

Knowledge of Dust and Use of Respiratory Protective Equipment among Quarry Workers in Edo State, Nigeria

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ABSTRACT

Introduction: Dusts are finely divided solid particles with sizes ranging from 0.1 to 150 microns. Good Knowledge of their potential hazard is key to maintaining good health in the quarry industry because this will inform workers in the quarry industry on the need to avoid undue inhalation of this noxious substance by minimizing dust generation and use of Respiratory Protective Equipment (RPE) as and when due.

Aim: The study was aimed at determining the knowledge of dust and use of Respiratory Protective Equipment (RPE) among quarry workers with a view to protecting workers in this industry from respiratory problems.

Methods: A descriptive cross-sectional study was utilized for this study. Knowledge of dust as hazard and use of Respiratory Protective Equipment were carried out with the aid of an interviewer-administered questionnaire adapted from the validated respiratory questionnaire. Data were entered and analyzed with IBM SPSS version 20 software. Statistical test of association was used to test the association between characteristics of interest. Knowledge score of 0-4 points (less than 50%) was regarded as poor knowledge and Knowledge score of 5-10 points (50-100%) was regarded as good knowledge.

Results: Total population of quarry workers (420) found in the quarry industries was surveyed at the time of the study but 411 of them agreed to participate in the study giving a response rate of 97.9%. Most of the respondents (92.0%) had good knowledge of dust as hazard while 96.4% of them had good knowledge of RPE and 91.0% of them use the provided RPE in the work place.

Conclusion: Findings from this study underscore the need for workers in the quarry industry to have good knowledge of dust and RPE so that appropriate measures can be put in place to protect workers from hazards in the quarry industry

Key words: Dust, Knowledge, Quarry workers, Respiratory Protective Equipment

INTRODUCTION

The quarry job involves exposure to inhalation of dust. Individuals working in dusty environment

face the risk of inhaling particulate materials that may lead to adverse respiratory effects.¹ Inhalation of air borne particles and the use of machines/equipment exposes workers in the quarry industry to a lot of health hazards. In the quarry industry, dusts are released into the atmosphere during crushing, grinding, abrading, loading and off-loading operations. Soluble dust

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dissolves slowly, enter the systemic circulation and are eventually eliminated by body metabolisms. The insoluble dust remains permanently in the lungs and are mainly the cause of respiratory problems. A huge amount of dust is constantly being produced and released into the atmosphere and most of the workers inhale the dust particles causing respiratory problems. The knowledge of dust as hazard among quarry workers will afford them the opportunity of protecting themselves against the respiratory problems that arise from such hazards because adequate knowledge creates background for behavioural initiative.

Undue exposure to dust in the work place can be prevented entirely. Therefore, the findings from this study will enable policy makers in the quarry industry to proffer solution to the problem of work-related respiratory problems.

The specific objectives of the study were to determine the knowledge of dust as hazard among quarry workers and ascertain their knowledge and use of respiratory protective equipment.

METHODS

Study area

The study was carried out in Edo State in six quarry industries located in three LGAs in Edo State (Etsako West, Akoko-Edo and Evbonogbo). Edo State is bounded by Kogi State to the north, Delta State to the south which also forms the eastern border. Ondo State forms the southwest border. It has a total land area of 19,187.93 square kilometers. The 2006 population and housing census (priority table IV) puts the population of Edo State at three million, two hundred and thirty three thousand, three hundred and sixty six (3,233,366) people with a male/female ratio of nearly 1:1 (1,633,946: 1,599,420).² The 2016 projected population of Edo State is four million two hundred and twenty thousand, four hundred and fifty five (4,220,455). The State lies at an elevation level of about 500 feet in the south and up to 1800 feet in the north. Edo State has eighteen Local Government Areas (LGA) and quarry industries are mainly located in three LGAs namely: Etsako West LGA (quarries

located in Imeke and Iyuku), Akoko-Edo LGA (quarries located in Ikpeshi) and Ovia South West LGA (quarries located in Evbonogbo).³ The natural deposits of large stones in these areas necessitated the establishment of quarry industries in these locations. The substances quarried in the sites include granite, limestone, and dolomite.⁴ The proportion of people living below poverty line in Edo State is high and ranges between 40% and 83% with poverty highest among women, children, youth, unemployed and people living with HIV/AIDS.⁵

A descriptive cross-sectional study design was utilized for this study.

The study population included workers who were directly involved in quarrying.

This study was carried out over a period of ten months. Planning and proposal writing were carried out over six months, data collection and analysis were carried out over three months and the final write-up carried out in one month.

The minimum sample size for the study population of quarry workers was 262. However, total population of all the quarry workers (420) was recruited for the study.

There was no sampling as total population of all eligible quarry workers who met the inclusion criteria were recruited for the study.

The study instruments used included an interviewer-administered questionnaire adapted from the validated respiratory questionnaire⁸, and an observational checklist.

An interviewer-administered semi-structured questionnaire adapted from the validated Medical Research Council (MRC) respiratory questionnaire⁸ was used to assess the knowledge of hazard associated with quarrying; knowledge and use of RPE. The questionnaire contained both open and close ended questions in 4 sections. The first section assessed the Socio-demographic characteristics of the respondents, the second section assessed the knowledge of hazards associated with the respiratory system, and the third section assessed the knowledge of RPE while the fourth section assessed the use of RPE among quarry workers.

Data from the questionnaire were coded and entered into an electronic spread sheet.

Knowledge of Dust and Use of RPE among Quarry Workers

Analysis was done with the aid of IBM SPSS version 20.0 software. Knowledge of dust and knowledge of Respiratory Protective Equipment (RPE) among the quarry workers were assessed by a grading system developed by the researcher whereby points were awarded to a set of 11 and 4 questions respectively. With regards to knowledge of dust among quarry workers, a correct answer was graded 1 point, and inappropriate response was graded as 0 point. A total of 20 points was awarded to all the questions on knowledge of dust.

As regards knowledge of RPE among quarry workers, eight points were awarded to a set of 4 questions. An incorrect answer or inappropriate response was graded as 0 point. Knowledge score of 0-4 (less than 50%) = poor knowledge. Knowledge score of 5-10 (50-100%) = good knowledge.

Ethical Considerations

Ethical Approval

Ethical approval to conduct this research was sought and obtained from the University of Benin Teaching Hospital Research Ethics Committee.

Establishment Approval

Approval to carry out this study in the quarry sites was obtained from the managements of the various quarry sites in Edo State.

Other ethical considerations.

All the details of the study were dully explained and communicated to the respondents. They were assured of confidentiality and no respondent was coerced or induced to participate in this study and participation was voluntary. For the sake of anonymity, the quarry sites were labelled A-F.

RESULTS

Table 1: Socio-demographic characteristics of respondents.

Variables n = 411)	Frequency	Percentage
Age group (years)		
≤20	2	0.5
21 – 30	51	12.4
31 – 40	162	39.4
41 – 50	106	25.8
51 – 60	65	15.8
≥61	25	6.1
Mean ± SD: 40.5±10.3		
Sex		
Male	402	97.8
Female	9	2.2
Religion		
Christianity	345	83.9
Islam	53	12.9
African Traditional Religion (ATR)	13	3.2
Marital Status		
Married	331	80.5
Single	73	17.8
Divorced	5	1.2
Widowed	2	0.5
Educational attainment		
No formal	14	3.4
Primary	64	15.6
Secondary	308	74.9
Tertiary	25	6.1
Ethnic group		
Bini	118	28.7
Etsako	110	26.8
Owan	79	19.2
Esan	46	11.2
Hausa	22	5.4
Yoruba	21	5.1
Others*	15	3.6

*Others: Igbo 8 (1.9%), Ukwuani 4 (1.0%), Tiv 3 (0.7%)

About two-fifth of the respondents 162 (39.4%) were of the age group 31-40 years. Most of them

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were males 402 (97.8%) and majority of them 331(80.5%) were married. Seventy three (17.8%) were single while 2(0.5%) were widows. Christianity was the most predominant religion representing 345 (83.9%) of the respondents. Majority of the respondents 308 (74.9%) had secondary level of education. More of the respondents were Bini 118 (28.7%).

Most of the respondents 378 (92%) had good knowledge of dust as hazard while only a few of them 33 (8%) had poor knowledge of dust as hazard affecting the respiratory system.

All the respondents with good knowledge of RPE use RPE, a few 3(8.1%) who had poor knowledge of RPE use RPE while most 34 (91.9%) who had poor knowledge of RPE did not use RPE and the association was statistically significant ($p < 0.001$). Most of the respondents 374 (91%) use the provided RPE while only 37 (9%) of them do not use the provided RPE.

Most of the respondents 296 (96.1%) with secondary level of education used RPE as compared to those with no formal education 10 (71.4%), primary 48 (75.0%) and tertiary level of education 30 (76.9%) and the association between use of RPE and level of education was statistically significant ($p < 0.001$). Most of the respondents 319 (92.5%) who use RPE were Christians as compared to Muslims 43 (81.1%) and ATR 12 (92.3%) and the association was statistically significant ($p = 0.027$).

Table 2: Knowledge of Respiratory Protective Equipments among respondents.

Knowledge of RPE	Frequency	Percentage
Poor knowledge	15	3.6
Good knowledge	396	96.4
Total	411	100.0

Most of the respondents 396 (96.4%) had good knowledge of RPE while a few of them 15 (3.6%) had poor knowledge of RPE.

Table 3: Knowledge and use of the Respiratory Protective Equipments among Quarry workers.

Knowledge of RPE	Use of RPE Frequency (%)		Total	Fisher's exact p-value
	Yes	No		
Good	374(100.0)	0 (0.0)	374 (100.0)	<0.001
Poor	3 (8.1)	34 (91.9)	37 (100.0)	
Total	377 (91.7)	34 (8.3)	411 (100.0)	

Table 4: Socio-demographic characteristics and use of RPE among Quarry workers.

Variables	Use of RPE (n = 411)		
	Yes	No	Total
Educational attainment			
No formal	10 (71.4)	4 (28.6)	14 (100.0)
Primary	48 (75.0)	16 (25.0)	64 (100.0)
Secondary	296 (96.1)	12 (3.9)	308 (100.0)
Tertiary	30 (76.9)	9 (23.1)	39 (100.0)
	$\chi^2 = 42.816, p < 0.001$		
Religion			
Christianity	319 (92.5)	26 (7.5)	345 (100.0)
Islam	43 (81.1)	10 (18.9)	53 (100.0)
African Traditional Religion (ATR)	12 (92.3)	1 (7.7)	13 (100.0)
	$\chi^2 = 7.229, p = 0.027$		

DISCUSSION

Workers in the quarry industry are exposed to dust hazard. Inhalation of dust in the workplace can be prevented entirely through minimization of dust generation, use of RPE as and when due and managements deliberate attempt to keep the work environment safe for its workforce.

Finding from this study showed that majority of the respondents had good knowledge of dust as hazard affecting the respiratory system. This finding is similar to a study done in Abia State⁹ where majority of the quarry workers knew that their jobs exposed them to health hazard and most were aware that their working environment could negatively impact on their health. This finding was also similar to the finding of a study done in Zaria, Nigeria¹⁰ where majority of the respondents were aware of safety protective devices that can be used in quarry work and is corroborated by another study in Northern Nigeria¹¹ which showed that about two-third of quarry workers were aware of the need for them to use safety devices and also to institute safety or preventive measures at the worksite. Also, this finding agrees with a study done in Hong Kong.¹² It however contradict a study done in Ifo, Nigeria¹³ which showed that the artisans displayed a low level of awareness of work-related hazards and its impacts on their health. The finding of good knowledge of dust as hazard among the quarry workers in this study could stem from the training the workers received from the managers as it was learnt from the in-depth interview conducted that the managers instituted training of work process to their workers. The quarry industry remains one of the most dangerous industries to work in because of the effects of the respiratory hazard associated with the art of quarrying which may manifest long after the worker ceases to work in the quarry.⁷ Dust is one of the major hazards to health from substances in quarries as it is generated at all stages of the production process and are hazardous due to its ability to reach the lower part of the lungs. This finding of good knowledge among most of the respondents in this study could also be because most of the respondents who had worked for 12-21 years had

good knowledge of dust as hazard affecting the respiratory system when compared to respondents who worked for less than 12 years. This finding is expected because the longer the workers stay in the quarry industry, the better their awareness and knowledge of safety measures and use of safety equipment and also because many of them were informed about the hazards associated with their job by their employers as revealed by the in-depth interview conducted for the quarry managers. So, it is expected that this good knowledge of the workers will translate to taking adequate measures to protect themselves by wearing protective equipment and also do everything to minimize hazard in the work place. Findings from this study was however in contrast to the study done in Hong Kong in which health and safety awareness was low¹⁴ and also contrast the study done in a rural community in Edo state, Nigeria which showed that majority of the workers had poor knowledge of dusts as hazard associated with their work.⁷ This difference could be due to the fact that a high proportion of the respondents used for the rural study were predominantly young people and had few working years which may translate to low knowledge of health hazards associated with their work and the difference could also be because of the high level of illiteracy and low educational level among respondents in the rural community. Good knowledge of dusts as hazard among quarry workers may translate to use of personal protective equipment at work and this could reduce exposure to the hazards which in turn reduces the potential of the harmful effects of dust. The implication of training of workers to enhance the knowledge of hazards was exemplified by the Thomas Legge's axioms which states, 'all workmen should be told something of the dangers of the materials with which they come into contact, and not be left to find it out for themselves- sometimes at the cost of their lives'.¹⁵ Most of the respondents had secondary level of education. This could be responsible for good knowledge of dust as hazard among the respondents because most of the respondents who had good knowledge of dust as hazard had secondary level of education as compared to

those with no formal education. The use of appropriate respiratory protection for quarry work involves experience and knowledge in the field of occupational health and safety. Effective respiratory protection programs depend on the knowledge of the factors that affect workers use of equipment. Good knowledge gained from training enables workers to properly protect themselves from hazard by use of RPE.¹⁶

Furthermore, this study found that most of the respondents had good knowledge of use of respiratory protective equipment. This is in tandem with a study done in Hong Kong¹⁷ and Nigeria¹⁸ where the workers had predominantly better awareness of the hazards of the job, working environment and the negative impact of the work on their health. This study is also similar to a study done in Northern Nigeria¹⁰ which showed that majority of the respondents were aware of safety protective equipment that could be used in quarry work. This is also corroborated by another study done in Zaria, Nigeria¹¹ which showed that about two-third of quarry workers were aware of the need for them to use safety devices and also to institute safety or preventive measures at the worksite. Good knowledge of RPE may produce actual practice of use of RPE provided by employer. When the worker has good knowledge of the importance of use of RPE due to training and experience, he will do everything to protect himself.

Furthermore, most of the respondents in this study use the provided RPE and the frequency of use showed that most of them use it always. This is similar to a study in Kaduna, Nigeria¹⁰ which indicated that majority of the respondents use safety protective devices and that majority of them use the safety devices always. This is the inverse of the finding of a study done in Abia State⁹ which showed that few use safety devices. This study is also contrary to a study done in Ifo, Nigeria¹³ where a few of the respondents used Personal protective equipment (PPE) during work. This may be due to the poor awareness of job hazard among the workers. It is also in contrast to a study done in a rural community in Edo State⁷ in which use of PPE was poor as only one third of the

workers use the equipment all the time. The finding from the rural community study could be attributed to the fact that a higher proportion of the workers had no training on the use of this equipment. However, the finding of most of the respondents in this study using provided RPE and also most of them using it all the time could be that they equally had good knowledge of use of RPE, had secondary level of education and majority of them received training on the use of RPE as revealed by the in-depth interview held with the managers which showed that the workers received training on the use of RPE to minimize hazard. Also, those with higher level of education may be better informed and assimilate training better than those with no formal education. Good knowledge from training and experience translate to good practice. This may be responsible for the finding in this study. A study carried out in Palestine,¹⁹ safety training and education were believed by workers to be the elements with the greatest impact on construction site safety. Communication with the workers was identified by a study done in Palestine¹⁹ as the second key element essential to improving worksite safety. Good communication enables effective feedback about the safety of the workplace and workers' concerns, which can contribute to improved safety situations. It is therefore recommended to the management of quarries to ensure that training of workers is given a priority. This will improve workers performance and enhance productivity.

CONCLUSION AND RECOMMENDATIONS

The study showed that most of the respondents had good knowledge of dust as hazard and equally had good knowledge of use of RPE. Majority of the respondents reported that RPE was provided by their employers and training organized for them and most of them use the provided RPE always.

The following recommendations are made based on the findings from this study with the hope that they will go a long way in improving the health of the quarry workers.

1. The quarry managers should continue to

train and retrain their employees on the use of PPE so as to minimize dust inhalation

2. The workers unions in the quarry industries should organize seminars geared at improving the knowledge of their colleagues on the harmful effect of dust
3. The federal government through the ministry of solid minerals and environment should enforce their regulatory role on the quarry industries so as to protect workers in the quarry industries in Edo State.

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