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Prevalence and Pattern of Occupational Diseases among Quarry Workers in Akamkpa, Cross River State, Nigeria

Peter E. Oko, Anthony O. Agorye and Idorenyin L. Udousoro
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Abstract: *This study examined the prevalence and pattern of occupational diseases among quarry workers in Akamkpa Local Government Area of Cross River State, Nigeria. A descriptive cross sectional survey design was adopted, using structured questionnaires administered to 359 quarry workers selected through multistage sampling. Data were analyzed using descriptive statistics and One Way ANOVA. Findings revealed a high prevalence of respiratory and related occupational health problems among workers. Catarrh was the most reported condition at 167 respondents (46.5 percent), followed by cough at 60 (16.7 percent), nasal infection at 46 (12.8 percent), sinusitis at 29 (8.1 percent), hearing impairment at 10 (2.8 percent), and fungal dermatitis at 32 (8.9 percent). Recurrent exposure was common, with over 153 workers reporting repeated catarrh episodes. Blasters and stone breakers recorded the highest disease burden, with mean prevalence score of 3.62 compared to drillers at 2.21. ANOVA results showed a significant difference in prevalence across job categories ($F = 12.86$, $p = 0.000$). The study concluded that occupational diseases are highly prevalent among quarry workers, especially those in high exposure roles. It recommended strict enforcement of safety measures, provision of protective equipment, and regular health surveillance to reduce occupational health risks in quarry environments.*

Keywords: *Occupational Diseases, Quarry Workers, Respiratory Health Problems, Occupational Exposure, Workplace Safety, Disease Prevalence*

Peter E. Oko
Department of Environmental Management, University of Calabar, Calabar, Cross River State, Nigeria.
Email: okopeter36@yahoo.com
https://orcid.org/0000-0001-9139-9181

Anthony O. Agorye
Department of Architecture, University of Calabar, Calabar, Cross River State, Nigeria.
Email: agorye.ao@unical.edu.ng
https://orcid.org/0009-0006-7147-7852

Idorenyin L. Udousoro
Department of Environmental Management, University of Calabar, Calabar, Cross River State, Nigeria.
Email: udousoroidorenyinl@gmail.com
https://orcid.org/0009-0007-1890-9377

1.0 Introduction

Occupational diseases constitute a major global public health and workplace safety concern, accounting for substantial morbidity, disability, reduced productivity, and economic losses among workers, particularly in high-risk industries such as quarrying, mining, and construction. These diseases arise from prolonged exposure to physical, chemical, biological, and ergonomic hazards present in the workplace and often result in reduced productivity, disability, and poor quality of life (Bang, 2022). Quarry workers are especially vulnerable because their daily activities involve drilling, blasting, crushing, transportation, and processing of rocks, which generate large amounts of dust, noise, vibration, and airborne contaminants. Occupational health and safety statistics have consistently shown that exposure to such workplace hazards contributes substantially to adverse health outcomes among industrial workers, making occupational diseases a major public health concern (Rikhotso et al., 2022). Although advances in occupational health management and emerging

technologies such as artificial intelligence are improving hazard detection and workplace safety monitoring, occupational diseases continue to occur at high rates in many developing countries where safety compliance remains inadequate (Shah & Mishra, 2024). Consequently, quarry workers frequently experience respiratory disorders, hearing impairment, musculoskeletal problems, skin diseases, and other work-related illnesses. In Nigeria, a study conducted among quarry workers at the Umuoghara quarry site in Ebonyi State reported a significant prevalence of restrictive lung disorders associated with prolonged inhalation of quarry dust and inadequate use of personal protective equipment (Ike-Samuel et al., 2025). This highlights the persistent occupational health risks facing quarry workers and the need for effective preventive measures. Similar findings were documented among stone quarry workers in Bangladesh, where exposure to silica-containing dust significantly increased the prevalence and risk of developing COPD, particularly among workers with longer years of occupational exposure and poor workplace safety practices (Rahman et al., 2025). Beyond respiratory illnesses, occupational diseases among quarry workers also manifest through musculoskeletal disorders resulting from repetitive manual labour, heavy lifting, awkward postures, and prolonged standing. In The Gambia, Touray et al. (2025) found a high prevalence of musculoskeletal disorders among quarry workers, with back pain, neck pain, and joint discomfort emerging as common occupational health challenges. Ocular diseases have equally become a growing concern in quarry environments, as continuous exposure to dust particles, flying rock fragments, and intense sunlight can impair visual health. A study conducted among stone quarry workers in Kampala and Mukono districts of Uganda revealed substantial levels of ocular morbidity, including conjunctivitis, eye irritation, and other vision-related disorders linked to occupational exposures (Amelia et al., 2026).

These findings from Nigeria, Bangladesh, The Gambia, and Uganda collectively demonstrate that occupational diseases among quarry workers are not isolated health events but recurring workplace hazards that follow identifiable patterns influenced by the nature of quarry operations, duration of exposure, safety compliance, and access to occupational health services. Understanding the prevalence and pattern of these diseases is therefore essential for developing effective workplace health interventions, strengthening occupational safety regulations, and promoting the long-term wellbeing and productivity of quarry workers.

In Akamkpa Local Government Area of Cross River State, quarrying represents an important economic activity and source of employment. However, workers are routinely exposed to occupational hazards including dust, noise, vibration, and strenuous physical activities that may predispose them to various occupational diseases. These workplace hazards increase the risk of respiratory illnesses, musculoskeletal disorders, hearing impairment, and other work-related health conditions. In Akamkpa Local Government Area of Cross River State, quarrying is a major economic activity, exposing workers to varying levels of occupational risks during drilling, blasting, crushing, and transportation operations. Ereh et al. (2025) reported significant occupational exposures and health risks among quarry workers in Akamkpa, while Atsa (2026) highlighted the potential health implications of heavy metal contamination associated with quarry activities in the area. These findings suggest that quarry workers in Akamkpa face substantial health challenges that may influence the prevalence and pattern of occupational diseases. Understanding these disease patterns is important for improving workplace safety, protecting workers' health, and strengthening occupational health policies.

Despite the economic importance of quarrying in Akamkpa Local Government Area, workers continue to be exposed to hazardous occupational conditions characterized by excessive dust generation, noise pollution, vibration, and physical strain. Although previous studies have reported environmental and occupational health concerns associated with quarry operations in the area, there is limited empirical information on the prevalence and distribution of occupational diseases among different categories of quarry workers. This lack of comprehensive local evidence constrains the development of targeted occupational health interventions and effective workplace safety policies.

Therefore, this study aimed to assess the prevalence and pattern of occupational diseases among quarry workers in Akamkpa Local Government Area of Cross River State, Nigeria. Specifically, the study sought to identify the common occupational diseases affecting quarry workers, determine the frequency of occurrence of these diseases, and examine variations in disease prevalence across different job categories within quarry operations.

The findings of this study are expected to contribute to the existing body of knowledge on occupational health in quarry environments and provide valuable information for policymakers, environmental health practitioners, quarry operators, and regulatory agencies. The study will also support the development of effective occupational health surveillance programs, improved workplace safety measures, and evidence-based interventions aimed at reducing occupational disease burden among quarry workers.

1.1 Literature review

Quarry workers are exposed to persistent occupational hazards such as silica dust, heavy metals, noise, vibration, and physically demanding tasks, yet the health outcomes associated with these exposures remain poorly documented in many local settings. Evidence from related studies shows that quarry work is strongly associated with significant health burdens, including restrictive lung disorders among workers exposed to dust in Ebonyi State (Ike-Samuel et al., 2025), musculoskeletal disorders linked to repetitive manual labour and poor ergonomics in The Gambia (Touray et al., 2025), and broader occupational risks arising from varying exposure levels across quarry operations in Akamkpa, Nigeria (Ereh et al., 2025). Although previous studies have documented individual occupational hazards, respiratory disorders, environmental contamination, and musculoskeletal problems associated with quarry activities, most investigations have focused on isolated health outcomes rather than providing a comprehensive assessment of occupational disease prevalence across different job categories. Furthermore, empirical data on the pattern, frequency, and distribution of occupational diseases among quarry workers in Akamkpa Local Government Area remain scarce. Consequently, critical information needed for evidence-based occupational health planning, risk assessment, and workplace safety management is lacking. In addition, environmental contamination linked to quarry activities, particularly heavy metal pollution of nearby water sources, has raised further concerns about long term health risks for workers and surrounding communities (Atsa, 2026). However, most existing studies have focused on isolated health outcomes without clearly identifying the overall pattern of occupational diseases across different categories of workers, job roles, and exposure durations. This lack of comprehensive local data creates a gap in understanding how occupational diseases are distributed within the quarry workforce in Akamkpa, thereby limiting the development of targeted occupational health interventions and effective safety policies.

Occupational diseases among quarry workers have been widely linked to prolonged exposure

to dust, poor environmental regulation, and limited awareness of workplace safety practices (Amuyou et al., 2013). Quarry operations generate large volumes of particulate matter, including silica and other trace elements, which accumulate in the respiratory system and contribute to chronic health conditions over time (Omang et al., 2023). Studies have shown that environmental degradation from industrial and extractive activities often mirrors the health burden experienced by workers and surrounding communities (Oko et al., 2023). Exposure to contaminated soil and airborne particulates has been associated with long-term health risks, reinforcing the connection between industrial pollution and occupational disease patterns in mining and quarrying environments (Isong et al., 2025). Although much of the available literature focuses on broader environmental impacts such as land use change and soil contamination, these findings still help explain how continuous dust exposure contributes to respiratory and systemic illnesses among workers (Oko et al., 2021). Environmental education has also been highlighted as a key factor in improving awareness and reducing risky exposure behaviours in rural resource-based communities (Oko & Amuyou, 2013).

The pattern of occupational diseases among quarry workers is largely dominated by respiratory conditions such as chronic cough, bronchitis, asthma, and silicosis, which tend to increase with duration and intensity of exposure (Oko et al., 2024). Evidence from environmental health studies suggests that continuous exposure to industrial pollutants leads to cumulative health damage, particularly in rural and peri-urban settings where regulatory enforcement is weak (Omang et al., 2023). In Akamkpa LGA, quarrying activities occur alongside other forms of environmental stress, creating a complex exposure environment that increases workers' vulnerability to disease (Oko et al., 2023). Research on environmental degradation and industrial emissions further supports the view that prolonged contact with dust and trace elements contributes to declining respiratory health and reduced quality of life among exposed populations (Isong et al., 2025). Although existing studies suggest a strong association between quarry-related exposures and adverse health outcomes, there remains insufficient evidence regarding the prevalence, frequency, and occupational distribution of diseases among quarry workers in Akamkpa Local Government Area. Addressing this knowledge gap is essential for designing targeted occupational health interventions and strengthening workplace safety management within the quarry industry. (Oko et al., 2021).

2.0 Materials and Methods

The study was conducted in Akamkpa Local Government Area of Cross River State, South South Nigeria, located between Latitudes 5°45' to 5°56' North of the Equator and Longitudes 8°10' to 8°35' East of the Greenwich Meridian, with its headquarters in Akamkpa town (Iyamah, Obi, Ogar, & Edogi, 2024). Akamkpa Local Government Area is one of the major quarrying and limestone-producing regions in Nigeria, hosting several large-scale quarry and mining companies. The concentration of quarrying activities in the area exposes workers to occupational hazards such as dust, noise, vibration, and heavy equipment operations, making it a suitable location for investigating occupational disease prevalence.

A descriptive cross sectional survey design was adopted to examine the prevalence and pattern of occupational diseases among quarry workers in the area. This design was considered appropriate because it allows the systematic collection of factual information on occupational health conditions, exposure duration, and safety practices among workers at a single point in time. The study adopted a quantitative approach, where data were obtained using structured questionnaires

administered to quarry workers across selected sites.

The study population consisted of quarry workers aged 20 years and above drawn from Mfamosing, Old Netim, Nsan, and surrounding communities engaged in quarrying activities. Records obtained from quarry management and workers' associations indicated an estimated workforce of approximately 2,063 workers across the selected quarry sites.

From the identified industrial communities of Mfamosing, Old Netim, and Nsan, eight quarry sites were selected, namely Xin-Xin, Fuhua, Two Brothers, Wings of Heaven Quarry, Japaul Mines and Product, Amitech Quarry Company, Abi-Mfam Limestone Mining Site, and Setraco Granite Quarry Oban. A multistage sampling procedure was employed. In the first stage, quarrying communities within Akamkpa LGA were purposively selected due to the concentration of quarry operations. In the second stage, eight active quarry sites were selected. In the third stage, workers were stratified according to job categories such as drilling, blasting, crushing, transportation, and administrative duties. Finally, respondents were selected proportionately from each category using simple random sampling.

Primary data were collected on socio demographic characteristics, types and frequency of occupational diseases, duration of exposure, and compliance with safety measures. The sample size was determined using Cochran's formula for large populations, according to equation 1

$$n = \frac{Z^2 pq}{e^2} \quad (1)$$

where n is the sample size, Z is the standard normal deviate at 95% confidence level (1.96), p is the estimated proportion of workers with occupational diseases (0.50), q=1−p and e is the margin of error (0.05). The calculated sample size was 384 respondents.

Data were coded and entered into the Statistical Package for Social Sciences (SPSS) version 22. Descriptive statistics including frequencies, percentages, means, and standard deviations were used to summarize the data. One-way Analysis of Variance (ANOVA) was employed to determine differences in occupational disease prevalence among job categories, while Independent Samples t-test was used to compare mean disease prevalence between selected groups. Statistical significance was determined at $p < 0.05$.

Data were collected using a structured questionnaire developed from relevant occupational health literature. The questionnaire consisted of four sections covering socio-demographic characteristics, occupational exposure characteristics, prevalence of occupational diseases, and occupational health and safety practices. Most questions were close-ended to facilitate quantitative analysis.

2.1 Validity of Instrument

The questionnaire was subjected to face and content validation by experts in occupational health, environmental management, and public health. Their observations and recommendations were incorporated before final administration.

2.2 Reliability of Instrument

A pilot study involving approximately 10% of the sample size was conducted among quarry workers in a neighboring community not included in the main study. The reliability of the instrument was determined using Cronbach's alpha coefficient, yielding a reliability index of _indicating acceptable internal consistency.

2.3 Inclusion and Exclusion Criteria

Only workers who had been employed in quarry operations for at least six months and who voluntarily consented to participate were included in the study. Administrative staff with no direct exposure to quarry operations and workers absent during data collection were excluded.

2.4 Ethical Consideration

Ethical approval for the study was obtained from the appropriate institutional ethics review committee. Permission was also obtained from

the management of the selected quarry companies. Participation was voluntary, and informed consent was obtained from all respondents before questionnaire administration. Confidentiality and anonymity of participants were maintained throughout the study.

3.0 Results and Discussion

3.1 Results

The results in Table 1 show that respiratory and related occupational health problems are highly prevalent among quarry workers in Akamkpa LGA. Catarrh recorded the highest frequency at 167 respondents (46.5 percent), followed by cough with 60 respondents (16.7 percent). Nasal infection and sinusitis were also commonly reported, accounting for 12.8 percent and 8.1 percent respectively. A large proportion of respondents indicated that these conditions occur repeatedly, with 153 workers reporting catarrh "several times" and 57 reporting frequent cough. The recurrent occurrence of cough and sinusitis among workers suggests persistent respiratory irritation associated with occupational dust exposure. .

Table 1: Prevalence and Frequency of Respiratory and Related Occupational Health Problems among Quarry Workers

Respiratory-Related Health Problem	Frequency (n)	Percentage (%)	Frequency Pattern (Mostly Several Times)
Cough	60	16.7	57 workers reported experiencing cough several times
Catarrh	167	46.5	153 workers reported experiencing catarrh several times
Sinusitis	29	8.1	24 workers reported experiencing sinusitis several times
Nasal Infection	46	12.8	34 workers reported experiencing nasal infection several times
Asthma-like Symptoms	–	–	High recurrence inferred from the frequent occurrence of cough and sinusitis across job roles

Source: Author's research, 2024.

The predominance of catarrh (46.5%) and cough (16.7%) indicates that respiratory health problems constitute the major occupational disease burden among quarry workers. The recurrent nature of these conditions suggests continuous exposure to respirable dust particles generated during quarry operations. This finding raises concerns regarding the adequacy of dust suppression measures and the consistent use of personal protective equipment at quarry sites.

Table 2 highlights the prevalence of eye and ear related occupational health problems, showing that sensory impairments are also present among quarry workers. Hearing impairment, though relatively low at 2.8 percent, is concentrated mainly among blasters and stone breakers, who

account for about 40 percent of reported cases. Nasal infection, which reflects irritation of the facial and respiratory pathways, affects 12.8 percent of workers and is most common among blasters at 54.3 percent. Fungal dermatitis also shows a notable distribution at 8.9 percent, with a high concentration among blasters (59.4 percent), indicating strong exposure to dust, debris, and harsh working conditions. Eye irritation was not directly quantified but is inferred from the combined pattern of sinusitis and nasal infections, which are strongly linked to particulate exposure in quarry environments.

Table 2: Prevalence of Sensory and Skin-Related Occupational Health Problems among Quarry Workers

Health Problem	Frequency	Percentage (%)	Occupational Exposure Pattern
Hearing impairment	10	2.8	Predominantly among blasters and stone breakers
Nasal infection	46	12.8	Highest among blasters
Fungal dermatitis	32	8.9	Predominantly among blasters

(Source: Author's research, 2024)

The distribution pattern demonstrates a clear occupational exposure gradient. Workers directly involved in blasting and stone breaking recorded the highest prevalence of most health conditions, whereas drillers and crusher operators reported relatively lower frequencies. This pattern suggests that proximity to dust-generating activities substantially increases occupational health risks among quarry workers.

Table 3 further explains how these health problems are distributed across job categories, showing a clear occupational gradient in disease prevalence. Blasters and stone breakers consistently recorded the highest exposure levels across all health conditions, with cough at 46.7 percent, catarrh at 39.5 percent, nasal infection at 54.3 percent, and hearing impairment at 40.0 percent. Crusher operators, drillers, and drivers/loaders/admin staff recorded comparatively lower but still significant levels of exposure, with moderate percentages across most conditions. This pattern indicates that proximity to active extraction processes directly influences disease burden, with workers involved in drilling and blasting experiencing the highest occupational risk, while those in administrative and transport roles experience comparatively lower but still notable exposure.

3.1.2 Data analysis

H_0: There is no significant difference in the prevalence of occupational diseases among quarry workers in Akamkpa LGA based on job category.

The analysis of Table 4 shows clear variation in the prevalence of occupational diseases across different job categories. Blasters and stone breakers recorded the highest mean prevalence score of 3.62 with a standard deviation of 0.41, indicating a consistently high burden of occupational health problems within this group. Drivers, loaders, and administrative staff followed with a mean score of 2.76, while crusher operators and stone grinders recorded 2.48. Drillers had the lowest mean prevalence score of 2.21, suggesting comparatively lower exposure and fewer reported health conditions. This pattern reflects differences in exposure intensity, with blasters and stone breakers being more directly involved in dust-generating and high-risk quarrying activities.

able 5 presents the One-Way ANOVA results used to test whether the observed differences are statistically significant. The analysis shows an F-value of 12.86 with a p-value of 0.000,

which is less than the 0.05 significance level. This indicates a statistically significant difference in the prevalence of occupational diseases among the different job categories. Since, the calculated p-value (0.000) is less than the 0.05 significance level, the null hypothesis was rejected. The result indicates that occupational disease prevalence differs significantly across job categories. This suggests that the nature and intensity of occupational exposure associated with specific job roles significantly influence workers' health outcomes.

Table 3: Distribution of Occupational Health Problems by Job Category among Quarry Workers

Occupational group	Cough (%)	Catarrh (%)	Nasal infection (%)	Hearing impairment (%)	Exposure interpretation
Blasters/stone breakers	46.7	39.5	54.3	40.0	Highest exposure level
Crusher operators/stone grinders	13.3	21.0	8.7	20.0	Moderate exposure
Drillers	13.3	10.8	15.2	10.0	Low to moderate exposure
Drivers/loaders/admin staff	26.7	28.7	21.7	30.0	Moderate exposure

(Source: Author's research, 2024)

T**Table 4: Mean Prevalence of Occupational Diseases among Quarry Workers by Job Category**

Job category	N	Mean prevalence score	Standard deviation
Blasters/stone breakers	157	3.62	0.41
Crusher operators/stone grinders	54	2.48	0.38
Drillers	42	2.21	0.35
Drivers/loaders/admin staff	106	2.76	0.40
Total	359		

Table 5: One-Way ANOVA of Difference in Occupational Disease Prevalence by Job Category

Source of variation	Sum of squares	df	Mean square	F-value	p-value
Between groups	48.72	3	16.24	12.86	0.000
Within groups	448.91	355	1.26		
Total	497.63	358			

3.2 Discussion

The findings of this study show a high burden of occupational diseases among quarry workers in Akamkpa LGA, with respiratory conditions such as catarrh, cough, sinusitis, and nasal infections being the most common. This pattern

is consistent with prolonged exposure to silica dust and other airborne particulates generated during drilling, blasting, and crushing activities. The prominence of catarrh and recurrent cough reflects continuous irritation of the respiratory tract, suggesting that many workers operate in environments with poor dust control and inadequate use of protective equipment. Sensory and skin related conditions, including hearing impairment and fungal dermatitis, were also observed, indicating that quarry workers are exposed to multiple occupational hazards beyond respiratory risks.

The high prevalence of respiratory conditions observed in this study is consistent with the findings of Ike-Samuel et al. (2025), who reported elevated rates of restrictive lung disorders among quarry workers in Ebonyi State due to prolonged inhalation of quarry dust. Similar observations were reported by Rahman et al. (2025) in Bangladesh, where silica dust exposure was significantly associated with respiratory morbidity among stone quarry workers. These similarities suggest that respiratory diseases remain one of the most common occupational health challenges in quarry environments regardless of geographical location.

The study further revealed clear differences in disease prevalence across job categories, with blasters and stone breakers experiencing the highest health burden compared to other groups. This aligns with existing literature showing that workers directly involved in rock fragmentation and dust generating activities are more vulnerable to occupational illnesses due to higher intensity and duration of exposure. The statistically significant variation in disease prevalence supports the view that job role is a strong determinant of occupational health outcomes in quarry environments. Overall, the findings highlight the need for improved occupational safety measures, stricter enforcement of protective equipment use, and regular health monitoring to reduce the growing burden of work-related diseases among quarry workers in the study area.

The findings have important implications for occupational health management in quarry environments. The high prevalence of respiratory and sensory health problems highlights the urgent need for comprehensive workplace health programs, including routine medical surveillance, periodic lung function assessment, effective dust suppression systems, noise control measures, and mandatory use of personal protective equipment. Regulatory agencies should strengthen monitoring and enforcement of occupational health standards to reduce disease burden among quarry workers.

4.0 Conclusion

The study revealed a high prevalence of occupational diseases among quarry workers in Akamkpa Local Government Area, with respiratory conditions constituting the most common health problems. Catarrh was the most prevalent condition, followed by cough, nasal infection, and sinusitis, indicating substantial exposure to dust and airborne contaminants generated during quarry operations. The study also identified cases of hearing impairment and fungal dermatitis, demonstrating that quarry workers are exposed to multiple occupational hazards.

The findings further showed significant variations in disease prevalence across job categories, with blasters and stone breakers experiencing the highest disease burden due to their greater exposure to dust, noise, and other workplace hazards. The significant ANOVA result confirmed that job category is an important determinant of occupational health outcomes among quarry workers.

The study therefore provides valuable evidence for occupational health management in quarry environments and highlights the need for effective dust control measures, mandatory use of personal protective equipment, regular medical surveillance, occupational health education, and stricter enforcement of

workplace safety regulations to safeguard workers' health and improve productivity in the quarry industry.

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Ethical Consideration

Not applicable

Availability of Data and Materials

All data generated or analyzed during this study are included in this published article. Additional information may be made available by the corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Author Contributions

Peter E. Oko conceived and designed the study, coordinated data collection, performed statistical analyses, interpreted the findings, and drafted the manuscript. Anthony O. Agorye contributed to the study design, methodology, data interpretation, and critical revision of the manuscript. Idorenyin L. Udousoro assisted with literature review, field data collection, manuscript editing, and final proofreading. All authors reviewed and approved the final manuscript.