



Name: Noor Haziqah Bte Kamaludin,
Assoc. Prof. Dr. Juliana Jalaludin*

Department of Environmental and
Occupational Health, Faculty of
Medicine and Health Sciences,
University Putra Malaysia.



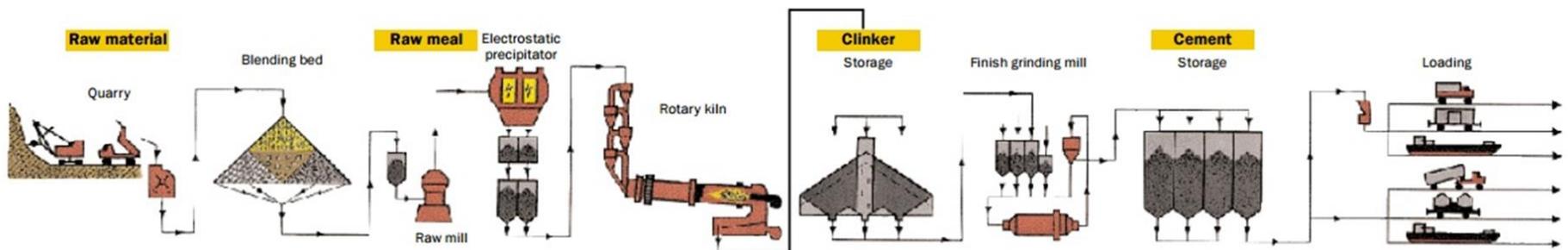
Respirable Cement Dust Exposure on Fractional Exhale Nitric Oxide (FENO) and Interleukin-8 (IL-8) in Airways Inflammation among Cement Workers'

Introduction

- Cement is a mixture of fine grayish powder that is used to bind fine sand and coarse aggregates together and hardens when water is added or known as hydraulic binder then become strong material known as concrete.
- Cement industry reported a strong growth demand and expected to increase due to government spending on infrastructure projects (Malaysia Cement Industry Report, 2015).
- The dust generated from this industry may cause health problem to workers either through dermal contact or inhalation (Ahmad et al. 2013) and lead to a greater prevalence of chronic respiratory symptoms and decrease of ventilator capacity.(Al-Neaimi et al., 2001).

Objectives:

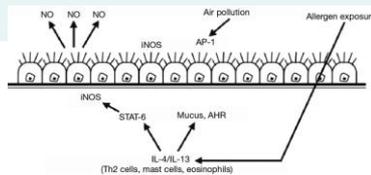
- 1) to compare respiratory health symptoms between cement workers and comparative group.
- 2) to compare the concentration of personal exposure to cement respirable dust between cement workers and comparative group.
- 3) to compare Lung Function status, Fractional exhaled Nitric Oxide (FeNO) Level and concentration of Interleukin8 (IL-8) between cement workers and comparative group.
- 4) to determine the relationship between Fractional exhaled Nitric Oxide (FeNO) Level, concentration of Interleukin8 (IL-8) and Lung Function status with the personal concentration exposure among Cement Industrial Workers



Literature Review

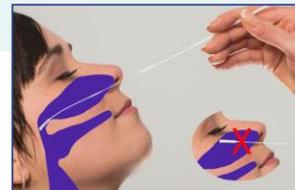
Exhaled Nitric Oxide

- When the eosinophilic become inflamed, inducible Nitric Oxide Synthase enzymes in eosinophils will catalyze L-arginine to overproducing Nitric Oxide (NJ Health, 2009)
- There is significant increase in fractional exhaled Nitric Oxide on the cement workers compared to non exposed workers (Meo et al., 2014; Tungu et al., 2012)



Interleukin-8

- The increases production of IL8-Chemokine will orchestrate to the increasing neutrophil chemoattraction to response of inflammatory mediators
- The worker who are exposed to the cement dust have elevated of cytokine IL-8 compared to the worker who are not exposed (Fell et al., 2010; Tolinggi et al., 2014).



Lung Function Test

- Is a test to measure how much air is going into the lungs and the airflow level is inhaled and exhaled from the lungs (Worker Health Protection Program, 2013).
- The lung function, FEV1 and PEF of cement workers across the shift were detected decrease (Fell et al., 2011; Poornajaf et al., 2010; Aminian et al., 2013)



Inhalation of **unwanted particle**



bronchial tubes airways have become **inflamed or swollen** and oversensitive due to unwanted particles and gases (Tarlo et al., 2010).



the cement workers have **respiratory symptoms** such as coughing, wheezing, dyspnea, sinusitis, shortness of breath bronchitis and bronchial asthma and coincide with their lower ventilator function level (Al-Neaimi et al., 2001)

Method

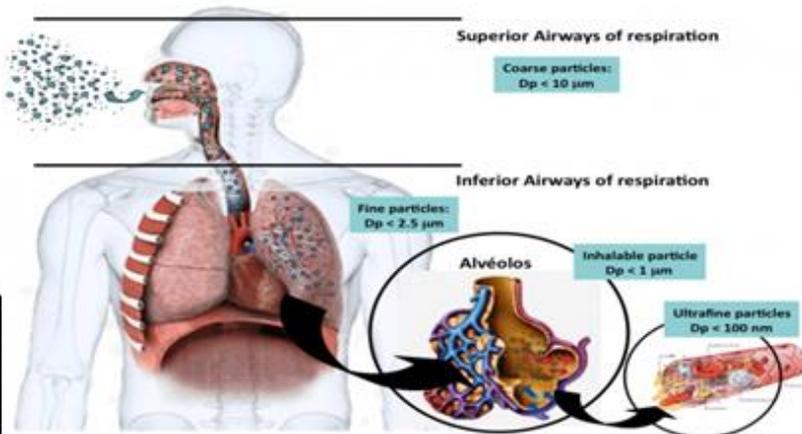
Cross-sectional Study

252 respondents

- 179 cement workers
- 173 school staff

Inclusion criteria:

- Age 20 to 60
- Male and Malaysian
- No history of Respiratory disease



Questionnaire : Adapted from ATS for adult respiratory health disease (ATS-DLD).



Lung function test: Spirometer (Chestgraph HI-105)



Fractional Exhaled Nitric Oxide (FENO): NIOX MINO



Nasopharyngeal Interleukin 8 (IL-8): flocked swab



Personal exposure monitoring: Gilian GilAir-3 Air Sampling Pump

Result and Discussion

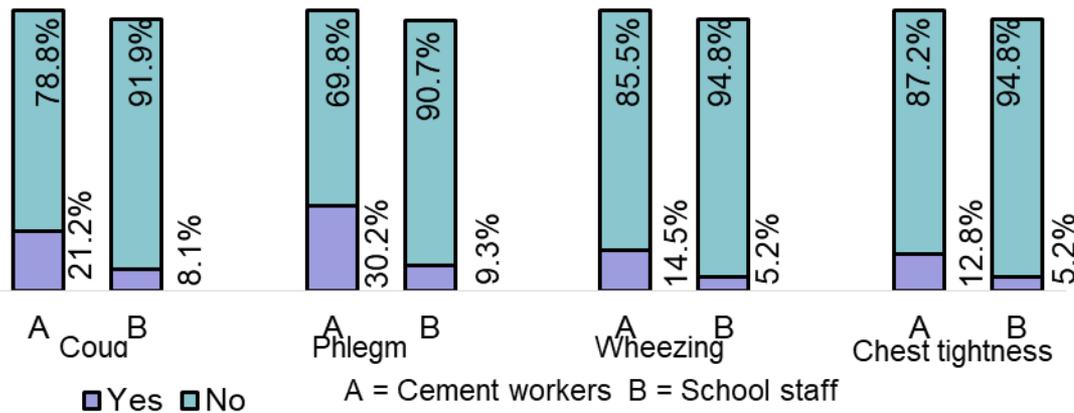
Table 1: Comparison of personal exposure level of between cement workers and school staff

Variable	Cement workers (N=140)	School staff (N=169)	z value	p value
	Mean ± SD	Mean ± SD		
Respirable dust (mg/m ³)	2.89 (3.21)	1.19 (0.78)	185.405	0.001*

Independent Sample T-Test, *Significant $p \leq 0.05$

- The mean of personal respirable cement dust concentration on workers was 2.89 ± 3.21 mg/m³.
- The permissible exposure limit set by Factories and Machinery (Mineral Dust) Regulations 1989 which is 5 mg/m³

Respiratory symptoms

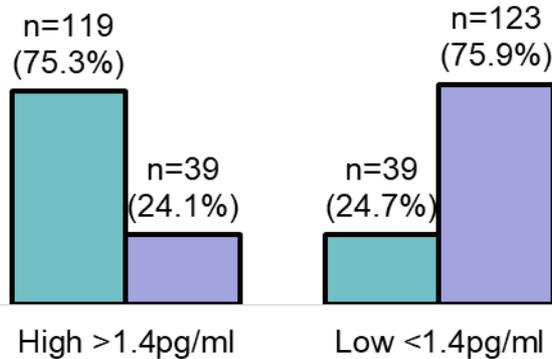


Variables	OR (95% CI)	*OR (95% CI)
Cough	1.508 (0.683-3.331)	0.951 (0.389-2.322)
Phlegm	3.240 (1.594-6.588)	3.278 (1.527-7.038)
Wheezing	1.137 (0.432-2.997)	1.539 (0.545-4.345)
Chest tightness	1.246 (0.491-3.167)	1.354 (0.545-3.644)

- Phlegm are the most likely to occur among cement workers (OR=3.240, 95% CI=1.594-6.588) and after adjusted for smoking and tenure status (OR=3.278, 95% CI =1.527-7.038).
- The prevalence of chronic phlegm is higher among cement workers (fell at el., 2003).
- Several clinical and epidemiological studies which shown a higher incidence of impairment of respiratory and prevalence of respiratory symptoms among cement production workers (Kakooei et al., 2011, Noor et al., 2013).

Result and Discussion

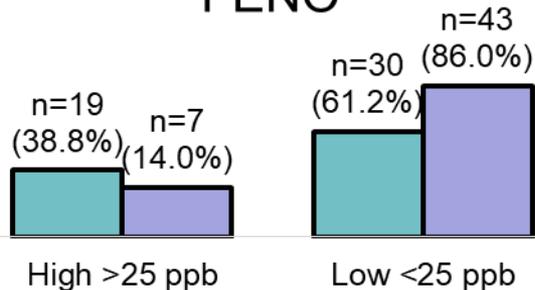
Interleukin 8



■ Cement workers ■ School staff
 OR=9.623, 95% CI= 5.776-16.032
 *OR=8.298, 95% CI= 4.830-14.257

- High level of IL-8 likely to occur among cement workers (OR= 9.623, 95% CI=5.776-16.032).
- High levels of IL-8 have been suggested by the clinical study as associated with increased risk of the pulmonary disease with respect to lung cancer (Orditura et al., 2002).

FENO

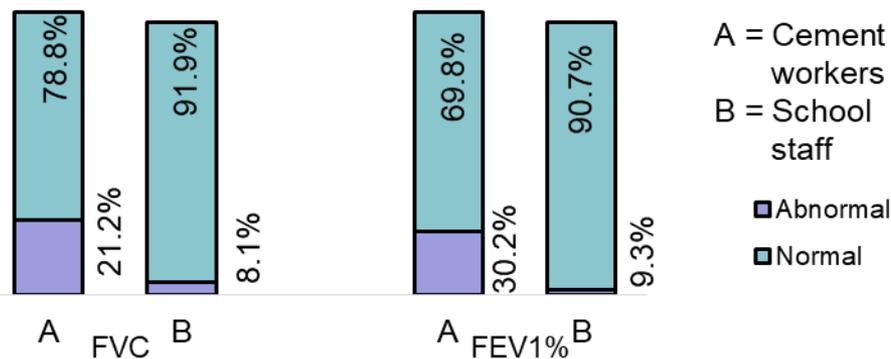


■ Cement workers ■ School staff
 OR=3.890, 95% CI= 1.454-10.408
 *OR=5.566, 95% CI= 1.901-16.299

- The risk of inflammation is 3 times highly to occur among cement workers with high level of FENO (OR=3.890, 95% CI=1.454-10.408).
- The high level of FENO which was classify based on American Thoracic Society among manufacturing due to high exposure of personal exposure level of *PM*_{2.5}. Meo et al., (2013) found that FENO was significantly increased with the increase of exposure dust level among cement mill workers.
- Patients with asthma have high levels of nitric oxide in their exhaled breath and high levels of inducible nitric oxide synthase (NOS₂) enzyme expression in the epithelial cells of their airways, suggesting a role for nitric oxide in asthma pathogenesis (Dweik et al., 2011).

Result and Discussion

Lung Function Status



Variables	OR (95% CI)	*OR (95% CI)
FVC%	2.686 (1.042-6.927)	2.870 (1.060-7.775)
FEV1%	7.817 (1.996-30.611)	7.159 (1.734-29.559)

- The cement workers is 2.6 times risk of getting restrictive diseases and 7.8 times risk of getting obstructive diseases.
- Cement dust irritates the respiratory epithelium that lead to reduce of ventilator capacity and increase prevalence of chronic respiratory symptoms (Al-Neimi et al., 2011).
- Smoking and tenure status may contribute to the prevalence of respiratory health problem (Bonnie et al., 2015). After adjusted for those factors, the results are not slightly different

Linear Regression, *Adjusted OR for Smoking and Tenure Status, Significant OR > 1 ,95% CI

Table 6: Correlation between cement respirable dust exposure level with lung function, IL-8 and FENO among cement workers and school staff

Variable	Cement workers (N=179)		School staff (N=173)	
	r	p-value	r	p-value
Lung Function				
• FVC%	-0.270	0.001*	-0.006	0.939
• FEV ₁ %	-0.272	0.001*	-0.008	0.920
• FEV ₁ /FVC%	-0.054	0.474	0.001	1.000
IL-8	0.508	0.001*	0.067	0.396
FENO	0.342	0.015*	0.227	0.113

Pearson Correlation, *Significant p < 0.05

- The increasing exposure to respirable cement dust significantly reduce FVC% (r=-0.270, p=0.001) and FEV₁% (r=-0.272, p=0.001).
- IL-8 was significantly strong relationship with the exposure of respirable cement dust (r=0.508, 0.001) while FENO is significantly moderate correlation to respirable cement dust (r= 0.342, p=0.015) among cement workers.

Conclusion

- Cement workers are highly risk of lung impairment by developing respiratory health symptoms, reducing lung function level, increasing high level of FENO and increase IL-8 concentration cause of their exposure to respirable cement dust.
- The higher magnitude of cement dust exposure may increase the risk of lung impairment.
- Cement particles contain variety of pollutants, eventually the direct impact on respiratory disease causes by specific-related pollutant was not assessed in this study. Particles contain in cements dust might be an absolute testament of the respiratory problem among workers.
- some of the factors also need to consider physical activities, types of diet, medicine and supplement also the level of awareness and knowledge

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