Salaries & Gender Discrimination Lawsuit at Houston College of Medicine

Margaret Hannum

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Abstract

Female physician plaintiffs claimed gender discrimination in salary determination. The author examined data from 261 Houston College of Medicine physicians and constructed multiple linear regression models of salary considering gender, department, primary emphasis, board certification, publication rate, experience, and rank to see if the data support the plaintiffs' claims. In 1995, mean salary was $130,876.90 (standard deviation (sd) $62,034.50) for women vs $194,914.10 ($94902.70)) for men with an absolute difference of $64,037.2 (95% confidence interval [CI]: $44,903.54, $83,179.81). However, gender did not remain a significant predictor of salary after adjusting for department, rank, primary emphasis, certification, and experience. The final model explained 94.6% of the variation in salary. The author did not observe systemic institution-wide gender discrimination in setting salaries, after adjusting for covariates. However larger sample size may be needed to determine department-specific discrimination.

1 INTRODUCTION

Difference in pay between male physicians and female physicians has been well established [1, 2, 3], with a perplexing 5-digit pay gap for even newly trained doctors [4]. As recently as 2013, the gender income ratio for female to male physicians was 61.0% [5]. According to the 2016 Physician Specialty Data Book, the percent of women in different specialties varied greatly, from 61.1% in pediatrics to 5.0% and 6.0% in Orthopedic and Thoracic surgery, respectively [10], which may explain some of the gap. A 1996 article in the New England Journal of Medicine determined that physicians with similar characteristics (specialty, department, years of experience, etc.) do not have a wage gap, although differences remain among older doctors and certain specialties [2]. However, there has also been evidence of systematic discrimination that has kept women physicians from earning the same pay and advancement as their male counterparts [3, 8].

When attempting to identify discrimination, particularly in court cases, fitting appropriate regression models is complicated since factors that might explain a difference in salary may also be related, such as measures of productivity and experience [7]. Additionally, including a predictor that is also subject to discrimination (such as rank) will dilute or underestimate the effects of discrimination on the variable of interest. Still, such variables "tainted by discrimination" should be included in court cases, especially to provide stronger evidence to the courts if a significant association between gender and salary can still be shown after adjusting for all other relevant variables [6].

Several years ago, female physicians from the Houston College of Medicine brought a discrimination case to the United States District Court of Houston, claiming that due to a pattern of discrimination, women earned less and were less likely to receive promotion, using a set of data from the college to support their claim. I will examine the same dataset to see if any factors besides gender might explain a lower salary for female physicians, and incorporate methods to address and correct for possible multicollinearity or "tainted" variables.

2 METHODS

2.1 Data Collection and Characteristics

I used data collected from 261 Houston College of Medicine physicians from 1994-1995. This data was provided for the purposes of the Linear Regression Models final analysis project.

In addition to gender and salary from 1994 and 1995, the data included information on Department (Biochemistry, Physiology, Genetics, Pediatrics, Medicine, and Surgery), primary emphasis (clinical vs research), board certification, publication rate (number of publications on CV divided by number of years between CV data and MD date), years' experience since obtaining MD, and rank (Assistant, Associate, or Full professor).

2.2 Statistical Analysis

I fit a multivariable linear regression model of salary (both 1994 and 1995) as a function of all available predictors. Most characteristics were categorical and were fit using indicator variables with reference categories. After constructing a full model, I used criterion procedures to reduce the model, then examined pairwise interactions with gender and looked for possible multicollinearity.

3 RESULTS

3.1 Characteristics of the Population

Characteristics of the population are presented in Table 1. The sample consisted of 261 physicians from the Houston College of Medicine. Of these, 106 were female (41%) and 155 were male (59%). Salary varied widely, with a minimum in 1994 of $34,510 and a max of $428,900, and a mean of $153,600 (80469). The salary range and mean were comparable in 1995, ranging from $38,680 to $472,600 with a mean of $168,900 ($88,778). Since salary between both years were comparable, main analysis was done using salary data from 1995.

Data Characteristics for 261 Houston College of Medicine Physicians, 1994-1995

Variable	Category: Number (Freq (%) of 261)
Dept.	Biochem/Molec Biol: 50 (19); Phys: 40 (15);Genetics: 21 (8); Peds: 30 (11); Med: 80 (31); Surg: 40 (15)
Gender	Female: 106 (41); Male: 155 (59)
Emphasis	Clinical: 101 (39); Research: 160 (61)
Board	Certified: 73 (28); Not Certified: 188 (72)
Rank	Assistant: 112 (43); Associate: 64 (25); Full: 85 (33)
Variable	**Range, Quartiles, Mean, Standard Dev.**
Pub. rate	Min 1.3, Q1 3.2, Med 4.4, Mean 4.93, Q3 6.9, Max 8.7, SD 1.94
Exper.	Min 1, Q1 6, Med 9, Mean 10.23, Q3 14, Max 37, SD 6.23
Sal '94	Min 34,510, Q1 90,770, Med 133,300, Mean 153,600, Q3 200,500, Max 428,900, SD 80,469
Sal '95	Min 38,680, Q1 99970, Med 148100, Mean 168,900, Q3 219,000, Max 472,600, SD 88,778.43

3.2 Earnings in 1995

In exploratory unadjusted univariable analysis, each variable, including gender, had a significant association with salary. In unadjusted analysis for the 1995 salaries, female physicians had lower mean salaries than men ($130,876.9 ($62,034.5) vs $194,914.1 ($94,902.7)) with an absolute difference of $64,037.2 (95% CI: $44,903.54, $83,179.81). The difference was highly significant (t(258)=6.59, p-value = 2.45e-10). Men also had a significantly higher change in salary from 1994 to 1995 than women, with an absolute mean difference of $5,569.69 (95% CI: $3,613, $7,526) (t(258)=5.6, p-value = 5.3e-08), suggesting that male physicians in the sample had an average raise that was $5,000 more than their female counterparts, in addition to earning around $64,000 more on average annually.

In the adjusted analysis, after variable selection (criterion based, which excluded publication rate), a model was fit with gender, department, certification, experience, rank, and primary emphasis as predictors of log transformation of 1995 salary (transformation was necessary for normality assumptions). Excluding publication rate as a predictor was also necessary due to suspected collinearity (VIF = 16.626), and its removal did not significantly change the coefficient estimates or standard errors for the other predictors. I chose to keep gender and primary emphasis in the model although they were not initially significant, since they were of interest and confounded slope estimates for other predictors. Both the full model and the parsimonious model had gender as a non-significant predictor, while the remaining predictors in the parsimonious model were all highly significant. The reduced model fit the data well with R^2 of 0.934 and AIC of -294.7, which was very slightly lower than the full model (AIC = -294.3).

3.3 Effects of Rank and Outliers

Because the literature suggested that certain specialties have fewer women [5] and that other fields have a hierarchy in place that bars women from advancement [8, 9], it seemed reasonable to suspect an interaction involving gender and department or rank. While in this dataset department did not have a significant interaction, rank and gender did for the interaction between gender and full professor rank (p-value=0.0286). The interaction remained significant when fit within the main effects model, and also made the coefficient for gender significant (p-value=0.009), suggesting that the association between salary and gender in this sample depends on rank. The presence of an interaction term complicates the interpretation of the model and would require stratified analysis by rank.

However, model diagnostics identified one particular outlier in the department of medicine (a male assistant professor with 2 years' experience and $276,163 salary in 1995), which turned out to be an influential point (student residuals = 6.81). When this point was taken out, the interaction term was no longer significant, and neither was gender. Additionally, in the stratified analysis by rank, gender was only significant in the assistant professor model when this subject was included in the model. Gender was not significant in the associate or full professor models regardless of this outlier. Thus, for this dataset I would recommend taking out the influential point since the aim of the court case was to identify systemic gender discrimination, and an outlier skewing the data for one department and rank would not support such a claim.

After throwing out the influential point, I returned to the final parsimonious model without any interaction terms.

The model fits the data extremely well, with an R^2 of 0.946, which means 94.6% of the variation in log(Salary 1995) can be explained by the model. Additionally, this model has the lowest AIC of the models I fit (AIC = -349.2), and model diagnostics were good for assumptions. In this model, gender is not a significant predictor for change in salary, although all other predictors included in the model are highly significant. The results are presented in Table 2.

Since the model was fit with a log transformed outcome, the coefficients must be exponentiated before interpretation (e.g. $e^{0.23}$=1.26). In this model, being a full professor would result in a salary 1.26 times higher and an associate 1.16 times higher than an assistant professor, on average, holding all else constant. A physician whose primary emphasis is clinical would result in a salary 1.26 times higher than one with a research emphasis, on average, holding all else constant. The largest difference comes with department. A physician in the department of surgery earns about 2.5 times more on average, and a physician in medicine earns 1.7 times more on average, than one in the department of biochemistry/molecular biology, holding all else constant. In this data, a male earns on average 1.01 times the salary of a female, holding all else constant, and this slight difference was not even significant.

Final Model Predictors for Outcome: log(Salary 1995)

	Coefficient β (SD)	T-Value	P-Value	e^{β}
(Intercept)	11.01 (0.02)	444.61	0.000	60,475
Gender: Male (Ref: Fem)	0.01 (0.02)	0.63	0.532	1.01
Department: Physiology (Ref: Biol)	-0.18 (0.03)	-6.89	0.000	0.84
Department: Genetics (Ref: Biol)	0.18 (0.03)	5.46	0.000	1.20
Department: Pediatrics (Ref: Biol)	0.19 (0.03)	5.88	0.000	1.21
Department: Medicine (Ref: Biol)	0.51 (0.03)	19.12	0.000	1.67
Department: Surgery (Ref: Biol)	0.92 (0.03)	28.65	0.000	2.51
Board Certified (Ref: Not Cert)	0.20 (0.02)	10.60	0.000	1.22
Clinical Emphasis (Ref: Research)	0.23 (0.02)	11.58	0.000	1.26
Experience: Years since MD	0.02 (0.00)	11.24	0.000	1.02
Rank: Associate Prof (Ref: Assistant)	0.15 (0.02)	6.91	0.000	1.16
Rank: Full Prof (Ref: Assistant)	0.23 (0.02)	9.69	0.000	1.26

4 CONCLUSION/DISCUSSION

In this sample of physicians from Houston College of medicine, I was able to fit a predictive model to adequately explain the variation in salary. Although women had significantly lower salaries on average, the model seems to show that when comparing salaries within department and rank, there is no evidence of gender discrimination. While it may be tempting to remove rank and department to show that gender significantly predicts salary, Ananda et al. described several instances where court cases were unsuccessful due to this kind of cherry-picking of the data [6].

While the data do not support the claims of institution-wide pattern of discrimination in setting salaries for the purposes of this court case, I would recommend the plaintiffs to be more specific in their allegations, in particular if they believe there was discrimination in the departments of genetics, medicine and surgery. They would require additional data to try to support claims of department or rank specific discrimination, since the department of surgery, for example, had only 5 women in the sample, and 35 men (this differential might also be an area of future interest as evidence of discrimination/hierarchy in the department itself). The sample from the genetics department was also small (11 women, 10 men). Additional variables may enable even better comparisons between male and female counterparts, such as

number of work hours, and additional years of data to see if annual raise is significantly different between genders.

The final model was highly significant and fit the data extremely well, explaining more than 94% of the variation in salary, however the coefficient for gender was not found to be significant in this model. This data suggests that gender differences in salaries of physicians at Houston Medical college are not significantly different between men and women with similar characteristics (rank, department, experience etc.). However, additional data and further study may be warranted especially in the departments of genetics, medicine, and surgery, along with investigation into whether likelihood of promotion to associate or full professor is associated with gender.

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