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Work as a Social Determinant of Health: A Necessary Foundation for Occupational Health and Safety

To the Editor:

Social determinants of health "are the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life."[1] Though historically not considered as such in occupational health and safety research or practice,[2] work is a social determinant of health.[3–5] Where a person has the opportunity to work is highly influenced by how their individual level characteristics (e.g., race, ethnicity, gender, income, education level, etc.) intersect with structural level factors (e.g., racism, classism, access to opportunity, etc.). For example, structural and institutionalized racism—manifest in schools, neighborhoods, and workplaces—has created deep and pervasive inequities in access to economic mobility, in large part due to where one can work. The workplace also drives health inequities through characteristics like job demands, benefits, compensation, access to healthcare, power/prestige, social networks, exposure to hazards, and more.[3] Occupational risks and benefits interact and accumulate over time, resulting in deep and pervasive health inequities.[6] Work is therefore a driver, marker, and outcome of inequity.

If occupational health and safety researchers and practitioners do not consider the larger social context and fail to recognize work as a social determinant of health, we effectively uphold systems and structures of inequity.[7] The purpose of this paper is therefore to amplify and add to previous calls to consider work as a social determinant of health (e.g.,[3–5,8]), and to encourage researchers and practitioners to employ equity-focused strategies. This paper adds to previous research by presenting a case study of how characteristics of work intersected with environmental factors to impact worker health, and situating this example within the larger context of work as a social determinant of health. This case study represents a snapshot of a particular time and place in society. Participants in this case study experienced this time and place in one way, while other workers experienced it differently, which highlights several ways in which work functions as a social determinant of health.

THE ACTIVE WORKPLACE CASE STUDY

In July 2018, we began enrolling call centers in the Active Workplace Study, a randomized trial to measure the impact of a workplace sedentary behavior intervention. The study design included four customer service call centers (two intervention and two control), and measures included an online survey, a physical health assessment, physiological markers of health, and physical activity accelerometry.[9,10] Three of the four worksites completed the full study protocol as planned.

Due to the global COVID-19 pandemic a shift in the study protocol was required for the fourth worksite, providing an opportunity to examine the role of work as a social determinant of health. In December 2019, we completed baseline enrollment and data collection with the fourth worksite ($n = 43$), and the worksite, which had been randomly assigned to the control condition, began the study protocol. In March 2020, COVID-19 mandates[11] halted the study, and it became clear that our post-study measurement, scheduled for June 2020, would not be possible. Participants at the fourth worksite could no longer access the same workplace resources and certain components of the study, confounding their post-study data compared to the previous three worksites. We are therefore excluding the fourth worksite from evaluations of intervention effectiveness.

We instead remotely collected follow-up data with the fourth worksite to explore how working at home during a pandemic impacted sedentary behavior and other health and safety outcomes compared to working in the office (at baseline enrollment). In September 2020, we sent participants a link to complete a follow-up survey, then mailed an accelerometer and a $30 incentive to each participant's home address. Participants wore the accelerometer during work hours for one workweek. However, the week in which participants wore accelerometers happened to coincide with the start of wildfires near the Portland, OR metro area.[12] The region was covered in thick wildfire smoke, air quality was categorized as hazardous, and local health agencies recommended staying indoors.

Of the 43 participants from the fourth worksite who enrolled at baseline, 31 completed the follow-up survey, and 28 wore and returned the accelerometer (8 participants had left the company, and 4 asked to not participate in follow-up data collection). We were not able to collect physical health assessment or physiological measures during follow-up data collection. Participant characteristics from baseline data collection are presented in Table 1. Using dependent samples *t* tests, we examined changes in accelerometry and survey measures between baseline (at work in December 2019) and follow-up (working at home during a pandemic and wildfires in September 2020).

The sample was majority female (93.5%), white (87.1%), Non-Hispanic (87.1%), and married/cohabitating (64.5%). On average, participants were 41.77 years old (SD = 11.9), obese with a body mass index of 36.27 kg/m^2 (SD = 11.6), had high blood pressure with a systolic blood pressure of 124.03 (SD = 16.3), and an average hemoglobin A1c of 5.58% (SD = 0.40). Nearly half of the sample (41.9%) had children under 18 living at home, 19.4% were providing care for an adult family member, 32.3% of the sample were college graduates, and 6.5% smoked cigarettes.

Dependent samples *t* test results for physical activity variables (Table 2) show significant decreases with moderate-to-large effect sizes for several variables when study participants were working from home during COVID-19 and wildfires compared to working at the office. There were

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Ethical Considerations and Disclosures: The Active Workplace Study was approved by the Oregon Health & Science University Institutional Review Board. Written, informed consent to participate was obtained from all participants.

The authors report no conflicts of interest.

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TABLE 1. Descriptive Statistics from Baseline Data Collection ($N = 31$)

Variable	Mean (SD)
Age	41.77 (11.9)
Weight (lbs)	214.48 (70.9)
Body mass index (kg/m^2)	36.27 (11.6)
Hemoglobin A1c (%)	5.58 (0.40)
Systolic blood pressure (mm Hg)	124.03 (16.3)
	Percent
Sex (female)	93.5
Race (White)	87.1
Hispanic	12.9
Highest grade of school completed:	
Grade 12 or GED (high school graduate)	29.0
College 1–3 years (some college or technical school)	38.7
College 4 years or more (college graduate)	32.3
Married/cohabitating	64.5
1 or more children under 18 at home	41.9
Providing elder care	19.4
Smoke cigarettes	6.5

significant decreases in the number of physical activity bouts per week ($P = .02$, Cohen's $d = 0.49$), total time in physical activity bouts ($P < .03$, Cohen's $d = 0.43$), percent time in moderate physical activity ($P < .01$, Cohen's $d = 0.53$), percent time in vigorous physical activity ($P = .02$, Cohen's $d = 0.45$), total time in moderate or vigorous activity ($P < .01$, Cohen's $d = 0.76$), percent time in moderate or vigorous activity ($P < .01$, Cohen's $d = 0.58$), percent time stepping ($P < .01$, Cohen's $d = 0.68$), and average daily step count ($P < .01$, Cohen's $d = 0.904$). There were no significant changes for accelerometry variables related to sedentary bouts, sedentary time, light physical activity, percent time standing, and percent time sitting/lying, which may be related to ceiling effects.

Dependent samples t test results for survey variables show a significant increase in turnover intentions ($P = .02$, Cohen's $d = 0.43$) when study participants were working from home during COVID-19 and wildfires compared to when they were working at the office. There were no significant changes in other survey variables, including measures of supervisor support, physical health, mental health, perceived stress, work-family conflict, musculoskeletal pain, sleep, or self-reported physical activity.[13–25]

CONTEXTUALIZING THIS CASE STUDY AND WORK AS A SOCIAL DETERMINANT OF HEALTH

The physical activity decreases observed in this case study could lead to negative health outcomes. A recent study by Saint-Maurice et al[26] found higher daily step counts were associated with lower all-cause mortality. Compared to taking 4000 steps per day, taking 8000 and 12,000 steps per day were associated with a 51% and 65% lower risk of all-cause mortality, respectively. Based on these results, a sustained decrease in average daily step count in this sample would move participants into a higher all-cause mortality risk category. Additionally, based on U.S. Department of Health and Human Services aerobic exercise recommendations,[27] participants completed about half of the recommended minutes at baseline and about one-sixth of recommended minutes at follow-up.

This case study highlights work as a social determinant of health by providing an example of how a person's occupation, and specific job characteristics within their occupation, influenced how, and how much, they experienced the intersection of environmental, social, and other structural factors. The organization that participated in this case study reacted to COVID-19 through policy changes. Employees transitioned to working from home, which decreased risk of exposure to COVID-19. The ability to work from home and remain indoors also diminishes the risk of exposure to wildfire smoke. Job characteristics intersected with larger forces and systems, influenced exposure risk factors, and impacted health in the form of decreased physical activity. Workers in different occupations had different experiences. Millions of workers lost their jobs during the pandemic,[28] while others were not able to work from home and faced increased COVID-19 exposure risks.[29] In addition, many workers were not able to work inside during hazardous air conditions caused by wildfires.[30] These different experiences illustrate how work is a driver of health inequities. Identities and positionalities, including race, ethnicity, gender,

TABLE 2. Dependent Samples t Tests and Effect Sizes for Actigraphy Variables

Variable	*n*	Mean Pre (SD)	Mean Post (SD)	*P*	Cohen's *d*
Number of physical activity bouts per week	28	1.46 (2.27)	0.29 (0.76)	.02*	0.49
Total time in physical activity bouts (min)	28	24.79 (43.62)	4.57 (13.93)	.03*	0.43
Average duration of sedentary bouts (min)	28	30.93 (5.90)	30.84 (7.83)	.95	0.01
% time in sedentary activity	28	75.36 (7.32)	77.03 (8.23)	.29	−0.20
% time in light physical activity	28	21.41 (6.62)	21.32 (7.67)	.95	0.01
% time in moderate physical activity	28	2.85 (2.14)	1.59 (1.38)	<.01*	0.53
% time in vigorous physical activity	28	0.37 (0.72)	0.04 (0.14)	.02*	0.45
Total time in moderate or vigorous activity (min)	28	77.93 (70.53)	24.00 (26.45)	<.01*	0.76
% time in moderate or vigorous activity	28	3.22 (2.55)	1.65 (1.46)	<.01*	0.58
% time stepping	28	4.01 (2.87)	2.44 (1.83)	<.01*	0.68
% time standing	28	14.31 (12.09)	11.61 (10.23)	.36	0.177
% time sitting or lying	28	81.46 (13.68)	85.73 (10.30)	.18	−0.262
Average daily step count	28	10,292.54 (7120.50)	4,562.54 (3307.41)	<.01*	0.904

*Significant difference ($P \leq .05$). A physical activity bout is defined as 10+ consecutive minutes of moderate to vigorous activity. A sedentary bout is defined as 20+ minutes of consecutive sitting.

education, and economic status, and how these identities and positionalities intersect with structural factors, drive what work opportunities one has, and lead to inequitable exposures and ultimately inequitable outcomes.

In the United States, American Indian/Alaska Native, Black/African American, and Hispanic/Latino people are more likely to have had, been hospitalized, and die from COVID-19 compared to white people.[31] One hypothesis to explain these disparities is structural racism leading to inequities in exposure, including exposure through work. Selden and Berdahl[29] "observed large racial/ethnic differences in job characteristics, with Blacks being substantially more likely than whites to work in health, public safety, and public utility jobs. Hispanics were much more likely than whites to work in food-related jobs, and as in the prior literature, both Blacks and Hispanics were less likely than whites to be able to work from home. Especially when we factor in the much larger Black and Hispanic household sizes, a picture emerges in which employment may be an important pathway for infection of minority workers and their household members." In the case study, we presented, the majority white sample experienced substantial decreases in physical activity, but also had lower work-related COVID-19 and wildfire smoke exposure risks.

Wildfire smoke exposure further illustrates how the workplace impacts health equity because structural and social factors strongly influence job characteristics, which impact smoke exposure and exacerbate health inequities. In the United States, Black/African American, and Hispanic/Latino people are more likely to have jobs that require them to work outside, are less likely to have health insurance, and less likely to have paid time off at work compared to whites, increasing exposure risks and risks for adverse health outcomes.[32–35] Exposure to wildfire smoke has substantial health consequences.[36] Climate change is increasing the frequency and severity of wildfire events in many areas, which is increasing outdoor worker's exposure to hazardous air quality.[37] Oregon does not have a hazardous air quality protocol in place for employers of outdoor workers and outdoor workers. In September 2020, in response to worker advocate groups, Oregon OSHA issued a nonenforceable statement strongly recommending employers protect workers by avoiding outdoor work or providing N95 masks for necessary outdoor work when the air quality index is 151 or greater.[38]

Agriculture workers were especially vulnerable to the hazardous air conditions from the wildfires in September 2020.[30] This vulnerability is the result of several job characteristics: agriculture workers do not receive benefits such as paid time off and health insurance[39,40]; they are excluded from overtime pay and some are excluded from minimum wage laws[41,42]; immigration status excludes some agriculture workers from government assistance such as Medicaid and unemployment benefits[43] and creates circumstances where workers are less likely to report safety concerns.[44] Migrant and immigrant agriculture workers are also underserved by occupational health and safety institutions, and are less likely to receive health and safety information or training.[45] In the wildfire event in September 2020, agriculture workers were stuck with choosing between working in hazardous conditions or staying home without pay and risk losing their job. If an employer gave workers the option to stay home, agriculture workers had financial pressure to prioritize their job and income over their health.[30,46] These work characteristics result in increased exposure to hazardous air quality and drive health inequities for agricultural workers.

A NECESSARY FOUNDATION FOR OCCUPATIONAL HEALTH AND SAFETY

The experience of work among U.S. adults is strongly patterned by how identities and individual-level factors including race, ethnicity, immigration status, gender, socioeconomic position, sexual orientation, and more, intersect with structural and social factors. These patterns occur not because identities and positionalities relate to skills or capacities, but because society structures access to opportunity based on them. Social determinants of health—including racism, classism and other drivers—uphold the hierarchical systems that shape what work looks like and how people experience it. These drivers create and support opportunities that privilege some and marginalize others, creating vast differences in risk, opportunity, wealth, poverty, and health. The ways in which these structural factors intersect with work further illustrate how work is a driver, marker, and outcome of inequity. Ignoring this context upholds and reifies systems that produce inequity.

In order to improve health equity, occupational safety and health researchers and practitioners must recognize and consider work as a social determinant of health. Work provides "a venue for population-level—rather than individual-focused—intervention, because interventions in the workplace provide opportunities to change both the physical and social environments to support health.[3]" One way to address work as a social determinant of health in occupational safety and health research and practice is by applying the Racism as a Root Cause Approach,[47] a framework for developing strategies, policies, and mechanisms that address racism to improve racial health inequities. While this approach specifically addresses racism, the concepts can be applied to other structural factors that impact health inequities as well. Ahonen et al,[3] also suggest several strategies, including using intersectional approaches that examine how different identities and personal characteristics form work experiences, using a life course perspective that examines work and health over time, and studying the impact of policies and system-level trends on work and health inequities. We encourage occupational safety and health researchers and practitioners to incorporate these and other equity-focused and anti-racist approaches into the organization of work, the physical and social environment, and workplace health and safety initiatives and interventions. Work is a place in which structures and policies can be modified in ways that reduce health inequities. The ways in which work impacts these inequities should be a foundational consideration in all occupational health and safety research and practice.

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