Original research

Does stressful workplace characteristics moderate or confound the association between occupational physical activity and elevated depressive symptoms? A large study including 36,442 adults

Running head: Occupational physical activity and elevated depressive symptoms

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Abstract

Background: We tested whether stressful workplace characteristics confound or moderate the association between occupational physical activity and depressive symptoms.
Method: We used data of 36,442 employed adults (16,992 women), with a mean age of 39.3±12.6y, from the 2013 Brazilian National Health Survey. Depressive symptoms were assessed through the Patient Health Questionnaire-9 (cut-point: ≥10). Occupational physical activity was self-reported and classified using the cut-point of 150 min/week and the highest quintile. Ten stressful workplace characteristics (e.g. exposure to stress, noise, violence) were also self-reported dichotomously. Logistic regression models were used considering the adjustment for potential confounders. **Results:** Most of the stressful workplace characteristics were associated with elevated depressive symptoms (8 characteristics) and higher occupational physical activity (9 characteristics). Although there were no interactions in combined associations, we found that the association between occupational physical activity and depressive symptoms consistently reduced after adjusting for the cluster of positive screening for at least two stressful workplace characteristics in men [highest quintile: $OR_{unadjusted:}$ 1.63 (95%CI 1.22-2.17) vs $OR_{adjusted}$: 1.36 (1.08-1.91); ≥150min/week: $OR_{unadjusted}$: 1.43 (1.09-1.88) vs $OR_{adjusted}$: 1.25 (0.95-1.64)], and women [highest quintile: $OR_{unadjusted}$: 2.15 1.73-2.66) vs $OR_{adjusted}$: 1.83 (1.47-2.29); ≥150min/week: $OR_{unadjusted}$: 2.11 (1.68-2.65) vs $OR_{adjusted}$: 1.80 (1.42-2.27)].
Limitations: The cross-sectional design limits the causal inference.
Conclusions: Stressful work environment did not moderate, but acted as confounders in the association between occupational physical activity and elevated depressive symptoms and should be considered in future studies.

Keywords: work; exercise; occupational stress, wellbeing

Introduction

Depression is the leading cause of disability worldwide (Ferrari et al., 2013), with an increasing burden over the last decades (Liu et al., 2020). In Brazil, the 2013 National Health Survey revealed approximately 4% of the adult population meet the criteria for depression (Munhoz et al., 2016). The prevalence of subclinical depressive symptoms is higher, with approximately 21% of respondents reporting depressive mood (Barros et al., 2017).

Among the protective factors for depression, physical activity is gaining increasing interest and previous studies found that physical activity is prospectively associated with a lower incidence of depression (Schuch et al., 2018). However, most of the studies are focused on leisure-time physical activity and domain-specific physical activity (e.g., leisure, occupational, transport) can influence its association with depressive symptoms, with high occupational physical activity being a possible risk factor (Werneck et al., 2020; White et al., 2017). This finding is in line with the "physical activity paradox", which is consistently discussed and reported for all-cause mortality and cardiovascular outcomes, in which leisure-time physical activity is consistently a protective factor, while occupational physical activity is inconsistently associated with higher odds of mortality and cardiovascular diseases, with studies presenting null or even positive associations (Cillekens et al., 2020; Coenen et al., 2020, 2018; Hayashi et al., 2016; Holtermann et al., 2018; Krause et al., 2015).

The mechanisms linking that influence occupational physical activity and health outcomes, including elevated depressive symptoms, is unclear, but some hypothesized mechanisms include the extremely low intensity, mandatory practice, short recovery times, increasing in the inflammation among others (Holtermann et al., 2018). Beyond the direct factors, there may be some confounders in this association. Stressful workplace

characteristics (e.g. stress, exposure to the sun, noise, urban waste, chemical materials) are common, with more than 50% of Brazilian employees reporting at least one stressful workplace characteristic (Oenning et al., 2018). Also, previous study found that the majority of the stressful workplace characteristics are associated with elevated depressive symptoms (Oenning et al., 2018). Considering that the workplace environmental characteristics and occupational physical activity occur simultaneously, stressful workplace characteristics can act both as a confounder or as a moderator of the association between occupational physical activity and elevated depressive symptoms, but to our knowledge, the exact role of workplace environment characteristics was not previously tested. We aimed to investigate the role of stressful workplace factors as confounders or moderators in the association between occupational physical activity and elevated depressive symptoms among workers. Considering that both occupational physical activity and stressful workplace environment are associated with depressive symptoms and occur concomitantly, we hypothesize that the harmful association between occupational physical activity and elevated depressive symptoms can change according to the presence of stressful workplace environment characteristics.

Methods

Sample

We used data from the Brazilian National Health Survey (Instituto Brasileiro de Geografia e Estatística - IBGE, 2014). The 2013 Brazilian National Health Survey was a cross-sectional epidemiological study, conducted with a nationally representative sample of adults (>18 years old) in Brazil. The sampling process occurred through three stages. Firstly, census tracts were randomly selected; next, households were randomly selected; and finally, in the households, one adult was randomly selected. More details of the

sampling process and weighting have been published elsewhere (Instituto Brasileiro de Geografia e Estatística - IBGE, 2014). The minimum sample size per federal unit (i.e. State) (n = 27) was 1,800 participants, with a total of 64,348 households, where interviews were conducted. Due to missing data, the final sample was composed of 60,202 adults. Due to our research purposes, we only included active workers (n=36,442). Estimates were weighted considering the characteristics of the general population as well as the non-response rate. The Brazilian Council of Ethics in Research approved all procedures according to the Helsinki declaration (CONEP process: 10853812.7.0000.0008).

Depressive symptoms

We used the Patient Health Questionnaire-9 (PHQ-9) to assess depressive symptoms (Kroenke et al., 2001). This tool evaluates the frequency of depressive symptoms (depressed mood, anhedonia, trouble sleeping, tiredness or lack of energy, change of appetite or weight, feeling of guilt or uselessness, trouble concentrating, feeling slow or agitated and having recurrent thoughts about death or suicidal ideation) over the two weeks before data collection. The questionnaire is composed of nine questions, with four possible answers each on a Likert-scale: “not at all”, which has a value of 0; “several days”, which has a value of 1; “more than half the days”, which has a value of 2; and “nearly every day”, which has a value of 3. Considering final score of the questionnaire (0-27), the standardized classification is: 0-4 = “none or minimum”, 5-9 = “mild”, 10-14 = “moderate”, 15-19 = “moderately severe”, and 20-27 = “severe”. In the present study, we adopted the cut-point of ≥10 for elevated depressive symptoms. This instrument is validated for Brazilian adults and presented adequate values of sensitivity and specificity comparing to the Mini International Neuropsychiatric Interview diagnosis tool (Santos et al., 2013).

The questionnaire presented a good Cronbach's alpha value in the present sample (0.836).

Occupational physical activity

Occupational physical activity was assessed using the occupational physical activity section of the Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone Survey (VIGITEL) questionnaire, which is a previously validated questionnaire for Brazilian adults (Moreira et al., 2017). The section includes questions on frequency and duration of vigorous and moderate physical activity during work. Considering the lack of specific cut-off points for occupational physical activity, we summed moderate and vigorous activities and dichotomized using two cut-off points, 150 min/week as previous study (Werneck et al., 2020) and the highest quintile of occupational physical activity according to sex [600min/week for men and any activity (>0 min/week) for women].

Stressful workplace characteristics

The survey included stressful workplace characteristics, based on the "Basic questionnaire and methodological criteria for Surveys on Working Conditions, Employment, and Health in Latin America and the Caribbean", which is a valid questionnaire (Benavides et al., 2016). The questions were dichotomic ("Considering all of your jobs, are you exposed to some of the following health risk factors?" Possible answers: yes or not). There were questions about the presence of workplace violence (physical or psychological), exposure to chemical substances, noise, sun, radioactive materials, urban waste, biological materials, marble dust, stress and night/shift work. Also, we created a cluster of positive screening for at least two stressful workplace

characteristics, considering all the characteristics included (i.e. presence of workplace violence, exposure to chemical substances, noise, sun, radioactive materials, urban waste, biological materials, marble dust, stress and night/shift work).

Confounders

We included age, ethnicity, educational achievement, quintiles of per capita income, type of occupation, fruit consumption, leisure-time physical activity, tobacco smoking, binging drinking, TV-viewing and multimorbidity as confounding variables, based on previous studies (Oenning et al., 2018; Werneck et al., 2020). Chronological age was included as a categorical variable (18-34, 35-49, 50-64, 65+). Ethnicity was self-reported and categorized as white, black, mixed or other. Educational achievement was collected through the question: "What is your highest academic qualification?" Which was categorized in four categories (1 = no formal education; 2 = less than secondary; 3 = complete secondary and 4 = complete college or more). Per capita income was estimated dividing the total income of all the members of each household by the number of residents. For the analyzes, we divided per capita income in quintiles. Type of occupation was classified in six categories, according to the International Standard Classification of Occupations (1 = Military/police/firefighter; 2 = Managers/qualified professionals; 3 = Technicians/ associate professionals; 4 = Clerks/service workers; 5 = Qualified manual workers; 6 = Elementary manual workers). Tobacco smoking was evaluated through the question: "Do you use any tobacco product?"; answers were "yes, daily", "yes, but not daily" and "no". We considered those who answered "yes, daily" and "yes, but not daily" as having exposure and the dichotomous response was used as the covariate. Binging drinking in the past 30 days was created considering ≥5 doses in the same occasion for men and ≥4 doses in the same occasion for women. Participants reported on how many

days per week they consumed fruits. We adopted the cutoff point of consumption during five or more days in the week. Leisure-time TV-viewing was also considered in the analyses with the cut-off point of ≥3h/day (Ross et al., 2020). Self-rated health was classified as 0 = "very good" or "good"; 1 = "regular", "bad" or "very bad"

Statistical analysis

We used values of frequency and 95% confidence interval to describe the characteristics of the sample according to the level of depressive symptoms. We analyzed the associations of occupational physical activity and different stressful workplace characteristics with elevated depressive symptoms, as well as the association between occupational physical activity and stressful workplace characteristics using logistic regression models. We stratified the analyzes by gender, considering the different associations between stressful workplace characteristics and elevated depressive symptoms according to gender (Oenning et al., 2018). We also examined whether occupational activity (exposure variable) and stressful workplace characteristics (moderator/confounder) were jointly associated with depressive symptoms (outcome variable), and whether stressful characteristics moderated or confound this relationship, with the insertion of interaction terms. All the models were adjusted for age, ethnicity, educational achievement, type of occupation, fruit consumption, leisure-time physical activity, tobacco smoking, binging drinking, TV-viewing and self-rated health. The analyzes were conducted in the software Stata 15.1 (Stata Corporation, College Station, TX, USA).

Results

The final sample was composed of 36,442 adults (16,992 women), with a mean age of 39.3±12.6y, which reported being employed during the survey administration. The characteristics of the sample according to elevated depressive symptoms status (2,490 participants presented elevated depressive symptoms) are presented in **Table 1**. The proportion of women, middle-aged adults, intermediary education level, elevated occupational physical activity (both highest quintile and ≥150min/week), stressful work environment characteristics, inactive at leisure time, tobacco smoking, elevated TV-viewing and regular or poor self-rated health were higher among the group with elevated depressive symptoms.

Table 2 shows the association of occupational physical activity and stressful workplace characteristics with elevated depressive symptoms stratified by gender. Both cut-off points for occupational physical activity were associated with elevated depressive symptoms among both sexes (women: Q5: OR: 2.15; 95%CI:1.73-2.66, ≥150min/week: OR: 2.11; 95%CI: 1.68-2.65. Men: Q5: OR: 1.63; 95%CI:1.22-2.17, ≥150min/week: OR: 1.43; 95%CI: 1.09-1.88). Among men, workplace violence, exposure to noise, sun, urban waste, stress, night/shift work and the cluster of positive screening for at least stressful workplace characteristics were associated with elevated depressive symptoms, while among women, all stressful workplace characteristics were associated with elevated depressive symptoms, with exception of exposure to radioactive and biological materials.

The association between occupational physical activity and stressful work environment factors are presented in **Table 3**. Among men, workplace violence and exposure to radioactive materials were the only components that were not associated with occupational physical activity, while among women, only workplace night/shift work was not associated with occupational physical activity. Except for night/shift work,

which was associated to a lower occupational physical activity among men, all other work environmental factors were associated to a higher physical activity at work.

Table 4 shows the independent and combined associations of occupational physical activity and stressful workplace characteristics with elevated depressive symptoms. There were no interactions between occupational physical activity and stressful work environment characteristics. However, the odds of occupational physical activity reduced with the inclusion of stressful workplace characteristics in the model. Occupational physical activity reduced the association with elevated depressive symptoms among men (highest quintile: OR: 1.36; 95%CI: 1.08-1.91; ≥150min/week: OR: 1.25; 95%CI: 0.95-1.64) and women (highest quintile: OR: 1.83; 95%CI: 1.47-2.29; ≥150min/week: OR: 1.80; 95%CI: 1.42-2.27) with the inclusion of the cluster of positive screening for at least two stressful workplace characteristics, indicating a confounding role.

Discussion

We aimed to investigate the role of stressful environmental factors in the association between occupational physical activity and elevated depressive symptoms using a nationally representative survey among Brazilian adults. Our main finding was that stressful work environment characteristics did not moderate the association between occupation physical activity and elevated depressive symptoms, only acting as confounders in the association. These results indicate that the association between higher occupational physical activity and elevated depressive symptoms do not change depending on the presence of stressful workplace environment characteristics, and future studies should consider including stressful workplace environment characteristics as a confounding factor in the analysis of the association between occupational physical

activity and depressive symptoms, considering that stressful workplace environment characteristics were associated with both occupational physical activity and elevated depressive symptoms and acted as a confounder in the analyzes.

Taking into account the accumulation of evidence on a possible harmful association of greater occupational physical activity with mental health-related outcomes, including elevated depressive symptoms (Werneck et al., 2020; White et al., 2017), one of the hypotheses to explain this association would be that jobs that demand occupational physical activity greater would be those who also have a more stressful work environment (Holtermann et al., 2018; Oenning et al., 2018). In this sense, the deleterious association between occupational physical activity and high depressive symptoms could be potentiated or attenuated according to the presence of stressful characteristics in the work environment. However, we did not find a moderation, which indicates that there are possibly other factors that may potentiate or attenuate the association between occupational physical activity and high depressive symptoms.

We found that stressful workplace environment characteristics, associated with both depressive symptoms and higher occupational physical activity, could as a confounder in the association between occupational physical activity and elevated depressive symptoms. Considering that occupational physical activity can occur concomitantly with the stressful work environments, it would be possible that the role of occupational physical activity on depressive symptoms is overestimated and part of this association should exist due to stressful work environment characteristics. We highlight that the association between occupational physical activity and elevated depressive symptoms was not moderated by stressful work environments, which figured out as potential confounders of this association.

More specifically, we found that with the inclusion of stressful work environment characteristics clustering, the association between occupational physical activity and depressive symptoms was no longer significant among men and substantially reduced among women. In general, the association between occupational physical activity and depressive symptoms were stronger in women than in men, indicating that the energy expenditure of the occupation physical activity can potentially be more associated to depressive symptoms in women, while the role of stressful workplace characteristics can have a stronger role among men. Also, women may be more vulnerable than men to stressful work environments, in relation to depressive symptoms, including vigorous physical activity (Niedhammer et al., 2015; Oenning et al., 2018; Theorell et al., 2015).

Our findings could lead to different possible interventions. Considering occupational physical activity itself, more attention should be provided to the employees to minimize the need for recovery and consequently, improve the comfort in performing the work-related physical activity as through the promotion of relaxation work, increase the number of short breaks and stimulate leisure-time physical activity as well as relaxation activities at home (Arvidson et al., 2013; Coffeng et al., 2015). In concomitant, as part of the association between occupational physical activity and elevated depressive symptoms are derived from concomitant stressful work conditions, improvements in the protection of employees to stressful work environment and mental health support for those working in insalubrious activities are needed. Future research should also consider stressful workplace environment characteristics as confounders in the analyzes.

Our study presented data on a large nationally representative sample of Brazilian workers. However, our findings should be inferred considering potential limitations. The cross-sectional design does not allow us to assess the direction of causality. Also, all variables were self-reported and recall bias can be present. Even though the included

questionnaire on stressful workplace environment characteristics has not been previously validated, the questionnaire was created based on the questionnaire "Basic questionnaire and methodological criteria for Surveys on Working Conditions, Employment, and Health in Latin America and the Caribbean", which is a valid questionnaire (Benavides et al., 2016). However, the workplace environment characteristics were used in previous studies . Even with limitations, previous findings also showed that the section of occupational physical activity is moderately associated with device-measured methods (Kwak et al., 2012, 2011). Also, as there is no cut-off point for specific physical activity domains, we used two cut-off points, the 150 min/week as previously used (Werneck et al., 2020) and the highest quintile, increasing the comparability with other studies.

Conclusion

The association between occupational physical activity and elevated depressive symptoms was not moderated by stressful workplace environment characteristics, which acted as confounders in the association. Future studies should investigate the role of stressful work environment factors in the association between occupational physical activity and elevated depressive symptoms using prospective designs.

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Table 1. Characteristics of the sample (n = 36,442)

	Elevated depressive symptoms	
	No (n=33,952) % (95%CI)	**Yes** (n=2,490) % (95%CI)
Gender (Women)	41.4 (40.4-42.4)	66.3 (62.8-69.7)
Age group		
18-34	43.1 (42.2-44.0)	36.1 (32.9-39.4)
35-49	34.3 (33.5-35.2)	39.0 (35.7-42.4)
50-64	19.2 (18.4-20.0)	22.2 (19.4-25.3)
65+	3.3 (3.0-3.7)	2.7 (1.7-4.3)
Ethnicity		
White	48.6 (47.2-49.9)	45.8 (42.2-49.5)
Black	9.1 (8.5-9.7)	11.0 (9.2-13.1)
Mixed	41.0 (39.8-42.3)	42.6 (39.3-45.9)
Other	1.3 (1.1-1.5)	0.1 (0.5-1.5)
Educational achievement		
No formal education	8.6 (8.0-9.2)	10.4 (8.6-12.4)
Less than secondary	37.1 (36.0-38.2)	42.2 (38.9-45.6)
Complete secondary	37.8 (36.8-38.9)	32.4 (29.4-35.6)
Complete college or more	16.5 (15.5-17.5)	15.0 (12.4-17.9)
Type of occupation		
Military/police/firefighter	1.3 (1.1-1.5)	1.2 (0.6-2.3)
Managers/qualified professionals	15.6 (14.7-16.5)	13.8 (11.3-16.7)
Technicians/ associate professionals	16.6 (15.9-17.4)	13.4 (11.3-15.8)
Clerks/service workers	19.8 (19.0-20.6)	24.8 (22.0-27.9)
Qualified manual workers	28.5 (27.5-29.6)	21.8 (19.0-24.8)
Elementary manual workers	18.2 (17.4-19.1)	25.0 (22.3-28.0)
Occupational PA (highest quintile)	19.4 (18.5-20.3)	31.7 (28.5-35.0)
Occupational PA (≥150min/week)	22.5 (21.6-23.5)	30.3 (27.2-33.6)
Workplace violence (yes)	1.1 (0.9-1.3)	3.6 (2.4-5.3)
Exposure to chemical substances (yes)	17.7 (16.9-18.5)	26.2 (23.1-29.6)
Exposure to noise (yes)	32.3 (31.3-33.3)	39.5 (36.1-42.9)
Exposure to sun (yes)	28.5 (27.5-29.6)	29.4 (26.4-32.7)
Exposure to radioactive materials (yes)	1.6 (1.4-1.8)	1.9 (1.2-3.1)
Exposure to urban waste (yes)	7.0 (6.5-7.5)	13.8 (11.7-16.3)
Exposure to biological materials (yes)	4.7 (4.3-5.2)	7.1 (5.5-9.1)
Exposure to marble dust (yes)	9.1 (8.5-9.7)	9.8 (7.9-12.0)
Exposure to stress (yes)	33.9 (32.8-35.1)	58.4 (55.0-61.7)
Night/shift work (yes)	14.6 (14.0-15.4)	18.1 (15.7-20.9)
At least two exposures (yes)	43.6 (42.7-44.6)	60.4 (56.9-63.9)
Leisure-time PA (≥150min/week)	21.3 (20.5-22.1)	15.6 (13.3-18.3)
Fruit consumption (≥5 days/week)	40.1 (39.1-41.2)	40.9 (37.6-44.3)
Tobacco smoking (yes)	14.8 (14.1-15.5)	20.6 (18.1-23.4)
Binging drinking (yes)	13.3 (12.7-14.0)	13.1 (11.1-15.3)
TV-viewing (≥3h/day)	23.3 (22.4-24.3)	28.5 (25.5-31.7)
Regular or poor self-rated health (yes)	22.6 (21.7-23.4)	54.5 (51.0-58.0)

Note. CI, confidence interval. PA, physical activity.

Table 2. Association of occupational physical activity and stressful workplace characteristics with elevated depressive symptoms according to gender (n = 36,442).

	Men (n=19,450) OR (95%CI)	**Women** (n=16,992) OR (95%CI)
Occupational PA		
Q5 (ref: Q1-Q4)	1.63 (1.22-2.17)	2.15 (1.73-2.66)
≥150min/week (ref: <150min/week)	1.43 (1.09-1.88)	2.11 (1.68-2.65)
Stressful workplace characteristics		
Workplace violence (ref: No)	4.51 (1.93-10.51)	2.83 (1.65-4.88)
Exposure to chemical substances (ref: No)	1.35 (1.00-1.83)	2.08 (1.65-2.62)
Exposure to noise (ref: No)	1.56 (1.21-2.02)	1.97 (1.62-2.41)
Exposure to sun (ref: No)	1.46 (1.12-1.90)	1.48 (1.18-1.86)
Exposure to radioactive materials (ref: No)	1.64 (0.74-3.62)	1.26 (0.68-2.36)
Exposure to urban waste (ref: No)	1.97 (1.29-3.00)	1.62 (1.28-2.05)
Exposure to biological materials (ref: No)	1.63 (0.90-2.96)	1.42 (1.00-2.03)
Exposure to marble dust (ref: No)	1.31 (0.93-1.84)	2.51 (1.74-3.63)
Exposure to stress (ref: No)	3.16 (2.45-4.06)	3.32 (2.77-3.97)
Night/shift work (ref: No)	1.80 (1.35-2.41)	1.35 (1.06-1.72)
At least two conditions (ref: No)	2.45 (1.84-3.26)	2.44 (2.02-2.93)

Note. Adjusted age, ethnicity, educational achievement, type of occupation, fruit consumption, leisure-time physical activity, tobacco smoking, binging drinking, TV-viewing and self-rated health. PA, physical activity. OR, odds ratio. CI, confidence interval.

Table 3. Association between work environment characteristics and occupational physical activity according to gender and cut-off point (n = 36,442).

	Men (n=19,450)		**Women** (n=16,992)	
	Occupational physical activity		**Occupational physical activity**	
	Highest quintile	**≥150min/week**	**Highest quintile**	**≥150min/week**
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
Workplace violence (ref: no)	0.84 (0.51-1.39)	0.98 (0.59-1.64)	1.72 (1.09-2.73)	1.19 (0.67-2.13)
Exposure to chemical substances (ref: no)	1.86 (1.58-2.21)	2.00 (1.72-2.32)	2.19 (1.85-2.60)	2.31 (1.92-2.78)
Exposure to noise (ref: no)	1.68 (1.47-1.92)	1.77 (1.58-1.99)	1.59 (1.35-1.87)	1.60 (1.34-1.91)
Exposure to sun (ref: no)	3.03 (2.63-3.49)	2.76 (2.43-3.13)	1.13 (1.74-2.61)	1.85 (1.52-2.27)
Exposure to radioactive materials (ref: no)	1.15 (0.69-1.90)	1.21 (0.76-1.93)	2.33 (1.36-4.00)	2.67 (1.50-4.73)
Exposure to urban waste (ref: no)	1.51 (1.19-1.91)	1.66 (1.33-2.09)	2.17 (1.76-2.69)	2.29 (1.84-2.85)
Exposure to biological materials (ref: no)	1.13 (0.78-1.64)	1.47 (1.02-2.13)	2.08 (1.54-2.81)	2.18 (1.57-3.03)
Exposure to marble dust (ref: no)	2.33 (1.99-2.74)	2.38 (2.04-2.77)	1.86 (1.30-2.68)	1.99 (1.36-2.91)
Exposure to stress (ref: no)	1.24 (1.08-1.44)	1.25 (1.10-1.42)	2.06 (1.77-2.41)	2.14 (1.80-2.54)
Night/shift work (ref: no)	0.60 (0.50-0.72)	0.64 (0.55-0.76)	1.16 (0.92-1.45)	1.11 (0.87-1.42)
At least two conditions (ref: no)	2.07 (1.80-2.39)	2.12 (1.87-2.39)	2.40 (2.07-2.80)	2.43 (2.06-2.87)

Note. Adjusted for age, ethnicity, educational achievement, type of occupation, fruit consumption, leisure-time physical activity, tobacco smoking, binging drinking, TV-viewing and self-rated health. OR, odds ratio. CI, confidence interval.

Table 4. Independent and combined associations of occupational physical activity and stressful workplace characteristics with elevated depressive symptoms according to gender and cut-off point (n = 36,442).

	Men (n=19,450)		**Women** (n=16,992)	
	Occupational physical activity		**Occupational physical activity**	
	Highest quintile OR (95%CI)	**≥150min/week** OR (95%CI)	**Highest quintile** OR (95%CI)	**≥150min/week** OR (95%CI)
Adjusted model + workplace violence				
Workplace violence (ref: No)	4.58 (1.95-10.77)	4.53 (1.94-10.58)	2.64 (1.50-4.64)	2.75 (1.56-4.86)
Occupational PA (ref: No)	1.64 (1.22-2.19)	1.44 (1.09-1.89)	2.12 (1.71-2.64)	2.10 (1.67-2.64)
Interaction	0.30 (0.05-1.77)	0.85 (0.12-5.92)	1.21 (0.32-4.59)	1.21 (0.30-4.91)
Adjusted model + exposure to chemical substances				
Exposure to chemical substances (ref: No)	1.29 (0.95-1.75)	1.30 (0.95-1.76)	1.90 (1.50-2.40)	1.91 (1.51-2.41)
Occupational PA (ref: No)	1.58 (1.18-2.12)	1.39 (1.06-1.83)	1.98 (1.59-2.47)	1.93 (1.53-2.43)
Interaction	1.00 (0.54-1.87)	0.96 (0.52-1.75)	0.88 (0.56-1.39)	0.85 (0.53-1.36)
Adjusted model + exposure to noise				
Exposure to noise (ref: No)	1.50 (1.16-1.93)	1.51 (1.17-1.94)	1.89 (1.54-2.31)	1.90 (1.55-2.32)
Occupational PA (ref: No)	1.54 (1.16-2.05)	1.35 (1.04-1.77)	2.04 (1.64-2.53)	2.01 (1.59-2.53)
Interaction	1.28 (0.71-2.30)	1.46 (0.84-2.53)	1.04 (0.68-1.60)	0.99 (0.64-1.54)
Adjusted model + exposure to sun				
Exposure to sun (ref: No)	1.34 (1.01-1.78)	1.37 (1.04-1.82)	1.32 (1.05-1.67)	1.36 (1.07-1.72)
Occupational PA (ref: No)	1.51 (1.11-2.05)	1.33 (1.00-1.77)	2.08 (1.67-2.59)	2.05 (1.62-2.58)
Interaction	0.95 (0.50-1.78)	0.99 (0.54-1.79)	0.95 (0.60-1.51)	0.78 (0.47-1.30)
Adjusted model + exposure to radioactive materials				
Exposure to radioactive materials (ref: No)	1.62 (0.73-3.56)	1.62 (0.73-3.58)	1.14 (0.63-2.05)	1.13 (0.63-2.04)
Occupational PA (ref: No)	1.62 (1.21-2.17)	1.43 (1.09-1.88)	2.14 (1.73-2.66)	2.11 (1.68-2.65)
Interaction	1.55 (0.37-6.62)	1.66 (0.37-7.53)	2.54 (0.63-10.28)	2.98 (0.69-12.77)
Adjusted model + exposure to urban waste				
Exposure to urban waste (ref: No)	1.92 (1.25-2.94)	1.91 (1.25-2.94)	1.43 (1.13-1.82)	1.44 (1.13-1.83)
Occupational PA (ref: No)	1.60 (1.19-2.15)	1.40 (1.06-1.85)	2.07 (1.66-2.58)	2.03 (1.60-2.56)
Interaction	1.07 (0.46-2.47)	1.04 (0.44-2.46)	1.35 (0.80-2.26)	1.07 (0.63-1.80)
Adjusted model + exposure to biological materials				
Exposure to biological materials (ref: No)	1.63 (0.89-2.99)	1.58 (0.86-2.92)	1.33 (0.93-1.88)	1.33 (0.94-1.89)
Occupational PA (ref: No)	1.62 (1.21-2.17)	1.42 (1.08-1.87)	2.12 (1.71-2.63)	2.09 (1.66-2.62)
Interaction	0.78 (0.22-2.72)	0.53 (0.16-1.70)	1.40 (0.64-3.09)	1.61 (0.70-3.72)
Adjusted model + exposure to marble dust				
Exposure to marble dust (ref: No)	1.20 (0.84-1.72)	1.22 (0.85-1.75)	2.32 (1.61-3.35)	2.32 (1.61-3.35)
Occupational PA (ref: No)	1.59 (1.17-2.15)	1.39 (1.05-1.86)	2.10 (1.69-2.60)	2.06 (1.64-2.58)
Interaction	0.70 (0.35-1.41)	0.68 (0.33-1.40)	1.70 (0.78-3.71)	1.77 (0.76-3.81)
Adjusted model + exposure to stress				
Stress (ref: No)	3.11 (2.42-3.99)	3.11 (2.42-4.00)	3.10 (2.59-3.71)	3.12 (2.61-3.73)
Occupational PA (ref: No)	1.53 (1.16-2.04)	1.34 (1.02-1.75)	1.83 (1.47-2.27)	1.78 (1.42-2.24)

Interaction	1.57 (0.89-2.75)	1.39 (0.81-2.36)	1.31 (0.89-1.93)	1.46 (0.98-2.20)
Adjusted model + night/shift work				
Night/shift work (ref: No)	1.88 (1.40-2.53)	1.85 (1.38-2.50)	1.33 (1.04-1.70)	1.33 (1.05-1.70)
Occupational PA (ref: No)	1.70 (1.27-2.29)	1.49 (1.13-1.96)	2.14 (1.72-2.65)	2.11 (1.68-2.65)
Interaction	0.88 (0.45-1.73)	1.11 (0.57-2.17)	0.68 (0.39-1.18)	0.75 (0.42-1.37)
Adjusted model + at least two conditions				
At least two conditions (ref: No)	2.36 (1.77-3.15)	2.38 (1.79-3.17)	2.25 (1.86-2.72)	2.27 (1.88-2.75)
Occupational PA (ref: No)	1.36 (1.08-1.91)	1.25 (0.95-1.64)	1.83 (1.47-2.29)	1.80 (1.42-2.27)
Interaction	1.21 (0.64-2.28)	1.22 (0.68-2.17)	0.95 (0.61-1.46)	0.90 (0.57-1.41)

Note. Adjusted for age, ethnicity, educational achievement, type of occupation, fruit consumption, leisure-time physical activity, tobacco smoking, binging drinking, TV-viewing and self-rated health. OR, odds ratio. CI, confidence interval.