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Epidemiological Study of Cardiovascular Risk Factors among Freight Truck Drivers in Côte d'Ivoire in 2023

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Abstract

Introduction: Cardiovascular risk factors (CVRF) are commonly found and/or promoted by working conditions in certain occupational fields. The aim of the study was to determine the frequencies of cardiovascular risk factors and associated factors among freight truck drivers in Côte d'Ivoire. **Methods:** We conducted a 3-month cross-sectional analytical study of CVRFs among freight truck drivers in a merchandise transport company. Data were collected using two questionnaires that provided information on socio-professional characteristics, CVRF and stress. Global cardiovascular risk (GCVR) was assessed using the pooled cohort equation algorithm. Bivariate analysis was performed using the chi-square test. A multivariate analysis was then carried out by logistic regression with a significance threshold of 5%. **Results:** A total of 102 out of 120 truck drivers were included. They were all male (100%) with an average age of 39.2 years. The average daily working time was 10.5 hours. The most common cardiovascular risk factors were dyslipidemia (63.7%), sedentary (57.8%), obesity and overweight (40.2%) and arterial hypertension (21.6%). High GCVR was significantly associated with shiftwork (OR = 3.1; CI 95% = 1.04 - 9.12; p = 0.03) and age ≥ 40 years (OR = 14.8; CI 95% = 4.0 - 4.4; p = 0.001). **Conclusion:** A policy of screening and management of CVRF must be adopted in the workplace.

Keywords

Cardiovascular Diseases, Risk Factors, Truck Drivers, Côte d'Ivoire

1. Introduction

Cardiovascular diseases (CVDs) are the leading cause of mortality worldwide, accounting for approximately 17.9 million deaths each year, with more than three-quarters occurring in low- and middle-income countries [1]-[3]. According to WHO estimates, by 2030, global deaths due to CVDs will exceed 23.6 million [4]. Cardiovascular diseases encompass a range of disorders affecting the heart and blood vessels, including coronary artery disease, cerebrovascular disease, and rheumatic heart disease [1] [2].

These are serious, chronic conditions that can impair both physical and psychological capacities, thereby compromising individuals' occupational functioning. CVDs usually result from a combination of several risk factors, such as hypertension, diabetes, smoking, dyslipidaemia, obesity, excessive alcohol consumption, physical inactivity, and stress [1] [2] [5] [6]. Such cardiovascular risk factors are frequently observed or exacerbated by the working conditions in certain occupational sectors, notably among professional drivers [7].

Indeed, the working conditions of road drivers are characterised by prolonged driving hours, leading to sedentary behaviour and reduced physical activity. Their often-unhealthy eating habits irregular meal times and frequent consumption of fast food contribute to dyslipidaemia. Studies conducted by Hege in North Carolina and Wang in Taipei City reported dyslipidaemia prevalence rates of 65.2% and 75.7%, respectively [8] [9]. In Australia, Sendall *et al.* found that nearly 90% of truck drivers were overweight or obese in a sample of 231 participants [10]. Obesity is associated with an increased risk of road accidents among professional drivers; in fact, the rate of fatal crashes in this population is 50% higher than that observed among other motorists [11].

Despite these concerning findings, few studies have investigated the prevalence of cardiovascular risk factors among professional drivers in our setting. Hence, the present study aimed to assess cardiovascular risk factors among drivers employed by a freight transport company in Côte d'Ivoire in 2023. Specifically, it sought to estimate the prevalence of cardiovascular risk factors and analyse the determinants associated with the overall cardiovascular risk (CVR).

2. Materials and Methods

2.1. Materials

Study Design, Setting, and Duration

We conducted a cross-sectional analytical study on cardiovascular risk factors among road drivers working for a freight transport company in Côte d'Ivoire. The study was carried out over a three-month period, from 29 September to 29 December 2023.

Study Population

The study population comprised regularly employed road drivers of the aforementioned company.

Inclusion criteria

Included were company drivers who had been in service for at least one year and had completed all required paraclinical tests necessary for the assessment of overall cardiovascular risk.

Exclusion criteria

Excluded were drivers who:

- had not completed all required paraclinical tests;
- refused to participate in the survey;
- were absent during data collection.

Data collection tools

Data were collected using a structured questionnaire addressing demographic characteristics (age, sex, ethnicity, education level, lifestyle), occupational characteristics (working hours, years of service), and medical information (anthropometric measurements, systolic and diastolic blood pressure, blood glucose, total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides, stress level, and antihypertensive treatment).

Psychological stress was assessed using the 26-item **Job Content Questionnaire (JCQ)** developed by Karasek [12]. Blood pressure was measured using an electronic sphygmomanometer, weight using an electronic scale, height using a stadiometer, and waist circumference using a measuring tape.

2.2. Methods

Data collection procedures

Verbal authorisation was obtained from company management prior to data collection. Several participatory information sessions were conducted with key stakeholders, including the Occupational Health and Safety Committee (OHSC) and the head of drivers. The survey took place in the company's medical department in two stages:

Stage 1:

Fasting blood samples were collected and sent to a certified biomedical laboratory for analysis.

Stage 2:

Participants completed the questionnaire, followed by measurements of blood pressure, weight, height, and waist circumference.

Blood pressure was measured using an automatic arm sphygmomanometer. Drivers were seated in a quiet, temperature-controlled room after a 15-minute rest. A second measurement was taken after another 15-minute rest if the initial reading exceeded the normal range. Hypertension was defined according to the 2024 European Society of Cardiology (ESC) guidelines [13].

For body mass index (BMI) determination, drivers were weighed barefoot using an electronic scale accurate to 100 g, and height was measured with a stadiometer. BMI was calculated as weight (kg) divided by height squared (m^2). Participants with a BMI greater than 25 kg/m^2 and 30 kg/m^2 were classified as overweight and

obese, respectively.

Waist circumference was measured with participants standing, arms crossed over the chest, after a normal expiration and with the abdomen uncovered. The tape was positioned midway between the lower rib and the iliac crest. A waist circumference exceeding 102 cm was considered abnormal.

Drivers who spent more than eight hours per day in a seated position were classified as sedentary, in accordance with the WHO threshold for sedentary behaviour [14] [15].

Stress assessment

Stress was evaluated using the 26-item Karasek Job Content Questionnaire (JCQ). Responses to individual items were used to calculate the following scores:

- **Psychological demand score:** q10 + q11 + q12 + (5 − q13) + q14 + q15 + q16 + q17 + q18.

  If the score exceeded the median, psychological demand was considered high; otherwise, it was low [16].
- **Decision latitude score:**
  - Skill utilisation: [q1 + (5 − q2) + q3 + q5 + q7 + q9] × 2.
  - Decision authority: [q4 + (5 − q6) + q8] × 4.

    A total score above the median indicated high decision latitude; otherwise, it was low [16].
- **Social support score:**
  - Supervisors: q19 + q20 + q21 + q22.
  - Co-workers: q23 + q24 + q25 + q26.

    A total score above the median indicated high social support [16].

Work-related stress was considered present when psychological demand was above the median and decision latitude was below the median [16].

Interpretation of biological results

Participants with fasting plasma glucose levels >1.26 g/L were classified as diabetic [17].

Those with abnormal values in any cholesterol fraction or triglycerides were considered dyslipidaemic.

Overall cardiovascular risk was estimated using the Pooled Cohort Equation, an algorithm recommended by the American Heart Association (AHA) and the American College of Cardiology (ACC) to estimate the 10-year risk of developing atherosclerotic cardiovascular disease (ASCVD) [18] [19]. It incorporates variables such as age, sex, race/ethnicity, diabetes status, smoking, systolic and diastolic blood pressure, total cholesterol, HDL cholesterol, and antihypertensive treatment.

The 10-year CVD risk was categorised as follows:

- Low risk (<5%).
- Borderline risk (5% - 7.4%).
- Intermediate risk (7.5% - 19.9%).
- High risk (≥20%).

In this study, borderline, intermediate, and high risks were considered as ele-

vated CVR.

Data analysis

Data were analysed using Epi Info 7. Quantitative variables were expressed as means with standard deviations and ranges. Qualitative variables were presented as proportions. The Chi-square test (χ^2) was used for statistical comparisons. Subsequently, a multivariate analysis was conducted through logistic regression, applying a 5% level of statistical significance.

3. Results

3.1. Socio-Professional Characteristics

The study involved 102 road freight drivers out of a total of 120 active drivers employed by the company at the time of the survey, yielding a participation rate of 85%. The mean age was 39.2 ± 7.4 years, with a median age of 38.5 years and an age range from 23 to 58 years. The average daily working time was 10.5 ± 1.9 hours. Socio-professional characteristics of the drivers are presented in Table 1.

Table 1. Distribution of freight truck drivers by socio-professional characteristics.

Parameters	Frequency (n)	Percentage (%)
Sex		
Male	102	100
Age (years)		
<30	9	8.8
31 - 40	47	46.1
41 - 50	37	36.3
>50	9	8.8
Education level		
No formal education	6	5.9
Primary	44	43.1
Secondary	52	51.0
Work experience (years)		
≤5 years	41	40.2
>5 years	61	59.8
Daily working hours		
≤8 hours	31	30.4
>8 hours	71	69.6
Work schedule		
Standard working time	40	39.2
shiftwork	62	60.8

3.2. Cardiovascular Risk Factors

As shown in Table 2 and Table 3, among the 102 drivers, 92 (90.2%) presented at least one cardiovascular risk factor (CVRF). The most prevalent risk factors were dyslipidemia (63.7%), sedentary lifestyle (57.8%), overweight or obesity (40.2%), hypertension (21.6%), and stress (21.6%).

Table 2. Distribution of freight truck drivers according to cardiovascular risk factors (CVRF).

Cardiovascular risk factors	Frequency (n)	Percentage (%)
Presence of at least one CVRF		
Yes	92	90.2
No	10	9.8
High blood pressure (HBP)	22	21.6
Age ≥ 50 years	9	8.8
Family history of cardiovascular disease	7	6.9
Diabetes	4	3.9
Dyslipidaemia	65	63.7
Overweight/obesity	41	40.2
Sedentary lifestyle	59	57.8
Smoking	14	13.7

Table 3. Assessment of stress according to Karasek's model.

Psychological demand	Decision latitude		Total
	High	**Low**	
High	21 (20.6%)	**22 (21.6%)**	43 (42.2%)
Low	26 (25.5%)	33 (32.3%)	59 (57.8%)
Total	47 (46.1%)	55 (53.9%)	102 (100%)

3.3. Overall Cardiovascular Risk (OCVR)

According to the Pooled Cohort Equation, the overall cardiovascular risk among the drivers was borderline in 12.8% of cases and intermediate in 9.8% (Table 4).

Table 4. Distribution of freight truck drivers according to overall cardiovascular risk (10-year risk based on the Pooled Cohort Equation).

10-year OCVR category	**Frequency (n)**	**Percentage (%)**
High (≥20%)	1	0.9
Intermediate (7.5% - 19.9%)	10	9.8
Borderline (5% - 7.4%)	13	12.8
Low (<5%)	78	76.5
Total	**102**	**100**

Table 5. Association between cardiovascular risk factors and socio-professional characteristics of truck drivers.

(a)

Factors		Cardiovascular risk factors							
		Stress		**Sedentary lifestyle**		**HBP**		**Diabetes**	
		OR (95%CI)	p	OR (95%CI)	p	OR (95%CI)	p	OR (95%CI)	p
Age	**<40 years**	0.44	1	0.84	1	**20.76**	**1**	6.70	1
	≥40 years	[0.16 - 1.20]	0.10	[0.38 - 1.85]	0.660	**[4.51 - 5.63]**	**0.01**	[0.70 - 322.8]	0.12
Educational level	**Below secondary school**	0.59	1	0.79	1	1.05	1	0.5	1
	Secondary or higher	[0.23 - 1.53]	0.28	[0.36 - 1.75]	0.56	[0.40 - 2.70]	0.91	[0.04 - 3.70]	0.71
Length of service	**≥5 years**	0.42	1	**0.42**	**1**	1.58	1	1.36	1
	<5 years	[0.16 - 1.08]	0.06	**[0.18 - 0.98]**	**0.04**	[0.58 - 4.30]	0.36	[0.18 - 15.77]	0.72
Daily working time	**>8 hours**	0.47	1	**0.37**	**1**	1.21	1	0.86	1
	≤8 hours	[0.17 - 1.23]	0.12	**[0.14 - 0.95]**	**0.03**	[0.38 - 4.23]	0.71	[0.11 - 10.08]	0.87
Work schedule	**Standard working time**	2.86	1	**3.66**	**1**	1.97	1	3.42	1
	shiftwork	[0.89 - 10.76]	0.05	**[1.58 - 8.47]**	**0.01**	[0.69 - 5.56]	0.19	[0.38 - 30.42]	0.24

OR: odds ratio; CI: confidence interval; p: p-value; HBP: High Blood Pressure.

(b)

Factors		Cardiovascular risk factors							
		Dyslipidaemia		**Smoking**		**Overweight/obesity**		**Increased overall CVR**	
		OR (95%CI)	p	OR (95%CI)	P	OR (95%CI)	p	OR (95%CI)	p
Age	**<40 years**	0.86	1	2.48	1	1.88	1	**14.84**	**1**
	≥40 years	[0.38 - 1.93]	0.722	[0.67 - 10.14]	0.12	[0.30 - 11.78]	0.49	**[4.04 - 4.44]**	**0.001**
Educational level	**Below secondary school**	0.93	1	0.36	1	1.36	1	0.84	1
	Secondary or higher	[0.42 - 2.09]	0.87	[0.07 - 1.40]	0.09	[0.61 - 3.01]	0.44	[0.33 - 2.11]	0.72
Length of service	**≥5 years**	1.34	1	0.31	1	**0.38**	**1**	1.15	1
	<5 years	[0.59 - 3.04]	0.47	[0.07 - 1.17]	0.05	**[0.16 - 0.89]**	**0.02**	[0.45 - 2.97]	0.75
Daily working time	**>8 hours**	0.73	1	0.37	1	2.49	1	0.65	1
	≤8 hours	[0.30 - 2.68]	0.49	[0.11 - 1.18]	0.08	[0.98 - 6.32]	0.05	[0.25 - 1.71]	0.38
Work schedule	**Standard working time**	0.85	1	1.73	1	0.43	1	**3.09**	**1**
	shift work	[0.37 - 1.94]	0.70	[0.45 - 8.11]	0.37	[0.19 - 0.97]	0.04	**[1.04 - 9.12]**	**0.03**

OR: odds ratio; CI: confidence interval; p: p-value.

3.4. Analytical Findings

Analysis revealed that age, work experience, daily working hours, and work schedule were significantly associated with several cardiovascular risk factors (**Table 5(a)** and **Table 5(b)**). Drivers aged 40 years or older had a higher likelihood of high blood pressure (OR = 20.76; 95% CI: 4.51 - 5.63; p = 0.01) and an increased overall cardiovascular risk (OCVR) (OR = 14.84; 95% CI: 4.04 - 4.44; p = 0.001). Regarding work experience, those with less than five years in the job were less likely to exhibit sedentary behaviour (OR = 0.42; 95% CI: 0.18 - 0.98; p = 0.04) or overweight/obesity (OR = 0.38; 95% CI: 0.16 - 0.89; p = 0.02). Drivers working less than eight hours per day were also less exposed to sedentary behaviour (OR = 0.37; 95% CI: 0.14 - 0.95; p = 0.03). Finally, those with shift-based work schedules exhibited significantly higher levels of sedentary behaviour (OR = 3.66; 95% CI: 1.58 - 8.47; p = 0.01) and increased overall cardiovascular risk (OR = 3.09; 95% CI: 1.04 - 9.12; p = 0.03).

4. Discussion

4.1. Prevalence of Cardiovascular Risk Factors

The majority of drivers (90.2%) presented with at least one cardiovascular risk factor (CVRF), confirming a worrying situation in this occupational group. The main CVRFs identified were dyslipidaemia (63.7%), sedentary lifestyle (57.8%), overweight/obesity (40.2%), and high blood pressure (21.6%). These findings are consistent with several international studies showing that road drivers exhibit a particularly adverse cardiometabolic profile [20] [21].

The high prevalence of dyslipidaemia and sedentary behaviour observed may be explained by a lifestyle characterised by low levels of physical activity and unbalanced dietary habits, directly resulting from the itinerant nature of the profession. Indeed, time constraints and long driving hours limit opportunities for exercise and encourage the consumption of high-fat, high-sugar foods, particularly in roadside fast-food outlets. A study conducted in Nigeria reported comparable prevalences of dyslipidaemia (56.3%) and overweight/obesity (62.8%) among bus drivers [21].

Studies conducted in different geographical contexts confirm this trend: Hege in North Carolina, Wang in Taipei, and Behlouli in Algeria reported dyslipidaemia rates of 65.2%, 75.7%, and 69.4%, respectively [8] [9] [22]. Bremi *et al.* in Burkina Faso reported an obesity prevalence of 52.9% among heavy goods vehicle drivers [23]. In Australia, Sendall *et al.* found that nearly 90% of truck drivers were overweight or obese [10].

With regard to high blood pressure, several studies corroborate our findings: Lalla-Edward in South Africa, Montalti in Italy, and Sangaleti in Brazil reported prevalences of 35.8%, 35.6%, and 45.2%, respectively, among road drivers [24]-[26]. Given the strong correlation between high blood pressure and cardiovascular disease, early management is essential to prevent complications such as heart failure, hypertensive retinopathy, stroke, or chronic kidney disease, which may seri-

ously compromise both work capacity and road safety.

Road drivers are also prone to risky behaviours and lifestyles, such as alcohol consumption and smoking [27]. In our series, more than half of the drivers consumed alcohol (54.9%) and 13.7% were smokers. Although slightly lower than the rates reported by Amadi *et al.* (71% and 19.5%, respectively) [21], these figures reflect the high prevalence of these harmful habits in a population exposed to chronic occupational stress. In our study, 21.6% of drivers experienced stress, mainly linked to organisational factors such as irregular schedules, long waiting periods, delivery deadlines, and family isolation [28] [29].

Finally, the proportion of drivers presenting with hyperglycaemia (9.8%) highlights the need to strengthen periodic medical surveillance in order to detect metabolic disorders early and reduce the risk of progression to diabetes and its complications.

4.2. Factors Associated with CVRFs

Multivariate analysis revealed that age, length of service, daily working time, and shift work were significantly associated with CVRFs.

Drivers aged 40 years and above had a significantly higher risk of high blood pressure (OR = 20.76; 95% CI = 4.51 - 5.63; p = 0.01) and overall cardiovascular risk (OR = 14.84; 95% CI = 4.04 - 4.44; p = 0.001). These findings confirm the well-established trend of increasing prevalence of high blood pressure and metabolic disorders with age [20] [30] [31]. Arterial stiffening, prolonged exposure to occupational stress, and persistent unhealthy lifestyle habits are plausible explanatory mechanisms.

Length of professional experience also appeared to be a major determinant: drivers with less than five years of experience showed lower levels of sedentary behaviour (OR = 0.42; 95% CI = 0.18 - 0.98; p = 0.04) and a lower prevalence of overweight/obesity (OR = 0.38; 95% CI = 0.16 - 0.89; p = 0.02). These results suggest that longer exposure to occupational constraints (prolonged sitting, irregular eating patterns, sleep deprivation) favours metabolic dysregulation and weight gain. Hsinet *et al.* (2020) reported a correlation between driving seniority and metabolic syndrome among professional drivers [20].

Drivers working fewer than eight hours per day exhibited less sedentary behaviour (OR = 0.37; 95% CI = 0.14 - 0.95; p = 0.03). This finding underlines the deleterious role of prolonged working days on cardiovascular health, limiting recovery time and opportunities for physical activity. Previous research has shown that long driving hours are associated with increased cardiovascular events and premature mortality [32] [33].

Finally, shiftwork was significantly associated with an increased risk of sedentary behaviour (OR = 3.66; p = 0.01) and overall cardiovascular risk (OR = 3.09; p = 0.03). This association is consistent with evidence highlighting the impact of shift work on circadian rhythm disruption, hormonal and metabolic dysregulation, chronic fatigue, and sleep disturbances [34]. A meta-analysis encompassing

21 studies found that shift work increased the overall risk of cardiovascular disease by 17% and coronary heart disease by 26%, with a 7.1% progressive risk increase for every additional five years of exposure [35].

4.3. Study Limitations

This study presents certain limitations. Firstly, its cross-sectional design does not allow for establishing a causal relationship between CVRFs and associated factors. Secondly, the partial use of self-reported data (alcohol and tobacco consumption, diet, stress) may introduce recall or social desirability bias. Finally, participants were recruited from a single transport company, limiting the generalizability of findings. Despite these limitations, the study makes an important contribution to understanding the cardiovascular profile of road drivers in Côte d'Ivoire.

5. Conclusions and Recommendations

Cardiovascular diseases remain a major public health concern due to their high prevalence and associated mortality. Our study highlights a high proportion of CVRFs among road drivers, mainly dyslipidaemia, sedentary lifestyle, overweight/obesity, and hypertension. Shift work was found to triple the overall cardiovascular risk.

These results call for the implementation of an integrated prevention policy including: awareness campaigns on CVRFs and their consequences tailored to the transport sector; promotion of regular physical activity, even in the form of light exercises during driving breaks; strengthened medical monitoring with regular screening for hypertension, diabetes, and lipid disorders; and improvement of working conditions, particularly through better scheduling to reduce shift work and excessively long driving hours. A multidisciplinary approach involving occupational physicians, employers, trade unions, and health authorities is essential to safeguard the cardiovascular health of road drivers and ensure transport safety in Côte d'Ivoire.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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