

ORIGINAL ARTICLE

Occupational stress and cardiovascular risk among healthcare workers: a cross-sectional survey study

Mohammed J. M Kaware^{1*}, Mohammad Ali Maksoud², Anas Shmbal³,
Nada Gargab⁴, Olaa Awad Mohamed Ahmed Ismail⁵

Full list of author information is available at the end of the article.

ABSTRACT

Background: Work stress among health professionals is an increasing area of concern, which adds to the risk of cardiovascular disease (CVD). Stressful work conditions can also contribute to poor health habits like smoking and a lack of physical exercise when experienced over a prolonged period.

Aim: To evaluate the relationship between occupational stress and cardiovascular risk factors in Saudi Arabian healthcare workers.

Methods: A cross-sectional survey of 303 healthcare workers in Care Medical Hospital, Riyadh, Saudi Arabia was performed with the use of a structured questionnaire that covered demographic data, level of occupational stress, and cardiovascular risk factors such as blood pressure, blood sugar, body mass index (BMI), smoking status, physical activity, and chronic disease history. Descriptive and inferential statistical tests were used to compute associations through statistical analyses.

Results: The majority of healthcare employees identified a low level of occupational stress; yet, the stress level was significantly related to younger age, marital status, smoking, and hypertension ($p < 0.05$). The level of blood sugar was surprisingly greater in the non-stressed group ($p = 0.011$). The researchers found no significant differences in BMI or the prevalence of diabetes between stressed and non-stressed groups.

Conclusion: The results obtained show that occupational stress is closely related to certain cardiovascular risk factors, in particular, smoking and hypertension. Health care is a high-stress environment that requires targeted stress management and wellness programs to help eliminate long-term CVD risk factors.

Keywords: Occupational stress, cardiovascular risk, healthcare workers, hypertension, smoking, Saudi Arabia.

Introduction

Cardiovascular diseases (CVDs) are those diseases involving the heart and/ or blood vessels. The major conditions of CVDs include stroke, coronary heart disease, cardiomyopathy, arrhythmia, and heart valve issues [1]. CVD is the main reason of more than one-half of all mortalities in developed regions [2].

The prevalence of CVDs in Saudi Arabia among those aged 15 years and older is 1.6%, with a male prevalence of 1.9% and a female prevalence of 1.4% [3]. In Saudi Arabia, there are various factors that have elevated the risk of CVDs, such as changes in lifestyle, urbanization, and socio-economic status [4].

The identification of CVD risk factors might influence the prevention and planning of CVDs [5]. The risk factors of CVDs include low physical activity, overweight, smoking, high blood pressure, hyper-insulinemia, high blood cholesterol, and stress [6]. Stress related to home, work, live events, or financial conditions accounts for

Correspondence to: Mohammed J. M Kaware

*General Practitioner, Care Medical Hospital, Riyadh, Saudi Arabia.

Email: Dr.mohjabr@gmail.com

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32.5% of the population attributable risk for myocardial infarction [7].

Stress is an emotional, mental, and physical response to the feeling of danger from internal or external stimulators or factors [8]. Occupational stress (OS) is a psychological and physical stress that occurs when there is inconsistency between the abilities of the individual or worker and the cognitive demands of the job [9].

In hospital settings, most workers' stress is caused by the overload of work, inadequate resources, repetitive duties, long working hours, management issues, inadequate allocation of work, and psychological work environment such as inappropriate behavior and physical environment such as disruption, temperature, space, and lighting [10].

Additionally, healthcare workers are a unique high-risk category concerning CVDs due to their roles that demand prolonged working hours, irregular shift patterns that contribute to CVD progression [11]. OS is a very common issue in modern life, and it is increasing; it impacts the cardiovascular system (CVS) [12]. In the working environment, the CVS can be affected by several factors, including OS, and physical factors [12].

Stress can affect the CVS through psycho-neuro-physiological mechanisms and stimulate the autonomic nervous system, especially the sympathetic, leading to an elevation in the cardiovascular function, which then may lead to heart disease occurrence [13]. The mechanisms by which stress can influence CVD can be either direct or indirect; the direct mechanism, involves factors related to hypertension, high level of cholesterol, and triglycerides. On the other hand, the indirect mechanism involves behavioral risk factors such as smoking and the reduction of physical activity [14].

The correlations between OS and CVD risk factors such as smoking, diabetes, and triglyceride levels revealed contradictory findings [12]. Additionally, no previous Saudi study has investigated this subject among healthcare workers.

Aim of study

This study intends to examine the connection between OS and CVD risk in healthcare workers (HCWs). More specifically, the research aims at estimating the cardiovascular diseases and related risk factors prevalence, determining the occupational stress level in this group of population group, examining the relationship between occupational stress and CVD risk factors, as well as determining whether occupational stress can be a strong predictor of CVD risk in healthcare workers.

Materials and Methods

Study design

This study adopted a cross-sectional survey design to evaluate the prevalence and relationship between

occupational stress and cardiovascular risk factors among healthcare workers. It was conducted at Care Medical Hospital - Riyadh, Saudi Arabia, from 15 April to 15 May 2025. The target population included all clinical healthcare workers at the facility, including doctors, nurses, and paramedics, who met the inclusion criteria and provided informed consent. A convenience sampling technique was used to recruit participants. Non-clinical staff, those who refused to participate, or who were unavailable during the study period, were excluded. Ethical approval was obtained from the Ethics Committee, and written informed consent was collected from all participants. Confidentiality and anonymity were maintained, and the data were used solely for research purposes.

Data collection tool

The instrument used in collecting data was a structured survey, which consisted of two major sections:

Section I: Demographics and cardiovascular risk factors

This section collected data regarding demographic features (age, gender, marital status, job title, years of experience, and department) and cardiovascular risk factors of the participants, such as body mass index (BMI), lipid profile, blood pressure, smoking status, diabetes, and blood glucose levels. Laboratory data were self-reported regarding the latest clinical investigation of the participants.

Section II: Occupational stress evaluation

The assessment of occupational stress was based on the Osipow occupational stress inventory, which is a valid and reliable instrument and was applied in other studies [15]. The survey was composed of 60 questions based on 6 subscales. A five-point Likert scale (1 = never to 5 = most of the time) was used to score responses, and total scores fell into the following categories:

- 60 - 119: Trivial stress
- 120 - 179: Moderate stress
- 180 - 239: Moderate to acute stress
- 240 - 300: Acute stress

The Osipow questionnaire had already proven to have established validity and reliability in other researches [15], thus further validation was not necessary in this study.

Data analysis

SPSS version 25 was utilized in analyzing data. Descriptive statistics were reported (mean standard deviation in case of continuous variables, and frequency/percent in case of categorical variables). The relationships between occupational stress and cardiovascular risk factors were determined with the help of the relevant statistical tests)

Chi-square categorical variables test, Student's *t*-test or ANOVA for continuous variables, and Statistical significance was set at a *p*-value of 0.05 or below).

Results

Table 1 results revealed that the prevalent age group of the respondents was (31-35) years (19.1%), then (51-55) years (16.5%). Another significant age group was 36-40 years (14.5%), as well as (46-50) and (56-60) years (13.9% each). The largest group, 25-30 years, constituted 9.9%, whereas the smallest group, (60-65) years, comprised 6.9%. In terms of sex, over half of the respondents were male (53.8%), whereas females comprised 46.2%. Concerning marital status, most of the respondents were married (58.4%). There were 16.8% single and 16.8% widowed, and 7.9% were divorcees.

Concerning job experience as in Table 2, the majority of the participants had 11-20 years of service (42.6%), whereas 33.7% had 1-10 years of experience. Fewer, 23.8%, had over 20 years' experience. Regarding the working hours, most of the healthcare workers (69.7%) had to work more than 6 hours daily, whereas 31.3% had to work less than 6 hours. Such results indicate that the sample includes a high percentage of experienced workers, who have long work hours that can be a contributing factor to occupational stress and consequent health risks.

Table 3 results revealed that of the total 303 healthcare workers, 19.1% were smokers and 80.9% were non-smokers. The prevalence of one or more cardiovascular risk factors was approximately 41.6%: diabetes (13.9%), hypertension (15.2%), stroke (8.6%), and history of

myocardial infarction (4%). Nevertheless, 58.4% stated they have no risk factors. Concerning BMI, more than half (52.5%) were normal, 27.7% were overweight, and 16.8% were obese. Just 3% were underweight. The majority of the participants (83.2%) had normal blood pressure reading, yet 14.9% had high readings. Likewise, normal blood sugar levels were evident in 92.1%, whereas 7.9% indicated high levels. Finally, 55.1% reported not engaging in physical exercise, indicating a majority had sedentary habits that could contribute to long-term cardiovascular risk.

Table 4 results indicated that most healthcare workers experienced low perceived occupational stress levels. The majority of the participants reported that their working environment was neither uncomfortable nor hazardous (65.3%), and half of them (50.8%) believed that their occupation did not adversely influence their physical or emotional health. Few (38.9%) never felt overwhelmed due to excessive workloads or deadlines, while 26.5% felt this occasionally or frequently. More than one-half

Table 2. Description of work circumstances.

Description (n = 303)	
Length in the job (years)	
• 1-10	102 (33.7)
• 11-20	129 (42.6)
• >20	72 (23.8)
Working hours	
• <6 hours	94 (31)
• >6 hours	209 (69)

Table 1. Description of the basic characteristics.

Description (n = 303)	
Age	
• 25-30	30 (9.9)
• 31-35	58 (19.1)
• 36-40	44 (14.5)
• 41-45	16 (5.3)
• 46-50	42 (13.9)
• 51-55	50 (16.5)
• 56-60	42 (13.9)
• 60-65	21 (6.9)
Sex	
• Male	163 (53.8)
• Female	140 (46.2)
Marital status	
• Single	51 (16.8)
• Married	177 (58.4)
• Divorced	24 (7.9)
• Widowed	51 (16.8)

Table 3. Description of risk factors.

Description (n = 303)	
Smoking	
• Yes	58 (19.1)
• No	245 (80.9)
Risk factors	
• Diabetes	126 (41.6)
• Hypertension	42 (13.9)
• Myocardial infarction	46 (15.2)
• Stroke	12 (4)
• No Risk factors	26 (8.6)
	177 (58.4)
BMI	
• Underweight	9 (3)
• Normal weight	159 (52.5)
• Overweight	84 (27.7)
• Obese	51 (16.8)
Blood pressure	
• Low	6 (2)
• High	45 (14.9)
• Normal	252 (83.2)
Physical exercise	
• Yes	136 (44.9)
• No	167 (55.1)

Table 4. Occupational stress questionnaire.

	Never	Rarely	Sometimes	Often	Very often
Conditions at work are unpleasant or sometimes even unsafe	198 (65.3)	82 (27.1)	14 (4.6)	9 (3)	0 (0)
I feel that my job is negatively affecting my physical or emotional well-being.	154 (50.8)	138 (45.5)	2 (0.7)	9 (3)	0 (0)
I have too much work to do an/or too many unreasonable deadlines.	118 (38.9)	105 (34.7)	45 (14.9)	35 (11.6)	0 (0)
I find it difficult to express my opinions or feelings about my job conditions to my superiors.	159 (52.5)	103 (34)	22 (7.3)	19 (6.3)	0 (0)
I feel that job pressures interfere with my family or personal life.	179 (59.1)	67 (22.1)	47 (15.5)	10 (3.3)	0 (0)
I feel that I have inadequate control or input over my work duties.	207 (68.3)	71 (23.4)	9 (3)	16 (5.3)	0 (0)
I receive inadequate recognition or rewards for good performance.	202 (66.7)	73 (24.1)	18 (5.9)	10 (3.3)	0 (0)
I am unable to fully utilize my skills and talents at work.	196 (64.7)	88 (29)	9 (3)	10 (3.3)	0 (0)

Table 5. Distribution of occupational stress levels among healthcare workers.

Description (n = 303)	
Occupational stress level	
• Chilled out and relatively calm	249 (82.2)
• Fairly low	44 (14.5)
• Moderate stress	0 (0)
• Severe	1 (0.3)
• Stress level is potentially dangerous	9 (3)

Table 6. Association between demographic variables and occupational stress among healthcare workers.

	Occupational Stress level		p value
	Present (n = 54)	Absent (n = 249)	
Age			
• 25-30	9 (16.7)	21 (8.4)	0.000
• 31-35	18 (33.3)	40 (16.1)	
• 36-40	2 (3.7)	42 (16.9)	
• 41-45	1 (1.9)	15 (6)	
• 46-50	6 (11.1)	36 (14.5)	
• 51-55	0 (0)	50 (20.1)	
• 56-60	9 (16.7)	33 (13.3)	
• 60-65	9 (16.7)	12 (4.8)	
Sex			
• Male	29 (53.7)	134 (53.8)	0.988
• Female	25 (46.3)	115 (46.2)	
Marital status			
• Single	2 (3.7)	49 (19.7)	0.000
• Married	43 (79.6)	134 (53.8)	
• Divorced	0 (0)	24 (9.6)	
• Widow	9 (16.7)	42 (16.9)	

Bold value denotes: significant *p* value.

(52.5%) reported no difficulty in sharing opinions with those in authority, and 59.1 percent believed that work demands did not encroach on personal life. The majority of the respondents believed they possess adequate control in their responsibilities (68.3%), are recognized adequately (66.7%), and are able to utilize their abilities (64.7%).

In Table 5, the results revealed that most of the healthcare workers (82.2%) felt chilled out and relatively calm, reflecting very low occupational stress levels. A further 14.5% suffered a rather low stress level. Interestingly, all respondents either had low levels of stress or no stress at all, with only one participant (0.3%) having severe stress. Very few (3%) were in the potentially dangerous category of stress. These results indicate that the majority of healthcare employees in the sample were adjusting adequately to their working conditions, with only a very insignificant percentage experiencing excessive workplace pressure.

The Table 6 and Figure 1 results indicated that the analysis of the demographic factors related to occupational stress among the healthcare workers had significant results. The statistically significant correlates of occupational stress were age and marital status ($p = 0.000$). Healthcare workers of younger age, especially between 25 and 35 years old, had a higher proportion of stressed workers than older age groups, with 33.3% of stressed workers falling between 31 and 35 years old. Conversely, workers in the age group of 51-55 reported no stress. The marital status also impacted the stress levels, as the married people were the majority among those who experienced stress (79.6%), whereas single and divorced members reported lower stress levels. Nevertheless, the relationship between sex and occupational stress was not significant ($p = 0.988$) since the percentage of males and females who were stressed was almost equal. These findings indicate that age and marital status play a significant role in connection with occupational stress among persons in this group.

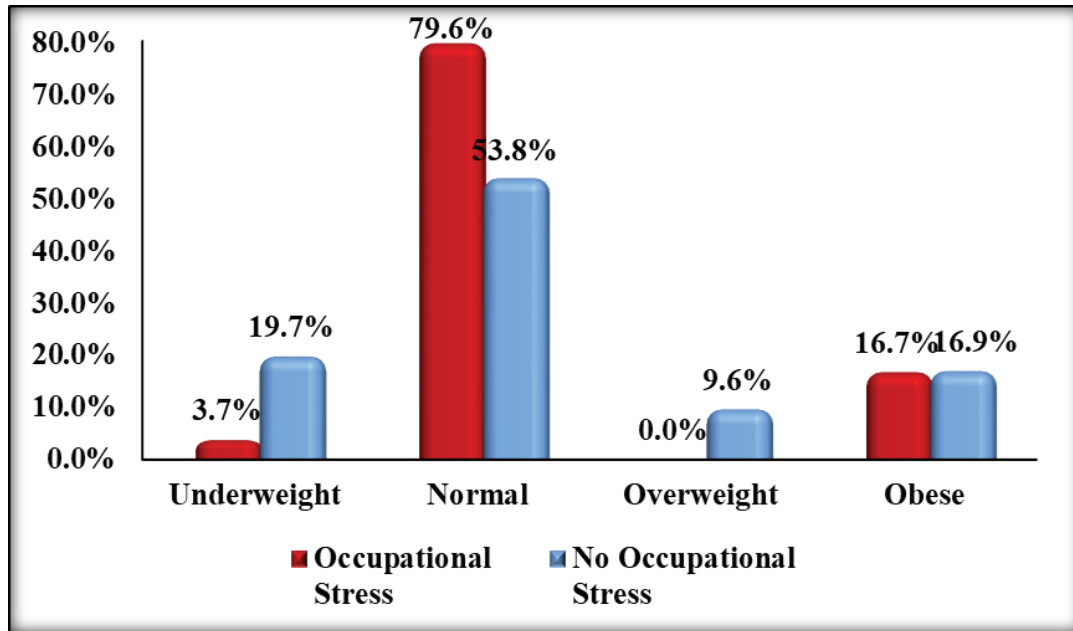


Figure 1. Association between demographic variables and occupational stress among healthcare workers.

Table 7. Association between occupational stress and work circumstances among healthcare workers.

	Occupational Stress level		p value
	Present (n = 54)	Absent (n = 249)	
Length in the job (years)			
• 1-10	20 (37)	82 (32.9)	0.470
• 11-20	19 (35.2)	110 (44.2)	
• >20	15 (27.8)	57 (22.9)	
Working hours			
• <6 hours	37 (68.5)	57 (22.9)	0.000
• >6 hours	17 (31.5)	192 (77.1)	

Bold value denotes: significant p value.

The results in Table 7 and Figure 2 show that the length of time on the job has no statistically significant relationship with the occurrence of occupational stress among healthcare workers ($p = 0.470$). Employees who had experienced less than 10 years, 11 and 20 years, and over 20 years of work had similar stress levels. Nevertheless, the correlation between the number of working hours and the level of stress was significant ($p = 0.000$). Interestingly, 68.5% of the workers with occupational stress had worked fewer than 6 hours, compared to 31.5% of the workers who had worked over 6 hours.

The results presented in Table 8 and Figure 3 depict occupational stress showing a distinct correlation with various health-related risk factors of the participants. Occupational stress was also much more common in smokers; 44.4% of the stressed group were smokers versus only 13.7% of the non-stressed group ($p = 0.000$),

showing a close connection between stress and tobacco consumption. Stress was also associated with other significant risk factors, such as hypertension. More than one-third (35.2%) of the respondents with occupational stress had hypertension, whereas only 10.8% of those without stress did, and the difference was statistically significant ($p = 0.000$). Interestingly, no one among the stressed people had a history of stroke or myocardial infarction, whereas 10.4% and 4.8% of the non-stressed group had it, respectively. Although the p -value was not significant in myocardial infarction ($p = 0.134$), the lack of stroke in the stressed group and the occurrence of stroke in the non-stressed group resulted in a significant p -value (0.007).

In other risk factors, the prevalence of diabetes in the stressed group was 16.7% and 13.3% in the non-stressed group, with no significant difference ($p = 0.510$). The broad term of risk factors (which can encompass any number of comorbid conditions) was somewhat more common in the stressed group (51.9% vs. 39.4%), but this was also not found to be significant ($p = 0.091$).

Regarding the BMI, the groups did not differ significantly ($p = 0.320$). Nevertheless, the proportion of overweight people was higher in the stressed (35.2%) than in the non-stressed (26.1%) group, whereas obesity prevalence was almost equal in both groups (16.7% vs. 16.9%). There were no underweight stressed people, against 3.6% of the non-stressed population.

In general, occupational stress is strongly related to smoking and hypertension, whereas other correlates, including diabetes, BMI, and history of cardiovascular events, were less strongly related and not statistically significant. These results support the need to focus

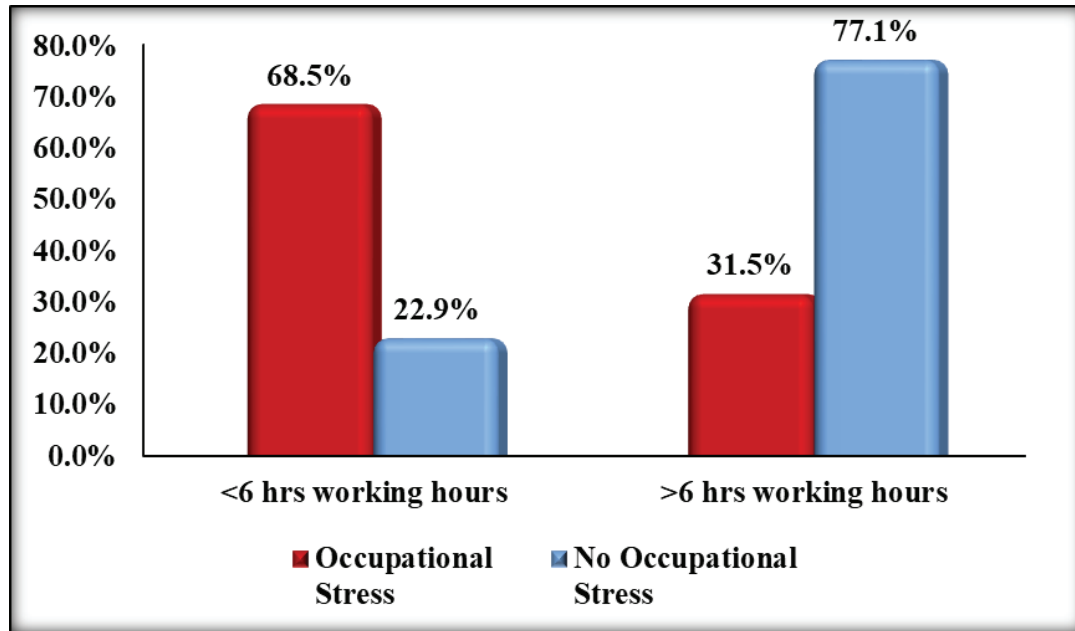


Figure 2. Association between occupational stress and work circumstances among healthcare workers.

Table 8. Association between occupational stress and health-related risk factors among participants.

	Occupational Stress level		p value
	Present (n = 54)	Absent (n = 249)	
Smoking			
• Yes	24 (44.4)	34 (13.7)	0.000
• No	30 (55.6)	215 (86.3)	
Risk factors	28 (51.9)	98 (39.4)	0.091
• Diabetes	9 (16.7)	33 (13.3)	0.510
• Hypertension	19 (35.2)	27 (10.8)	0.000
• Myocardial infarction	0 (0)	12 (4.8)	0.134
• Stroke	0 (0)	26 (10.4)	0.007
• No risk factors	26 (48.1)	151 (60.6)	0.091
BMI			
• Underweight	0 (0)	9 (3.6)	0.320
• Normal weight	26 (48.1)	133 (53.4)	
• Overweight	19 (35.2)	65 (26.1)	
• Obese	9 (16.7)	42 (16.9)	

Bold value denotes: significant *p* value.

on stress management as part of occupational health interventions, particularly to prevent or address hypertension and encourage smoking cessation.

Table 9 results indicate that there are relationships between occupational stress and some health indicators among 303 respondents. There was no statistically significant difference ($p = 0.485$) in blood pressure levels between stressed and non-stressed individuals, with the majority

of the participants in both groups registering normal values. Blood sugar levels; however, were statistically significantly associated with stress ($p = 0.011$), with none of the stressed participants having high blood sugar and 9.6% of the non-stressed participants. Such a surprise finding could be evidence of confounding variables or coping responses in people under stress. Concerning the physical activity, the prevalence of exercise among the respondents with occupational stress (53.7%) was higher than that of respondents without stress (43%), but the difference was not significant ($p = 0.151$).

Discussion

Overall, the research in 303 HCWs indicated rather low rates of work-related stress, but found strong relationships between stress and certain risk factors, including smoking and hypertension. In line with other researchers such as Ogunmoroti et al. [16], who determined that younger employees had a higher likelihood of reporting work-related stress and poor cardiovascular health outcomes, we also identified higher stress levels among the 25 35-year-old age groups. Likewise, Oso and Atolagbe [17] found that primary HCWs in Nigeria had high stress and a 38.6% hypertension prevalence, which is comparable to our study that showed a significant hypertension prevalence among stressed HCWs (35.2% vs. 10.8%, $p = 0.000$).

Although the multi-ethnic cohort study by Ogunmoroti et al. [16] revealed that workers with stress were less likely to have ideal cardiovascular measures, such as blood pressure and glucose, we did not replicate their finding of high blood pressure and glucose in stressed individuals.

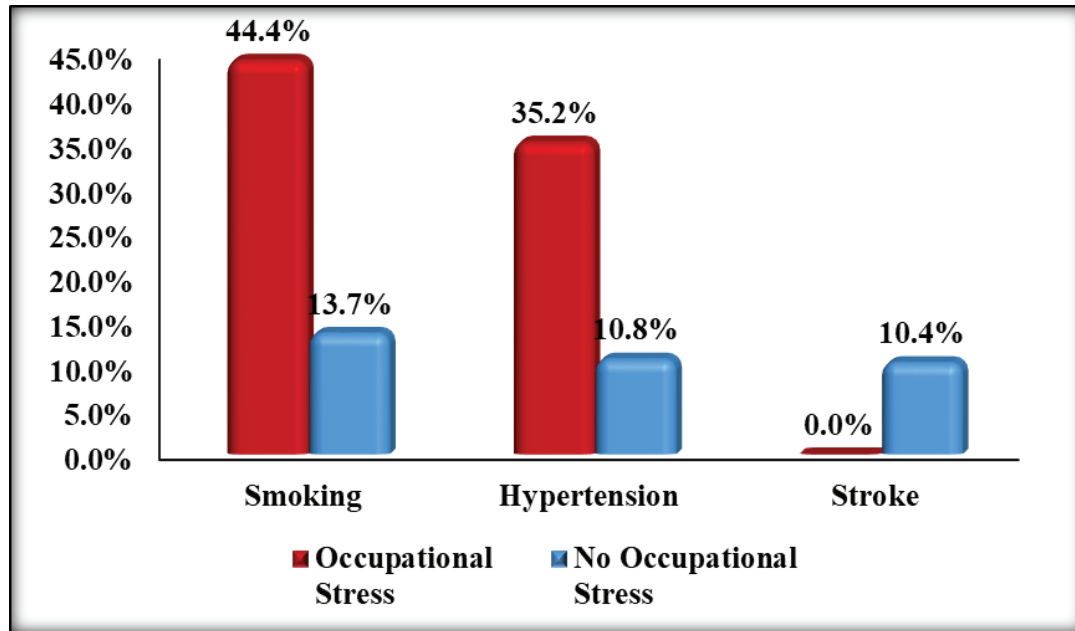


Figure 3. Association between occupational stress and health-related risk factors among participants.

Table 9. Association between occupational stress and physiological indicators (Blood Pressure, Blood Sugar, and Physical Exercise) among participants.

	Occupational Stress level		p value
	Present (n = 54)	Absent (n = 249)	
Blood pressure			
• Low	0 (0)	6 (2.4)	0.485
• High	9 (16.7)	36 (14.5)	
• Normal	45 (83.3)	207 (83.1)	
Blood sugar level			
• High	0 (0)	24 (9.6)	0.011
• Normal	54 (100)	225 (90.4)	
Physical exercise			
• Yes	29 (53.7)	107 (43)	0.151
• No	25 (46.3)	142 (57)	

Bold value denotes: significant *p* value.

Actually, none of our stressed subjects had elevated blood sugar, versus 9.6% of the non-stressed group ($p = 0.011$).

Our results regarding the strong association between smoking and occupational stress are consistent with the general evidence that stress fosters unhealthy habits, such as smoking, alcohol consumption, and inappropriate diet. Meta-analyses support the fact that job strain and effort-reward imbalance do increase the risk of hypertension and coronary heart disease [18]. This is a well-recognized association, which is supported by our finding of significantly increased hypertension in stressed HCWs. Also, the findings of Landsbergis et al. [19] highlight

the importance of higher ambulatory blood pressure in relation to job strain.

Surprisingly, our data also indicated that individuals with less than 6 hours of work per day experienced more stress, which could be related to burnout trends or collapsed workload stressors. Conversely, the majority of literature relates long work hours (>55 hour/week) to increased CVD risk, including a meta-analysis showing a 1.13-fold higher risk of coronary heart disease [20]. This difference could reflect contextual workplace relations unique in our study population. Similar to the Italian logistics worker study, job support, control, and physical activity have protective value against cardiovascular risk [21]. These mitigating factors may be the reason behind the generally low stress reports in our cohort, which may be an indication of structured work environments or conducive workplace cultures.

These study findings, which illustrated that younger and married healthcare workers, have a considerably high amount of occupational stress. In a cross-sectional study of hospital employees, nurses, and residents who were younger had higher burnout and emotional exhaustion compared to their older counterparts [22]. The finding of marriage being associated with higher stress levels reflects other environments - the usual suspect is integrated personal and work demands [23]. On the other hand, a systematic review of Ethiopian health workers reported that marital status was not associated with job stress [24].

The analysis of health risk behavior showed that stress was closely linked to smoking and hypertension, which aligns with a large-scale cross-sectional study that found that each 1-hour increase in work was linked to a 0.06%-point higher odds of hypertension ($p < 0.01$)

[25]. A Chinese industrial group also observed that there is a synergistic effect between stress and smoking, which increases the risk of hypertension [26]. Likewise, a Japanese study concluded that persistent smoking was associated with higher risks of hypertension (HR 1.34), whereas quitting smoking diminished risks [27].

These study findings are in line with current occurrence literature that associates work-related stress with cardiovascular health deterioration among healthcare workers on a wider scale. Research has shown that job burnout is linked to poor cardiovascular outcomes, including decreased fitness or excess fatigue, particularly in times of the pandemic [28]. Such trends highlight the importance of incorporating both behavioral (e.g., smoking) and physiological (e.g., blood pressure) variables in occupational health monitoring.

This study found that none of the stressed individuals had high blood sugar as opposed to 9.6% of non-stressed individuals, whereas broader literature implicates stress in insulin resistance and hyperglycemia. But others, like a cohort of doctors in Harbin, China, have reported stress to be linked with rising glycated hemoglobin and triglycerides [29], indicating that we may be capturing a still photograph when the action could be dynamic, such as stress-induced blood sugar surges or shift-work related metabolic disturbances.

Although a higher proportion of the more-stressed participants noted physical activity, it was not significant. Such a trend is in line with multiple studies that have emphasized the complexity of stress-exercise associations. A systematic review determined that exercise tends to decrease stress and burnout among healthcare employees [30]. This research contributes to understanding that while some stressed people may use exercise as a coping strategy, stress might limit leisure-time activity in others - producing a complex and inconsistent pattern.

Conclusion

This research paper demonstrates that occupational stress is substantially connected to cardiovascular risk factors in healthcare employees. Individuals who were younger and married tended to be more susceptible to stress, and stress was closely linked to smoking and hypertension. The majority of the participants perceived low levels of stress, but a significant minority had high-stress levels associated with detrimental health behavior. These results highlight the necessity of specific interventions in the workplace to alleviate stress and eliminate the potential of long-term cardiovascular issues in healthcare workers, which will subsequently enhance general work health and well-being.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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None.

Consent to participate

Written consent was obtained from all the participants/subjects/patients.

Ethical approval

The study was approved by Care IRB committee (approval no. IRB-001/280725) date: 28/7/2025.

Author details

Mohammed J. M Kaware¹, Mohammad Ali Maksoud², Anas Shmbal³, Nada Gargab⁴, Olaa Awad Mohamed Ahmed Ismail⁵

1. General Practitioner, Care Medical Hospital, Riyadh, Saudi Arabia
2. Medical Student, Alfaisal University, Riyadh, Saudi Arabia
3. Department of Surgery, Care Medical Hospital, Riyadh, Saudi Arabia
4. Internal Medicine Resident, Care Medical Hospital, Riyadh, Saudi Arabia
5. Physician, Care Medical Hospital, Riyadh, Saudi Arabia

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