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Journal of Workplace Behavioral Health

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/wjwb20

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To cite this article: Lily M. Monsey, Kerry L. Beckman & Marissa G. Baker (2023) How does gender and work location impact perceived worker stress during COVID-19? Findings from King County, WA, Journal of Workplace Behavioral Health, 38:1, 75-101, DOI: 10.1080/15555240.2023.2166057

To link to this article: https://doi.org/10.1080/15555240.2023.2166057

JOURNAL OF WORKPLACE BEHAVIORAL HEALTH
2023, VOL. 38, NO. 1, 75–101
https://doi.org/10.1080/15555240.2023.2166057

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RESEARCH ARTICLE

How does gender and work location impact perceived worker stress during COVID-19? Findings from King County, WA

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ABSTRACT

Using an online survey, we explored workplace determinants of perceived stress during COVID-19 in $n = 2910$ county government workers, and differences in perceived stress by gender and work arrangement (work from home v. do not work from home). We explored relationships with descriptive statistics and linear regression. Access to health and safety resources, increased workplace safety climate, support for work-life balance, and increased access to sick leave were related to lower stress; dependent care stress and female gender were related to higher stress. Among those working from home, higher stress related to an increase in workload and erosion of work/life boundaries. Findings show how the workplace impacts stress, differential determinants by gender/work arrangement, and areas to intervene to improve employee health and well-being.

ARTICLE HISTORY
Received 11 August 2022
Accepted 4 January 2023

KEYWORDS
COVID-19; worker stress; work from home; workplace determinants; female workers

Background

The COVID-19 pandemic has profoundly impacted worker health, with literature characterizing not only the increased risk of infection for workers, but also impacts to worker mental health, behavioral health, and stress (Baker, 2020; Baker, Peckham, & Seixas, 2020; Faghri, Dobson, Landsbergis, & Schnall, 2021). The body of occupational health literature looking at mental health and psychological stress of workers during COVID-19 has predominantly focused on in-person "essential workers" (Beckman et al., 2021; Greenberg et al., 2021; Mayer, Arora, Helm, & Barnett, 2022; Quinn, Stover, Otten, & Seixas, 2022; Srikanth, Monsey, Meischke, & Baker, 2022; Yassin et al., 2022). There is limited occupational health research investigating the psychological stress or mental health of those working from home,

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/15555240.2023.2166057.

who may have increased protection from infection, but encounter psychosocial stressors from scenarios such as working with a child, or lacking proper equipment, space, or training to adequately work at home (Galanti, Guidetti, Mazzei, Zappalà, & Toscano, 2021; Hayes, Priestley, Moore, & Ray, 2021; Sandoval-Reyes, Idrovo-Carlier, & Duque-Oliva, 2021).

Mayer et al. (2022) assessed perceived stress in 3,344 supermarket workers in the state of Arizona using the four question Perceived Stress Scale (PSS-4) and found a higher PSS-4 score for those reporting working in an unsafe workplace and experiencing more negative customer encounters. In a study of emergency medical technicians (EMTs) in Washington state, Srikanth et al. (2022) found an increased PSS-4 score was related to increased job demands and lack of appropriate pay and benefits. In a study of nearly 2000 in-person essential workers in the United States, Garfin et al. (2022) found having a prior mental or physical health condition, lack of access to health care, lost wages, and lacking childcare all to be associated with increased acute stress, as measured using the 10-item modified version of the Acute Stress Disorder Scale 5. Demographic factors (younger age, female gender, Hispanic ethnicity) were also related to increased acute stress.

Women have consistently been shown to have higher levels of psychological stress than males, whether stress is measured using biomarkers, validated scales, or qualitative methods (American Psychological Association, 2012; Lundberg & Frankenhaeuser, 1999; Remes, Brayne, van der Linde, & Lafortune, 2016; Warttig, Forshaw, South, & White, 2013). One hypothesis for this disparity is the greater unpaid workload and increased emotional labor women bear compared to their male counterparts, both at home and work (Boucher, 2016; Erickson & Ritter, 2001; Lundberg & Frankenhaeuser, 1999). During the COVID-19 pandemic, this increased unpaid workload was amplified for many women (particularly in heterosexual relationships) leading to women leaving the workforce temporarily or permanently (Ajibade, Aiyenitaju, & David, 2021; Power, 2020). However, there is limited occupational health research broadly characterizing how working during the COVID-19 pandemic impacted the psychological stress of women, with literature tending to focus on women in a single occupation (Brubaker, 2020; Sriharan, Ratnapalan, Tricco, & Lupea, 2021; Yildirim & Eslen-Ziya, 2021). There is also a research need to investigate how working during the pandemic may have differentially impacted men and women with the same employer, who receive similar employer-provided supports and benefits.

Stress is closely linked with work. Occupational or work-related stress is the negative physical and emotional response of workers when presented with perceived work demands or conditions that exceed their individual

coping resources and abilities (International Labour Organisation, 2016). Work-related stress is caused by psychosocial hazards encountered in the workplace, which arise from organizational factors (i.e., lack of infrastructure/equipment, unclear policies, mandatory overtime), job factors (i.e., work overload, poor interpersonal relationships, poor work-life balance, lack of benefits), poor safety climate (the perceived value that a workplace places on safety and their commitment to occupational health), and negative management practices (WorkSafe Victoria, 2022).

Previous research has found that jobs with high demands and low worker control is related to increased allostatic load (Karasek, 1990). Worker perceived stress has been associated with workplace safety climate (Lan, Huang, Kao, & Wang, 2020), harassment (Curtis, Meischke, Stover, Simcox, & Seixas, 2018), long working hours (Lee, Suh, Kim, & Park, 2017; Tomioka, Morita, Saeki, Okamoto, & Kurumatani, 2011), job insecurity (Heaney, Israel, & House, 1994), coworker and supervisor support (Babin & Boles, 1996; Steinhardt, Dolbier, Gottlieb, & McCalister, 2003), and an imbalance between worker efforts and rewards for those efforts (Siegrist, Wege, Pühlhofer, & Wahrendorf, 2009), in addition to employee intent to leave (Srikanth et al., 2022), attrition, and burnout (Kim, Roh, Won, Lee, & Chang, 2010). Stress is also related to physical health outcomes including cardiovascular disease, increased injury risk, musculoskeletal disorders, impaired immune function, and gastrointestinal outcomes (Landsbergis & Dobson, 2017).

Psychological stress is also closely linked with depression. In a literature review, Hammen (2005) summarized that stressors tend to precede symptoms and diagnoses of depression, though experiencing a stressful event is typically not sufficient to result in depression. In the same review, Hammen (2005) summarized that symptoms or a diagnosis of depression are related to an increased occurrence of stressful life events, indicating a bidirectional relationship between stress and depression. Given the myriad health outcomes associated with occupational stress, there is value in considering stress as a primary outcome, as intervening on workplace determinants of stress can positively impact both physical and mental health outcomes, as well as employee recruitment and retention.

Here, we sought to explore the determinants of stress for the government employees of King County, Washington state (USA) in the early months of the COVID-19 pandemic. King County is the largest county in Washington State and employed approximately 14,750 full-time, permanent government workers in 2020 (this does not include temporary or intern workers). County workers span nearly all occupational sectors, from financial and administrative, to engineering, computing, transportation, and construction. The diverse yet essential nature of the County workforce means that while

many workers could work remotely during the pandemic, others continued working from a traditional office or in a field-based setting (i.e., worked outside of the home, but not in a traditional office-based setting, such as guards in a prison, a bus or train operator, or park maintenance).

All full-time permanent King County employees have similar access to health-supportive benefits including paid sick and vacation leave, employer-paid medical benefits, retirement benefits, and standardized pay increases, and are generally afforded increased job security relative to workers in the same private-sector occupations. However, while county-wide policies would apply to all workers, there could be unit-level or individual differences in how employees' needs are met, how safe they feel at work, and whether they felt they had easy access to sick leave during the pandemic. Therefore, this population is ideal to explore differential pandemic impacts to workers based on their work arrangement (work from home v. worked outside of the home) and gender.

Here, our primary aim is to explore which workplace factors (including access to sick leave benefits, workplace safety climate, work-life balance support, and access to health and safety resources) are related to perceived stress for King County workers in the early months of the COVID-19 pandemic, and how relationships differ by work arrangement (worked from home v. worked outside of the home) and gender (male v. female). As a secondary aim, we explore whether there may be an interaction between work arrangement and gender, and how this interaction may impact worker perceived stress; an investigation which has not been previously explored in the literature. Lastly, we look specifically at those who always or sometimes worked from home and investigate how lack of resources or increased challenges of working from home impacted stress, and differential impacts by gender and work arrangement (always work from home v. sometimes work from home).

The findings from this study will further elucidate how work impacts perceived stress and identify potential areas of intervention for workplaces looking to manage employee stress. Additionally, this study will allow us to better understand COVID-19 stressors that may have differentially impacted workers of a particular gender or work arrangement, and provide a novel exploration of how the interaction between gender and work arrangement may have impacted worker perceived stress during the COVID-19 pandemic.

Methods

Researchers collaborated with the King County Auditor's Office to both develop the cross-sectional survey and disseminate it to county workers.

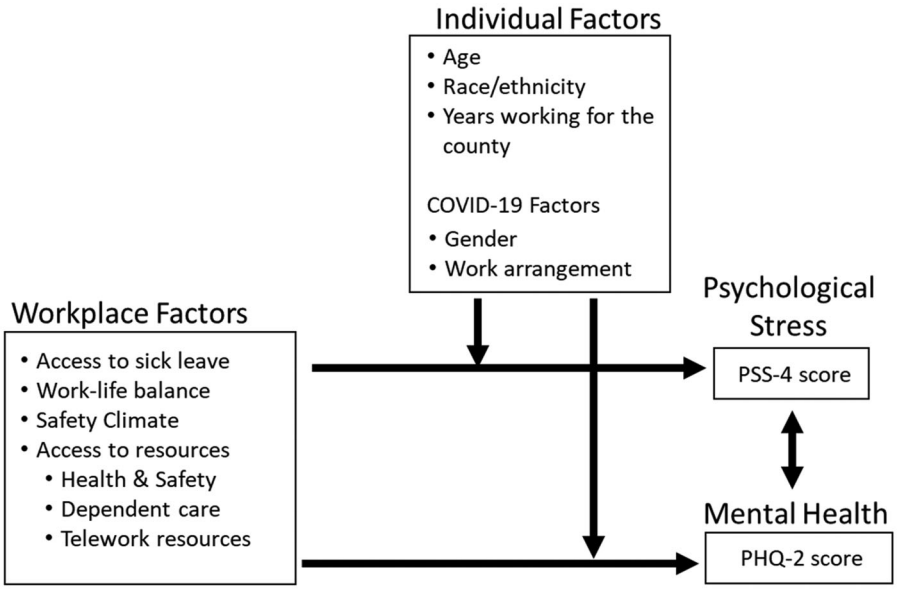

Figure 1. Conceptual model relating workplace and individual factors to psychological stress (considered the primary outcome in this analysis) and mental health which guided the development of this worker survey and analysis.

The survey development was guided by a conceptual model, presented in Figure 1. This conceptual model was influenced by previous conceptual models that have been developed investigating the relationship between workplace factors and stress (Nakata et al., 2006; Srikanth et al., 2022), and outlines how workplace factors can impact the outcome of psychological stress, with this relationship potentially modified by individual sociodemographic factors, and individual factors that are hypothesized to be exacerbated by COVID-19 (i.e., gender and work arrangement). While not included as the primary outcome in this analysis, the conceptual model also recognizes the bidirectional relationship between stress and depression. Workplace factors that were chosen to be included in the conceptual model and resultant survey were determined through conversations with King County collaborators, and through selecting scales or topics that were most applicable to the COVID-19 pandemic (i.e., access to sick leave was especially important during COVID-19).

In addition to questions on workplace health and safety perceptions, access to benefits and resources, and stressors as outlined on the conceptual model and detailed below, the survey also included questions specific to King County and their programmatic goals, which are not discussed or summarized here. The University of Washington Human Subject Divisions reviewed this project and deemed it to be minimal risk with approval number STUDY00011010; participants checked a box indicating they consented to taking the survey prior to being directed to the first question.

Survey development

Working with the King County Auditor's Office, and guided by a conceptual model, the research team developed a survey that adapted questions from previously validated scales and included new questions developed specifically for this population and the COVID-19 pandemic. The survey was pilot tested with ten King County employees and was revised based on their feedback. The full survey took about 15 minutes for respondents to complete, was administered online via REDCap, and open for responses between August 11, 2020, and September 7, 2020. Representatives of the King County Auditor's Office promoted the survey via email, direct mail postcard to employees, and other internal methods.

The survey assessed the primary outcome of perceived stress, utilizing the four question validated Perceived Stress Scale (PSS-4) (Cohen, Kamarck, & Mermelstein, 1983). Depression was also assessed with the two question validated Patient Health Questionnaire (PHQ-2) (Löwe et al., 2010). For both measures, a higher score indicates increased stress (PSS-4), or increased likelihood of major depressive disorder (PHQ-2).

All respondents were asked a series of questions where they indicated how much they agreed with a series of statements. Statements in this section were combined into a few composite scales, by averaging the score of a group of questions together, all of which utilized the agreement scale of 1 = strongly disagree, 2 = disagree, 3 = neither disagree or agree, 4 = agree, 5 = strongly agree. The Perceived Workplace Safety Climate scale consisted of the five questions: "King County has created a work environment where I feel safe, whether at home, in an office, or in the field," "In my workgroup, safety is valued over productivity," "My department leadership is promoting a culture of health and safety," "My safety needs have been adequately supported by my manager during the COVID-19 pandemic," and "King County is doing everything it can to meet my health and safety needs as an employee." These questions were inspired from the validated Nordic Occupational Safety Climate Questionnaire (Kines et al., 2011) but made to be specific to this worker population during COVID-19. Combining these questions resulted in a Cronbach α of 0.92, indicating strong reliability. A higher score indicated increased perceived workplace safety climate.

Two questions were combined to produce a Dependent Care Stressors Scale, scored on the same five-point agreement scale: "I feel stress and/or anxiety due to the anticipation of schools moving to remote learning," and "Dependent care responsibilities interfere with my ability to complete my work tasks." These questions were developed specifically for this worker survey in response to local school closures due to the COVID-19 pandemic.

Combining these two questions resulted in a Cronbach α of 0.73, for moderate reliability. A higher score indicated more dependent care stressors.

Four questions scored on the five point agreement scale were combined to produce a composite score for Access to Workplace Health and Safety Resources: "I have the tools and resources needed to do my job well," "I have the workplace resources I need to manage my physical health," "I have the workplace resources I need to manage my mental health, including stress," and "I feel that I receive timely information regarding COVID-19 from my workplace." These questions were developed specifically for this worker survey. When combining these four questions, a Cronbach α of 0.83 was attained, indicating appropriate reliability. A higher score indicated increased access to workplace health and safety resources.

All workers were also asked how much they agree with the statement, "My work-life balance needs have been adequately supported by my manager during the COVID-19 pandemic." This question was considered separately in subsequent analyses since its inclusion in a composite scale resulted in a decreased Cronbach α value. A higher score indicates more managerial support of work life balance.

To assess respondent ability to take sick leave during COVID-19, all respondents were also asked their level of agreement using the same five point agreement scale with a series of four questions: "If I were to test positive for COVID-19 I would be encouraged by my manager/supervisor to take as much sick leave as I need," "If I were to test positive for COVID-19 I wouldn't face negative repercussions for taking as much sick leave as I would need," "If I were to test positive for COVID-19 I am confident that I could take enough paid sick leave that it would not affect me economically," and "I know what actions I should take at work if I were to test positive for COVID-19." These questions were inspired by conversations with a variety of workers during the COVID-19 pandemic to learn barriers they faced in accessing sick leave. These four questions were combined into a Sick Leave Access scale, with the four measures having a Cronbach α of 0.72. A higher score indicated the respondent had more perceived access to sick leave during COVID-19.

Respondents who were either solely or partially working from home at the time of the survey were asked a series of questions about how often (1 = never, 2 = almost never, 3 = sometimes, 4 = fairly often, 5 = very often) they experience the following challenges: lack of reliable internet access, internet too slow to complete necessary work tasks, lack of appropriate space to take video calls, lack of ergonomic equipment (e.g., desk, chair, keyboard, mouse, screens), lack of equipment needed to complete all work tasks (e.g., printer, scanner, computer), consistent increase in workload, consistent increase in length of workday, erosion of boundaries between

work life and personal/home life. These questions were informed by conversations with King County employees who had been working from home during the COVID-19 pandemic.

Recognizing that workplace health and safety perceptions, access to benefits and resources, and stressors could differ between workers who worked from home and did not work from home, the survey characterized the primary and secondary work location of survey respondents at the time of the survey. Work arrangement was then coded into whether the worker only worked from home, worked some at home and some outside of home (partially worked from home), or only worked only outside of home, whether it was in an office setting or non-office-based setting. Additionally, an interaction term was created between gender (male, female) and work arrangement to explore whether PSS-4 score differed between groups defined by gender and work arrangement.

All respondents were asked a series of demographic questions where they could select which category or categories best describe their gender, race and ethnicity, age, and length of employment with King County. All questions on the survey, except for questions necessary to assess survey inclusion criteria, were optional. A total of $n = 3{,}046$ respondents completed the survey; employees who indicated they were on leave at the time of the survey were not retained for analysis. As such, $n = 2910$ survey responses were considered here, representing a 19.7% response rate from full-time, permanent King County employees.

Survey data analysis

After the survey closed, raw data were downloaded from REDCap. Questions were reverse coded if necessary for interpretation and combined into composite scores as detailed above. Recognizing there could be differences in health and safety outcomes between groups defined by work arrangement and groups defined by gender, descriptive statistics were compiled for each measure, stratified by work arrangement (only work from home, partial work from home, no work from home) and gender (male, female). Respondents who specified they were a gender other than male or female were not included in gender-stratified descriptive statistics due to small sample size. Respondents who did not specify a gender (either selected "prefer not to answer" or left the question blank) were dropped from gender-stratified descriptive statistics. However, all genders were included in the primary regression analyses. Questions specific to respondents who worked from home were considered separately, and stratified by gender (male v. female), and work arrangement (only work from home v. partially work from home).

Tests of significance were used to investigate differences between stratified groups (groups defined by work arrangement, and male v. female) for all descriptive measures. For differences in continuous measures between two groups, t-tests were used. For differences in continuous measures between three groups, one-way analysis of variance (ANOVA) was used. To assess differences in categorical variables (i.e., race/ethnicity) between two or three groups, Pearson's chi-square test was used, and to assess differences in ordinal variables (i.e., age, length of employment) between two groups, Mann Whitney U-Test was used. Kruskal-Wallis H Test was used to compare ordinal variables between three groups. A p-value of ≤ 0.05 was considered significant for all analyses.

A primary linear regression model was fit to explore the workplace determinants of stress in all respondents as informed by our conceptual model, and a secondary linear regression model was fit to explore the relationship between the interaction of work arrangement and gender, workplace factors, and perceived stress. Informed by our conceptual model, regression models included the PSS-4 score as the outcome and included the composite scores for access to sick leave, perceived workplace safety climate, work-life balance, dependent care stressors, access to workplace health and safety resources, and PHQ-2 score as predictors. Our primary regression model was adjusted for demographic and background variables including race/ethnicity, age, years of employment with the county, gender, and working arrangement. Our secondary regression model was adjusted for race/ethnicity, age, years of employment with the county, and the interaction between gender and working arrangement.

A third linear regression model was fit to explore how the challenges of working from home impacted the PSS-4 score of employees who work from home either solely or partially. This model included all variables and predictors in the primary model, as well as the eight work from home challenges.

Results

In total, $n = 2{,}910$ respondents met our inclusion criteria and were considered in survey data analysis. To explore how study measures differ by work arrangement and gender, descriptive statistics stratified by work arrangement and gender, are presented in Table 1. Of those who chose to answer, respondents predominantly identified as female, were between the ages of 35–64 and had been working for the county for less than 10 years. At the time of the survey, 58.4% of respondents indicated they were only working from home ($n = 1698$), 10.8% working partially from home ($n = 315$), and 30.9% only working outside of their home ($n = 898$). Both PSS-4 and

Table 1. Descriptive statistics of measures included in conceptual model, stratified by work arrangement and gender (male v. female).

	All *n* (%) or mean (SD) (*n* = 2910)	Only WFH *n* (%) or mean (SD) (*n* = 1698)	Partial WFH *n* (%) or mean (SD) (*n* = 314)	No WFH n (%) or mean (SD) (*n* = 898)	*p*	Male *n* (%) or mean (SD) *n* = 865	Female *n* (%) or mean (SD) *n* = 1382	*p*
PSS-4 total, mean (SD)	6.57 (3.23)	6.63 (3.10)	6.45 (3.23)	6.46 (3.49)	0.21	6.03 (3.21)	6.90 (3.18)	<0.001
Depression – total of PHQ-2, mean (SD)	1.47 (1.55)	1.48 (1.51)	1.48 (1.53)	1.47 (1.62)	0.95	1.33 (1.48)	1.57 (1.57)	<0.001
PHQ-2 score ≥ 3 (%)	458 (17.0%)	271 (16.0%)	52 (16.7%)	135 (18.9%)	0.09	142 (16.5%)	239 (17.3%)	0.60
Perceived workplace safety climate	3.74 (0.99)	4.05 (0.77)	3.67 (1.00)	3.13 (1.09)	<0.001	3.76 (0.97)	3.85 (0.91)	0.03
Dependent care stressors	3.25 (1.05)	3.44 (0.84)	3.34 (0.85)	3.28 (0.85)	<0.001	3.31 (0.84)	3.23 (0.85)	0.11
Work life balance support	3.69 (1.15)	3.93 (1.04)	3.62 (1.19)	3.24 (1.22)	<0.001	3.77 (1.12)	3.74 (1.15)	0.60
Access to workplace health & safety resources	3.66 (0.89)	3.85 (0.77)	3.65 (0.87)	3.27 (0.97)	<0.001	3.67 (0.90)	3.75 (0.84)	0.03
Gender								
Female	1382 (47.5%)	975 (57.5%)	151 (48.1%)	257 (28.6%)	<0.001	–	–	–
Male	865 (29.7%)	445 (26.2%)	85 (27.1%)	336 (37.4%)		–	–	
Other	30 (1.03%)	18 (1.1%)	3 (0.96%)	9 (1.00%)		–	–	
Prefer not to say	633 (21.8%)	260 (15.3%)	75 (23.9%)	296 (33.0%)		–	–	
Race/Ethnicity								
American Indian	37 (1.3%)	13 (0.77%)	5 (1.6%)	20 (2.2%)	<0.001	14 (1.6%)	21 (1.5%)	0.006
Asian/Pacific Islander	188 (6.5%)	144 (8.5%)	14 (4.5%)	32 (3.6%)		55 (6.4%)	132 (9.6%)	
Black/African American	144 (4.9%)	90 (5.3%)	10 (3.2%)	46 (5.1%)		51 (5.9%)	92 (6.7%)	
Hispanic	95 (3.3%)	56 (3.3%)	13 (4.1%)	27 (3.0%)		33 (3.8%)	60 (4.3%)	
Middle Eastern	10 (0.34%)	6 (0.35%)	1 (0.32%)	3 (0.33%)		5 (0.58%)	3 (0.22%)	
Native Hawaiian/Pac Islander	0 (0%)	0 (0%)	0 (0%)	0 (0%)		0 (0%)	0 (0%)	
White	1534 (52.7%)	972 (57.2%)	172 (54.8%)	393 (43.8%)		593 (68.6%)	906 (65.6%)	
More than one race/ethnicity	117 (4.0%)	74 (4.4%)	14 (4.5%)	31 (3.5%)		46 (5.3%)	65 (4.7%)	
Prefer not to answer	785 (27.0%)	343 (20.2%)	85 (27.1%)	346 (38.5%)		68 (7.9%)	103 (7.5%)	
Age								
18–24	18 (0.62%)	9 (0.53%)	5 (1.6%)	4 (0.45%)	<0.001	6 (0.69%)	12 (0.87%)	0.001
25–34	289 (9.9%)	176 (10.4%)	43 (13.7%)	70 (7.8%)		72 (8.3%)	207 (15.0%)	
35–44	495 (17.0%)	330 (19.4%)	49 (15.6%)	116 (12.9%)		189 (21.8%)	284 (20.5%)	
45–54	646 (22.2%)	399 (23.5%)	59 (18.8%)	188 (20.9%)		249 (28.8%)	372 (26.9%)	
55–64	689 (23.7%)	422 (24.9%)	67 (21.3%)	200 (22.3%)		272 (31.4%)	401 (29.0%)	
65+	133 (4.6%)	88 (5.2%)	16 (5.1%)	29 (3.2%)		59 (6.8%)	72 (5.2%)	
No answer	640 (22.0%)	274 (16.1%)	75 (23.9%)	291 (32.4%)		18 (2.1%)	34 (2.5%)	
Length of Employment								
< 1 year	197 (6.8%)	111 (6.5%)	24 (7.6%)	62 (6.9%)	0.003	70 (8.1%)	111 (8.0%)	0.002

1–5 years	721 (24.8%)	484 (28.5%)	77 (24.5%)	160 (17.8%)		213 (24.6%)	453 (32.8%)	
6–10 years	369 (12.7%)	226 (13.3%)	40 (12.7%)	103 (11.5%)		130 (15.0%)	191 (13.8%)	
10–15 years	305 (10.5%)	194 (11.4%)	27 (8.6%)	84 (9.4%)		121 (14.0%)	158 (11.4%)	
16–20 years	226 (7.8%)	124 (7.3%)	23 (7.3%)	79 (8.8%)		83 (9.6%)	128 (9.3%)	
>20 years	623 (21.4%)	356 (21.0%)	66 (21.0%)	201 (22.4%)		238 (27.5%)	328 (23.7%)	
No answer	469 (16.1%)	203 (12.0%)	57 (18.2%)	209 (23.3%)		10 (1.2%)	13 (0.94%)	
If I were to test positive for COVID-19, I would be encouraged by my manager/supervisor to take as much sick leave as I need	4.23 (1.00)	4.36 (0.86)	4.23 (1.00)	3.94 (1.19)	<0.001	4.29 (0.97)	4.25 (0.96)	0.34
If I were to test positive for COVID-19, I wouldn't face negative repercussions for taking as much sick leave as I would need	3.93 (1.13)	4.04 (1.07)	3.87 (1.13)	3.70 (1.23)	<0.001	4.07 (1.05)	3.91 (1.14)	<0.001
If I were to test positive for COVID-19, I am confident that I could take enough paid sick leave that it would not affect me economically.	3.47 (1.29)	3.58 (1.23)	3.50 (1.31)	3.21 (1.38)	<0.001	3.69 (1.21)	3.40 (1.31)	<0.001
I know what actions I should take at work if I were to test positive for COVID-19.	3.91 (1.01)	3.90 (0.99)	4.00 (1.01)	3.91 (1.06)	0.72	3.98 (0.95)	3.92 (1.02)	0.20

PHQ-2 scores were significantly higher in females than in males (6.03 v. 6.90 and 1.33 v. 1.57, respectively). No significant differences were noted in PSS-4 or PHQ-2 scores between groups stratified by work arrangement. The gender distribution and race/ethnicity distribution differed between groups that worked from home and did not work from home, with a larger percentage of the work from home group being female (57.5% in only work from home v. 28.6% in never work from home) and a larger percentage of the group that never worked from home group being male (37.4% never work from home v. 26.2% in only work from home).

Overall, respondents who worked from home had significantly higher composite scores related to workplace safety climate, dependent care stressors, work life balance support, and access to workplace safety and health resources relative to workers who either partially or never worked from home. This indicates that while those who worked from home felt more stressors related to dependent care, they also felt their work safety climate was better, had increased access to workplace health and safety resources, and more managerial support for work life balance. Though not significant, a greater percentage of workers who never work from home had a PHQ-2 score $\geq$3 (indicating major depressive disorder is likely) compared to workers who only worked from home (18.9% v. 16.0%). Overall, 17% of respondents had a PHQ-2 score indicating major depressive disorder is likely ($\geq$3) in this sample.

When comparing males and females, females reported significantly higher perceived workplace safety climate and significantly higher access to workplace health and safety resources than males. Females also reported they would be significantly more likely to face negative repercussions if they took as much sick leave as they might need for COVID-19, and significantly more likely to be impacted economically if they were to test positive for COVID-19 compared to males in this sample. Males also reported slightly higher levels of dependent care stressors than women, though this was not significantly different.

To explore the interaction between gender and work arrangement, descriptive statistics stratified by the interaction of work arrangement and gender are included in the online supplement. Though not presented in the main manuscript, when considering female workers, mean PSS-4 score was highest among females who did not work from home (7.26, SD: 3.54), and lower among females who either partially or solely worked from home (7.03, SD: 3.17 and 6.78, SD: 3.08, respectively). The opposite was true among males, with males who only worked from home having the highest mean PSS-4 score for males (6.30, SD: 3.16) and males who worked from home either partially or never having lower mean PSS-4 scores (5.46, SD: 3.14 and 5.82, SD: 3.26, respectively).

Table 2 explores challenges specific to working from home, stratified by work arrangement (only work from home v. partially work from home) and gender (male v. female). Workers who only worked from home were less likely to report they fairly or very often had internet too slow to complete necessary work tasks (11.1% v. 16.7%, $p = 0.03$) or lacked equipment needed to complete all work tasks (26.9% v. 34.3%, $p = 0.03$) but were more likely to report they fairly or very often had an increase in the length of their workday (35.6% v. 31.1%, $p = 0.03$) compared to workers who partially worked from home. Males were less likely to report they fairly or very often lacked ergonomic equipment compared to females (36.6% v. 41.4%, $p = 0.002$). Compared to males who worked from home, females who worked from home were more likely to lack ergonomic equipment (40.9% females fairly or very often lacked this v. 35.7% males, $p = 0.002$) and equipment needed to complete all work tasks (28.5% v. 20.4%, $p < 0.001$). Females also were more likely to fairly or very often experience a consistent increase in workload compared to males (38.9% v. 30.2%, $p = 0.001$). Overall, among all workers who work from home 41.5% reported they fairly or very often lack ergonomic equipment and 44.0% reported they fairly or very often experience an erosion of boundaries between work life and personal life. Thirty-seven and a half percent reported they fairly or very often experienced a consistent increase in workload, and 35% reported they fairly or very often experienced a consistent increase in length of workday.

Results from the primary linear regression model presented in Table 3 found several workplace factors that were related to PSS-4 score in this population, while controlling for age, length of employment for the county, gender, race/ethnicity, and work arrangement. A decrease in PSS-4 score was significantly associated with increased access to sick leave (coefficient: −0.29, 95% CI: −0.44, −0.15), higher perceived workplace safety (coefficient: −0.34, 95% CI: −0.62, −0.16), manager support of work-life balance needs (coefficient: −0.26, 95% CI: −0.38, −0.13), and access to workplace health and safety resources (coefficient: −0.71, 95% CI: −0.88, −0.53). An increase in PSS-4 score was significantly associated with increased dependent care stressors (coefficient: 0.43, 95% CI: 0.34, 0.53) and increased PHQ-2 score (coefficient: 1.09, 95% CI: 1.02, 1.16). Identifying as female was significantly associated with a higher PSS-4 score, and as age increased, PSS-4 score significantly decreased. In this model, working from home was associated with a significantly higher PSS-4 score than working partially from home or never working from home. Overall, this model had an adjusted R^2 of 0.48; when not including PHQ-2 score in the model, R^2 was 0.25. When considering the interaction model also presented in Table 3, few differences were observed in model outputs compared to the primary

Table 2. Work from home challenges, stratified by work arrangement and gender (male v. female).

How often have you experienced the situations outlined below?	Only WFH Mean (SD) n (%)* ($n = 1501$)	Partial WFH Mean (SD) n (%)* ($n = 257$)	p**	Male Mean (SD) n (%)* $n = 529$	Female Mean (SD) n (%)* $n = 1125$	p**
Lack of reliable internet access	2.41 (0.92)	2.40 (0.99)	0.85	2.33 (0.87)	2.43 (0.96)	0.03
	145 (9.7%)	30 (11.7%)		46 (8.7%)	117 (10.4%)	
Internet too slow to complete necessary work tasks	2.36 (1.00)	2.52 (1.11)	0.03	2.33 (1.00)	2.40 (1.02)	0.19
	166 (11.1%)	43 (16.7%)		55 (10.4%)	135 (12.0%)	
Lack of appropriate space to take video calls	2.12 (1.12)	2.15 (1.22)	0.69	2.09 (1.11)	2.09 (1.13)	0.98
	172 (11.5%)	38 (14.8%)		60 (11.3%)	121 (10.8%)	
Lack of ergonomic equipment	3.09 (1.35)	3.27 (1.37)	0.06	2.95 (1.39)	3.18 (1.33)	0.002
	609 (40.6%)	120 (46.7%)		189 (35.7%)	460 (40.9%)	
Lack of equipment needed to complete all work tasks	2.78 (1.25)	2.97 (1.28)	0.03	2.60 (1.18)	2.86 (1.27)	<0.001
	404 (26.9%)	88 (34.3%)		108 (20.4%)	321 (28.5%)	
Consistent increase in workload	3.16 (1.14)	3.08 (1.29)	0.38	3.00 (1.15)	3.20 (1.17)	0.001
	562 (37.4%)	98 (38.1%)		160 (30.2%)	438 (38.9%)	
Consistent increase in length of workday	3.02 (1.24)	2.83 (1.32)	0.03	2.95 (1.23)	3.00 (1.26)	0.38
	535 (35.6%)	80 (31.1%)		170 (32.1%)	386 (34.3%)	
Erosion of boundaries between work life and personal life	3.27 (1.25)	3.22 (1.30)	0.56	3.29 (1.28)	3.26 (1.25)	0.68
	664 (44.2%)	110 (42.8%)		240 (45.4%)	467 (41.5%)	

Average Frequency of experience reported on a 5-point scale: Never Experience (1), Almost Never (2), Sometimes (3), Fairly Often (4), Very Often Experience (5).
*Number and percent of respondents who reported experiencing each situation fairly often or very often.
**From *t*-test of mean score.

Table 3. Linear regression model exploring relationship between PSS-4 score and workplace factors, including gender and work arrangement separately, and exploring the interaction between gender and work arrangement.

	Primary Model ($n = 2248$)		Interaction Model ($n = 2059$)	
	Coef. (95% CI)	p	Coef. (95% CI)	p
Intercept	7.66 (6.84, 8.48)	<0.001	7.92 (7.06, 8.78)	<0.001
Increased access to sick leave	−0.29 (−0.44, −0.15)	<0.001	−0.29 (−0.44, −0.15)	<0.001
Increased workplace safety climate	−0.34 (−0.52, −0.16)	<0.001	−0.32 (−0.53, −0.14)	<0.001
Work-life balance support	−0.26 (−0.38, −0.13)	<0.001	−0.25 (−0.38, −0.13)	<0.001
Dependent care stressors	0.43 (0.34, 0.53)	<0.001	0.46 (0.36, 0.56)	<0.001
Access to health/safety resources	−0.71 (−0.88, −0.53)	<0.001	−0.71 (−0.89, −0.53)	<0.001
PHQ-2 score	1.09 (1.02, 1.16)	<0.001	1.08 (1.01, 1.15)	<0.001
Race/Ethnicity (REF: Non-Hispanic White)				
Not non-Hispanic White	−0.11 (−0.34, 0.13)	0.38	−0.12 (−0.35, 0.11)	0.31
Did not disclose race/ethnicity	−0.19 (−0.57, 0.20)	0.34	−0.09 (−0.49, 0.31)	0.67
Years working for the county	−0.005 (−0.07, 0.06)	0.87	0.007 (−0.06, 0.07)	0.84
Age	−0.14 (−0.22, −0.05)	0.001	−0.17 (−0.26, −0.07)	<0.001
Gender (REF: Male)				
Female	0.49 (0.27, 0.70)	<0.001		
Other Gender	0.27 (−0.64, 1.19)	0.56		
Did not disclose gender	0.58 (0.05, 1.11)	0.03		
Work Arrangement (REF: Only WFH)				
Partial WFH	−0.34 (−0.66, −0.02)	0.04		
No WFH	−0.39 (−0.64, −0.14)	0.002		
Work Arrangement x Gender (REF: Male Only WFH)				
Male Partial WFH			−0.50 (−1.04, 0.05)	0.08
Male No WFH			−0.80 (−1.16, −0.44)	<0.001
Female Only WFH			0.24 (−0.03, 0.51)	0.09
Female Partial WFH			−0.02 (−0.46, 0.42)	0.94
Female No WFH			0.18 (−0.20, 0.56)	0.35
Model adjusted R2	0.48		0.49	

Table 4. Relationship between PSS-4 score and workplace factors, stratified by gender (female, male).

	Males ($n = 798$)		Females ($n = 1251$)	
	Coef. (95% CI)	*p*	Coef. (95% CI)	*p*
Intercept	7.93 (6.52, 9.33)	<0.001	8.21 (7.16, 9.27)	<0.001
Increased access to sick leave	−0.49 (−0.73, −0.25)	<0.001	−0.17 (−0.36, 0.02)	0.08
Increased workplace safety climate	−0.26 (−0.56, 0.04)	0.09	−0.37 (−0.61, −0.13)	0.003
Work-life balance support	−0.13 (−0.32, 0.07)	0.21	−0.35 (−0.52, −0.18)	<0.001
Dependent are stressors	0.49 (0.33, 0.65)	<0.001	0.45 (0.32, 0.57)	<0.001
Access to health/safety resources	−0.62 (−0.91, −0.34)	<0.001	−0.76 (−1.00, −0.52)	<0.001
PHQ-2 score	1.14 (1.03, 1.26)	<0.001	1.03 (0.95, 1.12)	<0.001
Race/Ethnicity (REF: Non-Hispanic White)				
Not non-Hispanic White	−0.06 (−0.44, 0.32)	0.76	−0.13 (−0.43, 0.16)	0.38
Did not disclose race/ethnicity	−0.07 (−0.71, 0.56)	0.82	−0.07 (−0.59, 0.45)	0.78
Years working for the county	−0.0004 (−0.11, 0.10)	0.99	0.007 (−0.08, 0.09)	0.87
Age	−0.15 (−0.31, 0.006)	0.06	−0.18 (−0.29, −0.06)	0.003
Work Arrangement (REF: Only WFH)				
Partial WFH	−0.45 (−1.00, 0.10)	0.11	−0.26 (−0.67, 0.15)	0.21
No WFH	−0.77 (−1.15, −0.39)	<0.001	−0.07 (−0.43, 0.29)	0.71
Model Adjusted R2		0.49		0.48

model. However, males who did not work from home had a significantly lower PSS-4 score (coefficient: −0.80, 95% CI: −1.16, −0.44) compared to males who did work from home with all other coefficients held constant.

When stratifying by female v. male (Table 4), differences were seen in determinants of stress by gender, with males uniquely having a decrease in PSS-4 score significantly associated with increased access to sick leave (coefficient: −0.49, 95% CI: −0.73, −0.25), and females uniquely having a decrease in PSS-4 significantly associated with more manager support for work life balance (coefficient: −0.35, 95% CI: −0.52, −0.18). Table 5 also stratifies results from the linear regression analysis by work arrangement. It was only among workers who never work from home that increased access to sick leave was associated with a significant decrease in PSS-4 score (coefficient: −0.55, 95% CI: −0.83, −0.27), whereas increased access to workplace health and safety resources was significantly associated with a decrease in PSS-4 score in workers who only or partially work from home. Increased managerial work life balance support was found to be significantly associated with decreased stress in workers who only work from home (coefficient: −0.32, 95% CI: −0.48, −0.16).

Table 6 presents how eight work-from-home challenges relate to PSS-4 score in workers who partially or only work from home. When controlling for all other demographic and workplace variables considered in the primary regressions, a consistent increase in workload and a consistent erosion of boundaries between work and personal life were both significantly associated with an increased PSS-4 score (coefficient: 0.26, 95% CI: 0.13,

Table 5. Relationship between PSS-4 score and workplace factors, stratified by work arrangement.

	Only WFH ($n = 1279$)		Partial WFH ($n = 215$)		No WFH ($n = 545$)	
	Coef. (95% CI)	*p*	Coef. (95% CI)	*p*	Coef. (95% CI)	*p*
Intercept	7.54 (6.47, 8.60)	<0.001	9.10 (6.68, 11.51)	<0.001	7.42 (5.78, 9.06)	<0.001
Increased access to sick leave	−0.16 (−0.34, 0.04)	0.11	−0.26 (−0.74, 0.22)	0.29	−0.55 (−0.83, −0.27)	0.001
Increased workplace safety climate	−0.49 (−0.74, −0.24)	<0.001	−0.22 (−0.78, 0.35)	0.45	−0.01 (−0.36, 0.33)	0.95
Work-life balance support	−0.32 (−0.48, −0.16)	<0.001	−0.17 (−0.54, 0.19)	0.14	−0.19 (−0.44, 0.06)	0.14
Dependent care stressors	0.48 (0.37, 0.60)	<0.001	0.23 (−0.07, 0.55)	0.35	0.51 (0.29, 0.72)	<0.001
Access to health/safety resources	−0.89 (−1.11, −0.66)	<0.001	−0.97 (−1.52, −0.43)	<0.001	−0.25 (−0.63, 0.12)	0.18
PHQ-2 score	1.07 (0.98, 1.15)	<0.001	1.14 (0.94, 1.35)	<0.001	1.03 (0.89, 1.17)	<0.001
Race/Ethnicity (REF: Non-Hispanic White)						
Not non-Hispanic White	0.04 (−0.23, 0.32)	0.75	−1.21 (−1.92, −0.49)	0.001	−0.16 (−0.67, 0.35)	0.54
Did not disclose race/ethnicity	0.14 (−0.37, 0.66)	0.58	−0.98 (−2.27, 0.31)	0.14	−0.25 (−1.01, 0.50)	0.51
Years working for the county	−0.02 (−0.10, 0.06)	0.61	0.13 (−0.08, 0.33)	0.22	0.02 (−0.12, 0.16)	0.75
Age	−0.14 (−0.25, −0.03)	0.01	−0.24 (−0.51, 0.03)	0.08	−0.20 (−0.40, 0.05)	0.06
Gender (REF: Male)						
Female	0.25 (−0.008. 0.51)	0.06	0.44 (−0.19, 1.08)	0.17	0.94 (0.50, 1.38)	<0.001
Model Adjusted R2		0.51		0.53		0.45

Table 6. Relationship between PSS-4 score, workplace factors, and work from home challenges in workers who always or partially worked from home.

	WFH challenges ($n = 1453$)	
	Coef. (95% CI)	*p*
Intercept	4.76 (3.59, 5.93)	<0.001
Increased access to sick leave	−0.19 (−0.36, −0.02)	0.03
Increased workplace safety climate	−0.29 (−0.52, −0.05)	0.02
Work-life balance support	−0.10 (−0324, 0.04)	0.17
Dependent care stressors	0.30 (0.19, 0.41)	<0.001
Access to health/safety resources	−0.61 (−0.83, −0.38)	<0.001
PHQ-2 score	1.01 (0.93, 1.09)	<0.001
WFH challenges		
Lack of internet access	−0.02 (−0.19, 0.16)	0.85
Internet too slow for work tasks	0.06 (−0.10, 0.16)	0.47
Lack of space for video calls	0.10 (−0.02, 0.23)	0.09
Lack of ergonomic equipment	0.003 (−0.10, 0.10)	0.95
Lack of equipment for work tasks	0.04 (−0.06, 0.16)	0.41
Consistent increase in workload	0.26 (0.13, 0.39)	<0.001
Consistent increase in workday	−0.09 (−0.23, 0.05)	0.21
Erosion of boundaries between work/personal	0.42 (0.29, 0.54)	<0.001
Race/Ethnicity (REF: Non-Hispanic White)		
Not non-Hispanic White	−0.11 (−0.37, 0.14)	0.4
Did not disclose race/ethnicity	−0.0006 (−0.47, 0.46)	0.99
Years working for the county	−0.01 (−0.09, 0.06)	0.72
Age	−0.13 (−0.24, −0.03)	0.01
Work Arrangement (REF: Only WFH)		
Partial WFH	−0.35 (−0.66, −0.03)	0.03
Gender (REF: Male)		
Female	0.28 (0.04, 0.52)	0.02
Model adjusted R2		0.55

0.39 and coefficient: 0.42, 95% CI: 0.29, 0.54, respectively). As in previous models, increased access to sick leave, increased workplace safety climate, work-life balance support, and access to workplace health and safety resources remained significantly associated with decreased PSS-4 score, and dependent care stressors and PHQ-2 scores remained significantly associated with increased PSS-4 score.

Across all models, and regardless of how data were stratified, an increase in PHQ-2 score was significantly associated with an increased PSS-4 score; PSS-4 and PHQ-2 scores had a correlation coefficient of 0.65 in this sample.

Discussion

This is one of few occupational health studies investigating how workplace determinants of stress differed by work arrangement and gender during the early days of the COVID-19 pandemic for individuals who were employed by the same employer with access to a similar set of benefits. Findings presented here provide important insights into the differing workplace needs of males and females as well as needs and challenges specific to workers who were working from home early in the pandemic. These findings could

inform ongoing workplace well-being policies particularly as many workplaces weigh whether to continue having workers work from home or to bring employees back to the offices.

In this analysis, we found that many workers in our sample fairly or very often experienced challenges related to working from home, particularly with lack of access to ergonomic equipment (41.5%), despite King County having a COVID-19 Ergonomic Evaluations and Remote Office Equipment Policy (King County Department of Human Resources, n.d.). A lack of ergonomic equipment can put workers at increased risk of musculoskeletal disorders (MSDs) such as Carpal tunnel syndrome, back pain, or other strains, sprains, and tears. Strains, sprains, and tears makes up the largest number of reportable workplace injuries per the Bureau of Labor Statistics (Bureau of Labor Statistics, 2021) making proper office ergonomics (whether at home or at the office) not only important for reducing the burden of occupational injury, but also reducing the high cost of MSDs for employers. An ergonomically sound work environment with relatively low noise and comfortable temperature can also contribute to worker job satisfaction and productivity (Birimoglu Okuyan & Begen, 2022).

While many employers (including King County) offer employees an ergonomic assessment and access to ergonomic equipment when warranted, findings from this work indicate that even with these programs in place, many employees likely feel they don't have an ergonomic set-up at home. This could indicate additional supports are needed for at-home workers. This could include ongoing training and awareness-building related to ergonomics, and employer-provided home office equipment even for workers who work from home sometimes, but not always, as this group had a higher percentage of respondents fairly or very often experiencing a lack of access to ergonomic equipment (46.7% in those who sometimes work from home v. 40.6% in workers who only work from home). As many employers have decided to allow workers to continue working from home, either solely or partially, an emphasis on home office ergonomics will be vital for reducing reportable occupational injuries related to home office MSDs.

More than a third of respondents who worked from home reported fairly or very often experiencing a consistent increase in length of workday (35%), and consistent increase in workload (37.5%), These two challenges tended to occur more frequently for female workers compared to male workers. This could be because women, particularly in heterosexual relationships, tend to take on more of the domestic and caregiving load, and this added domestic load during the workday could make workdays run longer and workloads be heavier. Particularly as options for childcare were limited, this could have contributed to an increased burden on women workers and revival of traditional gender roles with women performing

more domestic labor than before the pandemic (Arntz, Ben Yahmed, & Berlingieri, 2020). However, these increases in workday length and workload could also be due to employees working during times they would have otherwise been commuting or socializing, and employers assigning more work assuming that employees had more time to devote to work due to restrictions on other activities outside of the home. Forty-four percent of respondents reported they fairly or very often experienced an erosion of boundaries between work life and personal/home life. While this may have been due to the unique scenario of the pandemic and closures keeping more people home, an ongoing erosion of boundaries can lead to employee burnout, decrease job satisfaction, and ultimately decrease employee retention. In our sample among workers who worked from home, erosion of boundaries and an increase in workload were significantly associated with an increased PSS-4 score, even when controlling for demographic and workplace factors. This underscores the importance of workplaces ensuring that employees who work from home are given clear guidance on work expectations and that employers recognize that the hours worked from home shouldn't exceed hours worked in the office.

In our sample, 17% of respondents had a PHQ-2 score indicating major depressive disorder is likely; among workers who never worked from home it was even higher, with 18.9% having a PHQ-2 score indicating major depressive disorder is likely. Moreover, in all regression models PHQ-2 score was significantly positively associated with increased PSS-4 score, further underscoring the relationship between perceived stress and depression in working populations. Taken together, it is likely that depression could be having a large impact on the employees in this survey, as well as their employers, and there may be unmet employee needs related to accessing mental health care or recognizing when mental health care may be needed in this population, and a secondary mental health assessment post-COVID-19 may be beneficial.

Overall, females had higher PSS-4 and PHQ-2 scores than males, and a higher percentage of female respondents had a PHQ-2 score indicating major depressive disorder is likely than did males. This is consistent with other literature looking at PSS-4 and PHQ-2 scores by gender both during the COVID-19 pandemic and before. This re-affirms the need for worker well-being programs to be tailored to represent the stressors and experiences faced by all genders in the workplace and their personal lives that could increase stress and risk for other adverse outcomes. In models stratifying by male and female, an increase in managerial work-life balance support was associated with a significant decrease in stress for females, which was not seen in male workers. Offering flexible working schedules and accommodating hybrid schedules can benefit all workers, but findings here

indicate it may be particularly beneficial for female workers, if the flexible schedule doesn't otherwise increase workload.

In our interaction analysis, we found males who work from home tended to be more stressed than males who were not working from home, but females who were working from home tended to be less stressed than females who were not working from home. We hypothesize this could have been due to the increased caregiving responsibilities many women with children (particularly in heterosexual relationships) took on during the COVID-19 pandemic with schools closing, and the historical increased burden of caregiving and domestic duties women perform relative to men. As such, females may have been less stressed working from home as they could provide childcare and help with online schooling, whereas males who may have been less used to balancing work and childcaring duties were confronted with additional caregiving responsibilities when working from home, increasing their stress relative to males not working from home. However, additional research is warranted to understand how the interaction of gender and work arrangement impacts worker stress and well-being, to continue to refine best practices for how employers can support at-home worker well-being. The unique circumstances early in the pandemic resulted in an unplanned collision of work and home lives, when prior to the pandemic remote work typically involved planning and preparation from employers to prepare employees to shift to remote work and ensure their work productivity and engagement (Galanti et al., 2021). Literature from both before and during the pandemic has found benefits and limitations to remote work for both employers and employees, with productivity, work engagement, employee satisfaction, and employee isolation dependent on factors such as management quality, nature of work, family-life conflict, and workplace supports (Galanti et al., 2021; Konradt, Hertel, & Schmook, 2003; Vander Elst et al., 2017). Pre-pandemic research investigating stressors faced by teleworkers found that non-job-related stressors were higher for teleworkers than office-based workers, which could also explain the higher stress scores seen in some King County workers who were working from home (Konradt et al., 2003).

Limitations

The study presented here is subject to some key limitations which must be acknowledged. This survey was administered early in the COVID-19 pandemic (August–September 2020) so many of the experiences and challenges faced by workers might have changed as employers adjusted to having some of their employers working from home. Workers' experiences may also have changed as local COVID-19 restrictions eased and eventually

lifted. Although working from home provides needed flexibility for many workers, more occupational health research is needed to explore the challenges associated with this work setup. The time period of this survey could uniquely impact the stress and experiences of the workers included in this study and as such it may lack generalizability to worker experiences during other time periods. Similarly, while the sample represents workers from many different types of occupations and work arrangements, the results presented here cannot assume to be representative of other workers, as the study population came from one employer in one specific geographic region. A few variables were not collected on the survey, including occupation of respondent and income of respondent, which could be important confounders to consider in models relating work arrangement, gender, and stress. With a 19.7% response rate, our survey may not be representative of King County Employees, and while we assume that some county departments or divisions were over or underrepresented in our survey, the nature of our data collection did not allow us to know which groups may be over or underrepresented. However, it is likely that job duties, job hours, and job location, likely influenced employees' ability to take a survey early in the COVID-19 pandemic, so internal generalizability of the survey may also be limited, particularly to workers in departments or divisions that were underrepresented in survey response.

As this was a cross-sectional study, the directionality of the relationships explored here cannot be concluded. While stress was considered as the primary outcome, questions to assess sources of stress outside of the workplace were not asked, which would have allowed us to better understand the role the workplace plays in total stress. Questions were not asked about whether the respondent experienced any stressful events in their personal life, or how the nationwide uprising around racial justice and equity may have impacted their stress levels. Additionally, due to small sample size our gender-stratified analysis only included respondents identifying as male and female, and thus does not capture the experiences of those who do not identify with these genders. For future work, understanding the full range of stressors a worker may be experiencing will help to elucidate how workplace stressors may contribute to an individual's overall stress. A longitudinal study would have allowed us to better understand how workplace determinants of stress changed over time, and how any workplace interventions may have impacted stress.

Conclusions

This study is novel as it characterizes a population working across a range of occupations who all have access to the same suite of workplace benefits

and supports. This allowed us an ideal population in which to investigate workplace determinants of stress early in the COVID-19 pandemic and quantify differences in determinants and experiences by gender (male v. female) and work arrangement.

From this study, we found that workers who worked from home either solely or partially tended to lack access to ergonomic work equipment, which could impact employee risk for MSDs, and workers tended to consistently experience an increase in workload, workday, and an erosion of boundaries between work and personal life. These factors were found to be related to employee stress in our sample, but could also impact burnout, job satisfaction, and employee retention.

Results from regression analyses indicate that access to workplace health and safety resources, increased access to sick leave, increased workplace safety climate, and support for work-life balance is associated with decreased perceived stress, while dependent care stressors is associated with increased perceived stress. Overall, respondents identifying as female had higher levels of stress and higher PHQ-2 scores, and in females increased manager support for work-life balance was significantly associated with lower stress, which was not seen in males. Additionally, females reported more barriers to taking sick leave than their male coworkers, as did workers who did not work from home at the time of the survey. Real or perceived barriers to taking sick leave can increase employee presenteeism—that is, coming to work even when sick. Presenteeism can not only spread infection throughout the workforce and public, but also can decrease employee productivity.

While these data were collected during August–September 2020, during the unique circumstances brought by the COVID-19 pandemic and related restrictions, findings here are still important for understanding how the workplace impacts stress, and differential determinants of stress by gender or work arrangement and identifies areas of intervention for workplaces that would be beneficial for employee stress and well-being. Even as the immediate threat of COVID-19 has decreased, there are many future research opportunities and needs related to this work. Additional research is needed on the long-term mental and physical health impacts of working from home, and how employers can best support employees that are working from home—for example, ensuring their at-home work stations are ergonomic, creating policies to ensure at-home workers don't routinely extend the length of their workdays or receive a larger workload, and taking steps to ensure there are employee social supports in place for at-home workers as well as in-person workers. Ongoing pulse surveys related to employee stress and mental health would also be a valuable tool for workplaces to use to understand how changes to work expectations or norms

has affected employees, whether new workplace initiatives are having positive impacts on worker mental health or stress, and which workers may be most in need of intervention. As reported in this manuscript, ensuring workers have access to ample paid sick leave they can take without consequence, managers are supportive of work-life balance (which could be through an initiative like allowing for workers to flex their time), and workers have access to resources supportive of their mental and physical health and safety will remain important for decreasing employee stress, and could also improve workplace recruitment and retention.

Acknowledgements

The authors thank the King County Auditor's Office for their assistance in helping to develop and promote this survey.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

Research presented here was supported by National Institute for Occupational Safety and Health (NIOSH) under grant T42OH008433 and by National Institute of Environmental Health Sciences (NIEHS) under grant P30ES007033. The findings and conclusions reported here are those of the authors and do not necessarily represent the official position of NIOSH or NIEHS.

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Data availability statement

The data that support the findings of this study are openly available at: https://github.com/bakermarissa/countyworkers

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