Practice composition and sex differences in physician income: observational study

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ABSTRACT

OBJECTIVE

To assess whether differences in income between male and female physicians vary according to the sex composition of physician practices.

DESIGN

Retrospective observational study.

SETTING

US national survey of physician salaries, 2014-18.

PARTICIPANTS

18 802 physicians from 9848 group practices (categorized according to proportion of male physicians ≤50%, >50-75%, >75-90%, and >90%).

MAIN OUTCOME MEASURES

Sex differences in physician income in relation to the sex composition of physician practices after multivariable adjustment for physician specialty, years of experience, hours worked, measures of clinical workload, practice type, and geography.

RESULTS

Among 11 490 non-surgical specialists, the absolute adjusted sex difference in annual income (men versus women) was $36 604 (£29 663; €32 621) (95% confidence interval $24 903 to $48 306; 11.7% relative difference) for practices with 50% or less of male physicians compared with $91 669 ($56 587 to $126 571; 19.9% relative difference) for practices with at least 90% of male physicians (P=0.03 for difference). Similar findings were observed among surgical specialists (n=3483), with absolute adjusted sex difference in annual income of $46 503 ($42 198 to $135 205; 10.2% relative difference) for practices with 50% or less of male physicians compared with $149 460 ($86 040 to $212 880; 26.9% relative difference) for practices with at least 90% of male physicians (P=0.06 for difference). Among primary care physicians (n=3829), sex differences in income were not related to the proportion of male physicians in a practice.

CONCLUSIONS

Among both non-surgical and surgical specialists, sex differences in income were largest in practices with the highest proportion of male physicians, even after detailed adjustment for factors that might explain sex differences in income.

WHAT IS ALREADY KNOWN ON THIS TOPIC

Differences in income between male and female physicians are well known

The relation between workplace diversity and sex differences in physician income has not been investigated, despite evidence in other industries that greater sex diversity is associated with reduced sex differences in income

WHAT THIS STUDY ADDS

Sex differences in income were present across all specialties and among both non-surgical and surgical specialists

Sex differences in income were largest in practices with the highest proportion of physicians who were male, even after adjustment for factors that might explain sex differences in income

Introduction

Differences in income between male and female physicians are well known. Among physicians overall, sex differences in income persist even after adjustment for specialty choice, hours worked, years of experience, and family structure.[1-9] Among academic physicians, sex differences in income persist after adjustment for factors such as age, marital status, race, years of experience, specialty, work hours, research productivity, and faculty rank.[10-16] Differences in income are not supported by differences in clinical quality.[17-20]

Although multiple factors influence sex differences in physician income, one area that has received little empirical investigation is the role of sex diversity in the workplace. Outside of healthcare, increased workplace sex diversity, a reduction in occupational segregation, and an increase in the proportion of female managers has been associated with reduced sex differences in income and smaller sex based wage gaps.[21 22] Workplace diversity has been linked to greater worker productivity,[23] and sex diversity has been linked to large productivity gains in knowledge intensive industries.[24]

Within healthcare, greater representation of female physicians could also be associated with reduced sex differences in income. For example, female physicians are less likely to have mentors than their male counterparts, partially because of a difficulty in identifying mentors and an underrepresentation of female mentors in leadership positions, which might limit career advancement and contribute to sex differences in income.[25 26] Salary and other job negotiations might also be more challenging for female physicians in instances when the composition of employers is overwhelmingly male.

Whether greater sex diversity in physician practices is associated with reduced sex differences in physician income is unknown. Using uniquely linked salary and practice composition data on nearly 19 000 physicians between 2014 and 2018, we analyzed whether the sex composition of physician group practices was associated with sex differences in physician income, hypothesizing that sex differences in income might be larger in heavily male dominated practices than in those with a more equal distribution of male and female physicians, even after adjusting for physician

specialty, years of experience, hours worked, measures of clinical workload, and geography.

Methods

Physician compensation in the US

US physicians are typically compensated in one of several ways: fully salaried, fully tied to clinical revenue that is generated, or some combination of the two. In publicly funded clinics, compensation is typically set by a fixed salary, which might vary with years of experience, clinical specialty, local market rates, and other factors. In privately owned organizations, including for profit and not-for-profit hospitals and group practices, compensation might be set by either a fixed salary, according to clinical revenue that is generated, or a combination of the two. For example, in academic and non-academic settings it is possible that physicians have a fixed salary on top of which bonuses could be paid that are a function of the amount of clinical revenue that a physician generates through either the types or number of procedures performed or the number of patients seen. Similarly, in private practice settings, a fixed salary plus bonus structure could occur or compensation that is completely tied to clinical revenue. An additional factor that influences income is that some physicians own partnership interest in practices such that their total income also includes compensation for overhead costs (sometimes called facility fees). Negotiations that occur between physicians and the employing practices might concern the time required to gain partnership and the monetary amount required for investment. With the exception of settings when the salary is publicly determined and additional negotiation is not possible, sex differences in income might arise across physicians owing to differences in underlying compensation negotiations.

Physician characteristics, income, and group practice composition

We obtained data on physician characteristics from Doximity, an online platform for physicians. The platform includes more than one million members and more than 70% of US physicians.[27] Doximity has collected information on physician characteristics for both registered members and non-registered physicians through multiple sources and data partnerships, including the National Plan and Provider Enumeration System (NPPES), National Provider Identifier Registry, the American Board of Medical Specialties, state licensing boards, specialty societies, and collaborating medical schools and hospitals. The database includes information on physician age, sex, specialty, medical school attended (name and type of training, ie, allopathic or osteopathic), years in practice, and practice location. Details and validation of the database are described elsewhere.[17 28-32]

We obtained data on annual incomes from Doximity, which since 2014 has conducted an ongoing survey of physician income.[33] Since 2014, 102 129 physicians have completed the compensation survey, providing information on annual income, practice type (eg, hospital or group practice), and average hours worked each week. After limiting responses to full time physicians with valid national provider identifiers and limiting to the 2014-18 period of our data on physician practice structure, 68 099 physician responses overlapped. Income was reported in categories with increments of $5000 (£4057; €4445) between $40 000 and $250 000 and increments of $25 000 between $250 000 and $1 000 000. We linked income to data on physician characteristics using each physician's national provider identifier. In all analyses, we modeled income as a continuous variable, in which the specific income for a physician was the top value within each income category.

Information on practice composition was obtained for 2014-18 from the SK&A office based physicians' database provided by IQVIA, a commercial database of healthcare providers[34 35] that provides a nearly complete sampling frame of US office based physicians (>95% coverage according to IQVIA).[36] A group of academic researchers concluded the database captures about 75% of US physicians.[37] Data in the SK&A database are collected through a national survey of physicians and their group practice affiliations. The database contains unique practice identifiers for each physician, which we used to link individual physicians with available information on salary to other physicians in the same practice group or system using physician national provider identifier. Not all physicians with income data were surveyed in the SK&A database and vice versa. Because some physicians might report several practice affiliations, we used the primary affiliation reported in the SK&A database to link physicians to groups.

Statistical analysis

Our goal was to study whether differences in income between male and female physicians were related to the sex composition of groups in which these physicians practice.

Analysis was limited to groups with a minimum of five physicians (see supplemental file for sensitivity analysis without this cut-off) and to physicians who reported practicing full time and working at least 40 hours a week. Overall, 18 802 physicians (from 9848 group practices) were in both the compensation and the SK&A databases and met the inclusion criteria. We divided physicians into three specialty categories—primary care physicians, non-surgical specialists (eg, cardiologists, radiologists), and surgical specialists (eg, general and orthopedic surgeons). The supplemental file includes a flow diagram and detailed specialty list.

For each physician with information on income, we used SK&A data to compute within each group the share of physicians who were male. Then, within each of the specialty categories and for physicians overall, we categorized practices into four groups based on the proportion of male physicians (≤50%, >50-75%, >75-90%, and >90%). These categories approximately corresponded to quarters among physicians overall and were selected to be the same across specialty groupings for ease of interpretation. To allow for a non-

linear relation between the per cent of physicians in a practice that are male and sex differences in income, we modeled the sex composition of practices as a categorical variable.

Multivariable models were used to examine differences in income between male and female physicians across groups of varying male practice share. We estimated a multivariable generalized linear model with a log link and gamma distributed error term of physician income (dependent variable) as a function of physician level covariates, including years since medical school graduation, number of hours worked a week, and the annual amount billed to Medicare during 2014 to 2016, obtained from the Centers for Medicare and Medicaid Services, the last two variables accounting for potential physician sex differences in hours worked and clinical workload; indicator variables for each physician's detailed specialty; practice covariates, including number of physicians in the practice and an indicator variable for whether the practice was owned by a hospital or health system; metropolitan statistical area indicator variables to adjust for time invariant geographic factors that might be associated with sex differences in physician income; and an interaction term between the category of the male physician practice share and an indicator variable for female physician. The model estimated the average, adjusted difference in income between male and female physicians in each of four categories of practice share by male physician. To allow for a non-linear relation with sex differences in income, we treated the practice share by male physicians as a categorical variable. Log link models were chosen to account for known skewness in income,[38] and we calculated adjusted sex differences in income using the marginal standardization form of predictive margins.[39] Robust standard errors were clustered at the practice level.

Our analysis involved a between practice rather than a within practice statistical design, such that we compared sex differences in physician income between male and female physicians working in different practices that varied in proportion of male physicians rather than within the same practice. Although a within practice study design would adjust for practice invariant characteristics that are correlated with both overall salaries and male physician practice share, such a design was not possible given the limited number of physician practices with available information on salary for both male and female physicians.

Sensitivity analyses

We conducted several sensitivity analyses. First, we estimated models in which the share of male physicians in a practice was treated as a continuous, rather than a categorical, variable. Second, we estimated models using multivariable linear regression rather than a generalized linear model. Third, a concern with our empirical approach is that female physicians who are selected for predominantly male practices might differ in unobserved ways that are correlated with income compared with female physicians who are selected for predominantly female practices (eg, they might not have children or might have different work preferences), even after accounting for the variables described previously.[40] In this case, the relation between the share of male physicians in a practice and sex differences in physician income would be biased by unmeasured confounders. To tackle this concern, we performed two tests. First, we weighted the sample to be representative of the US physician workforce (see supplemental file for methods). Second, we estimated sex differences in physician income according to male practice share without adjusting for other physician or practice covariates (ie, an unadjusted analysis), under the assumption that the observed covariates in our model would likely be correlated with any unmeasured confounders. Finding a similar adjusted and unadjusted relation between sex differences in physician income and the proportion of male physicians in a practice might suggest that unmeasured confounding is unlikely to be important. A similar concern is that adjusting for Medicare patient workload might capture differences in patient composition between patients with public insurance coverage and those with private sources of insurance coverage, which given the structure of physician payments in the US could account for observed differences in income. We therefore conducted a sensitivity analysis that excluded the Medicare workload covariate from the multivariable regression. Finally, we estimated separate models for physicians employed by academic and non-academic institutions, under the assumption that sex differences in income might be smaller for academic physicians.

Analysis was performed using Stata, version 16.

Patient and public involvement

No patients were involved in setting the research question or the outcome measures, nor were they involved in developing plans for design or implementation of the study, primarily because of author resource constraints in soliciting this input, the statistical methodology and software required for answering the research question, and the proprietary nature of the secondary data.

Results

Characteristics of study population

Overall, 18 802 physicians were analyzed, of whom 3829 (20.4%) were primary care physicians, 11 490 (61.1%) were non-surgical specialists, and 3483 (18.5%) were surgical specialists (table 1). The mean annual income was $376 223 ($252 872 among primary care physicians, $374 774 among non-surgical specialists, and $516 608 among surgical specialists).

The mean number of physicians in a group was 18.1 for primary care physicians, 24.0 for non-surgical specialists, and 20.3 for surgical specialists (see supplemental figure S2 for distribution of group size). Mean years since graduation from medical school were similar across specialty categories (primary care

Table 1 | Characteristics of study population, 2014-18. Values are percentages (numbers) unless stated otherwise

Characteristics	Primary care physicians (n=3829)	Non-surgical specialists (n=11 490)	Surgical specialists (n=3483)
Mean (SD) income ($)	252 872 (89 455)	374 774 (164 064)	516 608 (216 991)
Median (interquartile range) income ($)	274 99 (224 999-324 999)	399 999 (299 999-499 999)	499 999324 999-674 999
Women	33.6 (1286)	22.7 (2710)	9.2 (320)
Mean (SD) practice size (No of physicians)	18.1 (−33.3)	24.0 (−48.3)	20.3 (−47.8)
Practice size (No of physicians):			
5-10	57.8 (2210)	46.2 (5304)	58.9 (2050)
11-20	21.3 (817)	26.4 (3036)	23.7 (827)
>20	20.9 (802)	27.4 (3150)	17.4 (606)
Mean (SD) Medicare allowed amount, total ($)	73 798 (79 523)	136 991 (278 009)	131 931 (142 370)
Mean (SD) years since medical school graduation	20.8 (10.1)	22.5 (9.9)	21.4 (9.7)
Mean (SD) weekly hours worked	53.8 (11.5)	58.7 (12.2)	65.3 (13.3)
Census region:			
North east	19.6 (750)	22.9 (2631)	21.4 (745)
Midwest	23.5 (900)	23.7 (2723)	23.9 (832)
South	32.0 (1225)	32.3 (3711)	33.8 (1177)
West	24.9 (953)	21.1 (2424)	20.9 (728)

$1.00 (£0.81; €0.89).
2014-18 data were from Doximity, 2014-18 data from SK&A office based physicians' database (now IQVIA), and 2014-16 data from Centers for Medicare and Medicaid Services' Medicare physician and other supplier data. Primary care physician specialties included: family medicine (n=1362), geriatric medicine (n=153), internal medicine (n=1194), medicine/pediatrics (n=84), occupational medicine (n=13), other allopathic/osteopathic medicine (n=17), pediatric emergency medicine (n=958), pediatric medicine (n=30), and preventive medicine (n=5). Surgical specialists included: colon and rectal surgery (n=84), general surgery (n=687), neurosurgery (n=277), oral and maxillofacial surgery (n=3), orthopedic surgery (n=1111), plastic surgery (n=131), thoracic surgery (n=176), urology (n=363), and vascular surgery (n=183). Physicians with specialties not already listed were considered non-surgical specialists. The five largest specialties among non-surgical specialists were anesthesiology (n=1481), cardiology (n=1204), radiology (n=989), obstetrics and gynecology (n=907), and psychiatry (n=402).

physicians, 20.8 years; non-surgical specialists, 22.5 years; surgical specialists, 21.4 years). On average, physicians reported working 58.9 hours a week, with primary care physicians reporting working on average 53.8 hours a week compared with 58.7 hours for non-surgical specialists and 65.3 hours for surgical specialists.

Distribution of male physicians across group practices

Among primary care physicians, on average 66.4% of physicians were male (fig 1) and 32.4% worked in practices with 50% or less of men, 47.8% in practices with >50-75%, 15.0% in practices with >75-90%, and 4.8% in practices with at least 90%. Among non-surgical specialists, on average 77.3% of physicians were male and 14.3%, 38.0%, 30.2%, and 17.5% worked in practices with 50% or less, >50-75%, >75-90%, and at least 90% of male physicians, respectively. Among surgical specialists, on average 90.8% of physicians were male and the respective practice shares were 2.0%, 18.7%, 34.9%, and 44.4%.

Practice composition and sex differences in physician income

Mean annual income was larger among male physicians, even after adjustment for covariates (unadjusted income for men $402 540, and for women $285 121, difference $117 419; adjusted income for men $394 139, and for women $314 269, difference $79 871 (95% confidence interval $78 126 to $81 615).

The relation between sex differences in income and the share of physicians in a practice who were male varied according to specialty (fig 2). For example, among primary care physicians, women reported lower income than men, but no relation was observed between sex differences in adjusted income and the share of physicians in a practice who were male (fig 2, panel A). Among non-surgical specialists and surgical specialists, however, sex differences in adjusted income were largest in practices with a high share of male physicians. For instance, among non-surgical specialists (fig 2, panel B), the adjusted sex difference in income was $36 604 (95% confidence interval $24 903 to $48 306) for practices with 50% or less of male physicians (11.7% relative difference), $40 653 ($33 418 to $47 889) for practices with >50-75% (12.6% relative difference), and $29 901 ($17 107 to $42 695) for practices with >75-90% (7.3% relative difference), compared with $91 669 ($56 587 to $126 751) for practices with at least 90% of male physicians (19.9% relative difference). In a test of interactions, sex differences in income were significantly different for practices with at least 90% of male physicians compared with practices with 50% or less, >50-75%, and >75-90% (P<0.01, P=0.01, and P<0.01, respectively).

Among surgical specialists, sex differences in income also increased with the proportion of male physicians in a practice (fig 2, panel C). The adjusted sex difference in income was a non-statistically significant $46 503 (−$42 198 to $135 205) for practices with 50% or less of male physicians (10.2% relative difference), $44 666 ($13 659 to $75 763) for practices with >50-75% (9.3% relative difference), and $76 958 ($49 060 to $104 858) for practices with >75-90% (15.1% relative difference), compared with $149 460 ($86 040 to $212 880) for practices with at least 90% of male physicians (26.9% relative difference). In a test of interactions, sex differences in income were significantly different in practices with at least 90% of male physicians compared with practices with 50% or less, >50-75%, and >75-90% (P=0.06, P=0.03, and P=0.04, respectively).

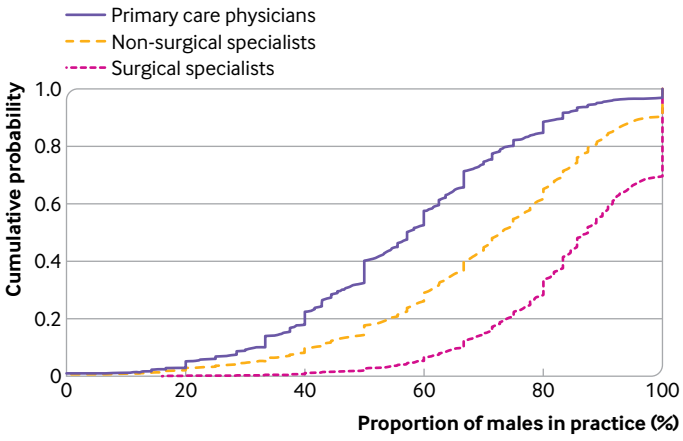

Fig 1 | Distribution of practices according to proportion of male physicians, by specialty. 2014-18 data from SK&A office based physicians' database (now IQVIA)

Sensitivity analyses

Similar findings were observed when we treated the share of male physicians in a practice as a continuous variable and estimated multivariable linear models. Findings were also unchanged by using alternative thresholds of group practice size, weighting results to be representative of the US physician population, comparing academic and non-academic physicians, and excluding the Medicare clinical workload covariate. Finally, similar findings were observed when comparing unadjusted and adjusted relations between male practice share and sex differences in income, an analysis intended to examine potential bias due to unmeasured confounders (see supplemental file).

Discussion

In this study we linked data on physician salaries to the sex composition of group practices and found that among non-surgical and surgical specialists, sex differences in income were largest in those practices with the highest proportion of male physicians, a pattern that was present even after adjustment for full time status, hours worked, measures of clinical workload, years in practice, practice ownership, and geography.

The sex differences in specialist income that were observed in predominantly male practices were large. For example, among surgical specialists who worked in practices with at least 90% of male physicians, male physicians earned $149 460 more a year than female physicians (relative difference 26.9%), even after adjustment for full time status, hours worked, measures of clinical workload, years in practice, practice ownership, and geography. In contrast, among surgical specialists who worked in practices with 50% or less of male physicians (ie, the sex distribution of physicians was more equal), male physicians earned $46 503 more a year than female physicians (relative difference 10.2%).

Among surgical specialists, 22% of the difference in income between male and female physicians was explained by differences in the sex composition of the practices. In other words, if sex differences in income were held at the level observed for practices with 50% or less of male physicians, the overall income gap for female physicians that has been observed in other studies would be 22% lower, if our findings are causal. Similarly, among non-surgical specialists, 7% of the difference in income between male and female physicians was explained by sex differences in income based on the practice share of male physicians.

The observation that sex differences in specialist income were largest in predominantly male practices could be due to several factors. First, residual confounders might be correlated with both practice choice and sex differences in income, even after adjusting for specialty, full time status, hours worked, measures of clinical workload, years in practice, practice ownership, and geography. However, these unmeasured confounders would not only need to differ between men and women but would need to differ between the women who practice in predominantly male versus more balanced groups.

Second, our findings could be partly explained by implicit or explicit bias against women in predominantly male practices. Substantial evidence shows that bias exists, including female physicians being less likely to be referred to as a doctor,[41] and among academic physicians, disparities in promotion, receipt of large grants, start-up packages, mentor involvement, and leadership opportunities.[28 42-44] More than 30% of female physicians also report having experienced sexual harassment or sex discrimination.[45 46] It is possible that the large sex differences in specialist income that we observed in predominantly male practices partly stems from these systemic issues.

Third, our findings could be explained by differences in how female specialists in predominantly male practices negotiate income. In many group practices, income has a variable component that is not fully linked to clinical workload, which could lead to sex differences in income if bargaining power is lower among female physicians working in predominantly male practices. Even in practices where income is closely tied to clinical workload, partnership opportunities (the probability of partnership, cost of becoming a partner, and time to partnership) might differ between male and female physicians, and those differences might be larger in predominantly male practices. Future work should examine the extent to which physician compensation structure leads to the observed disparities.

Fourth, previous work has suggested that women in predominantly male practices might receive fewer patient referrals, or receive referrals for less profitable patients.[47] Although our analysis adjusted for each physician's total Medicare billing, we were unable to adjust for billing to commercial payers or patient profitability. Examining the patient impacts of differential referral patterns that potentially lead to differences in compensation is important for future studies.

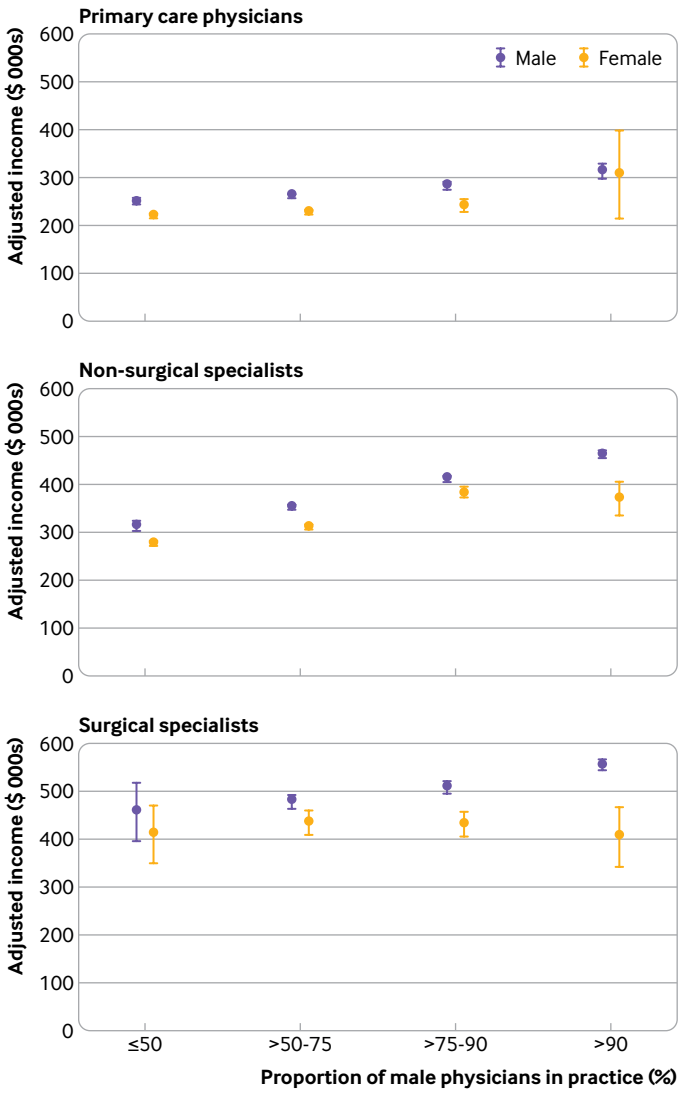

Fig 2 | Sex differences in adjusted income according to proportion of male physicians in a practice, by specialty. 2014-18 data from Doximity, 2014-18 data from SK&A office based physicians' database (now IQVIA), and 2014-16 data from Centers for Medicare and Medicaid Services' Medicare physician and other supplier data. Figure plots adjusted incomes of male physicians and female physicians according to proportion of male physicians in a practice. Adjusted incomes were obtained from a generalized linear model of income as a function of physician, practice, and geographic characteristics, estimated separately for each specialty type. Whiskers represent 95% confidence intervals

Implications of the findings

Our findings have several implications. If causal, our findings suggest that for specialist physicians, group composition could be an important determinant of differences in income between male and female physicians. In particular, increasing diversity and representation of women within groups could reduce disparities in compensation between men and women. Moreover, the large contribution of sex differences in income in predominantly male practices to the overall difference in income between male and female specialist physicians also suggests that policies to increase the representation of women in medicine could reduce sex differences in income as practices achieve more sex balance. From the individual physician perspective, our results, if causal, suggest that female specialists might benefit financially from working in practices with a larger proportion of female colleagues. Female specialists who work in predominantly male practices might also benefit from salary transparency or access to salary benchmarks to ensure that their compensation aligns with that of their male counterparts. Additional studies are needed to assess whether salary transparency might lessen the compensation gap for female physicians.

Limitations of this study

Our study has limitations. First, as the study was observational, unmeasured confounders could be correlated with both practice choice and sex differences in income. Physicians self-select into groups and it is possible that female specialists with lower earnings expectations self-select into predominantly male groups. However, we observed similar findings in both unadjusted and adjusted analyses, suggesting that unmeasured confounding might be less likely to the extent that confounders, if present, would be expected to be correlated with observed physician covariates. We also observed similar relations when excluding adjustment for Medicare clinical workload, suggesting that our findings were not explained by differences in patient composition. Second, income data were self-reported and might be subject to measurement error. Relatedly, because income data were self-reported it is possible that male physicians over-estimated annual income compared with female physicians. This should not affect our analysis if any sex differences in income estimation do not vary according to the sex composition of physicians' practices. Third, our income data, although the largest of its kind to date and geographically diverse, were not nationally representative. However, any differences in mean income compared with nationally representative income data should not bias an analysis of how sex differences in income vary according to the predominance of male physicians in a practice. In addition, in our sensitivity tests we observed similar results when weighting the sample to be nationally representative. Fourth, our analysis could not identify the mechanisms behind larger sex differences in specialist income in practices that were predominantly male. Fifth, our approach to classifying the sex composition of practices was based on the count of male and female physicians within a practice, as opposed to the share of total full time equivalents, represented by male versus female physicians (eg, a practice with a one full time equivalent male physician and four 0.25 full time equivalent female physicians was classified as one fifth male as opposed to one half male based on full time equivalents).

Conclusions

When we linked data on physician salaries to the sex composition of group practices, we found that among non-surgical and surgical specialists, sex differences

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in income were largest in those practices that were predominantly male, even after adjustment for factors that might explain sex differences in income. Our findings are consistent with the hypothesis that greater diversity in the workplace could help to deal with disparities in income.

Contributors: All authors contributed to the design and conduct of the study, data collection and management, analysis and interpretation of the data; and preparation, review, or approval of the manuscript. ABJ supervised the study and is the guarantor. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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Ethical approval: This study was approved by the institutional review boards at Harvard Medical School and at Rand.

Data sharing: No additional data available.

ABJ affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies are disclosed.

Dissemination to participants and related patient and public communities: The results of this work will be disseminated to the public through institutional press release, ensuing news articles, and an opinion piece authored by the study's authors that describe the study's findings for the public.

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Supplementary information: figures S1 and S2 and tables S1-S10