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Gender and sex differences in job status and hypertension

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Abstract

Objectives—Studies have shown greater health risks associated with blue-collar manufacturing employment for women than men. It remains challenging, however, to distinguish cultural gendered factors influencing employment decisions (e.g., expected work roles, family responsibilities) from sex-linked biological differences shaping physiological response to workplace physical hazards.

Methods—We examined effects of hourly (blue-collar) status on incident hypertension among men and women, using health claims data for 14,618 white- and blue-collar aluminum manufacturing employees in eight U.S. states. To explore gender differences in job status, we developed sex-stratified propensity score models identifying key socioeconomic predictors of hourly status for men and women. To examine effects of hourly employment on hypertension risk, after adjusting for gender differences in job placement, we applied time-weighted logistic regression models, stratified by propensity score, with additional adjustment for socioeconomic confounders.

Results—Family structure (partnership, parity) influenced job status for both sexes; single mothers were more likely to hold hourly jobs (OR = 2.02 (95% CI = 1.37–2.97)), partnered men with children less likely (OR = 0.68 (0.56–0.83)). Education, age at hire, and race influenced job placement for both sexes. The effect of hourly status on hypertension was significant only among women predicted to be hourly (OR = 1.78 (1.34 – 2.35)).

Conclusions—Our results indicate significant risks of hypertension associated with hourly status for women, possibly exacerbated by sociodemographic factors predicting hourly status (e.g., single parenthood, low education). Greater attention to gender differences in job status, workplace stressors, and health risks associated with hourly work, is warranted.

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Keywords

Gender; sex; hourly status; hypertension; propensity scores

Introduction

Studies have reported greater cardiovascular health risks associated with blue-collar manufacturing work for women than for men[1–3]. It remains unknown, however, whether this risk is attributable to gender differences in job placement (e.g., cultural expectations, family responsibilities) or to sex-linked biological differences in response to physical hazards. This distinction between sex (i.e., biological differences by chromosomal complement, including reproductive organs and hormonal composition) and gender (i.e., socially-derived roles and behaviors)[4] is critical towards accurately disaggregating health risks which differ between women and men, and for designing effective interventions.[5,6]

Gender differences in job status are well documented.[7, 8] Men and women differ, on average, in job-related chemical exposures,[9] ergonomic demands,[10] and psychosocial stressors.[11] Family roles influence employment decisions and women's greater average domestic task burden[12] may affect fatigue, non-occupational stress,[13, 14] response to workplace stressors, and return to work following illness or injury.[15,16,17] Further, the same workplace or job may be experienced differently by women and men; differences in anthropomorphic measurements and work equipment designed for male bodies can increase women's task burden,[18,19,20] and women are more likely to experience harassment, discrimination,[21,22] or low job control.[11, 23] Gender and sex are tightly intertwined, and therefore difficult to distinguish in epidemiological data. Several frameworks have been developed towards disentangling these effects,[24] and nascent methods from gender analysis are allowing for some (albeit imperfect) differentiation of social and biological risks.[25]

Women comprise a small proportion of blue-collar workers, but are overly represented in low-grade jobs,[26,27] and earn less than men doing the same job.[7] This gendered stratification is important for reasons including demonstrated links between low job grade and heart disease,[28] hypertension,[29] and injury.[30, 31] Most, but not all, research on the health effects of job status[32] has focused on predominantly male, "white-collar" populations,[33] thus it remains unclear whether job status operates similarly among women or blue-collar workers. Finally, lower-grade and manufacturing work is associated with many chemical, physical, and psychosocial stressors, thus the specific aspects of low-grade work which cause health effects remain unknown, and may vary by age, gender, and setting.[34]

We compared effects of hourly (blue-collar) status on hypertension using health claims data for 14,618 male and female white- and blue-collar aluminum manufacturing employees across eight U.S. states. In a prior analysis, we observed elevated hypertension risks with hourly status, after adjustment for socioeconomic status (SES),[35] with stronger effects among women than men. Elevated risks were also observed with low job grade, more prevalent among hourly women than men. Here, we investigate these gender and sex effects in greater detail, exploring propensity scores as one possible method for disentangling gendered job status from sex-linked biological differences in the health effects of manufacturing work. Notably, however, the method can not differentiate the sources of sex-differing physiological responses to workplace physical exposures from gendered exposures operating after hire (e.g., workplace harassment or discrimination). The method also does not inherently adjust for differences in job characteristics, or by job grade, within blue- and white-collar job classes.

To examine gender influences in job status, we developed sex-stratified propensity score models wherein job status (hourly vs. salaried) is modeled as a function of pre-hire sociodemographic characteristics and personal life factors (e.g., marital status, parity) which may differently influence men's and women's employment decisions and job status. We identified men and women more likely to hold hourly (blue-collar) or salaried (white-collar) jobs, then developed propensity-stratified time-weighted logistic regression and Cox proportional hazard models to examine sex-specific risks associated with hourly status, with further multivariate adjustment for SES and other risk factors.

METHODS

Study Population

We examined health and employment records for all male and female hourly (mainly production) and salaried (production supervisors and administrative) personnel in 11 U.S. Alcoa aluminum manufacturing plants who were actively employed full-time as of January 1, 2000. Eligibility was restricted to 14,618 workers with at least one medical insurance claim during the seven-year period, January 1, 1996 to December 31, 2002, retaining 98% of employees. Gender or job status differences in likelihood of using their own or a partner's health insurance could bias results, but only minimally, given that 98% of our cohort showed some medical claim.

Incident cases of hypertension in medical claims data

We examined hypertension onset as a risk factor for stroke and ischemic heart disease (IHD)[36] and broad indicator of systemic illness. To identify incident hypertension, we excluded subjects with IHD-related claims prior to the first hypertension diagnosis and required two years without any claims for hypertension or heart disease; follow-up thus begins on the latter of January 1, 1998 or two years after date of hire. Follow-up ends on the earliest of December 31, 2002, date of termination, or the employee's 65th birthday (when Medicare coverage begins), for up to five years.

Incident cases were defined by two or more diagnoses following two disease-free years, as previously validated by medical record review (Solberg et al., 2006). Date of onset was defined as date of initial diagnosis in a face-to-face medical encounter classified as ICD-9 codes 401 through 405. Eighty-one potential cases with new-onset IHD (ICD-9 codes 410 through 414) prior to first observed hypertension diagnosis during follow-up were also excluded. As the claims file contains claims for 98% of employees, and because of the high quality coverage offered, consistent across all job grades, we may assume that most employee families use this as their primary coverage and that few employees with poor adherence in hypertension care should be missed by the two-year wash-out. Our use of medical claims data for this cohort is detailed elsewhere.[37]

Because family composition may differently affect men's and women's employment decisions and job status, we also used medical clams files to identify evidence on whether each employee had a partner or dependent children. Partners were identified by any claim coded ‘spouse’ linked to the employee's ID. Dependent children were identified by any claim (coded ‘dependent’) with a birthdate indicating age less than 18 years on any diagnosis date during follow-up.

Other Data Sources

Demographic characteristics (sex, date of birth, race/ ethnicity, education) and employment characteristics (hourly/ salaried status, job grade, dates of hire and job termination, plant location) were obtained from human resource files (PeopleSoft). As these characteristics changed little over follow-up, we used the characteristics of the job held on January 1, 2000, the mid-point of follow-up. Age on this date was centered and transformed to reduce collinearity between higher order terms (age^2, age^3), adjusting for non-linear age effects.

Smoking behaviors, height, and weight were identified from on-site health examination records for 2001–2002. Income data was available from W-2 records, but only for 2002–2004. W-2 data excludes income from non-company sources, but is highly accurate, as these records are reported to the government for tax purposes. Mean annual income for each employee was calculated excluding income-years below $20,000 (an imperfect indicator of part-time status for that year(s)), and divided into tertiles. Notably, some higher-wage part-time employees may be retained, possibly differentially retaining women. Income for persons leaving full-time work before 2002 is classified as unknown. W-2 income may misrepresent total family income, especially for women, although sex-stratified propensity and hypertension models should minimize this bias.

Job grade, two separate 2–30 scales for hourly and salaried staff, is uniformly used by all company locations to discriminate jobs by experience, skill level, seniority, and prestige (i.e., hourly jobs above 23 typically require a technical skill, such as electrician or maintenance mechanic). Tenure (years on the job), was calculated using standard field codes for hire date in human resource files. Tenure was calculated for January 1, 2000, the center of follow-up. Notably, tenure may also indicate secular changes and generational attitudes towards gendered work roles, as there are very few long-tenure hourly women.

Analytic approach

In this longitudinal study, we modeled cumulative incidence of hypertension as a function of hourly status and duration of employment, adjusting for confounding by demographic and socioeconomic factors. We aimed to adjust for confounding by pre-hire characteristics, particularly gendered job assignment, in order to evaluate health risks associated with hourly status for women and men. To these ends, we used a two-stage analytic approach wherein we first modeled the sex-specific likelihood of holding an hourly position, based on pre-hire characteristics, producing a subject-specific predicted probability (propensity score) of being an hourly (versus salaried) employee. We then stratified by propensity scores (more or less than 0.50) and fit multivariable regression models to better estimate sex-linked differential response to workplace exposures.

Propensity score analyses—We created propensity score models wherein we separately predict men's and women's likelihood of hourly status, based upon known pre-hire characteristics. The propensity score is an individual's probability of being exposed (here, hourly), given observed pre-exposure (here, pre-hire) characteristics.[38, 39] To reduce confounding by socioeconomic factors differing between hourly (blue-collar manufacturing) and salaried (white-collar) workers, we compare risks within propensity strata, among workers with similar likelihoods of hourly status, given pre-existing socioeconomic characteristics. Propensity scores were calculated using logistic regression to estimate each employee's probability of hourly status as a function of partnership, parity, age, education, and race/ ethnicity. Job grade, income, smoking, and BMI were not included in propensity models because these may be consequences, rather than antecedents, of job status (further examined in sensitivity analyses). Propensity model fits were assessed by the C-statistic,[40] which assesses the model's ability to correctly discriminate binary outcomes.

Using this method, we identified subjects more likely to be hired into hourly or salaried jobs, improving our socioeconomic adjustment beyond that afforded by multivariable analysis. Due to possible residual confounding within the wide propensity bands, we retained all potential confounders in multivariable models for hypertension.

Multivariable models for hypertension—To estimate effect of hourly status on hypertension, we fit time-weighted logistic regression to model cumulative incidence of hypertension.[41] We opted for this approach, rather than Cox models, because of the relatively short follow-up (maximum of 5.0 years: 7.0 years minus 2.0-year washout for incidence), little variation in length of follow-up across subjects (70% contributed the full five years), and time-invariant primary exposure of interest (hourly vs. salary status). Cumulative incidence (CI) was calculated as the proportion of newly diagnosed cases during follow-up, after a 2-year wash-out. We report adjusted odds ratios (ORs), in logistic models stratified by propensity scores. We retained all observations with complete data on the continuous variables of interest in propensity and multivariate models.

Sensitivity analyses

We examined the consistency of results to perturbations in the analytic methods. Internal cross-validation was performed by dropping observations sequentially, and comparing model fits to identify influential observations. We examined alternative case criteria, using number of visits as a surrogate for illness severity; case criteria were varied from one to five hypertension-related visits.

We validated propensity and hypertension models for robustness to adjustment for worksite, and the exclusion of two plants with only salaried positions. We also tested the exclusion of problematic confounders, such as income (measured after illness onset in some cases), and adjustment for percent hourly women at each plant. In propensity models, we tested the effect of including BMI and smoking, both possible predictors and results of job status.

Due to significant missing data for smoking, education, and BMI, each of these exposures was examined as a categorical indicator, with one category defined as ‘unknown.’ This practice allowed us to retain all other information on those individuals in our analyses. For BMI, the only continuous indicator among these, a sensitivity analysis was performed retaining only those individuals with known BMI, to ensure that results were consistent.

Finally, Cox proportional hazard models were developed as a sensitivity analysis for the effect of hourly status, stratified by sex and predicted job status. This method provided more rigorous adjustment for confounding by age, by using age as the time metric in the hazard function. To verify the underlying assumption of proportional hazards, we examined survival functions. Although these investigations did not confirm proportional hazards, authors have shown that violation of the assumption does not affect the validity of hazard ratios for large sample sizes.[42]

All statistical analyses were performed using SAS Version 9.1 (SAS Institute, Cary NC). Propensity and hypertension models were fit using Proc Logistic. Cox proportional hazard models were developed using Proc PHReg.

RESULTS

We examined job status and hypertension onset among 14,618 employees in 11 plants in eight U.S. states (Indiana, Iowa, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Texas). Women comprised 8.4% (n = 793) of hourly and 36% (n = 1,223) of salaried workers. Our cohort is largely male (86%), Caucasian (86%), and hourly (69%). On average, employees were 46.3 years old (SD = 9.1 years) at the center of follow-up, and employed for 17.3 years (SD = 11.3 years). Age did not differ significantly by sex or job status. Salaried women averaged 43.0 years old (SD = 8.8), on average, while hourly women were 44.4 years old (SD = 8.9). Salaried men were 45.6 year old on average (SD = 8.4), while hourly men were 47.1 years old, on average (SD = 9.2).

1,580 cases of incident hypertension (10.7% overall incidence) occurred during follow-up, with higher incidence among hourly than salaried workers (11.9% vs. 8.4%), and among men than women (11.2% vs. 8.1%). Male and female hourly employees had comparable incidence (11.9%), compared to 5.61% among salaried females and 9.5% among salaried males. Cohort demographics are detailed in Table 1.

In simple sex-stratified logistic regression models, adjusted only for age (Table 2), we found that hourly status, age, tenure, above-median BMI, low- or medium-tertile income, African-American race, and prior smoking were associated with increased risk for male workers. Hispanic ethnicity and job grade were protective. Effects of hourly status, tenure, income, African-American race, and prior smoking were stronger among women. When all covariates were included in a sex-stratified multivariable models, (Table 3), hypertension was associated with hourly status only among women. In multivariable models including the full cohort (n = 14,618), we found that, after adjusting for potential confounders, hourly status increased risks of hypertension (adj OR = 1.11 (CI = 1.04 to 1.20) (model not shown). Stratifying this model by sex, we found that the effect of hourly status appeared stronger among the 2,016 women in our cohort (adj OR = 1.68 (CI = 1.39 to 2.02) than among the 12,602 men (adj OR = 1.03 (CI = 0.95 to 1.11)) (models not shown); the interaction of sex and hourly/salaried status was highly significant ($p < .0001$). Importantly, however, this model does not account for important differences between men and women in their overall likelihood of hourly status, or in the factors which may differently influence employment decisions and job status for women and men.

Propensity score models

We fit sex-stratified logistic models to estimate the probability of being 'hourly,' based on known pre-hire characteristics: family structure (partnership, parity), height, age at hire, sex, education, and race/ ethnicity (Table 4). High c-statistics indicated good model fit, especially for women (c = 0.88 vs. 0.82) even after including height, which significantly predicted job status only among men.

Male single parents were more likely hourly. Men with a partner and child were more likely salaried, as were taller men. Older age at hire, lower education, and African-American race increased men's likelihood of hourly status. For women, single parenthood strongly increased likelihood of hourly status, though partnership alone conferred no significant effect. Older, less educated, and African-American women were more likely hourly.

Hourly men's scores are right-skewed; most hourly men had high likelihoods of hourly status. Salaried men's score distributions indicated that about 30% were highly unlikely to hold hourly jobs, although about half had scores suggesting likelihood of hourly status ($Pr > 0.5$).

Hourly women's propensity scores were less skewed than hourly men's, though most hourly women were predicted hourly. Very few salaried women were likely hourly; about 45% were highly unlikely to be hourly ($Pr < .03$). Strongly imbalanced propensity distributions between our male and female cohorts limited our analysis to propensity stratification with relatively wide propensity bands ($Pr > 0.5$, or $Pr \le 0.5$), as 1:1 matching would leave many hourly men and salaried women unmatched, reducing efficiency.[39]

Bivariate effects of hourly status, by propensity strata

To improve comparability between hourly and salaried workers (i.e., to avoid off-support inference), we stratified workers by propensity scores, comparing only among those more ($Pr > 0.50$) or less ($Pr < 0.50$) likely to be hourly. Adjusting only for age, we observed elevated risks associated with hourly status among men predicted salaried (OR = 1.47 (1.20–

1.79)). Hourly status increased risks for women predicted to be hourly (OR = 1.84 (1.43 – 2.38)) or salaried (OR = 1.52 (1.15 – 2.01)) (models not shown).

Sex- and propensity-stratified multivariate models

In sex- and propensity-stratified multivariable models (Table 5), hourly status increased risk of hypertension solely among women likely to be hourly (OR = 1.78 (1.34–2.35)); this effect was not attenuated by adjustment for the percent of hourly women at each plant (model not shown), which varied from 5 to 12 percent. Among the women predicted to be hourly, hypertension risks also increased with tenure, BMI, African-American race, and prior smoking. For women likely to be salaried, hypertension risks increased with tenure, BMI, lower income, and African-American race.

Among men likely to be hourly (Model 1), risks increased with age, tenure, BMI, low income, and African-American race; Hispanic ethnicity was protective. Among men likely to be salaried (Model 2), risks increased with BMI, lower income, and smoking.

Job grade effects on hypertension

While men in our cohort were more likely to be hourly workers, women of both hourly and salaried groups were more likely to hold a low-grade job. Hourly women's median job grade was 6 (mean = 7.3, SD = 5.7) vs. 10 for hourly men (mean = 12.4, SD = 8.3). For salaried women, the median job grade was 10 (mean = 10.9, SD = 4.6) vs. 15 for salaried men (mean = 14.8, SD = 5.7). Women's job grade distributions were left-skewed, with very few hourly or salaried women above grade 18. Although higher job grade generally reduced the risk of hypertension for women, those in the highest grades had notably higher relative risks. Due to the small number of women in high job grades, however, as well as imbalanced job grades distributions by sex and apparent non-linear effect of job grade on hypertension, job grade was not explored further in this analysis.

Sensitivity analyses

Regression diagnostics did not indicate any influential observations in the final logistic models, based on one-at-a-time exclusion of observations. Varying the case definition, we consistently found elevated risks of hourly status only for women, and increasing risks with more stringent case criteria. For the least stringent criteria of one hypertension-related visit claim (15.9% incidence), the adjusted OR was 1.97 (1.54 – 2.52) among women likely to be hourly. For the most stringent criteria, five or more claims (6.4 % incidence), the OR for hourly status among women likely to be hourly was 2.70 (1.77–4.12). No case criteria produced a significant effect of hourly status for men in either propensity group. If greater case stringency is correlated with greater illness severity, then the higher risks among women suggest that hourly status is also associated with more severe illness.

We examined the robustness of our results to covariates with problematic measurement, such as income, and found no influence on risk estimates when we removed these terms from the model. Likewise, the inclusion of BMI and smoking, which may be both predictors and antecedents of job assignment, did not alter propensity distributions or hypertension risks. Similarly, we tested the effect of adjusting for BMI as a continuous variable, for the subset of the cohort where it was available, and found that results were consistent with those presented here. Adjustment for plant location did not change the coefficients for hourly work status or tenure, nor did exclusion of two salaried-only plants. Finally, we found no significant change in observed risks after adjusting for the percent of hourly workers who are female in each plant.

As a sensitivity analysis, we used Cox PH models to examine the effect of hourly status on hypertension, after propensity stratification and multivariate adjustment; we confirmed that hourly status conferred a significantly elevated hazard ratio only among women predicted to be hourly (adj HR = 1.426; p = .006) (model not shown).

DISCUSSION

Our results suggest that job placement is influenced by family characteristics for both women and men. Single parents, especially women, were more likely to be hourly; partnered men with children were more likely salaried. After adjusting for sociodemographic factors predicting job status, hourly work increased hypertension risks solely among women predicted hourly, an effect which was stronger with more stringent case criteria.

Our results suggest that manufacturing work may increase women's risks, beyond socioeconomic confounding and gendered job assignment. Possible explanations include differential physiologic responses to workplace hazards (chemical, physical, or psychosocial), or gender differences in the manufacturing environment experience, as women remain a small minority of manufacturing workers. Further investigation of sex and gender differences in task burden, susceptibility, workplace status, and social experiences at work, including gender discrimination or harassment, is warranted. Our main result of stronger adverse health effects of hourly (blue-collar) work among women corroborates other studies.[1,2,3] It has been unclear whether greater risks among women are largely attributable to sex-linked biological differences (e.g., body size, genetic susceptibility) or to gender differences (e.g., workplace experience, job placement). Although we have attempted to distinguish sex from gender effects using sex-stratified propensity models to predict job placement based on gender-related factors, residual confounding by unmeasured covariates remains possible, and many gendered factors beyond job placement may also influence the sex-differing responses to hourly work. For example, one may hypothesize that more "masculine" women (by physiological attributes, such as body size) may self-select into hourly jobs. We find some support for this hypothesis, as we observed slightly greater heights and BMI's among hourly women.

The negative effect of hourly status on women's health, combined with higher risks associated with job tenure among women with sociodemographic characteristics predictive of hourly status (e.g., lower education), together raise important questions about how the nature of manufacturing work may differently affect men and women. Why employment duration is associated with higher risk of hypertension among women than men is unclear, and may indicate different responses to cumulative physical, chemical, or psychosocial exposures at work. Without incorporating measures of physical and chemical exposures in these models, we can not differentiate sex-specific responses to chemical exposures from non-chemical hazards such as ill-fitting equipment or task burden. Equally plausible are gender-based hypotheses wherein women in manufacturing environments may lack support, equal advancement opportunity, experience greater harassment of discrimination, or have home demands which may differently affect response to workplace exposures. Importantly, the heightened effects observed among women and men predicted to be hourly may suggest interaction effects between SES and job-related exposures, suggesting the possibility of heightened susceptibility with lower SES.

Limitations

Epidemiological research using health claims data raises several challenges[37]; here, most such structural deficiencies should drive effects towards the null. For example, some claims may be missing for persons with multiple insurance plans, leading to outcome misclassification, and lower observed incidences and relative risks. The presence of multiple

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insurances may differ by gender and SES, if traditional families rely on the husband's income or insurance. Such under-reporting should minimally influence our results, however, as 98% of employees have at least one medical claim in our database, and because the company provides exhaustive medical coverage for families at all job grades.

Among blue-collar workers, we expect some healthy-worker effect due to selective hiring of relatively healthy individuals.[43] In studies restricted to active workers, we expect that healthy worker survivor bias may weaken associations, as employees affected by chronic disease are more likely to terminate employment, leaving behind a less susceptible population still employed. Even in an analysis based on internal comparisons, the relative risks are likely biased downward.[44]

Income data were available only for 2002 through 2004, after disease onset in some cases, posing directionality problems. We also lack total household income, which may differentially predict men's and women's SES. Future analyses follow-up of this cohort will enable us to observe the prospective effects of income on health.

Finally, the 11 plants included in this analysis did not provide adequate variability between plants or regions for multi-level modeling, and our one plant-level covariate of interest, percent of blue-collar workers who are female, varied little by plant. Future analyses will include more plants, and will employ multi-level techniques to examine interactions between individual- and plant-level covariates.

Strengths

The limitations do not detract from our central finding; hourly status increased hypertension risks solely among women likely to be hourly, based on adjustment for pre-hire factors influencing job placement. Lower SES, predictive of hourly status, may indicate greater susceptibility among these female workers.

Our dataset allowed examination of risk factors differentially influencing women's and men's job placement and health. We were also uniquely able to compare data for blue- and white-collar workers in the same locations and employer, wherein all workers are provided identical health benefits and provider networks. These characteristics of the data allow better distinction between job-related health effects from those associated with job placement, for both men and women.

CONCLUSIONS

We found that female workers showed greater likelihood of hypertension onset with hourly (blue-collar manufacturing) work than did male employees, after adjustment for confounding using propensity stratification and multivariable analysis. This effect was stronger among women with sociodemographic characteristics predictive of hourly status, suggesting greater susceptibility among lower-SES women.

Propensity modeling revealed that job status was influenced by family characteristics for both women and men. Single parents, especially women, were more likely to be hourly; partnered men with children were more likely salaried. By allowing sociodemographic characteristics and family structure to differently predict employment decisions, propensity stratification improved adjustment for confounding, and to begin to differentiate gendered job assignment from sex-differing biological response. Further investigation of differences in task burden, susceptibility, job status, and social experiences at work is warranted.

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'What is already known about this topic'

Multiple studies have reported elevated health risks to women performing 'blue-collar' manufacturing work.

It remains unknown, however, what portion of these elevated risks are due to gendered job assignment, or to sex-linked biological susceptibility to workplace chemical or physical exposures.

'What this study adds'

We develop a method, using propensity scores, to begin to separate the effects of gendered job assignment from the effects of performing manufacturing work.

We found that socioeconomic factors and family structure predicted job status for both women and men.

After adjustment for sociodemographic confounding, we found that hourly ('blue-collar') status predicted hypertension onset among women.

In addition, we found that women with sociodemographic characteristics predictive of hourly status (e.g., lower education) showed associations between hourly status and hypertension, potentially suggesting greater susceptibility among lower-SES workers.

Table 1

Cohort demographics by sex in eleven plants

	Male				Female			
	Hourly (n = 9,280)		**Salaried (n = 3,322)**		**Hourly (n = 793)**		**Salaried (n = 1,223)**	
	Mean	**(SD)**	**Mean**	**(SD)**	**Mean**	**(SD)**	**Mean**	**(SD)**
Age	46.7	(9.0)	45.6	(8.4)	44.4	(8.9)	43.0	(8.8)
Income	50,685	(11,389)	95,025	(134,791)	45,707	(10,385)	67,436	(47,581)
(median income):	49,201		75,883		45,025		55,134	
Tenure								
(years on the job)	18.4	(11.8)	16.7	(10.2)	12.1	(9.1)	13.5	(9.3)
BMI	30.0	(5.2)*	29.2	(5.0)*	29.9	(6.0)	26.5	(5.7)
Job grade	12.4	(8.3)	14.8	(5.7)	7.3	(5.7)	11.0	(4.6)
	N	(%)	N	(%)	N	(%)	N	(%)
Education:								
Less than HS	4,133	(44.5)	405	(12.2)	337	(42.5)	104	(8.5)
HS grad+	1,306	(14.1)	751	(22.6)	138	(17.4)	185	(15.1)
Unknown	3,841	(41.4)	2,166	(65.2)	318	(40.1)	934	(76.4)
Race/ ethnicity:								
Caucasian	7,942	(85.6)	2,979	(89.7)	569	(71.8)	1,068	(87.3)
African-American	875	(9.4)	166	(5.0)	188	(23.7)	109	(8.9)
Hispanic	410	(4.4)	107	(3.2)	27	(3.4)	28	(2.3)
Other/ Unknown	53	(0.6)	70	(2.1)	9	(1.1)	18	(1.5)
Smoking:								
Current	1,623	(17.5)	209	(6.3)	169	(21.3)	43	(3.5)
Prior	1,412	(15.2)	287	(8.6)	85	(10.7)	55	(4.5)
Never	2,021	(21.8)	610	(18.4)	198	(25.0)	196	(16.0)
Unknown	4,224	(45.5)	2,216	(66.7)	341	(43.0)	929	(76.0)
Hypertension	1,101	(11.9)	316	(9.5)	94	(11.9)	69	(5.6)
Heart disease	392	(4.2)	106	(3.2)	16	(2.0)	12	(1.0)

*BMI distribution is based on the 54% of all hourly and 41% of salaried personnel with non-missing data; missing BMI was not significantly associated with other covariates.

Table 2

Odds Ratios from bivariate logistic regression models for hypertension risk. ORs are adjusted for non-linear effects of age, and weighted by person-time in cohort.

	Male employees (n = 12,602)		**Female employees (n = 2,016)**	
	OR (95 % CI)		**OR (95 % CI)**	
Employment status				
Hourly	**1.18**	**(1.11 – 1.25)**	**2.10**	**(1.80–2.43)**
Salaried	1.00		1.00	
Age (years)	**1.041**	**(1.035 – 1.047)**	**1.024**	**(1.007–1.04)**
Job grade	**0.992**	**(0.989 – 0.995)**	**0.973**	**(0.959–0.987)**
BMI				
Above-median	**2.37**	**(2.20–2.55)**	**2.18**	**(1.78–2.66)**
Below-median	1.00		1.00	
Income				
Lowest tertile (below $44,464)	**1.28**	**(1.20 – 1.37)**	**1.64**	**(1.33–2.01)**
Medium ($44,464 – $65,943)	**1.08**	**(1.01 – 1.16)**	**1.65**	**(1.33–2.05)**
Highest tertile (above $65,943)	1.00		1.00	
Education				
High school grad or less	1.01	(0.94–1.09)	0.89	(0.72–1.10)
More than high school	1.00		1.00	
Race/ ethnicity				
African-American	**1.46**	**(1.34 – 1.59)**	**1.99**	**(1.67–2.38)**
Hispanic	**0.78**	**(0.68 – 0.91)**	1.21	(0.76–1.94)
Caucasian	1.00		1.00	
Smoking				
Current	0.99	(0.90–1.08)	0.98	(0.76–1.27)
Prior	**1.14**	**(1.05–1.24)**	**1.72**	**(1.34–2.22)**
Never	1.00		1.00	
Tenure (per year)	**1.014**	**(1.010–1.017)**	**1.021**	**(1.021–1.031)**

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Table 3

Multivariate models for effect of hourly status on hypertension, including all men and women. 'Unknown' categories for BMI, smoking, and education are included in the model, but not reported here.

	All Male employees (n = 12,602) (9,280 hourly) (1,417 cases total)		**All Female employees (n = 2,016) (793 hourly) (163 cases total)**	
	Adj OR	**95% CI**	**Adj OR**	**95% CI**
Hourly (vs. Salaried)	1.03	(0.95–1.11)	**1.68**	**(1.39–2.02)**
Age (year)	**1.028**	**(1.020 – 1.035)**	1.009	(0.99 – 1.03)
Tenure (years):	**1.013**	**(1.010–1.016)**	**1.027**	**(1.016–1.038)**
BMI:				
Above-median	**2.39**	**(2.22 – 2.57)**	**1.81**	**(1.47 – 2.24)**
Below-median	1.00	(ref)	1.00	(ref)
Income:				
Lowest tertile	**1.23**	**(1.13–1.33)**	1.24	(0.99 – 1.56)
Medium tertile	1.04	(0.96 – 1.12)	**1.33**	**(1.06 – 1.67)**
Highest tertile	1.00	(ref)	1.00	(ref)
Education:				
High school	0.92	(0.85–0.995)	**0.70**	**(0.56–0.87)**
More than high school	1.00	(ref)	1.00	(ref)
Race/ ethnicity:				
African-American	**1.37**	**(1.26–1.49)**	**1.60**	**(1.33–1.93)**
Hispanic	**0.73**	**(0.63–0.85)**	1.14	(0.71–1.84)
Caucasian	1.00	(ref)	1.00	(ref)
Smoking:				
Current vs. Never	1.06	(0.97–1.16)	0.96	(0.74 – 1.26)
Prior vs. Never	**1.13**	**(1.04 – 1.23)**	**1.87**	**(1.44–2.43)**
Never	1.00	(ref)	1.00	(ref)

Table 4

Sex-stratified propensity score models predicting likelihood of hourly status, adjusted for plant location and decade of hire to account for secular hiring trends.

	Male employees (n = 12,602) (9,280 hourly)		**Female employees (n = 2,016) (793 hourly)**	
	Odds Ratio	**95% Wald Confidence Limits**	**Odds Ratio**	**95% Wald Confidence Limits**
Family:				
Single, no child	(ref)		(ref)	
Single parent	**1.67**	**(1.20 – 2.32)**	**2.02**	**(1.37–2.97)**
Partner, child	**0.68**	**(0.56–0.83)**	1.04	(0.77–1.41)
Partner, no child	1.01	(0.82–1.24)	0.99	(0.71–1.39)
Height tertile (by sex):				
Tall	**0.67**	**(0.57–0.80)**	1.37	(0.92–2.04)
Medium	**0.76**	**(0.63 – 0.92)**	1.46	(0.95–2.26)
Short	1.00	(ref)	1.00	(ref)
Age at hire (years)	**1.02**	**(1.01 – 1.03)**	**1.04**	**(1.02–1.06)**
Education:				
High school or less	**5.95**	**(5.15–6.87)**	**4.24**	**(2.98–6.03)**
More than high school	1.00	(ref)	1.00	(ref)
Race/ ethnicity:				
African-American	**1.89**	**(1.53 – 2.33)**	**2.86**	**(1.96–4.17)**
Hispanic	**1.40**	**(1.08 – 1.83)**	1.72	(0.85–3.49)
C aucasian	1.00	(ref)	1.00	(ref)
	c = 0.819		c = 0.881	

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Table 5

Sex-stratified multivariate models for effect of hourly status on hypertension, adjusted for non-linear effects of age. All variables are measured at mid-point of follow-up.

	Male employees				**Female employees**			
	Predicted hourly (Pr > 0.5; n = 10,995) (1,287 cases)		**Predicted salaried (Pr < 0.5; n = 1,607) (130 cases)**		**Predicted hourly (Pr > 0.5; n = 831) (95 cases)**		**Predicted salaried (Pr < 0.5; n = 1,185) (68 cases)**	
	Adj OR (95% CI)		**Adj OR (95% CI)**		**Adj OR (95% CI)**		**Adj OR (95% CI)**	
Hourly (vs. Salaried)	0.92	(0.85–1.003)	1.16	(0.88–1.52)	**1.78**	**(1.34–2.35)**	0.74	(0.53–1.04)
Tenure (per year)	**1.013**	**(1.010–1.017)**	0.995	(0.983–1.008)	**1.028**	**(1.013–1.043)**	**1.019**	**(1.001–1.036)**
Age (per year)	**1.03**	**(1.02 – 1.04)**	0.999	(0.97–1.03)	1.012	(0.984 – 1.041)	0.993	(0.96–1.02)
BMI:								
Above-median	**2.39**	**(2.22 – 2.58)**	**2.52**	**(1.83–3.49)**	**1.79**	**(1.39 – 2.30)**	**2.45**	**(1.64–3.66)**
Below-median	1.00	(ref)	1.00	(ref)	1.00	(ref)	1.00	(ref)
Income (by terlie):								
Low	**1.22**	**(1.12 – 1.32)**	**1.49**	**(1.13–1.97)**	0.94	(0.69 – 1.30)	**1.92**	**(1.36–2.71)**
Medium	1.02	(0.94 – 1.11)	**1.26**	**(1.01–1.59)**	0.93	(0.67 – 1.29)	**2.30**	**(1.64–3.22)**
High	1.00	(ref)	1.00	(ref)	1.00	(ref)	1.00	(ref)
Education:								
High school	0.95	(0.87–1.04)	N/A		0.91	(0.66–1.26)	0.64	(0.35–1.16)
More than high school	1.00	(ref)	1.00	(ref)	1.00	(ref)	1.00	(ref)
Race/ ethnicity:								
African-American	**1.39**	**(1.28 –1.52)**	0.63	(0.33–1.21)	**1.47**	**(1.18–1.84)**	**1.68**	**(1.12–2.52)**
Hispanic	**0.72**	**(0.61–0.84)**	1.002	(0.51–1.96)	1.29	(0.72–2.31)	0.63	(0.25–1.61)
Caucasian	1.00	(ref)	1.00	(ref)	1.00	(ref)	1.00	(ref)
Smoking status:								
Current vs. Never	1.04	(0.95–1.14)	**1.67**	**(1.10–2.53)**	0.96	(0.70 – 1.32)	1.50	(0.89–2.53)
Prior vs. Never	1.08	(0.99 – 1.18)	**2.43**	**(1.68–3.53)**	**2.29**	**(1.68–3.13)**	0.94	(0.54–1.63)
Never	1.00	(ref)	1.00	(ref)	1.00	(ref)	1.00	(ref)