Family Medicine & Primary Care Review 2023; 25(2): 150–154, https://doi.org/10.5114/fmpcr.2023.127672

ORIGINAL PAPERS

ISSN 1734-3402, eISSN 2449-8580

Evaluation of cardiovascular disease risk factors in healthcare workers

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A – Study Design, **B** – Data Collection, **C** – Statistical Analysis, **D** – Data Interpretation, **E** – Manuscript Preparation, **F** – Literature Search, **G** – Funds Collection

Summary **Background.** Cardiovascular diseases (CVD) are chronic diseases that can be asymptomatic for a long time, and the first symptom may be sudden death.
Objectives. This study was designed to draw attention to the frequency of both individual and occupational cardiovascular risk factors and to warn health professionals about variable risk factors.
Material and methods. This research was conducted between 01.03.2022–01.09.2022. 160 participants were included in the study. The questionnaire form in which sociodemographic data was asked, the international physical activity questionnaire (short) form and the work stress scale form were directed to the participants. Blood pressure, height, weight and waist circumference were measured, and CVD risks were calculated using the SCORE (Systematic Coronary Risk Evaluation) 2 cardiovascular risk estimation algorithm.
Results. Medium, high and very high CVD risks were determined in 41.8% of the employees. The risk was found to be significantly different among occupational groups ($p < 0.001$) and economic status ($p = 0.036$). Considering the relationship between shift work status and CVD risk, the risk was found to be significantly higher in those working only during day shifts compared to those working during alternating day and night shifts ($p = 0.033$). It has been shown that work stress does not increase the CVD risk of healthcare workers (HCW) ($p = 0.857$). However, it was observed that work stress significantly increases LDL and total cholesterol ($p = 0.026$ and $p = 0.018$).
Conclusions. In this study, it is emphasised that work-related risks should be taken into consideration, as well as individual CVD risks.
Key words: work, exercise, occupational stress, cardiovascular diseases.

Ezber R, Gülseven ME, Koyuncu A, Sarı G, Sarı G, Şimşek C. Evaluation of cardiovascular disease risk factors in healthcare workers. *Fam Med Prim Care Rev* 2023; 25(2): 150–154, doi: https://doi.org/10.5114/fmpcr.2023.127672.

Background

Cardiovascular diseases (CVD) include coronary heart disease, heart failure, cerebrovascular disease, hypertension, peripheral arterial disease, heart valve diseases and cardiac rhythm disorders [1]. CVDs are chronic diseases that can be asymptomatic for a long time until the disease progresses, and the first symptom may be sudden death [2]. The World Health Organization (WHO) announced that approximately 17.9 million people worldwide died due to CVDs in 2019. This figure represents 32% of all global deaths, and CVDs are the prominent cause of death worldwide [3].

Because of its high mortality and morbidity, CVDs have been studied by researchers for years. While some of the risk factors are non-variable, such as age, gender, family history of CVD, others are variable risk factors, such as smoking, hypertension, diabetes mellitus, physical inactivity, unhealthy diets, dyslipidaemia and obesity. In addition, some factors such as occupational or environmental exposure to toxic agents and stress are thought to contribute to the development of CVDs, although the magnitude of the risk is unknown [4].

In the last century, population growth has been observed along with the prolongation of human lifespan, urbanisation has increased rapidly, and employment rates have increased in business areas such as industry, construction, service and agriculture [5]. There are approximately 59 million healthcare workers (HCW) in the world [6]. There are more than 1 million HCWs in our country [7]. HCWs are all employees who provide care and service to patients as doctors, nurses, allied health personnel, laboratory workers and cleaning personnel. The health of HCWs, who constitute such an important part of the working population, is one of the issues that occupational health practitioners should pay attention to. HCWs are exposed to hazards such as biological (HIV, hepatitis, tuberculosis, etc), chemical (glutaraldehyde, formaldehyde, ethylene dioxide, etc), physical (ergonomic, such as lifting weights, standing for long periods of time, radiation, noise, etc), working long hours and shifts and work stress [8]. Occupational health and safety practices include dealing with occupational diseases, occupational accidents and risk factors for CVDs [9].

Objectives

It is important to specify the frequency of individual and occupational risk factors of CVDs, which are the most common cause of death all over the world. Individual risk factors for CVDs have been known for many years, and the effects of occupational risk factors are being investigated. Some studies have specifically examined the effects of work stress and shift work on the

development of CVD. The results, on the other hand, contradict each other and lead to some discussions [10–12].

This study was designed to draw attention to the frequency of both individual and occupational cardiovascular risk factors and to warn health professionals about variable risk factors.

Material and methods

The study was conducted in an employee health outpatient clinic of a tertiary training and research hospital between 01.03.2022–01.09.2022. The study was started after the approval of the clinical research ethics committee (2012-KAEK-15/2472). Informed voluntary consent was obtained from all participants.

The population of this study consisted of HCWs working in a tertiary training and research hospital (n = 3728). The G Power 3.1 program was used to calculate the number of samples and perform power analysis. Based on a research article with similar hypotheses, it was determined that at least 150 samples should be studied with 95% power and 5% alpha error. Considering 20% more of the calculated sample size, 180 people were included in the study by using the simple random sampling method. 13 people didn't accept to be included in the study, and 7 participants were excluded because they did not fill in the forms completely. The study was conducted with the analyses of 160 participants. Data was collected by face-to-face interview. The personal information form, international physical activity questionnaire (short) form, work stress scale and SCORE (Systematic Coronary Risk Evaluation) 2 cardiovascular risk scoring were used in the study.

The personal information form asked about the sociodemographic characteristics of the individuals, disease histories, family disease history, smoking, alcohol use and shift work status and consisted of 18 questions.

The international physical activity questionnaire (short) form consisted of 7 questions, and its validity and reliability studies in Turkey were performed by Öztürk in 2005 [13].

In the study, the work stress scale was used to see the stress levels of the employees quantitatively. The work stress scale was developed by Cohen and Williamson. Its validity and reliability in our country were verified by Baltaş et al [14].

The blood pressure measurements of the employees and grouping were carried out as recommended in the hypertension guideline of the Turkish Society of Endocrinology and Metabolism [15].

Employees' body weight, body mass index (BMI) (kg/m^2) and grouping, waist circumference and height were measured by us as recommended in the obesity guideline of the Turkish Society of Endocrinology and Metabolism [16].

Employees' 10-year risk of fatal and non-fatal CVD was evaluated using the SCORE 2 risk estimation algorithm over the HeartScore application. They were the divided into low to moderate, high and very high risk groups [17].

In order to calculate the 10-year CVD risk of the participants in the study, the laboratory records that had passed through the hospital automation system were examined by obtaining the permission of the participants. Total cholesterol, HDL cholesterol, LDL cholesterol, triglyceride, fasting blood sugar and creatinine levels taken over the last year were recorded. It was observed that 5 employees did not have blood tests over the last year and were recorded as missing data.

The frequency of CVD risk was given, and comparisons were made with other CVD studies in HCWs and in the general population in our country.

Statistical analysis

Data analysis was carried out using the SPSS (Statistical Package for the Social Sciences) 20 program. The conformity of the quantitative data to normal distribution was tested with the Kolmogorov-Smirnov test. Pearson's Chi-square test for statistical analysis of categorical data, unpaired t-Test and one-way ANOVA test (post hoc Tukey test) or Mann-Whitney U test and Kruskal-Wallis analysis of variance (post hoc Dunn's test) for statistical analysis of quantitative data were used. The statistical significance of difference was accepted as $p < 0.05$.

Results

The mean age of the participants included in the study was 34 ± 9 (20–59) years. 78.1% of the participants were female and 21.9% male. Detailed sociodemographic data, smoking, alcohol use, shift work, chronic diseases and family history for CVDs are given in Table 1.

Table 1. Sociodemographic data of healthcare workers

		(n = 160)	%
Gender	female	125	78.1%
	male	35	21.9%
Marital status	married	95	59.4%
	single	59	36.9%
	divorced/deceased spouse	6	3.7%
Occupation	doctor	21	13.1%
	nurse	102	63.7%
	health officer	7	4.4%
	other	30	18.8%
Shift work	day shift only	47	29.4%
	alternate shifts day and night	113	70.6%
Alcohol	I use	25	15.6%
	I quit	10	6.3%
	I've never used	125	78.1%
Smoking	I smoke	48	30.0%
	I quit	18	11.2%
	I've never smoked	94	58.8%
Chronic disease	no	126	78.8%
	hypertension	14	8.8%
	chronic heart disease	1	0.6%
	rhythm disorder	4	2.5%
	other	15	9.3%
Family history of CVD*	yes	64	40.0%
	no	96	60.0%

* CVD – cardiovascular disease.

CVD risk was found to be higher in males ($p < 0.001$), and a relationship was found between marital status and CVD risk ($p = 0.007$). The CVD risks of divorced/deceased spouse participants were higher than single participants. A high risk was found in those with children ($p < 0.001$). A relationship was found between occupational groups and CVD risk ($p < 0.001$). The risks of participants from other occupational groups (cleaning personnel, medical secretaries, patient caregivers, pathology technicians) were higher than nurses. The age, waist circumference and triglyceride levels of the group labelled other was significantly higher than nurses ($p < 0.001$, $p = 0.006$ and $p = 0.028$). Educational status was found to be significantly related. CVD risks for undergraduates were found to be significantly lower than primary, secondary and high school graduates ($p < 0.001$). Considering the relationship between shift work status and CVD risk, the risk was found to be significantly higher in those working only during day shifts compared to those working during alternating day and night shifts ($p = 0.033$). It has been observed that there is a significant relationship between economic status and CVD risk, and this is due to the higher

Table 2. Evaluation of the relationship between CVD risk and laboratory data				
Variables	Low to moderate CVD# risk	High CVD risk	Very high CVD risk	p*
	Median (IQR)	Median (IQR)	Median (IQR)	0.021
Fasting blood glucose (mg/dL)	85 (80–90)	88.5 (81.5–96.5)	96 (85–116)	< 0.001
Creatinine (mg/dL)	0.73 (0.70–0.80)	0.96 (0.84–1.05)	0.86 (0.70–1.02)	< 0.001
Total cholesterol (mg/dL)	170 (152–195)	187 (168.5–220)	226.5 (214–240)	< 0.001
LDL cholesterol (mg/dL)	98 (84–1116)	111.5 (96.5–145.5)	142 (124–159)	< 0.001
HDL cholesterol (mg/dL)	54 (48–63)	46 (40–51.5)	42.5 (36–51)	< 0.001
Triglyceride (mg/dL)	72 (57–97)	105.5 (78–166)	195.5 (117–324)	< 0.001
Systolic blood pressure (mm Hg)	110 (100–120)	120 (110–120)	130 (114–130)	0.001
Diastolic blood pressure (mm Hg)	70 (65–80)	72.5 (70–80)	80 (78–85)	0.003

* Kruskal-Wallis test; # CVD – cardiovascular disease.

risk of low-income participants compared to middle-income participants (p = 0.036). It was observed that the risk of CVD increased significantly with smoking (p < 0.001). No significant relationship was found between alcohol use and CVD risk (p = 0.144). It was observed that there was a significant relationship between those with concomitant chronic diseases and CVD risk (p = 0.005). The risk of those with a family history of CVD was found to be high (p = 0.002). No direct and significant relationship was found between physical activity level and CVD risk (p = 0.393). No correlation was found between work stress and CVD risk (r = 0.015, p = 0.857).

There was a low to moderate risk in 75.5% (n = 117), high risk in 18.1% (n = 28) and very high risk in 6.5% (n = 10) of HCWs. A significant relationship was found between CVD risk and blood sugar, creatinine, lipid profile and blood pressure (Table 2).

It was observed that 28.7% of the participants were overweight, 11.2% were mildly obese, 1.2% were moderately obese, and 0.6% were morbidly obese. A positive correlation was found between CVD risk and weight (r = 0.552, p < 0.001), body mass index (r = 0.425, p < 0.001) and waist circumference (r = 0.543, p < 0.001).

It was observed that normal blood pressure was found in 48.8% of the participants, elevated blood pressure in 46.9%, stage 1 hypertension in 3.1% and stage 2 hypertension in 1.2%.

It was determined that 39.4% of the HCWs were inactive, 31.6% were minimally active, and 29% were very active. There was no significant relationship between the physical activity levels of the employees and the risk of CVD (p = 0.393).

According to the work stress scale scores, 33.6% of the employees had stress categories (A, B, E, F) that can affect productivity (Figure 1).

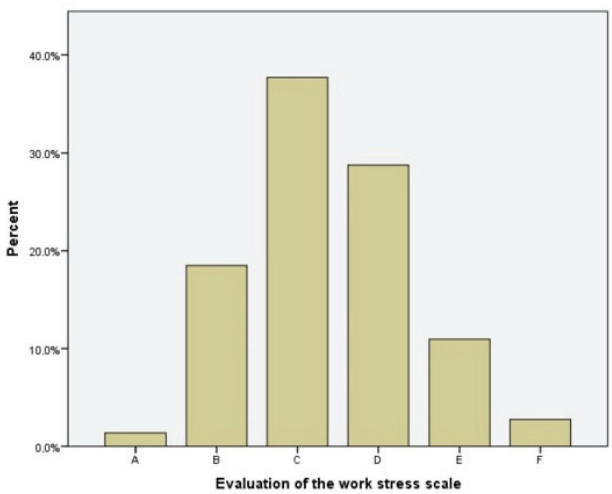

Figure 1. Evaluation of work stress in healthcare workers according to work stress scale

It has been shown that work stress does not increase the CVD risk of HCWs (p = 0.857). However, work stress had a significant effect on LDL and total cholesterol (p = 0.026 and p = 0.018). This significance is due to the fact that the LDL and total cholesterol levels of the group B stress category are significantly higher than group C.

Discussion

Studies have provided strong evidence that CVDs are largely preventable. In the ′Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries′ (INTERHEART) study published in 2004, dyslipidaemia, smoking, alcohol, hypertension, diabetes mellitus, obesity, psychosocial factors, low consumption of fruits and vegetables and inactivity constitute a large part of the risk of myocardial infarction worldwide, regardless of gender [18]. The necessity of taking precautions to reduce the incidence of CVDs was demonstrated once again with this study.

In this study, the 10-year risk of CVD and the work-related and individual risk factors were evaluated. 78.1% of the participants were female, and the SCORE 2 CVD risk was found to be significantly higher in male participants in the study. The 10-year risk of developing CVD was found to be of high risk in 18.1% and very high risk in 6.5% of the participants. These rates are expected to be higher in studies to be conducted taking into consideration the gender of the participants. On the other hand, in another study among HCWs, the 10-year risk of developing CVD was found to be high in 0.7%, moderate in 1.0% and low in 98.3% [19]. Another study found that 14% of HCWs had a cardiac risk greater than 2% in cardiovascular risk assessment through the SCORE system [20]. In another study conducted with HCWs, the Framingham heart scale was used, and the probability of predicting 10-year CVD in 7% of the workers was 10–15%, 2% had a risk of 16–20%, and 1% had a greater than 20% risk [21]. In a population-based study conducted in our country, the CVD risk was found to be 13.6% [22]. The results of this study were found to be higher than the CVD risk in our country and the risks of HCWs in other countries.

The risk of CVD increases with age [23]. The mean age of the employees in our study was 34 ± 9 years. In the evaluation of a group with a higher mean age, the risk of developing CVD will be higher. On the other hand, this study is a warning that although the mean age is 34 years, the CVD risk is not low, and the start of precautions should not be delayed. Studies on income inequality and CVD risk have shown that people with low income have a higher CVD risk because of problems such as accessing healthcare services and managing risk factors [24]. Our study supports other studies, and CVD risk was found to be significantly higher in employees with a low income level compared to those at a middle income level.

HCWs make important decisions due to their profession. In addition to this stress and pressure, they are exposed to physical violence and psychological threats. Due to shift work, they stay awake for long periods, and their circadian rhythms are disrupted. As a result, both metabolic and psychological health problems develop. There are many studies examining the risks between shift work and CVD risk. This has been associated with disruption of circadian rhythm, changes in diet, caffeine intake and smoking [25]. In addition, a meta-analysis showed that CVD risk increases by 7.1% every five years after the first five years of shift work [26]. On the other hand, in a study conducted on industrial workers, it was shown that the CVD risk of those working during day shifts is significantly higher than those working only during night shifts and alternating day and night shifts [27]. In our study, the CVD risk of those working only during day shifts was found to be significantly higher than those working during alternating shifts day and night. It is thought that the reason for this may be reducing the number of day and night shifts or switching them to only during day shifts due to the aging of the HCWs and the presence of chronic diseases, etc.

Studies have shown that there is a relationship between workload and CVD risk. In this study, CVD risk was found to be significantly higher in the group labelled as other personnel (cleaning personnel, medical secretary, patient caregiver, pathology technician) compared to nurses. It is thought that this is related to the age, waist circumference and triglyceride levels of the group labelled other, which was significantly higher than nurses. There are many studies concerning work stress and CVD risk factors, and there are conflicts about this effect, and a significant relationship could not be shown in some of them [28, 29]. In our study, no significant relationship could be shown between work stress and CVD risk. However, a significant relationship was found between LDL and total cholesterol, which are associated with CVD risk, and work stress. As in our study, a study conducted in Brazil in 2022 found a positive relationship between anxiety and dyslipidaemia in primary healthcare nursing professionals [30].

Conclusions

Knowledge and intervention concerning the risk factors of CVD, which is the most common cause of death all over the world, is of vital importance. Indication of the frequency of possible individual and occupational CVD risks in HCWs can determine the priority to be given to interventions. Some interventions such as smoking cessation, weight control, healthy diet, supporting regular physical activity, training to increase the knowledge level of the employee about CVD and risk factors can reduce the development of CVD. Increasing the health of HCWs will both increase their work performance and reduce health expenses for the country's economy, and any awareness formed in the employee will also provide a social benefit, since HCWs are seen as role models. In this study, both individual and work-related risk factors of HCWs are mentioned. It was concluded that while many individual factors directly increase the risk of CVD, work-related factors may also have an indirect effect. There is a need for studies to determine the work-related CVD risks of employees who make up a large part of society, not only in the field of health but also in other service areas.

Source of funding: This work was funded from the authors' own resources.
Conflicts of interest: The authors declare no conflicts of interest.

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Tables: 2
Figures: 1
References: 30

Received: 09.01.2023
Reviewed: 16.02.2023
Accepted: 24.02.2023

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