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Original

Prevalence of Respiratory Symptoms among Quarry Workers in Brunei Darussalam

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ABSTRACT

Background: The mining and quarrying industry is considered a hazardous work sector due to occupational exposure to quarry dust and particulate matter, resulting in workers' respiratory illnesses. These occupational respiratory illnesses tend to have a long latency before the diagnosis is made, and therefore early detection of respiratory symptoms is crucial to prevent the development of chronic irreversible respiratory conditions. This study aimed to assess quarry workers' self-reported respiratory symptoms and their health-related quality of life (HRQOL) in Brunei. **Methods**: A descriptive study using a convenient sampling method was involving 23 quarry workers from three quarry companies in Brunei. The data were collected using the adapted St. George's Respiratory Questionnaire (SGRQ), which was self-administered to all participants. Data were analyzed using descriptive statistics. **Results**: Cough was the most typical reported symptom (26.1%) among quarry workers, followed by cough with phlegm (8.6%), shortness of breath (4.3%), and chest discomfort (4.3%). The mean total SGRQ score was 7.51 (±11.70), while the sub-domain scores for symptoms, activity, and impact were 10.60 (±12.37), 6.30 (±11.43), and 7.35 (±15.87), respectively. **Conclusion**: The key findings revealed that there was a low prevalence of respiratory symptoms in quarry workers. Prevalence of respiratory symptoms was higher among workers who were smokers, those who were exposed to quarry materials, and those who had been employed longer. The study's findings can be utilized by health professionals to plan, implement and evaluate preventative measures for mining and quarrying work settings.

Keywords: Respiratory symptoms; Quarry workers; St. George Respiratory Questionnaire; Quality of life; Occupational Health

Introduction

The quarrying and mining industry remains a hazardous work sector for workers due to exposure to particulates, natural gases, vapors, noise, and vibration. The severity of the hazards depends on the type of mine or quarry, its depth, the ore and surrounding rock composition, and mining method or quarrying.[1] The UK Health and Safety Executive (HSE) 2019 report found that fatal injury rates among mining and quarry workers in the United Kingdom were four to five times higher than the average fatal injuries across all work sectors.[2] In some countries, this industry is considered small scale or part of the informal work sector, where there is usually a lack of regulatory framework and policies on health and safety and lack of compliance with international best practices. The incidence of occupational accidents in small scale mining has been six to seven times higher than accidents occurring in larger mining operations.[3]

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Occupational respiratory illnesses in miners were among the first occupational illnesses reported.[4] Occupational exposure to quarry dust can cause acute and chronic respiratory illnesses such as chronic obstructive pulmonary disease, silicosis, and lung cancer.[5,6] Respiratory morbidity was observed by the high prevalence of respiratory symptoms among quarry workers in studies conducted in Nigeria and India, where the main symptoms were chest pain, cough, shortness of breath, and wheezing.[7,8] Quarry workers were also found to have abnormal chest radiographs7 and impaired pulmonary functions with a significant decline in FEV1, FVC, and PEFR measurements.[5,7-8]

Health-related quality of life (HRQOL) is an important assessment tool used to measure the impact of chronic health conditions. Several respiratory disease-specific HRQOL questionnaires have been developed, and among them, the St. George Respiratory Questionnaire (SGRQ) has become one of the most widely used instruments for assessing HRQOL among patients with respiratory illnesses.[9-11]Brunei Darussalam is a country located on the northwest coast of Borneo Island in South East Asia, with extensive petroleum and natural gas reserves. It has a land area of approximately 6000 sq. km and a total population of 459,500.[12] Demand of construction raw material like sand, gravel and rocks are mostly imported from neighboring countries; however, a few privately owned small scale quarrying operations are still carried out in the country.[13] This study aimed to assess self-reported respiratory ill-health and health-related quality of life (HRQOL) of quarry workers in Brunei Darussalam.

Methods

A descriptive study using a convenient sampling method involving 23 quarry workers from three quarry companies in Brunei was conducted from August to November 2018. The study was approved by the PAPRSB Institute of Health Sciences Research and Ethics Committee (Ref No: UBD/IHS/B3/8). We contacted five quarry companies listed in the national directory and invited their workers to participate in the study. The inclusion criteria were workers between 18-60 and worked for at least 12 months. Data of respiratory symptoms and HRQOL were collected using a validated and self-administered SGRQ in the local language. SGRQ is a standardized, widely used respiratory questionnaire used to measure HRQOL, divided into two parts, the first part (Symptoms Components) evaluates the symptoms like cough, cough with phlegm, wheeze, breathlessness, and chest discomfort, as well as their duration.

The second part assesses the "Activity" and "Impact" components, which address the effect of respiratory symptoms on routine physical activity and addresses the impact on psycho-social functions. Reliability of the questionnaire was tested with Cronbach's alpha (0.71 for the whole questionnaire, and 0.67, 0.66, and 0.94 for the Symptom, Activity, and Impact components, respectively). SGRQ scores were calculated for individual domains (Symptoms, Activity, and Impact) and all domains' total score. Scores range from 0 – 100, with a higher score representing higher impairment for quality of life.[14] The variables measured were demographic characteristics (age, gender, education, body mass index), work factors, and smoking habit. Data analysis was done using R Statistical Software and descriptive statistics. Non-parametric tests for significance and Mann-Whitney U were used to compare SGRQ scores.

Results

Table 1 shows that the majority of the workers were male (78.3%) and above 40 years old (52.2%), with a mean age of 39.09 years (±11.37). The average weekly working hours was 53.90hours (±4.80), and the mean duration of employment was 7.90 years (± 8.63). 78.3% did job tasks in non-office work areas such as stockpiling of imported products and who had exposure to dust (exposed group), while 21.7% did mainly administrative duties in an office environment and were not directly exposed to dust (non-exposed

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group). About 39% of workers were smokers, and the mean BMI was 25.7 (±3.4), with more than 65% being overweight and obese.

Figure 1 illustrates that cough (26.1%) was the commonest reported respiratory symptom among workers, followed by cough with phlegm (8.7%), shortness of breath (4.3%), and chest discomfort (4.3%). The prevalence of respiratory symptoms (dry cough, cough with phlegm, shortness of breath, and chest discomfort) was higher in smokers, exposed workers, and those who had been employed longer than five years.

Table 2 indicates that the mean total SGRQ score of quarry workers was 7.51 (±11.70), and sub-domain scores for Symptoms, Activity, and Impact were 10.60 (±12.37), 6.30 (±11.43), and 7.35 (±15.87), respectively. There was no significant association observed between demographic data of workers and the SGRQ scores. Smoking was significantly associated with a high SGRQ total score (14.24) and in the sub-domains of Symptom (17.27) and Impact (16.0).

Table 1. Demographic and work-related characteristics of quarry workers

	Demographic characteristics	Number (%)	Mean (±SD)	Range
Gender	Male	18 (78.3)		
	Female	05 (21.7)		
Age (in years)	≤ 30	06 (26.1)	39.09 (±11.37)	19-58
	31 – 40	05 (21.7)		
	41 – 50	08 (34.8)		
	> 50	04 (17.4)		
Education	Primary	05 (25)		
	Secondary	12 (60)		
	Tertiary and above	03 (15)		
Employment duration	≤5 years	13 (56.5)	7.9 (±8.63)	1-35
	>5 years	10 (43.5)		
Work hours (per week)	≤48 hours	06 (26.1)	53.9 (±4.8)	44-64
	>48 hours	17 (73.9)		
Work Group	Non-Exposed	05 (21.7)		
	Exposed	18 (78.3)		
BMI	<25	08 (34.8)	25.7 (±3.4)	15.6-30.5
	≥25	15 (65.2)		
Smoking	Smoker	09 (39.1)		
	Non-smoker	14 (60.9)		

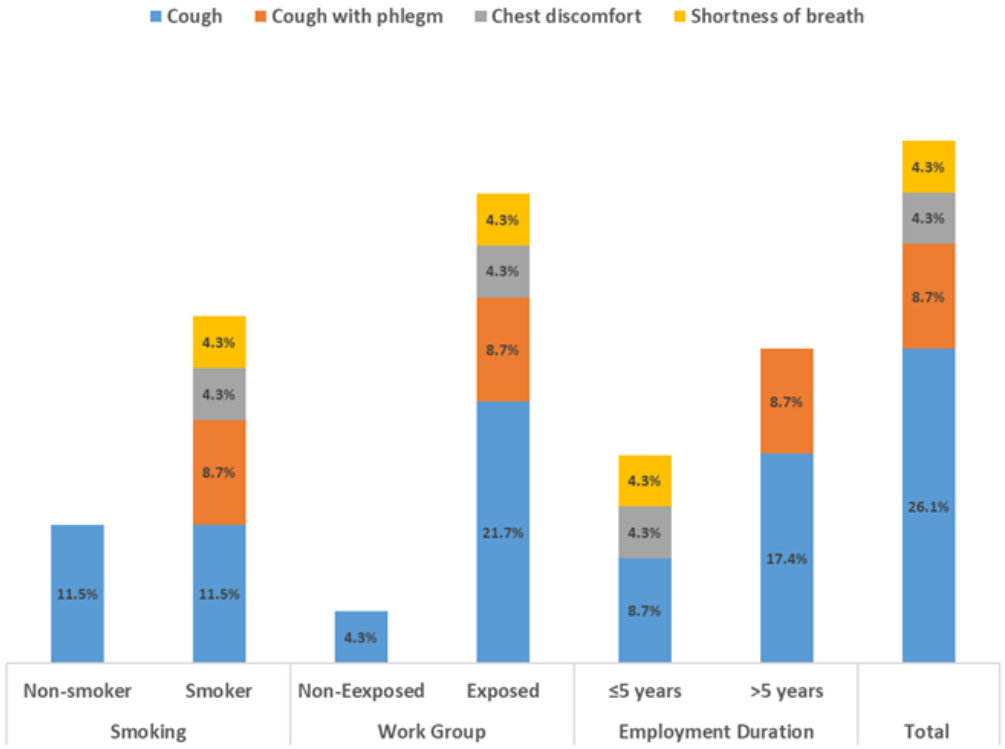

Figure 1. Respiratory Symptoms and Its Relation with Work Characteristics and Smoking Among Quarry Workers

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Table 2. SGRQ scores of quarry workers about demographic and work characteristics.

		Symptoms	Activity	Impact	Total
	Mean	10.63	6.30	7.35	7.51
	Std. Deviation	12.37	11.43	15.87	11.70
	Range	0-42.23	0-39.5	0-70.14	0-45.90
		Score (Mean (±SD))	Score (Mean (±SD))	Score (Mean (±SD))	Score (Mean (±SD))
Gender	Male	11.0 (13.4)	5.52 (9.8)	8.54 (17.5)	7.97 (12.5)
	Female	9.1 (8.4)	9.10 (17.2)	3.10 (6.7)	5.84 (9.2)
Age	≤40 years	12.91 (14.5)	11.6 (14.8)	13.7 (21.7)	12.91 (15.2)
	>40 years	8.54 (10.1)	01.4 (3.5)	01.5 (3.5)	2.54 (3.1)
Work duration	≤5 years	10.84 (12.4)	10.28 (13.5)	10.92 (19.8)	10.67 (14.3)
	>5 years	10.36 (12.9)	1.11 (3.7)	02.70 (4.5)	3.37 (3.8)
Work hours (per week)	≤48 hours	14.65 (15.5)	12.66 (17.7)	7.30 (12.2)	10.08 (13.2)
	>48 hours	9.21 (11.3)	4.10 (7.8)	7.37 (17.3)	6.60 (11,4)
Work Group	Non-Exposed	9.13 (8.4)	9.09 (17.2)	3.06 (6.7)	5.84 (9.2)
	Exposed	11.04 (13.4)	5.52 (9.8)	8.54 (17.5)	7.97 (12.4)
BMI	<25	13.25 (14.2)	10.89 (15.6)	7.83 (10.4)	9.65 (11.2)
	≥25	9.23 (11.6)	3.85 (8.1)	7.09 (18.5)	6.36 (12.2)
Smoking	Smoker	17.27(15.5)* (p=0.047)	9.80 (12.2)	16.0 (22.7)* (p=0.015)	14.24 (15.2)* (p=0.011)
	Non-smoker	6.36 (8.2)	4.04 (10.7)	1.80 (4.6)	3.18 (5.9)

*Statistically significant (p<0.05) using Mann-Whitney U Test

Discussion

This study showed that cough was the commonest reported respiratory symptom among quarry workers, and the prevalence was low. In contrast, some studies in Malaysia (60%)15 and Nigeria (65%)7 observed a high prevalence of cough among quarry workers. The prevalence of respiratory symptoms among quarry workers reported in other studies showed wide variabilities, such as cough (10-55%), shortness of breath (6.4-79%), and chest pain (17-79%).[7,8,15-17] The wide variability in respiratory symptoms may be due to differences in mining and quarrying processes, materials, work practices, and control measures implemented at different workplaces in different countries. Countries such as Africa, Australia, and China still see large scale mining and quarrying activities from blasting of rocks to transporting raw materials.[18] In Brunei, the quarry activities are limited to the importation of gravel and sandstone, thus eliminating the processes of excavating, crushing, drilling, and washing minerals with higher occupational exposures to dust.

Another finding of this study showed that respiratory symptoms were more prevalent among smokers and those with higher exposure. These results are comparable with other studies.[7,16] There was no comparable evidence showing the association between HRQOL and respiratory morbidity among quarry workers; however, poor HRQOL among quarry workers was reported in Nigeria. [19-20] The current study revealed a high mean total SGRO score among quarry workers, and being a smoker was significantly associated with high SGRQ total score and scores for symptom and impact domains. In contrast, a study conducted by Ferrer et al. in Spain on the general population[9] reported the mean and range of scores for total and sub-domains of symptoms, activity, and impact were 6.0 (5-7), 12.0 (9.0-15.0), 9.0 (7.0-12.0), and 2.0 (1.0-3.0), respectively. This

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indicates some impairment in HRQOL among quarry workers because of their respiratory ill-health compared to that of the general population.

This study's main strength was that the data were collected using a validated questionnaire, whereas the limitation was a small sample size due to the small number of registered mining and quarrying companies in the country. Moreover, these companies employed workers who were not involved in major quarrying activities with high dust exposure, which may explain why these study participants reported fewer respiratory symptoms. The self-administered questionnaire for assessing respiratory ill-health was conducted without supplementary lung function tests and chest radiograph due to inadequate financial support. Thus the results may be subjected to reporting bias.

Conclusion

This study showed respiratory adverse effects on quality of life using SGRQ scores among quarry workers in Brunei Darussalam and its relation with work factors and smoking habit. The findings from this study will be helpful for mining and quarrying companies in implementing proper preventive measures, e.g., proper general and local exhaust ventilation, the wet method for processes that generate dust particles in the quarry work area, periodic medical examinations, adherence to proper personal protective equipment usage, smoking cessation program at the workplace. Further research may focus on diagnostic investigations to confirm the clinical diagnosis of the underlying respiratory illness and environmental dust measurements.

Ethical Approval

This study was approved by the PAPRSB Institute of Health Sciences Research and Ethics Committee (Ref No: UBD/IHS/B3/8).

Conflict of Interest

No conflict of interest to declare

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