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TITLE: Gender-based pay differences in academic medicine reside in discretionary pay

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Abstract

Objectives: Previous studies demonstrate women faculty within academic medicine are paid less than their men counterparts. To close the wage gap in academic medicine, it is critical to know where this disparity originates. The primary objective was to evaluate differences in pay based on gender, rank and research productivity for three academic medical specialties with diverse gender distributions. The authors hypothesized that the wage gap would be largest outside of base pay across all ranks, even after accounting for rank and research productivity.

Design: This was a retrospective review of compensation for assistant, associate, and full professors during the year of 2016. Total compensation ("gross pay") was defined as regular pay plus "other" pay.

Setting: A publicly available database was used to collect information on gross pay, regular pay, "other" pay, and rank.

Participants: Archived online faculty profiles were reviewed to collect information on gender. Elsevier's SCOPUS was used to collect data on h-index, a measure of research productivity. Participants included 799 total faculty members, including 225 assistant, 200 associate, and 374 full professors from general surgery, obstetrics and gynecology, and radiology departments at six state-run, publicly funded academic medical centers in the western United States.

Results: Gross salary was significantly higher for men across all professorial ranks in both general surgery and obstetrics and gynecology. This disparity originates from gaps in "other" pay, as regular pay was not significantly different between men and women.

Conclusions: Further investigations should focus more on discrepancies in discretionary or "other" pay which may preferentially benefit men. No significant gender difference in gross

salary for radiology was found. Additional studies of radiology departments could identify ways in which it could serve as a model for gender-based salary structures for clinicians.

Strengths and limitations of the study

- This is a large population study assessing distribution of salary among three diverse disciplines based on their presumed gender distributions and distribution of the types of clinical work.
- Linear regression models were estimated to determine the relationship between specialty, gender, rank, h-index and income.
- We focus on only one set of state-based academic institutions from the west coast of the United States and so are unable to be certain whether our findings would generalize to private practices or to those in other parts of the country.
- We examined salaries from only three departments and therefore cannot be certain that other clinical specialties would follow similar patterns.
- Our data was obtained from websites only, we are unable to delve more deeply into the components of "other" salary beyond the general description that is offered publicly.

Introduction

The more education a woman has, the greater the disparity she will see in her wages.[1] This disparity is especially glaring for physicians and surgeons, with women earning about 72 cents for every dollar men earn.[2] Representation of women in medicine is increasing dramatically, however the gender income gap remains.[3] Women faculty have been shown to have lower salaries, smaller start-up packages, and limited authorship roles.[4,5] Despite the Equal Pay Act of 1963, this gap continues to exist across specialties, practice settings, work hours, and other characteristics,[6-10] and persists even after accounting for age, experience, specialty, faculty rank, and measures of research productivity and clinical revenue.[6-12] Commonly cited explanations for this gender gap include differences in negotiating skills, opportunities to join networks of influence within organizations, discrimination, and implicit and explicit bias.[6,7,9,13-15]

These issues span far beyond the medical setting. Despite making up almost half the workforce, women continue to earn less in nearly every single occupation for which there is sufficient earnings data to calculate an earnings ratio.[16] In general, the highest paid occupations have the largest wage gaps. According to the Institute for Women's Policy Research, it will take nearly 40 years for women to finally reach pay parity if changes continue at the current rate.[17] Persistent pay inequality has far-reaching economic consequences; providing equal pay would cut the poverty rate for all working women in half.[18]

There is an increasingly large body of evidence that gender not only impacts pay but also faculty rank and research productivity.[6-12] Gender disparities in faculty rank within academic medicine persist after accounting for age, years since completion of residency, specialty, scientific

authorship, National Institutes of Health (NIH) research funding, clinical trial participation, and clinical revenue.[9] In academic medicine specifically, there is a significant gender difference in rate and impact of publications, with women showing lower productivity than men in surgical specialties.[12]

In order to close the wage gap in academic medicine, we must be clear where in total compensation packages this disparity originates. Data suggests that gender differences in income can be attributed to the income gaps within specific occupations, not across occupations.[19] As such, we chose to focus this study on academic salary at a single time point, expecting to see differences in pay based on gender, faculty rank and h-index, a metric for evaluating the cumulative impact of an author's scholarly output and performance calculated by comparing number of publications to citations.[20] The primary objective of our study was to identify where in total compensation the wage gap originates by evaluating differences in pay based on gender, rank and research productivity for three diverse academic medical specialties. Our areas of interest – income, academic rank, and research productivity – are typical benchmarks for professional development.[21] Three diverse specialties – general surgery, obstetrics and gynecology, and radiology - were chosen, primarily because of their presumed gender distributions and distribution of the types of clinical work.[22] We hypothesized that women would earn significantly less gross pay across all ranks, even after accounting for rank and research productivity.

Methods

Study Design

This was a retrospective population study of total faculty compensation for assistant, associate and full professors at six major public academic medical centers using a single time point during 2016. We chose the time point of 2016 as it was the most recent year for which data was available at the time. Three diverse disciplines were examined: general surgery, obstetrics & gynecology, and radiology. General surgery is typically a male-dominated specialty, obstetrics and gynecology a female-dominated specialty, while radiology has a more equal gender distribution. There is also a diversity of clinical work throughout these three subspecialities with general surgery being dominated by surgical procedures, radiology not being surgical in nature, and obstetrics and gynecology with a more diverse balance of clinical work.[3,23] Ethics approval and consent to participate was waived by the Institutional Review Board of the Stanford University School of Medicine.

Study Population

988 total employees were assessed for eligibility (see **Figure 1**). 110 (11%) were excluded for having a role other than assistant, associate or professor. A further 79 (8%) were excluded because they were listed on the department website but not in the payroll database. After exclusions, our analysis included 799 faculty members, including 225 (28%) assistant, 200 (25%) associate, and 374 (47%) full professors. 312 (39%) were identified as women and 487 (61%) as men.

Patient and Public Involvement

How were the development of the research question and outcome measures informed by patients' priorities, experiences, and preferences?

No patients were involved in the study. For this research question, we had a publicly available data set of wages. Our research questions and outcome measures were developed to determine equity in participants wages. Although specifically priorities and preferences were not asked, it is an important question to identify any wage discrepancies.

How did you involve patients in the design of this study?

No patients were involved in the design of study

Were patients involved in the recruitment to and conduct of the study?

No patients were involved in the design of study

How will the results be disseminated to study participants?

Data are already available in a publicly shared website. The results of our analysis of this publicly available data will be disseminated by a publication of this manuscript.

For randomized controlled trials, was the burden of the intervention assessed by patients themselves? This was not a randomized control trial.

Total Compensation, Rank and Research Productivity

A publicly available database which contains all of the compensation information for faculty and employees at a large university system was used to look at total faculty compensation in three different ways: Gross Pay, Regular Pay, and Other Pay.[24] Gross Pay was defined as Regular Pay

plus Other Pay. Regular Pay was defined as Base Pay minus reductions due to participation in the voluntary Employee Reduction in Time and phased retirement programs. Other Pay (commonly referred to as "discretionary pay") was defined as negotiated additional pay for clinical care and research which was funded from earned clinical revenue as well as contracts and grants. This includes: pay for Summer Session or University Extension teaching, pay for research performed during summer months that is funded by extramural contracts and grants, performance-based incentive compensation and similar payments that recognize achievement of specific performance goals or exemplary service, pay for shift differentials (e.g., night or holiday call), payout of unused vacation leave upon separation, and lump sum payments made as part of the settlement of union bargaining agreements. Data on academic rank and specialty was collected from the same database. The internet archive service Wayback Machine[1] was used to collect data on gender from 2016 online faculty profiles at each department's website. Elsevier's SCOPUS was used to collect data on h-index. Faculty members' h-indexes were obtained using their full name, last name and first and middle initials, and/or maiden name when appropriate.

Statistical Analysis

Our data set consisted of 6 variables: (1) Department – a three-level categorical variable (surgery, obstetrics & gynecology, and radiology); (2) Rank - three-level categorical variables (assistant, associate, and full); (3) Gender; (4) h-index – a measure of publication output; (5) Regular Pay – i.e. salary; and (6) Other pay – e.g. bonuses, pay for extra work. Linear regression models were estimated to determine the relationship between these factors and income. Pay was

[1] The Internet Archive provides free access to over 20 years of web history accessible via the Wayback Machine: https://archive.org/web/

selected as our primary variable and gender, academic rank and h-index as secondary variables. Rank, gender, and h-index were treated as independent variables, whereas "regular pay" and "other pay" were treated as dependent variables. Because rank is a three-level categorical level, it was split into two dummy variables with "Full" as reference value. Three regression models were run per department: one to predict gross pay (regular pay plus other pay), one to predict regular pay, and one to predict other pay. Data was entered into SPSS version 20, with a *p* value of less than 0.05 considered to be significant.

Results

Overall, women represented 26% of general surgery faculty (n=126), 70% of obstetrics and gynecology faculty (n=106), and 34% of radiology faculty (n=80). Women also made up 51% of all assistant professors (n=115), 40% of associate professors (n=79), and 32% of full professors (n=118) (see **Table 1).** Distribution of gross pay, regular pay, and other pay stratified by gender and academic rank is presented in **Figure 2** and **Table 2.**

General Surgery

Distribution of pay for general surgery is presented in **Figure 3**. Within general surgery, the overall regression for gross pay was significant ($R^2 = .159, F(4, 299) = 14.123, p < .01$). Gender was significantly different with women earning lower gross salaries than men ($\beta = -84{,}970, p < 0.05$). Rank was not significantly different for gross pay; however, higher h-index was significantly associated with higher gross pay ($\beta = 5{,}023, p < 0.01$).

In an attempt to analyze what specifically drove the effect on gross pay, we ran an analysis on "regular pay" and "other pay" separately. In terms of regular pay, the overall regression was significant ($R^2 = 0.323, F(4, 299) = 35.737, p < 0.01$). However, gender was not significantly associated with regular pay with men and women receiving similar regular salaries. Unsurprisingly, rank was associated with regular salary, with assistant professors ($\beta = -51{,}031, p < .01$) and associate professors ($\beta = -40{,}680, p < 0.01$) earning significantly less regular pay than full professors. Higher h-index was also significantly associated with higher regular pay ($\beta = 1{,}606, p < .01$).

For "other pay", the overall regression was significant ($R^2 = 0.096, F(4{,}299) = 7.900, p < 0.01$). Furthermore, gender was significantly associated with "other pay" ($\beta = -79{,}467, p < 0\ .05$) with women earning significantly less of this salary component than men. There was no difference in rank in "other pay". Higher h-index was significantly associated with "other pay" ($\beta = 3{,}418, p < 0.01$).

Obstetrics and Gynecology

Distribution of pay for obstetrics and gynecology is presented in **Figure 4**. For obstetrics and gynecology, the overall regression for gross pay was significant ($R^2 = 0.068, F(4, 174) = 3.172, p < 0.05$). There was a significant difference in gender, with women earning less gross pay than men ($\beta = -84{,}221, p < 0.02$). Rank was not found to be significantly different for gross pay for either assistant or associate professors compared to full professors. H-index was also not significantly associated with gross pay.

For regular pay, the overall regression was significant ($R^2 = 0.485, F(4, 174) = 40.986, p < 0.01$). There was no significant difference between women and men in regular pay. Rank was associated with regular pay, with both assistant ($\beta = -52{,}696, p < 0.01$) and associate professors ($\beta = -36{,}711, p < 0.01$) earning significantly less than full professors. H-index was also significant ($\beta = 1{,}314, p < 0.01$), with higher h-index linked to higher regular pay.

For "other pay", the overall regression was not significant ($R^2 = .037, F(4, 174) = 1.666, n.s.$). However, there was a significant difference in gender, with women earning less other pay than men ($\beta = -74{,}168, p < 0.05$). There were no significant differences in "other pay" for the variables of rank or h-index.

Radiology

Distribution of pay for radiology is presented in **Figure 5**. Within radiology, the overall regression for gross pay was not significant ($R^2 = 0.01, F(4{,}266) = .591, n.s.$). No factors showed any significant association with gross pay.

In terms of regular pay, the overall regression was significant ($R^2 = 0.395, F(4{,}265) = 43.293, p < 0.01$). However, gender was not significantly associated with regular pay as men and women earned similar base salaries. Significant differences in regular salary by rank were identified with assistant professors ($\beta = -52{,}145, p < 0.01$) and associate professors ($\beta = -43{,}848, p < 0.01$) earning significantly less regular pay than full professors. Higher h-index was also significantly associated with higher regular pay ($\beta = 979, p < 0.01$).

For "other pay", the overall regression was significant ($R^2 = 0.064, F(4, 266) = 4.567, p < 0.01$); however, there was no significant association between gender and "other pay". Rank was also not associated with "other pay". H-index was significantly associated with "other pay" ($\beta = -947, p < 0.05$), with a higher h-index linked to lower "other pay".

Discussion

Our results show that while there are significant differences in gross pay for women faculty in general surgery and obstetrics and gynecology, it is not "base" or regular pay that accounts for the income gap between women and men. Instead, other components of income, classified in our data as "other pay," appear to contribute to acknowledged differences in salary between female and male faculty members within our target institutions. In our review of publicly available salary data,[24] women faculty within the departments of general surgery and obstetrics and gynecology earned almost $75,000 less than their men colleagues. This "other pay" is described as coming from additional clinical responsibilities such as call pay as well as support for administrative work or leadership positions.[24] These findings echo the work of the economist Claudia Goldin who has described the gender pay gap in a variety of professions as being related not to differences in "base" pay but rather to differences related to flexibility or amount of work that is taken on by women versus men.[25,26]

Previous studies offer many theories to explain the gender gap, including women are less likely to be asked to serve as leaders, experience effective mentoring, receive equitable allocation of research funding, and seek additional call hours or clinical work in favor of different household and childrearing obligations.[3,27] Women faculty who work flexible hours may be less likely than

men to receive leadership positions that result in bonus salary.[27] In fact, faculty who need a more flexible work schedule remain as junior faculty and receive less support.[28] These circumstances help to explain our findings the lower "additional" or "other" pay for women faculty within the two specialties. One solution is to alter promotion policies to better support the diversity of needs.[28] Additional solutions can be found in the NIH's Gender Inequality Task Force Report.[29]

Interestingly, the gender gap for "other" pay in our study was true within obstetrics and gynecology, despite the fact that women comprise a majority of faculty members within this specialty. Furthermore, no gender gap was identified for the department of radiology, despite its male predominance. This finding suggests that the gender distribution of the department alone does not necessarily guide pay discrepancies between women and men faculty members. Instead, it seems that other factors, such as the nature of the clinical work itself, may contribute to the gender salary gap.[27] It has been acknowledged in previous studies that surgical subspecialties are highly technical and predominantly occupied by men, and often times men are among the highest paid with roles as researchers, opposed to women within these specialties occupying lower status communal roles as educators.[27] For instance, no gender differences were noted for any portion of salaries within the radiology departments which we examined in this study. Radiology clinical work differs from that of other specialties in that it is predominantly shift-based and less procedural than general surgery and obstetrics and gynecology. Radiology may thereby offer fewer opportunities for gender-based increases to "other pay" which might be earned through additional clinical work.

Our findings also validate previous studies finding striking gender inequities in the higher academic ranks.[12] Common explanations for these gender differences include the gender-based hiring disparities of previous generations, lack of transparency of salary, promotion, mentoring and female role-models, and time away for childbearing and family obligations.[27,28,30] There is also recent evidence that women physicians might start their career with lower salary expectations than men, which could become a self-fulfilling prophecy for later pay.[27,31] Furthermore, there is some indication that women prioritize salary less than men do and are judged more harshly for initiating negotiations.[6,27]

In summary, gender disparities have been well documented in academic medicine, and our study offers a unique perspective of the different components that make up the academic medicine physician salary. Previous studies have offered suggestions to improve this disparity, which will be important for closing this "other" pay gap. Suggestions include transparency of starting salaries to young professionals, initiating negotiation training to improve starting salary packages, mentorship in career advancement for women junior faculty, investigation of research grant award processes, and further adoption of programs to address disparities in grant award processes.[28] Implementation of a university-wide objective compensation planned implemented by the Association of American Medical Colleges regional median salary (AAMC-WRMS) was associated with reduced gender-based differences in salary among surgery faculty within the institution and a statistically significant increase in salary among female faculty. Objective compensation plans may mitigate gender-based implicit bias in salary negotiations and promotions.[32]

Limitations

Our study has several limitations. First, we focus on only one set of state-based academic institutions from the west coast of the United States and so are unable to be certain whether our findings would generalize to private practices or to those in other parts of the country. Furthermore, we examined salaries from only three departments and therefore cannot be certain that other clinical specialties would follow similar patterns. However, the departments were chosen to accurately reflect a set of departments with a diverse set of gender distribution and clinical work. Finally, since our data was obtained from websites only, we are unable to delve more deeply into the components of "other" salary beyond the general description that is offered publicly.

Conclusion

In sum, our study observed the trends of salary within three clinical specialties at state-run, publicly funded academic institutions. For this sample, gender differences were most notable in the fields of general surgery and obstetrics and gynecology. We suggest that further investigations should focus less on gender inequities of base salary, which may not be relevant to clinical faculty in academic settings as they are institutionally set to be independent of gender, and more on discrepancies in discretionary or "other" pay which may preferentially benefit men. With closer analysis, we might be able to achieve a better understanding of whether women are not receiving their full earning potential or, as has been suggested in the economic literature,[25,33] whether they are instead prioritizing flexibility in work hours over compensation. Finally, with our observation that the gender salary gap might not be as prominent within the field of

radiology, additional studies of this specialty could identify ways in which it could serve as a model for gender-based salary structures for clinicians.

Figure 1. Participant Exclusions. Participants included 799 faculty members. 988 institution employees were assessed for eligibility. 189 were excluded for having a non-professorial, full-time role. A further 79 were excluded for only being listed on the department website, not being on 2016 payroll.

Figure 2. Overall Pay. Distribution of gross pay (A), regular pay (B) and "other pay" (C) of women and men in general surgery, obstetrics and gynecology, and radiology departments stratified by academic rank.

Figure 3. General Surgery Pay. Distribution of gross pay (A), regular pay (B) and "other pay" (C) of women and men in general surgery stratified by academic rank.

Figure 4. Obstetrics and Gynecology Pay. Distribution of gross pay (A), regular pay (B) and "other pay" (C) of women and men in obstetrics and gynecology stratified by academic rank.

Figure 5. Radiology Pay. Distribution of gross pay (A), regular pay (B) and "other pay" (C) of women and men in radiology stratified by academic rank.

Table 1. Demographic data for women and men faculty by institution and department at six academic institutions in 2016.

Institution	*Department*	*Total*	*Assistant*		*Associate*		*Professor*	
			W[1]	M[2]	W	M	W	M
Institution 1		121						
	Surgery	52	6	9	1	12	5	19
	Ob/Gyn	26	10	1	4	2	5	4
	Radiology	43	5	8	3	3	6	18
Institution 2		77						
	Surgery	32	5	3	4	7	0	13
	Ob/Gyn	22	4	1	8	1	4	4
	Radiology	23	0	3	2	7	5	6
Institution 3		175						
	Surgery	70	5	7	4	18	4	32
	Ob/Gyn	40	17	3	4	3	5	8
	Radiology	65	9	16	4	12	9	15
Institution 4[3]		15						
	Surgery	0	0	0	0	0	0	0
	Ob/Gyn	15	9	1	2	0	2	1
	Radiology	0	0	0	0	0	0	0
Institution 5		168						
	Surgery	72	5	12	7	14	8	26
	Ob/Gyn	27	3	0	4	0	8	12
	Radiology	69	2	9	8	7	9	34
Institution 6		243						
	Surgery	79	5	12	10	13	11	28
	Ob/Gyn	50	15	3	5	3	17	7
	Radiology	114	15	22	9	19	20	29

[1]Women; [2]Men

[3]Institution 4 did not have a surgery or radiology department.

Table 2. Average gross, base and "other" pay stratified by department, rank and gender at six academic institutions in 2016.

Department	*Rank*	*Gender*	*Total*	*Gross Pay (Mean ± SD)*	*Base Pay (Mean ± SD)*	*Other Pay (Mean ± SD)*
General Surgery	Assistant	W[1]	58	325,154 ± 167,202	100,013±21,259	**225,141±165,366**
		M[2]	9	401,248 ± 211,949	102,668±10,160	**298,580±215,319**
	Associate	W	27	321,560 ±137,854	127,005±28,489	**194,556±129,298**
		M	9	463,437 ±209,438	118,118±7,564	**345,320±211,383**
	Professor	W	41	355,631±135,205	160,583±40,006	**195,048±114,816**
		M	36	431,458±265,881	193,647±70,290	**237,811±235,410**
Ob/Gyn	Assistant	W	31	272,521±117,227	106,264±27,706	**166,257±97,851**
		M	58	306,085±108,154	111,412±26,998	**194,673±89,110**
	Associate	W	26	306,375±117,688	128,085±27,904	**178,291±97,833**
		M	48	318,068±138,353	128,023±34,574	**190,045±114,220**
	Professor	W	49	349,216±121,677	189,281±61,148	**160,329±90,079**
		M	102	330,763±155,221	190,616±65,553	**140,147±122,192**
Radiology	Assistant	W	26	271,733±101,797	116,400±32,331	**155,333±78,648**
		M	43	317,801±180,669	116,310±45,245	**201,492±149,107**
	Associate	W	26	334,010±192,702	129,735±46,725	**204,274±167,891**
		M	64	439,549±272,289	142,086±53,949	**297,463±250,756**
	Professor	W	28	432,943±221,201	196,264±65,213	**236,680±185,151**
		M	118	552,015±365,815	207,686±88,078	**344,329±320,399**

[1]Women; [2]Men

Author's contributions: Hayley Miller was a major contributor in the writing of the manuscript. Elizabeth Seckel analyzed and interpreted the data and contributed to manuscript preparation. Chrislyn White performed data abstraction and collection. Diana Sanchez performed data abstraction and collection. Erika Rubesova edited the manuscript. Claudia Mueller designed the study, analyzed and interpreted the data and was a major contributor in writing of the manuscript. Katherine Bianco designed the study, analyzed and interpreted the data and was a major contributor in writing of the manuscript. All authors read and approved the final manuscript.

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Figure 1. Participant Exclusions. Participants included 799 faculty members. 988 institution employees were assessed for eligibility. 189 were excluded for having a non-professorial, full-time role. A further 79 were excluded for only being listed on the department website, not being on 2016 payroll.

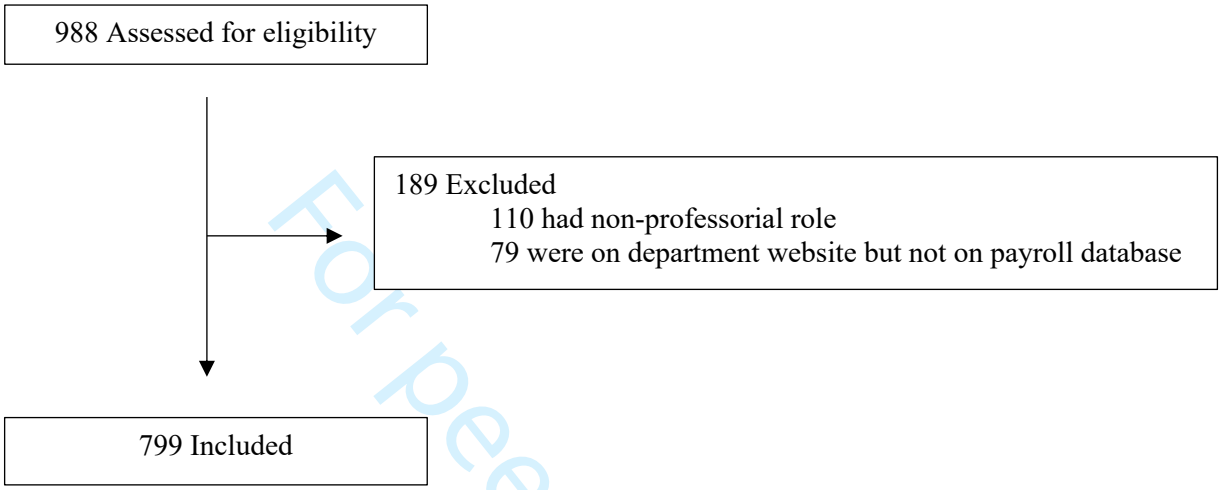
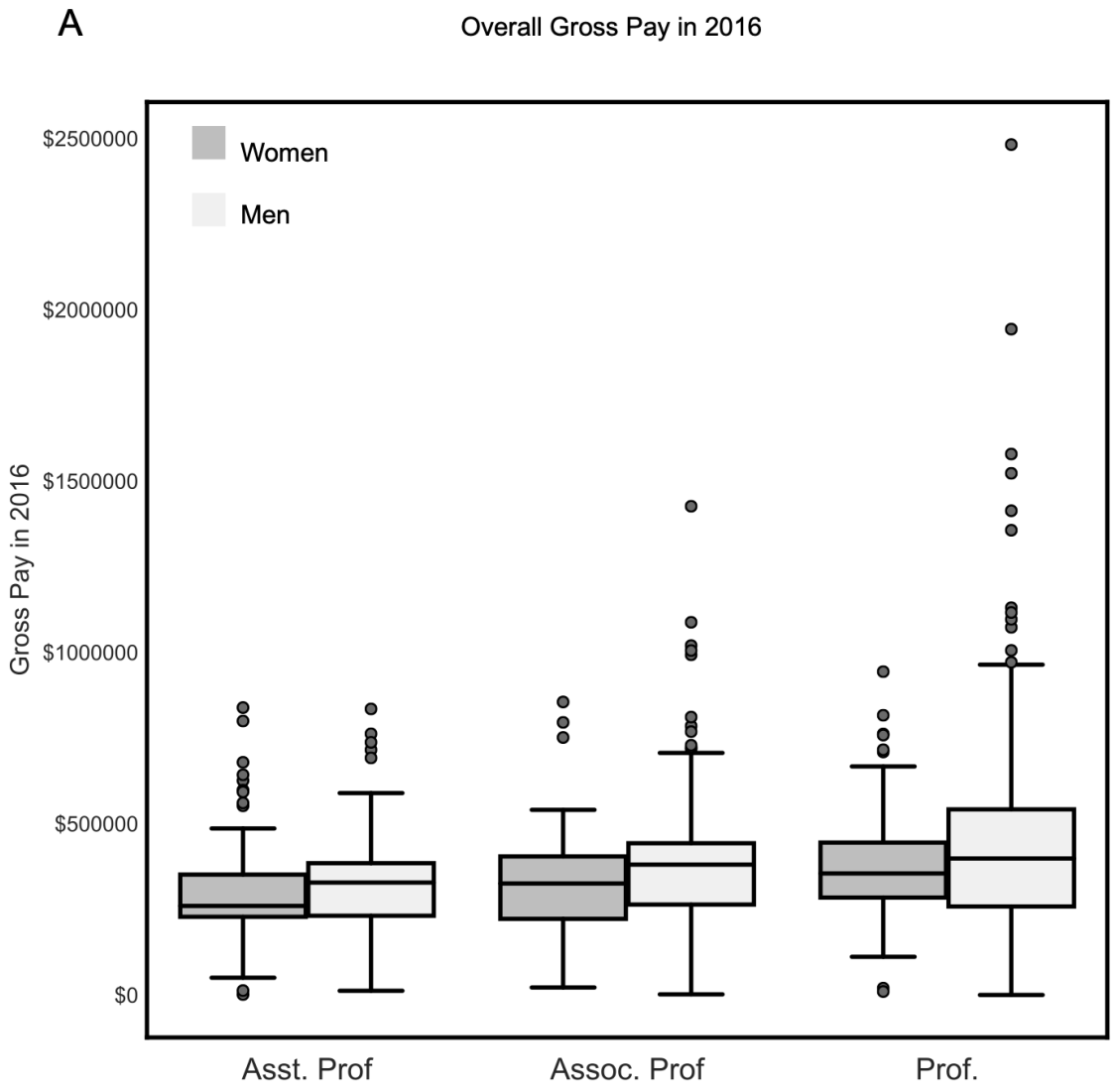
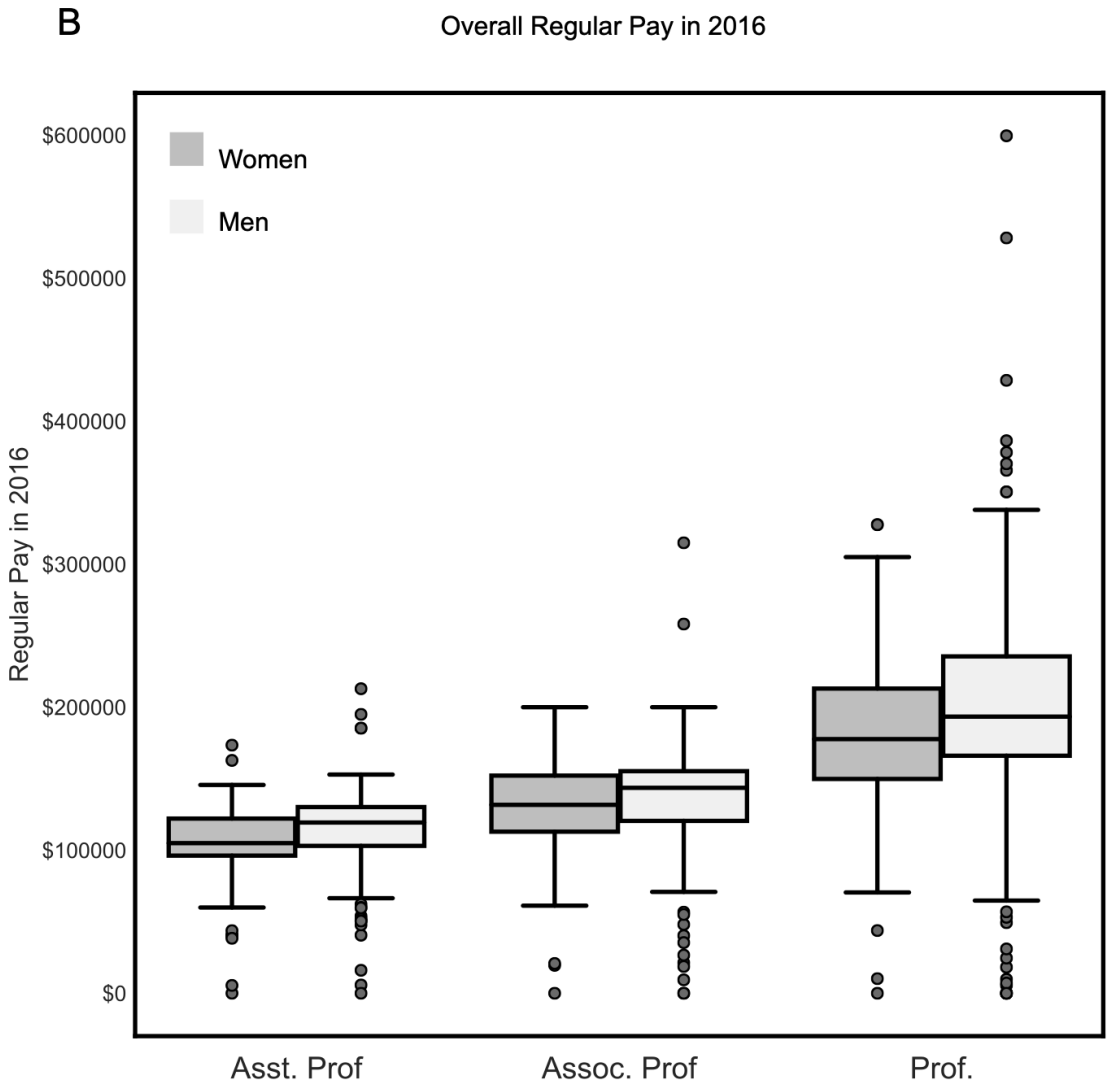


Figure 2. Overall Pay. Distribution of gross pay (A), regular pay (B) and "other pay" (C) of women and men in general surgery, obstetrics and gynecology, and radiology departments stratified by academic rank.





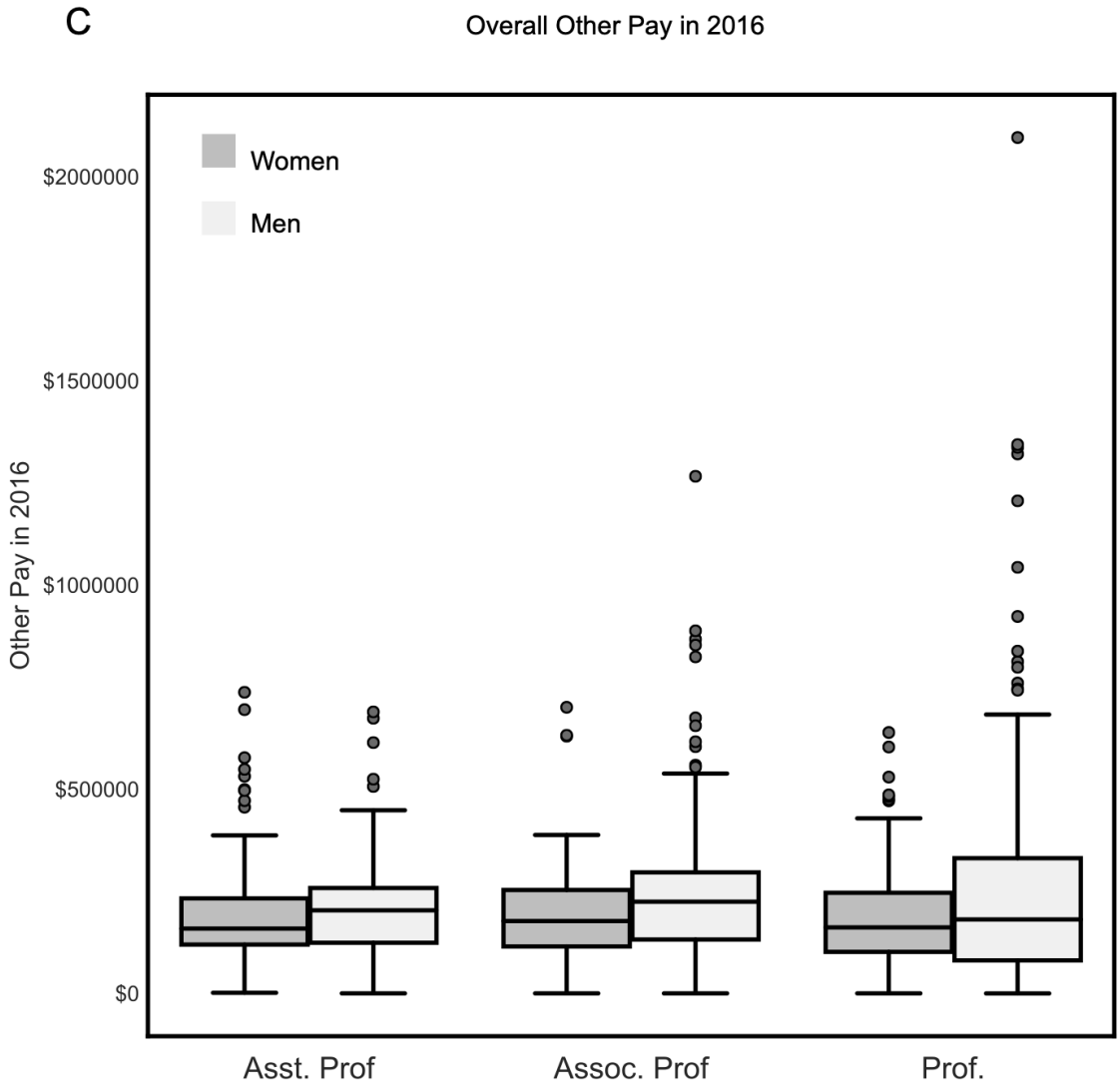
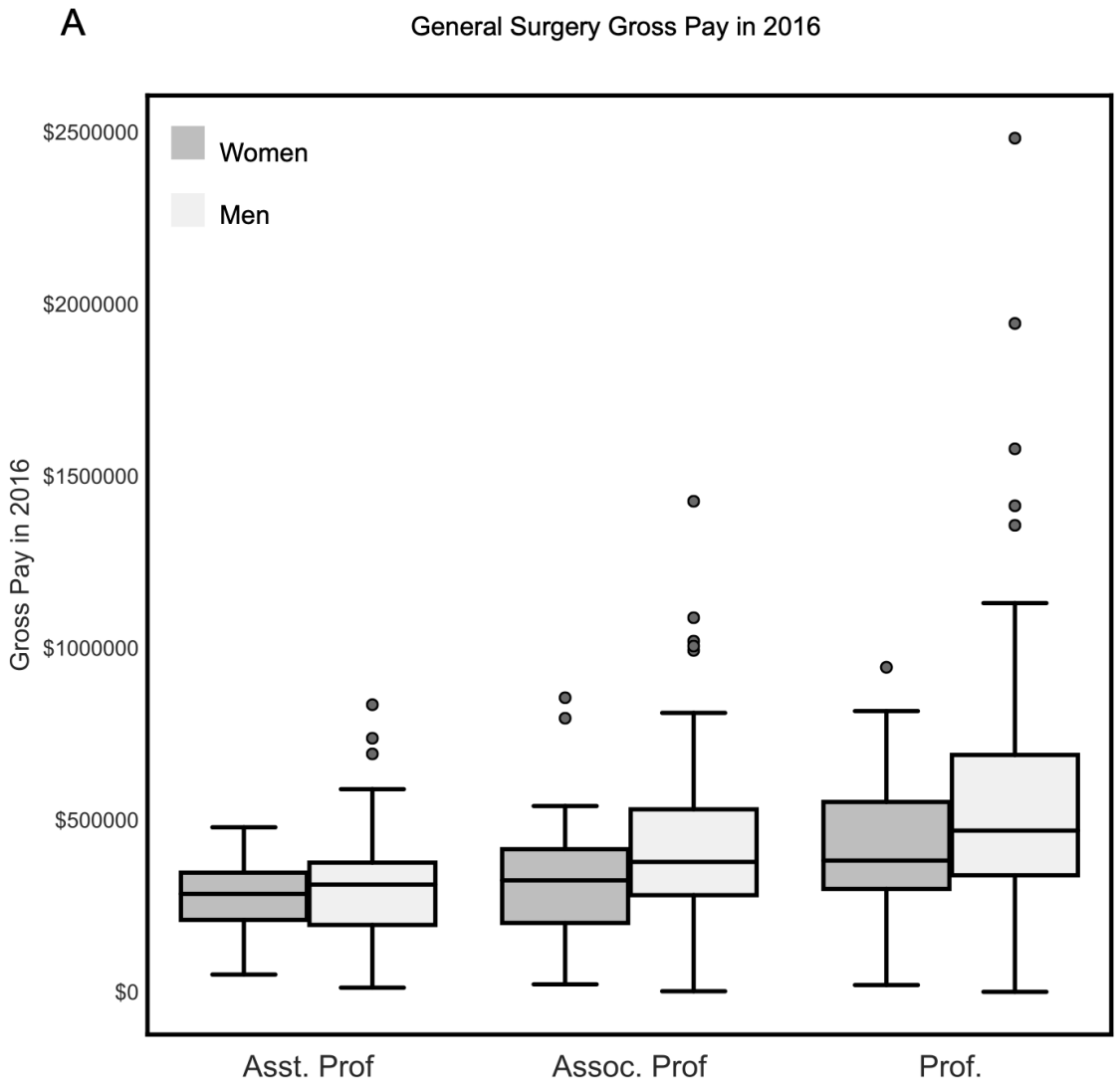
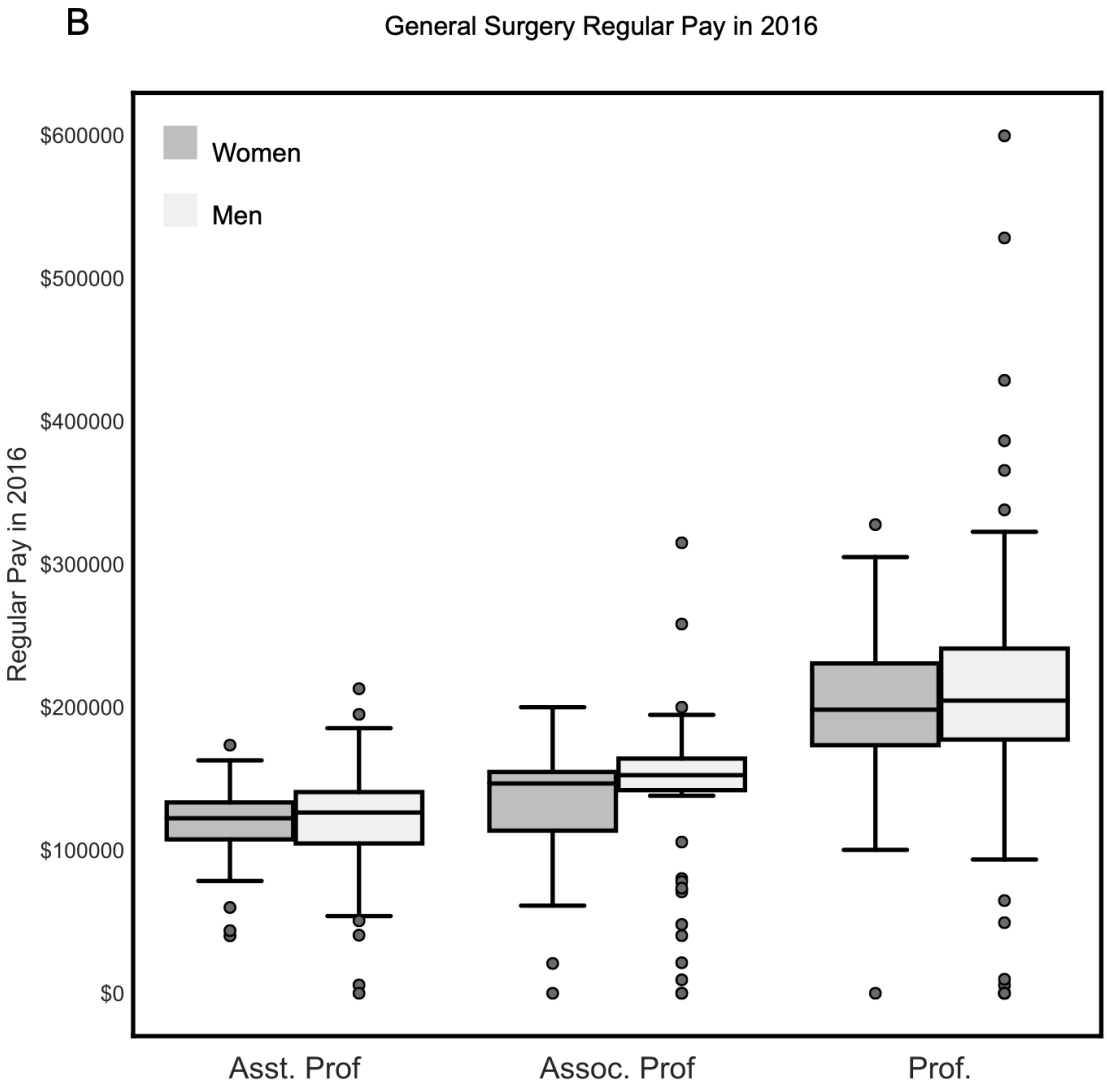


Figure 3. General Surgery Pay. Distribution of gross pay (A), regular pay (B) and "other pay" (C) of women and men in general surgery stratified by academic rank.





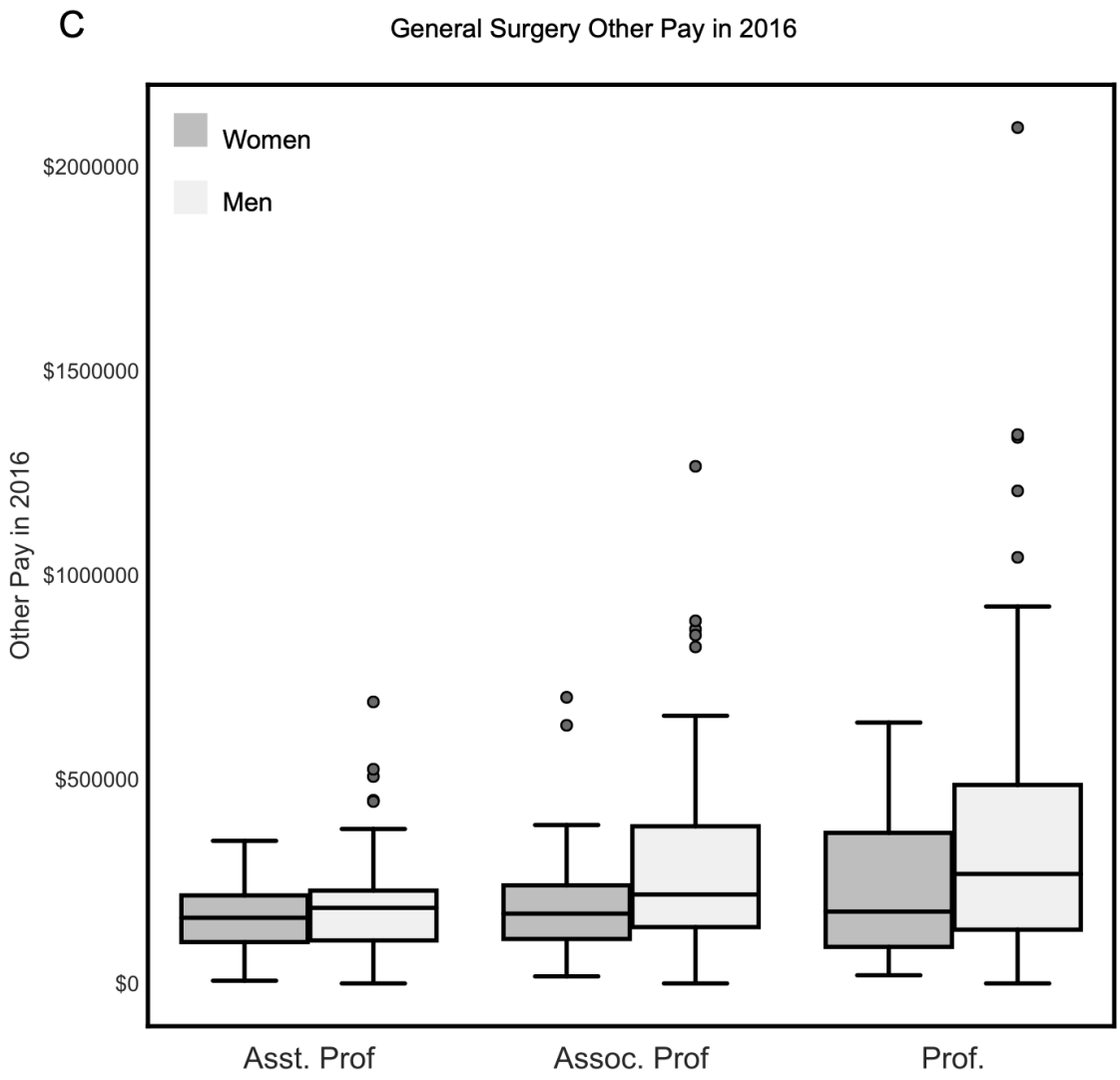
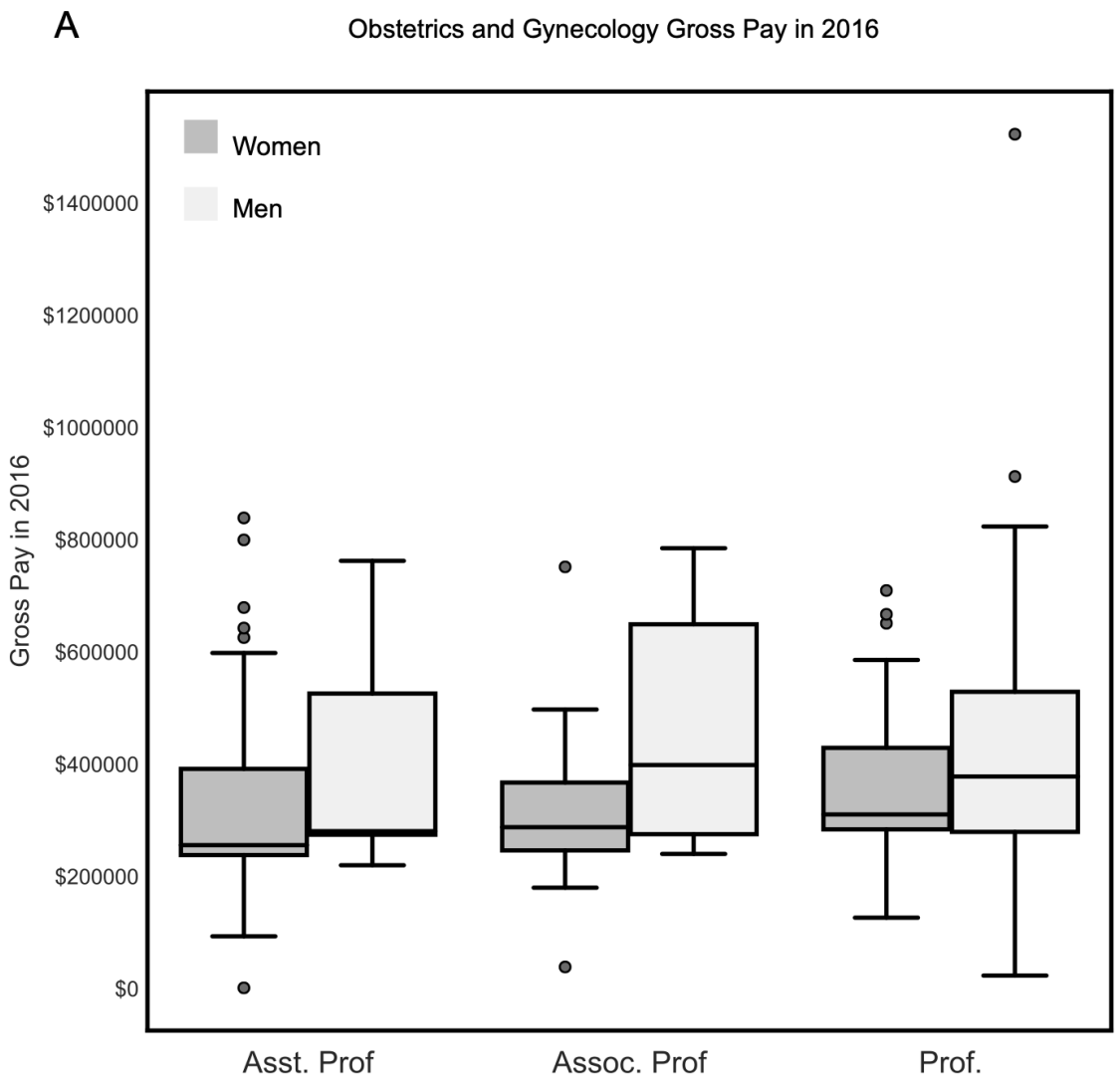
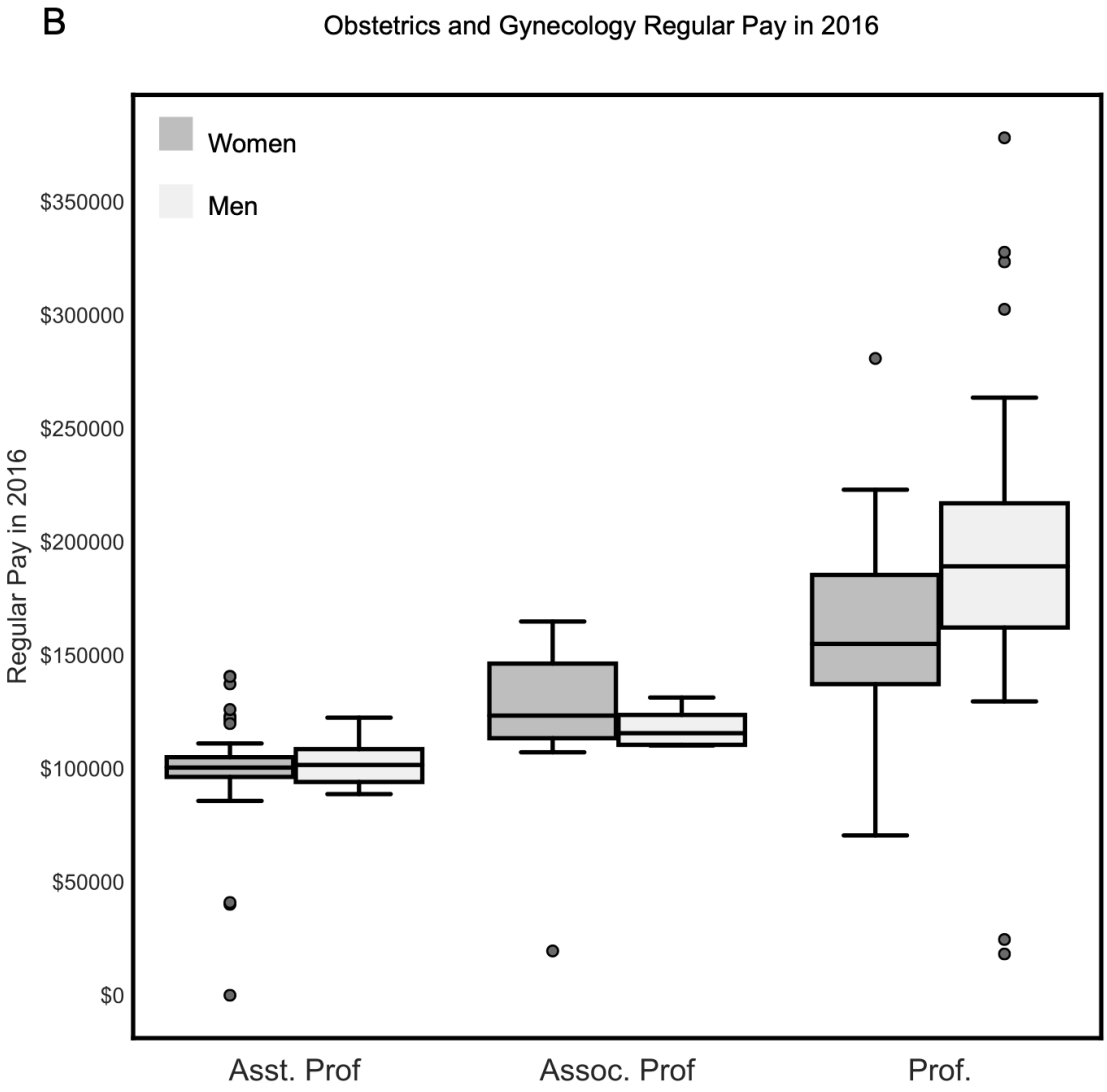


Figure 4. Obstetrics and Gynecology Pay. Distribution of gross pay (A), regular pay (B) and "other pay" (C) of women and men in obstetrics and gynecology stratified by academic rank.





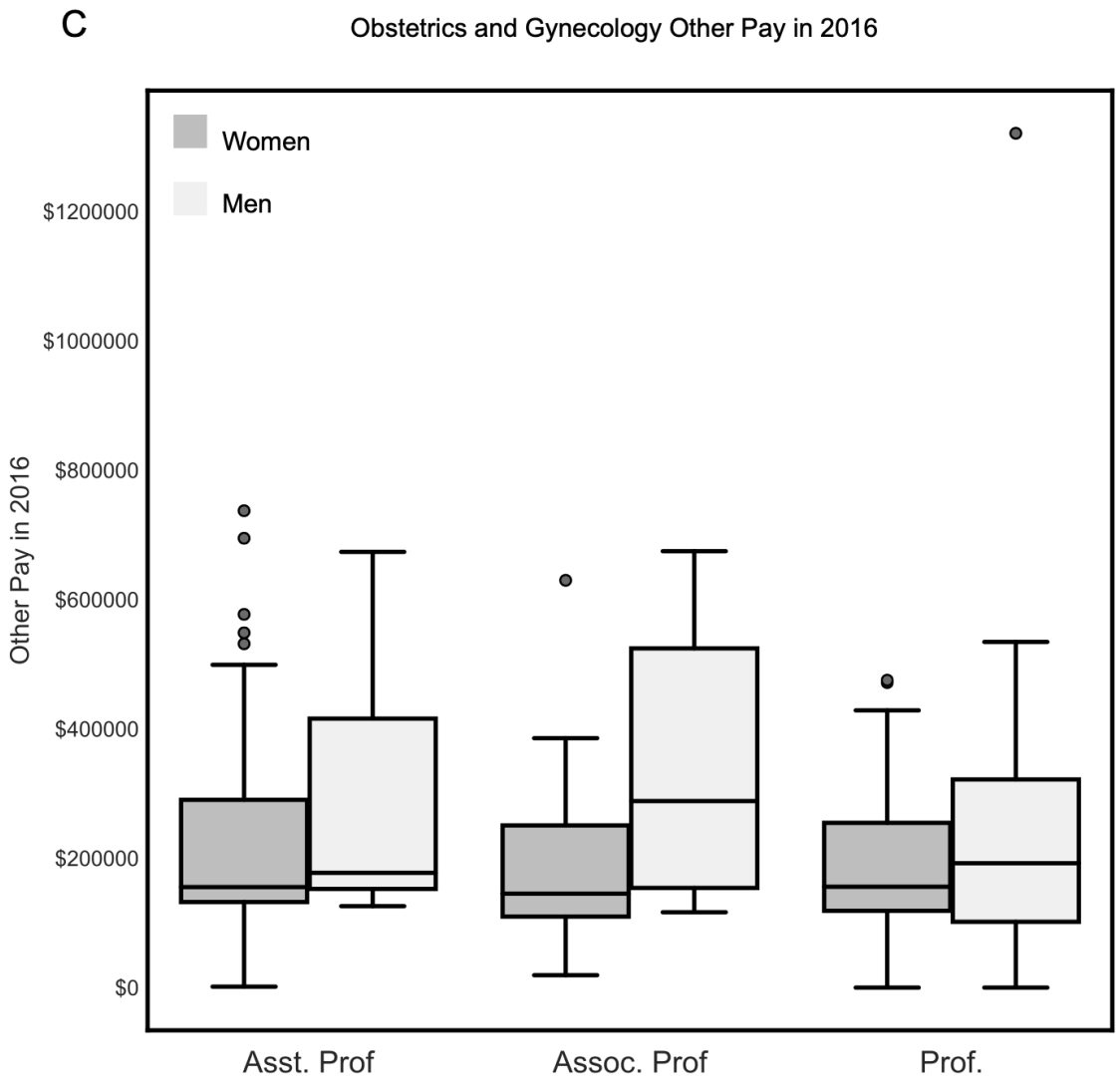
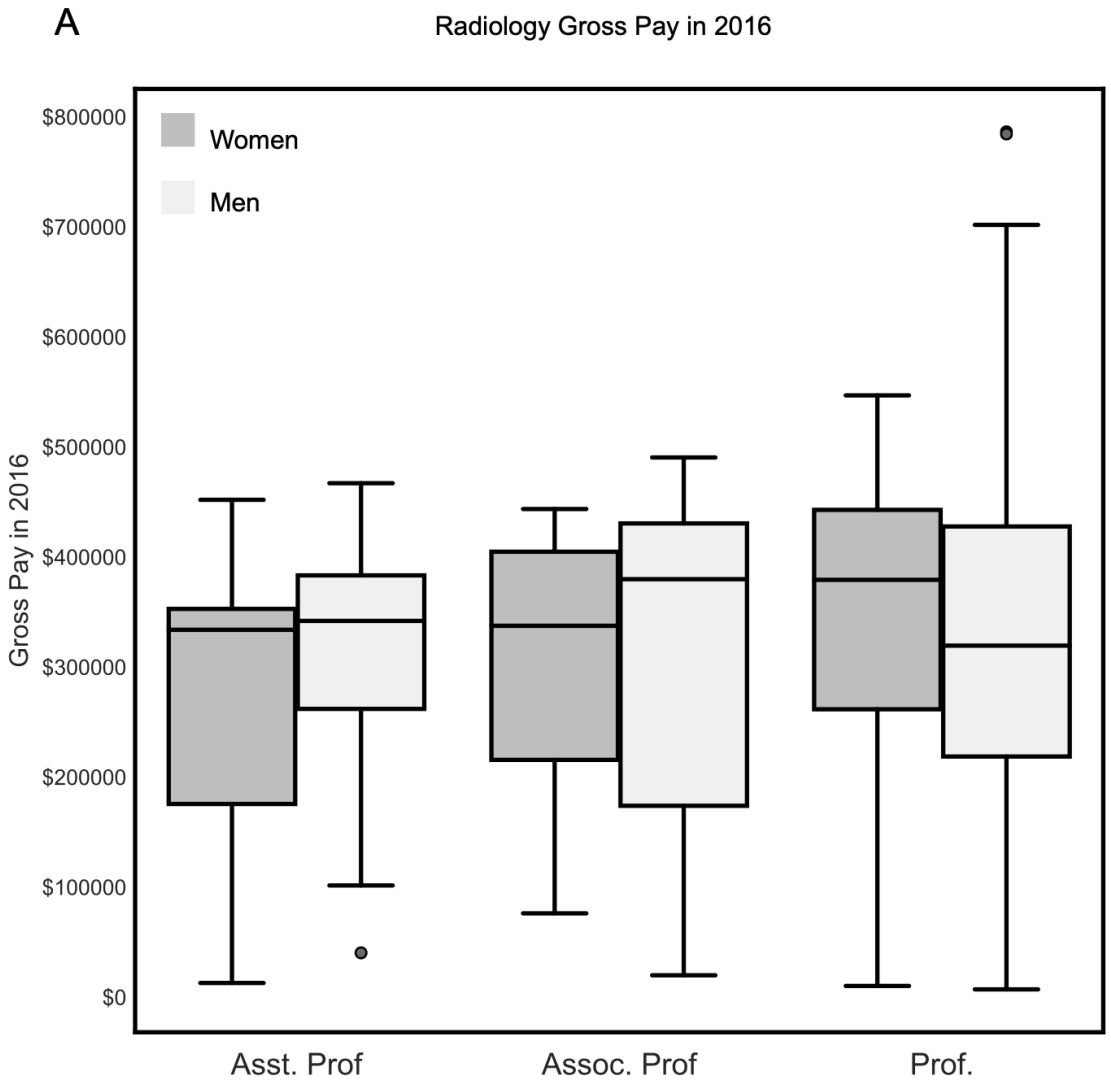
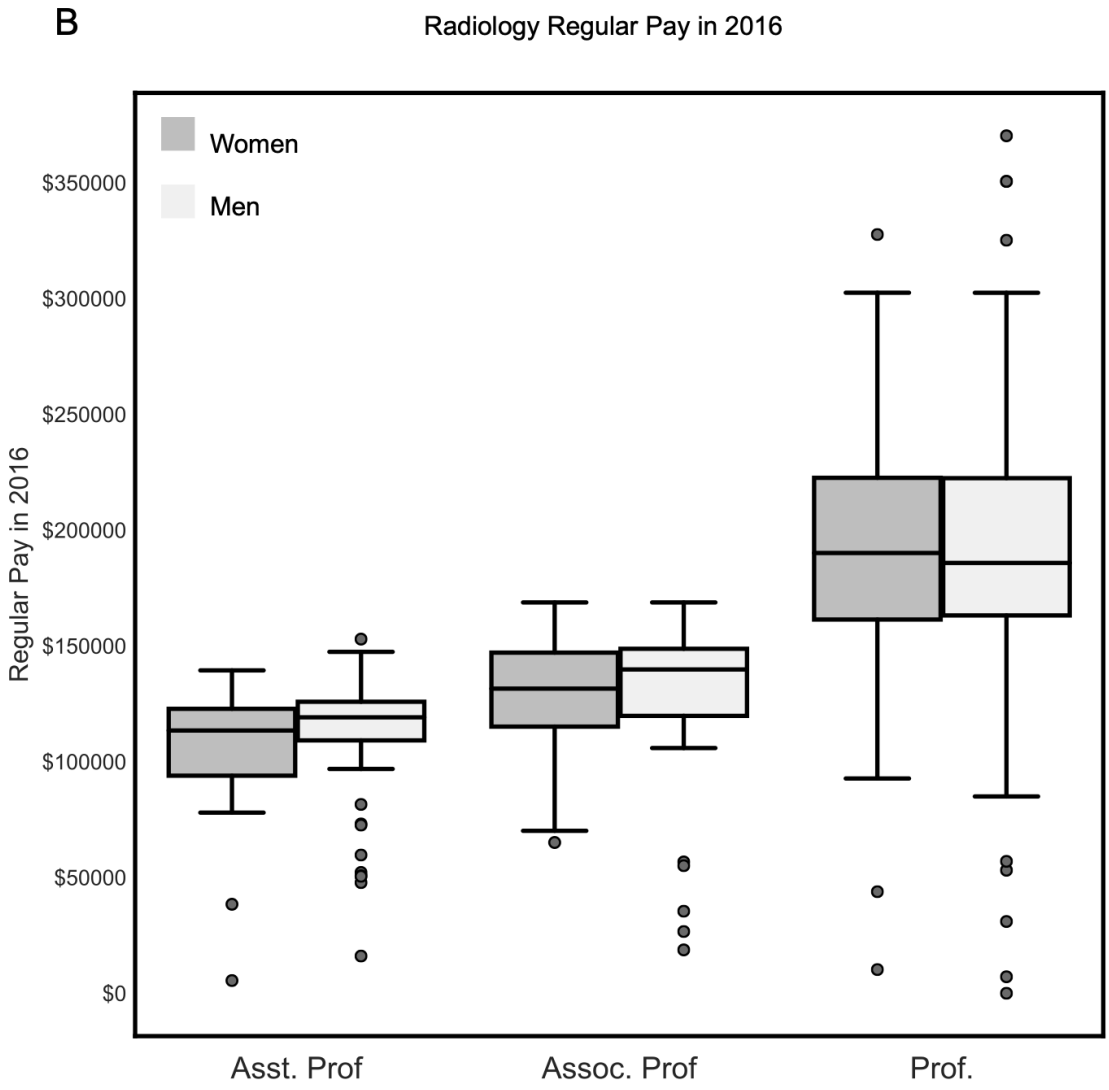
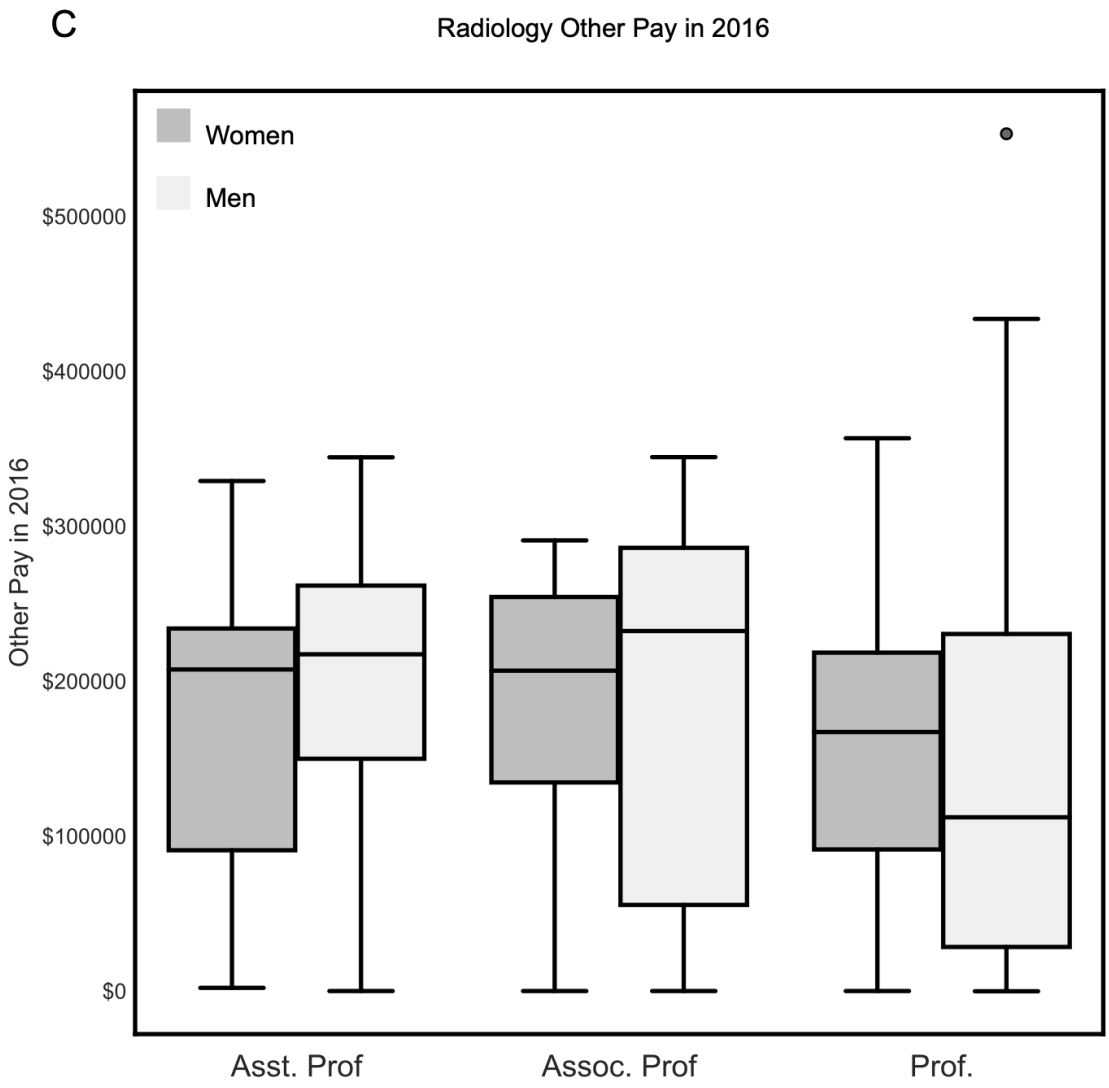


Figure 5. Radiology Pay. Distribution of gross pay (A), regular pay (B) and "other pay" (C) of women and men in radiology stratified by academic rank.







CHEERS Checklist
Items to include when reporting economic evaluations of health interventions

The **ISPOR CHEERS Task Force Report**, *Consolidated Health Economic Evaluation Reporting Standards (CHEERS)—Explanation and Elaboration: A Report of the ISPOR Health Economic Evaluations Publication Guidelines Good Reporting Practices Task Force*, provides examples and further discussion of the 24-item CHEERS Checklist and the CHEERS Statement. It may be accessed via the *Value in Health* or via the ISPOR Health Economic Evaluation Publication Guidelines – CHEERS: Good Reporting Practices webpage: http://www.ispor.org/TaskForces/EconomicPubGuidelines.asp

Section/item	Item No	Recommendation	Reported on page No/ line No
Title and abstract			
Title	1	Identify the study as an economic evaluation or use more specific terms such as "cost-effectiveness analysis", and describe the interventions compared.	1
Abstract	2	Provide a structured summary of objectives, perspective, setting, methods (including study design and inputs), results (including base case and uncertainty analyses), and conclusions.	2
Introduction			
Background and objectives	3	Provide an explicit statement of the broader context for the study. Present the study question and its relevance for health policy or practice decisions.	4-5
Methods			
Target population and subgroups	4	Describe characteristics of the base case population and subgroups analysed, including why they were chosen.	6
Setting and location	5	State relevant aspects of the system(s) in which the decision(s) need(s) to be made.	6-8
Study perspective	6	Describe the perspective of the study and relate this to the costs being evaluated.	6-8
Comparators	7	Describe the interventions or strategies being compared and state why they were chosen.	6-8
Time horizon	8	State the time horizon(s) over which costs and consequences are being evaluated and say why appropriate.	6
Discount rate	9	Report the choice of discount rate(s) used for costs and outcomes and say why appropriate.	N/A
Choice of health outcomes	10	Describe what outcomes were used as the measure(s) of benefit in the evaluation and their relevance for the type of analysis performed.	7-8
Measurement of effectiveness	11a	*Single study-based estimates:* Describe fully the design features of the single effectiveness study and why the single study was a sufficient source of clinical effectiveness data.	6-8

			N/A
	11b	*Synthesis-based estimates:* Describe fully the methods used for identification of included studies and synthesis of clinical effectiveness data.	6-8
Measurement and valuation of preference based outcomes	12	If applicable, describe the population and methods used to elicit preferences for outcomes.	6-8
Estimating resources and costs	13a	*Single study-based economic evaluation:* Describe approaches used to estimate resource use associated with the alternative interventions. Describe primary or secondary research methods for valuing each resource item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs.	N/A
	13b	*Model-based economic evaluation:* Describe approaches and data sources used to estimate resource use associated with model health states. Describe primary or secondary research methods for valuing each resource item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs.	N/A
Currency, price date, and conversion	14	Report the dates of the estimated resource quantities and unit costs. Describe methods for adjusting estimated unit costs to the year of reported costs if necessary. Describe methods for converting costs into a common currency base and the exchange rate.	8-9
Choice of model	15	Describe and give reasons for the specific type of decision-analytical model used. Providing a figure to show model structure is strongly recommended.	8-9
Assumptions	16	Describe all structural or other assumptions underpinning the decision-analytical model.	8-9
Analytical methods	17	Describe all analytical methods supporting the evaluation. This could include methods for dealing with skewed, missing, or censored data; extrapolation methods; methods for pooling data; approaches to validate or make adjustments (such as half cycle corrections) to a model; and methods for handling population heterogeneity and uncertainty.	8-9
Results			
Study parameters	18	Report the values, ranges, references, and, if used, probability distributions for all parameters. Report reasons or sources for distributions used to represent uncertainty where appropriate. Providing a table to show the input values is strongly recommended.	9-11
Incremental costs and outcomes	19	For each intervention, report mean values for the main categories of estimated costs and outcomes of interest, as well as mean differences between the comparator groups. If applicable, report incremental cost-effectiveness ratios.	9-11
Characterising uncertainty	20a	*Single study-based economic evaluation:* Describe the effects of sampling uncertainty for the estimated incremental cost and incremental effectiveness parameters, together with the impact	N/A

		of methodological assumptions (such as discount rate, study perspective).	N/A
	20b	*Model-based economic evaluation:* Describe the effects on the results of uncertainty for all input parameters, and uncertainty related to the structure of the model and assumptions.	9-11
Characterising heterogeneity	21	If applicable, report differences in costs, outcomes, or cost-effectiveness that can be explained by variations between subgroups of patients with different baseline characteristics or other observed variability in effects that are not reducible by more information.	12-14
Discussion			
Study findings, limitations, generalisability, and current knowledge	22	Summarise key study findings and describe how they support the conclusions reached. Discuss limitations and the generalisability of the findings and how the findings fit with current knowledge.	19
Other			
Source of funding	23	Describe how the study was funded and the role of the funder in the identification, design, conduct, and reporting of the analysis. Describe other non-monetary sources of support.	19
Conflicts of interest	24	Describe any potential for conflict of interest of study contributors in accordance with journal policy. In the absence of a journal policy, we recommend authors comply with International Committee of Medical Journal Editors recommendations.	

For consistency, the CHEERS Statement checklist format is based on the format of the CONSORT statement checklist

The **ISPOR CHEERS Task Force Report** provides examples and further discussion of the 24-item CHEERS Checklist and the CHEERS Statement. It may be accessed via the *Value in Health* link or via the ISPOR Health Economic Evaluation Publication Guidelines – CHEERS: Good Reporting Practices webpage: http://www.ispor.org/TaskForces/EconomicPubGuidelines.asp

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A retrospective review of gender-based salary differences in academic medicine among six public medical centers in the western United States

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TITLE: A retrospective review of gender-based salary differences in academic medicine among six public medical centers in the western United States

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Abstract

Objectives: We sought to evaluate differences in salary based on gender, rank and research productivity among faculty at academic medical centers to better understand the origin of disparities in salary.

Design: A retrospective review of salary for assistant, associate, and full professors during the year of 2016.

Setting: Faculty from six state-run, publicly funded academic medical centers in the western United States.

Participants: Participants included 799 total faculty members, including 225 assistant (51% women), 200 associate (40% women), and 374 full professors (32% women) from General Surgery (26% women), ObGyn (70% women), and Radiology departments (34% women).

Interventions: Archived online faculty profiles were reviewed to collect information on gender, total compensation, baseline compensation, supplemental income, and rank. Elsevier's SCOPUS was used to collect data on h-index, a measure of research productivity.

Primary and secondary outcome measures: The primary objective of our study was to identify where in total compensation the salary gap originates by evaluating differences in salary based on gender, rank and research productivity for three academic medical specialties. Linear regression models were estimated to determine the relationship between these factors and salary.

Results: Total compensation was significantly higher for men across all professorial ranks in both General Surgery and ObGyn. Women faculty within these departments earned almost $75,000 less than their men colleagues. The disparity in salary originates from gaps in supplemental income, as baseline compensation was not significantly different between men and women. No significant gender difference in total compensation for Radiology was found. Higher

h-index was associated with higher baseline compensation across all departments as well as with supplemental income for General Surgery. Higher h-index was related to lower supplemental income for Radiology and was not related to supplemental income for ObGyn.

Conclusions: Further investigations should focus on discrepancies in supplemental income which may preferentially benefit men.

Strengths and limitations of the study

- This is a large population study assessing distribution of salary among three diverse disciplines based on their gender distributions and distribution of the types of clinical work.
- Linear regression models were estimated to determine the relationship between specialty, gender, rank, h-index and salary.
- We focus on only one set of state-based academic institutions from the west coast of the United States and so are unable to be certain whether our findings would generalize to private practices or to those in other parts of the country.
- We examined salaries from only three departments and therefore cannot be certain that other clinical specialties would follow similar patterns.
- Our data was obtained from websites only, we are unable to delve more deeply into the components of supplemental income beyond the general description that is offered publicly.

Introduction

The more education a woman has, the greater the gender disparity in salary is seen.[1] This disparity is especially glaring for physicians and surgeons, with women earning about 74 cents for every dollar men earn.[2] Representation of women in medicine is increasing dramatically, however the gender salary gap remains.[3-4] Women faculty have been shown to have lower salaries, smaller start-up packages, and limited authorship roles.[3-13] Despite the Equal Pay Act of 1963, this gap continues to exist across specialties, practice settings, work hours, and other characteristics,[6-10] and persists even after accounting for age, experience, specialty, faculty rank, and measures of research productivity and clinical revenue.[6-13] Commonly cited explanations for this gender disparity in salary include differences in negotiating skills, opportunities to join networks of influence within organizations, discrimination, and implicit and explicit bias.[6,7,10,14-16]

There is an increasingly large body of evidence that gender not only impacts salary but also faculty rank and research productivity.[6-13] Gender disparities in faculty rank within academic medicine persist after accounting for age, years since completion of residency, specialty, scientific authorship, National Institutes of Health (NIH) research funding, clinical trial participation, and clinical revenue.[10] In academic medicine specifically, there is a significant gender difference in number and impact of publications, with women showing lower productivity than men in surgical specialties.[13]

In order to close the salary gap in academic medicine, we must be clear where in total compensation packages this disparity originates. Previous data as it relates to non-medical

occupations suggests that gender differences in salary can be attributed to the salary gaps within specific occupations, not across occupations.[17] As such, we chose to focus this study on academic salary at a single time point, expecting to see differences in salary based on gender, faculty rank and h-index, a metric for evaluating the cumulative impact of an author's scholarly output and performance calculated by comparing number of publications to citations.[18] The primary objective of our study was to identify where in total compensation the salary gap originates by evaluating differences in salary based on gender, rank and research productivity for three diverse academic medical specialties. Our areas of interest – salary, academic rank, and research productivity – are typical benchmarks for professional development.[6-11,18,19] We hypothesized that women would earn significantly less total compensation across all ranks, even after accounting for rank and research productivity.

Methods

Study Design

This was a retrospective population study of total faculty compensation for assistant, associate, and full professors at six major public academic medical centers using a single time point during 2016. We chose the time point of 2016 as it was the most recent year for which data was available at the time. Three diverse disciplines were examined: general surgery, obstetrics & gynecology, and radiology. Three diverse specialties – general surgery, obstetrics and gynecology, and radiology - were chosen, primarily because of their gender distributions and distribution of the types of clinical work.[8,20-25] General surgery and radiology are male-dominated specialties, while obstetrics and gynecology is a female-dominated specialty.[20-25] There is also a diversity of clinical work throughout these three subspecialities with general surgery being

dominated by surgical procedures, radiology not being surgical in nature, and obstetrics and gynecology with a more diverse balance of clinical work.[3,8,20-26] Ethics approval and consent to participate was waived by the Institutional Review Board of the Stanford University School of Medicine.

Study Population

Archived online faculty profiles were reviewed to collect information on gender. Trained research staff utilized the internet archive service Wayback Machine[26] to collect data on gender from 2016 online faculty profiles at each department's website. Gender was identified on faculty profile by identifying the pronoun included on faculty profile. In the occasion that the pronoun was not specifically stated, the research staff used faculty photo and name to identify gender. Faculty from six academic institutions were included. We were able to stratify by assistant, associate, or full professor faculty rank.

Patient and Public Involvement

There was no patient or public involvement.

Total Compensation, Rank and Research Productivity

A publicly available database which contains all of the compensation information for faculty and employees at a large university system was used to look at total faculty compensation in three different ways: Total compensation, baseline compensation, and supplemental income.[27] Total compensation was defined as baseline compensation plus supplemental income. Baseline compensation was defined as base salary minus reductions due to participation in the voluntary Employee Reduction in Time and phased retirement programs. Supplemental income (commonly

referred to as “discretionary pay”) was defined as negotiated additional salary for clinical care and research which was funded from earned clinical revenue as well as contracts and grants. This includes: pay for Summer Session or University Extension teaching, pay for research performed during summer months that is funded by extramural contracts and grants, performance-based incentive compensation and similar payments that recognize achievement of specific performance goals or exemplary service, pay for shift differentials (e.g., night or holiday call), payout of unused vacation leave upon separation, and lump sum payments made as part of the settlement of union bargaining agreements. Data on academic rank and specialty was collected from the same database. Elsevier's SCOPUS was used to collect data on h-index. Faculty members’ h-indexes were obtained using their full name, last name and first and middle initials, and/or maiden name when appropriate. (Supplementary Table)

Statistical Analysis

Our data set consisted of 6 variables: (1) Department – a three-level categorical variable (surgery, obstetrics & gynecology, and radiology); (2) Rank - three-level categorical variables (assistant, associate, and full); (3) Gender; (4) h-index – a measure of publication output; (5) baseline compensation – i.e. salary; and (6) supplemental income – e.g. bonuses, income for extra work. Linear regression models were estimated to determine the relationship between these factors and salary. Compensation was selected as our primary variable and gender, academic rank and h-index as secondary variables. Rank, gender, and h-index were treated as independent variables, whereas “baseline compensation” and “supplemental income” were treated as dependent variables. Because rank is a three-level categorical level, it was split into two dummy variables with “Full” as reference value. Three regression models were run per department: one

to predict total compensation (baseline compensation plus supplemental income), one to predict baseline compensation, and one to predict supplemental income. Data was entered into SPSS version 20, with a *p* value of less than 0.05 considered to be significant.

Results

988 total employees were assessed for eligibility (see **Figure 1**). 110 (11%) were excluded for having a role other than assistant, associate, or full professor. A further 79 (8%) were excluded because they were listed on the department website but not in the payroll database. After exclusions, our analysis included 799 faculty members, 312 (39%) were identified as women and 487 (61%) were identified as men and distribution among ranks included 225 (28%) assistant, 200 (25%) associate, and 374 (47%) full professors (**Table 1**).

Overall, women represented 26% of general surgery faculty (n=126), 70% of obstetrics and gynecology faculty (n=106), and 34% of radiology faculty (n=80). Among ranks, women made up 51% of all assistant professors (n=115) and men made up 49% (n=110), women made up 40% of associate professors (n=79) and men made up 60% (n=121), and women made up 32% of full professors (n=118) while men made up 68% (n=256) (**Table 1).** Distribution of stratified by gender and academic rank is presented in **Figure 2** and **Table 2.**

General Surgery

Distribution of salary for general surgery is presented in **Figure 3**. Within general surgery, the overall regression for total compensation was significant ($R^2 = .159, F(4, 299) = 14.123, p < .01$). This means that, when they are examined together, the independent

variables of gender, rank, and h-index influence the dependent variable of total compensation. Looking specifically at the three independent variables, we found that: Gender was significantly different with women earning lower total compensation than men ($\beta = -84{,}970, p < 0.05$). Rank was not significantly different for total compensation. Higher h-index was significantly associated with higher total compensation ($\beta = 5{,}023, p < 0.01$).

In an attempt to analyze what specifically drove the effect on total compensation, we ran separate analyses on "baseline compensation" and "supplemental income" separately. In terms of baseline compensation, the overall regression was significant ($R^2 = 0.323, F(4, 299) = 35.737, p < 0.01$). Again, these analyses took into account the combined effect of all three independent variables of gender, rank, and h-index on baseline compensation. Looking specifically at each variable within the regression: Gender was not significantly associated with baseline compensation with men and women receiving similar baseline compensation. Rank was associated with regular salary, with assistant professors ($\beta = -51{,}031, p < .01$) and associate professors ($\beta = -40{,}680, p < 0.01$) earning significantly less baseline compensation than full professors. Higher h-index was also significantly associated with higher baseline compensation ($\beta = 1{,}606, p < .01$).

For "supplemental income", the overall regression was significant, again examining the combined effect of gender, rank, and h-index, was significant ($R^2 = 0.096, F(4{,}299) = 7.900, p < 0.01$). In terms of specific variables: Gender was significantly associated with supplemental income ($\beta = -79{,}467, p < 0\ .05$) with women earning significantly less of this

salary component than men. There was no difference for rank on supplemental income. Higher h-index was significantly associated with supplemental income ($\beta = 3{,}418, p < 0.01$).

Obstetrics and Gynecology

Distribution of salary for obstetrics and gynecology is presented in **Figure 4**. For obstetrics and gynecology, the overall regression, which included the variables of gender, rank, and h-index, for total compensation was significant ($R^2 = 0.068, F(4, 174) = 3.172, p < 0.05$). Looking at each variable specifically, there was a significant difference in gender, with women earning less total compensation than men ($\beta = -84{,}221, p < 0.02$). Rank was not found to be significantly different for total compensation for either assistant or associate professors compared to full professors. H-index was also not significantly associated with total compensation.

For baseline compensation, the overall regression of the combined effect of gender, rank, and h-index was significant ($R^2 = 0.485, F(4, 174) = 40.986, p < 0.01$). For the specific variables: There was no significant difference between women and men in baseline compensation. Rank was associated with baseline compensation, with both assistant ($\beta = -52{,}696, p < 0.01$) and associate professors ($\beta = -36{,}711, p < 0.01$) earning significantly less than full professors. H-index was also significant ($\beta = 1{,}314, p < 0.01$), with higher h-index linked to higher baseline compensation.

For supplemental income, the overall regression of the combined effect of gender, rank, and h-index was not significant ($R^2 = .037, F(4, 174) = 1.666, \ n.s.$). However, when we looked at the three variables specifically within the regression, there was a significant difference in gender,

with women earning less supplemental income than men ($\beta = -74{,}168, p < 0.05$). There were no significant differences in supplemental income for the variables of rank or h-index.

Radiology

Distribution of salary for radiology is presented in **Figure 5**. Within radiology, the overall regression, which again examined the combined effect of gender, rank, and h-index for total compensation was not significant ($R^2 = 0.01, F(4{,}266) = .591, n.s.$). Furthermore, none of the individual variables of gender, rank, or h-index showed any significant association with total compensation.

In terms of baseline compensation, the overall regression, which again included the combined effect of gender, rank, and h-index, was significant ($R^2 = 0.395, F(4{,}265) = 43.293, p < 0.01$). For the specific variables: Gender was not significantly associated with baseline compensation as men and women earned similar base compensation. Significant differences in baseline compensation by rank were identified with assistant professors ($\beta = -52{,}145, p < 0.01$) and associate professors ($\beta = -43{,}848, p < 0.01$) earning significantly lower baseline compensation than full professors. Higher h-index was also significantly associated with higher baseline compensation ($\beta = 979, p < 0.01$).

For supplemental income, the overall regression of the combined effect of gender, rank, and h-index was significant ($R^2 = 0.064, F(4, 266) = 4.567, p < 0.01$). In terms of the specific variables, there was no significant association between gender and supplemental income. Rank also not associated with supplemental income. H-index was significantly associated with supplemental income ($\beta = -947, p < 0.05$). Interestingly, a higher h-index linked to lower supplemental income.

Discussion

Our results show that while there are significant differences in total compensation for women faculty in general surgery and obstetrics and gynecology, it is not baseline compensation that accounts for the salary gap between women and men. Instead, other components of salary, classified in our data as supplemental income, appear to contribute to acknowledged differences in salary between female and male faculty members within our target institutions. In our review of publicly available salary data,[26,27] women faculty within the departments of general surgery and obstetrics and gynecology earned almost $75,000 less than their men colleagues. This supplemental income is described as coming from additional clinical responsibilities such as call income as well as support for administrative work or leadership positions and was not consistently linked to academic productivity, as defined by h-index, across specialties in our study.[27] These findings echo the work of the economist Claudia Goldin who has described the gender pay gap in a variety of professions as being related not to differences in baseline compensation but rather to differences related to flexibility or amount of work that is taken on by women versus men.[27,28]

Previous studies offer many theories to explain the gender gap, including women are less likely to be asked to serve as leaders, experience effective mentoring, receive equitable allocation of research funding, and seek additional call hours or clinical work in favor of different household and childrearing obligations.[3,29-35] Women faculty who work flexible hours may be less likely than men to receive leadership positions that result in bonus salary.[29] In fact, faculty who need a more flexible work schedule remain as junior faculty and receive less support.[30] These

circumstances help to explain our findings the lower "additional" or supplemental income for women faculty within the two specialties. One solution is to alter promotion policies to better support the diversity of needs.[30] Additional solutions can be found in the NIH's Gender Inequality Task Force Report.[31]

Interestingly, the gender gap for supplemental income in our study was true within obstetrics and gynecology, despite the fact that women comprise a majority of faculty members within this specialty. Furthermore, no gender gap was identified for the department of radiology, despite its male predominance. This finding suggests that the gender distribution of the department alone does not necessarily guide salary discrepancies between women and men faculty members. Instead, it seems that other factors, such as the nature of the clinical work itself, may contribute to the gender salary gap.[31] It has been acknowledged in previous studies that surgical subspecialties are highly technical and predominantly occupied by men, and often times men are among the highest paid with roles as researchers, opposed to women within these specialties occupying lower status communal roles as educators.[34] For instance, no gender differences were noted for any portion of salary within the radiology departments which we examined in this study. Radiology clinical work differs from that of other specialties in that it is predominantly shift-based and less procedural than general surgery and obstetrics and gynecology. Radiology may thereby offer fewer opportunities for gender-based increases to supplemental income which might be earned through additional clinical work.

Our findings also validate previous studies finding striking gender inequities in the higher academic ranks.[13] Common explanations for these gender differences include the gender-based

hiring disparities of previous generations, lack of transparency of salary, promotion, mentoring and female role-models, and time away for childbearing and family obligations.[14,15,29,30,33] There is also recent evidence that women physicians might start their career with lower salary expectations than men, which could become a self-fulfilling prophecy for later salary.[30,34] Furthermore, there is some indication that women prioritize salary less than men do and are judged more harshly for initiating negotiations.[6,14,15, 30]

In summary, gender disparities have been well documented in academic medicine, and our study offers a unique perspective of the different components that make up the academic medicine physician salary. Previous studies have offered suggestions to improve this disparity, which will be important for closing this supplemental income gap. Suggestions include transparency of starting salaries to young professionals, initiating negotiation training to improve starting salary packages, mentorship in career advancement for women junior faculty, investigation of research grant award processes, and further adoption of programs to address disparities in grant award processes.[31] Implementation of a university-wide objective compensation planned implemented by the Association of American Medical Colleges regional median salary (AAMC-WRMS) was associated with reduced gender-based differences in salary among surgery faculty within the institution and a statistically significant increase in salary among female faculty. Objective compensation plans may mitigate gender-based implicit bias in salary negotiations and promotions.[35]

Limitations

Our study has several limitations. First, we focus on only one set of state-based academic institutions from the west coast of the United States and so are unable to be certain whether our findings would generalize to private practices or to those in other parts of the country. Furthermore, we examined salaries from only three departments and therefore cannot be certain that other clinical specialties would follow similar patterns. However, the departments were chosen to accurately reflect a set of departments with a diverse set of gender distribution and clinical work. Finally, since our data was obtained from websites only, we are unable to delve more deeply into the components of supplemental income salary beyond the general description that is offered publicly. We are therefore not able to completely explain what aspect of compensation supplemental incomes represents or why it is not related to academic productivity in the same way across the three departments. The 2016 data may not reflect more contemporary remuneration, however, based on salary disparity trends, we do not anticipate the salary gap narrowing since the study time period. Additionally, during the study period, gender pronouns were included in the majority of faculty profiles, however, were not available on a limited number of the included study population profiles. For faculty members who did not include gender pronouns, we were limited to faculty name and profile photo and a trained research staff member selected the assumed gender. Additionally, we did not have granular data to distinguish non-binary and gender expansive people. We recognize that diversity and equity is of utmost importance in all underrepresented populations. Further research is warranted on the impact of other variables such as race, ethnicity, and LGBTQ+ people.

Conclusion

In sum, our study observed the trends of salary within three clinical specialties at state-run, publicly funded academic institutions. For this sample, gender differences were most notable in the fields of general surgery and obstetrics and gynecology. We suggest that further investigations should focus less on gender inequities of base salary, which may not be relevant to clinical faculty in academic settings as they are institutionally set to be independent of gender, and more on discrepancies in discretionary or supplemental income which may preferentially benefit men. With closer analysis, we might be able to achieve a better understanding of whether women are not receiving their full earning potential or, as has been suggested in the economic literature,[28,36] whether they are instead prioritizing flexibility in work hours over compensation. Finally, with our observation that the gender salary gap might not be as prominent within the field of radiology, additional studies of this specialty could identify ways in which it could serve as a model for gender-based salary structures for clinicians.

Table 1. Demographic data for women and men faculty by institution and department at six academic institutions in 2016.

Institution	*Department*	*Total*	*Assistant*		*Associate*		*Professor*	
			W[1]	M[2]	W	M	W	M
Institution 1		121						
	Surgery	52	6	9	1	12	5	19
	Ob/Gyn	26	10	1	4	2	5	4
	Radiology	43	5	8	3	3	6	18
Institution 2		77						
	Surgery	32	5	3	4	7	0	13
	Ob/Gyn	22	4	1	8	1	4	4
	Radiology	23	0	3	2	7	5	6
Institution 3		175						
	Surgery	70	5	7	4	18	4	32
	Ob/Gyn	40	17	3	4	3	5	8
	Radiology	65	9	16	4	12	9	15
Institution 4[3]		15						
	Surgery	0	0	0	0	0	0	0
	Ob/Gyn	15	9	1	2	0	2	1
	Radiology	0	0	0	0	0	0	0
Institution 5		168						
	Surgery	72	5	12	7	14	8	26
	Ob/Gyn	27	3	0	4	0	8	12
	Radiology	69	2	9	8	7	9	34
Institution 6		243						
	Surgery	79	5	12	10	13	11	28
	Ob/Gyn	50	15	3	5	3	17	7
	Radiology	114	15	22	9	19	20	29

[1]Women; [2]Men

[3]Institution 4 did not have a surgery or radiology department.

Table 2. Average total compensation, baseline compensation and supplemental income stratified by department, rank and gender at six academic institutions in 2016.

Department	*Rank*	*Gender*	*Total*	*Total Compensation (Mean ± SD)*	*Baseline Compensation (Mean ± SD)*	*Supplemental Income (Mean ± SD)*
General Surgery	Assistant	W[1]	58	325,154 ± 167,202	100,013±21,259	**225,141±165,366**
		M[2]	9	401,248 ± 211,949	102,668±10,160	**298,580±215,319**
	Associate	W	27	321,560 ±137,854	127,005±28,489	**194,556±129,298**
		M	9	463,437 ±209,438	118,118±7,564	**345,320±211,383**
	Professor	W	41	355,631±135,205	160,583±40,006	**195,048±114,816**
		M	36	431,458±265,881	193,647±70,290	**237,811±235,410**
Ob/Gyn	Assistant	W	31	272,521±117,227	106,264±27,706	**166,257±97,851**
		M	58	306,085±108,154	111,412±26,998	**194,673±89,110**
	Associate	W	26	306,375±117,688	128,085±27,904	**178,291±97,833**
		M	48	318,068±138,353	128,023±34,574	**190,045±114,220**
	Professor	W	49	349,216±121,677	189,281±61,148	**160,329±90,079**
		M	102	330,763±155,221	190,616±65,553	**140,147±122,192**
Radiology	Assistant	W	26	271,733±101,797	116,400±32,331	**155,333±78,648**
		M	43	317,801±180,669	116,310±45,245	**201,492±149,107**
	Associate	W	26	334,010±192,702	129,735±46,725	**204,274±167,891**
		M	64	439,549±272,289	142,086±53,949	**297,463±250,756**
	Professor	W	28	432,943±221,201	196,264±65,213	**236,680±185,151**
		M	118	552,015±365,815	207,686±88,078	**344,329±320,399**

[1]Women; [2]Men

Author's contributions: Hayley Miller was a major contributor in the writing of the manuscript. Elizabeth Seckel analyzed and interpreted the data and contributed to manuscript preparation. Chrislyn White performed data abstraction and collection. Diana Sanchez performed data abstraction and collection. Erika Rubesova edited the manuscript. Claudia Mueller designed the study, analyzed and interpreted the data and was a major contributor in writing of the manuscript. Katherine Bianco designed the study, analyzed and interpreted the data and was a major contributor in writing of the manuscript. All authors read and approved the final manuscript.

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Ethics approval and consent to participate for this study was waived by the Institutional Review Board of the Stanford University School of Medicine.

Figure 1. Participant Exclusions. Participants included 799 faculty members. 988 institution employees were assessed for eligibility. 189 were excluded for having a non-professorial, full-time role. A further 79 were excluded for only being listed on the department website, not being on 2016 payroll.

Figure 2. Overall Salary. Distribution of total compensation (A), baseline compensation (B) and supplemental income (C) of women and men in general surgery, obstetrics and gynecology, and radiology departments stratified by academic rank.

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Figure 4. Obstetrics and Gynecology Salary. Distribution of total compensation (A), baseline compensation (B) and supplemental income (C) of women and men in obstetrics and gynecology stratified by academic rank.

Figure 5. Radiology Salary. Distribution of total compensation (A), baseline compensation (B) and supplemental income (C) of women and men in radiology stratified by academic rank.

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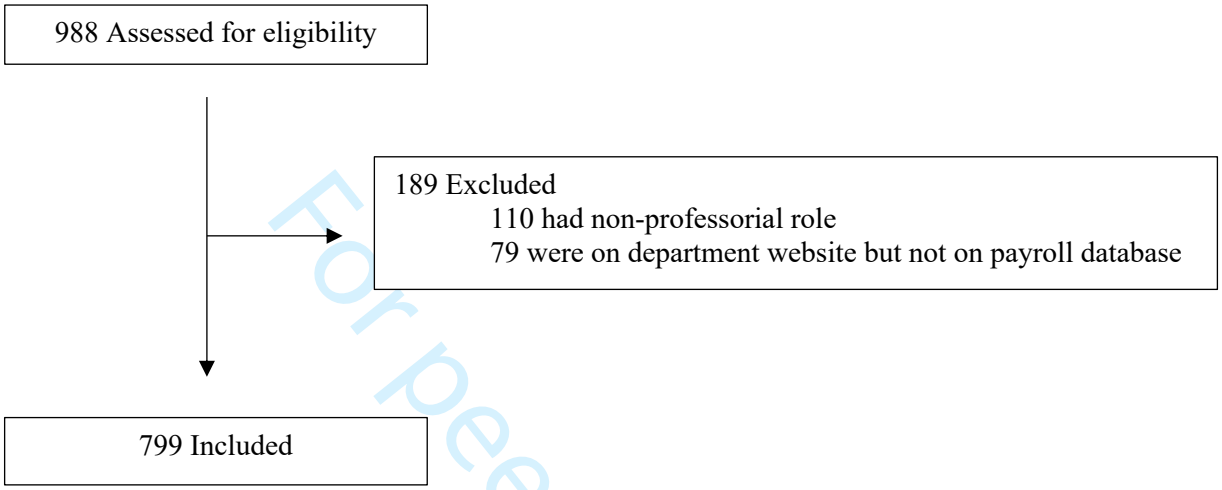

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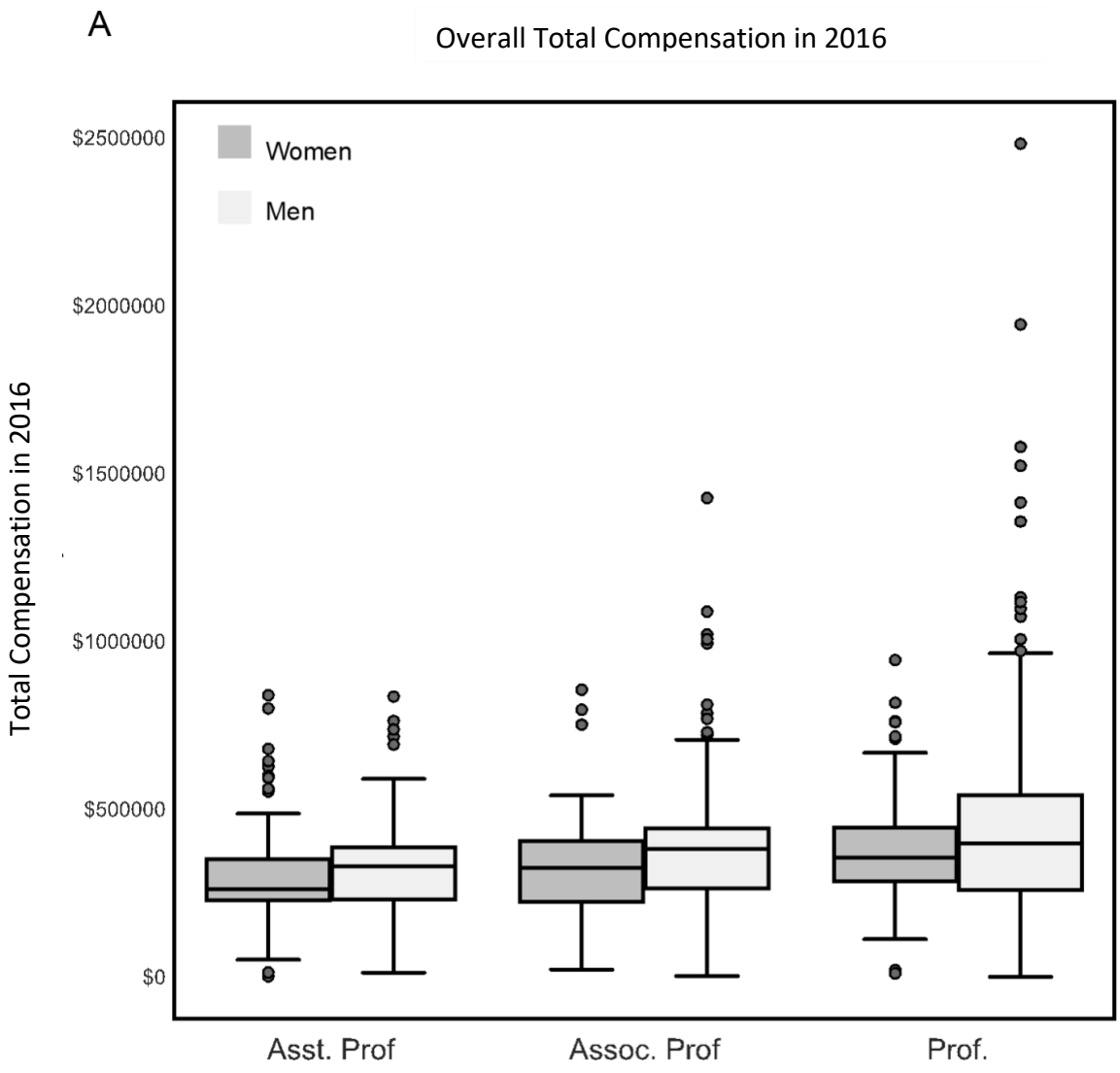

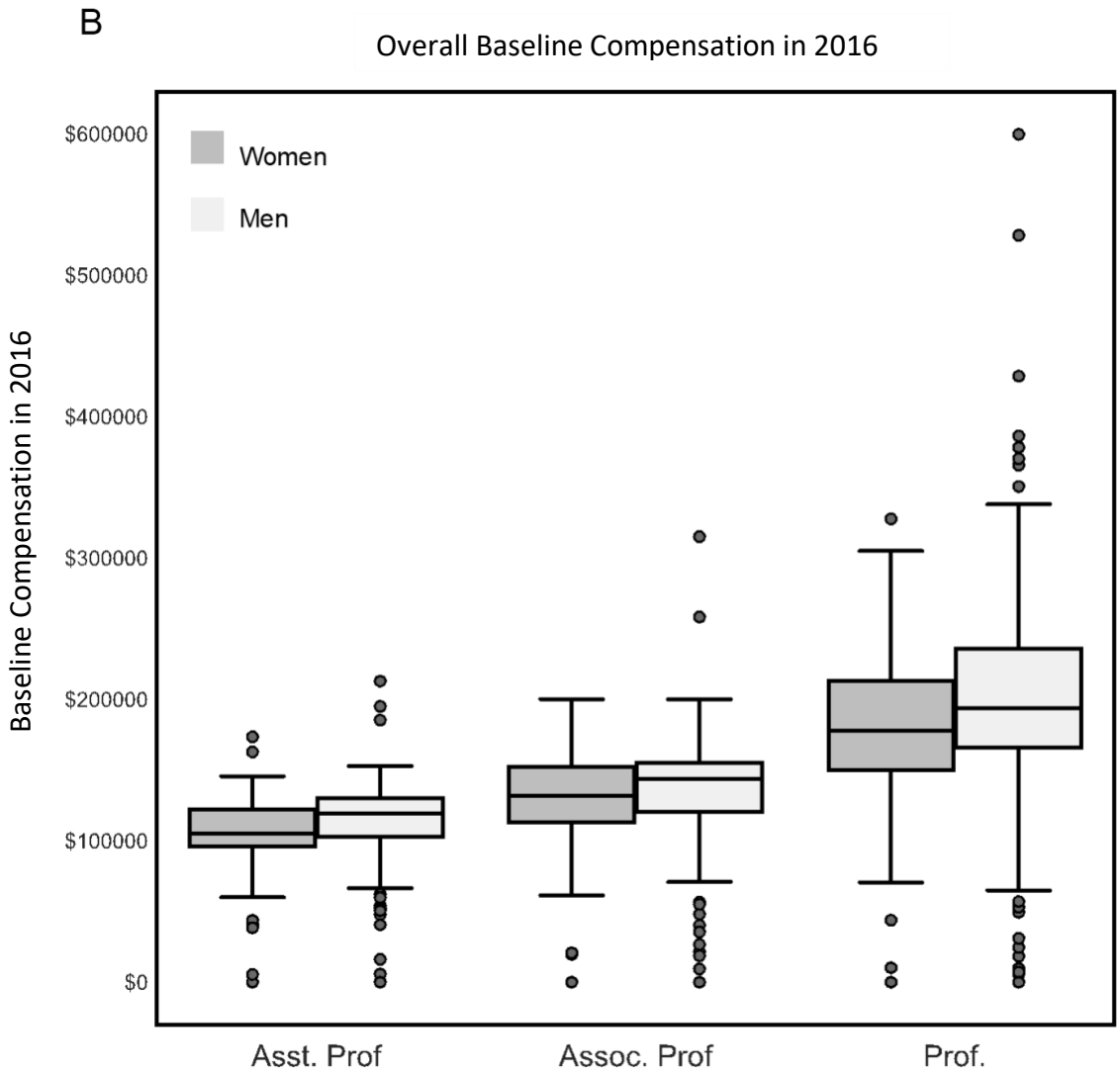

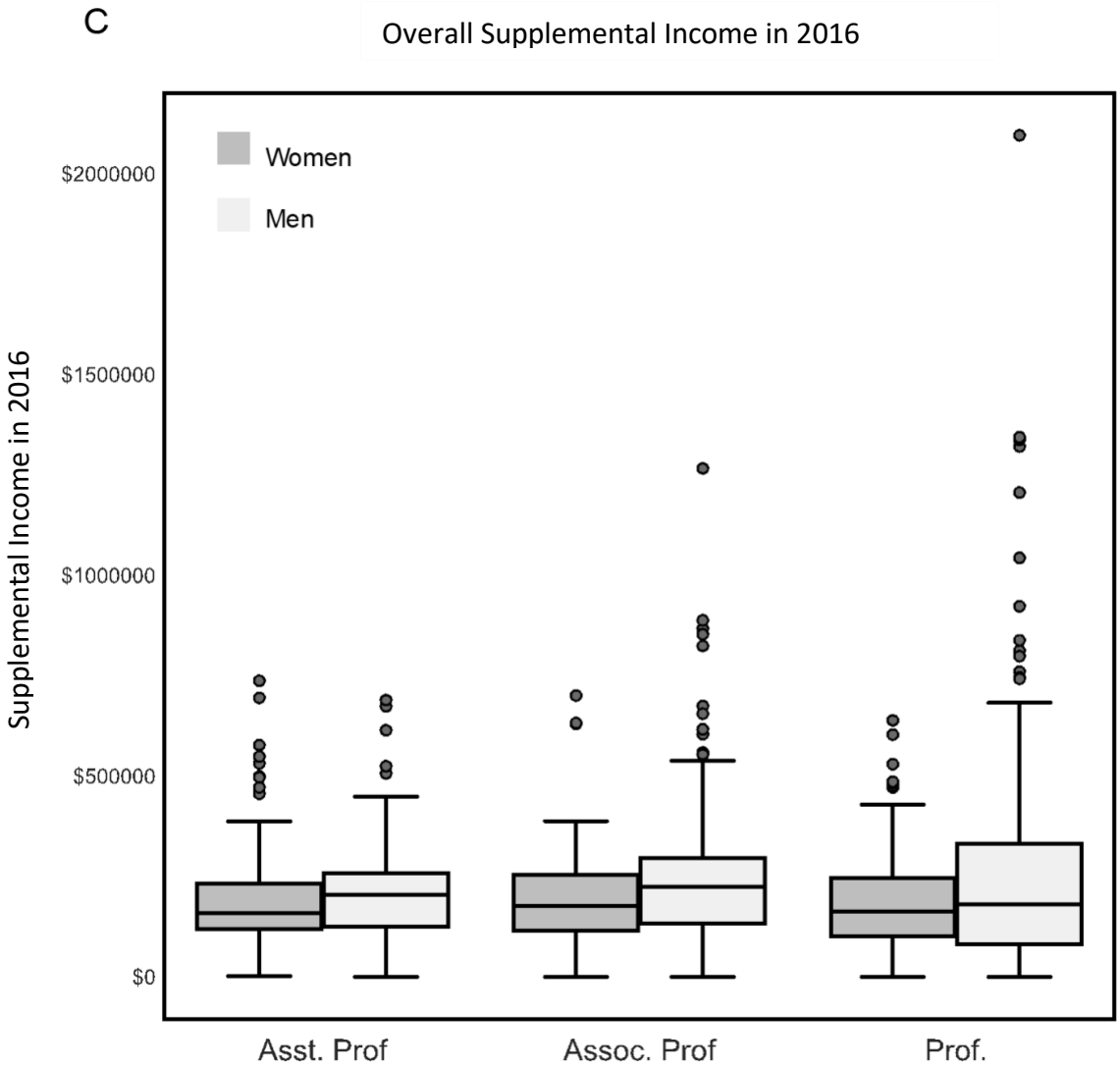

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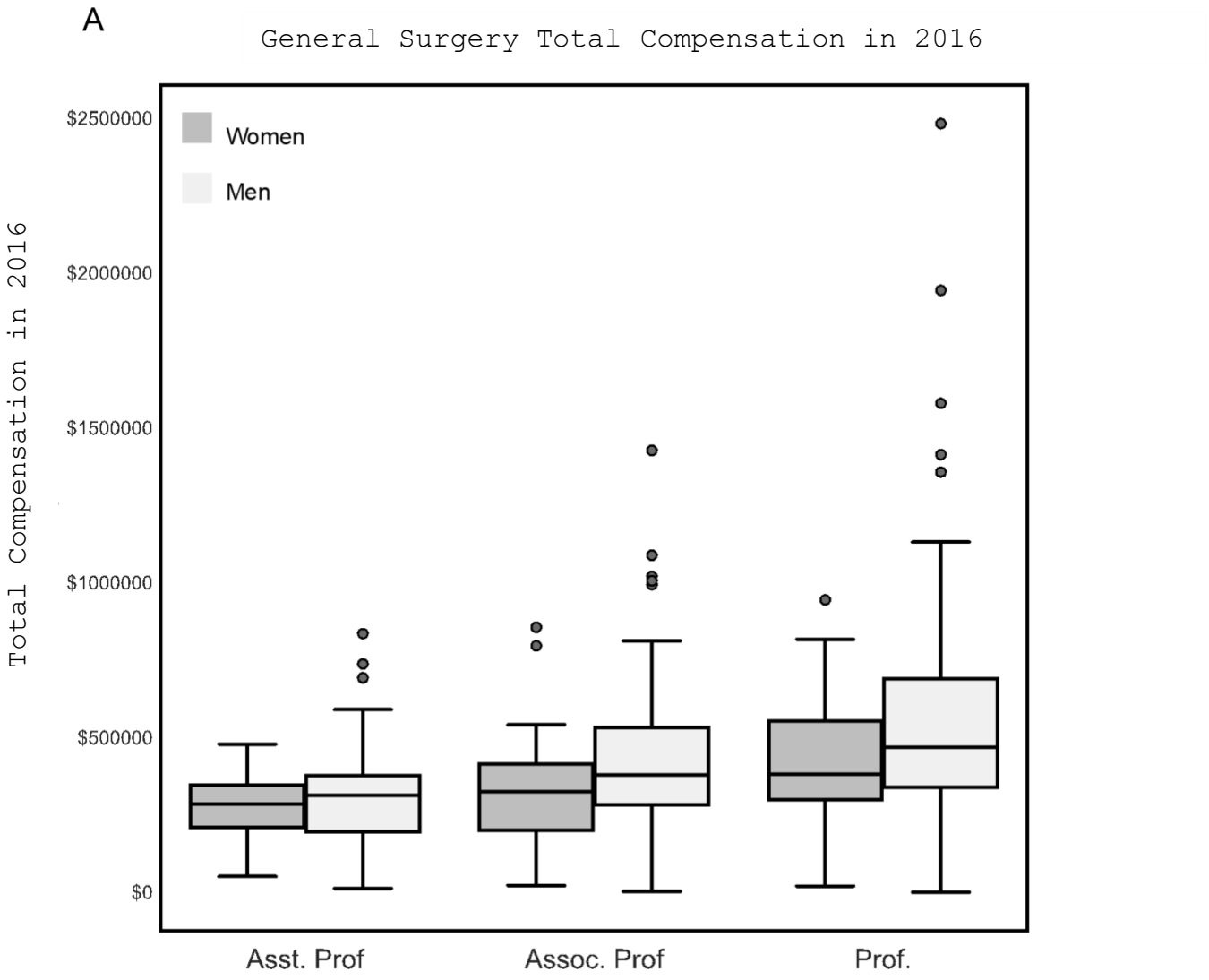

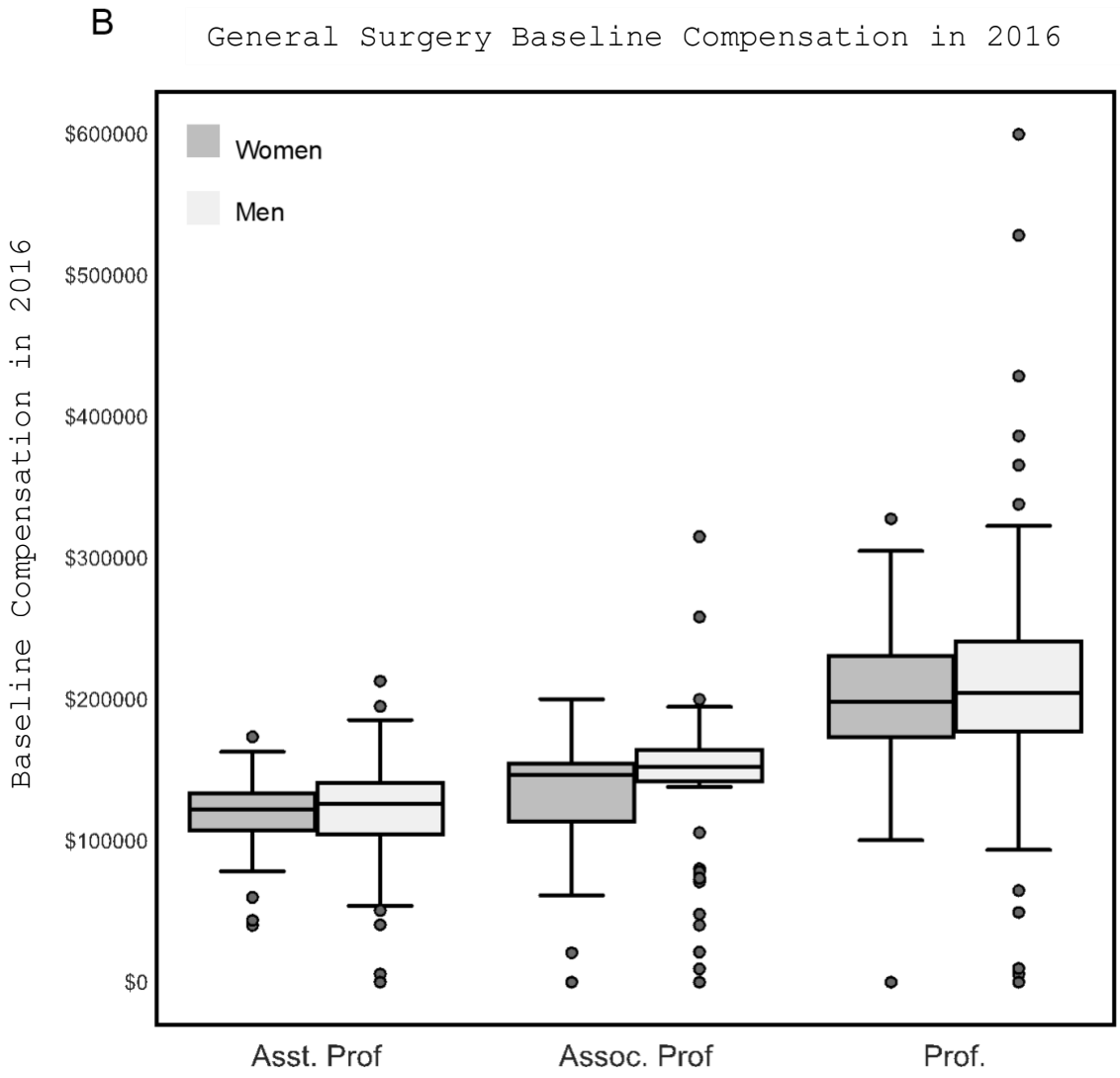

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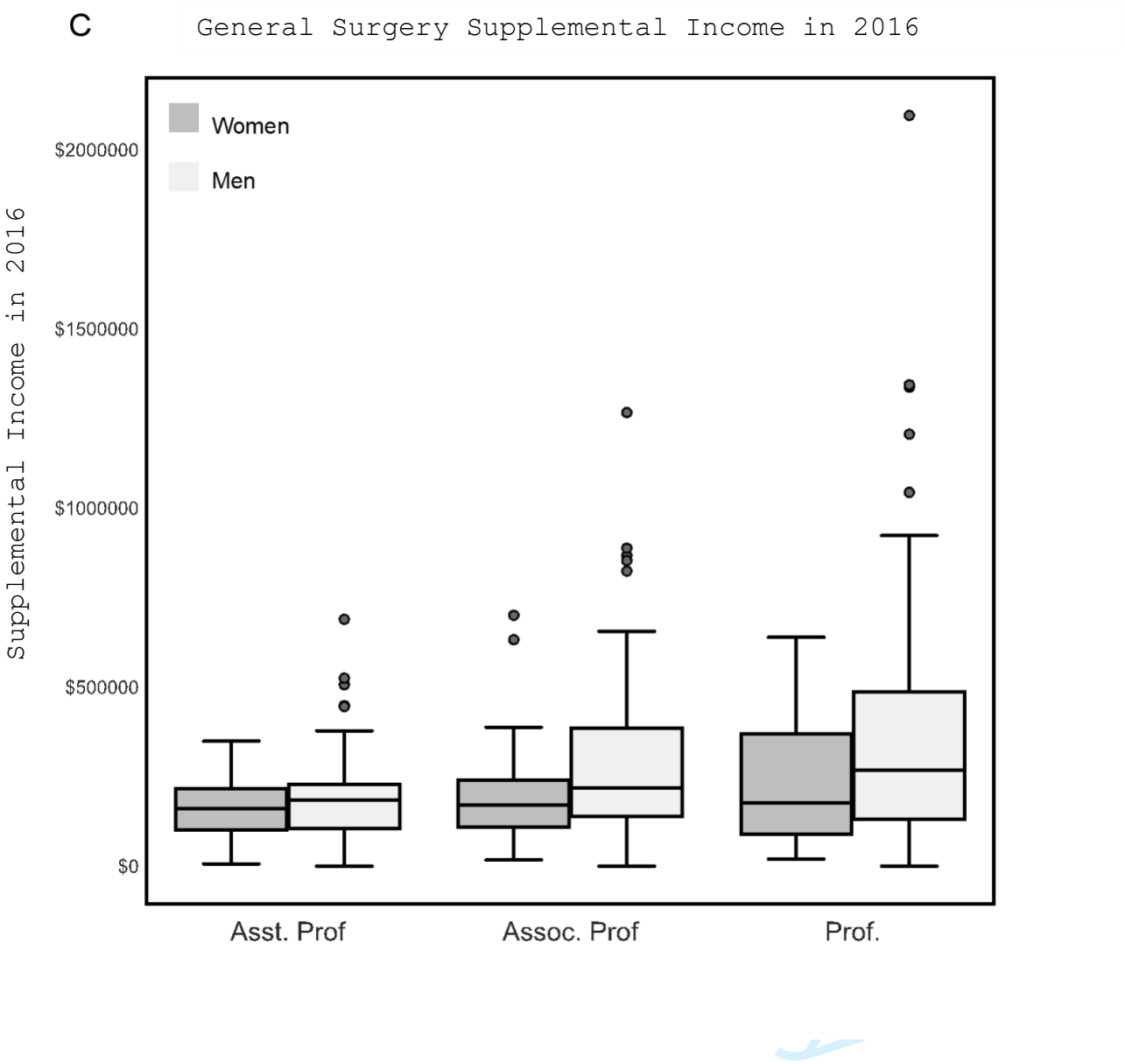

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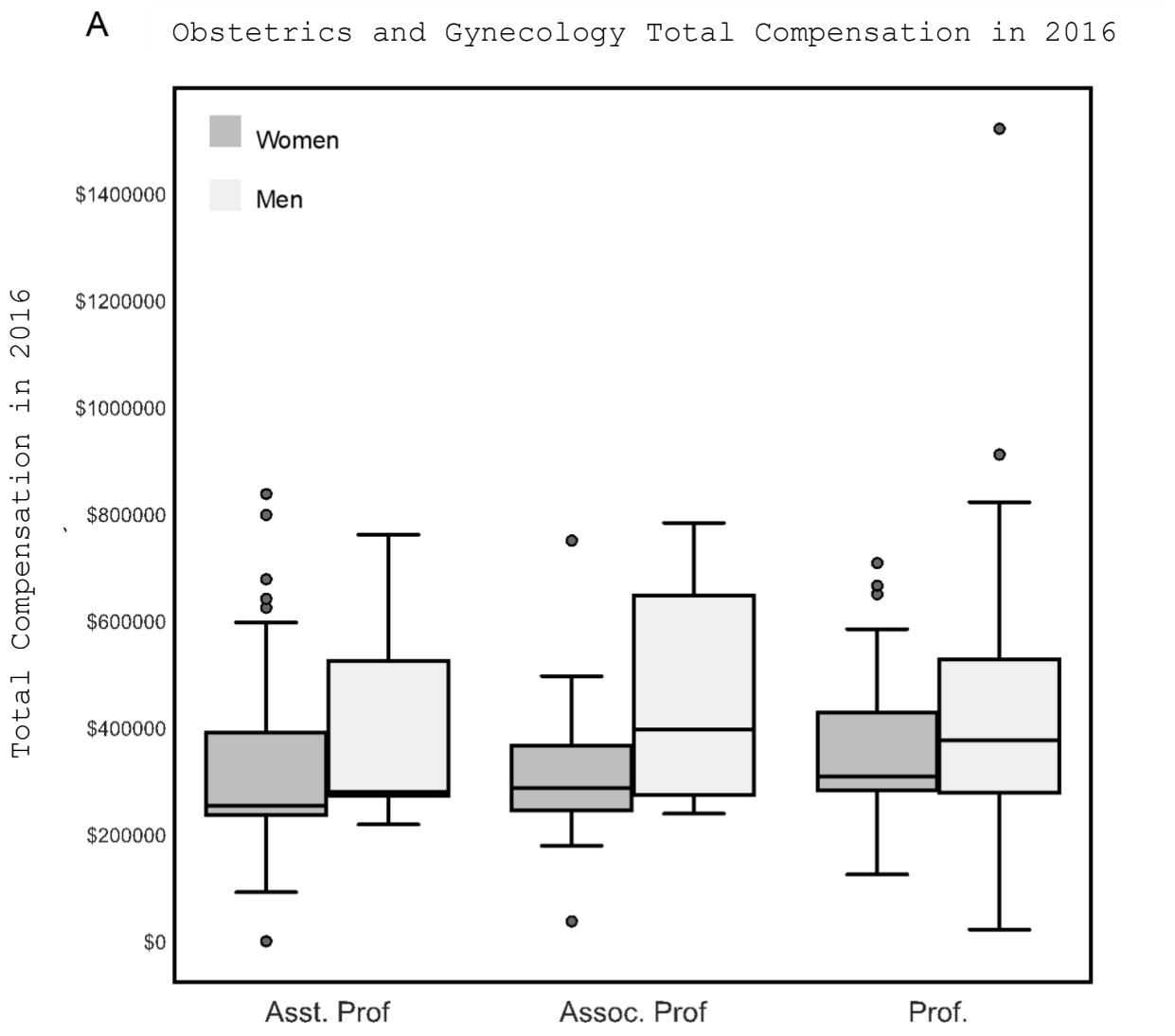

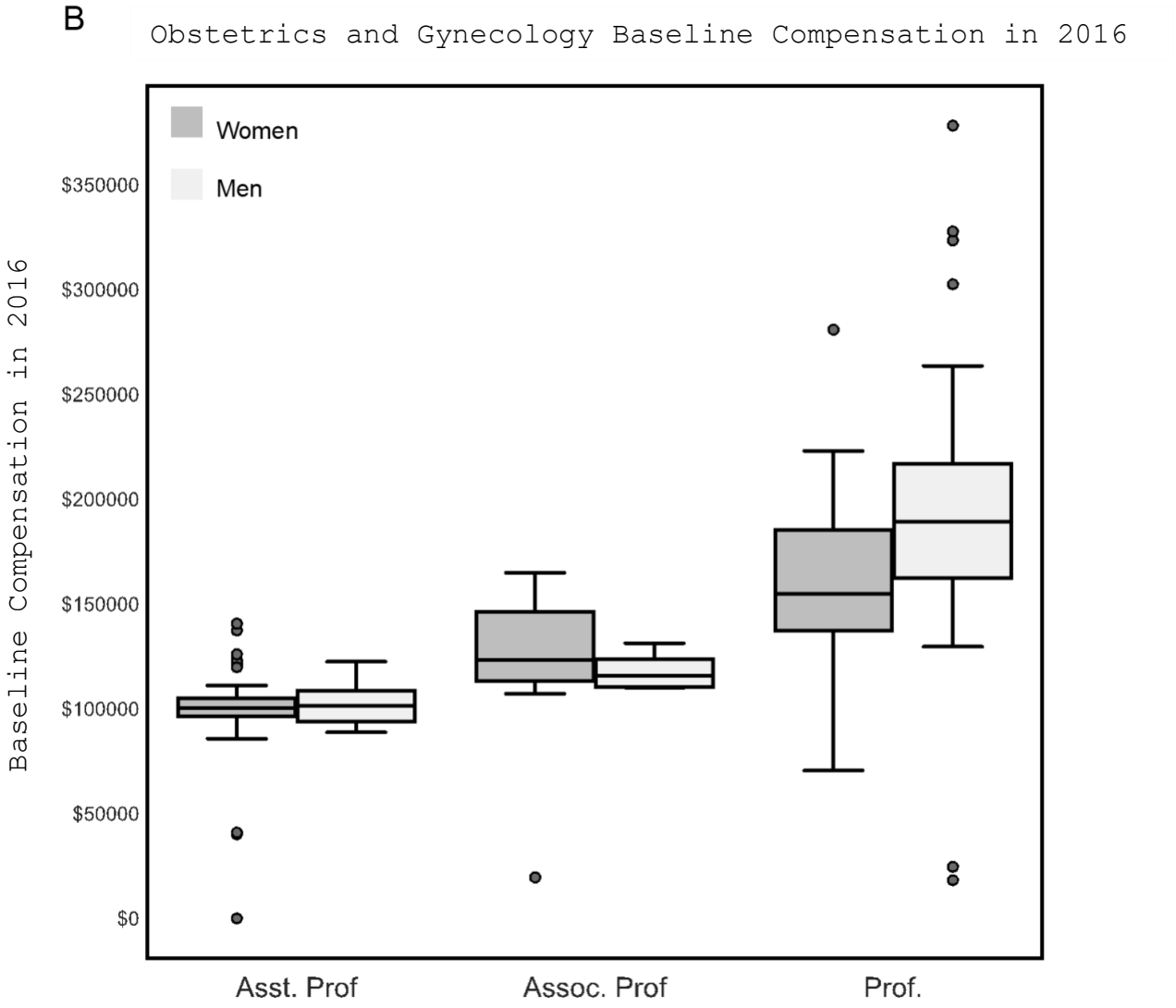

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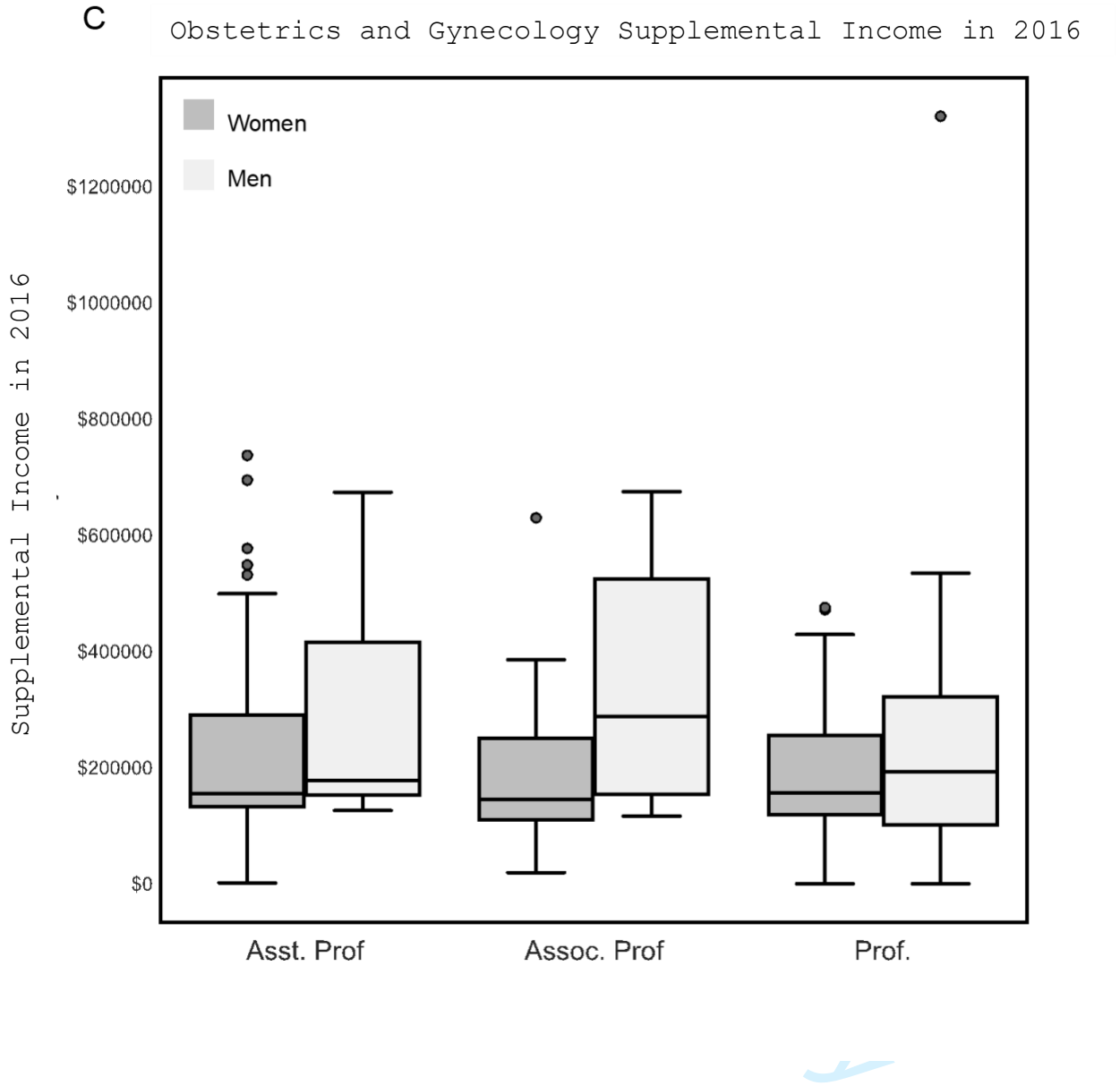

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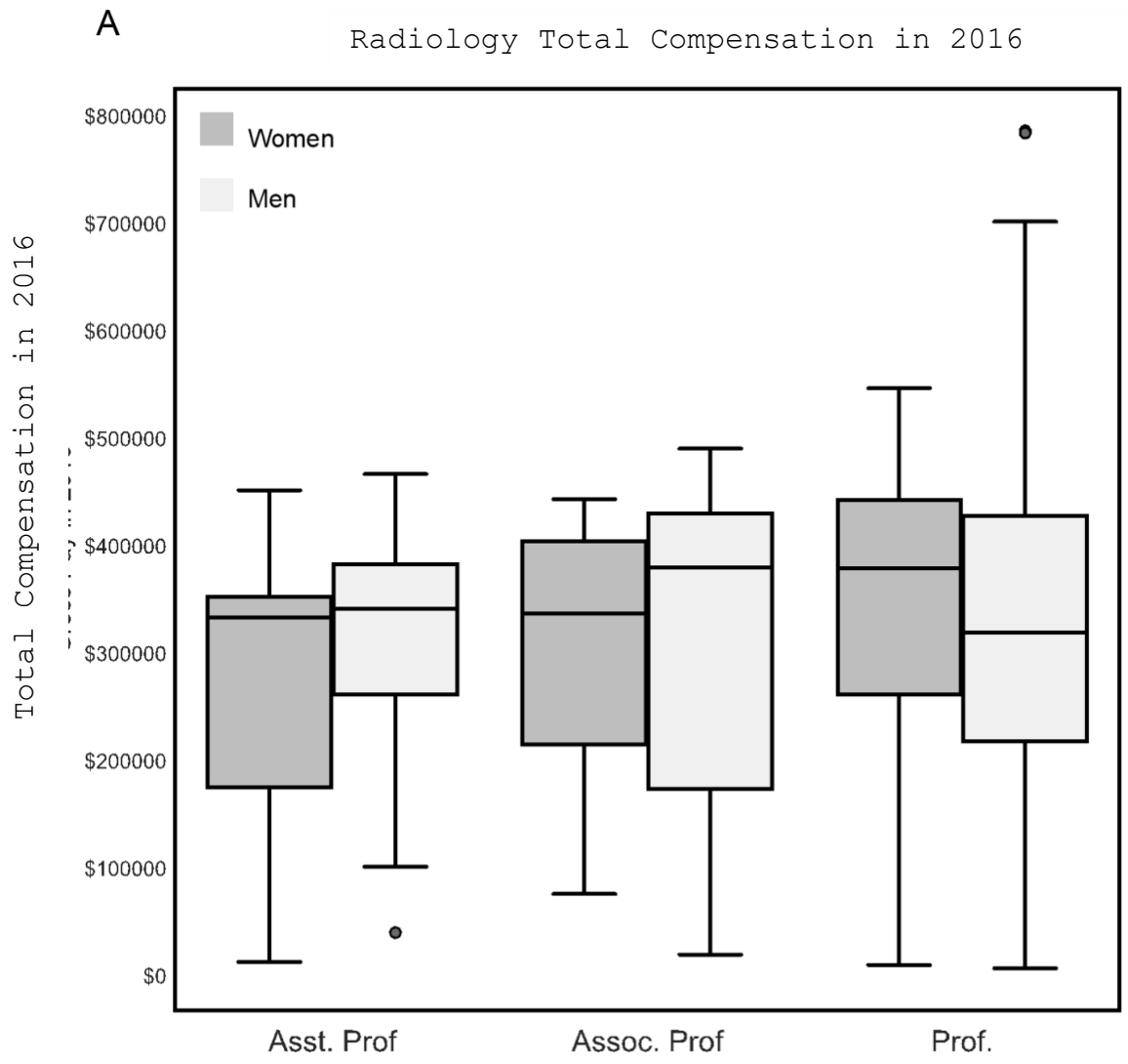

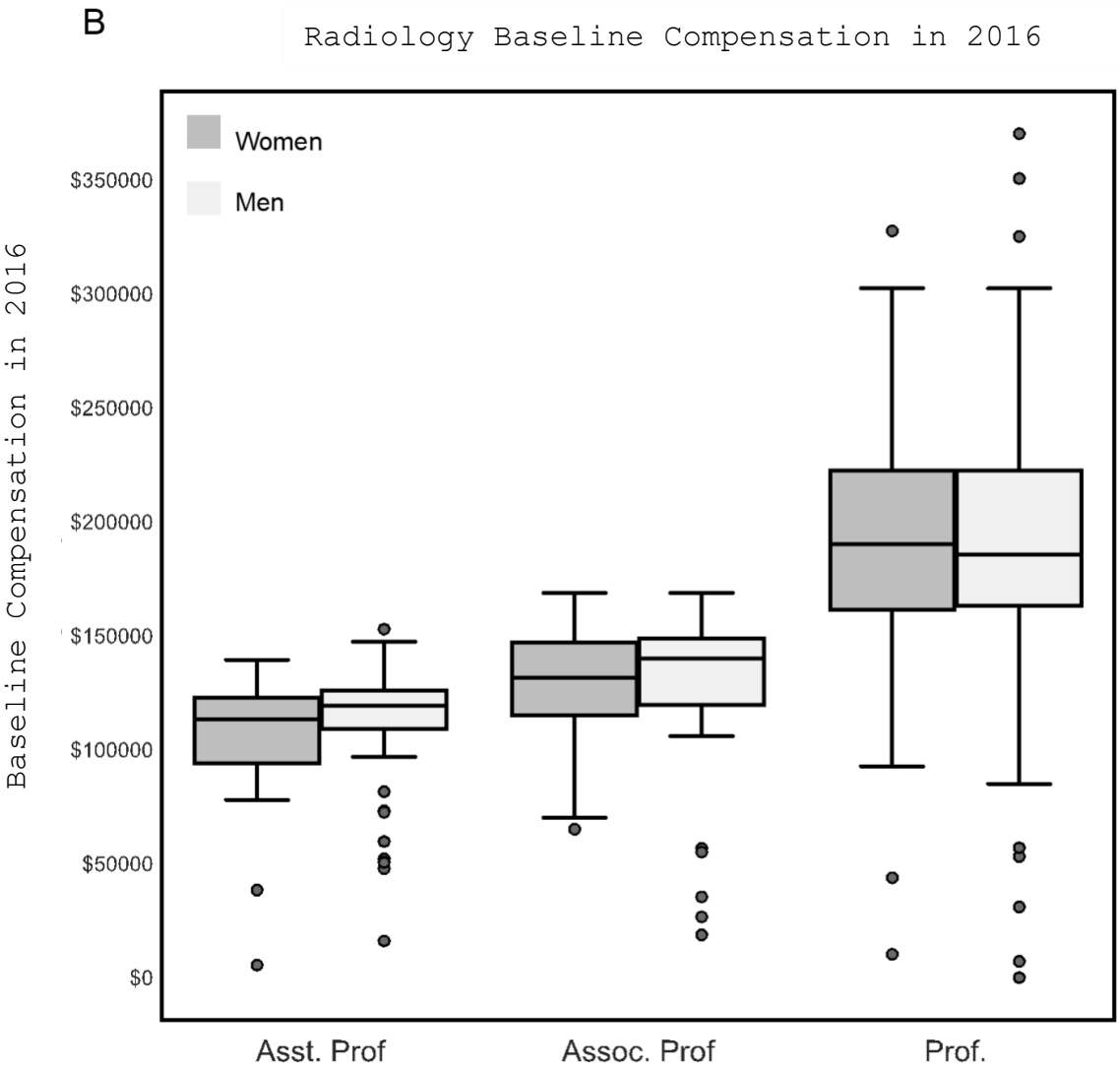

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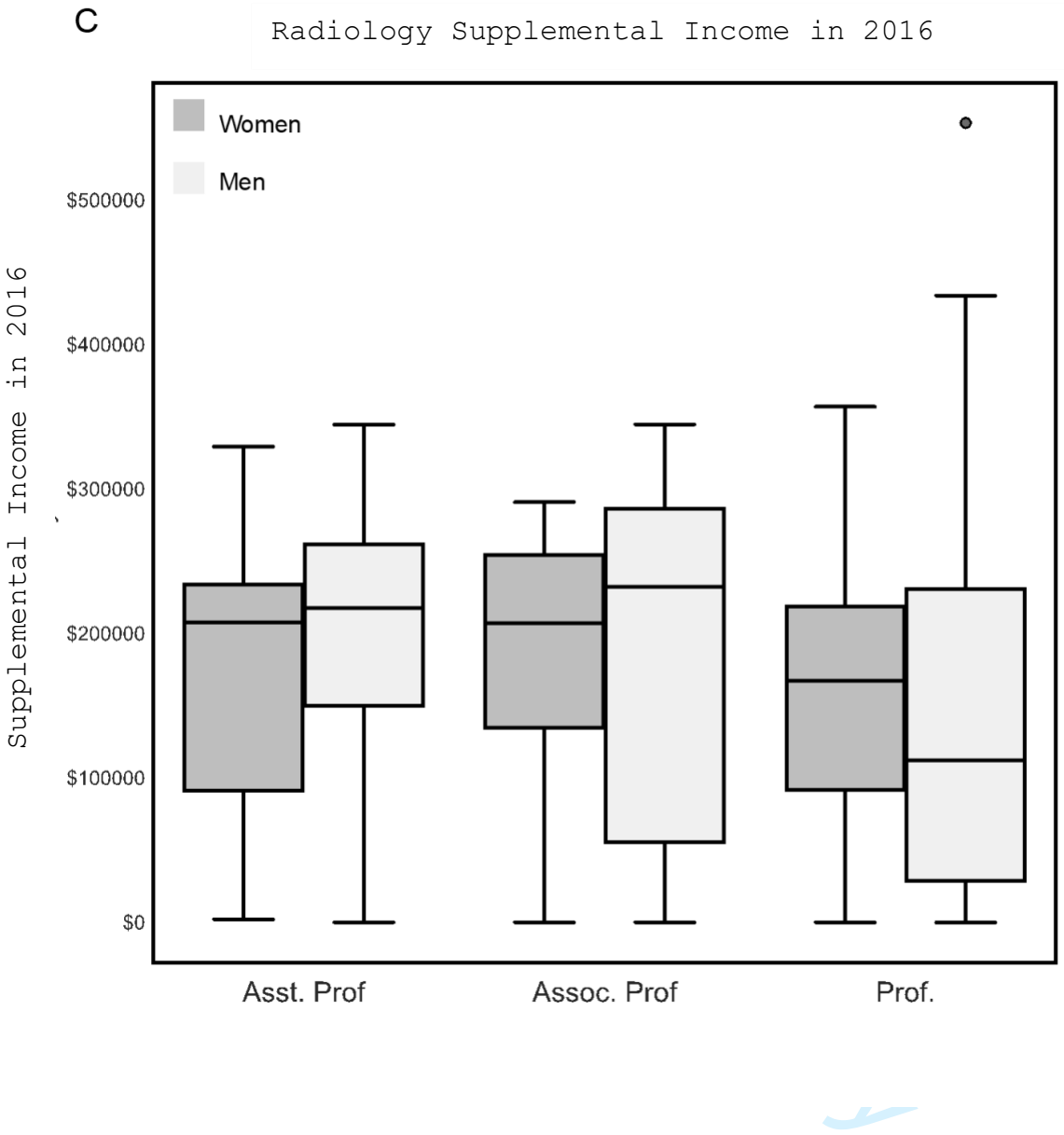

Supplementary Table

Department	Gender (W[1], M[2])		h-index
Ob/Gyn	W	Mean	7.67
		N	152
		Stand. Dev[3]	10.131
	M	Mean	17.32
		N	65
		Std. Dev	14.784
	Total	Mean	10.56
		N	217
		Std. Dev	12.496
Surgery	W	Mean	15.36
		N	94
		Std. Dev	14.366
	M	Mean	21.68
		N	269
		Std. Dev	17.358
	Total	Mean	20.04
		N	363
		Std. Dev	16.845
Radiology	W	Mean	17.86
		N	100
		Std. Dev	16.341
	M	Mean	22.55
		N	217
		Std. Dev	20.864
	Total	Mean	21.07
		N	317
		Std. Deviation	19.646
Total	W	Mean	12.71
		N	346
		Std. Deviation	14.070
	M	Mean	21.51
		N	551
		Std. Deviation	18.593
	Total	Mean	18.11
		N	897
		Std. Dev	17

[1]Women; [2]Men; [3]Standard Deviation

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Page 1- Lines 1-2 Page 2 line 39
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Page 2-3, lines 39-62
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Page 4-5, lines 84-114
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 5-6, lines 108-114
Methods			
Study design	4	Present key elements of study design early in the paper	Page 5-6, lines 118-128, lines 133-139
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Page 5-6, lines 118-128, lines 133-139, lines 145-161
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	Page 5-6, Lines 133-139
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Page 6-7 Lines 284-289, Lines 295-375
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Page 6-7 Lines 284-289, Lines 295-375
Bias	9	Describe any efforts to address potential sources of bias	Page 6, Lines 285-289, 373, 375
Study size	10	Explain how the study size was arrived at	Page 6 lines 283-286

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Page 7-8, Lines 378-401
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Page 7-8, Lines 378-401
		(*b*) Describe any methods used to examine subgroups and interactions	Page 7-8, Lines 378-401
		(*c*) Explain how missing data were addressed	N/A
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Page 8 Lines 404-409
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Page 8 Lines 404-415
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	Pages 8-11 Lines 419 -566
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	N/A
		Cross-sectional study—Report numbers of outcome events or summary measures	N/A
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Pages 8-11 Lines 419 -566
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	Pages 12-14, Lines 628-723
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Page 15, Lines 732-751
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Page 15, Lines 756-767
Generalisability	21	Discuss the generalisability (external validity) of the study results	Page 15, Lines 732-734
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Page 20 Lines 893-894

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Gender-based salary differences in academic medicine: a retrospective review of data from six public medical centers in the western United States

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Gender-based salary differences in academic medicine: a retrospective review of data from six public medical centers in the western United States

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Abstract

Objectives: We assessed the effect of gender, rank and research productivity on compensation for faculty at academic medical centers.

Design: A web-based retrospective review of salary for professors in 2016.

Setting: Faculty from six state-run, publicly-funded academic medical centers in the western US.

Participants: 799 faculty, 225 assistant (51% women), 200 associate (40% women), and 374 full professors (32% women) from general surgery (26% women), obstetrics and gynecology (70% women), and radiology (34% women).

Methods: Archived online faculty profiles were reviewed for gender, rank, and compensation (total, baseline, and supplemental). Total compensation was defined as baseline compensation plus supplemental income. Baseline compensation was defined as base salary minus reductions due to participation in the voluntary Employee Reduction in Time and phased retirement programs. Supplemental income was defined as additional salary for clinical care and research (eg, grants). Elsevier's SCOPUS was used to collect data on h-index, a measure of research productivity. Linear regression models were estimated to determine the relationship between these factors and salary.

Results: Total compensation was significantly higher for men across all professorial ranks in both general surgery ($R^2 = 0.159, F(4, 299) = 14.123, p < 0.01$) and obstetrics and gynecology ($R^2 = 0.068, F(4, 174) = 3.172, p < 0.05$). Women faculty within these departments earned almost $75,000 less than their men colleagues. The disparity in salary

originates from gaps in supplemental income, as baseline compensation was not significantly different between men and women. No significant gender difference in total compensation for radiology was found ($R^2 = 0.01, F(4,266) = 0.591, n.s.$). Higher h-index was associated with higher baseline compensation across all departments as well as with supplemental income for general surgery. Higher h-index was related to lower supplemental income for radiology and was not related to supplemental income for obstetrics and gynecology.

Conclusions: Further investigations should focus on discrepancies in supplemental income, which may preferentially benefit men.

Strengths and limitations of this study

- This is a large population study assessing distribution of salary among three diverse disciplines based on their gender distributions and distribution of the types of clinical work.
- Linear regression models were estimated to determine the relationship between specialty, gender, rank, h-index and salary.
- We focus on only one set of state-based academic institutions from the west coast of the United States and so are unable to be certain whether our findings would generalize to private practices or to those in other parts of the country.
- We examined salaries from only three departments and therefore cannot be certain that other clinical specialties would follow similar patterns.
- As the data were obtained from websites, we were unable to delve more deeply into the components of supplemental income beyond the general description that was offered publicly.

Introduction

The more education a woman has, the greater the gender disparity in salary is seen.[1] This disparity is especially glaring for physicians and surgeons, with women earning about 74 cents for every dollar men earn.[2] Representation of women in medicine is increasing dramatically, however the gender salary gap remains.[3-4] Women faculty have been shown to have lower salaries, smaller start-up packages, and limited authorship roles.[3-13] Despite the Equal Pay Act of 1963, this gap continues to exist across specialties, practice settings, work hours, and other characteristics,[6-10] and persists even after accounting for age, experience, specialty, faculty rank, and measures of research productivity and clinical revenue.[6-13] Commonly cited explanations for this gender disparity in salary include differences in negotiating skills, opportunities to join networks of influence within organizations, discrimination, and implicit and explicit bias.[6,7,10,14-16]

There is an increasingly large body of evidence that gender not only impacts salary but also faculty rank and research productivity.[6-13] Gender disparities in faculty rank within academic medicine persist after accounting for age, years since completion of residency, specialty, scientific authorship, National Institutes of Health (NIH) research funding, clinical trial participation, and clinical revenue.[10] In academic medicine specifically, there is a significant gender difference in number and impact of publications, with women showing lower productivity than men in surgical specialties.[13]

In order to close the salary gap in academic medicine, we must be clear where in total compensation packages this disparity originates. Previous data as it relates to non-medical occupations suggests that gender differences in salary can be attributed to the salary gaps within specific occupations, not across occupations.[17] As such, we chose to focus this study on academic salary at a single time point, expecting to see differences in salary based on gender, faculty rank and h-index, a metric for evaluating the cumulative impact of an author's scholarly output and performance calculated by comparing number of publications to citations.[18] The primary objective of our study was to identify where in total compensation the salary gap originates by evaluating differences in salary based on gender, rank and research productivity for three diverse academic medical specialties. Our areas of interest – salary, academic rank, and research productivity – are typical benchmarks for professional development.[6-11,18,19] We hypothesized that women would earn significantly less total compensation across all ranks, even after accounting for rank and research productivity.

Methods

Study Design

This was a retrospective population study of total faculty compensation for assistant, associate, and full professors at six major public academic medical centers using a single time point during 2016. We chose the time point of 2016 as it was the most recent year for which data was available at the time. Three diverse specialties – general surgery, obstetrics and gynecology, and radiology - were chosen, primarily because of their gender distributions and distribution of the types of clinical work.[8,20-25] General surgery and radiology are male-dominated specialties, while obstetrics and gynecology is a female-dominated specialty.[20-25] There is also a diversity of

clinical work throughout these three subspecialities with general surgery being dominated by surgical procedures, radiology not being surgical in nature, and obstetrics and gynecology with a more diverse balance of clinical work.[3,8,20-26] Ethics approval and consent to participate was waived by the Institutional Review Board of the Stanford University School of Medicine.

Study population

Archived online faculty profiles were reviewed to collect information on gender. Trained research staff utilized the internet archive service Wayback Machine[26] to collect data on gender from 2016 online faculty profiles at each department's website. Gender was identified on faculty profiles by identifying the pronoun included on faculty profiles. In the occasion that the pronoun was not specifically stated, the research staff used faculty photo and name to identify gender. Faculty from six academic institutions were included. We were able to stratify by assistant, associate, or full professor faculty rank.

Total compensation, rank and research productivity

A publicly available database that contains all the compensation information for faculty and employees at a large university system was used to look at total faculty compensation in three different ways: Total compensation, baseline compensation, and supplemental income.[27] Total compensation was defined as baseline compensation plus supplemental income. Baseline compensation was defined as base salary minus reductions due to participation in the voluntary Employee Reduction in Time and phased retirement programs. Supplemental income (commonly referred to as "discretionary pay") was defined as negotiated additional salary for clinical care and research that was funded from earned clinical revenue as well as contracts and grants. This

includes: pay for Summer Session or University Extension teaching, pay for research performed during summer months that is funded by extramural contracts and grants, performance-based incentive compensation and similar payments that recognize achievement of specific performance goals or exemplary service, pay for shift differentials (e.g., night or holiday call), payout of unused vacation leave upon separation, and lump sum payments made as part of the settlement of union bargaining agreements. Data on academic rank and specialty was collected from the same database. Elsevier's SCOPUS was used to collect data on h-index. Faculty members' h-indexes were obtained using their full name, last name and first and middle initials, and/or maiden name when appropriate. (Supplementary Table)

Statistical analysis

Our data set consisted of 6 variables: (1) Department – a three-level categorical variable (surgery, obstetrics and gynecology, and radiology); (2) Rank - three-level categorical variables (assistant, associate, and full); (3) Gender; (4) h-index – a measure of publication output; (5) baseline compensation – i.e., salary; and (6) supplemental income – e.g. bonuses, income for extra work. Linear regression models were estimated to determine the relationship between these factors and salary. Compensation was selected as our primary variable and gender, academic rank, and h-index as secondary variables. Rank, gender, and h-index were treated as independent variables, whereas "baseline compensation" and "supplemental income" were treated as dependent variables. Because rank is a three-level categorical level, it was split into two dummy variables with "Full" as reference value. Three regression models were run per department: one to predict total compensation (baseline compensation plus supplemental income), one to predict

baseline compensation, and one to predict supplemental income. Data was entered into SPSS version 20, with a *p* value of less than 0.05 considered to be significant.

Patient and Public Involvement

There was no patient or public involvement.

Results

988 total employees were assessed for eligibility (see **Figure 1**). 110 (11%) were excluded for having a role other than assistant, associate, or full professor. A further 79 (8%) were excluded because they were listed on the department website but not in the payroll database. After exclusions, our analysis included 799 faculty members, 312 (39%) were identified as women and 487 (61%) were identified as men and distribution among ranks included 225 (28%) assistant, 200 (25%) associate, and 374 (47%) full professors (**Table 1**).

Overall, women represented 26% of general surgery faculty (n=126), 70% of obstetrics and gynecology faculty (n=106), and 34% of radiology faculty (n=80). Among ranks, women made up 51% of all assistant professors (n=115) and men made up 49% (n=110), women made up 40% of associate professors (n=79) and men made up 60% (n=121), and women made up 32% of full professors (n=118) while men made up 68% (n=256) (**Table 1).** Distribution of stratified by gender and academic rank is presented in **Figure 2** and **Table 2.**

General surgery

Distribution of salary for general surgery is presented in **Figure 3**. Within general surgery, the overall regression for total compensation was significant ($R^2 = 0.159, F(4, 299) = 14.123, p < 0.01$). This means that, when they are examined together, the independent variables of gender, rank, and h-index influence the dependent variable of total compensation. Looking specifically at the three independent variables, we found that: Gender was significantly different with women earning lower total compensation than men ($\beta = -84{,}970, p < 0.05$). Rank was not significantly different for total compensation. Higher h-index was significantly associated with higher total compensation ($\beta = 5{,}023, p < 0.01$).

In an attempt to analyze what specifically drove the effect on total compensation, we ran separate analyses on "baseline compensation" and "supplemental income." In terms of baseline compensation, the overall regression was significant ($R^2 = 0.323, F(4, 299) = 35.737, p < 0.01$). Again, these analyses took into account the combined effect of all three independent variables of gender, rank, and h-index on baseline compensation. Looking specifically at each variable within the regression: Gender was not significantly associated with baseline compensation with men and women receiving similar baseline compensation. Rank was associated with regular salary, with assistant professors ($\beta = -51{,}031, p < 0.01$) and associate professors ($\beta = -40{,}680, p < 0.01$) earning significantly less baseline compensation than full professors. Higher h-index was also significantly associated with higher baseline compensation ($\beta = 1{,}606, p < 0.01$).

For "supplemental income", the overall regression was significant, again examining the combined effect of gender, rank, and h-index, was significant ($R^2 = 0.096, F(4{,}299) = 7.900,$

$p < 0.01$). In terms of specific variables: Gender was significantly associated with supplemental income ($\beta = -79{,}467, p < 0.05$) with women earning significantly less of this salary component than men. There was no difference for rank on supplemental income. Higher h-index was significantly associated with supplemental income ($\beta = 3{,}418, p < 0.01$).

Obstetrics and gynecology

Distribution of salary for obstetrics and gynecology is presented in **Figure 4**. For obstetrics and gynecology, the overall regression, which included the variables of gender, rank, and h-index, for total compensation was significant ($R^2 = 0.068, F(4, 174) = 3.172, p < 0.05$). Looking at each variable specifically, there was a significant difference in gender, with women earning less total compensation than men ($\beta = -84{,}221, p < 0.02$). Rank was not found to be significantly different for total compensation for either assistant or associate professors compared to full professors. H-index was also not significantly associated with total compensation.

For baseline compensation, the overall regression of the combined effect of gender, rank, and h-index was significant ($R^2 = 0.485, F(4, 174) = 40.986, p < 0.01$). For the specific variables: There was no significant difference between women and men in baseline compensation. Rank was associated with baseline compensation, with both assistant ($\beta = -52{,}696, p < 0.01$) and associate professors ($\beta = -36{,}711, p < 0.01$) earning significantly less than full professors. H-index was also significant ($\beta = 1{,}314, p < 0.01$), with higher h-index linked to higher baseline compensation.

For supplemental income, the overall regression of the combined effect of gender, rank, and h-index was not significant ($R^2 = 0.037, F(4, 174) = 1.666,\ n.s.$). However, when we looked at the three variables specifically within the regression, there was a significant difference in gender, with women earning less supplemental income than men ($\beta = -74{,}168, p < 0.05$). There were no significant differences in supplemental income for the variables of rank or h-index.

Radiology

Distribution of salary for radiology is presented in **Figure 5**. Within radiology, the overall regression, which again examined the combined effect of gender, rank, and h-index for total compensation was not significant ($R^2 = 0.01, F(4{,}266) = 0.591, n.s.$). Furthermore, none of the individual variables of gender, rank, or h-index showed any significant association with total compensation.

In terms of baseline compensation, the overall regression, which again included the combined effect of gender, rank, and h-index, was significant ($R^2 = 0.395, F(4{,}265) = 43.293,\ p < 0.01$). For the specific variables: Gender was not significantly associated with baseline compensation as men and women earned similar base compensation. Significant differences in baseline compensation by rank were identified with assistant professors ($\beta = -52{,}145, p < 0.01$) and associate professors ($\beta = -43{,}848, p < 0.01$) earning significantly lower baseline compensation than full professors. Higher h-index was also significantly associated with higher baseline compensation ($\beta = 979, p < 0.01$).

For supplemental income, the overall regression of the combined effect of gender, rank, and h-index was significant ($R^2 = 0.064, F(4, 266) = 4.567, p < 0.01$). In terms of the specific variables, there was no significant association between gender and supplemental income. Rank also not associated with supplemental income. H-index was significantly associated with supplemental income ($\beta = -947, p < 0.05$). Higher h-index linked to lower supplemental income.

Discussion

Our results show that while there are significant differences in total compensation for women faculty in general surgery and obstetrics and gynecology, it is not baseline compensation that accounts for the salary gap between women and men. Instead, other components of salary, classified in our data as supplemental income, appear to contribute to acknowledged differences in salary between women and men faculty members within our target institutions. In our review of publicly available salary data,[26,27] women faculty within the departments of general surgery and obstetrics and gynecology earned almost $75,000 less than their men colleagues. This supplemental income is described as coming from additional clinical responsibilities such as call income as well as support for administrative work or leadership positions and was not consistently linked to academic productivity, as defined by h-index, across specialties in our study.[27] These findings echo the work of the economist Claudia Goldin who has described the gender salary gap in a variety of professions as being related not to differences in baseline compensation but rather to differences related to flexibility or amount of work that is taken on by women versus men.[27,28]

Previous studies offer many theories to explain the gender gap, including women are less likely to be asked to serve as leaders, experience effective mentoring, receive equitable allocation of research funding, and seek additional call hours or clinical work in favor of different household and childrearing obligations.[3,29-35] Women faculty who work flexible hours may be less likely than men to receive leadership positions that result in bonus salary.[29] In fact, faculty who need a more flexible work schedule remain as junior faculty and receive less support.[30] These circumstances help to explain our findings the lower "additional" or supplemental income for women faculty within the two specialties. One solution is to alter promotion policies to better support the diversity of needs.[30] Additional solutions can be found in the NIH's Gender Inequality Task Force Report.[31]

Interestingly, the gender gap for supplemental income in our study was true within obstetrics and gynecology, despite the fact that women comprise a majority of faculty members within this specialty. Furthermore, no gender gap was identified for the department of radiology, despite its male predominance. This finding suggests that the gender distribution of the department alone does not necessarily guide salary discrepancies between women and men faculty members. Instead, it seems that other factors, such as the nature of the clinical work itself, may contribute to the gender salary gap.[31] It has been acknowledged in previous studies that surgical subspecialties are highly technical and predominantly occupied by men, and often times men are among the highest paid with roles as researchers, opposed to women within these specialties occupying lower status communal roles as educators.[34] For instance, no gender differences were noted for any portion of salary within the radiology departments that we examined in this study. Radiology clinical work differs from that of other specialties in that it is predominantly shift-

based and less procedural than general surgery and obstetrics and gynecology. Radiology may thereby offer fewer opportunities for gender-based increases to supplemental income that might be earned through additional clinical work.

Our findings also validate previous studies finding striking gender inequities in the higher academic ranks.[13] Common explanations for these gender differences include the gender-based hiring disparities of previous generations, lack of transparency of salary, promotion, mentoring and female role-models, and time away for childbearing and family obligations.[14,15,29,30,33] There is also recent evidence that women physicians might start their career with lower salary expectations than men, which could become a self-fulfilling prophecy for later salary.[30,34] Furthermore, there is some indication that women prioritize salary less than men do and are judged more harshly for initiating negotiations.[6,14,15, 30]

In summary, gender disparities have been well documented in academic medicine, and our study offers a unique perspective of the different components that make up the academic medicine physician salary. Previous studies have offered suggestions to improve this disparity, which will be important for closing this supplemental income gap. Suggestions include transparency of starting salaries to young professionals, initiating negotiation training to improve starting salary packages, mentorship in career advancement for women junior faculty, investigation of research grant award processes, and further adoption of programs to address disparities in grant award processes.[31] Implementation of a university-wide objective compensation planned implemented by the Association of American Medical Colleges regional median salary (AAMC-WRMS) was associated with reduced gender-based differences in salary among surgery faculty within the

institution and a statistically significant increase in salary among female faculty. Objective compensation plans may mitigate gender-based implicit bias in salary negotiations and promotions.[35]

Limitations

Our study has several limitations. First, we focus on only one set of state-based academic institutions from the west coast of the United States and so are unable to be certain whether our findings would generalize to private practices or to those in other parts of the country. Furthermore, we examined salaries from only three departments and therefore cannot be certain that other clinical specialties would follow similar patterns. However, the departments were chosen to accurately reflect a set of departments with a diverse set of gender distribution and clinical work. Finally, since our data was obtained from websites only, we are unable to delve more deeply into the components of supplemental income salary beyond the general description that is offered publicly. For instance, we cannot determine how much is related to compensation for clinical or administrative work versus research funding. We are also not certain what types of research funding are included in this supplemental income and whether certain grants (eg, external) might be differently influenced by factors such as competitiveness of topic or number of proposals submitted. We are therefore not able to completely explain what aspect of compensation supplemental incomes represents or why it is not related to academic productivity in the same way across the three departments. Another limitation is that the 2016 data may not reflect more contemporary remuneration, however, based on salary disparity trends, we do not anticipate the salary gap narrowing since the study period. Additionally, during the study period, gender pronouns were included in most faculty profiles, however, pronouns were not available

on a limited number of faculty profiles. For faculty who did not include gender pronouns, we were limited to faculty name and profile photo and a trained research staff member selected the assumed gender. Additionally, we did not have granular data to distinguish non-binary and gender expansive people. We recognize that diversity and equity is of utmost importance in all underrepresented populations. Further research is warranted on the impact of other variables such as race, ethnicity, and LGBTQ+ people.

Conclusion

In sum, our study observed the trends of salary within three clinical specialties at state-run, publicly-funded academic institutions. For this sample, gender differences were most notable in the fields of general surgery and obstetrics and gynecology. We suggest that further investigations should focus less on gender inequities of base salary, which may not be relevant to clinical faculty in academic settings as they are institutionally set to be independent of gender, and more on discrepancies in discretionary or supplemental income, which may preferentially benefit men. With closer analysis, we might be able to achieve a better understanding of whether women are not receiving their full earning potential or, as has been suggested in the economic literature,[28,36] whether they are instead prioritizing flexibility in work hours over compensation. Finally, with our observation that the gender salary gap might not be as prominent within the field of radiology, additional studies of this specialty could identify ways in which it could serve as a model for gender-based salary structures for clinicians.

Table 1. Demographic data for women and men faculty by institution and department at six academic institutions in 2016.

Institution	*Department*	*Total*	*Assistant*		*Associate*		*Professor*	
			W[1]	M[2]	W	M	W	M
Institution 1		121						
	Surgery	52	6	9	1	12	5	19
	Ob/Gyn	26	10	1	4	2	5	4
	Radiology	43	5	8	3	3	6	18
Institution 2		77						
	Surgery	32	5	3	4	7	0	13
	Ob/Gyn	22	4	1	8	1	4	4
	Radiology	23	0	3	2	7	5	6
Institution 3		175						
	Surgery	70	5	7	4	18	4	32
	Ob/Gyn	40	17	3	4	3	5	8
	Radiology	65	9	16	4	12	9	15
Institution 4[3]		15						
	Surgery	0	0	0	0	0	0	0
	Ob/Gyn	15	9	1	2	0	2	1
	Radiology	0	0	0	0	0	0	0
Institution 5		168						
	Surgery	72	5	12	7	14	8	26
	Ob/Gyn	27	3	0	4	0	8	12
	Radiology	69	2	9	8	7	9	34
Institution 6		243						
	Surgery	79	5	12	10	13	11	28
	Ob/Gyn	50	15	3	5	3	17	7
	Radiology	114	15	22	9	19	20	29

[1]Women; [2]Men

[3]Institution 4 did not have a surgery or radiology department.

Table 2. Average total compensation, baseline compensation and supplemental income stratified by department, rank and gender at six academic institutions in 2016.

Department	*Rank*	*Gender*	*Total*	*Total Compensation (Mean ± SD)**	*Baseline Compensation (Mean ± SD)**	*Supplemental Income (Mean ± SD*)*
General Surgery	Assistant	W[1]	58	325± 167	100±21	225 ±165
		M[2]	9	401± 212	103±10	299±215
	Associate	W	27	322 ±138	127±28	195±129
		M	9	463±209	118±8	345±211
	Professor	W	41	356±135	161±40	195±115
		M	36	431±266	194±70	238±235
Ob/Gyn	Assistant	W	31	273±117	106±28	166 ±98
		M	58	306±108	111±27	195±89
	Associate	W	26	306±118	128±28	178±98
		M	48	318±138	128 ±35	190±114
	Professor	W	49	349±122	189±61	160 ±90
		M	102	331±155	191±66	140 ±122
Radiology	Assistant	W	26	271±102	116 ±32	155±79
		M	43	318±181	116 ±45	201±149
	Associate	W	26	334±193	130±47	204±168
		M	64	440±272	142 ±54	297±251
	Professor	W	28	433±221	196 ±65	237±185
		M	118	552±366	208 ±88	344±320

[1]Women; [2]Men

*Compensation data presented as thousands

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Data availability statement: All data used are publicly available.

Ethics approval: Ethics approval for this study was waived by the Institutional Review Board of the Stanford University School of Medicine. IRB-40645.

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Figure 1. Participant exclusions

Participants included 799 faculty members. 988 institution employees were assessed for eligibility. 189 were excluded for having a non-professorial, full-time role. A further 79 were excluded for only being listed on the department website, not being on 2016 payroll.

Figure 2. Overall salary

Distribution of total compensation (A), baseline compensation (B) and supplemental income (C) of women and men in general surgery, obstetrics and gynecology, and radiology departments stratified by academic rank.

Figure 3. General surgery salary

Distribution of total compensation (A), baseline compensation (B) and supplemental income (C) of women and men in general surgery stratified by academic rank.

Figure 4. Obstetrics and gynecology salary

Distribution of total compensation (A), baseline compensation (B) and supplemental income (C) of women and men in obstetrics and gynecology stratified by academic rank.

Figure 5. Radiology salary

Distribution of total compensation (A), baseline compensation (B) and supplemental income (C) of women and men in radiology stratified by academic rank.

Figure 1. Participant Exclusions. Participants included 799 faculty members. 988 institution employees were assessed for eligibility. 189 were excluded for having a non-professorial, full-time role. A further 79 were excluded for only being listed on the department website, not being on 2016 payroll.

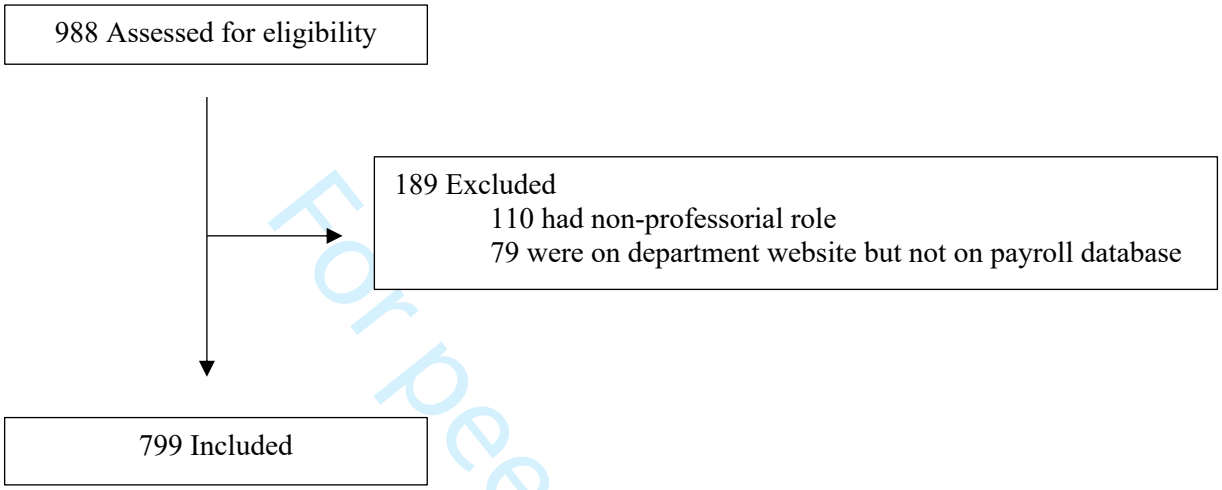


Figure 2. Overall Salary. Distribution of total compensation (A), baseline compensation (B), and supplemental income (C) of women and men in general surgery, obstetrics and gynecology, and radiology departments stratified by academic rank in 2016.

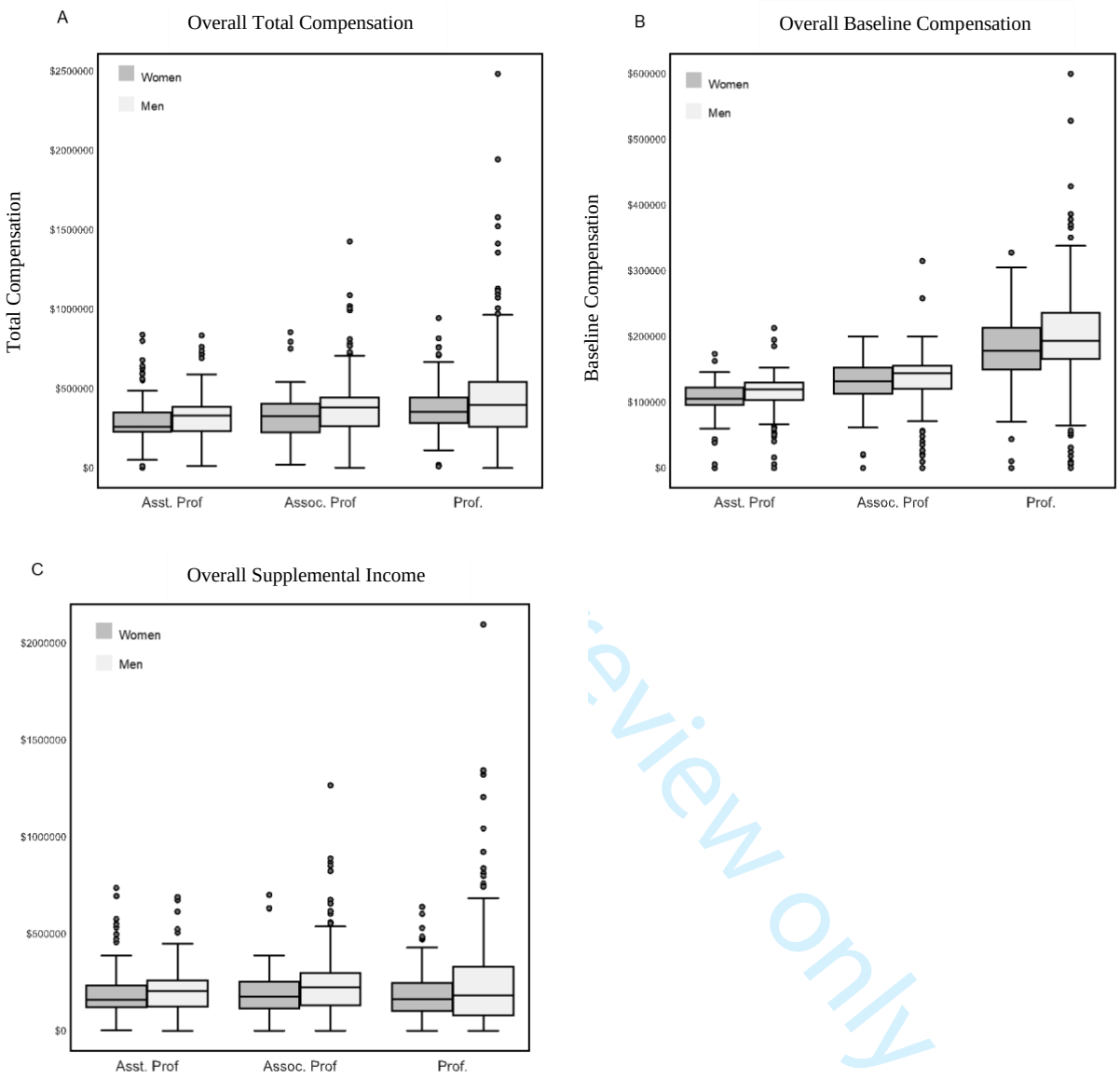


Figure 3. General Surgery Salary. Distribution of total compensation (A), baseline compensation (B), and supplemental income (C) of women and men in general surgery stratified by academic rank in 2016.

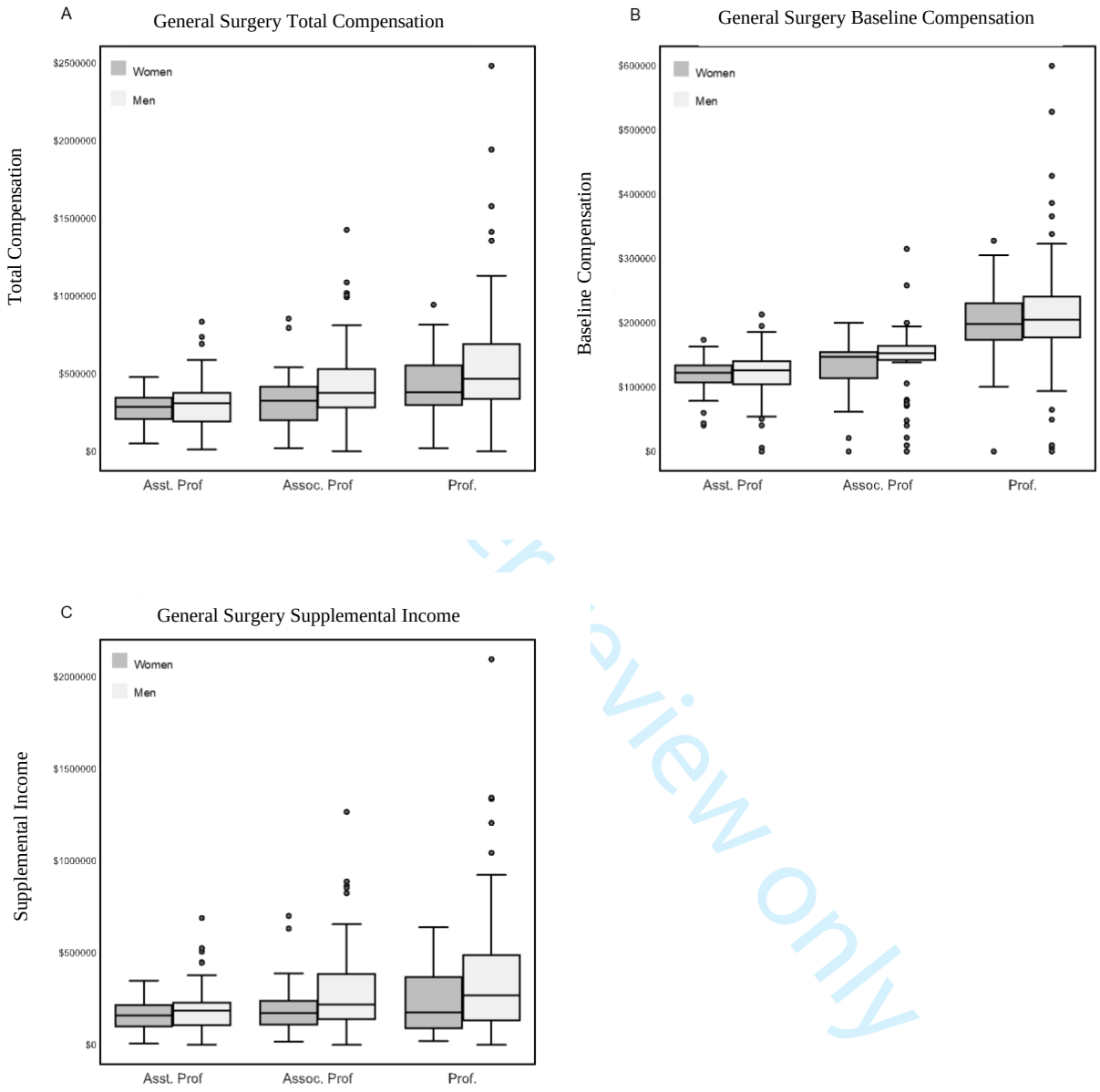


Figure 4. Obstetrics and Gynecology Salary. Distribution of total compensation (A), baseline compensation (B) and supplemental income, (C) of women and men in obstetrics and gynecology stratified by academic rank in 2016.

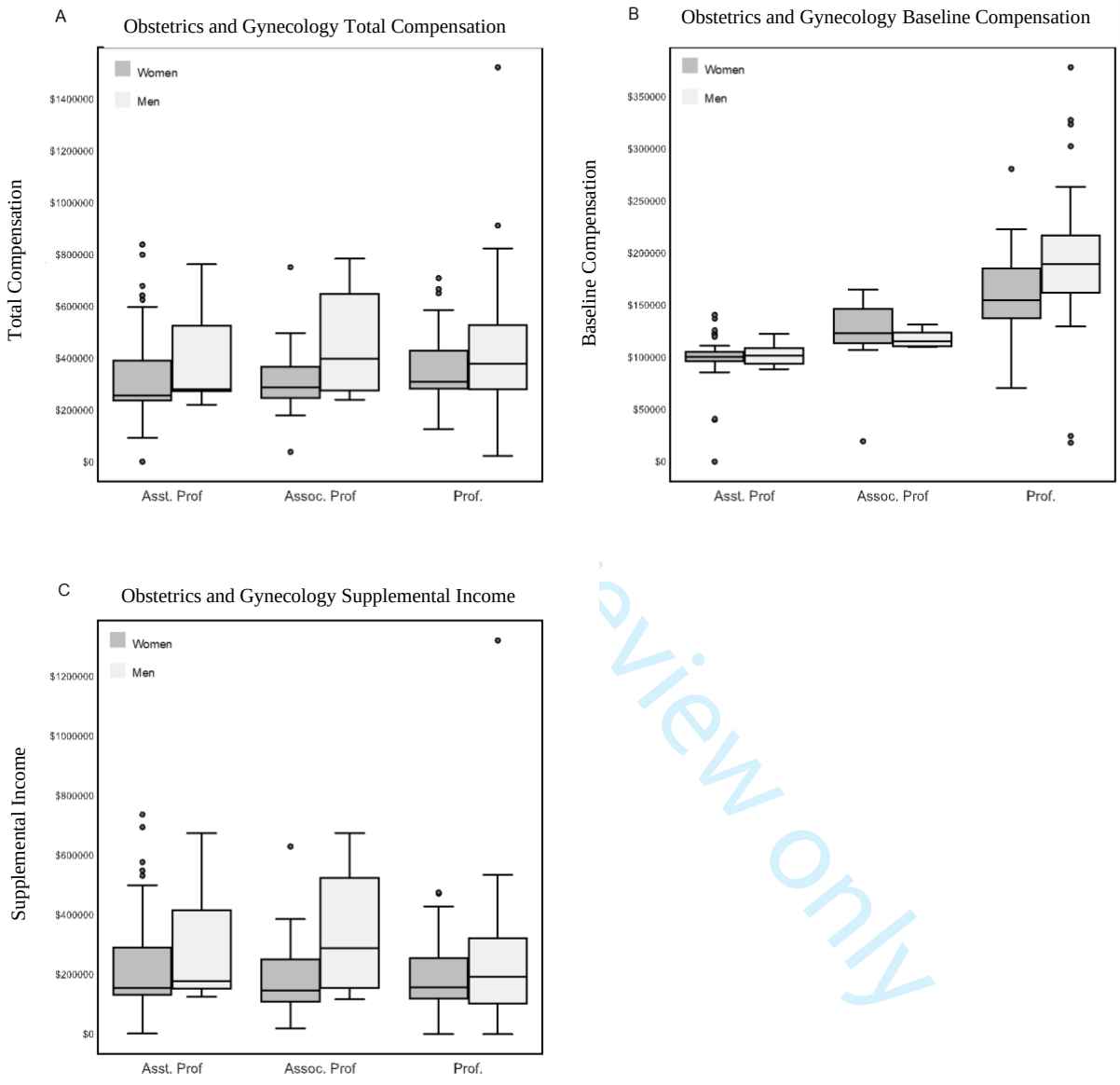
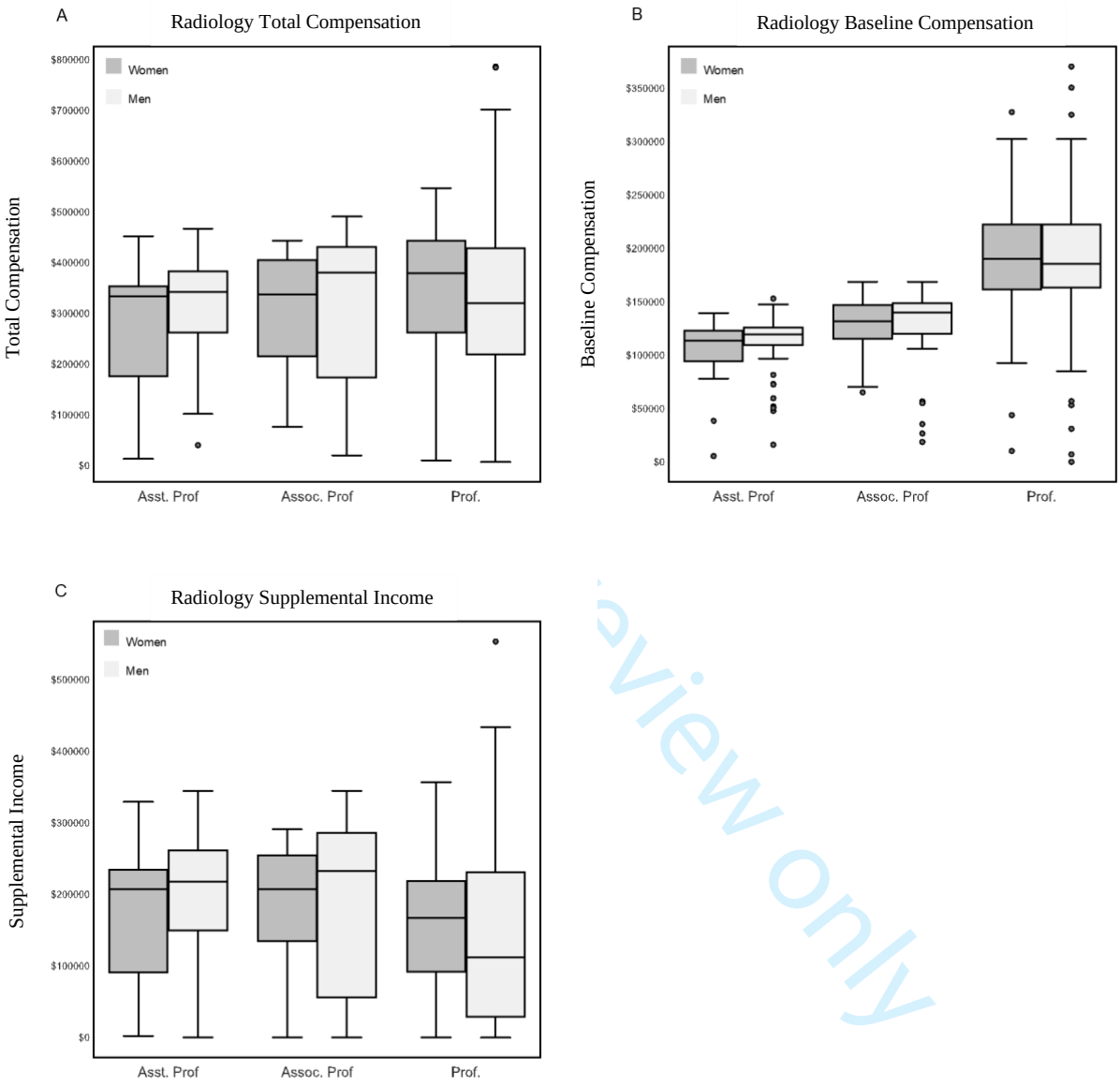


Figure 5. Radiology Salary. Distribution of total compensation (A), baseline compensation (B) and supplemental income (C) of women and men in radiology stratified by academic rank in 2016.



Supplementary Table

Department	Gender (W[1], M[2])		h-index
Ob/Gyn	W	Mean	7.67
		N	152
		Stand. Dev[3]	10.131
	M	Mean	17.32
		N	65
		Std. Dev	14.784
	Total	Mean	10.56
		N	217
		Std. Dev	12.496
Surgery	W	Mean	15.36
		N	94
		Std. Dev	14.366
	M	Mean	21.68
		N	269
		Std. Dev	17.358
	Total	Mean	20.04
		N	363
		Std. Dev	16.845
Radiology	W	Mean	17.86
		N	100
		Std. Dev	16.341
	M	Mean	22.55
		N	217
		Std. Dev	20.864
	Total	Mean	21.07
		N	317
		Std. Deviation	19.646
Total	W	Mean	12.71
		N	346
		Std. Deviation	14.070
	M	Mean	21.51
		N	551
		Std. Deviation	18.593
	Total	Mean	18.11
		N	897
		Std. Dev	17

[1]Women; [2]Men; [3]Standard Deviation

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Page 1- Lines 1-2 Page 2 line 39
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Page 2-3, lines 39-62
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Page 4-5, lines 84-114
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 5-6, lines 108-114
Methods			
Study design	4	Present key elements of study design early in the paper	Page 5-6, lines 118-128, lines 133-139
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Page 5-6, lines 118-128, lines 133-139, lines 145-161
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	Page 5-6, Lines 133-139
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Page 6-7 Lines 284-289, Lines 295-375
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Page 6-7 Lines 284-289, Lines 295-375
Bias	9	Describe any efforts to address potential sources of bias	Page 6, Lines 285-289, 373, 375
Study size	10	Explain how the study size was arrived at	Page 6 lines 283-286

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Page 7-8, Lines 378-401
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Page 7-8, Lines 378-401
		(*b*) Describe any methods used to examine subgroups and interactions	Page 7-8, Lines 378-401
		(*c*) Explain how missing data were addressed	N/A
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Page 8 Lines 404-409
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Page 8 Lines 404-415
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	Pages 8-11 Lines 419 -566
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	N/A
		Cross-sectional study—Report numbers of outcome events or summary measures	N/A
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Pages 8-11 Lines 419 -566
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	Pages 12-14, Lines 628-723
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Page 15, Lines 732-751
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Page 15, Lines 756-767
Generalisability	21	Discuss the generalisability (external validity) of the study results	Page 15, Lines 732-734
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Page 20 Lines 893-894

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.