GSC Advanced Research and Reviews

eISSN: 2582-4597 CODEN (USA): GARRC2

Cross Ref DOI: 10.30574/gscarr

Journal homepage: https://gsconlinepress.com/journals/gscarr/

(RESEARCH ARTICLE)

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# The prevalence and associated risk factors of work-related cardiovascular disorders among healthcare workers in five reference hospitals in the city of Douala, Cameroon

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GSC Advanced Research and Reviews, 2023, 14(01), 036–046

Publication history: Received on 15 November 2022; revised on 27 December 2022; accepted on 30 December 2022

Article DOI: https://doi.org/10.30574/gscarr.2023.14.1.0370

## Abstract

**Background**: Recent investigations suggest that environmental, psychosocial, non-specific job stressors such as work overload, repetitive tasks, and shift work could have a negative influence on the cardiovascular systems of workers. This study aimed to investigate the prevalence and associated risk factors of work-related cardiovascular disorders (WRCVDs) among healthcare workers in five reference hospitals in the city of Douala, Cameroon.

**Methods**: A quantitative, descriptive cross-sectional study was conducted from 2019 to 2022 among 561 healthcare professionals working in the city of Douala, Cameroon. Participants were selected using a convenient sampling technique. Cardiovascular complaints and risk factors were explored through questions on the family history, and personal health profile of participants, body mass index together with information got from records of the automated blood pressure machine. Data were analyzed using SPSS version 26 for descriptive and inferential statistics, and excel 2019 for data coding, cleaning, filtering and sorting. Chi Square, Odd Ratios and Logistics regressions were used to examine associations and identify risk factors.

**Results**: The prevalence of WRCVDs for the last 12 months was 6.4% (36/562) among healthcare workers. Furthermore, self-reported data on symptoms and possible signs showed that in the last 12 months 38.9% (218/561) have had a family member diagnosed of at least one cardiovascular disorders. Proportions of 23.4% (131/561) and 29.8% (167/561) participants reported to have experienced discomfort in their left chest and shortness of breath respectively lasting for more than an hour in the previous six months. Also, 22.5% (126/561), 29.4% (165/561) and 3.9% (22/561) reported coldness of feet, palpitations and loss of consciousness respectively. This study also found that there was a significant association between specialty (0.044), institution of work (0.028) and the risk of having WRCVDs with the highest prevalence's being the nursing profession 52.8% (19/561) and GHD 33.3% (12/561) respectively. It was further unveiled that secondary smoking is a significant predictor of having a work-related cardiovascular disorder ($p = 0.009$), all factors held constant. Age was significantly associated with WRCVDs ($Chi^2 = 13.945$, $p < 0.005$).

**Conclusion**: The prevalence of WRCVDs among healthcare professionals was low in Douala hospitals. There was an interesting association between WRCVDs and demographics of the study participants with age and secondary smoking being significant predictors of WRCVDs.

**Keywords:** Cardiovascular disorders; Healthcare professionals; Risk factors; Prevalence; Douala-Cameroon

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## 1. Introduction

Cardiovascular diseases occur when coronary arteries are choked by plaques or atheroma in a process known as atherosclerosis (1) and work-related cardiovascular disorders (WRCVDs) are conditions of the heart or blood vessels that are caused by working conditions making them a work-related illness (2). Most of these conditions are associated with mental stress at work, low social support at work, exposure to ionizing radiation, noise and presence of physical hazard (3). Cardiovascular disorders (CVDs) are a major burden for health in many public workers throughout the world with about 50% of all causes of death, and 25% of work-related disability as reported by Yusuf et al. (4). CVDs includes coronary artery diseases (CAD) such as angina and myocardial infarction (commonly known as a heart attack) (5). Other CVDs include stroke, heart failure, hypertensive heart disease, rheumatic heart disease, cardiomyopathy, abnormal heart rhythms, congenital heart disease, valvular heart disease, carditis, aortic aneurysms, peripheral artery disease, thromboembolic disease, and venous thrombosis (5). Patients suffering from cardiovascular diseases are more likely to experience symptoms such as chest pain or pressure, pain or discomfort in the arms, jaw, or back, shortness of breath, nausea, weariness, dizziness or lightheadedness, and cold sweats (6).

Cardiovascular diseases represents the leading cause of death in the US and the world at large (7). Together CVDs resulted in 17.9 million deaths (32.1%) in 2019, up from 12.3 million (25.8%) in 1990 (7). Deaths, at a given age, from CVDs are more common and have been increasing in much of the developing world, while rates have declined in most of the developed world since the 1970s It is estimated that dietary risk factors are associated with 53% of CVDs deaths (8). High blood pressure is estimated to account for approximately 13% of CVDs deaths, while tobacco accounts for 9%, diabetes 6%, lack of exercise 6%, and obesity 5%, and rheumatic heart disease may follow untreated strep throat (8).

At present, most of the research involves the general population while research on medical staff is almost entirely absent (9). Yu et al., (9) reported that medical staffs are essential to protect the health of the general population but would seldom carter for their own health. This is particularly true as these workers are exposed to vigorous job tasks, extended work shifts in some cases to meet the needs of a patient in dare need of life (10). For instance, during emergencies like the COVID-19 pandemic, medical staff fought really hard on the front line against the epidemic and saving the lives of patients to the neglect of their own health (11).

Yu et al., (9) aimed to estimate the prevalence and clustering of CVDs risk factors and to investigate the association between relevant characteristics and the clustering of CVDs risk factors among medical staff in Northeast China. A cross-sectional survey of 3720 medical staff from 93 public hospitals in Jilin Province was conducted. Findings showed that the prevalence of hypertension, diabetes, dyslipidemia, overweight, smoking, and drinking was 10.54%, 3.79%, 17.15%, 39.84%, 9.87%, and 21.75%, respectively. The prevalence of hypertension, diabetes, and dyslipidemia was higher in general hospitals than in traditional Chinese medicine hospitals ($p \leq 0.05$). In addition, the prevalence of the six risk factors differed significantly by gender, being higher in men than in women ($p < 0.001$), especially for being overweight, smoking, and drinking.

Little is known about occupational risks for heart diseases, but links have been established between CVDs and certain toxins (including carbon disulfide, nitroglycerin, and carbon monoxide), extreme heat and cold, exposure to tobacco smoke, ultrafine particles, depression, and occupational stress (12). Other occupational hazards potentially related to CVDs includes noise exposure at work, shift work, and physical activity at work. In 2008, CVDs accounted for 29 % of all deaths worldwide (13). The World Health Organization (WHO) estimates that this figure could reach 35 % by 2030 if prevention and detection of CVDs do not improve on the working conditions (14).

Recent literature suggests that environmental, socioeconomic changes, job type, psychosocial and organizational factors have an influence on the development of CVDs (15, 16), at the workplace. Different studies have revealed relationship between specific work-related factors and acquiring CVDs, an example being the report by Wang et al. (17) that included a comprehensive analysis of non-chemical risk factors for employment cardiovascular disease. These factors include psychosocial stress, long working hours without work shifts, Work environment with loud noise, an unbalanced effort-reward system, frequent sympathetic stimulation of the nervous system (17).

More so, CVDs are a common cause of long- term disability with an increasing prevalence globally, affecting hundreds of millions of individuals, especially professionals whose jobs require them to maintain a stationary position for long periods of time (16). Furthermore, several investigations have linked CVDs to occupational factors (18, 19).

Although several researchers have studied the prevalence (21) of CVDs and risk among several workers of different professions in Africa and the world, similar studies are limited in the context of Cameroon and in Douala in particular

(20). Thus, the main aim of this paper was to investigate the prevalence and risk factors of cardiovascular disorders among healthcare providers in five reference hospitals in the city of Douala, Cameroon.

## 2. Materials and methods

### 2.1. Study Design

This was a quantitative, descriptive cross-sectional study undertaken between September 2019 and October 2022 in selected reference hospitals in Douala, Cameroon.

### 2.2. Study population

All participants in this study are healthcare professionals working in the city of Douala, Cameroon. They were in service at the HLD, GHD, NBDH, NDH and BDH, all hospitals in the city of Douala, Cameroon.

### 2.3. Sample and procedure

Participants were selected from five reference hospitals in the city of Douala, Cameroon using a convenient sampling method. 561 healthcare professionals were included. Cardiovascular complaints were explored through questions on the family history and personal health profile of the participants, together with information gotten from records of the automated blood pressure machine.

Inclusion criteria was full-time healthcare workers in the chosen hospitals who consented to take part in our study and have been working for at least 12 months while exclusion criteria were those who refused to participate in this study: students on internship, part-time workers and also visiting physicians, nurses and physiotherapists and other healthcare workers from other regions or countries.

### 2.4. Data collection

*2.4.1. Socio-demographic variables*

A self-administrated questionnaire about the respondent's demographic information including age, gender, job history, marital status, place and duration of employment and the practicing posture in the different professions, medical specialty, longevity, place of work (hospital/clinic). Education was categorized into five (certificate, diploma, bachelors, masters, and doctorate). Medical specialty was measured in terms of nursing, physiotherapist, physician others. longevity was measured in the range “less than 1-year, 1-3 years, 4-6 years, 7-9 years, 10 years and above. Marital status was captured into single, married, widowed, divorced, others. The questionnaire also included questions about some work characteristics, mostly pertaining to the given professions, namely number of patients/clients consulted/attended to per month, time and duration of work per day, design and arrangement of the patient's/clients and professionals’ chairs and the posture of body while working. Also, we assessed the various types of services provided each day.

Cardiovascular complaints were explored through questions on the family history and personal profile of the participants, together with information got from records of the automated blood pressure machine.

### 2.5. Risk factors

The risk factors considered in this study included obesity, secondary smoking, working conditions, noisy work environment, staying in the same working position for long, lack of physical exercise, elevated blood pressure, weight.

### 2.6. Data management and analysis

Data were analyzed using SPSS version 26 for descriptive and inferential statistics, and excel 2019 for data coding, cleaning, filtering and sorting. Chi Square, Odd Ratios and Logistics regressions were used to examine associations and identify risk factors. Correlation used to establish relationship among variables. Also, Chi Square, Odd Ratios and Logistics regressions were used to examine associations and identify risk factors. Correlation was used to establish relation trends among variables. Observed differences between groups were significant at $p < 0.05$. The data pre-processing handled missing values and outliers.

For cases where the missing values were less than 30%, the mode was used for categorical data and mean used for continuous data with a normal distribution. For data with more than 30%, the list wise method was used.

### 2.7. Ethical consideration

Ethical clearance No. 2021/1511-07/UB/SG/IRB/FHS was obtained from the ethical committee of the University of Buea faculty of health sciences, and research authorizations from the Regional Delegation of Public Health and all the five reference hospitals signed by the different directors. This study respected the ethical principles of the European Union. The fundamental principles of medical research according to Helsinki's Declaration were strictly respected.

All authors consented and accepted for this article to be submitted for publication.

## 3. Results

### 3.1. Socio-demographic Characteristics of Healthcare Workers in Douala Hospitals

The average age of participants was 34.10 (SD $\pm$ 4.23) years. Respondents between the ages of 30 and 39 years, who are the active working age dominated in this study with 232(41.4%) and were followed closely by the respondents between 20 and 29 years 207(36.9%). Significantly the study participants were females 396(70.6%). As concerns education, most participants in this study had equal to or less than Bachelor's degree 77.4% (434/561). The study was largely 353(62.9%) made up of nurses who formed more than half of healthcare providers, and 37.1% distributed among medical laboratory scientists (MLS) (n =80, 14.3%), medical doctors (MD) (n =52, 9.3%), physiotherapists (PT) (n=26, 4.6%) and other healthcare providers (n=50, 8.9%). In the study, 26% (148/561) of the participants work in the HLD, 24.2% (136/561) from GHD, 18.4% (103/561) from BDH, 10.0% (56/561) from NBDH, and 21.0% (118/561) from NDH hospitals. The participants had varied years of working experience and about 75% (421/561) of the respondents had less than 5 years of working experience in their current institutions. Pertaining to marital status, 60.1% (337/561) of the participants were single, while 36.9% (207/561) were married (Table 1).

**Table 1** Socio-Demographic Characteristics of Healthcare Providers Working in Douala Hospitals

| Variables | Categories | N (%) |
|---|---|---|
| Age | 20-29 years | 207(36.9) |
| | 30-39 years | 232(41.4) |
| | 40-49 years | 87(15.5) |
| | 50-59 yeas | 34(6.1) |
| | Total | 560(100) |
| Gender | Male | 165(29.4) |
| | Female | 396(70.6) |
| | Total | 561(100) |
| Education | Advanced level and below | 191(34.0) |
| | Higher National Diploma (HND) | 83(14.8) |
| | Bachelors | 160(28.5) |
| | Masters | 69(12.3) |
| | Ph.D. | 40(7.1) |
| | Total | 544(96.7) |
| Specialty | MLS | 80(14.3) |
| | MD | 52(9.3) |
| | Nurse | 353(62.9) |
| | PT | 26(4.6) |
| | Others | 50(8.9) |

| | | |
|---|---|---|
| | Total | 561(100) |
| Place of work | HLD | 148(26.4) |
| | GHD | 136(24.2) |
| | BDH | 103(18.4) |
| | NBDH | 56(10.0) |
| | NDH | 118(21.0) |
| | Total | 561(100) |
| Longevity | less than 1 year | 148(26.4) |
| | 1-3 years | 190(33.9) |
| | 4-6years | 86(15.3) |
| | 7-9years | 69(12.3) |
| | 10 years plus | 68(12.1) |
| | Total | 561(100) |
| Marital Status | Single | 337(60.1) |
| | Married | 207(36.9) |
| | Widowed | 9(1.6) |
| | Divorced | 6(1.1) |
| | Others | 2(0.4) |
| | Total | 561(100) |

**SD: standard deviation**

### 3.2. The Prevalence of Work-Related Cardiovascular Disorder (WRCVDs)

The overall prevalence of work-related Cardiovascular Disorder (WRCVDs) in Douala hospitals is 6.4% in the last 12 months (See Figure 1).

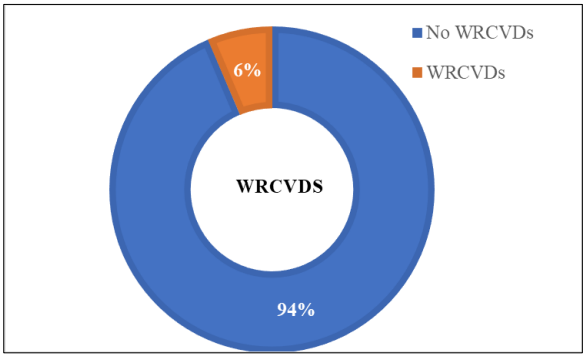
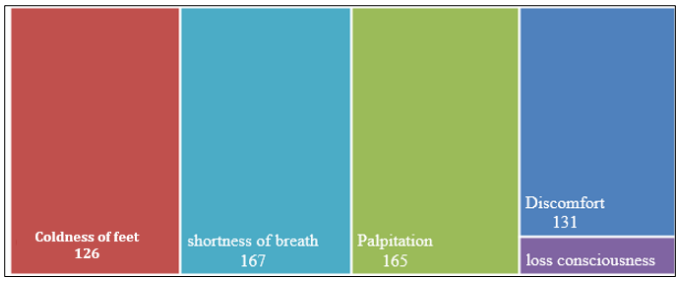



**Figure 1** The prevalence of WRCVDs among healthcare providers in hospitals in the city of Douala Symptoms and Possible Signs

In figure 2, further examination using self-reported data on symptoms and possible signs showed that in the last 12 months 38.9% (218/561) have had some one in their family diagnosed of cardiovascular disorder. In addition, 23.4% (131/561) reported to have experienced discomfort in their left chess lasting for more than an hour in the previous 6 months. The prevalence of shortness of breath within the same period was 29.8% (167/561); 22.5% (126/561) reported coldness of feet and legs while 29.4% (165/561) have experienced irregular heartbeats (palpitation) and loss of consciousness prevalence rate was 3.9% (22/561) (see figure 2).




The size of the rectangle represents the frequency of participants

**Figure 2:** Symptoms and Possible Signs Prevalence of WRCVDs and Demographic Factors

**Table 2** Prevalence of WRCVDs and Demographic factors

| Variable | Categories | No WRCVD | WRCVD | X(p) |
|---|---|---|---|---|
| Age | 20-29 years | 198(37.7%) | 9(25.0%) | 13.945 (0.003) |
| | 30-39 years | 220(41.9%) | 12(33.3%) | |
| | 40-49 years | 79(15.0%) | 8(22.2%) | |
| | 50 plus yeas | 28(5.3%) | 7(19.4%) | |
| Gender | male | 154(29.3%) | 11(30.6%) | 0.024 (0.876) |
| | female | 371(70.7%) | 25(69.4%) | |
| Education | Advanced level and below | 17(33.3%) | 16(44.4%) | 4.850 (0.434) |
| | HND | 80(15.2%) | 3(8.3%) | |
| | Bachelors | 152(29.0%) | 8(22.2%) | |
| | Masters | 66(12.6%) | 3(8.3%) | |
| | Ph.D. | 36(6.9%) | 4(11.1%) | |
| | Other qualification | 16(3.0%) | 2(5.6%) | |
| Specialty | MLS | 77(14.7%) | 3(8.3%) | 9.780 (.044) |
| | MD | 47(9.0%) | 5(13.9%) | |
| | Nurse | 334(63.6%) | 19(52.8%) | |
| | PT | 21(4.0%) | 5(13.9%) | |
| | Others | 46(8.8%) | 4(11.1%) | |
| longevity | less than 1 year | 141(26.9%) | 7(19.4%) | 19.428 (0.001) |
| | 1-3 years | 180(34.3%) | 10(27.8%) | |
| | 4-6years | 82(15.6%) | 4(11.1%) | |
| | 7-9years | 64(12.2%) | 5(13.9%) | |
| | 10 years plus | 58(11.0%) | 10(27.8%) | |
| marital status | Single | 318(60.6%) | 19(52.8%) | 10.661 (0.014) |
| | married | 195(37.1%) | 13(36.1%) | |
| | widowed | 8(1.5%) | 2(5.6%) | |
| | divorced | 4(0.8%) | 2(5.6%) | |
| place of work | HLD | 140(26.7%) | 8(22.2%) | 10.873 (0.028) |
| | GHD | 124(23.6%) | 12(33.3%) | |
| | BDH | 103(19.6%) | 0(0.0%) | |
| | NBDH | 51(9.7%) | 5(13.9%) | |
| | NDH | 107(20.4%) | 11(30.6%) | |

In Table 2, the bivariate analysis revealed interesting association between WRCVDs and demographics of the study participants. We found that the highest prevalence rate 33.3% (12/561) of WRCVDs was recorded among healthcare workers between the age 30-39 years and beyond had a prevalence rate of 12(33.3%) compared to 19.4% (7/561) for those between 50 years and above. Age was a significantly associated with WRCVDs ($x^2$ =13.945, p <0. 003).

Concerning gender, we found that WRCVDs increased in female with a prevalence rate of 69.4% (25/561) compared to 30.6% (11/561) for the male gender. Gender was not a significantly associated with WRCVDs ($x^2$ =.024, p >0.5).

The findings showed that as the duration of service of workers influenced the prevalence of WRCVDs: the prevalence was high in the first 3 years of working experience 27.8% (10/561) and in those above 10 years of working experience 27.8% (10/561). Longevity was significantly associated with WRCVDs (x2=19.428, p <0.001).

Regarding the place of work of the participants, high prevalence rate 33.3% (561) was recorded for those at GHD with the prevalence rate being 33.3% (12/561), and the lowest prevalence rate 0.0% (00/561), was found among workers at BDH. Place of work was a significantly associated with WRCVDs ($x^2$ =.10.873, p <0.025).

Lastly, marital status was significantly associated to WRCVDs with 52.8% (19/561) for the single and 5.6% (02/561) each for divorced and widows. Being single was found to be associated with WRCVDs ($x^2$ =.10.661, p=.014) (see Table 2).

### 3.3. The Presumable Associated Risk Factors of Work-related Cardiovascular Disorders among Healthcare Workers in Hospitals in Douala-Cameroon

This study assessed the level of participant's heartbeat and the results revealed the majority of the participants 79.1% (444/561) had heartbeat within the normal rate of 60 to 100 beats/min, while 19.6% (110/561) of the workers heartbeat fell below and 1.2% above this acceptable rate. For BMI, a significant proportion of the workers were overweight, 31.6% (177/561) with (BMI 25–29.9 kg/m2), followed by 28.8% (162/561) who were obese (BMI ≥ 30 kg/m2) according to the WHO recommendations BMI classifications (See Table 3).

We decided to examine whether work-related cardiovascular disorders can be predicted based on secondary smoking, working conditions, noisy work environment, staying in the same working position for long, exercise, elevated blood pressure, heart rate, weight, height and BMI (see Table 3).

**Table 3** Values of Heart Rate, BMI and BP

| **Heart rate** | **Below Normal** | **110(19.608)** |
|---|---|---|
| | Normal Heart rate | 444(79.144) |
| | Above Normal Heart rate | 7(1.248) |
| BMI | Underweight | 59(10.517) |
| | Normal Weight | 163(29.055) |
| | Overweight | 177(31.551) |
| | Obese | 162(28.877) |

There was no difference between the observed and predicted model and in this study the value, x2 = 240.830, P<0.001 which indicates a good fit mode. Unlike the adjusted R2 for linear regression, the Psuedo R-Square precisely the Nagelkerke R Square was used in this study to examine the amount of criterion results from the predictors. The model (Nagelkerke R Square = .367) indicating that 70.7% change in the cardiovascular disease can be accounted to the predictor variables in the model. The overall accuracy of the model was evaluated to be 93.9% given that these numbers of cases were correctly classified.

The workers who were exposed to secondary smoking has 12.177 times (OR) the odds of the workers who are not exposed to secondary smoking in having WRCVDs and the study further found that secondary smoking is a significant predictor of having WRCDs (p = 0.009) all factors held constant. Workers under pressure working conditions were 0.195 times less likely to have WRCVDs compared to those who are not working under such stressful condition; thus, this was not a factor of WRCVDs. In sum, the findings found that in Douala hospitals, excessive workload, job security,

noisy worksite, working position exceeds, blood pressure and body mass index (BMI) were not risk factors of WRCVDs (*see Table 4*).

**Table 4** Logistic Regression on Presumable Risk Factors associated with Work-related Cardiovascular Disorder among HealthCare Workers in Douala Hospital

| | **Estimate** | **OR** | **P** |
|---|---|---|---|
| (Intercept) | -22.028 | 2.714 | 0.997 |
| Smoking (Yes) | 2.500 | 12.177 | 0.009*** |
| Stressful (Yes) | -1.634 | 0.195 | 0.197 |
| Poor management (Yes) | 0.961 | 2.613 | 0.503 |
| Conflicts Colleagues (Yes) | -18.913 | 6.112 | 0.997 |
| Excessive workload (Yes) | 0.325 | 1.384 | 0.758 |
| Job security (Yes) | -0.885 | 0.413 | 0.604 |
| Noisy worksite (Yes) | -0.703 | 0.495 | 0.548 |
| Workingpositionexceeds4hours (3-5 times) | -0.869 | 0.419 | 0.381 |
| Workingpositionexceeds4hrs (6 times plus) | 43.851 | 1.107 | 0.999 |
| Exercises week (1-2 times) | -22.439 | 1.799 | 0.999 |
| Exercises week (3-5 times) | -20.035 | 1.991 | 0.999 |
| Exercises week (6 times plus) | -20.494 | 1.257 | 0.999 |
| Blood pressure (once a week) | 19.690 | 3.560 | 0.998 |
| Blood pressure (once a month) | 0.406 | 1.501 | 1.000 |
| Blood pressure (irregular) | 18.764 | 1.409 | 0.998 |
| BPmmHg | 0.148 | 1.160 | 0.512 |
| BMI | 0.044 | 1.045 | 0.393 |

*Statistically significant at P <0.05, **statistically significant at P <0.01, *** statistically significant at P < 0.001

## 4. Discussion

The study determined the prevalence of WRCVDs among health care workers in Douala-Cameroon as well as its associated factors.

The overall prevalence of WRCVDs was 6.4% among healthcare workers in Douala-Cameroon within the study period (2019-2022). This prevalence is much lower than the rate reported by Prajjwal et al. (22) who found that the prevalence of cardiovascular diseases (CVDs) was 13.8 %. This difference could be due the differences in study population given that the study of Prajjwal was carried out in an industrial area. Again, the prevalence obtained from this study was very low compared to the prevalence (16.0%) reported by Mansour and Ajeel (23). This may be explained by the fact that their study population were already having an associated risk factor of cardiovascular disease being diabetes type 2.

Regarding the factors associated with WRCVDs, this study revealed that longevity in service was significantly associated to WRCVDs consistent with the findings of lopez et al. (5) and Van der Hulst (24). Also, long working hours was reported to constitute a risk factor to WRCVDs as reported by Virtanen et al. (25). WRCVDs was significantly associated with the Nursing profession and the institution of work and the highest rate was recorded for workers of a 1st category hospital (GHD). This may be explained by the fact that health workers in level 1 hospital centers have high work load and the study of Gebrekidan et al. (26) demonstrate that increased workload increased work-stress which is already an established risk factor of WRCVDs (27). With regards to the association between the nursing profession and WRCVDs, it may be due to the fact that high levels of work stress which is an identified risk factor of CVDs is reported to be more

in Nurses than other health professionals (28). Another aspect that was found to be associated with WRCVDs was age, this is consistent with reports in literature (29, 30).

Risk factors for WRCVDs like secondary smoking, working conditions, noisy work environment, staying in the same working position for long, lack of exercise, elevated blood pressure and overweight were also studied. The findings showed that only secondary smoking is a significant predictor of WRCVDs among the healthcare providers consistent with reports in literature (31). However, the study did not find any significant evidence to conclude that excessive workload, job security, noisy worksite, and working position were risk factors of WRCVDs. The findings differ from those established by other researchers (3, 18) who reported that CVDs are linked to occupational factors. Recent literature suggests that environmental factors, socioeconomic changes, job type, psychosocial and organizational factors have an influence on the development of CVDs at the workplace (32); (33);(3). More so, Wang et al., postulates that psychosocial stress, long working hours without work shifts, work environment with loud noise are related to WRCVDs (17).

### *Abbreviations*

- CVDs; Cardiovascular disorders,
- WRCVDs; Work-related cardiovascular disorders,
- BMI; Body mass index,
- WHO; World Health Organization.
- MD; Medical doctor
- PT: Physiotherapist
- MLS: Medical laboratory scientist

## 5. Conclusion

- WRCVDs prevalence was low (6.4%) among healthcare workers within the study period.
- The prevalence of WRCVDs was high among healthcare workers between the ages of 30 to 39 years.
- Nurses are more likely to develop WRCVDs than other healthcare workers.
- The most significant risk factor to WRCVDs was secondary smoking.
- WRCVDs are manifested through discomfort in the left chest, shortness of breath and coldness of feet and legs based on self-reported data.

## Compliance with ethical standards

### *Acknowledgments*

My sincere gratitude goes to participants of this study for all their time and patience which greatly contributed to the completion of this article.

Equally, I thank Madam TEBUG Razita NGOH and NAIN Benadette for proofreading this article and making relevant corrections that have greatly ameliorated the quality of this article.

### *Disclosure of conflict of interest*

The authors certify there is no conflict of interest. All for authors consented and accepted for this article to be submitted for publication.

### *Statement of ethical approval*

Ethical clearance No. 2021/1511-07/UB/SG/IRB/FHS was obtained from the ethical committee of the University of Buea faculty of health sciences, and research authorizations from the Regional Delegation of Public Health and all the five reference hospitals signed by the different directors. This study respected the ethical principles of the European Union. The fundamental principles of medical research according to Helsinki's Declaration were strictly respected.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

### *Availability of data and materials*

Most data generated or analysed during this study are included in this article. Also, all findings that support the result of this study are included below.

### *Author's contributions*

B.K.M. conceived the idea of the study, designed the methodology, carried out field and laboratory experiments, took part in data analysis, interpretation and wrote the manuscript. B.M.O.S. conceived the idea of the study designed the methodology and supervised laboratory experiments. F.B.C, carried out field and laboratory experiments, took part in data analysis and interpretation. T.F. carried out data analysis. M.S.H. designed the methodology, corrected manuscript and supervised field experiments. All Authors fully reviewed the manuscript.

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