UNIVERSITI PUTRA MALAYSIA

PREVALENCE OF RESPIRATORY SYMPTOMS AMONG CEMENT WORKERS AT IPOH, PERAK, MALAYSIA

PERAKAS RAV A/L AANANANDHA RAV NAIDU

FPSK(m) 2022 18

PREVALENCE OF RESPIRATORY SYMPTOMS AMONG CEMENT WORKERS AT IPOH, PERAK, MALAYSIA

By

PERAKAS RAV A/L AANANANDHA RAV NAIDU

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

January 2022

DEDICATION

This thesis is dedicated to my beloved wife, parents and family.
Thank you for your understanding and support all throughout these years

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

PREVALENCE OF RESPIRATORY SYMPTOMS AMONG CEMENT WORKERS AT IPOH, PERAK, MALAYSIA

By

PERAKAS RAV A/L AANANANDHA RAV NAIDU

January 2022

Chairman : Karmegam Karuppiah, PhD
Faculty : Medicine and Health Sciences

The respiratory system is the cement industry's most weak organ. Air pollution, with a range of health consequences, known to cause major public health issues. Few studies have been carried out on acute effects of cement dust exposure on Occupational Health and Safety of the workers. The objective of this study is to determine the prevalence of occupational safety and health among cement workers using lung functions test in Ipoh, Perak. This study is conducted to investigate the associations between current "total" dust exposure and acute respiratory symptoms and lung function among cement factory workers. This study was conducted in a cement factory in Ipoh, Perak. A total of 104 workers involved in this study. This study design is cross-sectional study utilising the quantitative method and polling sampling method was utilised to sample the respondents based on the inclusion criteria in order to measure the particulate matter from different work stations (raw material, kiln and packing), respiratory symptoms data and lung function test. The data were obtained by a set of questionnaire adapted from the European Community Respiratory Health Survey II (EC-RHS II, 2014), spirometer and DustTrak. Kiln workstation recorded the highest distribution of lung function abnormalities. Meanwhile, the highest reading of dust measurements is in the packing (0.44 mg/m^3). This is due to the work process in this work station which generated high volume of dust. The correlation between the dust exposure and lung function, FVC and FEV1 showed significant relationship with the exposure of dust with value of ($r = -0.307$, p-value = 0.002) and ($r = -0.270$, p-value = 0.006) respectively. Most significant symptoms reported by the workers was coughing in the morning (p-value = 0.044). The comparison of lung function between all work station, FVC and FEV1 shows statistical differences among work station with the value of ($z = 9.568$, p-value = 0.008) and ($z = 7.769$, p-value = 0.021) respectively. Majority of the workers had respiratory symptoms of shortness of breath. The highest number of workers that exposed to the dust was workers from the kiln work station. To conclude, there is a prevalence of occupational safety and health among cement workers using lung functions test in Ipoh, Perak. This

study shows that respiratory problems are associated with exposure to cement dust. Exposure to high concentration of cement dust in the cement manufacturing facility is associated with the decrease in the lung function of the workers. The exposure of dust also found to be responsible for the increased prevalence of respiratory symptoms towards of the respondents. Personal monitoring using compact, battery-powered equipment allows for the assessment of an individual's exposure while they go about their everyday activities. Personal monitoring can significantly minimise misclassification of exposure and increase the ability to find associations between particle pollution and negative health consequences Also, cement dust exposure could be decreased by using wet or dry dust reduction engineering controls, enclosed cabs, and implementing a dust control program. Furthermore, this research can be used as a baseline for the core business. It is also critical for management to arrange with specialists such as Occupational Health Doctors (OHD) for a thorough medical examination and frequent lung function tests more frequently for their workers.

Keywords: Lung function, spirometry test, cement manufacturing, particulate matter.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

KELAZIMAN SIMPTOM PERNAFASAN DALAM KALANGAN PEKERJA SIMEN DI IPOH, PERAK, MALAYSIA

Oleh

PERAKAS RAV A/L AANANANDHA RAV NAIDU

Januari 2022

Pengerusi : Karmegam Karuppiah, PhD
Fakulti : Perubatan dan Sains Kesihatan

Tiada banyak kajian yang telah dijalankan terhadap kesan akut (genting) pendedahan habuk simen terhadap Kesihatan dan Keselamatan Pekerjaan pekerja. Objektif kajian ini adalah untuk menentukan kelaziman keselamatan dan kesihatan pekerjaan di kalangan pekerja simen menggunakan ujian fungsi paru-paru di Ipoh, Perak. Kajian ini dijalankan untuk menyiasat perkaitan antara pendedahan debu jumlah keseleruhan semasa dan gejala pernafasan akut dan fungsi paru-paru di kalangan pekerja kilang kuari.. Oleh itu, tujuan utama kajian ini dijalankan adalah untuk mengenalpasti kelaziman simptom-simptom respiratori dan fungsi paru-paru dalam kalangan pekerja kilang simen menggunakan ujian fungsi paru-paru. Kajian ini dijalankan di salah sebuah kilang simen di Ipoh, Perak. Seramai 104 pekerja yang telah terlibat dalam kajian ini. Reka bentuk kajian ini adalah kajian keratan rentas menggunakan kaedah kuantitatif dan kaedah persampelan undian digunakan untuk mengambil sampel responden berdasarkan kriteria kemasukan bagi mengukur zarah dari stesen kerja yang berbeza (bahan mentah, tanur dan pembungkusan), data gejala pernafasan. dan ujian fungsi paru-paru. Maklumat untuk kajian ini diperolah dengan menggunakan borang soal selidik yang diadaptasi dari Kaji Selidik Komuniti Kesihatan Respiratori Eropah (EC-RHS II, 2014), spirometer dan DustTrak. Stesen kerja Kiln merekodkan pengedaran tertinggi bagi fungsi paruparu yang tidak normal. Sementara itu, catatan pengukuran habuk paling tinggi adalah di stesen kerja Pembungkusan (0.44 mg/m3). Hal ini disebabkan oleh proses kerja di tempat tersebut menghasilkan habuk yang paling banyak. Kolerasi antara pendedahan habuk dan fungsi paru-paru, FVC dan FEV1 menunjukkan perhubungan yang penting terhadap pendedahan habuk dengan nilai (r = -0.307, nlai p = 0.002) dan (r = -0.270, nilai p = 0.006) masing-masing. Simptom-simptom penting yang dilaporkan oleh pekerja-pekerja adalah batuk pada waktu pagi (nilai p = 0.044). Pembandingan fungsi paru-paru antara semua stesen kerja, FVC dan FEV1 menunjukkan perbezaan statistik antara stesen kerja dengan nilai (z = 9.568,

nilai p = 0.008) dan (z = 7.769, nilai p = 0.021) masing-masing. Kebanyakkan pekerja mengalami simptom sesak nafas. Pekerja yang paling banyak terdedah dengan habuk adalah dari stesen kerja Kiln. Hasil pemerhatian mendapati pekerjapekerja tidak mengamalkan pemakaian alat pelindung diri yang betul di stesen kerja. Oleh itu, beberapa program pencegahan perlu dijalankan terhadap pekerja-pekerja untuk memupuk mereka terhadap kepentingan pemakaian alat pelindung diri. Pemantauan peribadi boleh meminimumkan salah klasifikasi pendedahan dengan ketara dan meningkatkan keupayaan untuk mencari perkaitan antara pencemaran zarah dan akibat kesihatan negatif Selain itu, pendedahan habuk simen boleh dikurangkan dengan menggunakan kawalan kejuruteraan pengurangan habuk basah atau kering, teksi tertutup dan melaksanakan program kawalan habuk.Tambahan pula, kajian ini juga boleh digunakan sebagai data asas bagi kilang simen tersebut. Juga, hal ini penting bagi pihak pengurusan untuk menyusun jadual untuk pemeriksaan fungsi paru-paru secara berkala oleh pakar seperti Doktor Kesihatan Pekerjaan.

Kata kunci: Fungsi paru-paru, ujian spirometer, kilang simen, zarah terampai.

ACKNOWLEDGEMENTS

Firstly, I would like to express my deepest gratitude to Associate Professor Dr. Karmegam Karuppiah, my research supervisor, for his patient guidance, willingness to give his time so generously and enthusiastic encouragement during this entire research work. I would also like to extend my thanks to my co-supervisor, Ts. Dr. Velu Perumal for his patient guidance throughout my study. My gratefulness and thanks are also extended to all members of this department for their great teamwork and cooperation in making this research project a success.

Finally, I wish to thank my wife and family for their support and encouragement throughout my study. Last but not least, to all who had directly and indirectly given their encouragement which was very needed in helping me during my pursuit of knowledge here in Universiti Putra Malaysia.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Karmegam Karuppiah, PhD
Associate Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

Velu Perumal, PhD
Senior Lecturer
Faculty of Design and Architecture
Universiti Putra Malaysia
(Member)

ZALILAH MOHD SHARIFF, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 9 June 2022

Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

Signature: _____
Name of Chairman
of Supervisory Committee: Assoc. Prof. Dr. Karmegam Karuppiah

Signature: _____
Name of Member
of Supervisory Committee: Ts. Dr. Velu Perumal

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

%	Percentage
ATS	American Thoracic Society
COPD	Chronic Obstructive Pulmonary Disorders
DOSH	Department of Occupational, Safety and Health
DOSM	Department of Statistics Malaysia
EC-RHS II	European Community Respiratory Health Survey II
EPA	Environmental Protection Agency
FEF	Forced Expiratory Flow
FEV	Forced Expiratory Volume
FEV1/FVC	Forced Expiratory Volume in One Second per Forced Vital Capacity
FVC	Forced Vital Capacity
HSE	Health, Safety and Environment
IQR	Interquartile Range
KPDNKK	Kementerian Perdangangan Dalam Negeri, Koperasi dan Kepenggunaan
LM	Loesche Mill
n	Frequency
OHD	Occupational Health Doctor
OSHA	Occupational Safety and Health Act
$PaCO_2$	Arterial carbon dioxide partial pressure
PaO_2	Arterial oxygen partial pressure
PEF	Peak Expiratory Flow
PIF	Peak Inspiratory Flow

PM	Particulate Matter
PM_{10}	PM_{10} is particulate matter with an aerodynamic diameter of 10 µm or less.
$PM_{2.5}$	$PM_{2.5}$ is particulate matter with an aerodynamic diameter of 2.5 µm or less.
PPE	Personal Protective Equipment
SOCSO	Social Security Organization
SPSS	Software Package used for Statistical Analysis.
SWP	Safe Work Practice.
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VRM	Vertical Raw Mill
WBCSD	World Business Council for Sustainable Development

CHAPTER 1

INTRODUCTION

1.1 Background

Malaysia is classified as a country with a middle income. Malaysia has changed in recent years from an agro-based economy to a manufacturing economy. Malaysia is one of ASEAN's fastest-growing economies. This rapid rate of growth is mainly attributed to the ability to exploit the country's very environmental resource base. As a result of a succession of environmental difficulties, Malaysia has shifted to environmental deterioration as a result of rapid urbanisation and the quest of a better quality of life. Harmful waste secretions, climate change, degradation of the soil and destruction of the ecosystem, to name a few, are the environmental disasters that the general public is used to. A large number of researchers from various scientific disciplines have long formulated these (Asmuni, Hussin, Khalili, & Zain, 2015; Latif et al., 2014)..

Atmospheric dust, especially in dry climates, is a major source of pollution. Mineral powder is a source of heavy metals, many of which are considered to be toxic (Gbadebo & Bankole, 2007). The industrial production of cement is a significant emitter of noise, gas and particulate matter in the industrial sector. (Farmer, 1993). Portland cement is the most widely used cement in civil buildings around the world, particularly as it is an important concrete ingredient. It is composed primarily of small percentages of oxides of calcium, silicon, aluminum, iron, magnesium, sulphates and other compounds. The mixture of minerals is sent through a rotating tube furnace set almost horizontally during the production process, a process called "fire." Different pollutants are emitted during this process, such as heavy metals, dioxins, particulates, iron, aluminum, silicon, copper, sulfur dioxide and nitrogen dioxide. (Drack & Vázquez, 2018; Dziri & Hosni, 2012; Tajudeen, Okpuzor, & Fausat, 2011). Pollution caused by particulate matter, particularly that generated from cement factories, is one of the greatest threats to the environment and human health. In many of the world's cement-producing countries, such activity is considered to pose a great risk to the environment as cement dust can adversely affect human development and growth. (Siqueira-Silva, Pereira, de Lemos-Filho, Modolo, & Paiva, 2017). There is plenty of cement dust, a by-product of stone grinding, cutting, sieving and crushing, and it can cause many environmental problems on-site and off-site (Lim et al., 2017).

1.2 Problem Statement

Air pollution has become an accepted occurrence for Ipoh residents as during the haze season during the non-rain (hot) weather periods in the middle of the

year will cause unhealthy levels of air quality in Ipoh every year. So far there has not been a full study carried out on Ipoh residents respiratory symptoms prevalence.

Cement is one of the world's most important construction materials (Zeleke, Moen, & Bråtveit, 2011). Malaysia is one of Southeast Asia's major cement users per capita. Demand patterns observed over the last 4-5 years were expected to improve in 2020 as a result of an infusion of government-backed projects.Throughout various processing and distribution processes, such as quarrying and handling of raw materials, cement mill employees are exposed to dust throughout clinker grinding, blending, packaging and shipment of finished products. (Meo, 2004). Calcium oxide (CaO) (62–66%), Silicon oxide (SiO_2) (19–22%), Aluminum trioxide (Al_2O_3) (4–8%), Ferric oxide (Fe_2O_3) (2–5%), Magnesium oxide (MgO) (1–2%), as well as Selenium, Thallium, and other impurities, are all found in cement. The aerodynamic diameter of cement particles range from 0.05 to 5.0 μm. Therefore, Portland cement is significant as a potential cause of occupational lung disease (Meo, 2004; Rafeemanesh, Alizadeh, Saleh, & Zakeri, 2015). The severity of pulmonary function impairment and respiratory illness has not always been linked to the amount of cement dust exposure. If available on the jobsite, cement workers could be protected by wearing suitable personal protection equipment on a regular basis (Jabale, 2015).

Industrial dust has been linked to an increase in morbidity, mortality, and the chance of developing respiratory disorders in people who are exposed to it, according to previous research (Bauleo et al., 2019; Sampatakakis et al., 2013). The number of cases of Occupational Lung Diseases reported to the Malaysian Department of Occupational, Safety and Health (DOSH) increased from 86 in 2015 to 96 in 2018. As a result, occupational dust exposure proved harmful to the workers. It was critical to consider the workers who were exposed to the dust, as this can have a negative impact on their health. In addition, Malaysia's cement sector is expanding, with 18 facilities now in operation.

The prevalence of respiratory diseases among Malaysian industrial employees was alarming. According to a report published by the Malaysian Social Security Organization in 2016, there were 451 occurrences of respiratory symptoms reported, with 325 cases involving male workers and 126 cases involving female workers (SOCSO, 2016). Because the number of cases of respiratory symptoms has increased in Malaysia over the last five years, it was necessary to conduct this research in order to evaluate the degree of lung function and respiratory symptoms among cement employees, who were the main groups who were exposed to the dust.

For diagnosing a variety of lung problems, as well as identifying a variety of non-pulmonary ailments, pulmonary function tests are extremely crucial (Dempsey & Scanlon, 2018). However, lung function tests among cement

industry workers in Malaysia have only been studied in a few cases. As a result, this research was carried out to assess the lung function of people who work in the cement industry. This research can be utilised as a guide for the cement industry in terms of overcoming or minimising pulmonary disease among employees.

1.3 Significance of the Study

Recently, many issues affecting the respiratory system of the human body have arisen and there have been many factors causing different conditions and severe breathing illnesses such as: epidemic, lung fibrosis, acute and chronic infections, and asthma. The cement dust affecting the pulmonary function by causing some of these diseases (Rabe et al., 2007). So, as a result of the problem of working in concrete plants, there are many problems and lack of awareness, where the effect of non-use of protective supplies has a negative impact on the respiratory health of workers in the plants and on the air quality in the region (Christopher et al., 2015). Very few follow-up studies have investigated the respiratory function of cement employees (R. H. Ibrahim & Ramadhan, 2022). Only a few research on occupational exposures and the worsening of lung function and respiratory symptoms among cement industry workers have been undertaken in Malaysia. This study is significant because it provided baseline data for assessing lung function among cement industry workers, as well as a benchmark for management to determine whether the control measures were acceptable.

This study explored the health effects of workers ' exposure to cement dust and advice for long hours of work and concern for the respiratory system. Because of the lack of data available and because of the limited availability of data on health effects in the respiratory tract which could lead cement workers to concrete and to cement dust exposure (Nurul, Bahri, & Ismail, 2014).

1.4 Objective of Study

The general objective of the study was to determine the prevalence of respiratory symptoms among cement workers using lung functions test in Ipoh, Perak.

1.4.1 Specific Objectives

i. To determine the socio-demographic of the cement workers.
ii. To determine the distribution of dust exposure according to workstation
iii. To determine the distribution of lung function abnormalities, respiratory symptoms and exposure to dust according to the workstation among workers from different workstations.

iv. To determine the relationship between occupational exposure to dust and lung function among workers from different workstations.
v. To determine the relationship between occupational exposure to dust and respiratory symptoms among workers from different workstations.
vi. To compare the differences of lung function and exposure to dust between workstation among workers from different workstations.

1.5 Research Questions

The researcher has developed the following research questions for his study, and dived them into six questions .

i. There is significant relationship between the distribution of lung function abnormalities with the work station among workers from different workstations.
ii. There is significant relationship between respiratory symptoms with the work station among workers from different workstations.
iii. There is significant relationship between the exposure to dust with the work station among workers from different workstations.
iv. There is significant relationship between occupational exposure to dust and lung function among workers from different workstations.
v. There is significant relationship between occupational exposure to dust and the respiratory symptoms among workers from different workstations.
vi. There is significant differences between lung function and exposure to dust between the work station among workers from different workstations.

1.6 Research Hypotheses

Following are the hypotheses for our study:

i. There is significant relationship between the distribution of lung function abnormalities with the work station among workers from different workstations.
ii. There is significant relationship between respiratory symptoms with the work station among workers from different workstations.
iii. There is significant relationship between the exposure to dust with the work station among workers from different workstations.
iv. There is significant relationship between occupational exposure to dust and lung function among workers from different workstations.
v. There is significant relationship between occupational exposure to dust and the respiratory symptoms among workers from different workstations.
vi. There is significant differences between lung function and exposure to dust between the work station among workers from different workstations.

1.7 Conceptual Framework

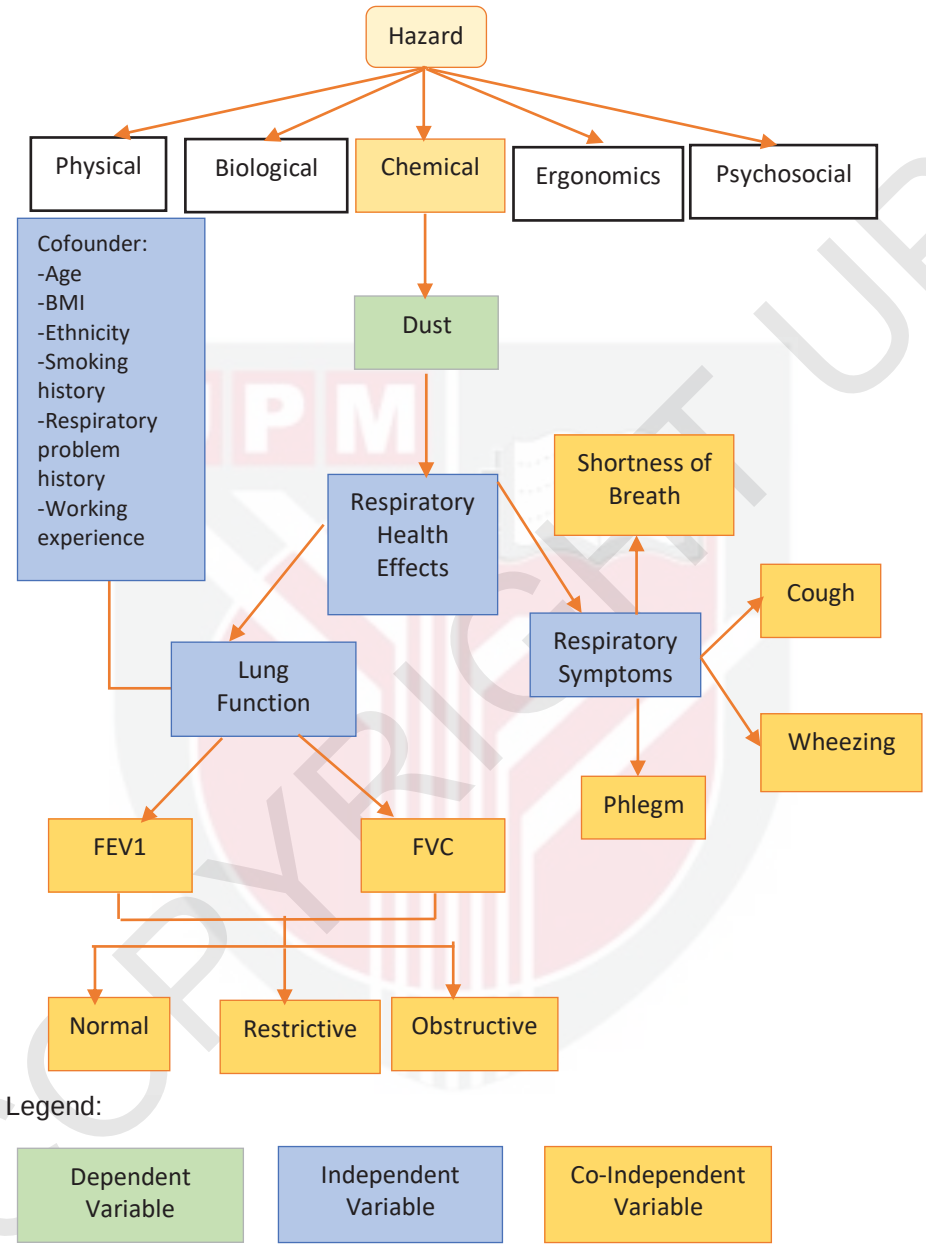

Figure 1.1: Conceptual Framework

This study was done to determine the prevalence of occupational safety and health among cement workers at Ipoh, Perak (Figure 1.1). A hazard is something which has the potential to cause injury or damage to people, the environment, or items, whether or not it can be seen, smelled, or touched..

There are five categories of common occupational hazards that can endanger humans, including physical hazards, chemical hazards, biological hazards, psychosocial hazards and ergonomics hazards. Nonetheless, the extent of these dangers is determined by the state of the workplace or work unit, the duration, the hazards' contact, and the hazards' concentration. Every hazard had its own set of impacts on human health. Chemical and physical hazards were the main hazards for cement industry workers, and there had been a lot of research done on it in the past. Dust was the most common hazard faced by cement workers. The implications of dust exposure on human health can be divided into two categories: pulmonary and respiratory health effects.

The impacts of respiratory health were the focus of this study. A lung function test was necessary to determine the effects, and abnormalities in lung function were measured using a spirometer. The respiratory symptoms were assessed using a questionnaire, and the association between them and various circumstances was investigated. In this study, workers exposed to high levels of dust in their work unit or workplace are more likely to develop respiratory symptoms, which can lead to occupational lung illness such as Chronic Obstructive Pulmonary Disease (COPD).

1.8 Justification

The justification of this study, were to:

1. Protect the health of workers in cement plants, especially respiratory systems, so that their lives are safe.
2. Reduce respiratory diseases for staff by advocating the potential use of protective devices in the future.
3. Increase awareness of the respiratory disease among workers and owners of concrete plants.

1.9 Definition of Important Terms

Lung Function Test

A method used to measure the performance of the lungs. It is possible to use a lung function test to diagnose a lung disease and see how well the medication treatment works. This tests how much air the lungs can carry and how easily air travels in and out of the lungs. It also tests how much oxygen is used during breathing and how much carbon dioxide is emitted. Also called PFT and pulmonary function test (Jabłonski, 2018).

Forced Vital Capacity (FVC)

FVC were the primary variables in spirometry. This is a lung size metric (in litres) that describes the volume of air in the lungs that can be exhaled after a deep inhalation. (Karimi-Shah & Chowdhury, 2015).

Forced Expiratory Volume (FEV)

FEV is the calculation of how much air can be exhaled in a second after a deep inhalation and FEV is the average amount of air exhaled in the first second of the FVC maneuver, often expressed in litres (Karimi-Shah & Chowdhury, 2015).

FEV1/ FVC ratio

This is the lung scale (FVC), which can be exhaled in a second. The FEV1 ratio would be 4/5 or 80 percent if the FVC is 5, for example. It ensures that 80% of the inhaled oxygen in the lungs can be inhaled within a second (Karimi-Shah & Chowdhury, 2015).

Restrictive Lung Disease

Small lung disease was an illness in which people could not fill their lungs entirely with oxygen. This was because the lung become restricted from expanding and there was stiffness in the lungs. But, there were some other factors such as stiffness of the wall, weak muscles or damaged nerves in the lung (Mason et al., 2010).

Respiratory Symptoms

Breathlessness, chest pain, wheezing, nausea and sputum development were the primary symptoms of respiratory disorders. Lungs can also cause non-respiratory symptoms such as lung malignancy paraneoplasty (S. Singh, 2016).

1.10 Chapter Summary

Malaysia has been listed as a middle-income economy. Malaysia has transitioned from an agricultural to a manufacturing economy in recent years. As a result of a range of environmental difficulties, Malaysia's rapid urbanisation and quest of a better quality of life has contributed to environmental degradation. Cement is one of the most essential building

materials on the planet. Throughout various processing and manufacturing processes, such as quarrying and handling of raw materials, cement mill employees are exposed to dust throughout clinker grinding, mixing, packaging and shipment of finished products. Through causing some of these diseases, the cement dust affects the pulmonary function. Thus, as a result of the problem of working in concrete plants, there are many problems and lack of awareness, where the impact of non-use of protective supplies has a negative impact on the respiratory health of workers in the plants and on the air quality in the area. This study explored the health effects on the respiratory system resulting in workers being subjected to dust, cement, and guidelines for long hours of contentious work. Because of the lack of available data and the submission of a study on the health effects in the respiratory tract that can trigger concrete to manufacturers and the limited availability of cement dust-related data. The general objective of the study was to determine the prevalence of respiratory symptoms and lung functions among cement workers using lung functions test in Ipoh, Perak.

REFERENCES

(NIOSH), N. I. f. O. S. a. H. (2018). *Reducing Hazardous Dust Exposure when Rock Drilling During Construction*. Retrieved from USA:

Abdul-Wahab, S. A. (2006). Impact of fugitive dust emissions from cement plants on nearby communities. *Ecological Modelling, 195*(3-4), 338-348.

Afroz, R., Hassan, M. N., & Ibrahim, N. A. (2003). Review of air pollution and health impacts in Malaysia. *Environmental research, 92*(2), 71-77.

Ahluwalia, V., & Malhotra, S. (2008). *Environmental science*: CRC Press.

Aïtcin, P.-C. (2016). Portland cement. In *Science and Technology of Concrete Admixtures* (pp. 27-51): Elsevier.

Al Johani Abdulrahman, A. (2016). *Knowledge, Awareness And Practice Of Needle Stick And Sharps Injuries Among Healthcare Service Providers In King Fahd Hospital Saudi Arabia.* (Master of Science (Occupational Safety and Health)). Universiti Putra Malaysia, Serdang, Selangor, Malaysia.

Ali, B., Ballal, S., Albar, A., & Ahmed, H. (1998). Post-shift changes in pulmonary function in a cement factory in eastern Saudi Arabia. *Occupational medicine, 48*(8), 519-522.

American Thoracic Society, A. (2017). American Thoracic Society International Conference Abstracts. In: A6275. American Thoracic Society.

Anand, S. (2012). *The prevalence of respiratory morbidity and the risk factors associated, among the workers of cement industry in South India: A cross sectional study.* SCTIMST,

Asmuni, S., Hussin, N. B., Khalili, J. M., & Zain, Z. M. (2015). Public participation and effectiveness of the no plastic bag day program in Malaysia. *Procedia-Social and Behavioral Sciences, 168*, 328-340.

Atkinson, R. W., Bremner, S. A., Anderson, H. R., Strachan, D. P., Bland, J. M., & Ponce de Leon, A. (1999). Short-term associations between emergency hospital admissions for respiratory and cardiovascular disease and outdoor air pollution in London. *Archives of Environmental Health: An International Journal, 54*(6), 398-411.

Awang, M. B., Jaafar, A. B., Abdullah, A. M., Ismail, M. B., Hassan, M. N., Abdullah, R., . . . Noor, H. (2000). Air quality in Malaysia: impacts, management issues and future challenges. *Respirology, 5*(2), 183-196.

Awodele, O., Popoola, T. D., Ogbudu, B. S., Akinyede, A., Coker, H. A., & Akintonwa, A. (2014). Occupational hazards and safety measures amongst the paint factory workers in Lagos, Nigeria. *Safety and health at work, 5*(2), 106-111.

Azmi, S. Z., Latif, M. T., Ismail, A. S., Juneng, L., & Jemain, A. A. (2010). Trend and status of air quality at three different monitoring stations in the Klang Valley, Malaysia. *Air Quality, Atmosphere & Health, 3*(1), 53-64.

Bakhtyar, B., Kacemi, T., & Nawaz, M. A. (2017). A review on carbon emissions in Malaysian cement industry. *International Journal of Energy Economics and Policy, 7*(3), 282-286.

Banerjee, A., Chaudhury, S., Singh, D., Banerjee, I., Mahato, A., & Haldar, S. (2007). Statistics without tears-inputs for sample size calculations. *Indian Psychiatr Jr, 16*, 150-152.

Bauleo, L., Bucci, S., Antonucci, C., Sozzi, R., Davoli, M., Forastiere, F., & Ancona, C. (2019). Long-term exposure to air pollutants from multiple sources and mortality in an industrial area: a cohort study. *Occup Environ Med, 76*(1), 48-57.

Boon, M., Ruijgrok, J., & Vardaxis, M. (1995). Collagen implants remain supple not allowing fibroblast ingrowth. *Biomaterials, 16*(14), 1089-1093.

Brauer, M., Amann, M., Burnett, R. T., Cohen, A., Dentener, F., Ezzati, M., . . . Van Dingenen, R. (2012). Exposure assessment for estimation of the global burden of disease attributable to outdoor air pollution. *Environmental science & technology, 46*(2), 652-660.

Caglar, I., Ates, S., Boztoprak, Y., Aslan, Y., & Duymus, Z. Y. (2018). Effect of Sandblasting, Silica Coating, and Erbium: Yttrium-Aluminum-Garnet Laser Treatment on the Shear Bond Strength of Self-adhesive Resin Cement to Alumina Ceramics. *Nigerian journal of clinical practice, 21*(8), 1000-1007.

Casadei, K., & Kiel, J. (2019). Anthropometric Measurement. In *StatPearls [Internet]*: StatPearls Publishing.

Chang, C.-C., Kuo, C.-C., Liou, S.-H., & Yang, C.-Y. (2013). Fine particulate air pollution and hospital admissions for myocardial infarction in a subtropical city: Taipei, Taiwan. *Journal of Toxicology and Environmental Health, Part A, 76*(7), 440-448.

Chen, C., Habert, G., Bouzidi, Y., & Jullien, A. (2010). Environmental impact of cement production: detail of the different processes and cement plant variability evaluation. *Journal of Cleaner Production, 18*(5), 478-485.

Christopher, L., Kosai, N., Reynu, R., Levin, K., Taher, M., Sutton, P., . . . Das, S. (2015). Effect of exercise on pulmonary function tests in obese Malaysian patients. *Clin Ter, 166*(3), 105-109.

Chung, J. Y., Kowal-Vern, A., Latenser, B. A., & Lewis, R. W. (2007). Cement-related injuries: review of a series, the National Burn Repository, and the prevailing literature. *Journal of Burn Care & Research, 28*(6), 827-834.

Colls, J. J., & Micallef, A. (1997). Towards better human exposure estimates for setting of air quality standards. *Atmospheric Environment, 31*(24), 4253-4254.

Çöplü, L., Demir, A. U., Kalyoncu, A. F., Çöplü, N., Selçuk, Z. T., Enünlü, T., . . . Barış, Y. İ. (2005). Lung health in workers exposed to reed dust. *Respiratory medicine, 99*(4), 421-428.

Coppeta, L., Pietroiusti, A., Magrini, A., Somma, G., & Bergamaschi, A. (2008). Prevalence and characteristics of functional dyspepsia among workers exposed to cement dust.

Cox, S., James, B., Walker, D., Wenham, D., & Hunting, G. (1995). Tolley's Office Health & Safety Handbook. In: Hyperion Books.

Cunningham, W. P., Cunningham, M. A., & Saigo, B. W. (2010). *Environmental science: A global concern* (Vol. 412): McGraw-Hill Boston, MA.

Das, P., & Jha, N. (2009). Occupational exposure and pulmonary function of jute mill workers in Sunsari, Nepal. *Age (yrs), 29*(8.57), 28.43.

Delfino, R. J., Staimer, N., Gillen, D., Tjoa, T., Sioutas, C., Fung, K., . . . Kleinman, M. T. (2006). Personal and ambient air pollution is associated with increased exhaled nitric oxide in children with asthma. *Environmental health perspectives, 114*(11), 1736-1743.

Demirbağ, B. C., Bayrak, B., Özkan, Ç. G., & Çaylak, E. (2017). Evaluation of the Life Quality of Workers in a Cement Factory. *Procedia-Social and Behavioral Sciences, 237*, 1462-1467.

Dempsey, T. M., & Scanlon, P. D. (2018). *Pulmonary function tests for the generalist: A brief review.* Paper presented at the Mayo Clinic proceedings.

Department of Statistics, M. (2018). MALAYSIA, MONTHLY MANUFACTURING STATISTICS. In: Chicago.

Devi, K. S., Lakshmi, V. V., & Alakanandana, A. (2017). Impacts of cement industry on environment-an overview. *Asia Pac. J. Res, 1*, 156-161.

Drack, J. M. E., & Vázquez, D. P. (2018). Morphological response of a cactus to cement dust pollution. *Ecotoxicology and environmental safety, 148*, 571-577.

Dziri, S., & Hosni, K. (2012). Effects of cement dust on volatile oil constituents and antioxidative metabolism of Aleppo pine (Pinus halepensis) needles. *Acta physiologiae plantarum, 34*(5), 1669-1678.

Enger, E. D., & Smith, B. F. (2013). Environmental Science, A study of Interrelationships.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics, 5*(1), 1-4.

Ezejiofor, T., & Mba, I. (2003). Serum Bicarbonale Levels In Cement Factory Workers: A Predictor For Occupational Lung Disease. *Journal of Medical Investigation and Practice, 4*(1), 15-18.

Farmer, A. M. (1993). The effects of dust on vegetation—a review. *Environmental pollution, 79*(1), 63-75.

Fell, A. K. M. (2011). *Lung function, inflammatory markers, and occupational exposure in cement production workers.* (Masters). University of Oslo, Oslo, Norway.

Fell, A. K. M., & Nordby, K. C. (2017). Association between exposure in the cement production industry and non-malignant respiratory effects: a systematic review. *BMJ open, 7*(4), e012381.

Flick, U. (2015). *Introducing research methodology: A beginner's guide to doing a research project*: Sage.

Gbadebo, A., & Bankole, O. (2007). Analysis of potentially toxic metals in airborne cement dust around Sagamu, Southwestern Nigeria. *J Appl Sci, 7*(1), 35-40.

Gizaw, Z., Yifred, B., & Tadesse, T. (2016). Chronic respiratory symptoms and associated factors among cement factory workers in Dejen town, Amhara regional state, Ethiopia, 2015. *Multidisciplinary respiratory medicine, 11*(1), 13.

Gold, W. M., & Koth, L. L. (2016). Pulmonary function testing. In *Murray and Nadel's Textbook of Respiratory Medicine* (pp. 407-435. e418): Elsevier.

Gupta, R., Majumdar, D., Trivedi, J., & Bhanarkar, A. (2012). Particulate matter and elemental emissions from a cement kiln. *Fuel processing technology, 104*, 343-351.

Gurjar, B., Butler, T. M., Lawrence, M. G., & Lelieveld, J. (2008). Evaluation of emissions and air quality in megacities. *Atmospheric Environment, 42*(7), 1593-1606.

Hayhurst, E. R. (1920). Health Hazards of Non-poisonous Dusts—A Résumé of Some Recent Investigations. *American Journal of Public Health, 10*(1), 60-65.

Hime, W. G., & Marusin, S. L. (2001). A discussion of the paper"Chemical changes in concrete due to the ingress of chemical species"by PW Brown and April Doerr. *Cement and Concrete Research, 1*(31), 157.

Hoffmann, B., Moebus, S., Dragano, N., Stang, A., Möhlenkamp, S., Schmermund, A., . . . Erbel, R. (2009). Chronic residential exposure to particulate matter air pollution and systemic inflammatory markers. *Environmental health perspectives, 117*(8), 1302-1308.

Hofman, A., Brusselle, G. G., Murad, S. D., van Duijn, C. M., Franco, O. H., Goedegebure, A., . . . Peeters, R. P. (2015). The Rotterdam Study: 2016 objectives and design update. *European journal of epidemiology, 30*(8), 661-708.

Huang, C. Y. Y. C. C., Chiu, H. F. C. J. F., & Ko, S. J. L. Y. C. (1996). Effects of occupational dust exposure on the respiratory health of Portland cement workers. *Journal of Toxicology and Environmental Health Part A, 49*(6), 581-588.

Humblet, M., Zarka-Martres, M., Trebilcock, A., Gernigon, B., Odero, A., Guido, H., . . . Horii, Y. (2001). International labour standards.

Huntzinger, D. N., & Eatmon, T. D. (2009). A life-cycle assessment of Portland cement manufacturing: comparing the traditional process with

alternative technologies. *Journal of Cleaner Production, 17*(7), 668-675.

Ibrahim, M. H., Hadi, A. S., & Ariffin, K. (2011). Menyingkap perkembangan perbandaran Ipoh menjadi sebuah bandaraya. *Sari-International Journal Of The Malay World And Civilisation*.

Ibrahim, R. H., & Ramadhan, A. F. (2022). The Health of Workers in Cement Factory: Evaluation of Lung Function. *Malaysian Journal of Medicine and Health Sciences 18*, 195-199. Retrieved from https://medic.upm.edu.my/upload/dokumen/2022011912032626_MJMHS_0154.pdf

Ishii, S., Bell, J., & Marshall, F. (2007). Phytotoxic risk assessment of ambient air pollution on agricultural crops in Selangor State, Malaysia. *Environmental pollution, 150*(2), 267-279.

Jabłonski, I. (2018). Nonstandardized Lung Function Tests. *Lung Function Testing in the 21st Century: Methodologies and Tools Bridging Engineering to Clinical Practice*, 49.

Jamal, H., Pillay, M., Zailina, H., Shamsul, B., Sinha, K., Zaman Huri, Z., . . . Rahimah, A. (2004). A study of health impact & risk assessment of urban air pollution in Klang Valley. *UKM Pakarunding Sdn Bhd, Malaysia, Kuala Lumpur*.

Juneng, L., Latif, M. T., Tangang, F. T., & Mansor, H. (2009). Spatio-temporal characteristics of PM10 concentration across Malaysia. *Atmospheric Environment, 43*(30), 4584-4594.

Kampa, M., & Castanas, E. (2008). Human health effects of air pollution. *Environmental pollution, 151*(2), 362-367.

Karimi-Shah, B. A., & Chowdhury, B. A. (2015). Forced vital capacity in idiopathic pulmonary fibrosis—FDA review of pirfenidone and nintedanib. *New England Journal of Medicine, 372*(13), 1189-1191.

Kayhan, S., Tutar, U., Cinarka, H., Gumus, A., & Koksal, N. (2013). Prevalence of occupational asthma and respiratory symptoms in foundry workers. *Pulmonary medicine, 2013*.

Kumar, S., & Phrommathed, P. (2005). *Research methodology*: Springer.

Kuschner, W. G., Chitkara, R. K., & Sarinas, P. (1998). Occupational asthma. Practical points for diagnosis and management. *Western journal of medicine, 169*(6), 342.

Langan, R. C., & Goodbred, A. J. (2020). Office spirometry: indications and interpretation. *American family physician, 101*(6), 362-368.

Latif, M. T., Azmi, S. Z., Noor, A. D. M., Ismail, A. S., Johny, Z., Idrus, S., . . . Mokhtar, M. B. (2011). The impact of urban growth on regional air quality surrounding the Langat River Basin, Malaysia. *The Environmentalist, 31*(3), 315.

Latif, M. T., Dominick, D., Ahamad, F., Khan, M. F., Juneng, L., Hamzah, F. M., & Nadzir, M. S. M. (2014). Long term assessment of air quality from a

background station on the Malaysian Peninsula. *Science of the total environment, 482*, 336-348.

Lim, S. K., Tan, C. S., Li, B., Ling, T.-C., Hossain, M. U., & Poon, C. S. (2017). Utilizing high volumes quarry wastes in the production of lightweight foamed concrete. *Construction and Building Materials, 151*, 441-448.

Mabahwi, N. A., Leh, O. L. H., & Omar, D. (2015). Urban air quality and human health effects in Selangor, Malaysia. *Procedia-Social and Behavioral Sciences, 170*, 282-291.

Machovcova, A. (2010). Caustic ulcers caused by cement aqua: report of a case. *Industrial health, 48*(2), 215-216.

Mackey, A., & Gass, S. M. (2015). *Second language research: Methodology and design*: Routledge.

Mackie, A., Boilard, S., Walsh, M., & Lake, C. (2010). Physicochemical characterization of cement kiln dust for potential reuse in acidic wastewater treatment. *Journal of hazardous materials, 173*(1-3), 283-291.

Manin, B. (2004). *The Principles of Representative Government*: Cambridge University Press.

Manjula, R., Praveena, R., Clevin, R. R., Ghattargi, C., Dorle, A., & Lalitha, D. (2013). Effects of occupational dust exposure on the health status of portland cement factory workers. *International Journal of Medicine and Public Health, 3*(3).

Mariammal, T., Jaisheeba, A. A., & Sornaraj, R. (2012). Work related respiratory symptoms and pulmonary function tests observed among construction and sanitary workers of Thoothukudi. *Int J Pharm Tech Res, 4*(3), 1266-1273.

Marquez, L. O., & Smith, N. C. (1999). A framework for linking urban form and air quality. *Environmental Modelling & Software, 14*(6), 541-548.

Mason, D. P., Thuita, L., Nowicki, E. R., Murthy, S. C., Pettersson, G. B., & Blackstone, E. H. (2010). Should lung transplantation be performed for patients on mechanical respiratory support? The US experience. *The Journal of thoracic and cardiovascular surgery, 139*(3), 765-773. e761.

Masron, T., Yaakub, U., & Masami, F. (2001). Population Growth and Urbanisation in Peninsular Malaysia from 1911 to 2000.

Mavroulidou, M., Hughes, S. J., & Hellawell, E. E. (2004). A qualitative tool combining an interaction matrix and a GIS to map vulnerability to traffic induced air pollution. *Journal of Environmental Management, 70*(4), 283-289.

McClellan, R. O. (2002). Setting ambient air quality standards for particulate matter. *Toxicology, 181*, 329-347.

Mei, N. S., Wai, C. W., & Ahamad, R. (2016). Environmental awareness and behaviour index for Malaysia. *Procedia-Social and Behavioral Sciences, 222*, 668-675.

Meo, S. A. (2004). Health hazards of cement dust. *Saudi Med J, 25*(9), 1153-1159.

Meo, S. A., Azeem, M. A., Qureshi, A. A., Ghori, G. M., Al-Drees, A. M., & Feisal Subhan, M. M. (2006). Dose response effect of cement dust on respiratory muscles competence in cement mill workers. *International journal of environmental health research, 16*(6), 439-447.

Merenu, I., Mojiminiyi, F., Njoku, C., & Ibrahim, M. (2007). The effect of chronic cement dust exposure on lung function of cement factory workers in Sokoto, Nigeria. *African journal of biomedical research, 10*(2).

Meyers, L. S., Gamst, G., & Guarino, A. J. (2016). *Applied multivariate research: Design and interpretation*: Sage publications.

Mijakoski, D., Minov, J., Karadzinska-Bislimovska, J., Vasilevska, K., Risteska-Kuc, S., & Stoleski, S. (2011). Exercise-induced bronchoconstriction and exercise-induced respiratory symptoms in nurses. *Journal of allergy, 2011*.

Miller, G. A., & Azad, S. (2000). Influence of soil type on stabilization with cement kiln dust. *Construction and Building Materials, 14*(2), 89-97.

Mirzaee, R., Kebriaei, A., Hashemi, S., Sadeghi, M., & Shahrakipour, M. (2008). Effects of exposure to Portland cement dust on lung function in Portland cement factory workers in Khash, Iran. *Journal of Environmental Health Science & Engineering, 5*(3), 201-206.

Mohamed, H. A.-k. (2017). Occupational hazards and their relation with health problems among construction building workers at El Sherouk City. *American Journal of Nursing Research, 5*(3), 96-103.

Mohammad, N., & Hussain, R. (2013). ASSESSMENT OF PARTICULATE MATTER (PM 10 & PM 2.5) AND ASSOCIATED HEALTH PROBLEMS IN DIFFERENT AREAS OF CEMENT INDUSTRY, HATTAR, HARIPUR.

Moore, V. (2012). Spirometry: step by step. *Breathe, 8*(3), 232-240.

MUHAMMAD, M. B., AZIZ, R. A., & CHIN, Y. W. (2021). THE EFFECTS OF AIR POLLUTANTS FROM THE CEMENT INDUSTRY ON THE HEALTH OF THE KALAMBAINA COMMUNITY, SOKOTO, NIGERIA. *Journal of Sustainability Science and Management, 16*(4), 220-235.

Musa, R., Naing, L., Ahmad, Z., & Nordin, R. (2002). Respiratory symptoms and pulmonary function among male quarry workers in Kelantan, Malaysia. *Malaysian Journal of Public Health Medicine, 2*(1).

Mwaiselage, J., Bråtveit, M., Moen, B., & Yost, M. (2005). Variability in dust exposure in a cement factory in Tanzania. *Annals of occupational hygiene, 49*(6), 511-519.

Mwaiselage, J., Moen, B., & Bråtveit, M. (2006). Acute respiratory health effects among cement factory workers in Tanzania: an evaluation of a simple health surveillance tool. *International archives of occupational and environmental health, 79*(1), 49-56.

Mwiya, S. (2004). An Overview of Semi-Quantitative, Qualitative and Knowledge-Based System Methodologies Relevant to Solid Waste Disposal Site Design in Arid and Semiarid Environments. *Communications of the Geological Survey of Namibia, 13*(1), 1-8.

Naidu, D. (1999). *Contract labour in South Asia*: Bureau for Workers Activities, International Labour Office.

Nurul, A., Bahri, M. S., & Ismail, N. H. (2014). Respiratory symptoms and pulmonary function among male steel workers in Terengganu, Malaysia. *Malaysian Journal of Public Health Medicine, 14*(1), 10-18.

Oanh, N. K., Upadhyay, N., Zhuang, Y.-H., Hao, Z.-P., Murthy, D., Lestari, P., . . . Dung, N. (2006). Particulate air pollution in six Asian cities: Spatial and temporal distributions, and associated sources. *Atmospheric Environment, 40*(18), 3367-3380.

OSHA, O. S. a. H. A. U. S. (2011). *Occupational Safety and Health Guidelines for Chemical Hazards*: US Department of Health and Human Services, Public Health Service, Centers ….

Ostad-Ahmad-Ghorabi, M. J., & Attari, M. (2013). Advancing environmental evaluation in cement industry in Iran. *Journal of Cleaner Production, 41*, 23-30.

Özden, Ö., Döğeroğlu, T., & Kara, S. (2008). Assessment of ambient air quality in Eskişehir, Turkey. *Environment International, 34*(5), 678-687.

Peters, S., Thomassen, Y., Fechter-Rink, E., & Kromhout, H. (2009). Personal exposure to inhalable cement dust among construction workers. *Journal of Environmental Monitoring, 11*(1), 174-180.

Pramchoo, W., Geater, A. F., Jamulitrat, S., Geater, S. L., & Tangtrakulwanich, B. (2017). Occupational Tasks Influencing Lung Function and Respiratory Symptoms Among Charcoal-Production Workers: A Time-Series Study. *Safety and health at work, 8*(3), 250-257.

Rabe, K. F., Hurd, S., Anzueto, A., Barnes, P. J., Buist, S. A., Calverley, P., . . . Van Weel, C. (2007). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. *American journal of respiratory and critical care medicine, 176*(6), 532-555.

Rafeemanesh, E., Alizadeh, A., Saleh, L. A., & Zakeri, H. (2015). A study on respiratory problems and pulmonary function indexes among cement industry workers in Mashhad, Iran. *Medycyna pracy, 66*(4), 471-477.

Rampuri, S. (2017). Study and analysis of occupational & health diseases in cement industries. *Int J Adv Res Dev, 2*(3), 1-7.

Robards, J., Evandrou, M., Falkingham, J., & Vlachantoni, A. (2012). Marital status, health and mortality. *Maturitas, 73*(4), 295-299.

Robinson, R. S. (2014). Purposive sampling. *Encyclopedia of Quality of Life and Well-Being Research*, 5243-5245.

Rovira, E., Cuadras, A., Aguilar, X., Esteban, L., Borràs-Santos, A., Zock, J.-P., & Sunyer, J. (2014). Asthma, respiratory symptoms and lung function in children living near a petrochemical site. *Environmental research, 133*, 156-163.

Saji, K., Zubair, M., Nair, S. B., & Varghese, P. (2018). An epidemiological study on effect of occupational exposure of cement. *International Journal Of Community Medicine And Public Health, 5*(12), 5105-5109.

Sampatakakis, S., Linos, A., Papadimitriou, E., Petralias, A., Dalma, A., Papasaranti, E., . . . Stoltidis, M. (2013). Respiratory disease related mortality and morbidity on an island of Greece exposed to perlite and bentonite mining dust. *International journal of environmental research and public health, 10*(10), 4982-4995.

Sana, S., Bhat, G., & Balkhi, H. M. (2013). Health risks associated with workers in cement factories. *Int J Scientific and Res Publications, 3*(1), 2250-3153.

Scanlon, P. D., Festic, E., Bansal, V., & Gupta, E. (2016). Association of inhaled corticosteroids with incident pneumonia and mortality in COPD patients; systematic review and meta-analysis. *COPD: Journal of Chronic Obstructive Pulmonary Disease, 13*(3), 312-326.

Schumacher, K. (1999). India's cement industry: productivity, energy efficiency and carbon emissions.

Schwartz, J. (1996). Air pollution and hospital admissions for respiratory disease. *Epidemiology*, 20-28.

Secretariat, A.-P. C. S. (2013). Ipoh City Overview. Retrieved from http://apcs.city.fukuoka.lg.jp/en/city/malaysia/ipoh/

Sentian, J., Herman, F., Yih, C. Y., & Wui, J. C. H. (2019). Long-term air pollution trend analysis in Malaysia. *International Journal of Environmental Impacts, 2*(4), 309-324.

Setia, M. S. (2016). Methodology series module 3: Cross-sectional studies. *Indian journal of dermatology, 61*(3), 261.

Shah, A. S., Langrish, J. P., Nair, H., McAllister, D. A., Hunter, A. L., Donaldson, K., . . . Mills, N. L. (2013). Global association of air pollution and heart failure: a systematic review and meta-analysis. *The Lancet, 382*(9897), 1039-1048.

Shahadin, M. S., Mutalib, N. S. A., Latif, M. T., Greene, C. M., & Hassan, T. (2018). Challenges and future direction of molecular research in air pollution-related lung cancers. *Lung Cancer, 118*, 69-75.

Shao, Y., Lefort, T., Moras, S., & Rodriguez, D. (2000). Studies on concrete containing ground waste glass. *Cement and Concrete Research, 30*(1), 91-100.

Shaw, S. R., Gomes, P., Polotskaia, A., & Jankowska, A. M. (2015). The relationship between student health and academic performance: Implications for school psychologists. *School Psychology International, 36*(2), 115-134.

Silverman, D. (2016). *Qualitative research*: Sage.

Singh, S. (2016). Respiratory symptoms and signs. *Medicine, 44*(4), 205-212.

Singh, V., & Pandey, D. (2011). Human Health Risk due to Cement Dust Exposure. Policy-Brief, Climate Change and CDM Cell. *Rajasthan State Pollution Control Board, Jaipur, India*.

Siqueira-Silva, A. I., Pereira, E. G., de Lemos-Filho, J. P., Modolo, L. V., & Paiva, E. A. S. (2017). Physiological traits and antioxidant metabolism of leaves of tropical woody species challenged with cement dust. *Ecotoxicology and environmental safety, 144*, 307-314.

Skevington, S. M., Lotfy, M., & O'Connell, K. (2004). The World Health Organization's WHOQOL-BREF quality of life assessment: psychometric properties and results of the international field trial. A report from the WHOQOL group. *Quality of Life Research, 13*(2), 299-310.

Society, A. T. (2003). Occupational contribution to the burden of airway disease [American Thoracic Society statement]. *Am J Respir Crit Care Med, 167*, 787-797.

Subbarao, P., Mandhane, P. J., & Sears, M. R. (2009). Asthma: epidemiology, etiology and risk factors. *Cmaj, 181*(9), E181-E190.

Suen, L.-J. W., Huang, H.-M., & Lee, H.-H. (2014). A comparison of convenience sampling and purposive sampling. *Hu Li Za Zhi, 61*(3), 105.

Szram, J., & Cullinan, P. (2012). *Occupational asthma.* Paper presented at the Seminars in respiratory and critical care medicine.

Tajudeen, Y., Okpuzor, J., & Fausat, A. T. (2011). Investigation of general effects of cement dust to clear the controversy surrounding its toxicity. *Asian J Sci Res, 4*(4), 315-325.

Tajudin, M. A. B. A., Khan, M. F., Mahiyuddin, W. R. W., Hod, R., Latif, M. T., Hamid, A. H., . . . Sahani, M. (2019). Risk of concentrations of major air pollutants on the prevalence of cardiovascular and respiratory diseases in urbanized area of Kuala Lumpur, Malaysia. *Ecotoxicology and environmental safety, 171*, 290-300.

Tan, P. K., Mohd Suradi, N. R., & Saludin, M. N. (2013). *The impact of complaint management and service quality on organizational image: A case study at the Malaysian public university library.* Paper presented at the AIP Conference Proceedings.

Taylor, S. J., Bogdan, R., & DeVault, M. (2015). *Introduction to qualitative research methods: A guidebook and resource*: John Wiley & Sons.

Tucker, G. E. (1915). Physical Examination of Employees Engaged in the Manufacture of Portland Cement. *American Journal of Public Health, 5*(6), 560-571.

Ulvestad, B., Bakke, B., Eduard, W., Kongerud, J., & Lund, M. (2001). Cumulative exposure to dust causes accelerated decline in lung

function in tunnel workers. *Occupational and Environmental Medicine, 58*(10), 663-669.

Wells, J., & Programme, I. L. O. S. A. (2001). *The construction industry in the twenty-first century: its image, employment prospects and skill requirements: report for discussion at the Tripartite Meeting on the Construction Industry in the Twenty-first Century: Its Image, Employment Prospects and Skill Requirements, Geneva, 2001*: International Labour Office, Geneva, Switzerland.

WHO, W. H. O. (1999). *Hazard prevention and control in the work environment:: airborne dust*. Retrieved from

WHO, W. H. O. (2005). *Regional Strategy on occupational health safety in sear countries*. Retrieved from

WHO, W. H. O. (2006). *WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide: global update 2005: summary of risk assessment*. Retrieved from

WHO, W. H. O. (2009). *Global health risks: mortality and burden of disease attributable to selected major risks*: Geneva: World Health Organization.

WHO, W. H. O. (2016). WHO Global Strategy on Occupational Health for All. The Way to Health at Work. Geneva: WHO; 1995. In.

WHO, W. H. O., & IPCSMC, I.-O. P. f. t. S. M. o. C. (2004). *IPCS risk assessment terminology* (Vol. 1): World Health Organization.

Wilson, J. G., Kingham, S., & Sturman, A. P. (2006). Intraurban variations of PM10 air pollution in Christchurch, New Zealand: implications for epidemiological studies. *Science of the total environment, 367*(2-3), 559-572.

Zeleke, Z. K., Moen, B. E., & Bråtveit, M. (2011). Lung function reduction and chronic respiratory symptoms among workers in the cement industry: a follow up study. *BMC pulmonary medicine, 11*(1), 50.

Zhu, Q. (2011). *CO2 abatement in the cement industry*: IEA Clean Coal Centre.