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Gender, depression, and blue-collar work: A retrospective cohort study of U.S. aluminum manufacturers

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Abstract

Background: Industrial blue-collar workers face multiple work-related stressors, but evidence regarding the burden of mental illness among today's blue-collar men and women remains limited.

Methods: In this retrospective cohort study, we examined health and employment records for 37,183 blue- and white-collar workers employed by a single U.S. aluminum manufacturer from 2003 – 2013. Using Cox proportional hazards regression, we modeled time to first episode of treated depression by gender and occupational class. Among cases, we modeled rates of depression-related service utilization with generalized gamma regression.

Results: Compared with their white-collar counterparts, blue-collar men were more likely to be treated for depression (HR = 1.3, 95% CI 1.1 – 1.4) as were blue-collar women (HR = 1.4, 1.2 – 1.6). Blue-collar women were most likely to be treated for depression as compared with white-collar men (HR = 3.2, 95% CI 2.1 – 5.0). However, blue-collar workers used depression-related services less frequently than their white-collar counterparts among both men (RR = 0.91, 95% CI 0.84 – 0.98) and women (RR = 0.82, 95% CI 0.77 – 0.88).

Conclusion: Blue-collar women were most likely to be treated for depression compared with white-collar workers, and blue-collar women were most likely to be treated for depression compared with white-collar men. However, blue-collar men and women used depression-related healthcare services less frequently than white-collar workers. These findings underscore that blue-

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Data Sharing: As an alternative to providing a de-identified data set to the public domain, we currently allow access for the purpose of re-analyses or appropriate follow-up analyses by any qualified investigator willing to sign a contract with the host institution limiting use of data without direct PHI/PII identifiers, in accordance to HIPAA regulations, and with a 15-day manuscript review for compliance purposes. For access to the data, interested parties can contact the study PI, Dr. Mark Cullen, at mrcullen@stanford.edu.

collar women may be uniquely susceptible to depression, and suggest that blue-collar workers may encounter barriers to care-seeking related mental illness other than their insurance status.

Keywords

Occupational class; manufacturing; depression; gender differences

Introduction

Increased risk of psychiatric distress is consistently observed among workers of lower occupational strata.[1–3] Similarly, prior research finds increased risk for depression and anxiety among industrial blue-collar workers compared with white-collar workers.[4] Trends such as these may be explained by the fact that a predisposition towards mental illness may lead to downward social mobility into blue-collar jobs (i.e. “drift”) or may preclude the attainment of socioeconomic position that otherwise might be expected (i.e. “selection”). Alternatively, aspects of blue-collar work may increase the risk of mental illness through an etiologic process or prolong the duration of symptoms.[5–7] These processes may work simultaneously to increase the burden of depression among blue-collar workers,[2] although most longitudinal analyses of depression suggest socioeconomic position plays an etiologic role in the onset of depression.[8–11] Indeed, past research identifies several aspects of blue-collar jobs – including physical demand; their monotonous, repetitive nature; oftentimes inflexible and demanding work hours; negative coworker interactions; and requirements to work quickly – as independent risk-factors for depression and anxiety.[12–16]

The existing literature on blue-collar workers’ mental health faces at least two notable limitations, however. First, findings from present-day working-class populations remain scarce despite labor trends that have fundamentally altered the nature of blue-collar jobs over the past 30 years. In the United States, these trends include industry deregulation; technological innovations (computerization and automation); union decline and weakened institutional protections for workers; and an overall decline in manufacturing.[17–21] The net effect of these trends is that blue-collar jobs are increasingly scarce and decreasingly characterized by the benefits and entitlements that once made them desirable.

Second, past research also largely fails to consider the mental health of women in industrial blue-collar jobs. Even within occupations, women often have different experiences with respect to pay, promotion, and assigned tasks as compared with men.[22,23] Women in blue-collar jobs may face a wide range of additional stressors including increased physical strain if tools and work arrangements are not optimized for female anthropometrics;[22,24,25] workplace-based sexual harassment and sex discrimination from managers and coworkers;[26–29] increased job insecurity and lack of control over work;[28,30] and greater conflict between work schedules and family obligations.[31,32] Careful study of female blue-collar workers’ mental health should be further motivated by the fact that women now constitute a substantial proportion of the U.S. manufacturing workforce (approximately 29% in 2013),[33] and that in the general population, risk of mood disorders is approximately doubled in women compared with men.[34–36]

In this retrospective cohort study, we characterize trends in depression by gender and occupational class among 37,183 men and women employed by a single U.S. aluminum manufacturer between 2003 and 2013. Because of substantive changes in blue-collar work in recent decades and the additional stressors faced by women in these jobs, our focus is on occupational class, which relates to social relations of ownership and control over productive assets, rather than occupational status, which refers to the ordering of persons along a continuum based on their socioeconomic attributes.[7] To that end, white-collar workers constitute an appropriate comparison group insofar as their jobs are less likely to be characterized by isolation, temporal inflexibility, physical demand, or gender discrimination.

Our study had two primary scientific objectives. First, we modeled time to first episode of treated depression over the course of the study period by gender and occupational class. Second, among workers who experienced at least one episode of treated depression, we compared rates of monthly depression-related service utilization by gender and occupational class. We hypothesized *a priori* that, due to factors such as selection, drift, and the wide range of stressors associated with blue-collar jobs, both male and female blue-collar workers would be more likely to experience depression and would utilize depression-related services more frequently than their counterparts in white-collar jobs.

Methods

Study Population and Design

We conducted a retrospective cohort study of workers employed by a single firm at one of 32 U.S. aluminum plants between January 1, 2003 and December 31, 2013. Study data comprised distinct administrative datasets. Records for individual workers were deterministically linked across datasets with a unique, encrypted identifier. Complete medical claims data were available for workers enrolled in their local preferred provider organization (PPO) health insurance plan. We therefore examined health and employment records for all personnel who were actively employed and enrolled in their local PPO plan for at least one month throughout the study period (approximately 97% of workers). Plan characteristics for this study population have been described in detail previously, and local PPO plans were identical with respect to coverage, including psychiatric services, and differed only with respect to family coverage and deductible rates.[37]

Follow-up for each worker extended from the date they first became eligible for insurance (on or after January 1, 2003) until either the end of eligibility or 31 December 2013. We restricted our cohort to workers between the ages of 18 and 65 at the start of follow-up. To ensure that retirees were excluded from our analysis, we further restricted our sample to workers hired after 1 January 1975 with activity in their employment records within three years of the date they first became eligible.

Occupational Class

Occupational class was ascertained from company personnel files. Consistent with previous analysis of these data, we classified hourly workers as blue-collar and salaried employees as white-collar.[38,39]

Depression Measures

We created two separate measures of depression using primary outpatient diagnostic codes from the International Classification of Diseases, Ninth Revision (ICD-9) and records of filled prescriptions from medical claims. We included ICD-9 codes 293.84, 296.2 – 296.3, 300.00 – 300.02, 309 and 311 and prescriptions for antidepressants included selective serotonin reuptake inhibitors (SSRI), selective norepinephrine reuptake inhibitors (SNRI), tricyclic antidepressants (TCAs), and monoamine oxidase inhibitors (MAOIs).

We first created a case definition for treated depression, which included all workers with at least two depression-related outpatient visits *or* two prescribed antidepressants within 365 days at any point throughout the study period. We defined the date of the first episode of treated depression as the date of the second prescribed antidepressant or the second depression-related outpatient visit (whichever came first). We intended this case definition to be sufficiently flexible so as to capture workers who were being actively treated for depression through pharmacotherapy, but were not being billed with a depression-specific ICD-9 code by their provider. Because study data lacked additional information regarding workers' past histories of mental illness, we were unable to differentiate between new-onset versus preexisting disease. Our measure therefore corresponds to the date of the first observed episode of treated depression within the study period.

Second, we calculated rates of monthly depression-related service utilization among the cases. For each case, we summed all months in which there was a depression-related outpatient visit or prescription, and divided this sum by the total duration of PPO eligibility in years. Because prescriptions varied in duration, we assumed that prescriptions lasting between 45 and 75 days were equivalent to two consecutive months of depression-related service utilization, and prescriptions lasting 75 to 95 days were equivalent to three consecutive months of service utilization. The final rate measure summarized the average number of months per year in which each case utilized depression-related services and was bounded between zero and 12 months per year. Any rate that exceeded the upper bound – which occurred for a small fraction of cases when prescriptions extended into periods of non-eligibility – was truncated at 12 months per year.

Covariates

We derived basic demographic characteristics (gender, age, race/ethnicity), plant location, and calendar year from company personnel files. We created categorical variables for gender, race/ethnicity (Black, Hispanic, white, and other) and a set of indicator variables for plant location and calendar year. Using eligibility files, we measured the number of dependent children (i.e. children younger than 18) listed on their insurance policy for each worker for each year of follow-up. We created a categorical variable with values of zero, one, two, and three or more dependent children. We ascertained whether workers had a dependent spouse on their insurance policy for each year of follow-up using eligibility files.

We further characterized our study population by summarizing additional employment characteristics derived from personnel files, including whether workers were hired after the study period commenced (i.e. "new hires"); tenure at baseline for workers hired prior to

January 1, 2003; and annual wages at the start of follow-up, which we ascertained using W2 data. These variables were were not included in any analyses since they were temporally preceded by gender and occupational class, and therefore could not confound our associations of interest.

Analysis of Gender, Occupational Class, and Treated Depression

We modeled time to first episode of treated depression among blue-versus white-collar workers separately for men and women. To examine the combined roles of occupational class and gender, we conducted a pooled analysis of male and female workers in which we examined the time to first episode of treated depression among blue-collar women, blue-collar men, and white-collar women as compared with the referent group of white-collar men.

For both analyses, we used Cox proportional hazards regression with attained age as the underlying time scale. Age of entry was defined as age at the start of follow-up for each worker (on or after 1 January 2003). We allowed for changes in occupational class over the course of follow-up with a time-varying exposure variable. We adjusted for potential confounders, including race/ethnicity, dependent spouse, and number of dependent children. We accounted for regional differences in mental health provider network with fixed effects for plant location. Secular trends in mental healthcare utilization (i.e. before and after the Great Recession) have been studied previously in this study population.[40] In this analysis, we accounted for secular trends in mental healthcare utilization with fixed effects for calendar year.

Analysis of Monthly Depression-Related Service Utilization

We modeled the rate ratio for monthly depression-related service utilization among blue- and white-collar workers for men and women separately, and conducted a pooled analysis in which we examined service utilization among blue-collar women, blue-collar men, and white-collar women as compared with white-collar men. We used generalized linear models with the gamma family and log link specified. Generalized gamma regression is an alternative to linear regression with log transformation that is appropriate for positive, right-skewed, and continuous outcomes such as our rate measure.[41] Models were simultaneously adjusted for age, age squared, calendar year, race/ethnicity, number of dependent children, marital status, and plant location. Age was mean-centered and rescaled such that model coefficients correspond to the change in utilization rates for a 10-year increase in age. Values for all covariates were taken at the start of follow-up.

To account for non-independence of workers within plant locations (i.e. clustering), we used a cluster bootstrap approach to estimate 95% confidence intervals and resampled at the level of the plant location in all analyses. All statistical analyses were performed with R version 3.2.3. This study was approved by the Institutional Review Boards at the University of California, Berkeley and at Stanford Univeristy.

Sensitivity Analyses

Past research suggests reasonable concordance between medical claims and medical records or self-report.[42–44] The use of medical insurance claims data to define various health outcomes – including depression and anxiety – have also been described previously for this study population.[40,45,46] To assess the robustness of outcomes defined using medical claims in the present study, we created six alternative case definitions for treated depression, ranging from very sensitive (i.e., first prescribed antidepressant) to very specific (i.e., two outpatient visits plus one prescription within 365 days). We additionally assessed the robustness of our findings to the inclusion and exclusion of anxiety-related diagnostic codes (ICD9 293.84, 300.00 – 300.02).

Additional sensitivity analyses included an analysis of time to first episode of treated depression *among* workers hired after the start of follow-up (i.e. after January 1, 2003) and separate assessment of the counts of unique depression-related outpatient visits and prescriptions by occupational class.

Results

Of the 37,201 workers who satisfied the inclusion criteria, we excluded 17 for whom race/ethnicity was missing. Our final study sample included 7,148 women followed for 309,565 person–months and 30,035 men followed for 1,681,394 person–months. Demographic, employment, and health characteristics for the study sample are presented in Table 1. The majority of workers had blue-collar jobs for both women (74%) and men (80%). Examples of blue-collar job titles included material handler, machine operator, and pot tender. White-collar job titles included human resources manager, senior general accountant, and associate electrical engineer. A small fraction of white collar workers had supervisory roles in the factory environment (i.e. production supervisors). Only a small percentage of workers (3.7%) were promoted from blue- to white-collar jobs over the course of the study period.

As compared with blue-collar workers, white-collar workers were more likely to be white with higher median annual wages at baseline. Male workers were more likely to have a dependent spouse and dependent children on their health insurance plan at baseline. Using our primary case definition, there were 1,903 blue-collar women (36%) and 629 white-collar women (34%) who were treated for depression at some point throughout study period. Among men, 4,689 blue-collar workers (19%) and 1,171 white-collar workers (20%) were treated for depression (Table 1). Among the cases, we find that half of workers received treatment for depression through a combination of outpatient visits and prescriptions (50%), although many cases were treated exclusively through prescriptions for antidepressants (37%) and a minority of cases were treated exclusively in outpatient visits. Median rates of depression-related service utilization were higher in white-collar workers for both men and women (Table 1 and eFigures 1 and 2 in the Supplemental Materials).

Gender, Occupational Class, and Treated Depression

Among men, blue-collar workers were more likely to be treated for depression over the study period compared with white-collar workers (Hazard Ratio = 1.3, 95% CI 1.1 – 1.4).

Similarly, blue-collar women were more likely to be treated for depression compared with white-collar women **(**HR = 1.36, 1.7 – 1.6) (Table 2, eFigures 1 and 2). In our pooled analysis, we found that blue-collar women were most likely to be treated for depression compared with white-collar men (HR = 3.2, 95% CI 2.1 – 5.0), followed by white-collar women (HR = 2.4, 95% CI 1.7 – 3.7) and blue-collar men (HR = 1.3, 95% CI 1.1 – 1.5). For both men and women, workers with dependent children were more likely to be treated for depression whereas non-white workers were less markedly likely to be treated for depression over the study period (Table 2, Table 3).

Rates of Monthly Depression-Related Service Utilization

Among workers treated for depression, blue-collar men and women utilized depression-related healthcare services less frequently than their white-collar counterparts. The rate of monthly depression-related service utilization among blue-collar men was 0.91 times the rate of monthly utilization among white-collar men (95% CI 0.84 – 0.98). Similarly, the rate of monthly depression-related service utilization among blue-collar women was 0.82 times that of white-collar women (95% CI 0.77 – 0.88). As compared with white-collar men, rates of service utilization were lowest among blue-collar men (RR = 0.90, 95% CI 0.85 – 0.97) and highest among white-collar women (RR = 1.3, 95% CI 1.2 – 1.4). Overall, rates were decreased among those with dependent children and among non-white workers, and utilization rates were substantially lower for non-White workers (Tables 4 and 5, eFigures 3 and 4).

Sensitivity Analyses

To assess the robustness of outcome, we created six alternative outcome definitions and further assessed whether results were sensitive to the exclusion of anxiety-related outpatient visits (Figure). We found that HRs for time to first depression episode were consistent across all case specifications (top panel). Results were similar, though slightly attenuated, with the exclusion of anxiety-related outpatient visits (bottom panel). We summarize our six alternative case definitions as well as HRs and 95% CI from Cox proportional hazards regression in the Supplemental Materials (eTable 1).

Next, we modeled time to first episode of treated depression since hire by restricting our analysis to workers hired after the start of follow-up (eTable 2). Consistent with our primary analysis, blue-collar men hired after the start of follow-up were more likely to be treated for depression (1.3, 1.1 – 1.5). In contrast with our primary analysis, we found no evidence that blue-collar women were more likely to be treated for depression than white-collar women among the new hires (0.95, 0.80 – 1.1). Our analyses of the counts of unique depression-related outpatient visits and prescriptions, respectively, were consistent with findings from our analysis of the rate of monthly depression-related service utilization (eTables 3 and 4).

Discussion

In this retrospective cohort study, we characterized trends in depression by gender and occupational class among more than 37,000 men and women employed by a single U.S. aluminum manufacturer between 2003 and 2013. We first modeled time to first episode of

treated depression by gender and occupational class. We additionally examined trends in monthly depression-related service utilization by gender and occupational class among workers with at least one episode of treated depression within the study period (i.e. cases). All workers in our study population received health insurance from their employer, and psychiatric services were covered through local PPO plans.

We observed that women were substantially more likely than to be treated for depression within the study period than men (35% of female workers versus 20% of male workers). This finding is consistent with findings from the general populations, and with women's greater propensity to seek mental health treatment[47] and higher frequency of affective disorders or mental distress that is consistently documented among women in the general population.[34] Among both men and women, we found that blue-collar workers were more likely to be treated for depression at least once over the study period as compared with white-collar workers, although examination of the percentages of blue- and white-collar workers treated for depression over the study period suggests that the differences between blue- and white-collar workers are slight as compared with the differences between men and women overall.

In our pooled analysis of male and female workers, we found that blue-collar women were more than three times as likely to experience an episode of treated depression within the study period as compared with white-collar men, which underscores that women in blue-collar jobs may uniquely susceptible to depression. Non-white workers were considerably less likely than white workers to experience depression throughout the study period, which may reflect decreased propensity to seek care in general or greater stigma surrounding mental illness within racial and ethnic minority groups.[48–50]

These trends in depression by occupational class may reflect a variety of factors, such as the downward social mobility among individuals predisposed to mental illness (i.e. "drift"), the downward selection into lower occupational strata than would otherwise be expected, or an etiologic role of work in onset or exacerbation of underlying depression.[5–7] Aspects of the blue-collar work environment that may lead to depression onset include physical demand; the monotonous, repetitive nature of production; inflexible and demanding work hours; negative coworker interactions; and requirements to work quickly.[12–16] Among female blue-collar workers, physical strain, sexual harassment and discrimination, job insecurity and lack of control over work, and work-life conflict may also contribute to onset of depression or exacerbate underlying disease.[22,24–32] For today's blue-collar worker, these stressors exist within the broader context of economic uncertainty, real or perceived job insecurity, and weakened statutory entitlements and protections.

As a sensitivity analysis, we restricted our analysis to workers hired after the start of follow-up and modeled time to first episode of treated depression *since hire*. Consistent with findings for all male workers, we find that blue-collar men hired after the start of follow-up are more likely to be treated for depression within the study period as compared with white-collar men. However, we find no evidence that blue-collar women hired after the start of follow-up were more likely to experience depression. While there is no clear, single explanation for the observed heterogeneity among female workers, our findings could reflect

a higher burden of depression among newly hired white-collar women, a decreased burden of depression among newly hired blue-collar women, or greater stigma and less permissive norms surrounding mental healthcare utilization among women newly hired into blue-collar jobs.

Finally, we examined rates of monthly depression-related healthcare utilization over the course of the study period among workers treated for depression. Although we hypothesized that blue-collar workers would use depression-related services more frequently, we found that male and female blue-collar workers used depression-related services less frequently than their white-collar counterparts. As compared with white-collar men, blue-collar men used depression-related services the least frequently and white-collar women utilized services most frequently. In this insured population, patterns of utilization by occupational class and gender cannot be explained by systematic differences in insurance status. Less frequent service use may reflect systematically less severe depression among blue-collar men and women. Perhaps more plausibly, lower rates among blue-collar workers may reflect barriers to mental healthcare service use other than insurance status, including greater stigma or less permissive norms surrounding mental healthcare use in working class populations; scheduling demands and temporal inflexibility associated with hourly work; blue-collar workers' sensitivity to the out-of-pocket costs associated with service use; or provider behaviors.

Limitations

The present study is not without limitations. First, our study was based on data from a single firm and may therefore have limited generalizability even to other U.S. manufacturers if differences in organizational culture and institutional practices translate to meaningful differences in worker mental health and mental healthcare utilization. No direct measures of household composition were available, and we could only ascertain whether workers had a dependent spouse or child on their health insurance policy each year. These measures are likely to systematically underestimate parity and marital status, especially for women, but nevertheless may be an important indicator of each worker's economic responsibilities towards household members. We were also unable to adjust for several characteristics – including previous employment and educational attainment – that likely confound our analyses. Our analysis of depression-related service utilization is restricted to cases, and therefore be susceptible to collider stratification bias if there are unmeasured common causes of caseness and service utilization rates (such as genetic factors, underlying disease severity, or careseeking propensity). These unmeasured factors will be negatively correlated with occupational class among the cases even if they are independent of occupational class in the general woring population class, thereby confounding our association of interest.

Our analysis entailed comparison of two broad and heterogeneous groups – blue- and white-collar workers. Some white-collar jobs may be characterized by work experiences that are similar to blue-collar jobs and vice versa. For example, production managers and supervisors are white-collar workers whose jobs may entail exposure to physical demand, occupational hazards and social environment that is similar or equivalent to those of blue-collar workers. Similarly, clerical workers may be more equivalent to blue-collar workers with respect to

their control over work and job security. This heterogeneity inherent in our definition of occupational class is equivalent to exposure misclassification.

Finally, there are at least three notable limitations related to our outcome of interest. First, absent any information on workers' past histories of mental illness, we are unable to differentiate between incident and prevalent depression, even among new hires. Second, we anticipate that outcome misclassification is likely. Because we measured depression outcomes using medical claims, our case definition does not capture untreated depression or treatment for depression received outside of the worker's PPO network. It is commonly noted that the majority of individuals with psychiatric illness do not receive treatment,[51] and moreover it cannot be assumed that treated depression is more severe than untreated depression given multiple cultural and economic pathways to treatment.[52,53] Finally, we are unable to identify instances of off-label antidepressant prescriptions (for fibromyalgia, neuropathic pain, or other psychiatric morbidities). Unless these sources of outcome misclassification are collectively differential with respect to occupational class, however, we anticipate that their net effect would be to attenuate study findings.

Conclusion

For the present study, we found that blue-collar workers were more likely to be treated for depression within study period than white-collar workers. Blue-collar women were most likely to be treated for depression as compared with white-collar men, a finding which underscores that women in blue-collar jobs may uniquely susceptible to depression. Among both men and women, non-white workers were less likely to experience depression throughout the study period. In our analysis of depression-related service utilization, we found that blue-collar men and women utilized depression-related services less frequently than their white-collar counterparts. In this insured population, our findings may reflect additional barriers to mental healthcare utilization among blue-collar workers including increased stigma or less permissive norms around mental healthcare utilization; provider behavior; temporal inflexibility; blue-collar workers' greater sensitivity mental healthcare costs. As many of these barriers are potentially modifiable, future public health research may aim to identify the predominant mechanisms that explain systematic differences in mental healthcare utilization by occupational class that we have observed.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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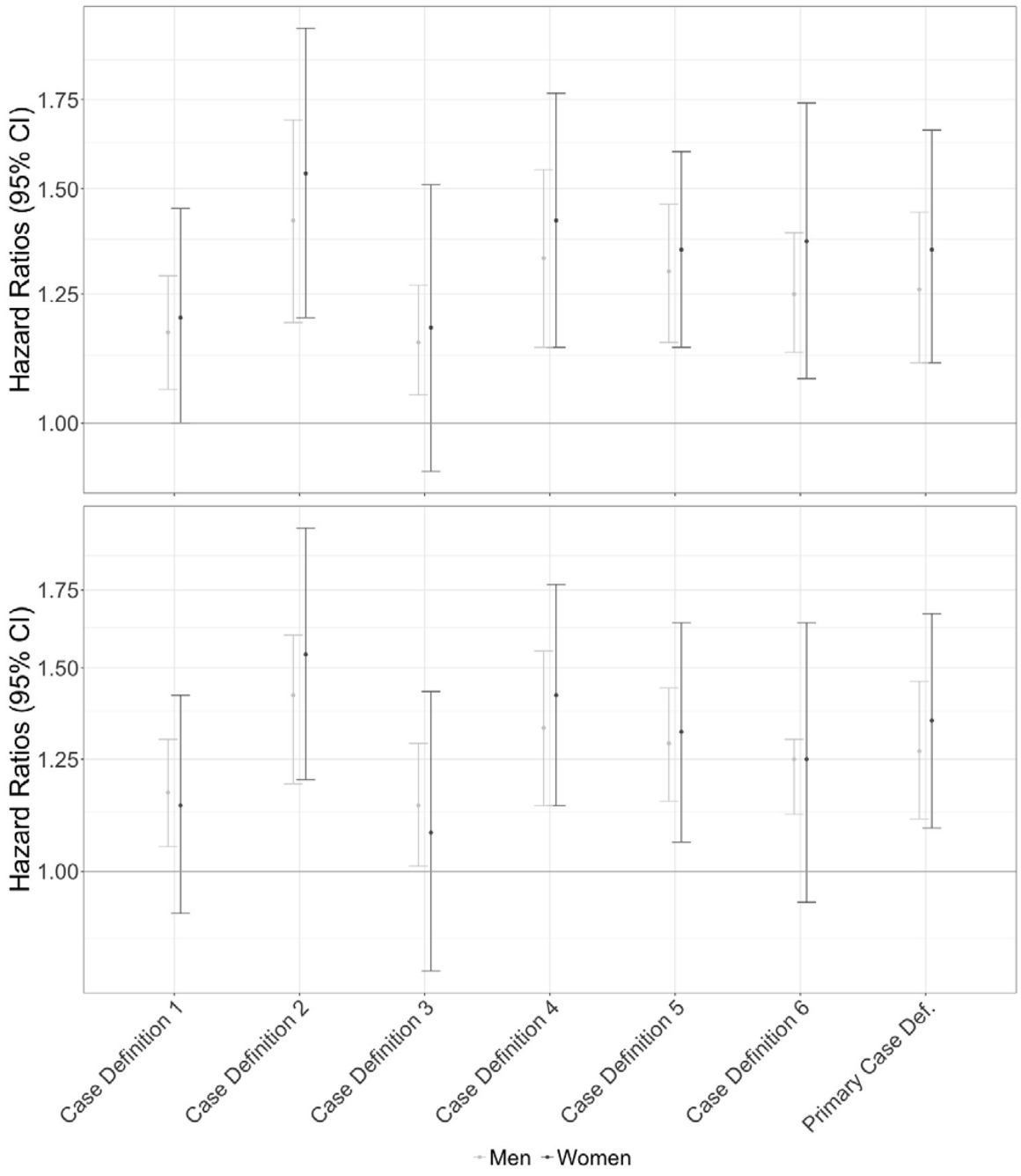

Figure:

Sensitivity analysis of alternative case definitions for first depression episode We constructed six alternative case definitions for first depression episode: first outpatient visit (Case Definition 1); first prescribed antidepressant (Case Definition 2); second outpatient visit in 365 days (Case Definition 3); second prescription in 365 days (Case Definition 4); one outpatient visit and one prescribed antidepressant in 365 days (Case Definition 6); and two outpatient visits plus one prescribed outpatient visit in 365 days (Case Definition 6). Depression-related outpatient visits were identified using ICD-9 codes 293.84, 296.2 – 296.3, 300, 309, and 311; antidepressants included selective serotonin reuptake inhibitors

(SSRI); selective norepinephrine reuptake inhibitors (SNRI); tricyclic antidepressants (TCAs) and monoamine oxidase inhibitors (MAOIs). We assessed the robustness of our case-definition to the inclusion (top panel) and exclusion (bottom panel) of anxiety-related ICD-9 codes (293.84, 300.00 – 300.02). All models used attained age as the timescale, were simultaneously adjusted for race/ethnicity, dependents spouse, number of dependent children, plant location and calendar year. We included a product term between sex and occupational class in order to estimate separate HRs for men and women. We estimated 95% confidence intervals by resampling from plant location using a cluster bootstrap with 200 repetitions.

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Table 1.

Baseline Demographic, Employment, and Health Characteristics for Active Workers at 32 U.S. Aluminum Plants, 2003 – 2013

	Women (N = 7,148)		Men (N = 30,035)	
	Blue Collar (N = 5,279)	**White Collar (N = 1,869)**	**Blue Collar (N = 24,124)**	**White Collar (N = 5,911)**
Demographic Characteristics				
Age – Median (IQR)[a]	44 (36 – 51)	41 (32 – 49)	42 (32 – 51)	44 (36 – 50)
Race – N (%)				
White	3,427 (65)	1,513 (81)	17,561 (73)	5,004 (85)
Black	871 (17)	164 (8.8)	2,585 (11)	355 (6.0)
Hispanic	748 (14)	101 (5.4)	2,839 (12)	278 (4.7)
Other	233 (4.4)	91 (4.9)	1,139 (4.7)	274 (4.6)
Dependent Spouse – N (%)	2,033 (39)	820 (44)	15,213 (63)	4,487 (76)
Number of Dependent Children – N (%)				
None	3,247 (62)	1,239 (66)	12,875 (53)	2,844 (48)
One	1,007 (19)	310 (17)	4,457 (19)	1,151 (20)
Two	655 (12)	231 (12)	4,093 (17)	1,237 (21)
Three or more	370 (7.0)	89 (4.8)	2,699 (11)	679 (12)
Employment Characteristics				
New Hires– N (%)	2,446 (46)	831 (45)	10,053 (42)	1,974 (33)
Tenure at Baseline (Years)[b] – Median (IQR)	2.9 (1.0 – 5.2)	5.0 (1.8 – 15)	5.5 (2.0 – 19)	4.0 (1.4 – 17)
Annual Wages[c] – Median (IQR)	$29K (17 – 40)	$46K (31 – 61)	$40K (23 – 50)	$59K (42 – 76)
Health Characteristics				
Person–months of Follow-Up– N	221,210	88,355	1,301,649	379,745
Number of Cases– N (%)[d,e]	1,903 (36)	629 (34)	4,689 (19)	1,171 (20)
Avg. Utilization Rate for Cases[f] – Median (IQR)	2.8 (1.0 – 7.0)	4.0 (1.4 – 8.6)	2.08 (0.73 – 5.8)	2.61 (0.8 – 7.2)

[a] IQR = Interquartile range

[b] Tenure at baseline is calculated for workers who were hired prior to the start of follow-up on January 1, 2003

[c] Wage data are missing for 200 women and 809 men

[d] We define the date of the first depression episode within the study period as the second depression-related outpatient visit *or* the second prescribed antidepressant within 365 days (whichever was first). Depression-related outpatient visits were identified using ICD-9 codes 293.84, 296.2 – 296.3, 300, 309, and 311; antidepressants included selective serotonin reuptake inhibitors (SSRI); selective norepinephrine reuptake inhibitors (SNRI); tricyclic antidepressants (TCAs) and monoamine oxidase inhibitors (MAOIs).

[e] Percentages do not account for variable follow-up time.

[f] Average utilization rates for cases correspond to the sum of all months in which there was either a depression-relate outpatient visit or filled prescription for a prescribed antidepressant by the total duration of PPO eligibility in years, taking into account prescription duration.

Table 2.

Adjusted hazards ratios time to first depression episode by occupational class among male and female workers[a,b]

Covariates	Women (N = 7,148)			Men (N = 30,035)		
	Workers	Cases – N (%)[c,d]	Hazard Ratios[e] (95% CI)	Workers	Cases – N (%)[c,d]	Hazard Ratios[e] (95% CI)
Occupational Class						
White-collar	1,869	629 (34)	1.0	5,911	1,171 (20)	1.0
Blue-collar	5,279	1,866 (35)	1.4 (1.2 – 1.6)	24,124	4,689 (19)	1.3 (1.1 – 1.4)
Dependent Children						
None	4,486	1,570 (35)	1.0	15,719	2,906 (19)	1.0
One	1,317	482 (36)	1.1 (1.0 – 1.2)	5,608	1,111 (20)	1.1 (0.98 – 1.2)
Two	886	303 (34)	1.1 (0.91 – 1.3)	5,330	1,185 (22)	1.2 (1.1 – 1.3)
Three or more	459	140 (31)	1.3 (1.1 – 1.5)	3,378	658 (20)	1.2 (1.1 – 1.3)
Dependent Spouse						
No	4,295	1,400 (33)	1.0	10,335	1,414 (14)	1.0
Yes	2,853	1,095 (38)	0.90 (0.83 – 0.97)	19,700	4,446 (23)	1.0 (0.95 – 1.1)
Race/Ethnicity						
White	4,940	1,990 (40)	1.0	22,565	5,092 (23)	1.0
Black	1,035	245 (24)	0.50 (0.42 – 0.60)	2,940	278 (9.5)	0.46 (0.34 – 0.62)
Hispanic	839	195 (23)	0.75 (0.63 – 0.91)	3,117	387 (12)	0.73 (0.62 – 0.87)
Other	334	65 (20)	0.52 (0.32 – 0.82)	1,413	103 (7.3)	0.43 (0.29 – 0.63)

[a] Results correspond to separate analyses among male workers (N = 30,035) and female workers (N = 7,148).

[b] Attained age was used as the timescale in Cox proportional hazards models. Separate models for male and female workers were adjusted for occupational class, dependent children, dependent spouse, race/ethnicity (Black, Hispanic, white, other), and included fixed effects for plant location and calendar year.

[c] We defined the date of the first depression episode within the study period as the second depression-related outpatient visit *or* the second prescribed antidepressant within 365 days (whichever was first). Depression-related outpatient visits were identified using ICD-9 codes 293.84, 296.2 – 296.3, 300, 309, and 311; antidepressants included selective serotonin reuptake inhibitors (SSRI); selective norepinephrine reuptake inhibitors (SNRI); tricyclic antidepressants (TCAs) and monoamine oxidase inhibitors (MAOIs).

[d] Percentages do not account for variable follow-up time.

[e] We estimated 95% confidence intervals by resampling from plant location using a cluster bootstrap with 1,000 repetitions.

Table 3.

Adjusted hazards ratios time to first depression episode by gender and occupational class[a]

Covariates	All Workers (N = 37,183)		
	Workers, N	Cases, N (%)[b,c]	Hazard Ratios[d] (95% CI)
Gender and Occupational Class			
White-Collar Men	5,911	1,171 (20)	1.0
Blue-Collar Men	24,124	4,689 (19)	1.3 (1.1 – 1.5)
White-Collar Women	1,869	629 (34)	2.4 (1.7 – 3.4)
Blue-Collar Women	5,279	1,866 (35)	3.2 (2.1 – 5.0)
Dependent Children			
None	20,205	4,476 (22)	1.00
One	6,925	1,593 (23)	1.1 (1.0 – 1.2)
Two	6,216	1,488 (24)	1.2 (1.0 – 1.3)
Three or more	3,837	798 (21)	1.2 (1.1 – 1.3)
Dependent Spouse			
No	14,630	2,814 (19)	1.0
Yes	22,553	5,541 (25)	0.97 (0.92 – 1.0)
Race/Ethnicity			
White	20,205	7,082 (35)	1.00
Black	3,975	523 (13)	0.48 (0.35 – 0.66)
Hispanic	3,966	582 (15)	0.73 (0.61 – 0.87)
Other	1,737	168 (9.6)	0.46 (0.30 – 0.71)

[a] Attained age was the timescale in Cox proportional hazards regression. The model was adjusted for gender and occupational class categories, dependent children, dependent spouse, race/ethnicity (Black, Hispanic, white, other), and included fixed effects for plant location and calendar year.

[b] We defined the date of the first depression episode within the study period as the second depression-related outpatient visit *or* the second prescribed antidepressant within 365 days (whichever was first). Depression-related outpatient visits were identified using ICD-9 codes 293.84, 296.2 – 296.3, 300, 309, and 311; antidepressants included selective serotonin reuptake inhibitors (SSRI); selective norepinephrine reuptake inhibitors (SNRI); tricyclic antidepressants (TCAs) and monoamine oxidase inhibitors (MAOIs).

[c] Percentages do not account for variable follow-up time.

[d] We estimated 95% confidence intervals by resampling from plant location using a cluster bootstrap with 1,000 repetitions.

Table 4.

Adjusted rate ratios for monthly depression-related service utilization by occupational class among male and female workers[a,b]

Covariates	Women (N = 2,495)		Men (N = 5,860)	
	Workers, N (%)	Rate Ratios (95% CI)[d,e]	Workers, N (%)	Rate Ratios (95% CI)[d,e]
Age[c]		1.2 (1.1 – 1.2)		1.2 (1.2 – 1.2)
Age Squared		0.99 (0.95 – 1.0)		0.99 (0.79 – 1.0)
Occupational Class				
White-collar	592 (24)	1.0	1,065 (18)	1.0
Blue-collar	1,903 (76)	0.82 (0.77 – 0.88)	4,795 (82)	0.91 (0.84 – 0.98)
Dependent Children				
None	1,433 (57)	1.0	2,566 (44)	1.0
One	514 (21)	0.87 (0.77 – 1.0)	1,183 (20)	0.86 (0.79 – 0.94)
Two	348 (14)	0.81 (0.72 – 0.91)	1,274 (22)	0.91 (0.85 – 0.97)
Three or more	200 (8.0)	0.71 (0.61 – 0.82)	837 (14)	0.86 (0.80 – 0.94)
Dependent Spouse				
No	1,412 (57)	1.0	1,506 (26)	1.0
Yes	1,083 (43)	0.97 (0.92 – 1.0)	4,354 (74)	2.0 (0.92 – 1.1)
Race/Ethnicity				
White	1,990 (80)	1.0	5,092 (87)	1.0
Black	245 (9.8)	0.68 (0.61 – 0.76)	278 (4.7)	0.63 (0.45 – 0.71)
Hispanic	195 (7.8)	0.72 (0.59 – 0.89)	387 (6.6)	0.63 (0.55 – 0.73)
Other	65 (2.6)	0.85 (0.68 – 1.1)	103 (1.8)	0.76 (0.63 – 0.93)

a. Results correspond to separate analyses restricted to male workers (N = 5,680) and female workers (N = 2,495) who satisfied our primary case definition for depression.

b. We used a generalized linear model with the gamma distribution and log link to estimate average rate ratios. Separate models for male workers and female workers were simultaneously adjusted for age, age squared, occupational class, dependent children, dependent spouse, race/ethnicity (Black, Hispanic, white, other), and included fixed effects for plant location.

c. Age was mean-centered and rescaled such that average rate ratios correspond to a 10-year increase in age.

d. Average utilization rates for cases correspond to the sum of all months in which there was either a depression-relate outpatient visit or filled prescription for a prescribed antidepressant by the total duration of PPO eligibility in years, taking into account prescription duration. Depression-related outpatient visits were identified using ICD-9 codes 293.84, 296.2 – 296.3, 300, 309, and 311; antidepressants included selective serotonin reuptake inhibitors (SSRI); selective norepinephrine reuptake inhibitors (SNRI); tricyclic antidepressants (TCAs) and monoamine oxidase inhibitors (MAOIs).

e. We estimated 95% confidence intervals by resampling from plant location using a cluster bootstrap with 1,000 repetitions.

Table 5.

Adjusted rate ratios for monthly depression-related service utilization by gender and occupational class[a]

Covariates	All Cases (N = 8,355)	
	Workers (%)	Rate Ratios (95% CI)[c,d]
Age[b]		1.2 (1.2 – 1.2)
Age Squared		0.99 (0.97 – 1.0)
Gender and Occupational Class		
White-collar men	1,065 (13)	1.0
Blue-collar men	4,795 (57)	0.90 (0.85 – 0.97)
White-collar women	592 (7.1)	1.3 (1.2 – 1.4)
Blue-collar women	1903 (23)	1.0 (0.98 – 1.1)
Dependent Children		
None	3,999 (48)	1.0
One	1,697 (20)	0.86 (0.81 – 0.92)
Two	1,622 (19)	0.88 (0.83 – 0.94)
Three or more	1,037 (12)	0.83 (0.76 – 0.89)
Dependent Spouse		
No	2,918 (35)	1.0
Yes	5,437 (65)	0.98 (0.94 – 1.0)
Race/Ethnicity		
White	7,082 (85)	1.0
Black	523 (6.3)	0.61 (0.54 – 0.69)
Hispanic	582 (7.0)	0.66 (0.57 – 0.75)
Other	168 (2.0)	0.79 (0.67 – 0.93)

[a] We used a generalized linear model with the gamma distribution and log link to estimate average rate ratios. The model was simultaneously adjusted for age, age squared, gender and occupational class categories, dependent children, dependent spouse, race/ethnicity (Black, Hispanic, white, other), and included fixed effects for plant location.

[b] Age was mean-centered and rescaled such that average rate ratios correspond to a 10-year increase in age.

[c] Average utilization rates for cases correspond to the sum of all months in which there was either a depression-relate outpatient visit or filled prescription for a prescribed antidepressant by the total duration of PPO eligibility in years, taking into account prescription duration. Depression-related outpatient visits were identified using ICD-9 codes 293.84, 296.2 – 296.3, 300, 309, and 311; antidepressants included selective serotonin reuptake inhibitors (SSRI); selective norepinephrine reuptake inhibitors (SNRI); tricyclic antidepressants (TCAs) and monoamine oxidase inhibitors (MAOIs).

[d] We estimated 95% confidence intervals by resampling from plant location using a cluster bootstrap with 1,000 repetitions.