwest	1858 (18.1)	1235 (18.5)	623 (17.6)	.26
South	4552 (44.4)	2986 (44.6)	1566 (44.1)	.63
West	3831 (37.4)	2471 (36.9)	1360 (38.3)	.17

Abbreviation: NIH, National Institutes of Health.

[a] *P* values reflect comparison between men and women using 2-sided *t* tests and χ^2 comparisons where appropriate. *P* value for age reflects comparison of age distributions.

[b] Top 20 medical school according to *US News and World Report* 2013 medical school research rankings. Schools were located in 3 of 4 census regions (Midwest, South, and West; none in the Northeast).

Figure 1. Salary Distribution by Sex



Distribution of salaries among 10 241 male and female physician faculty in 24 US public medical schools.

research according to *US News and World Report* (821 [23.1%] vs 1667 [24.9%]; *P* = .11).

The salary distribution of women was skewed leftward compared with men, with a substantially higher proportion of women receiving lower salaries (**Figure 1**). For example, most women earned less than $200 000 annually compared with men (2026 [57.1%] vs 2254 [33.7%]). Similarly, fewer women than men earned more than $400 000 annually (114 [3.2%] vs 776 [11.6%]).

Multivariable Analysis

Adjustment for faculty rank, age, years since residency, specialty, NIH funding, clinical trial participation, publication count (total as well as first- or last-authored articles), total Medicare payments, and graduation from a medical school ranked among the top 20 by *US News and World Report* explained only a portion of the observed salary difference between male and female physicians (adjusted mean salaries: $227 783 [95% CI, $224 117-$231 448] for women vs $247 661 [95% CI, $245 065-$250 258] for men; absolute difference: $19 878 [95% CI, $15 261-$24 495]) (**Table 2**). After adjustment, 38.7% of the unadjusted sex difference in salary remained ($19 878 vs $51 315).

Mean adjusted salary was higher among full professors ($274 614 [95% CI, $269 414-$279 814]) than associate professors ($240 422 [95% CI, $236 001-$244 843]; *P* < .001) and assistant professors ($217 179 [95% CI, $212 963-$221 395]; *P* < .001). Although salary rose with age in unadjusted analysis, this association disappeared after multivariable adjustment (and income was lower among individuals older than 65 years compared with all other groups; *P* < .001). Among specialties, adjusted salaries were highest in orthopedic surgery ($358 093 [95% CI, $344 354-$371 831]), surgical subspecialties ($318 760 [95% CI, $311 030-$326 491]), and general surgery ($302 666 [95% CI, $294 060-$311 272]) and lowest in infectious disease, family medicine, and neurology (mean income, <$200 000). Years of experience, total publications, clinical trial participation, and Medicare payments were positively associated with salary.

Table 2. Multivariable Analysis of Factors Associated With Physician Salary[a]

Characteristic	Salary, $ Unadjusted, Mean (SD)	Salary, $ Adjusted, Mean (95% CI)	P Value
Sex			
Male	257 957 (137 203)	247 661 (245 065 to 250 258)	
Female	206 641 (88 238)	227 783 (224 117 to 231 448)	<.001
Rank			
Assistant professor	207 913 (93 111)	217 179 (212 963 to 221 395)	
Associate professor	239 303 (118 221)	240 422 (236 001 to 244 843)	<.001
Full professor	285 166 (151 344)	274 614 (269 414 to 279 814)	<.001
Age, y			
<40	207 147 (95 621)	241 430 (233 753 to 249 107)	
40-44	225 572 (108 927)	245 500 (239 193 to 251 807)	.26
45-49	246 958 (127 610)	250 330 (244 743 to 255 918)	.04
50-54	261 280 (138 644)	249 234 (243 453 to 255 016)	.14
55-59	259 157 (126 502)	238 158 (231 298 to 245 018)	.60
60-64	263 973 (137 492)	236 456 (227 199 to 245 713)	.51
≥65	258 165 (151 665)	210 663 (198 095 to 223 231)	.001
Specialty			
Anesthesiology	271 883 (96 541)	286 337 (277 879 to 294 796)	
Cardiology	276 151 (128 230)	254 188 (243 251 to 265 124)	<.001
Emergency medicine	229 182 (63 082)	235 975 (224 995 to 246 955)	<.001
Family medicine	171 270 (56 815)	191 341 (181 807 to 200 876)	<.001
Gastroenterology	265 024 (129 705)	258 690 (244 709 to 272 670)	.001
Hematology/oncology	265 921 (148 804)	244 404 (233 968 to 254 840)	<.001
Infectious disease	181 743 (68 994)	190 184 (176 325 to 204 044)	<.001
Internal medicine	198 687 (73 413)	202 332 (195 421 to 209 243)	<.001
Neurology	197 991 (96 739)	192 674 (182 812 to 202 537)	<.001
Obstetrics/gynecology	259 635 (121 156)	273 507 (263 536 to 283 477)	.054
Orthopedic surgery	355 704 (162 508)	358 093 (344 354 to 371 831)	<.001
Other	225 200 (115 126)	214 406 (208 521 to 220 290)	<.001
Pathology	214 248 (96 759)	212 111 (202 052 to 222 170)	<.001
Pediatrics	191 576 (78 601)	210939 (205 041 to 216 837)	<.001
Psychiatry	198 777 (73 897)	206 568 (196 799 to 216 337)	<.001
Radiology	290 402 (107 125)	282 368 (273 058 to 291 678)	.54
Surgery	310 895 (171 207)	302 666 (294 060 to 311 272)	.008
Surgery subspecialty	330 992 (191 272)	318 760 (311 030 to 326 491)	<.001

(continued)

Table 2. Multivariable Analysis of Factors Associated With Physician Salary[a] (continued)

Characteristic	Salary, $ Unadjusted, Mean (SD)	Salary, $ Adjusted, Mean (95% CI)	*P* Value
NIH grant			
None	238 853 (123 028)	243 071 (240 763 to 245 378)	
≥1	247 944 (135 029)	227 667 (221 160 to 234 175)	<.001
Clinical trial			
None	235 461 (121 243)	239 356 (237 159 to 241 554)	
≥1	280 994 (146 639)	253 501 (246 631 to 260 371)	<.001
Years since residency, per 1-y increment	1764.5	559 (18.2 to 1100.0)	.04
Publications, total, per 1-publication increment	784.7	409 (298.7 to 518.3)	<.001
Publications, first or last author, per 1-publication increment	683.2	−79 (−196.6 to 38.9)	.19
Medicare payment, per $1 increment	0.3	0.3 (0.3 to 0.3)	<.001
Graduated from a top 20 US medical school			
No	237 264 (121 460)	239 799 (237 338 to 242 260)	
Yes	252 643 (135 563)	243 768 (239 465 to 248 072)	.13

Abbreviation: NIH, National Institutes of Health.

[a] Estimates are from a multivariable linear regression of salary as a function of age, years of experience, sex, NIH funding, publication count (total as well as first or last author of publications), clinical trial participation, Medicare payments, and medical school fixed effects. Medicare payments reflect the amount a physician was reimbursed by Medicare in 2013 as reported in publicly available data published by the Centers for Medicare & Medicaid Services. This figure was used as a proxy for clinical revenue and full-time vs part-time effort, which may influence a physician's salary.

Table 3. Sex Differences in Salary by Specialty[a]

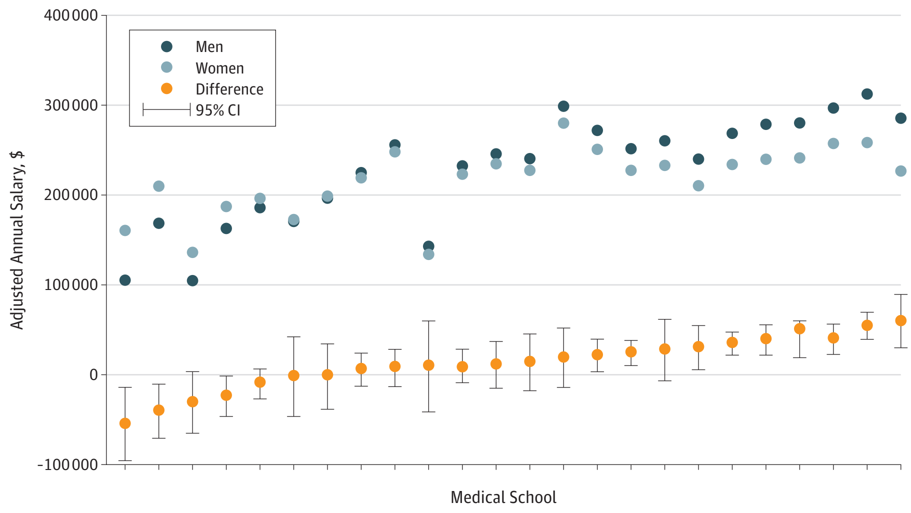
Specialty	Salary, $ Unadjusted Men	Unadjusted Women	Unadjusted Difference	Adjusted Men	Adjusted Women	Adjusted Difference (95% CI)
Anesthesiology (n = 654)	278 931	256 981	21 950	291 617	276 684	14 933 (−2822 to 32 688)
Cardiology (n = 369)	284 378	243 904	40 474	263 690	229 940	33 749 (6479 to 61 020)
Emergency medicine (n = 361)	234 997	214 007	20 990	239 257	232 534	6723 (−17 907 to 31 353)
Family medicine (n = 519)	179 080	162 330	16 750	191 879	185 635	6244 (−12 529 to 25 017)
Gastroenterology (n = 228)	273 915	235 666	38 249	263 838	251 130	12 709 (−20 499 to 45 916)
Hematology/oncology (n = 419)	282 705	229 021	53 684	256 959	219 166	37 793 (16 030 to 59 556)
Infectious disease (n = 237)	192 077	166 023	26 054	196 449	177 886	18 563 (−9889 to 47 016)
Internal medicine (n = 927)	210 062	183 700	26 362	207 497	191 338	16 159 (2256 to 30 061)
Neurology (n = 449)	210 705	170 504	40 201	202 832	172 351	30 482 (9371 to 51 592)
Obstetrics/gynecology (n = 418)	290 183	236 978	53 205	289 777	253 387	36 390 (16 375 to 56 406)
Orthopedic surgery (n = 233)	363 847	308 045	55 802	368 070	327 117	40 953 (2277 to 79 628)
Other (n = 1331)	237 452	202 230	35 222	217 786	207 800	9985 (−2262 to 22 233)
Pathology (n = 440)	223 214	197 924	25 290	216 592	203 614	12 977 (−7812 to 33 767)
Pediatrics (n = 1285)	210 366	171 671	38 695	220 009	195 457	24 553 (13 058 to 36 047)
Psychiatry (n = 455)	211 892	174 826	37 066	211 709	196 909	14 799 (−5709 to 35 308)
Radiology (n = 573)	290 660	289 797	863	282 749	285 127	−2378 (−22 631 to 17 875)
Surgery (n = 590)	323 149	269 990	53 159	312 411	280 030	32 381 (12 253 to 52 509)
Surgery subspecialty (n = 744)	342 810	266 353	76 457	329 097	285 369	43 728 (22 272 to 65 184)

[a] Specialty-specific sex differences in salary were estimated using a multivariable linear regression of salary as a function of age, years of experience, sex (interacted with specialty), National Institutes of Health funding, publication count (total as well as first or last author of publications), clinical trial participation, Medicare payments, and medical school fixed effects.

Differences by Specialty and Faculty Rank

There was substantial heterogeneity across specialties in the size of sex differences in salary (**Table 3**). In all specialties but radiology, the estimated adjusted salary among men exceeded that of women; this difference was statistically significant in 9 of 18 specialties. Surgical subspecialties demonstrated the largest absolute adjusted sex differences in salary ($329 097 vs $285 369; absolute difference, $43 728 [95% CI,

Figure 2. Sex Differences in Salary According to Medical School



School-specific sex differences in salary were estimated using a multivariable linear regression of salary as a function of age, years of experience, sex (interacted with school), National Institutes of Health funding, publication count (total as well as being first or last author on publications), clinical trial participation, and Medicare payments. See the Salary Data subsection of the Methods section for a list of the included schools. Limit lines indicate 95% CI.

$22 272-$65 184]), orthopedic surgery ($368 070 vs $327 117; absolute difference, $40 953 [95% CI, $2277-$79 628]), hematology/oncology ($256 959 vs $219 166; absolute difference, $37 793 [95% CI, $16 030-$59 556]), obstetrics/gynecology ($289 777 vs $253 387; absolute difference, $36 390 [95% CI, $16 375-$56 406]), and cardiology ($263 690 vs $229 940; absolute difference, $33 749 [95% CI, $6479-$61 020]).

Sex differences in salary were present at all faculty ranks and were largest among full professors (male-female difference among assistant professors, $13 240 [95% CI, $6884-$19 596]; associate professors, $20 329 [95% CI, $11 381-$29 276]; and full professors, $33 620 [95% CI, $24 439-$42 801] (eFigure in the Supplement). Of note, adjusted salaries of female associate professors ($226 884 [95% CI, $219 504-$234 264]) were comparable to those of male assistant professors ($221 046 [95% CI, $216 098-$225 995]). Moreover, adjusted salaries of female full professors ($250 971 [95% CI, $242 307-$259 635]) were comparable to those of male associate professors ($247 212 [95% CI, $241 850-$252 575]).

Differences by Medical School and Census Region

Adjusted salaries of male physicians were significantly higher than the salaries of female physicians in 9 of 24 schools (37.5%), although point estimates were higher in 17 schools (70.8%) (**Figure 2**). The 2 schools with the largest male-female earnings gap had absolute adjusted sex differences in salary of $54 174 (95% CI, $38 901-$69 446) and $59 338 (95% CI, $29 572-$89 104). In contrast, female physicians had significantly higher adjusted salaries than male physicians at 2 schools. Female physicians had lower adjusted salaries than male physicians in all 3 census regions in which schools were located, with the largest sex differences observed in schools in the West (eg, adjusted sex difference, $33 042 in the West vs $16 044 in the South and $4541 in the Midwest; $P < .001$ for difference between West vs South and West vs Midwest) (eTable in the Supplement).

Additional Analyses

Adjusted sex differences in salary were present among physicians self-registered with Doximity ($255 825 vs $233 843; absolute difference, $21 982 [95% CI, $15 073-$28 890]) and among those with NIH funding ($268 165 vs $245 666; absolute difference, $22 499 [95% CI, $9465-$35 533]). Adjusted sex differences in salary were also present among physicians in the upper 3 quartiles of earnings within each school and institution, which was an analysis conducted to increase the likelihood that our sample included physicians who held full-time positions. Finally, adjusted sex differences in salary were present in analyses of earnings models that included years since residency as a categorical variable or models that included counts of NIH grants and clinical trials as opposed to binary indicators for each (eTable in the Supplement).

Discussion

We analyzed sex differences in salary between male and female academic physicians at 24 US public medical schools using contemporary administrative salary data of state employees made publicly available online by state governments. After adjusting these analyses for physician age, years of experience, specialty, faculty rank, several measures of research productivity, and payments by Medicare (information obtained from a comprehensive database of US physicians), we found that annual salaries of female academic physicians were 8.0% ($19 879) lower than those of male physicians. This difference represents 38.7% of the unadjusted difference in salary between men and women. The magnitude of sex differences in adjusted salary varied across specialties and institutions. Sex differences in salary were present at all faculty ranks. In fact, female full and associate professors had adjusted salaries comparable to those of male associate and assistant professors, respectively. By relying on administrative salary data and a rich set of physician characteristics, we were able to analyze a substantially larger population of academic physicians than has previously been possible with survey data, making this, to our knowledge, the largest study of sex differences in earnings among academic physicians to date.

Several studies[3-11] have documented persistent sex differences in faculty rank at US medical schools, including a recent analysis[12] using the same physician database that we used. However, fewer studies[17-22] have investigated sex differences in salary among academic physicians. Two relatively recent national surveys[17,18] found that female academic physician researchers earn less than males after adjustment for demographics, experience, specialty, work hours, research productivity, and faculty rank, but those studies were survey based, were smaller than the present study, and focused on investigators with specific forms of early career investigator funding by the NIH.

Our study has several implications. First, sizeable differences in salary between male and female physicians in public medical schools persist after accounting for a rich set of factors that influence salary. Many explanations have been put forth to explain sex differences in salary and academic advancement more generally.[5-7,25-29] One set of explanations focuses on factors that may lead to lower research and clinical productivity among women, which would result in unadjusted income differences. Such factors include differential household responsibilities,[27,30,31] childrearing, greater difficulty finding effective mentors,[5,25,26,32] inequitable allocation of institutional research funding and work space,[15,17,18,33] and different preferences on work-life balance,[34,35] although evidence on the last factor is mixed.[36,37] Another set of explanations focuses on factors that may explain sex differences in salary even among men and women who are similarly productive in research and clinical work. Such factors include several of those listed above, as well as women physicians being less likely to receive recognition for achievements,[5,25,26,32] overt discrimination, and the possibility that women physicians may place less emphasis on salary negotiations compared with male counterparts in both initial and subsequent salary negotiations.[38]

Although a number of strategies have been proposed to address the issue of sex differences in academic physicians' salaries,[39] a second implication of our study is that publicly available administrative salary data potentially allow for transparency to facilitate efforts to understand, and even close, the male-female physician salary gap. Specifically, publicly available salary information may compel institutions or specific departments within institutions to serially assess progress toward reducing sex differences in salary. Relatedly, our linkage of administrative salary data to a broad range of clinical and research productivity measures of individual physicians that can be updated frequently and in an automated manner implies that sex differences in salary may be continually evaluated by departments and institutions.

A third implication of our study is that sex differences in salary varied considerably across specialties and institutions. Specialties such as orthopedic surgery, surgical subspecialties, obstetrics and gynecology, and cardiology had the largest absolute sex differences in salary, whereas radiology, family medicine, and emergency medicine had differences that were small in magnitude and not statistically significant. In a study[12] that used the same database of physician characteristics as the present study, radiology had among the smallest sex differences in full professorship of all specialties, which suggests the potential importance of evaluating specific specialties to understand the practices associated with improved male-female equity in academic medicine. Similarly, the variation in sex differences in salary across institutions underscores both the importance of institutional accountability and the potential role for interinstitutional initiatives to learn about practices that promote or undermine sex equity in physician compensation. Finally, because our findings were among physicians who are state employees of public medical schools, interest in reducing sex differences in salary should lie at the state level as well as at the school level.

A potential concern with our study was that we lacked information on faculty track or part-time status, which could confound sex differences in salary if women are more likely to enter lower-paying tracks or work part-time. Nonetheless, we adjusted for total Medicare payments, which should correlate with clinical volume after adjusting for clinical specialty and institution-specific fixed effects (which would adjust for interinstitutional variations in insurance case-mix and reimbursement patterns). Sex differences in clinical revenue are arguably as important to account for as information on full-time or part-time effort given that physicians with similar effort may differ in clinical revenue owing to differences in billing practices, volume, and procedural mix. However, our use of Medicare reimbursements as a proxy for clinical revenue and effort would not apply well to fields such as pediatrics or obstetrics.

In addition to the specific issue of sex differences in part-time status, it is possible that women and men may differ in their likelihood of being in research vs clinical tracks. To address the issue that women may be less likely to enter research tracks, which correlate with more rapid promotion and possibly higher salaries,[12,24] we demonstrated persistent sex differences in salary among faculty who were NIH-funded investigators and therefore more likely to be on research tracks and unlikely to be part-time. Finally, although part-time status is frequently endorsed as a reason for female academic physicians to have lower earnings and slower academic advancement than male physicians, part-time status arguably mediates much of its effect through decreased research productivity and clinical volume. Once these factors are accounted for, however, it remains unclear how large an independent residual effect the part-time status should have on sex differences in earnings. Nonetheless, we cannot exclude the possibility of part-time status as an unmeasured confounder.

Our study had several additional limitations. First, it is possible that reported incomes in some schools or states may exclude other payments to physicians (eg, incentive payments, grant income, and clinical income from sources other than states) and therefore not reflect the full salary. The extent to which this issue varies across schools and departments within schools is unknown. However, to reduce our estimated sex differences in earnings, these payments would have to be higher among women than men, which seems unlikely. Moreover, Medicare reimbursements, which we argue are a proxy for clinical revenue, were approximately $14 000 higher among men than women, suggesting that any incentive payments to physicians that are correlated with clinical revenue are unlikely to be higher among women than men. Therefore, our estimated sex differences in income are likely lower bounds of true salary differences.

Second, we examined only public medical schools because of the availability of salary data. Observed sex differences in salary may not generalize to private institutions. Nonetheless, the schools that we considered had wide geographic representation, and the proportion of male physician faculty at these schools was similar to that of all remaining US medical schools.

Third, although we took several steps to validate the accuracy of our physician-salary matches, matching errors may have occurred. However, to influence our findings, these errors would need to be correlated with physician sex, which is unlikely given that the proportion of male physician faculty in our sample mirrored the proportion of male physician faculty in US medical schools overall.

Fourth, our database of physician characteristics was externally developed, and data on publications, NIH funding, and clinical trial investigations were gathered through links to other databases. Although a previous study audited a randomly selected subset of the database to verify its accuracy,[12] we cannot exclude the possibility that the database contains errors. Nonetheless, to meaningfully affect the outcomes of this analysis, any errors in the primary data set would have to correlate with physician sex. Moreover, our sensitivity analyses confirmed persistent sex differences in salary among registered Doximity members, who presumably verified their profile information. Fifth, our database lacked information on physician race and ethnicity, which may influence earnings as well. Sixth, we lacked data on subspecialty training (eg, interventional cardiology and electrophysiology within the field of cardiology), which may confound our analysis. However, our adjustment for Medicare reimbursements would arguably capture differences in income stemming from procedural case-mix differences across specialties. Seventh, we lacked data on other graduate degrees that may influence salary (eg, PhD), although we would expect much of this effect to be mediated through our research productivity measures. Finally, despite extensive efforts to control for potential confounders, our results, like those of all observational studies, could be influenced by unmeasured variables (eg, sex differences in administrative or leadership positions, teaching, and committee service).

Conclusions

Among academic physicians in 24 US public medical schools, annual salaries of female physicians were substantially lower than those of male physicians after adjustment for a rich set of factors that influence salary. Nearly 40% of the unadjusted difference in mean salaries between men and women remained unexplained after adjustment for these potential confounders. Our use of publicly available state employee salary data highlights the importance of physician salary transparency to efforts to reduce the male-female earnings gap.

ARTICLE INFORMATION

Accepted for Publication: April 11, 2016.

Published Online: July 11, 2016. doi:10.1001/jamainternmed.2016.3284.

Author Contributions: Dr Jena had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: All authors.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Jena, Olenski.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Jena, Olenski.
Obtained funding: Jena.
Administrative, technical, or material support: Blumenthal.
Study supervision: Jena, Blumenthal.

Conflict of Interest Disclosures: None reported.

Funding/Support: Funding was received through grant 1DP5OD017897-01, an Early Independence Award from the National Institutes of Health (Dr Jena).

Role of the Funder/Sponsor: The National Institutes of Health had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

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