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Racial And Ethnic Differences In The Frequency Of Workplace Injuries And Prevalence Of Work-Related Disability

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ABSTRACT Occupational injuries and illnesses lead to significant health care costs and productivity losses for millions of workers each year. This study used national survey data to test for differences between members of minority groups and non-Hispanic white workers in the risk of workplace injuries and the prevalence of work-related disabilities. Non-Hispanic black workers and foreign-born Hispanic workers worked in jobs with the highest injury risk, on average, even after adjustment for education and sex. These elevated levels of workplace injury risk led to a significant increase in the prevalence of work-related disabilities for non-Hispanic black and foreign-born Hispanic workers. These findings suggest that disparities in economic opportunities expose members of minority groups to increased risk of workplace injury and disability.

Occupational injuries and illnesses are an important public health concern, imposing significant costs on injured workers, employers, and society at large. Recent evidence suggests that the costs of occupational injuries and illnesses in the United States are as high as $250 billion per year.[1,2] Studies focusing on the economic consequences of disabilities resulting from injuries in the workplace have found that some disabled workers can lose up to 30 percent of their earnings even years after an injury.[3–5]

However, there has been less study of whether and how work-related injuries differentially impact minority populations. Evidence is mixed about the association between race/ethnicity and workplace injury rates. Most evidence suggests that members of minority populations face higher workplace injury risk, compared to whites,[6–17] although other studies have found no association.[18–23] One reason this evidence is inconsistent might be that racial disparities in workplace injury risk are strongly influenced by differences in the availability of different types of jobs according to race and ethnicity.

For example, evidence suggests that immigrant Hispanic construction workers face elevated risk of fatal and nonfatal injuries, compared to native-born Hispanic or non-Hispanic workers.[24–27] Previous work also indicates that the injury rate among non-Hispanic black workers is higher than it would be if they worked the same hours as non-Hispanic white workers.[28–30] Analyses of specific occupational diseases, including lung cancer[31–33] and silicosis,[34,35] have also shown racial disparities in the incidence of disease. However, more work is needed to understand disparities in workplace injury risk and these disparities' longer-term consequences for minority populations.

We examined how workplace injury risk and the prevalence of work-related disability (that is, a disability attributed to a workplace injury) varied across different racial and ethnic groups. Our first objective was to describe how the risk of workplace injury varies according to racial differences in job type (that is, whether workers across racial and ethnic groups hold more or less risky jobs). Our second objective was to observe how differences in workers' workplace injury risk affect the prevalence of work-related

disability. Combining these two analyses allowed us to assess how disparities in exposure to workplace injury risk affected disparities in work-related disabilities.

Study Data And Methods

We used two large data sets from nationally representative surveys published by the Census Bureau to capture information on racial/ethnic disparities in workplace injury risk: the 2006–13 American Community Survey and the 1996, 2001, 2004, and 2008 panels of the Survey of Income and Program Participation. The American Community Survey data were used to construct what we call "expected" workplace injury rates, defined as the average injury rates that people face based on the types of jobs held by workers with comparable demographic characteristics (specifically, race/ethnicity, age, education, and sex).

The large size of the American Community Survey allowed us to compute reasonably precise measures of expected workplace injury rates. However, the data did not track information on health outcomes in a way that allowed us to test whether injury risk was associated with lasting impacts on health. The Survey of Income and Program Participation, although a smaller survey, contains similar data on demographics with more detailed information on disability. Previous studies have used the survey to study the labor-market outcomes of disabled workers.[36–44] Importantly, for each respondent who reports a disability, the survey asks whether the disability was caused by an injury that occurred at work.

All calculations were done using Stata/MP, version 14.0, and computed using survey weights that reflected the relevant survey's complex design. For more complete information on the data and methods used in the study, see the online Appendix.[45]

MEASURING WORKPLACE INJURY RISK One of the strongest predictors of workplace injury risk is a worker's occupation: A construction worker clearly has higher injury risk than someone in a white-collar managerial position. To measure occupational risk, we matched American Community Survey respondents who had been employed for at least one week in the previous year to data from the Bureau of Labor Statistics on annual rates of workplace injuries that involved days away from work. The Bureau of Labor Statistics publishes aggregate injury statistics in the annual Survey of Occupational Injuries and Illnesses, which include data on injury rates by detailed occupation. We focused on lost-workday injuries because they are more likely to result in long-term disabilities. We merged the Bureau

of Labor Statistics injury data and the American Community Survey sample at the occupation level, using four-digit codes from the Standard Occupational Classification system. The survey and injury data were merged for the period 2006–13, the years for which we had data from both sources.

We used these data to estimate the number of lost-workday injuries per 1,000 workers at the race-age-education-sex level. Note that we refer to this as the expected workplace injury rate because it was calculated by taking the weighted average of the injury rates across all jobs—with the weights being the shares of people in each group in each job. If one race-age-education-sex combination had a relatively high share of individuals working in high-risk jobs such as construction, that group would have had a higher expected workplace injury rate (all else being equal). Note also that the Bureau of Labor Statistics reports injury rates based on full-time equivalent (FTE) workers, assuming that there are 2,000 hours per work year. To adjust for possible differences in hours worked per year across racial groups, we adjusted the injury rate for each worker according to the percentage of an FTE's hours that she or he worked (for more detail on how this adjustment was done, see the Appendix).[45]

To test differences across racial groups, we compared the expected workplace injury rates of non-Hispanic white workers to the rates of non-Hispanic blacks, Hispanics, Asians, and a general category of "other" race/ethnicity (which captured groups that were too small in our samples to be broken out separately). Because average economic opportunities and job types differ substantially between native- and foreign-born Hispanics, we considered these groups as separate categories (thus, we had six categories for race/ethnicity).

We calculated the expected workplace injury rates for each group, overall and by sex, to reflect known differences in the types of jobs held by women and men.[46] To allow for differences in workplace injury risk over the course of a worker's life, we computed expected workplace injury rates for workers in the following age categories: ages 18–29, 30–39, 40–49, and 50–64. Similarly, we grouped workers by education into the following categories: less than high school, high school with no college, some college, and four-year college degree or higher. This yielded average expected workplace injury rates for 192 race/ethnicity-age-education-sex combinations.

To control for average demographic differences across racial/ethnic groups, we computed regression-adjusted expected workplace injury rates by race/ethnicity, holding age, sex, and

education constant at their mean values within each group (for details on the regression specification, see the Appendix).[45] We interpreted this analysis as examining how differences in economic opportunities by race/ethnicity affected exposure to workplace injury risk.

MEASURING PREVALENCE OF WORK-RELATED DISABILITIES The Survey of Income and Program Participation collects information on respondents monthly for up to four years. Data are collected in four-month waves, and different waves include "topical modules" that ask supplemental questions on selected topics.

We used data from the four most recent panels—1996, 2001, 2004, and 2008—to collect information on age, sex, education, and race/ethnicity that was comparable to the American Community Survey data for the working-age population (ages 18–64). To be eligible for our analysis, we did not require individuals to be currently working, as the disabled are less likely to be employed. However, we did require them to have worked at some point in their lives (otherwise they would not have had the opportunity to experience a workplace injury).

Additionally, a topical module asked in the second wave of each panel includes questions that provide information on disability status. The sequence of questions asks whether the respondent has a health limitation that affects whether or how much he or she can work; if so, whether the condition was caused by an injury; and if it was, whether the injury occurred at work.[47] Note that the wording of this question is such that it may not identify disabilities as being work related if they were caused by work-related illnesses (as opposed to injuries). The Bureau of Labor Statistics injury data do include lost-workday cases resulting from work-related illnesses, but this is a small portion of all lost-workday cases (just 6.4 percent in 2014).[48]

We used these data to estimate the prevalence of disabilities that were caused by workplace injuries. We compared unadjusted disability prevalence across racial/ethnic groups. Because we expected workers' prevalence of disability to increase over time, we compared the prevalence for younger (ages 18–29) and older (ages 50–64) workers.

To assess whether racial/ethnic differences in prevalence of disabilities were related to other individual characteristics (particularly education, which is related to job type) we used logistic regression to test for racial/ethnic differences in the odds of having a disability caused by a workplace injury. We conducted separate regressions with and without other covariates, including controls for sex, education, age, survey year, and the expected workplace injury rate (where the expected rate was merged from the American Community Survey data at the race-age-education-sex level).

Finally, to identify how differences in expected workplace injury rates are associated with the prevalence of work-related disabilities, we used the logistic regression model to compare two sets of predicted probabilities (both holding all other covariates at their mean values). First, we computed the predicted probability of a work-related disability for each race/ethnicity, holding constant the expected workplace injury rate at the mean value for non-Hispanic white workers. Second, we computed the predicted probability with the expected workplace injury rate equal to the mean value for each race/ethnicity category. In both cases, we focused on workers ages 50–64 because work-related disability prevalence is relatively low in younger populations. The difference between these two sets of probabilities indicates how disparities in expected workplace injury rates based on job types are associated with disparities in the prevalence of work-related disability.

LIMITATIONS Our study had several limitations, including our measure of workplace injuries. Although the Bureau of Labor Statistics data are widely used, past studies have shown that the bureau undercounts injuries.[49–51] Additionally, our analytic approach implicitly assumed that within-job injury rates were the same across races/ethnicities. But if members of minority groups are more likely than whites to receive riskier job tasks even within the same listed occupation, as has been suggested by past studies,[31,52,53] our findings will understate racial/ethnic disparities in workplace injury risk.

Our work-related disability measure also had limitations. Self-reported disability measures are known to suffer from biases such as justification bias.[43,54] It is also possible that focusing on disabilities caused by a specific event such as a workplace injury could introduce other biases, such as recall bias. However, it is unknown whether these biases would differ across race/ethnicity lines in such a way as to confound our results.

Finally, our focus on workplace injuries may have caused us to understate the extent to which occupational factors contribute to poor health for members of minority groups. In general, injury risk has fallen considerably over the past several decades, as technology has led to both safety improvements and a shift away from dangerous jobs. Despite this, adverse working conditions can have consequences for health that appear later in life and are not always recognized as work related.[55] To the extent that these conditions are correlated with injury risk, this could exacerbate the disparities found here.

Study Results

We had data for 11,632,466 respondents to the American Community Survey and 198,308 respondents to the Survey of Income and Program Participation. Overall, the demographic characteristics of the two samples were similar (for a summary of these characteristics, see Appendix Table 1).[45] The American Community Survey sample had a slightly lower percentage of non-Hispanic whites (66.6 percent), compared to the Survey of Income and Program Participation (71.4 percent), and a lower share of Hispanics and Asians. These differences might have reflected the American Community Survey's more recent samples. The American Community Survey also had a higher share of males (52.5 percent versus 49.9 percent), possibly because we restricted the American Community Survey sample to current workers, whereas the Survey of Income and Program Participation included all people who had ever worked.

We found significant differences in expected workplace injury rates by race/ethnicity in the American Community Survey data. As we had anticipated, the expected workplace injury rate was higher for men than for women (Exhi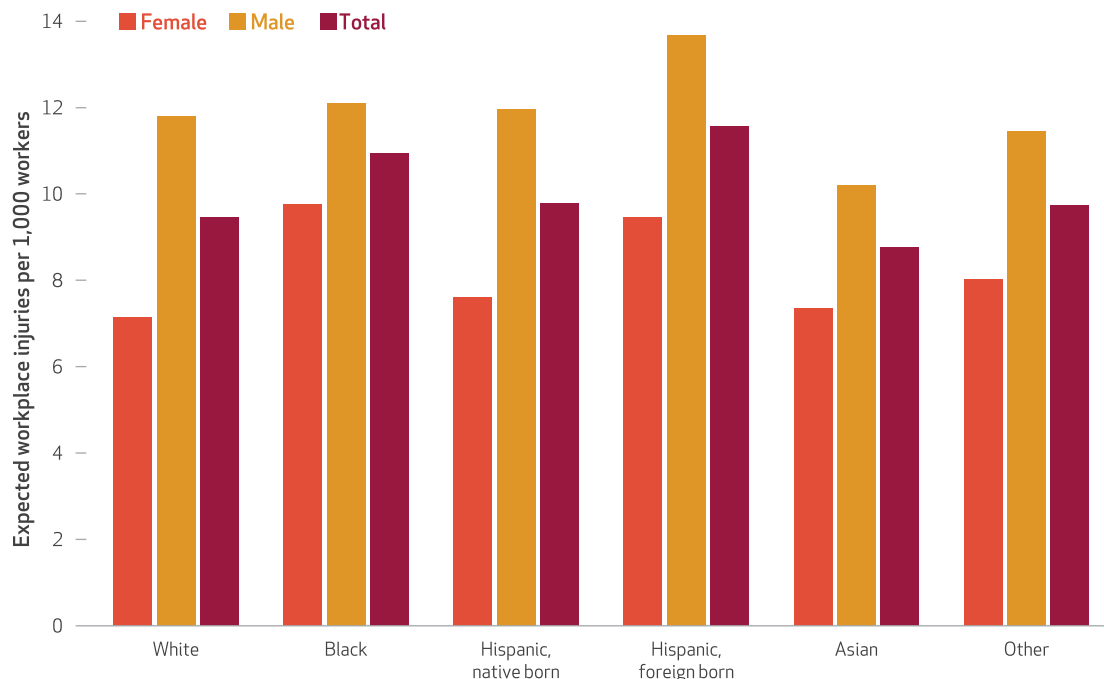bit 1), which reflects the fact that men tend to work in riskier jobs.[46] The pattern across races/ethnicities was similar for men and women, though the differences across groups were somewhat more pronounced for women. Male foreign-born Hispanics had expected workplace injury rates that were higher than those of white males (13.7 versus 11.8 per thousand). However, for the total population (both women and men), the expected workplace injury rates for whites were similar to those of native-born Hispanics, Asians, and other. These findings were consistent when we used regression adjustment to control for confounding racial differences in sex, age, or education (see Appendix Table 2).[45]

Using data from the Survey of Income and Program Participation, we compared the prevalence of work-related disability across different races/ethnicities. Black workers had the highest prevalence of work-related disability, at 2.0 percent (data not shown). In comparison, the prevalence was 1.7 percent for foreign-born Hispanics, native-born Hispanics, and Asians; 1.6 percent for whites; and 1.1 percent for other races and ethnicities.

While work-related disability prevalence was similar across race/ethnicity categories, this masked heterogeneity across those categories

EXHIBIT 1

Mean expected workplace injuries per year per 1,000 workers ages 18–64, overall and by race/ethnicity and sex

SOURCE Authors' analysis of data from the 2006–13 American Community Survey (ACS) linked to Bureau of Labor Statistics (BLS) injury and illness data. **NOTES** "Workplace injuries" are injuries in the workplace that cost the employee at least one lost workday. BLS injury data were merged to ACS respondents' data based on the occupation of each respondent's longest-held job in the previous year. Injury rates for people working less than full time (defined as 2,000 hours per year) were adjusted downward proportional to the number of hours they worked. Means were calculated using sampling weights that reflected the survey design of the ACS.

at different age groups. For workers ages 18–29, the work-related disability prevalence was low, presumably because workers had not been exposed to job-related risks for very long (Exhibit 2). However, even in this age group there were differences across racial and ethnic groups, with foreign-born Hispanics having a notably higher prevalence than whites (0.7 percent versus 0.3 percent). For workers ages 50–64, the rate of work-related disabilities for all of minority groups (except the "other" category) was higher than that for whites. For example, in this age range, the rate for blacks was 4.4 percent, compared to 2.5 percent for whites.

We used logistic regression to examine how expected workplace injury rates as well as other observable characteristics—including age, sex, and education—explained racial/ethnic differences in the prevalence of work-related disabilities. In the unadjusted model, which did not control for other covariates, whites had lower odds of a work-related disability than blacks, native-born or foreign-born Hispanics, or Asians for all ages and for ages 50–64 (Exhibit 3). For ages 18–29, the odds were not statistically different from 1 for any race/ethnicity category except foreign-born Hispanics. Adjusting for the other covariates eliminated the difference in prevalence between whites and blacks or Hispanics at older ages, though the difference persisted between whites and Asians. The expected work-
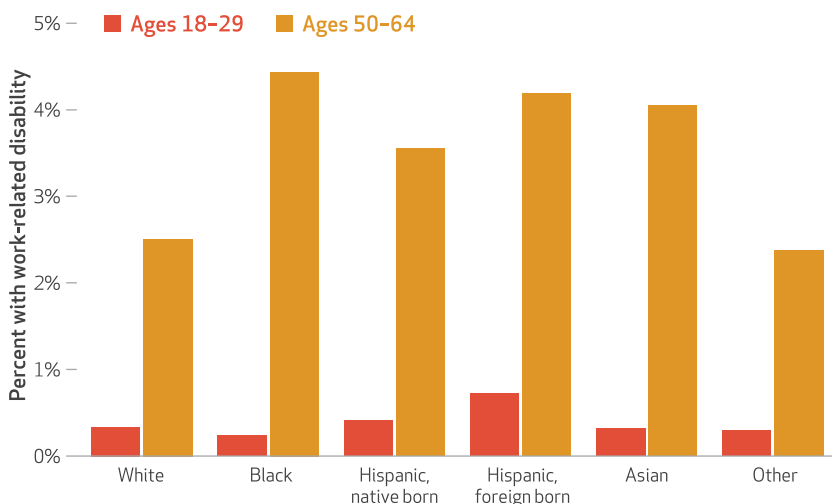
place injury rate was positively associated with the prevalence of work-related disability overall, in the sense that the odds ratio was greater than 1, but the effect was significantly largest in the older age group and not statistically different from 1 for ages 18–29.

We also used the logistic regression model to generate predicted probabilities of work-related disability for ages 50–64 in the hypothetical scenario in which all race/ethnicity categories had the same expected workplace injury rate, and we compared those probabilities to the probabilities in a scenario that used the observed expected workplace injury rates. Note that the expected workplace injury rate for whites was 8.8 per 1,000 workers, compared to 12.3 for blacks, 11.3 for native-born Hispanics, 13.5 for foreign-born Hispanics, 9.6 for Asians, and 9.5 for others (see the Appendix).[45]

When we held the expected workplace injury rate constant at the rate of non-Hispanic white workers, we found that the predicted probability of a work-related disability was within 0.4 percentage point for all race/ethnicity categories except Asians, who had a comparatively high rate (Exhibit 4). When we instead used the observed average expected workplace injury rate for each race/ethnicity category, disability prevalence rose for blacks (39 percent), native-born Hispanics (27 percent) and foreign-born Hispanics (57 percent). This suggests that differences in expected workplace injury rates due to job type are an important factor that leads to higher rates of work-related disability for blacks and Hispanics, but not for Asians.

Discussion

In this study, we compared the workplace injury risks of different racial/ethnic groups in the United States. We found that non-Hispanic white workers consistently had among the lowest risk of workplace injury, particularly at older ages. As a result, non-Hispanic black and Hispanic workers were more likely to experience a work-related disability, compared to white workers. Foreign-born Hispanic workers had the highest expected workplace injury rates but comparatively low disability rates. This might have been because of sample attrition due to injured and disabled workers' returning to their home country if they were unable to work, or it might have been due to some other factor such as ethnic differences in the perception of disability. Asians had comparatively low workplace injury risk but higher-than-expected prevalence of disability due to workplace injuries.

This study is similar to a recent study of occupational injury disparities at the national level,

Prevalence of work-related disabilities, by race/ethnicity and age

SOURCE Authors' analysis of data from the Survey of Income and Program Participation (SIPP). NOTES "Work-related disability" is disability that can be attributed to work-related injuries. Respondents to SIPP are flagged as having such a disability if they report a health condition that limits the type or amount of work they can do, report that the condition was caused by an injury, and report that the injury occurred at work. The data came from respondents ages 18–64 to the 1996, 2001, 2004, and 2008 SIPP panels. Values are calculated using sampling weights to reflect the survey design of SIPP.

EXHIBIT 3

Odds of disability among racial and ethnic minorities compared with non-Hispanic whites

	Total		Ages 18–29		Ages 50–64	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Black, non-Hispanic	1.268****	0.820***	0.716	0.560*	1.806****	1.062
Hispanic, native-born	1.068	1.015	1.229	1.106	1.434**	0.987
Hispanic, foreign-born	1.022	0.582***	2.169***	1.172	1.698****	0.814
Asian	1.286***	1.452****	0.947	1.159	1.643****	1.638****
Other	0.690***	0.774*	0.894	1.300	0.948	0.885
Expected workplace injury rate		1.171****		1.050		1.114****

SOURCE Authors' analysis of data from the Survey of Income and Program Participation (SIPP). **NOTES** The exhibit shows estimated odds ratios from a logistic regression model for reporting a work-related disability (that is, a disability attributed to a work-related injury), comparing racial and ethnic minorities to non-Hispanic whites. For example, the odds of having a work-related disability were 1.268 times higher for a non-Hispanic black than for a non-Hispanic white. "Adjusted" means that the regression model controlled for the expected workplace injury rate (that is, the average number of workplace injuries per 1,000 workers) and other covariates. Other covariates included sex, age, education and survey year. The Appendix presents odds ratios for other covariates (see Note 45 in text). The data came from respondents ages 18–64 to the 1996, 2001, 2004, and 2008 SIPP panels. Variance estimates were computed using heteroskedasticity-consistent "robust" variance estimates. *$p < 0.10$ **$p < 0.05$ ***$p < 0.01$ ****$p < 0.001$

which used occupational injury rates compared with occupational racial/ethnic composition to draw conclusions about disparities.[16] Like our study, that one found a much greater proportion of non-Hispanic black and Hispanic workers and a smaller proportion of Asian workers employed in high-risk occupations. Our findings expand on this study and other previous work by demonstrating that the elevated risk persisted despite adjustment for other demographic characteristics, including education. We also show how the higher risk of injury translates into long-term health effects from more work-related disabilities for blacks and foreign-born Hispanics, compared to whites.

A key implication of our findings is that systematic differences in economic opportunities are strongly associated with members of minority groups' being subjected to greater workplace injury risk. Unfortunately, these disparities reflect a long history of racial/ethnic minority groups' facing the worst job conditions. More than forty years ago, J. William Lloyd[31] found that among steel workers, coke oven workers had the highest lung cancer mortality. Moreover, such workers who were black had systematically

EXHIBIT 4

Racial/ethnic differences in the predicted probability of a work-related disability, based on expected workplace injury risk, for workers ages 50–64

	Predicted probability of a work-related disability		Difference	
	Fixed injury rate equal to that of white workers	Injury rate equal to observed mean for each race/ethnicity category	Percentage points	Percent
White, non-Hispanic	0.022	0.022	0.000	0
Black, non-Hispanic	0.024	0.033	0.009	39
Hispanic, native-born	0.022	0.028	0.006	27
Hispanic, foreign-born	0.018	0.029	0.010	57
Asian	0.036	0.038	0.003	8
Other	0.020	0.021	0.001	7

SOURCE Authors' analysis of data from the Survey of Income and Program Participation (SIPP). **NOTES** The exhibit shows the predicted probability from a logistic regression model of reporting a work-related disability (that is, a disability attributed to a workplace injury) according to two scenarios for the expected workplace injury rate (that is, the average number of workplace injuries per 1,000 workers). Predicted probabilities are equal to the predicted value based on logistic regression of disability caused by workplace injury as a function of race, age, education, sex, survey year and expected workplace injury rate, with all variables except race and expected injury rate held constant at their mean values for workers ages 50–64. Differences between the injury rates may not equal the percentage points of difference shown because of rounding. The data came from respondents to the 1996, 2001, 2004, and 2008 SIPP panels.

higher risk than whites. Lloyd determined that this group was relegated to working on the top-side of the coke ovens, which were worse jobs and resulted in more exposure to carcinogenic emissions. The US workplace has gotten safer for all workers, but our findings indicate that these kinds of disparities in workplace injury risk have not been eliminated.

Although our study clearly established the existence of disparities in workplace injury risk, it was not designed to identify the underlying mechanisms that cause these disparities. Assigning workers to job tasks on a discriminatory basis within jobs, such as relegating the black coke workers to the riskiest position within the same occupational category, is a potential explanation. Another possibility is discrimination in hiring or promotion, which keeps equally qualified minority workers from attaining better and safer jobs. To the extent that our results do reflect discrimination, it could be institutional, conscious, or implicit in nature. Nevertheless, we cannot rule out other explanations that may not be related to discrimination.

It is perhaps not surprising that people with limited labor-market opportunities have not only low wages but also poor working conditions, including greater risk of occupational injuries and illnesses. However, occupational safety and health professionals have historically focused on identifying policies and practices that induce employers to improve conditions for current workers, either voluntarily or because of pressure from government regulators, and not on hiring practices. Although improving work conditions could be of great value, it would not directly address discrimination-based disparities in workplace injury risk. Based on our findings, policy makers and regulators may need to review whether employers are systematically assigning people of different races and ethnicities different jobs or job tasks according to the risk.

Our results also imply that future efforts to eliminate workplace injuries should consider the population of workers most affected. If workplace safety and health interventions increase labor costs, economic theory suggests that this could lead to lower wages, reduced employment opportunities, or both. Our results suggest that such outcomes would disproportionately affect minority workers. Care needs to be taken to ensure that efforts to make workplaces safer do not at the same time reduce economic opportunities for vulnerable populations. Finally, it is important to recognize that minority workers are a growing part of the labor force, and that the issues raised here will only become more salient and politically charged as the US population continues to become more diverse.

Conclusion

We found systematic disparities across racial/ethnic groups in the risk of workplace injuries. These findings suggest that disparities in economic opportunities in the United States result in members of minority groups' working in more hazardous jobs and, as a result, often experiencing worse health, compared to whites. ∎

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45 To access the Appendix, click on the Appendix link in the box to the right of the article online.

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