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Occupational Health Problems: An Assessment of the Cardiovascular Health Status of Road Construction Workers in Imo State, Nigeria

John Mark Bwala
Agwu Nkwa Amadi
Chimezie Christian Iwuala
Department of Public Health, School of Health Technology,
Federal University of Technology Owerri, Nigeria
Ugo Uwadiako Enebeli
Department of Community Medicine,
University of Port Harcourt Teaching Hospital, Nigeria

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Abstract

Aims and Scope: Road construction work is uniquely demanding and highly stressful, which may impact the cardiovascular system, and this study assessed the cardiovascular health status of road construction workers in Imo State, Nigeria, focusing on blood pressure (BP) and pulse rate (PR). **Methods**: A cross-sectional descriptive design was employed, using a multi-stage sampling technique from different construction sites across the 3 senatorial zones of Imo State to collect data from 353 male road construction workers through structured questionnaires and physical assessments (BP and PR measurements). Data were analyzed using descriptive statistics, including frequency distributions for categorical variables (e.g., prevalence of hypertension and tachycardia) and summary statistics such as means and standard deviations for continuous variables (e.g., BP and PR). **Results:** The results indicated that 23.2% of participants had systolic hypertension, 48.4% had high-normal systolic blood pressure (SBP), and only 28.3% had optimal and normal SBP. Also, 9.9% had diastolic hypertension, 19.8% had high-

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normal diastolic blood pressure (DBP), and 70% had optimal and normal DBP. The differences across the classes of BP were statistically significant, $p<0.001$. Also, 6.2% participants exhibited tachycardia, and the differences in the occurrence of diastolic hypertension and tachycardia across the senatorial zones were not statistically significant ($p=0.11$ and 0.45, respectively). Additionally, 76.2% of the workers lacked regular medical check-ups, and only 29.2% consistently used personal protective equipment (PPE). **Conclusions:** These findings underscore the significant cardiovascular health risks faced by road construction workers, exacerbated by limited access to healthcare and occupational safety measures. The findings highlight the need for improved occupational health policy enforcement, health education, routine screenings, and worksite health interventions.

Keywords: Occupational health, Road construction workers, Cardiovascular health, Blood pressure, Pulse rate, Imo State

Introduction

Road construction work is physically demanding and often conducted under extreme environmental conditions, which places significant stress on the cardiovascular system (Kumar et al., 2025). Workers are exposed to a myriad of occupational hazards such as intense physical exertion, prolonged exposure to sunlight, vibration from machinery, noise pollution, and inhalation of particulate matter and fumes (Kamardeen, 2022). These factors have been associated with the development and exacerbation of cardiovascular health problems, particularly high blood pressure (hypertension) and rapid pulse rate (tachycardia) (Karthick et al., 2023). Previous studies have shown that strenuous physical activity, environmental stressors (e.g., noise, heat, and vibration), environmental pollution, and long working hours are common in construction work. However, the availability and proper use of personal protective equipment can help to mitigate the effects of stressors, including physical strain and exposure to environmental pollution, noise, heat, and vibration (Darabont et al., 2024; Liu et al., 2020). These occupational stressors are recognized as contributing factors to cardiovascular diseases by the World Health Organization (WHO, 2021). Consequently, it is critical to prioritize the assessment of the health effects of occupational stressors in high-risk occupations, especially in construction work (Chung et al., 2018). Yet there is limited health research on Nigerian road construction workers.

Cardiovascular diseases are among the leading causes of morbidity and mortality worldwide (WHO, 2021). Occupational exposure, particularly in physically demanding jobs like road construction, is a significant risk factor for elevated cardiovascular parameters. In Nigeria, especially in States such as Imo State, where infrastructure development is on the rise, road construction

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activities have surged. However, this progress comes with potential health risks to the labour force, which often comprises low-income workers with inadequate access to routine medical checkups or protective workplace policies (Agwah et al., 2025). Despite the global emphasis and regulations on occupational health, especially by the Occupational Safety and Health Administration (OSHA, 2023) and the International Labour Organization (ILO, 2024), cardiovascular risk assessments specific to road construction workers in Nigeria remain limited in scope.

Accordingly, this study investigates a largely under-researched population (road construction workers) in a developing country context, providing insights that could inform workplace health interventions and policy. With the research question: What is the cardiovascular health status, by blood pressure and pulse rate measurements, among road construction workers in Imo State, Nigeria? This study aims to assess cardiovascular health, with a focus on blood pressure and pulse rate among road construction workers in Imo State, Nigeria. The findings could inform health interventions and policy development for occupational safety in similar environments.

Methods

A cross-sectional study was conducted, involving 353 male road construction workers selected with a multi-stage sampling technique from different construction sites across the 3 senatorial zones of Imo State, Nigeria. In the first stage, the three clusters, which were the three senatorial zones in Imo State, were selected. In the second stage, major construction sites were randomly selected from the local government areas in the three zones in Imo State. In the third stage, a simple random sampling technique was used to select the construction workers from the different construction sites until the required sample size was obtained. The inclusion criteria were being employed as a road construction worker, aged 18 years and above, and having a minimum of 6 months in the profession. Non-road construction workers, non-consenting, and acutely ill workers were excluded from the study.

There were 121, 122, and 110 respondents in Imo West, Imo East, and Imo North senatorial zones, respectively. Structured questionnaires were used to collect sociodemographic data. The blood pressure (systolic and diastolic) and pulse rate were measured using a digital sphygmomanometer. The readings were taken under standardized conditions, with participants seated after a ten-minute rest. Each parameter was measured thrice with two-minute intervals and averaged for accuracy.

Data was uploaded into the Statistical Package for Social Sciences (SPSS) software (version 23). Descriptive statistics, including means and frequency distributions, were used to summarize the data, and frequency distribution tables were constructed for categorical variables. Blood pressures

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and pulse rates were categorized based on the Nigerian Hypertension Society Classification (The Nigerian Hypertension Society, 2020) and the World Health Oganization guidelines (WHO, 2020).

Results

A total of 353 road construction workers were surveyed across all three senatorial zones of Imo State, Nigeria. The results show that 82(23.2%) road construction workers had systolic hypertension and 35(9.9%) had diastolic hypertension. Almost half of the workers, 171(48.4%) of the road construction workers, had high-normal systolic blood pressure (SBP), and 70(19.8%) had high-normal diastolic blood pressure (DBP). Only 100(28.3%) of the workers had optimal and normal systolic BP (Table 1). The differences across the classes of BP were statistically significant, $p<0.001$ (Table 1). The occurrence of systolic hypertension was 32(26.4%), 31(25.4%), and 19 (17.3%) in Imo West, Imo East, and Imo North zones, respectively; and the difference across the zones was not statistically significant ($p=0.348$) (Table 2).

Thirty-five (10%) of all the workers had diastolic hypertension, and this was 12(9.8%), 13(10.3%), and 11 (10%) in Imo West, Imo East, and Imo North, respectively. The differences among the zones were not statistically significant ($p=0.11$) (Table 3). Twenty-two (6.2%) workers had tachycardia (raised pulse rates): 10(8.3%), 6(4.9%), and 6(5.5%) in Imo West, Imo East, and Imo North zones respectively; and the difference across the zones was not statistically significant ($p=0.45$) (Table 4).

Up to 70(19.8%) workers were ignorant that road construction work could predispose to cardiovascular problems, 47(13.3%) had ever been diagnosed with a cardiovascular condition, 103(29.2%) responded they always wore PPE, 269(76.2%) did not go for regular (at least annual) medical check-ups, and 210(59.5%) did not have easy access to healthcare services (Table 5).

Table 1: Summary Distribution of Systolic and Diastolic Blood Pressure Classes of Road Construction Workers in Imo State

	Systolic Blood Pressure (SBP)			**Diastolic Blood Pressure (DBP)**		
BP Category	SBP (mmHg)	n	%	DBP (mmHg)	n	%
Optimal & Normal BP	<130	100	28.3	<85	248	70.3
High-normal BP	130 – 139	171	48.4	85 – 89	70	19.8
Hypertension, Grade 1	140 – 159	62	17.6	90 – 99	25	7.1
Hypertension, Grades 2&3	160 & above	20	5.7	100 & above	10	2.8
Total		353	100.0		353	100.0
Min (Max)		*90 (178)*			*50 (113)*	
Mean ± SD		*128.9 ± 17.4*			*75.4 ± 11.2*	
P-value		*< 0.0001*			*< 0.0001*	

n=Number; Min=Minimum value; Max=Maximum value; SD=Standard Deviation

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Table 2: Comparison of Systolic Blood Pressure values of Road construction workers at the different Senatorial zones of Imo State

Systolic Pressure (mmHg)	Imo West		Imo East		Imo North	
	n	%	n	%	n	%
Optimal & Normal BP (<130)	31	25.6	35	28.7	34	30.9
High-normal BP (130-139)	58	47.9	56	45.9	57	51.8
Hypertension, Grade 1 (140-159)	22	18.2	24	19.7	16	14.6
Hypertension, Grades 2&3 (160 & above)	10	8.3	7	5.7	3	2.7
Total	*121*	*100.0*	*122*	*100.0*	*110*	*100.0*
Min (max)	*90*	*173*	*102*	*178*	*98*	*177*
Mean ± SD	*127.3 ± 17.5*		*128.98±17.1*		*129.2±17.6*	
P-value			*0.348*			

n=Number; Min=Minimum value; Max=Maximum value; SD=Standard Deviation

Table 3: Comparison of Diastolic Blood Pressure values of Road construction workers at the different Senatorial zones of Imo State

Diastolic BP (mmHg)	Imo West		Imo East		Imo North	
	n	%	n	%	n	%
Optimal & Normal (<85)	86	71.1	84	68.8	78	70.9
High normal (85 – 89)	23	19.2	25	20.8	21	19.1
Hypertension, Grade 1 (90 – 99)	9	7.2	10	7.9	7	6.4
Hypertension, Grades 2&3 (100 and above)	3	2.5	3	2.5	4	3.6
Total	*121*	*100.0*	*122*	*100.0*	*110*	*100.0*
Min (max)	*50 (110)*		*52*	*113*	*53*	*105*
Mean ± SD	*74.7 ± 11.6*		*76.1 ± 10.0*		*75.9 ± 11.7*	
P-value			*0.11*			

n=Number; Min=Minimum value; Max=Maximum value; SD=Standard Deviation

Table 4: Comparison of Pulse Rate at different Senatorial zones

Pulse Rate (beats/min)	Imo West		Imo East		Imo North	
	n	%	n	%	n	%
41 – 60	10	8.2	11	9.0	8	7.2
61 – 80	61	50.4	62	50.8	58	52.7
81 – 100	40	33.1	43	35.3	38	34.6
>100 (Tachycardia)	10	8.3	6	4.9	6	5.5
Total	121	100.0	122	100.0	110	100.0
Min (max)	*53 (115)*		*52 (109)*		*55 (112)*	
Mean ± SD	*79.5 ± 12.4*		*76.7 ± 12.6*		*78.0 ± 12.5*	
P-value			*0.45*			

n=Number; Min=Minimum value; Max=Maximum value; SD=Standard Deviation

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Table 5: Response of Road Construction Workers on Cardiovascular Health

Information on Cardiovascular Health	Yes (%)	No (%)	Total (%)
GENERAL (ALL THREE ZONES)			
Do you think road construction work can predispose to cardiovascular health problems?	283 (80.2)	70 (19.8)	353 (100.0)
Have you ever been diagnosed with any cardiovascular condition?	47 (13.3)	306 (86.7)	353 (100.0)
Do you always wear PPE at work?	103 (29.2)	250 (70.8)	353 (100.0)
Do you go for regular (at least annual) medical check-ups, including BP and PR?	84 (23.8)	269 (76.2)	353 (100.0)
Do you have easy access to healthcare services?	143 (40.5)	210 (59.5)	353 (100.0)
IMO WEST			
Do you think road construction work can predispose to cardiovascular health problems?	97 (80.2)	24 (19.8)	121 (100.0)
Have you ever been diagnosed with any cardiovascular condition?	16 (13.2)	105 (86.8)	121 (100.0)
Do you always wear PPE at work?	37 (30.6)	84 (69.4)	121 (100.0)
Do you go for regular (at least annual) medical check-ups, including BP and PR?	29 (24.0)	92 (76.0)	121 (100.0)
Do you have easy access to healthcare services?	49 (40.5)	72 (59.5)	121 (100.0)
IMO EAST			
Do you think road construction work can predispose to cardiovascular health problems?	98 (80.3)	24 (19.7)	122 (100.0)
Have you ever been diagnosed with any cardiovascular condition?	17 (13.9)	105 (86.1)	122 (100.0)
Do you always wear PPE at work?	35 (28.7)	87 (71.3)	122 (100.0)
Do you go for regular (at least annual) medical check-ups, including BP and PR?	31 (25.4)	91 (74.6)	122 (100.0)
Do you have easy access to healthcare services?	53 (43.4)	69 (56.6)	122 (100.0)
IMO NORTH			
Do you think road construction work can predispose to cardiovascular health problems?	88 (80.0)	22 (20.0)	110 (100.0)
Have you ever been diagnosed with any cardiovascular condition?	14 (12.7)	96 (87.3)	110 (100.0)
Do you always wear PPE at work?	85 (28.2)	79 (71.8)	110 (100.0)
Do you go for regular (at least annual) medical check-ups, including BP and PR?	24 (21.8)	86 (78.2)	110 (100.0)
Do you have easy access to healthcare services?	41 (37.3)	69 (62.7)	110 (100.0)

*PPE: Personal Protective Equipment

Discussion

The high prevalence of systolic hypertension (23.2%), diastolic hypertension (9.9%), and tachycardia/elevated pulse rate (6.2%) among road construction workers in Imo State underscores a critical occupational health concern. The elevated cardiovascular parameters suggest that intense physical

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exertion and environmental exposure in road construction work significantly affected cardiovascular health. Chronic exposure to physical stress, high temperatures, and pollution in construction zones can activate the sympathetic nervous system, leading to sustained increases in heart rate and blood pressure (Li et al., 2024). Additionally, the physical demands of carrying heavy loads and operating machinery may predispose workers to long-term cardiovascular strain (Dias et al., 2023). Compared to other studies of road construction workers, the prevalence of systolic hypertension was lower at 17.9% in Jakarta (Debora & Widanarko, 2020) but higher than the 38.4% prevalence in Hong Kong (Yi & Chan, 2016).

These cardiovascular risks appear linked to both work-related stressors and behavioural health access factors. The low usage of PPE (29.2%) and low medical monitoring among the participants (23.8%) point to systemic gaps in occupational health management. The PPE usage in this study was higher than among building construction workers in Kampala, Uganda (Izudi et al., 2017), similar to the 27.8% among auto-technicians in Uyo, Nigeria (Johnson & Motilewa, 2016), the 31% among road transport workers in Imo State, Nigeria, (Nwakamma et al., 2025) and three regions in Ghana (27.0%) (Yankson et al., 2021). The finding is also similar to the multi-country trends in the global meta-analysis of workers by (Malta et al., 2024). This multifactorial risk environment signifies the necessity for comprehensive health monitoring and intervention strategies tailored to this vulnerable population.

The findings of this study align with global research that links physically demanding labour with increased risk of hypertension and tachycardia. They support WHO's assertion that occupational stress, physical strain and the work environment can compromise cardiovascular health. The limitations of this study are its male-only sample, as findings may not generalize to female workers; the cross-sectional design, which does not allow causal inferences; potential measurement biases from digital BP recordings; and the study's reliance on self-reported data for use of PPE and medical check-ups, which may introduce recall inaccuracies.

Conclusions

Road construction workers are exposed to physical stress, and pollution in construction zones can activate the sympathetic nervous system, leading to sustained increases in heart rate and blood pressure, which may predispose workers to long-term cardiovascular strain. The physical strain and exposure to environmental pollution, noise, heat, and vibration among construction workers can be mitigated with the availability and proper use of PPE. This study found a high prevalence of hypertension (23.2% systolic, 9.9% diastolic) and tachycardia (6.2%) among road construction workers in Imo State, Nigeria, with 76.2% lacking routine medical checkups and only

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29.2% consistently using PPE. Thus, this study uniquely contributes to the Nigerian occupational health literature with its findings that highlight significant cardiovascular risks and inadequate occupational health and safety measures among road construction workers. Consequently, there is an urgent need for routine health monitoring and the implementation of workplace wellness programs to mitigate cardiovascular risks among road construction workers in Imo State and similar environments.

Recommendations

Based on the findings, the following recommendations are proposed:

- Policy Intervention: State health departments and labour ministries should enforce occupational health regulations in the construction industry, including guidelines on cardiovascular risk assessment.
- Health Education Programs: Awareness campaigns should be conducted to educate workers on the dangers of hypertension, the benefits of healthy lifestyles, and the importance of regular health assessments.
- Routine Cardiovascular Screening: Employers should implement mandatory annual health checks focused on blood pressure and pulse monitoring to enable early detection and management.
- Worksite Health Clinics: Mobile clinics or onsite medical services should be considered, especially for large construction sites, to provide immediate health interventions and counselling.
- Provision of PPE and Structured Work Hours: Employers must ensure the availability of PPE and enforce scheduled work-rest cycles to reduce prolonged cardiovascular strain.

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Data Availability: All data are included in the content of the paper.

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