ORIGINAL ARTICLE

Worker's Perceptions and Attitudes of Coal-dust Exposure and Health Hazards: Case of a Coal-fired Power Station in Southern Africa

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ABSTRACT

Introduction: Exposure to coal dust is one of the major health hazards that result in respiratory problems in the coal industry. Literature on workers' perceptions of coal dust exposure and its health effects is limited. This study aimed to establish workers' perceptions and attitudes about coal dust exposure and health hazards. **Methods:** The study used a descriptive cross-sectional design and stratified sampling approach to select 152 workers from a coal-fired power station. Quantitative data was collected using a structured interviewer-administered questionnaire to solicit information on age, gender, work experience, knowledge and perception, with Chi-square tests used for inferential analysis. The study was conducted at Bulawayo Power Station, Zimbabwe. **Results:** Respondents between 18 to 39 years were the majority. 72.4% had worked at the coal-fired power station for more than a year. Most respondents were aware of the sources of coal dust, its exposure routes, the frequency of exposure that may result in respiratory problems, health effects and methods of prevention. Most respondents perceived they were exposed to coal dust, which they identified as a significant health hazard; they were at risk of having respiratory difficulties and could be protected from its exposure. There was no correlation between workers' perception of coal dust exposure and their work experience. **Conclusion:** Workers were knowledgeable of the health hazards associated with coal dust. Coal dust was perceived as the main health hazard resulting in respiratory complications. The perception was the same among workers with different work experiences.
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INTRODUCTION

Coal is an organic sedimentary rock consisting primarily of carbon and a low percentage of nitrogen and sulfur compounds (1). It is a fossil fuel formed through a geographical process that takes place over millions of years, as buried plant material and organic matter in the presence of high temperature and pressure are converted into peat, lignite, sub-bituminous, bituminous, and subsequently anthracite coal (2). South Africa supplies 3.5% of world coal, with Zimbabwe supplying 0.1% (3). Globally, coal is used in different industries with 41% of the global electricity currently is fueled by coal-fired power plants (4). During thermal power generation, coal is crushed and pulverized into coal dust. Coal dust is a "complex and heterogeneous mixture containing carbon, crystal silica and other trace elements such as boron, cadmium, nickel, iron, antimony, lead and zinc" (5).

Studies have shown that coal dust exposure in workplaces increases the probability of developing respiratory conditions. These include coal workers' pneumoconiosis, dust-related fibrosis, silicosis, and mixed dust pneumoconiosis (6). Respiratory health effects such as cough, chest pain, pneumonia, lung cancers, shortness of breath, emphysema, tuberculosis, asthma, wheezing, and chronic bronchitis were found among workers at a coal-fired power station (7).

A South African study revealed that the incidence of coal workers' pneumoconiosis at certain coal dust concentration levels was different in various country regions (8). National statistics in Zimbabwe from 2009 to 2013 revealed a nine-fold increase in the number of

confirmed coal workers' pneumoconiosis cases, i.e. an increase from three in 2009 to twenty-nine in 2013, with five cases being recorded at the coal-fired power station (9). The increasing cases have warranted the need to undertake a study to bring to light workers' perceptions and attitudes toward exposure to coal dust. The analysis of workers' perceptions is an essential proactive tool that can be used to design effective occupational health promotion programs that will contribute to the overall safety culture of organizations (10).

Literature and statistics have shown that coal dust exposure is a significant health hazard and respiratory diseases are aa serious public health problem in coal processing workplaces. Behaviour change theories and models are used to understand individual behaviours concerning specific health problems and identify essential knowledge for implementing interventions (11). Individual behaviour models such as the rational or the knowledge, attitudes and practice (KAP) states that increasing a person's knowledge will prompt a behaviour change (12). The Health Belief Model has six constructs: self-efficacy, cues to action, perceived barriers, benefits, severity, and susceptibility (12). Therefore, by using these models, the study explored workers' perceptions of coal dust exposure as a tool to develop interventions.

Knowledge is the understanding of or information about a subject acquired through experience and learning, from education and training (13). Safety and health training is vital in raising awareness of risk to workers' safety and health, proper use of protective equipment and compliance with safety procedures (14). Attitude includes beliefs, behaviours, and emotions concerning a particular subject, person, idea, or issue built from experience, social factors, and learning (15). Perception is awareness of a subject how it is understood, regarded or interpreted, whether one's thoughts and feelings or their social surroundings (16).

A study of the health risk perception of residents located around a smelter plant in Zimbabwe identified the smelter as the source of health problems that presented adverse health risks, and respondents perceived that the air quality was poor (17). Another study conducted in Nigeria on the health hazards of biomass smoke exposure revealed that most commercial food vendors were unaware that exposure to biomass smoke was detrimental to their health (18). A risk perception study on the effects of dust on communities living in a South African mining area showed that all participants acknowledged that dust in the air was a nuisance, identified the source and attributed it as the cause of their health problems (19). These previous studies on airborne exposures were conducted among community members in Africa. However, this study focused on workplaces and workers' perceptions of such airborne exposures.

Satisfactory perception was found in the South African steel industry as workers were aware of workplace hazards, adequately trained, using personal protective equipment and complied with safety procedures (20). Workers in food industries in Zimbabwe had a neutral perception about their work conditions being safe and were unaware of occupational safety and health laws that govern their work (21). Nigerian health care workers were highly knowledgeable of workplace hazards, and their risk perception was high (22). Previous studies concentrated on other industries (manufacturing, food and hospitals), excluding coal processing. Furthermore, they explored other occupational safety and health management issues like standards, training, and compliance. Therefore, this study covered the research gap by focusing on coal dust exposure in a coal-fired power station.

Wood processing workers in Zimbabwe were aware that they were exposed to wood dust, dust controls were inadequate, and they perceived that occupational health and safety were a less urgent priority (23). Nigerian stone crushers perceived dust as their significant hazard, a source of their ill health, and dust masks were useful for control (24). Similarly, gold miners in Ghana perceived that exposure to dust was the primary source of work-related illness and cited coughing as the major respiratory symptom (25). Construction workers in Nigeria were knowledgeable of hazards found in their operations. However, they had poor attitudes towards occupational safety measures (26). These studies focused on airborne exposures to different types of occupational dust such as silica, asbestos and wood.

Workers in Poland coal mining perceived that occupational health and safety regulations made their work challenging and would breach them to make the jobs easier (27). Coal miners at Shangla District had no regard for occupational safety issues as they were unaware of coal mine hazards and worked without protective equipment (28). A safety attitude study conducted in the Chinese coal mining industry revealed an overall improvement in the safety perceptions among managers between 2009 and 2014 (29). All these studies were conducted in coal dust environments but focused on safety procedures, safety regulations, protective equipment and safety hazards that result in occupational accidents and injuries. In addition, they were conducted in other parts of the world. In contrast, this study was done at a coal processing plant in sub-Saharan Africa and will unveil workers' perceptions of coal dust exposure.

Knowledge, attitude, and perception studies in occupational health and safety have been conducted in various sectors such as mining, manufacturing, and construction. These studies concentrated on other safety and health hazards/ physical agents, dust types, and

general occupational safety and health management. Previous risk perception studies in coal-dust industries have focused on other occupational health and safety facets, with no or limited literature on coal dust exposure and related health outcomes. Furthermore, there is no literature on the relationship between workers' perceptions of coal dust exposure and work experience. Work experience may determine the appreciation of risk perception as health behaviour models have postulated that knowledge and perception are also influenced by one's experience (13 and 14). Therefore, the study aimed to establish workers' perceptions and attitudes about coal dust exposure and health hazards, and the association between their risk perception and work experience.

MATERIALS AND METHODS

Study Area

The study was conducted at Bulawayo power station in Zimbabwe. The coal-fired power station has an installed capacity of 120 Mega Watts (MW), currently generating 90 MW and connected to the grid through 11 and 33 kilovolts (kV) systems (26). The study area was selected as coal was one of the primary raw materials in the power generation process. Thus, workers would be exposed to coal dust during its operations.

Study Design

The study used a descriptive cross-sectional design. It assessed workers' perceptions and knowledge of coal dust exposures with related adverse health effects, together with other population attributes such as length of work, simultaneously in a well-characterized population at a given time. The study used a quantitative approach as the data collected was numerical. The study was conducted between July and December 2018.

Study Population

The coal-fired power station has 450 workers, which includes 205 from office administration and 245 power generation process staff. The study's inclusion and exclusion criteria were the work environment and duration of work at the coal-fired power station. Therefore, the study population included workers from the power-generation process working in coal dust environments such as the coal plant, boiler and turbine house. Power generation workers were classified into three categories (Table I): operations (plant operators, assistants, attendants, auxiliary operators, plant cleaners, water treatment operators and laboratory analysts); maintenance (artisans and apprentices in mechanical, electrical, civil, instrumentation, information and technology); and security personnel. The study also included workers working continuously in the coal dust environments for more than six months. All office administrative staff members, including finance, administration and human resources were excluded. They were excluded because they work primarily in offices, which are not considered coal dust environments.

Table I: Socio-demographic characteristics of respondents

Description of variables	Frequency (n)	Percent (%)
Gender of respondents		
Male	114	75
Female	37	24.3
Missing	1	0.7
Age range of respondents		
18 – 29	74	48.7
30 – 39	35	23.0
40 – 49	21	13.8
≥50	21	13.8
Missing	1	0.7
Length of Work in Years (Year)	42	27.6
<1	60	39.5
1 - 9	28	18.4
10 - 19	19	12.5
≥20	3	2
Missing		
Distribution of respondents by departments		
Operations	76	50
Maintenance	67	44.1
Security	9	5.9

Sampling

A sample size of 152 of the study population was drawn from the 245 power station generation workers. The sample size was determined using the equation below, where n is the sample size, N is the population size, and e is the level of precision at ±5 per cent and a confidence level of 95 per cent (30).

$$n = \frac{N}{[1 + N(e)^2]}$$

A stratified random sampling strategy was employed to classify the participants according to their operations and then randomly sampled to select the number of samples in each group.

Data collection tool

The study collected primary data using a structured interviewer-administered quantitative questionnaire. The permission to undertake the study was obtained from management, and study participants at the coal-fired power station filled and signed a consent form. The participants were not obliged to participate fully and could withdraw from the research study at any time, with or without reason. Validity and reliability questionnaires were piloted among 15 respondents to correct any inappropriate wording and standardize the conditions under which the questions were answered. Thus, the pilot study respondents and its results were not part of the main reporting. The questionnaire had three sections: socio-demographic data including age, gender, department and length of work; six multiple-choice questions about their knowledge of coal dust exposure and related health problems, and seven questions about perceptions towards the adverse health effects of coal dust exposure. The level of knowledge was determined by the responses to multiple choice questions. A correct answer was assigned as high/ good knowledge and an incorrect response as low/ poor knowledge. The perception responses were rated using a 5-point Likert

scale (one indicating stronger disagreement, three - neutral, and five - stronger agreement).

Statistical Analysis

Data were computed and analyzed using the IBM SPSS Version 25 for frequency tables, percentages, and bivariate analysis levels with Chi-square for inferential analysis. The level of significance was set at p = 0.05.

Ethical Clearance

The study was approved by the Research and Ethics Committee, Faculty of Health Sciences University of Johannesburg; REC 241112-035

RESULTS

Demographics and Work experience

A 100% response rate was achieved as all participants recruited participated in the study to completion. Socio-demographic characteristics revealed that most respondents were male, compared to female, and one did not indicate their gender (Table I). Almost half of the respondents were between 18 and 29 years. Slightly below a quarter were within the age range of 30 to 39, and 14% were between 40 and 49 and 50 and 65 years, respectively. The respondents' work experiences at the coal-fired power station varied as the greater proportion had worked between one and nine years. More than a quarter had worked for less than a year. About 18.4% and 12.5% had worked between 10 and 19, and more than 20 years, respectively.

Knowledge of coal dust health hazards

More than three-quarters of the respondents were aware that the coal plant, coal yard and boiler house were the sources of coal dust exposure at the coal-fired power station (Table II). Most respondents were knowledgeable that inhalation was the route of exposure to coal dust, which may lead to respiratory illnesses. A lesser percentage had poor knowledge, indicating that eating and skin contact were routes of coal dust exposure. On the other hand, a most respondents reported that there were either no safe coal dust concentration levels or were not sure about them. Above a quarter indicated that there were safe coal dust concentration levels in the workplace at times.

The majority of the respondents were knowledgeable that continuous (repeated) exposure to coal dust might result in one developing breathing/ respiratory problems. Close to three-quarters of the respondents reported that breathlessness was a significant health outcome attributable to coal dust exposure at the coal-fired power station. Most of the respondents were aware that watering coal/ suppression and wearing dust masks (personal protective equipment) were ways the workers could be protected against coal dust exposure.

Table II: Knowledge of respondents about coal-dust health hazards

Description of Knowledge Variables	High/ Good n (%)	Low/ Poor n (%)
Sources of coal-dust exposure	123 (81)	29 (19)
Route of exposure for coal-dust	142 (93.4)	10 (6.6)
Safe coal dust concentration levels	27 (17.8)	125 (82.2)
Frequency of coal-dust exposure	88 (57.9)	64 (42.1)
Health effects caused by coal-dust exposure	113 (74.3)	39 (25.7)
Protection against coal-dust exposure	128 (84.2)	24 (15.8)

Attitudes and beliefs of respondents towards adverse health effects of coal dust

The greater majority of respondents agreed that power station workers were exposed to coal dust within their operations compared to those who were either neutral or disagreed (Table III). Thus, the respondents perceived that they were exposed to coal dust while at work. A large proportion of respondents agreed that coal dust was a primary health hazard in the power station, while a small proportion had an opposite view. More than three-quarters of the respondents perceived that they were at risk of developing respiratory or breathing challenges. At the same time, less than a quarter of the respondents were either neutral or in disagreement. Thus, workers perceived that they were at risk of having breathing difficulties.

Almost half of the respondents perceived that coal dust causes tuberculosis, with slightly more than a quarter disagreeing and a quarter of the respondents had a neutral perception. Therefore, when comparing the three categories, most respondents perceived that exposure to coal dust causes tuberculosis. Mixed responses were found concerning the perception of coal dust induced breathing challenges being curable through medicine. About 40.8% respondents agreed that coal dust induced breathing challenges were untreatable through medications. More than a quarter of the respondents were neutral, and more than a third disagreed. Thus, most respondents perceived that coal

Table III: Perceptions of respondents towards coal-dust exposure and health hazards

Perception variables	Agree n (%)	Neutral n (%)	Disagree n (%)
Power station workers exposed to coal-dust	144 (94.7)	4 (2.6)	4 (2.6)
Coal-dust is a major health hazard	144 (95.7)	5 (3.3)	2 (1.3)
Risk of developing breathing problems	116 (76.3)	24 (15.9)	11 (7.3)
Coal-dust exposure causes Tuberculosis	74 (49)	38 (25.2)	39 (25.8)
Risk of transmission through contact of coal-dust induced breathing problems between workers	12 (7.9)	20 (13.2)	119 (78.2)
Coal-dust induced breathing problems being curable by medicine	50 (32.9)	40 (26.3)	62 (40.8)
Workers being protected from coal-dust exposure that can lead to breathing problems	117 (77)	16 (10.5)	19 (12.5)

dust induced breathing challenges were untreatable by using medication. A majority of the respondents agreed that there are ways of protecting workers from exposure to coal dust. Therefore, respondents perceived that there are ways of protecting workers from exposure to coal dust.

Correlation between workers' perception of coal dust exposure and work experience

A bivariate analysis of work experience against perception variables revealed a correlation between the workers' perception of exposure to coal dust and their work experience (Table IV). However, there was no statistically significant correlation between work experience and workers' perception of coal dust as a health hazard. There was also no significant statistical correlation between workers' perception of the risk of developing induced respiratory/ breathing problems or causing tuberculosis and work experience. In addition, no statistical significant correlation between worker's perception to the risk of transmission of coal dust induced breathing challenges through contact among workers, it being curable and work experience. Lastly, no statistical significant correlation between the worker's perception of protection from coal exposure and work experience.

DISCUSSION

The socio-demographic of the study revealed that a greater proportion of the respondents had been working in a coal dust environment for more than one year. Further analysis showed a considerable proportion (12.5%) of workers who have worked in such settings for more than twenty years. This result may be attributed to the specific competencies of the workforce, which are exclusively required in the power generation process, such as plant operators and boiler attendants. Similar findings were found in a previous study on safety practice and the knowledge of hazards among construction workers. The majority of the employees had worked for more than a

Table IV: Relationship between workers' perception of coal-dust exposure and work experience

Length of Work	**Power station workers exposed to coal dust**			
(Years)	**Agree**	**Neutral**	**Disagree**	**p-value (< 0.05)**
<1	37 (88.1)	1 (2.4)	4 (9.5)	0.022*
1 – 9	60 (100)	0(0)	0 (0)	
10 – 19	26 (92.9)	2 (7.1)	0 (0)	
≥20	18 (94.7)	1 (5.3)	0 (0)	
Length of Work	**Coal dust a major health hazard**			
(Years)	**Agree**	**Neutral**	**Disagree**	**p-value**
<1	39 (95.1)	1 (2.4)	1 (2.4)	0.934
1 – 9	58 (96.7)	1 (1.7)	1 (1.7)	
10 – 19	27 (96.4)	1 (3.6)	0 (0)	
≥20	18 (94.7)	1 (5.3)	0 (0)	
Length of Work	**Risk of developing breathing problems**			
(Years)	**Agree**	**Neutral**	**Disagree**	**p-value**
<1	27 (64.3)	10 (23.8)	5 (11.9)	0.487
1 – 9	47 (78.3)	9 (15)	4 (6.7)	
10 – 19	24 (85.7)	3 (10.7)	1 (3.6)	
≥20	15 (83.3)	2 (11.1)	1 (5.6)	
Length of Work	**Coal dust exposure causes Tuberculosis**			
(Years)	**Agree**	**Neutral**	**Disagree**	**p-value**
<1	22 (52.4)	14 (33.3)	6 (14.3)	0.177
1 – 9	26 (44.1)	14 (23.7)	19 (32.2)	
10 – 19	13 (46.4)	8 (28.6)	7 (25)	
≥20	11 (57.9)	1 (5.3)	7 (36.8)	
Length of Work	**Risk of transmission through contact of coal dust induced breathing problems between workers**			
(Years)	**Agree**	**Neutral**	**Disagree**	**p-value**
<1	5 (11.9)	9 (21.4)	28 (66.7)	0.134
1 – 9	3 (5)	5 (8.3)	52 (86.7)	
10 – 19	1 (3.6)	2 (7.1)	25 (89.3)	
≥20	3 (16.7)	2 (11.1)	13 (72.2)	
Length of Work	**Coal dust induced breathing problems being curable through the use of medicine**			
(Years)	**Agree**	**Neutral**	**Disagree**	**p-value**
<1	13 (31)	16 (38.1)	13 (31)	0.430
1 – 9	21 (35)	14 (23.3)	25 (41.7)	
10 – 19	8 (28.6)	5 (17.9)	15 (53.6)	
≥20	6 (31.6)	4 (21.1)	9 (47.4)	
Length of Work	**Workers can they be protected from coal dust exposure**			
(Years)	**Agree**	**Neutral**	**Disagree**	**p-value**
<1	33 (78.6)	3 (7.1)	6 (14.3)	0.143
1 – 9	50 (83.3)	4 (6.7)	6 (10)	
10 – 19	16 (57.1)	7 (25)	5 (17.9)	
≥20	15 (78.9)	2 (10.5)	2 (10.5)	

year in a dusty work environment (31).

Knowledge is an understanding or awareness of a subject through experience and learning (13). The study results showed that a greater proportion of the respondents were aware that the coal plant, coal yard and boiler house were sources of exposure to coal dust at the power station. The respondents commented on this based on their experiences working in such environments. Our findings were consistent to another study on risk perceived for dust and its impact, which identified mine dumps and coal yards as sources of dust exposure (19). Furthermore, results indicated that most of the respondents were knowledgeable about inhalation as the route of exposure to coal dust, which may lead to respiratory complications. They may have gathered this knowledge from previous work experiences in other coal dust environments. Similar findings were reported in a study on the knowledge regarding respiratory symptoms among textile workers. Respondents cited that inhalation of cotton dust caused harmful effects on the lungs (32).

The study revealed that the respondents were unaware that there were safe coal dust concentration levels, with a large proportion of respondents indicating that there were none or not sure. This might be due to a lack of information on coal dust concentration levels and acceptable exposure limit values at the coal-fired power station. Our results further showed that most of the respondents were aware that continuous/ repeated exposure to coal dust pose a threat to the respiratory system leading to breathing challenges. The workers were likely educated and trained through toolbox talks on the dangers of exposure to coal dust. This result is similar to a previous study in South Africa, which reported that continuous coal dust exposure was significantly correlated to respiratory symptoms (8).

The study revealed that the respondents knew about the health problems caused by coal dust exposure as most reported breathlessness as a significant health outcome attributed to coal dust exposure. The respondents' knowledge can be attributed to the health outcomes they may be experiencing due to working in such environments. Our results were consistent with a previous study that reported a similar health problem of shortness of breath as a symptom of occupational respiratory diseases (33). In addition, the study showed that most respondents were knowledgeable on protection methods against exposure to coal dust, as they mentioned coal dust suppression/ watering and the use of dust masks. This result compares to a previous study in Nigeria, which found that construction workers knew about personal protective equipment against dust, such as dust masks (26).

The study revealed that the respondents perceived that power station workers were exposed to coal dust during their normal daily work routines. In addition, the majority of the respondents perceived coal dust as a primary health hazard at the power station. These perceptions may be due to the lack of monitoring of coal dust levels at the coal-fired power station. Our findings were consistent with other studies in which stone crushers reported exposure to dust and regarded dust exposure as a serious hazard (24) and (34).

Furthermore, the respondents perceived that they were at risk of developing respiratory or breathing problems due to coal dust exposure. This may be ascribed to their experience on work-related illnesses of co-workers who may have developed coal-induced respiratory problems due to coal dust exposure. Our results were consistent to a Kenyan study in which respondents perceived that industrial air pollution posed a considerable risk to their health (35).

The study also revealed that most respondents perceived that exposure to coal dust causes tuberculosis. This misconception may be due to the lack of training and information on the health effects of coal dust exposure and the stigma attached to tuberculosis. Similar misconceptions coupled with contradictory perceptions and attitudes regarding the causes of tuberculosis (TB) were reported in a previous study where respondents indicated that TB was caused by germs and smoking 27(36). This implies the need for advocacy and health promotion programmes focusing on the health risks of both occupational and community (public health) respiratory diseases.

Workers perceived that coal dust induced breathing challenges were non-transmissible. They indicated no transmission risk of coal dust induced breathing challenges among workers through contact. Studies have shown that inhalation and accumulation of coal dust in the lung tissues resulted in irreversible and non-infectious respiratory problems (37). Furthermore, the respondents perceived that coal dust induced breathing difficulties could not be treated using medications. Worker's perception was found to be in agreement with previous findings in which most respondents perceived that respiratory conditions would get progressively worse regardless of the treatment they received (38).

The majority of the respondents perceived that there are ways of protecting workers from exposure to coal dust. This may be attributed to the respondent's previous experience of working in other coal dust environments, which managed to control coal dust exposure. The findings were consistent with a perception and attitude study toward work-related ill health of quarry workers. The quarry crushers perceived that ill health caused by dust exposure could be controlled (24).

A binary analysis revealed no correlation between workers' perceptions of coal dust exposure and work

experience. Therefore, the perceptions were similar among respondents with different lengths of work. This may be due to parallel trends of coal dust concentration levels found at the coal-fired power station. Therefore, all workers may be fearful of developing respiratory problems. This finding is in line with a Nigerian study which found no correlation between workers' employment duration and their perception or knowledge of construction hazards (31).

The study revealed that respondents were knowledgeable about coal dust health hazards. The application of the rational model would assume that the good knowledge among respondents would equally mean a positive behavioural choice such as the use of respiratory protective equipment. However, positive behaviours are influenced by several factors besides increasing knowledge about coal dust health hazards. This implies that, in addition to recommending a safety and health training program to increase knowledge on safe coal dust concentration levels, other administrative and technological interventions should be recommended.

Furthermore, the study revealed that respondents perceived that they were exposed to coal dust. They were at risk of developing incurable respiratory problems and should be protected against them. Therefore, using the health belief model, one can argue that workers believed that they were susceptible to developing breathing difficulties when exposed to coal dust. In addition, the perceived severity was high, as they highlighted that they were at risk of having incurable breathing difficulty problems. The perceived severity was exacerbated by workers' false misconception that exposure to coal dust would cause tuberculosis. They believed that there were perceived benefits in taking action to reduce the risk. This may imply that the workers would be ready to change (cues to action) and confident in their ability (self-efficacy) to take action to protect themselves if they receive the necessary training and guidance, such as on the job training in the use of respiratory protective equipment.

Our study was limited to those workers in direct contact with the exposure agent (coal dust) while excluding office workers. It does not attempt to address other forms of exposure found in the power station. The workers' educational background was not considered. This is an important socio-demographic variable. It is often used in evaluating correlations with the knowledge or perception variable. The strength of the manuscript is that it focused on the risk perception of coal dust exposure, which has been underreported in the literature. In addition, it explored the relationship between the workers' perception and work experience. Therefore, suggestions for future research include the inclusion of safety practices, highlighting current safe and unsafe health behaviours concerning coal dust exposures. This will allow one to explore the association between workers' perceptions and behavioural practices.

CONCLUSION

Coal-fired power station workers demonstrated overall good knowledge about coal dust health hazards. They perceived that coal dust was a major health hazard to which they were exposed. They believe they are at risk of developing respiratory problems, but they can be protected against coal dust exposure. The perception and attitude were the same among workers regardless of their work experience at the coal-fired power station. Therefore, there is a need to develop sound safety and health policies and standards on coal dust control, including coal dust suppression, monitoring and respiratory protection. Workers' participation should be promoted in developing coal dust control mechanisms and the selection of respiratory protection. Health promotion and campaigns on coal dust health risks and the proper use of respiratory protective equipment for the general workers, supervisors and managers need to be advocated. Lastly, the power station management must provide occupational health services that encompasses workers' health surveillance systems (pre, periodic and exit) to ensure the adequate monitoring of workers' working conditions and health.

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