

*Full Length Research Paper*

# **Prevalence of occupational disorders in low socio-economic manual stone crushers and healthcare seeking behaviour among quarry workers in North-Central Nigeria**

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**Manual stone crushing is an established small-scale industry in Northern Nigeria with workers exposed to several hazards that place them at high risk of several medical conditions. The study aimed to describe health-related conditions of manual stone crushers in North Central Nigeria through a cross-sectional study. Workers were selected using a multistage sampling technique with 151 participants. Information on demographic and work-related profiles was obtained and analyzed using SPSS-23. Male participants were 63.6% while females were 36.4%. The mean age of respondents was  $34.2 \pm 13.9$  years. Children workers made up 12% of the population. All respondents (100%) had experienced at least one work-related health condition; mostly respiratory (51.0%), musculoskeletal (44.4%), and cutaneous (43.7%) systems. Common health complaints included headaches (62.3%), cough (54.3%), back pain (51.0%), and chest pain (50.3%). Longer working hours was associated with multiple system affection ( $p=0.030$ ). Over half of the respondents accessed public/private hospitals for health aid, while about 10% engaged in self-medication or traditional treatment. Manual stone crushers in Northcentral Nigeria are exposed to hazards that place them at high health risk conditions that affect their body systems. Manual stone crushing needs more organization to increase attention with regards to healthcare in terms of personal protection and management of health conditions.**

**Key words:** Health conditions, quarrying industry, cross-sectional study, labour-intensive job, health-seeking behavior, North-Central Nigeria.

## **INTRODUCTION**

Quarrying is an activity that involves the extraction of stone, ballast, gravel, clay and sand from the earth's

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surface. It can be done mechanically or manually. Population growth and industrialization had led to explosion of constructions which are heavily dependent on quarrying products; hence, the increasing demand on these products (Ilo et al., 2018; Chepchumba et al., 2020). In addition, the African region is experiencing higher levels of poverty and unemployment; hence, the increasing number of persons engaging in informal, menial jobs to make ends meet (Kappel, 2021). Nigeria has also suffered herder-farmer crises that pushed many agriculturists into other forms of menial jobs (Yikwab and Tade, 2022). Manual stone crushing is a labour-intensive job that has witnessed an increased involvement of women, underaged and young persons who are employed for lower cost. Therefore, it has become an unorganized small-scale industry in North Nigeria where rocky areas are located (Uwakwe et al., 2015).

Although it is a physically and mentally demanding job with benefits, however, workers and dwellers are exposed to a wide range of health risks and environmental hazards (Ilo et al., 2018; Chepchumba et al., 2020). The hazards of quarrying industry may generally include: (1) physical hazards such as dust, noise, vibration and fire for heating of rocks which cause respiratory disorders like silicosis and lung cancer, hearing impairments, burns and other multisystem diseases, (2) mechanical hazards from working tools, climbing of heights, use of heavy equipment that can lead to cuts, falls, and other musculoskeletal disorders, (3) biological hazards which may include exposure to stings and bites from insects, reptiles, scorpions and creeping creatures, (4) psychosocial problems such as being far away from home for migrant workers and poor remuneration from the job, and (5) chemical hazards due to exposure to ammonium triphosphate and oils used for maintaining equipment that may cause lung and skin problems (Oginyi, 2010; Ilo et al., 2018; Chepchumba et al., 2020; Prasad et al., 2019). Manual stone crushers may be at greater risk due to these hazards since they manually carry out the job that could have been substituted mechanically. Many of them are unaware of the dangers of such work environment and the risk of developing occupational diseases. The problem is further compounded by their lack of awareness of safety practices in their workplaces (Oginyi, 2010).

There are legislations to guide health expenditure of workers and their compensation when faced with occupational-related health diseases or injuries. One of such laws is The Employee Compensation Act (Law Business Research, 2023). Such laws are more effective in the formal sector or in large scale industries where the worker may benefit from some level of insurance or compensation when faced with injury in the workplaces. Many informal workers do not have access to these incentives and just like majority of Nigerians in the informal sector, pay for healthcare out-of-pocket. This may also determine the type of care that is sought when they are faced with work-related health problems. The

study aimed to assess the distribution of manual stone crushing activity, prevalence of health-related disorders of manual stone crushers and their health seeking behaviour in North Central Nigeria.

## METHODS

### Study setting

Nigeria has a distribution of different types of rocks used for quarrying ranging from igneous, metamorphic and sedimentary. Igneous and metamorphic rocks are most extensively found in the Northern part (Olutaiwo et al., 2018). This study was carried out at selected stone quarrying sites in the North-Central region of Nigeria that is made up of six states which are Niger, Kogi, Kwara, Benue, Nasarawa, Plateau as well as the Federal Capital Territory (FCT). These states are known to have regular quarrying activities.

### Study design

A cross-sectional study that assessed the distribution of manual stone crushing activity, the prevalence of work-related disorders among manual stone crushers and their health seeking behavior in North-Central Nigeria was designed.

### Study population

The study population included all workers that have engaged in manual stone crushing for a minimum of one month and were willing to participate in the study. These investigations included both adults and children alike.

### Sample size and sampling technique

A minimum sample size of 119 was determined for the survey using the following formula:

$$n = z^2 p(1-p) / d^2$$

where  $n$  = minimum sample size;  $z$  = value of 95% confidence level;  $p$  = 8.3% [the prevalence of the least common health related complaint (facial or head injury) among quarry workers in a previous study] (Sufiyan and Ogunleye, 2012);  $d$  = level of precision = 0.05. An addition of a 10% non-response rate gave a sample size of 131.

A two-stage sampling technique was used to select respondents. For the first stage, all quarrying sites in North-Central Nigeria were identified through GPS mapping, geo-information database, on-site observations and consultations with community leaders. A special distribution of the stone crushing sites in North-Central Nigeria is as shown in Figure 1. Out of a total of 88 sites identified for the study, 25% of the sites (25 in total) were chosen. The number of sites allocated to a state was based on proportion to size allocation. Simple random sampling technique by balloting was then used to select the number of sites per state. Where the security situation of a selected site could not be ascertained, another site close to the affected site, from within or outside the state, was selected from the list. The second stage involved selection of respondents using simple random sampling by balloting, except for sites that had few respondents where all consenting participants were included. The same selection method was applied to children.

### Data collection instrument and technique

A semi-structured interviewer questionnaire was used to collect

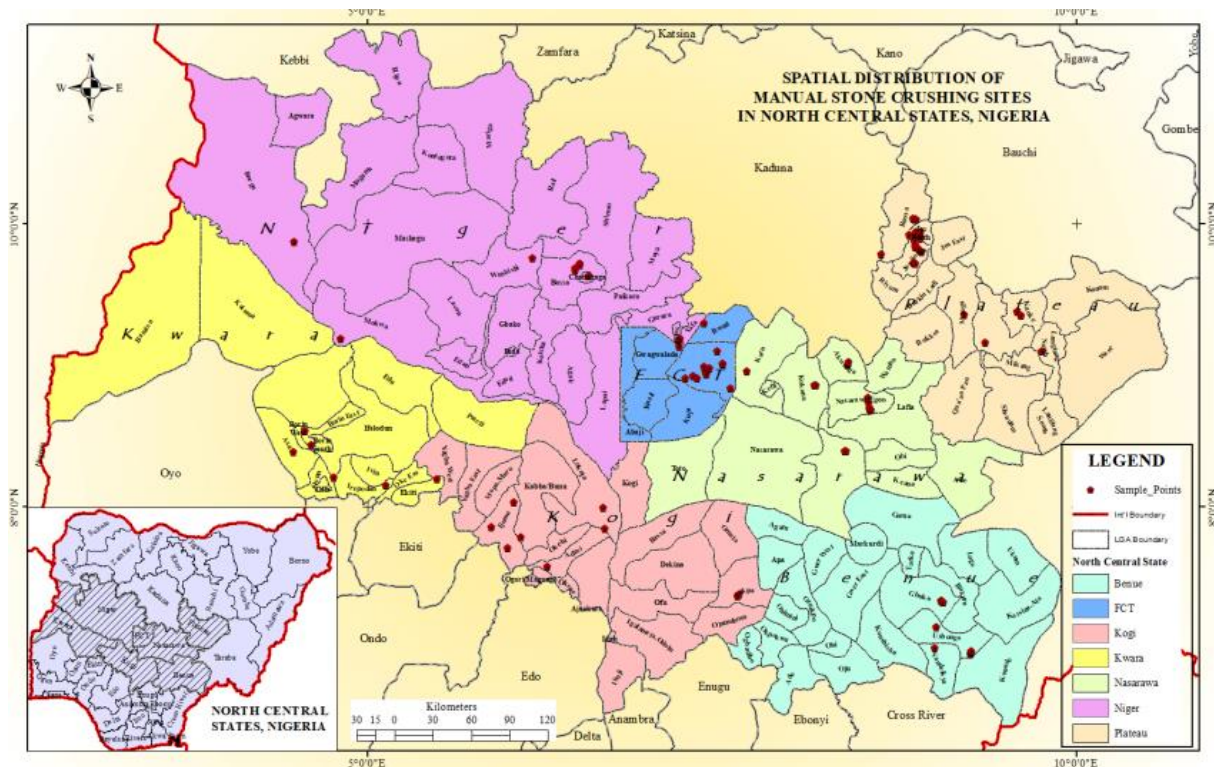


Figure 1. Spatial distribution of manual stone crushing sites in North central Nigeria.

data from respondents which included questions that cover the following sections: socio-demographics of respondents, health-related complaints/problems and health seeking behavior sections. The data collection instrument was adapted from previous studies (Chepchumba, 2020; Khan et al., 2016). Content validity of the instrument was done by experts in community medicine, while its reliability was measured by Chronbach alpha test with a calculated coefficient of 0.82. Ten research assistants were trained on data collection and pretesting by collection instruments among 20 respondents in a location not previously selected for the study in Plateau State. The pretest aided research assistants to identify and correct ambiguous poorly structured questions, as well as to determine ease and time of administration. Data was collected after a written informed consent was obtained from participant who were interviewed in a comfortable area within their work places.

#### Data management and analysis

All potential work-related disorders based on the various systems were evaluated by asking questions about the experience of specific symptoms and their frequency since the start of manual stone crushing. Those who "sometimes" or "always" reported having a health-related disorder were considered to have that disorder, while those who "never" or "rarely" reported having such were considered to not have it. This does not include occupational injuries like amputations or fractures that are likely to occur once. In order to differentiate occupational from non-occupational disorders, symptoms experienced prior to the start of manual stone crushing, and responses from those with other exposure histories such as cigarette smoking, family history, and other related occupations were excluded. Symptoms that occurred or got worse during or right after work hours were taken into consideration.

By grading and evaluating a series of questions on occupational environment hazards, health effects of hazards, and safety precautions, the awareness of health risks associated with stone crushing was evaluated. Respondents were considered to have awareness if their scores were at or above 60%. Health seeking behavior was assessed by asking respondents about where they would most likely seek medical attention if they became ill, or where they usually go for treatment.

The entered data was cleaned and analyzed using SPSS (Statistical Product and Service Solutions) Version 23. Quantitative data such as age were summarized using means and standard deviation. Chi-square analysis was used to determine significant associations between health risk awareness and having multiple system affection (when 2 or more systems are affected), as well as health risk awareness and health-seeking behaviour. Other factors associated with multiple system disorders such as socio-demographics, were also assessed using Chi-square test. At a confidence level of 95%, all p-values  $\leq 0.05$  were considered statistically significant.

#### Ethical consideration

Ethical approval for this study was obtained from the National Health Research Ethics Committees of the Federal Ministry of Health (NHREC/01/01/2007-01/06/2020). Permission for the study was obtained from the State Ministries of Health and Environment of all included states in the study, as well as heads of all selected communities. A written, signed informed consent was obtained from each adult participant while assent was gotten from children after their caregivers/parents must have given permission. All information obtained were kept confidential and used for only the purpose of this study.

**Table 1.** Place and person distribution of all (adult and children) Respondents (n=151).

Distribution by parameter	Frequency	Percentage
<b>Age group (years)</b>		
<18 (children)	18	11.9
≥18 (adults)	133	88.1
<i>Mean age ± SD =34.2 ± 13.9</i>		
<b>Gender</b>		
Male	96	63.6
Female	55	36.4
<b>Highest educational level</b>		
None	31	20.5
Primary	45	29.8
JSS3/BCE	22	14.6
Secondary	41	27.2
Tertiary	12	7.9
<b>State of residence</b>		
Abuja	3	2.0
Benue	13	8.6
Kogi	2	1.3
Kwara	2	1.3
Nasarawa	28	18.6
Niger	21	13.9
Plateau	36	23.8
Kaduna	11	7.3
Other states	34	22.5

JSS3/BCE = Junior Secondary School level 3/Basic Certificate Examination.

## RESULTS

### Section 1: Distribution of manual stone crushers

A total of 151 persons participated in the study, which was above the minimum sample size required for the study. The mean age of respondents was  $34.2 \pm 13.9$  years with adults being the majority representing 88% of included population. The male were more than female respondents representing 63.6 and 36.4% of studied population, respectively. Those with primary level of education or less were 50.3% of all respondents. Over 20% of respondents resided outside the geographical area of study (Table 1).

The respondents who engaged in stone crushing activity as their main employment were 75 (49.7%) of studied population. Almost 70% of all respondents resided at a distance of <5 km and also spent 0 to 8 h at work. However, the majority (86.7%) of respondents carried out stone crushing activity almost every day of the week. Moreover, up to 40% of them gain  $\leq 5,000$  Naira income every week from stone crushing occupation (Table 2).

### Section 2: Reported health disorders/complaints among stone crushers

Health disorders were grouped according to the various systems of the body. A system of the body is said to be affected if a respondent always or occasionally complained of 2 or more systemic symptoms. The respiratory system, musculoskeletal system and skin were the most commonly affected among all respondents representing 51.0, 44.4 and 43.7%, respectively, even after disaggregating into adults and children (Table 3).

All respondents (100%) complained of occasional or frequent health problem from at least one system of the body. The most commonly reported health problems among both adult and child respondents include headaches (62.3%), cough (54.3%), back pain (51.0%), and chest pain (50.3%) which were reported by  $\geq 50\%$  of the respondents. Other commonly reported symptoms among up to 40% respondents included: fever, hand pain, palm thickening and darkening, eye tearing and cuts (Figure 2).

Other less common health problems reported among respondents include eye symptoms such as tearing

**Table 2.** Occupational profile of all respondents (n=151).

Parameter	Frequency	Percentage
<b>Nature of employment</b>		
Full employment	75	49.7
Temporary employment	76	50.3
<b>Distance of residence from crushing location (km)</b>		
<5	104	68.8
5-10	39	25.8
>10	7	4.6
Mean $\pm$ SD =34.24 $\pm$ 13.941		
<b>Duration of work per day (hour)</b>		
<3	4	2.6
3-5	25	16.6
6-8	72	47.7
>8	50	33.1
Mean $\pm$ SD =34.24 $\pm$ 13.941		
<b>Days of work per week</b>		
0-2	3	2.0
3-5	17	11.3
6-7	131	86.7
Mean $\pm$ SD = 6.1 $\pm$ 1.0		
<b>Income from stone crushing per week (Naira)</b>		
$\leq$ 5,000	59	39.1
5,001-10,000	47	31.1
10,000-20,000	28	18.5
20,001-50,000	15	9.9
>50,000	2	1.3
Median=7,000: IQR=5,000-15,000		

(39.1%), redness and itching (37.1%), body itching (31.8%), and catarrh (26.8%). Uncommon health problems include injuries like fractures (6.0%) and amputation of fingers (5.3%) (Table 4).

A high prevalence of multiple system disorders (86.8%) was found among respondents. This includes respondents who had at least 2 systems affected since commencement of the job of stone crushing (Table 5).

There was found to be a statistically significant association between the duration of time spent at work on most days and the presence of multiple system disorders ( $p=0.030$ ). Other associated factors such as gender, age, educational status and distance of residence from work site were not statistically significant (Table 6).

### Section 3: Awareness of health risks associated with manual stone crushing

About 75% of respondents were aware of the health risks

associated with the job of manual stone crushing and were afraid that their health could be affected in the process. However, 66.2% of respondents were aware of the need to use personal protective equipment (PPEs) (Table 7).

Table 8 shows the association between awareness of health risk posed by manual stone crushing and having multiple (at least 2) system affection. Respondents who lacked awareness of health risks were twice as likely to have multiple system disorders, but this was not statistically significant.

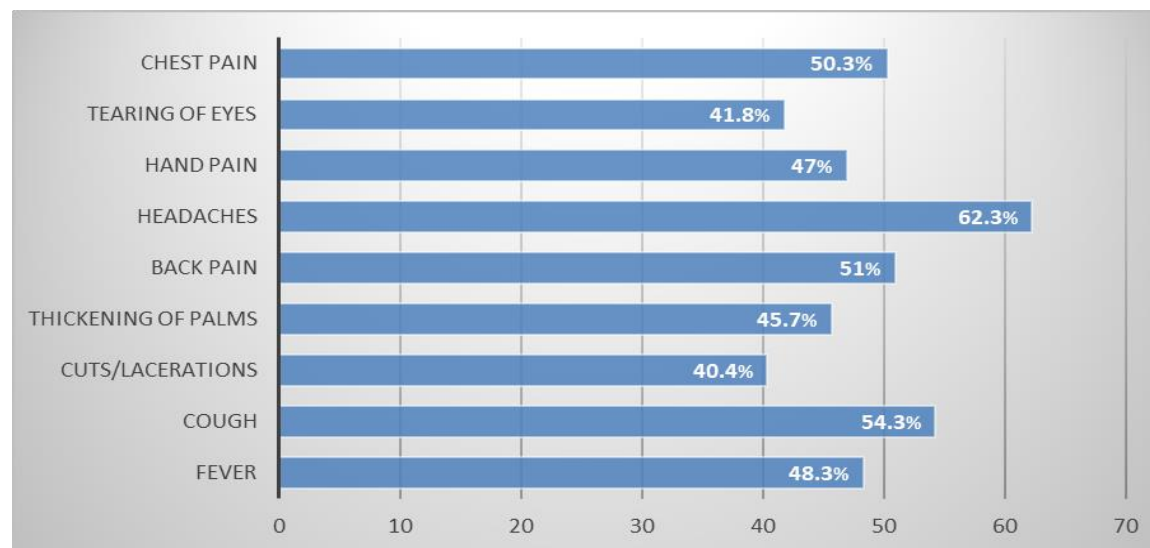
### Section 4: Health seeking behaviour of respondents

When asked about the forms of healthcare received during periods of ill-health, use of government hospital was found to be the most common among respondents (38.4%) followed by chemist/dispensary (23.2%) and private hospital (19.2%). The least patronized was

**Table 3.** Systemic symptoms among respondents.

Systemic symptoms	General (All respondents)			Adults			Children		
	Freq (n=151)	%	95% Conf. Int.	Freq (n= 133)	%	95% Conf. Int.	Freq (n= 18)	%	95% Conf. Int.
Respiratory	77	51.0	43.0-59.0	69	51.9	43.4-60.4	8	44.4	21.4-67.4
Musculoskeletal	67	44.4	36.5-52.3	62	46.6	39.6-56.7	5	27.8	7.1-48.5
CNS	31	20.5	14.1-26.9	27	20.3	13.5-27.1	4	22.2	3.0-41.3
Cutaneous/skin	66	43.7	51.0-84.0	59	44.4	35.9-52.8	7	38.9	6.3-61.4
Eye	51	33.8	26.3-41.3	49	36.8	28.6-45.0	2	11.1	3.4-25.6
Ear	34	22.5	15.8-29.2	30	22.6	15.5-29.7	4	22.2	3.0-41.3
Abdominal/GIT	20	13.2	7.8-18.6	18	13.5	7.7-19.3	2	11.1	3.4-25.6
Cardiovascular	17	11.3	6.3-16.4	16	12.0	6.4-17.5	1	5.6	5.2-16.2
<b>Other non-specific complaints</b>									
Fever	73	48.3	40.3-56.3	70	52.0	43.5-60.5	3	16.7	2.9-33.9
Insect bites/sting	52	34.4	26.8-41.9	47	35.2	27.1-43.3	5	27.8	7.1-44.8
Snake/Scorpion bites	24	15.9	10.1-21.7	22	16.6	10.3-22.9	2	11.1	3.4-25.6
Road side accidents	14	9.2	4.5-13.8	13	9.8	4.7-14.3	1	5.6	5.1-16.2

Freq= Frequency; Conf. Int. = Confidence interval.

**Figure 2.** Most commonly reported health problems/complaints for all respondents.

**Table 4.** Other health problems of respondents.

Symptoms	Frequency	Percentage	95% Conf. Int.
Tearing of eyes	59	39.1	31.3-46.9
Eye redness and itching	56	37.1	29.4-44.8
Abdominal pains	55	36.5	28.8-44.1
Dizziness	50	33.2	25.7-40.7
Body itching	48	31.8	24.3-39.2
Catarrh/sneezing	36	26.8	19.7-33.8
Eye discharge	39	25.8	18.8-32.7
Leg Pain	38	23.8	17.0-30.6
Falls	34	22.3	15.7-28.9
Ringing noise in the ears	29	19.2	12.9-25.4
Skin rashes	27	17.9	11.8-24.0
Breathlessness during and outside work hours	24	15.9	10.0-21.7
Diarrhoea	23	15.2	9.5-20.9
Palpitations/Hearing of heartbeat during work hours	19	12.6	7.3-17.9
Leg swelling	16	10.8	5.8-15.8
Decreased hearing	16	10.6	5.6-15.5
Vomiting	15	9.9	5.1-14.6
Yellow eye discoloration/jaundice	13	8.6	4.1-13.1
Fractures	9	6	2.2-9.7
Amputation of fingers	8	5.3	1.7-8.8
Loss of consciousness/fainting	8	5.3	1.7-8.8
Noisy breathing	13	2.6	0.1-0.5

Freq= Frequency; Conf. Int. = Confidence interval.

**Table 5.** Prevalence of multiple system disorders among manual stone crushers.

Multiple system disorders	Frequency	Percentage	95% Conf. Int
Absent	20	13.2	1.6-28.0
Present	131	86.8	81.0-92.6

Freq= Frequency; Conf. Int. = Confidence interval

traditional treatment (2.6%) as illustrated in Figure 3.

Respondents who were aware of the health risks posed by their job had higher odds of seeking medical care from hospitals or dispensaries compared to those who lacked the awareness. This was however, not statistically significant (Table 9).

## DISCUSSION

This study was carried out among manual stone crushers in North-Central Nigeria. The obtained results showed that the occupation was more common among men. Women and children have also become significant partakers in the job. This has been demonstrated in other studies as well. Aliyu and Shehu (2007) and Prasad et al. (2019) found that males are predominantly more involved

in cutting, drilling, extracting and crushing stones when compared with females; hence, the physical exertion involved in these activities which seemed more suitable for the males. However, the need for household income increase has introduced more women and children into this industry. Despite the intensity of work associated with the job, the workers earn 7,000 Naira median income which is far less than the country's current minimum wage of 30,000 Naira, and less than an average Nigerian worker. Thus, they may not be able to cater for their basic needs as an occupation of the low socio-economic populace (Khan et al., 2016).

All the respondents in this study, adults and children alike, reported to have experienced at least one work-related health disorder since commencement of the job. Previous studies have shown that majority of quarry workers have reported at least one workplace injury or

**Table 6.** Factors associated with multiple system disorders.

Factors	One system affected n=20	Multiple systems affected n=131	$\chi^2$	p-value
<b>Gender</b>				
Female	7 (12.7)	48 (87.3)	0.020	0.887
Male	13 (13.5)	83 (86.5)		
<b>Age</b>				
Children (<18 years)	1 (5.6)	17 (94.4)	1.052	0.305
Adults ( $\geq$ 18 years)	19 (14.3)	114 (85.7)		
<b>Educational status</b>				
No education	4 (16.0)	21 (84.0)	0.198	0.656
Some education	16 (12.7)	110 (87.3)		
<b>Distance of residence from work place</b>				
<5 km	12 (11.5)	92 (88.5)	0.847	0.357
$\geq$ 5 km	8 (17.0)	39 (83.0)		
<b>Duration of work per day</b>				
<8 hours	25 (25.0)	75 (75.0)	4.688	<b>0.030*</b>
$\geq$ 8 hours	5 (10.0)	45 (90.0)		

\*Statistically significant;  $\chi^2$ =Chi-square test.

**Table 7.** Awareness of health risks of stone crushing occupation.

Symptoms	Frequency (n=151)	%	95% Conf. Int.
Aware that stone crushing could affect health	114	75.5	68.6-82.4
Worried that exposure to dust and other hazards can affect his/her health	116	76.9	70.2-83.6
Aware of the need for personal protection	100	66.2	58.7-73.7

**Table 8.** Association between health risk awareness and having multiple system disorders.

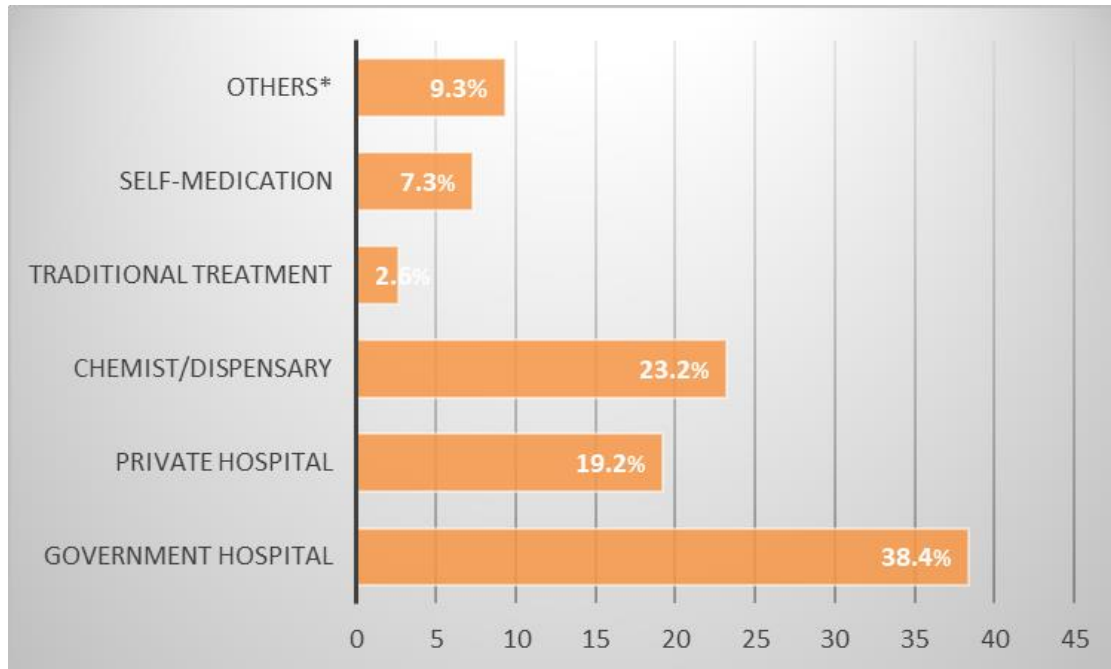
Health risk awareness	One system affected n=20	Multiple systems affected n=131	OR (95% Conf. Int)	$\chi^2$	p-value
Yes	17 (14.1)	97 (85.1)	1	1.125	0.289
No	3 (8.1)	34 (91.9)	2.0 (0.5-7.2)		

the other in the past. In a study conducted in a Local Government in Kaduna, Nigeria, over 80% of workers reported at least one work-related injury (Sufiyan and Ogunleye, 2012).

The most affected system among participants of this study was the respiratory system and cough was the most frequent respiratory symptom reported by over half of respondents. This is not surprising as manual stone crushers are particularly exposed to dust mostly during

the process of crushing and sieving of rock materials. There are several documented effects of dust inhalation to the respiratory and other systems of the body. The prolonged exposure of stone crushers to dust worsens these effects especially when workers do not use protective devices. One in three persons reported respiratory problems in a study by Prasad et al. (2019) of which cough was a common feature. Cough and shortness of breath was also demonstrated among





**Figure 3.** Health seeking behaviour of all respondents. \*Hardly falls ill or takes no action.

**Table 9.** Association between health risk awareness and health-seeking behaviour.

Health risk awareness	Seek medical care n=122	Seek non-medical care n=29	OR (95% Conf. Int)	$\chi^2$	p-value
Yes	94 (82.5)	20 (17.5)	1.4 (0.3-5.1)	0.828	0.363
No	28 (75.7)	9 (24.3)	1		

workers in Ghana (Apenteng and Asare, 2016). Chest pain may be central to many systems of the body as it could arise from disorders of the musculoskeletal, respiratory or cardiovascular system. As observed in this study, this is a common complaint among stone crushers, and other quarry workers (Apenteng and Asare, 2016; Nwibo et al., 2012). Dust exposure has also been found to be associated with cardiovascular diseases and may be a risk factor for ischemic heart disease. A few workers admitted having palpitations especially during work hours which may be due to physical exhaustion (Ugbogu et al., 2009). Loss of consciousness or fainting attacks was reported by a small fraction of respondents which could be a result of physical exhaustion, dehydration, hypoglycaemia, etc.

The most frequent singular complaint was headache. Headache which is a common symptom of Central Nervous System (CNS) affection could result from physical exhaustion especially after working for long hours. Prolonged headaches have also been reported as a common symptom in other studies (Khan et al., 2016; Subedi and Banamala, 2015). Apart from respiratory

system, musculoskeletal system was the second most affected system in this study. This is in agreement with the report that showed that slips and falls which could result in fractures, are the commonest accidents in the workplace (Chepchumba, 2020). Despite this, the study's findings suggest that falls are not extremely common in the manual quarrying sector because climbing is not much involved in the operation. Although a quarter of respondents reported frequent falls in this study, less than 10% reported amputation or fractures. The use of the stone-crushing hammer and other hand-held equipment may have explained the higher rate of cuts or lacerations at work, which were also found among quarry workers in other studies (Aliyu and Shehu, 2007; Sufiyan and Ogunleye, 2012). Other commonly reported musculoskeletal problems among quarry workers included body, back and joint aches (Subedi and Banamala, 2015; Prasad et al., 2019).

The eye and skin of workers in this small-scale industry are also not spared. Irritation and inflammation of the eyes can be presented as tearing, itching, redness, burning sensation, dryness or discharge which were all

observed among some respondents in this study. Constant exposure to dust particles and air pollutants can eventually lead to maculopathy, retinopathy, glaucoma and other degenerative eye diseases (Lin et al., 2022). In addition to eye problems, frequent use of hand-held crushing tools can cause palmar hypertrophy and this could explain the common complaint of palm thickening and darkening. These results were in agreement with Subedi and Banamala (2015) who also reported eye and skin irritations as common problems but did not specify the symptoms. Apenteng and Apenteng (2016) reported that over half of studied participants reported eye irritation while 30% had skin irritation.

All respondents had at least one system of the body affected, and majority of respondents had multiple systems affected. Other studies have shown that workers complain of symptoms that span across two or more systems especially the respiratory and musculoskeletal systems. This may be due complex interactions between exposure to hazardous materials, inadequate safety measures or use of protective devices, and limited access to appropriate healthcare. Spending more hours at work every day was significantly associated with multiple complaints that span across many systems, and this can be triggered by prolonged physical stress, insufficient rest, psychological stress, coupled with limited access to healthcare.

Although three-quarters of respondents were worried of the significant threat to health their work environment posed, over half of them realized the importance of using personal protective devices at work. This shows the need to create more awareness about work-place injury prevention. Inadequate or lack of financial risk protection among small scale and informal workers in Nigeria explains the high rate of out-of-pocket spending for healthcare. This further pushes households into poverty as they may have to spend catastrophically, thus explaining why self-treatment for health problems is an option for many individuals and households. In a study conducted in Cross-River State, Nigeria, over 80% of stone quarry workers reported self-treatment for health disorders (Ekong et al., 2020). Many more persons may have no other option than to spend out-of-pocket for healthcare in chemists or hospitals in order to get the needed attention. Some may resort to traditional treatment. The responses obtained in this study show that many of the manual stone crushers do not have access to good medical care both as a way of prevention and treatment, despite the hazards associated with their work. This was also corroborated in other studies (Aliyu and Shehu, 2007).

### Limitations of study

This study is purely a descriptive study that lacks a comparison group. Hence, it may be weak in providing adequate information that will attribute some of the

health-related disorders to the job of manual stone crushing. In addition, recall bias may be a possibility since the participants were made to recall some of the health symptoms they must have experienced in the past.

## CONCLUSION AND RECOMMENDATIONS

Manual stone crushers in North-Central Nigeria are exposed to hazards that place them at high risk of health-related conditions that affect every system of the body. Disorders of the respiratory system, musculoskeletal system and skin were the most common among respondents with headaches, cough, back and chest pain as the most common complaints. Over half of respondents sought treatment in public or private hospitals. However, 1 in 10 either engaged in self-treatment or sought traditional management for health problems.

It is necessary that these workers engaging in manual quarrying are properly educated about the hazards of the work environment and taught the appropriate means of safeguarding their health and preventing health-related disorders. Such will include the importance of the use of personal protective devices. The manual stone crushing occupation has become a very important means of livelihood for lots of households. The government and other relevant stakeholders should therefore, ensure that this sector is more organized so that workers can enjoy accessible, affordable, and effective healthcare in terms of prevention and management.

The government should also make efforts in enforcing regulations that discourage child labour, most especially those that involve intense physical activity such as stone crushing, so that they can mature and develop properly. In addition, more researches that involve a comparison group and the actual measurements of health conditions among this group of workers are encouraged.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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