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Gender Differences in Anesthesiologists' Annual Incomes

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Background: **Specialty, work effort, and gender have been shown to be associated with physicians' annual incomes; however, careful examination of the association between provider gender and annual income after correcting for other factors likely to influence income has not been conducted for anesthesiologists.**

Methods: **Survey responses collected throughout the 1990s from 819 actively practicing anesthesiologists and linear regression analysis were used to determine the association between provider gender and annual incomes after controlling for work effort, provider characteristics, and practice characteristics.**

Results: **White female anesthesiologists reported working 12% fewer annual hours than their white male counterparts. White female anesthesiologists had practiced medicine for fewer years than white males and were more likely to be employees, as opposed to having an ownership interest in the practice, but less likely to be board certified. After adjustment for work effort, provider characteristics, and practice characteristics, white females' mean annual income was $236,628, or $60,337 (20%) lower than that for white males (95% confidence interval, $81,674 lower to $39,001 lower; $P < 0.001$).**

Conclusions: **During the 1990s, female gender was associated with lower annual incomes among anesthesiologists. These findings warrant further exploration to determine what factors might cause these gender-based income differences.**

WOMEN have historically earned less than men have. In the United States, however, the ratio of women's to men's median hourly wage increased from 63% in 1979 to 77% in 1999. Women's wages increased relative to men's because more women entered the work force, fewer women received minimum wages, and the real wages of men decreased.[1]

Since the late 1970s, gender has been shown to be associated with lower incomes among US physicians, even after adjusting for work effort.[2] More recent studies that also adjusted for physician age and specialty[3–6] revealed similar income disparities, although one found that the combination of specialty status, personal data, and female internists' less lucrative practice arrangements eliminated income differences among young physicians.[7]

Because women represent an increasingly large proportion of medical students[8,9] and the practicing physician workforce,[10,11] we were interested in determining whether income disparities attributable to gender existed among a highly specialized and select group of physicians: anesthesiologists. To date, no studies have compared incomes of male and female anesthesiologists in the United States. Therefore, we used survey data from the 1990s to explore the association between physician gender and the annual incomes of white anesthesiologists, after adjusting for work effort, practice characteristics, and provider characteristics that are likely to influence physician incomes.

This article is featured in "This Month in Anesthesiology." Please see this issue of ANESTHESIOLOGY, page 5A.

Materials and Methods

This study was approved by Dartmouth Medical School's Committee for the Protection of Human Subjects, Hanover, New Hampshire (CPHS #17707).

Data Source

Between 1992 and 2001, the American Medical Association (AMA) conducted regular telephone surveys of a random sample of physicians that collected a broad variety of individual physician level data, including weeks and hours of practice, provider characteristics, practice characteristics, and physician incomes.[12] The survey was designed to provide representative information on the population of all actively practicing, nonfederal physicians who spend the greatest proportion of their time in patient care activities; weights for each respondent were calculated to correct for potential bias created by nonresponse within cells (defined below), survey eligibility, and to ensure physician responders reflected the national distribution of physicians.[12]

Survey Methods

Each year, the telephone-administered survey was conducted on a random sample of physicians in the AMA Masterfile who are eligible for the survey. The following physicians were excluded: doctors of osteopathy, foreign medical graduates with temporary licensure, inactive physicians, physicians who were sampled during

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the past 5 yr, physicians who are on the "do not contact" list, physicians not practicing in the United States, and physicians who have no license. In addition, after initial screening, federally employed physicians and physicians who spent less than 20 h each week in patient care activities were excluded.

The following field procedures were developed to minimize nonresponse bias: 2 weeks before data collection, advance letters were sent describing the process and the survey; many specialty organizations provided endorsement letters; and summaries of the type of expense questions to be asked were provide in advance of the survey. In addition, a minimum of four callbacks to respondents were made before abandoning interview efforts, letters encouraging participation were sent to physicians who initially refused participation, and refusal conversion attempts were made by select interviewers.[12] During the time period examined, the annual survey response rate for anesthesiologists ranged from 50.7% to 76%.

Survey Weights

Survey weights were derived by first dividing the AMA Physician Masterfile population and survey respondents into 200 cells defined by specialty, years since the respondent received an M.D., AMA membership status, and board certification status. Unit response rates were constructed as the ratio of the number of physicians in the population to the number of respondents in each cell. Second, an eligibility correction was used, because only nonfederal patient care physicians—excluding residents—are eligible. The eligibility correction divides the subset of the population for which eligibility is known into 40 cells (according to years in practice, AMA membership status, gender, and board certification) and calculates the proportion of physicians in each cell who are eligible. This defines the eligibility weight. The overall weight applied for a given respondent is the product of the unit response weight and the eligibility weight, and was calculated poststratification.[12]

Sample

Although the survey had been conducted for much longer, this analysis was limited to data collected between 1992 and 2001 for two reasons. First, during the study period, physicians were categorized into different specialty groups in a way that allowed for the separation of responses from anesthesiologists and other medical specialists. Second, these were the most recent data available for analysis and therefore likely to be the most relevant to the currently practicing physician workforce.

A sequential process of eliminating survey respondents was used to ensure that the physicians included in the analyses were comparable. Although we could have used other methods to generate a fair comparison group, this process of selection allowed us to analyze anesthesiologists with relatively similar provider and practice characteristics. Because we were interested in examining anesthesiologists with a common practice setup, we excluded those who worked primarily doing research, as medical educators, or as administrators or who were employed by hospitals. Because of a concern that race might influence results and because there were so few black respondents to the survey who were anesthesiologists, we included only self-identified white physicians in the study, and we further limited our analysis to those who graduated from a US medical school, leaving 1,000 white male and 138 white female anesthesiologists. In addition, only respondents who provided information on key variables were included; we excluded respondents who did not report an annual income, the number of hours worked in the past week, the number of weeks practiced in the past year, the number of years the respondent had been practicing medicine, and whether the respondent's practice offered Medicare services. This exclusion left 753 white male and 98 white female anesthesiologists for analysis. In addition, because of a concern that some responses might be grossly nonrepresentative of the overall population examined, we excluded extreme outliers in annual hours worked (those who reported working less than 364 h or more than 4,291 h in the previous year) and net incomes (those who reported making less than $60,837 or more than $658,395 in 2004 dollars). This process left 726 white male and 93 white female anesthesiologists available for analysis. Using survey weights, these respondents represented 708 white male and 87 white female anesthesiologists.

Variables Proposed to Influence Physicians' Incomes

From the AMA data set, we extracted three types of independent variables that were likely to influence the dependent variable—net annual income:

1. Physician Work Effort. The number of annual hours worked is an important variable in analysis of physician incomes.[3,4,6,7,13] Indeed, among the study sample, there was a modest linear relation between inflation-adjusted annual physician incomes and annual hours worked (using log-transformed data, $r = 0.21$, $P < 0.001$ overall; $r = 0.16$, $P < 0.001$ for males; $r = 0.26$, $P = 0.013$ for females).

2. Provider Characteristics. When making gender comparisons of physician incomes, age has commonly been used as an adjustment factor.[3,4,6,7] Over the working lifetime, incomes demonstrate an "inverted-U" pattern that typically peaks near age 55 yr for physicians,[14,15] or after 20–25 yr of practicing medicine. To dispel a concern that gender might influence the age at which a physician entered medical school and therefore bias results, we incorporated the number of years that respondents had been practicing medicine into the anal-

ysis instead of physician age. Among the study sample, the number of years practicing medicine was highly correlated with age ($r = 0.82$, $P < 0.001$). In addition, because practice arrangements, such as having an ownership interest in the practice, has been associated with differences in annual income among physicians,[5] we included whether the physician was an employee, as opposed to a full or partial owner of the practice, in the analysis. Finally, because board certification has been associated with higher incomes among physicians,[16] we included board certification status as an independent variable in the analysis.

3. Practice Characteristics. Physicians who live in different US Census regions have been shown to have modestly different annual incomes[12]; therefore, we collected information on the US Census region in which the practice was located. In addition, because physicians who live in poorly populated settings has been shown to have both lower[17] and higher[18] incomes, we categorized responding physicians' county codes into three categories of metropolitan settings (less than 50,000, between 50,000 and 500,000, or greater than 500,000). Finally, because of a concern that differences in reliance on government reimbursement might influence physicians' incomes, we incorporated whether the practice provides Medicare services into the analysis.

Calculated and Dummy Variables. We used the consumer price index to adjust reported net annual income to constant 2004 dollars. We multiplied the reported number of weeks worked in the past year by the total number of hours worked in the past week to calculate the annual number of hours worked. Because of the inverted-U relation between number of years practicing medicine and annual incomes, we constructed dummy variables that reflected the categorization of years practicing medicine into 5-yr increments, from 0 to 5 yr practicing through 40 plus yr practicing. While we used these dummy variables in the regression analysis, we aggregated years practicing into 10-yr increments through 30 plus yr practicing for the purposes of demographic comparisons.

Statistics

When comparing demographics for male and female anesthesiologists, we used the chi-square test to compare proportions and the independent samples *t* test to compare continuous variables. Because data on income, hours worked, and the number of years in practice were nonnormally distributed, we transformed those data to achieve normalcy. Although we conducted our statistical analyses on the transformed data, we present the untransformed means to help readers interpret the findings. To determine the association between gender and incomes, we generated a linear regression model that adjusted for practice and provider characteristics. Within the regression model, we used a dummy variable for provider gender to calculate regression coefficients and 95% confidence intervals in a model that used the independent variables detailed above and consumer price index adjusted annual income as the dependent variable. Further, we tested interaction terms between gender and the other covariates. We used SPSS (version 11.5; Chicago, IL) and survey weights for all analyses. Because some variables—such as income and hours worked—were not normally distributed, we repeated our analyses using log-transformed data and found the same results. To aid in interpretation of results, we present all data and coefficients using nontransformed data. In addition, we performed diagnostic tests that examined our regression models and found that there was not an appreciable amount of collinearity in the design matrix (the ratio of the largest to smallest eigenvalue of the design matrix was 6.9). Finally, to determine whether results were disproportionately sensitive to a single respondent, we used a jackknife procedure and repeated the weighted analysis 819 times, deleting each physician once in turn, and found results consistent with our primary analysis.

Results

After adjusting only for inflation, white male anesthesiologists had mean net annual incomes of $296,965 (table 1). Compared with white males, white females' annual inflation adjusted incomes were $78,283 (26%) lower. White female anesthesiologists reported working 12% fewer annual hours than their white male counterparts.

White female anesthesiologists had practiced medicine for slightly fewer years than white males; however, no white females who responded to the survey had practiced more than 30 yr. Females were much more likely to be employees, as opposed to having an ownership interest in the practice, and were slightly less likely to be board certified. White female anesthesiologists were more likely to live in the Western US Census regions. Very few white female anesthesiologists worked in areas of low population density. The large majority of anesthesiologists of both genders provided Medicare services.

The regression model accounted for 24% of the variance in annual incomes and had strong face validity (table 2). Higher numbers of annual hours worked was associated with higher incomes. The anticipated inverted-U lifetime earnings curve was reflected in the model, with incomes peaking after 20–25 yr of practice. Being an employee, as opposed to having an ownership interest in the practice, was associated with a lower income; board certification was associated with a higher income. On average, anesthesiologists practicing in the North Central or Southern census regions earned higher annual

Table 1. Comparison of Inflation-adjusted Income, Work Effort, Provider, and Practice Characteristics of White Anesthesiologists, by Gender

	White Anesthesiologists		
	Male (n = 726)	Female (n = 93)	*P* Value
Inflation adjusted annual income (2004 dollars)	$296,965	$218,682	< 0.001
Physician work effort			
Total annual hours worked	2,728	2,403	0.001
Provider characteristics			
Years in medical practice (mean)	13.4	11.1	0.015
Less than 10 yr	42.4%	52.6%	0.07
10–19 yr	38.4%	38.0%	0.9
20–29 yr	13.8%	8.8%	0.2
30 yr or more	5.4%	0.5%	0.04
Ownership interest and board certification			
Physician is an employee	28.2%	48.5%	< 0.001
Physician is board certified	81.2%	76.7%	0.3
Practice characteristics			
Census region of practice			
Northeast census region	18.6%	12.6%	0.2
North Central census region	21.7%	15.6%	0.2
Southern census region	33.8%	36.6%	0.6
Western census region	26.0%	34.9%	0.08
Practice setting			
Less than 50,000 population	3.6%	0.9%	0.2
Population between 50,000 and 500,000	36.2%	30.0%	0.2
Population greater than 500,000	60.2%	69.1%	0.1
Service population			
Proportion providing Medicare services	99.4%	97.7%	0.08

incomes. After adjustment for these variables, white females' mean annual income was $60,337 (20%) lower than that for white males (fig. 1; 95% confidence interval, $81,674 lower to $39,001 lower; $P < 0.001$). There was no significant interaction between gender and the other covariates.

Table 2. Coefficients in the Regression Model

	Coefficient	95% Confidence Interval	*P* Value
Physician work effort			
Total annual hours worked	$10.56	$1.60–$19.52	0.02
Provider characteristics			
Years in medical practice (5–9 yr is referent)			
Less than 5 yr	($31,851)	($55,520)–($8,182)	0.008
10–14 yr	($6,971)	($24,406)–$10,465	0.4
15–19 yr	$16,126	($5,675)–$37,926	0.15
20–24 yr	($15,201)	($41,851)–$11,449	0.3
25–29 yr	$20,148	($9,642)–$49,938	0.2
30–34 yr	($62,064)	($101,448)–($22,680)	0.002
35–39 yr	($23,937)	($78,275)–$30,400	0.4
40 yr or more	($69,248)	($176,618)–$38,121	0.2
Ownership interest and board certification			
Physician is an employee	($64,602)	($79,425)–($49,779)	< 0.001
Physician is board certified	$61,744	$44,224–$79,264	< 0.001
Practice characteristics			
Census region of practice (Western is referent)			
Northeast census region	$11,311	($8,969)–$31,591	0.3
North Central census region	$42,479	$23,426–$61,532	< 0.001
Southern census region	$34,256	$17,362–$51,149	< 0.001
Practice setting (population greater than 500,000 is referent)			
Less than 50,000 population	($12,410)	($49,808)–$24,988	0.5
Population between 50,000 and 500,000	($10,820)	($24,834)–$3,194	0.13
Service population			
Proportion providing Medicare services	$2,926	($73,180)–$79,032	0.9
Gender (white male is referent)			
White female	($60,337)	($81,674)–($39,001)	< 0.001

Values in parentheses are negative. Adjusted R^2 for the model = 0.24.

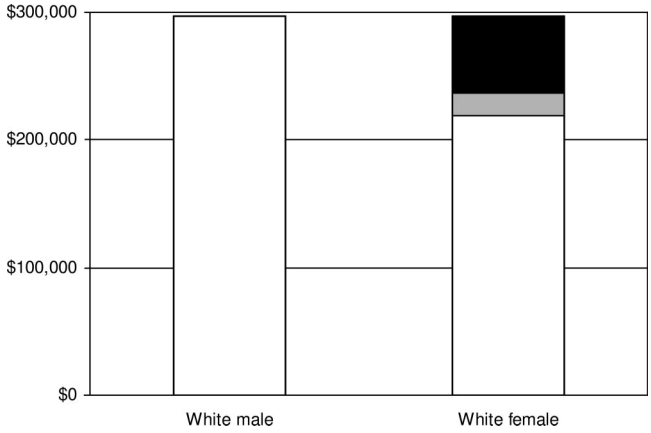

Fig. 1. Differences in income by gender. *Gray* represents the income difference accounted for by work effort, practice characteristics, and provider characteristics; *black* represents the income difference attributable to gender.

Discussion

This study examined provider and practice characteristics that were likely to be associated with physicians' annual incomes, revealed differences attributable to gender in those characteristics, adjusted net annual incomes for observed differences, and found that gender independently contributed to lower net annual incomes among practicing anesthesiologists.

We found a strong association between higher annual incomes and work effort, as measured by hours worked. This finding is intuitive: Anesthesiologists' reimbursement is largely based on the volume of cases completed, and more cases can be completed within more work hours. In addition, we found a strong association between being a nonowner employee and having a lower mean annual income. This finding also has strong face validity: Employed physicians might not be motivated as those with an ownership interest in the practice to work longer hours. The association between higher annual incomes and board certification is consistent with findings from the early 1980s.[16] This association might be explained in part by a propensity for provider organizations to require board certification for employment, by requirements by third-party payers that providers be board certified, or by market forces that use board certification as a marker for quality that is indirectly reimbursed.

After correcting for differences in provider and practice characteristics, we found that an anticipated 20% reduction in annual incomes found for white female anesthesiologists was somewhat greater than that found in other studies that compared work effort–adjusted female to male physicians' incomes[3–6]; however, because those analyses used different methods that did not take into account the breadth of provider and practice variables that were examined here, direct comparisons cannot be made.

This analysis has several limitations. First, because the number of black respondents to the survey was small, we had to limit our analysis to white anesthesiologists. Our findings may not apply to anesthesiologists of other races. Second, the study was limited by the methods used by the AMA in their conduct of an established survey of physicians that experienced a declining survey response rate and demonstrated substantial year-to-year variation in number of respondents during the time period examined. While the possibility of a nonresponse bias exists, the ability to combine 10 yr of data strengthened the study and offered a much more robust data set than would have been the case had fewer years of data been available. Third, although we adjusted incomes to constant dollars and for practice setting, the analysis was not able to adjust for differences in purchasing power parity across those settings—differences that were shown to mitigate constant dollar income differences among rural and urban physician practices.[18]

Finally, the study was inherently limited by the data available from the AMA survey. Although it would have been interesting to explore alternative explanations for the income disparities that we found, such as gender differences in the rate of highly reimbursed procedures, variation in procedure duration, procedure scheduling and operating room efficiency, payer mix, academic rank, respondents' educational debt burden, clinicians' levels of satisfaction with their practices, and even differences in the quality of care provided, the data that might answer these questions were not available. In addition, we could not explore the possibility that female anesthesiologists simply choose to do work that results in lower annual incomes. Indeed, the regression model accounted for only 24% of the variance in physician incomes. Clearly, additional factors that were not incorporated into the analysis are likely to influence expected physician incomes and might mitigate the differences found here. However, researchers who study gender differences in incomes among anesthesiologists in the future should be cautious about the circular reasoning that may be inherent in adjusting for some of the proposed alternative explanations. Differences in those factors may themselves reflect gender-based inequities.

Despite these limitations, the results of this study suggest that female gender is independently associated with lower annual incomes among anesthesiologists. Although salary differences between men and women may be common in the United States,[1] female anesthesiologists have achieved the same level of education, have made the same time commitment to training, and have experienced the same direct and opportunity costs required of such commitment[19] as their male counterparts. Additional efforts to elucidate the underlying causes of any salary differences and to suggest remedies are warranted.

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