INSIGHT INTO THE OCCUPATIONAL HEALTH AMONG THE INDUSTRIAL OPERATORS: A PHYSIOLOGICAL AND PSYCHOLOGICAL APPROACH

by

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A dissertation submitted in partial fulfilment of
the requirements for the
Degree of Bachelor of Health Sciences (Hons)
(Environmental and Occupational Health)

JUNE 2014

CERTIFICATE

This is to certify that the dissertation entitled 'Insight Into The Occupational Health Among The Industrial Operators: A Physiological And Psychological Approach' is the bonafide record of research work done by Ho Xiaojun, Matric Number 109507 during the period of July 2013 to June 2014 under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfilment for the degree of Bachelor of Health Sciences (Hons) (Environmental and Occupational Health). Research work and collection of data belong to the Universiti Sains Malaysia.

APPROVAL

This is to certify that I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation submitted in partial fulfilment for the degree of Bachelor of Health Sciences (Hons) (Environmental and Occupational Health).

DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions.

ACKNOWLEDGEMENT

I wish to dedicate my deepest gratitude to my supervisor and co. supervisor. Dr Foo Keng Yuen and Dr Lee Lai Kuan for all their supervision. assistance. patience. and constant believe in me to complete this project.

I also like to express my highest appreciation to all the organizations involved, who so willingly allowed me to access to their company. information and their workers.

Special thanks to all the participants in the study. This research would not have been possible without your participation.

Finally. greatest acknowledgement goes to my parents. family. and friends who gave me unconditional support throughout this journey.

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LIST OF ABBREVIATIONS

ACGIH	American Conference of Government Industrial Hygienists
AD	Anno Domini
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BC	Before Century
BMI	Body mass index
BP	Blood pressure
CMD	Common mental disorder
CVD	Cardiovascular disease
DASS	Depression, Anxiety, Stress Scales
DOSH	Department of Occupational Safety and Health
ESSA	Employees' Social Security Act 1969
GHQ	General Health Questionnaire
HI	Heat Index
ICOH	International Commission on Occupational Health
ILO	International Labour Organization
LOS	Length of service
MOHR	Ministry of Human Resources
MSD	Musculoskeletal disorders
NAQ-R	Negative Acts Questionnaire-Revised
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Act 1994
PMV	Predicted mean vote
PPD	Predicted Percentage Dissatisfied
PSI	Physiological strain index
PWIQ	Physical Workload Index Questionnaire
QoL	Quality of life
REBA	Rapid Entire Body Assessment
SOCSO	Social Security Organization
WBGT	Wet-bulb globe temperature
WHO	World Health Organization
WHOQoL-BREF	World Health Organization Ouality of Life Questionnaire Brief Version
WHQOOL	World Health Organization Ouality of Life Questionnaire

LIST OF SYMBOLS

%	Percent
$<$	Less than
$=$	Equals
$>$	Greater than
$\pm$	Plus-minus
$\geq$	Greater than or equal to
°C	Degree celcius
BP	Blood pressure
bpm	Beat per minute
d	Degree of accuracy
DBP	Diastolic blood pressure
H	Height
HR	Heart rate. bpm
HR_t	Heart rate at rest
HR_w	Heart rate after work
kg	Kilogram
M	Body mass
m	Meter
mmHg	Millimeter of mercury
N	Population size
n	Study sample size
p	p-value
P	Population proportion
RH	Relative humidity
s	Estimated sample size
SBP	Systolic blood pressure
SD	Standard deviation
T_{ar}	Ambient air temperature
T_c	Body core temperature
T_{c0}	Body core temperature at rest
T_{cw}	Body core temperature after work
T_{re}	Real time rectal body core temperature
T_{ty}	Infrared tympanic temperature
ρ	Spearman's rank correlation coefficient
χ^2	Chi-square table value

PENILAIAN KESIHATAN PEKERJAAN DALAM KALANGAN PENGUSAHA PERINDUSTRIAN: PENDEKATAN FISIOLOGI DAN PSIKOLOGI

ABSTRAK

Kajian ini menyiasat status kesihatan pekerjaan pengendali industri pertanian dan penyelenggaraan kapal melalui pendekatan fisiologi dan psikologi. Status kesihatan fisiologi pekerja telah diteliti dari segi Indeks jisim badan, Soal Selidik Indeks Bebanan Kerja Fizikal (PWIQ), Penilaian Cekap Keseluruhan Badan (REBA), perubahan fisiologi, Indeks Stress Fisiologi (PSI), dan Indeks Haba (HI). Status kesihatan psikologi pekerja telah dikenalpasti melalui Soal selidik tingkah laku negatif (NAQ-R), Skala Kemurungan, Keresahan, dan Tekanan (DASS-21), Soal Selidik Kesihatan Umum-12 (GHQ-12), dan Soal Selidik Pertubuhan Kesihatan Sedunia Kualiti Penilaian Hidup (WHOQoL-BREF). Status fisiologi dan psikologi pengendali pertanian dan penyelenggaraan kapal telah dinilai melalui kelaziman kondisi berpenyakit (37.0%), status darah tinggi (27.0%), obesiti (14.0%), *PWIQ* (min = 17.4, SD = 7.0), *REBA* (min = 4.4, SP = 7.9), *PSI* (min = 1.1, SP = 0.6), kekerapan dibuli (83.0%), kemurungan (12.0%), kebimbangan (25.0%), tekanan (6.0%), peramalan kes masalah mental umum (2.0%), dan nilai kualiti hidup yang rendah (persekitaran = 19%, psikologi = 18%, fizikal = 12%, hubungan sosial = 9%). Kelaziman kondisi berpenyakit, peramalan kes masalah mental umum, nilai kualiti hidup dari segi fizikal dan psikologikal yang rendah adalah lebih lazim di kalangan pengendali industry pertanian (46.3%, 3.7%, 14.8%, dan 16.7%) berbanding dengan

pekerja penyelengaraan kapal (26.1%, 0.5%, 11.1%, dan 17.4%). Walau bagaimanapun, pekerja penyelengaraan kapal adalah terdedah kepada tekanan fisiologi dan psikologi yang lebih tinggi seperti yang ditunjukkan oleh skor min PWIQ dan REBA. dan kelaziman pengalaman dibuli. kemurungan. kebimbangan tekanan, dan nilai kualiti hidup persekitaran yang rendah (min = 22.8, min = 6.7 , 93.5%, 13.0%, 26.1%, 8.7%, dan 17.4%) berbanding dengan pengusaha industri pertanian (min = 12.7, min = 2.5, 74.1%, 11.1%, 24.1%, 3.8%, dan 16.7%). Kajian ini juga mendapati bahawa faktor pekerjaan mempunyai impak yang lebih ketara terhadap kesihatan fisiologi dan psikologi berbanding dengan faktor individu kerana pekerjaan akan menentukan tahap pendedahan hazad ke atas individu. Kesihatan fisiologi dan psikologi pekerja adalah saling berkaitan. Taraf kesihatan pekerja perlu ditingkatkan lagi untuk kebaikan pekerja, syarikat dan industri.

INSIGHT INTO THE OCCUPATIONAL HEALTH AMONG THE INDUSTRIAL OPERATORS: A PHYSIOLOGICAL AND PSYCHOLOGICAL APPROACH

ABSTRACT

This study investigated the occupational health status of agricultural and ship maintenance operators via physiological and psychological approach. Physiological health status was examined in terms of Body Mass Index, Physical Workload Index Questionnaire (PWIQ), Rapid Entire Body Assessment (REBA), changes in physiological parameters, Physiological Stress Index (PSI), and Heat Index. Psychological health status of workers was investigated using Negative Act Questionnaire-Revised, Depression, Anxiety and Stress Scales-21, General Health Questionnaire-12, and WHO Quality of Life (QoL) – Brief Version. The physiological and psychological status of agricultural and ship maintenance industrial operators were quantified by prevalence of co-morbidity conditions (37.0%), hypertension (27.0%), obesity (14.0%), PWIQ (mean = 17.4, SD = 7.0), REBA (mean = 4.4, SD = 7.9), PSI (mean = 1.1, SD = 0.6), prevalence of bullying (83.0%), depression (12.0%), anxiety (25.0%), stress (6.0%), predicted common mental disorder cases (2.0%), and poor QoL (environmental = 19%, psychological = 18%, physical = 12%, social relationship = 9%). The prevalence of co-morbidity conditions, predicted common mental disorder cases, poor physical QoL, and psychological QoL were higher among agricultural operators (46.3%, 3.7%, 14.8%, and 16.7%) as compared to ship maintenance workers (26.1%, 0.5%, 11.1%, and

17.4%). However, ship maintenance workers were subjected to higher physiological and psychological strain as indicated by mean scores of PWIQ and REBA, and the prevalence of bullying experience, depression, anxiety and stress, and poor environmental QoL (mean = 22.8, mean = 6.7, 93.5%, 13.0%, 26.1%, 8.7% and 17.4%) as compared to agricultural industrial operators (mean = 12.7, mean = 2.5, 74.1%, 11.1%, 24.1%, 3.8%, and 16.7%). This study also found that work related factors and individual factors showed greater impact on physiological and psychological health as compared to individual factors, as the occupation will determine the exposure of hazard on an individual. The physiological and psychological health statuses of the workers were inter-correlated. The health statuses of workers need to be further improved for the benefit of the workers, companies, and industries.

CHAPTER ONE

INTRODUCTION

1.1 Recent advances in the occupational safety and health

1.1.1 Historical development of occupational safety and health

Organizations nowadays are under stress from a number of dynamic factors in their environment such as technological changes, globalization, and unstable market conditions. Examples of such changes include the automation of manual work, the increased use of foreign workers, the multicultural challenges at workplaces, and the use of new information technology to coordinate work and to communicate more effectively. Changes in the working environment in recent decades have both created new work related health problem and had worsen the existing health problems among different working populations (Niu, 2010). Therefore, various laws and regulations aimed at the prevention of occupational accidents and work related disease have been introduced in most part of the industrialized countries. Correspondingly, relevant organizations and department have been set up to monitor the occurrence of occupational accidents (International Labour Organization, ILO, 2003). At present, the new approach on safety and health focused on improving occupational safety management activities such as learning from accident models (understanding root causes), planning (expecting and responding to the unexpected), and change analysis (Hovden, Albrechtsen, & Herrera, 2010).

Occupational safety and health began with the ancient Babylonians. The government's effort to encourage safer workplace first revolved around punishing the wrong doer. At 2000 before century (BC), their ruler, Hammurabi, developed the Code of Hammurabi. The significance of the code from the perspective of safety and health is that it contained clauses dealing with injuries, allowable fees for physicians, and monetary damages assessed against those who injured others. Losses caused by errors were punished using the eye-for-an-eye concept. A builder could have his own child killed if his poorly done work led to a loss of another's child (Friend & Kohn, 2010; Goetsch's, 2010). The environment and its relation to workers health was further recognized as early as the fourth century BC when Hippocrates noted the characteristic features of lead toxicity including anaemia, colic, neuropathy, nephropathy, sterility, and coma in the mining industry (Papanikolaou *et al.*, 2005). In the 1st Anno Domini (AD), Pliny the Elder, a Roman scholar, described the perceived health risks to those working with zinc and sulphur. In 1556, Agricola, the German scholar described his observation on the diseases of miners and prescribed preventive measures in his book, *De re metallica* (On the Nature of Metals (Minerals)). Mine ventilation, workers protection, mining accidents, and diseases associated with mining occupations such as silicosis were discussed in the book, and it has remained the primary source of mining engineering for 200 years (Winkelstein, 2011). In 1700, Bernardino Ramazzini described 51 groups of workers within his seminal work *De Morbis Artificum Diatriba* (Diseases of workers). His book represented a medical and social triumph, and he was hailed as the father of occupational medicine (Franco, 2014; Hussain, 2014). Ulrich Ellenborg recognized, identified, and reported the occupational diseases and injury of gold miners which includes toxicity of carbon monoxide, mercury, lead, and nitric acid in 1743 (Gagliardi, Valenti, & Iavicoli, 2012).

The implementation of practical measures to protect workers' health started at the beginning of the 19th Century. In 1824, Trade Unions were formed in the Great Britain to improve the working conditions, especially related to the worker's right such as working schedules, protection of female, and child labour (Gagliardi, Valenti, & Iavicoli, 2012). The first factory inspectors were appointed under the provisions of the Factories Act 1833 (Health and Safety Executive, 2013). A Royal Commission was established in 1840 to investigate the working conditions in mining industry. They published their findings in 1842. Accidents, brutality, lung diseases, long hours, highly dangerous, and adverse working conditions were found to be the norm, and this brought into force the Mine Act 1842 (Health and Safety Executive, 2013). In 1893, the first "Lady Inspectors", May Abraham and Mary Paterson were appointed to investigate women's hour of employment and enforcing occupational health and safety in laundries and small workshops (Spurgeon, 2012). The first international scientific and professional association, "*Commission Internationale Permanente pour l'Étude des Maladies du Travail* (International Commission on Occupational Health [ICOH])" was established in 1906, and it is still the largest, non-governmental organization in the field on a global scale (ICOH, 2014). In 1919, ILO was created as part of the Treaty of Versailles that ended World War I with the aim of maintaining social justice in securing peace, against a background of exploitation of workers in the industrializing nations of that time (ILO, 2014b).

Now ILO is devoted to promote social justice and recognize human and labour rights internationally (ILO, 2014a). The "Guidelines on occupational safety and health management system 2001" published by ILO aimed for coherent policies to protect workers from occupational hazard and risk while improving productivities (ILO, 2001). In 2007, World Health Organization (WHO) implemented a Global Plan of Action on Worker's Health 2008-2017 endorsed by the World Health Assembly. The action plan deals with all aspects of worker's health. The scope of the plan includes prevention of occupational hazard, protection, and promotion of health at work, employment condition, and better health system response to worker's health (Sixtieth World Health Assembly, 2007).

1.1.2 The Malaysian's occupational safety and health development

In Malaysia, the first boiler inspector, Mr William Givan was appointed as Machinery Inspector in 1878. Steam boiler enactments were state oriented. The Selangor Boiler Enactment 1892 was believed to be the first steam boiler law legislated in Malaysia. The steam boiler enactments of the Allied Malay States were soon abolished on the 1st of January 1914, and replaced with Machinery Enactment of 1913. The scope of inspectors has expanded from inspecting steam boilers to machineries. The Machinery Enactment of 1913 was abolished and replaced with Machinery Enactment of 1932 to enforce the registration and inspection of installation of boilers and machinery. In 1953, all of the machinery enactments of the Allied Malay States, Non-Allied Malay States and Strait States were abolished and replaced with Machinery Ordinance 1953, which covered all aspects of factory workers safety. However the ordinance does not fully covered the health aspects of the workers (Department of Occupational Safety and Health [DOSH], 2013).

The Factory and Machinery Act 1967 was introduced to address the preliminary issues that arouse due to early industrialization in the country. Several regulations, codes of practices, and guidelines, were introduced to improve the occupational health and safety domain in the last decade (Masilamani, 2010). By 1968, the posts of inspectors in the Machinery Department were fully filled by locals. The Employees' Social Security Act 1969 (ESSA) was given the Royal Consent on 2nd April 1969. Consequently, the Social Security Organization (SOCSO) was established under ESSA in 1971 under the Ministry of Human Resources (MOHR) to implement and administer the social security schemes in line with the National Development Policy and Vision 2020 (SOCSO, 2014). In 1985, a National Institute of Occupational Safety and Health (NIOSH) has been suggested and approved by the Cabinet, and established in 1991. The institute is a government-backed company with the motive to provide training courses, information pooling, dissemination, and research and development in occupational safety and health (DOSH, 2013).

The Occupational Safety and Health Act 1994 (OSHA) which was enacted on 25th February 1994, covers all workers except those in the armed forces and workers on board ships. The Act places the responsibility of employers to formulate and implement safe system of work, and workers have to give their full cooperation to the employers to maintain a safe and healthy workplace. The OSHA was drafted with the philosophy "the responsibility to ensure safety and health lies with those who create the risk and those who work with the risk" (Rampal & Nizam, 2006). With the approval of this act, the Department of Factory and Machinery has been renamed as DOSH, and the Inspectors are called Occupational Safety and Health Officers.

To further enhance occupational safety and health in the national scale, the Occupational Safety and Health Master Plan for Malaysia 2015 aim to build a safe, healthy, and productive pool of human capital by creating, cultivating, and sustaining a safe and healthy work culture in all organization throughout Malaysia. The National Council of Occupational Safety and Health Malaysia is entrusted to monitor the status and progress of the programmes. As the middle stage of a series of three consecutive 5 year-action plans that began in 2005, it will culminate in 2020 with achievement on nurturing a preventive safety culture in Malaysia (MOHR, 2010). Figure 1.1 shows the timeline of occupational safety and health development worldwide and in Malaysia.

1.2 Current status of the physiological and psychological wellbeing among industrial operators

Recently, individual and social context are taken into consideration in the study of the causal relationship between work and health, which includes socio-economic status, worker's strengths and weakness, and the welfare of the job. Elements at work can have both beneficial and harmful effects on the physiological health, psychological health, and wellbeing. These factors interact with each other to influence the general health and wellbeing of the workers (Figure 1.2, Waddell & Burton, 2006). Industrial operators who work at the front-line of an industry are often faced with hazardous environment and occupational exposures that can be

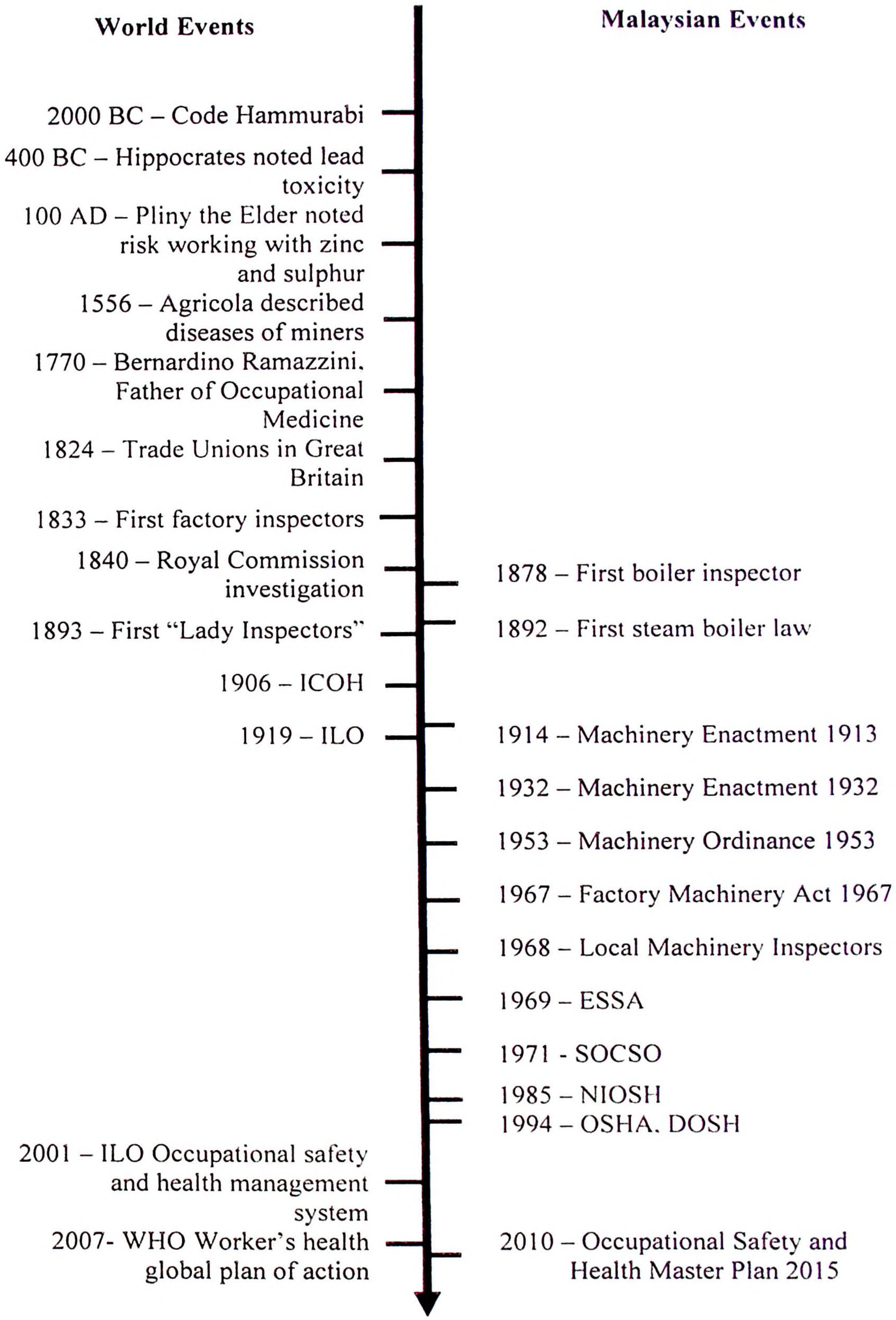

Figure 1.1: Timeline of occupational safety and health development

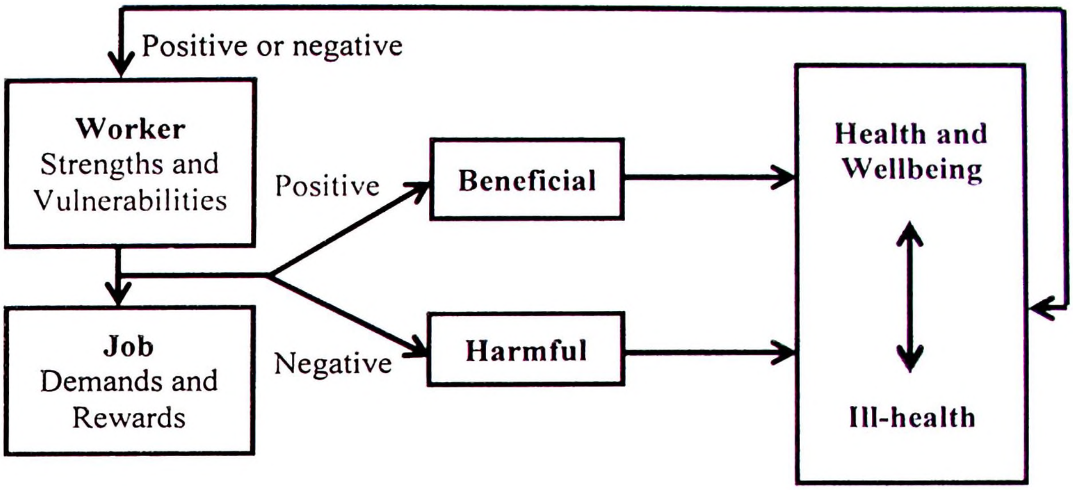

Figure 1.2: Work and health: Interactions that can lead to differing consequences (Waddell & Burton, 2006)

detrimental to their health and wellbeing. These operators are usually in the lowest wages group, and their welfare are always overlooked, as these jobs are performed by those who have no choices either limited by their educational level, social discrimination or due to some other inevitable conditions (Siegrist, 2004). Study conducted by Zheng, *et al.* (2014) reveals that the prevalence of machinery-related injuries in the agricultural sector was high. The study also shows that male gender, low family income, poor hearing, and stress were associated with a high risk of injury occurrence.

The relation between psychosocial job demand and decision latitude has been described by Karasek (1979) as two dimensions of the psychosocial work environment in his "job-strain model", also called the "demand–control model" (Figure 1.3). There are basically 4 different categories in the model. "High-strain jobs" are jobs with high job demand and low freedom in making decision. High-strain jobs worker often possess the highest risk and they lack resources to deal with the demands as they often face fatigue, anxiety, depression, and other physical illness. "Active jobs" are intensely demanding, but workers usually have sufficient control over their job. They usually have average psychological strain and have active leisure time. "Low-strain jobs" are jobs with low psychological strain and high levels of control. They are predicted to have levels of psychological strain and health risk lower than average because they are relatively few challenges and decision latitude to allows worker to respond optimally to challenges. The fourth type of job is the "passive job", which has low demands and low control. This kind of job is demotivating, and has average levels of physical and psychological strains (Karasek & Theorell, 1990). Study conducted by Canviet *et al.* (2013) on various occupation shows that high psychological demands, low decision latitude, and job strain were all confirmed as independent risk factors for subsequent disability pensions.

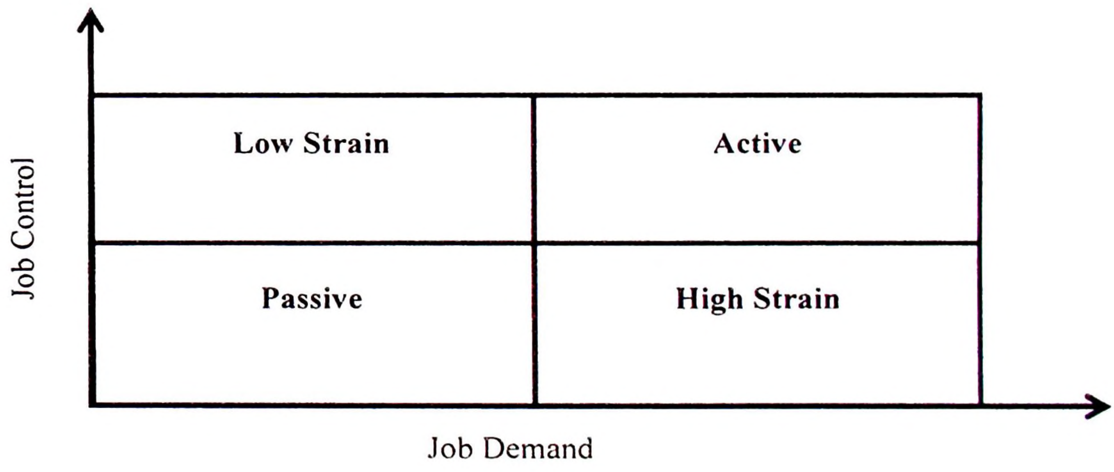

Figure 1.3: Karasek's job-strain model (Karasek, 1979)

Fast development of technology, with the introduction of new production procedure in the 20th Century, increased the number of new health and safety hazards.

To control health and safety hazards, different approaches have been used as shown in Figure 1.4. In 2013, there were a total of 2822 accidents in Malaysia. The highest accident rate industry is manufacturing, followed by agriculture, forestry, logging and fishing, and construction (DOSH, 2014a). Major accidents and incidents in Malaysia are listed in Table 1.1. Multiple factors have been studied to understand the effect of different factors on worker's physiological and psychological health. Recent studies show there is a relationship among singular or combined psychosocial, biological or socio-cultural factors as factors of hazard. Example includes discrimination based on age (Jones *et al.*, 2013; Zytoon, 2012), gender, sexuality (ILO, 2014c), religious beliefs, pregnancy, and disability; bullying, sexual or racial harassment, horseplay, practical jokes or "initiation rites" (Cowie *et al.*, 2002; Djurkovic, McCormack, & Casimir, 2004); and contagious illnesses and disease (Makin & Winder, 2008). Through understanding the effect of various factors on worker's occupational health, actions can be taken to overcome these factors thus improve the wellbeing of the workers.

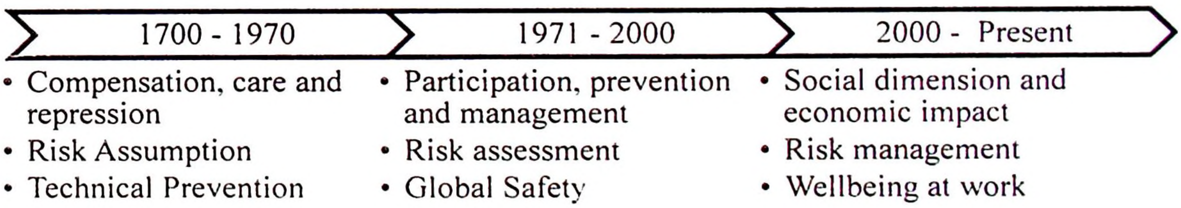

Figure 1.4: Occupational safety and health approach (Gagliardi, Valenti, & Iavicoli, 2012)

Table 1.1: Notable occupational accidents in Malaysia

Time	Accident	Reference
7 May 1991	Bright Sparkles Fireworks fire in Sungai Buloh, Selangor caught fire and caused a huge explosion. 26 were killed and over a hundred people were injured in the disaster.	Pereira & David (2001); Goh (2013)
28 May 2009	Jaya Surpermarket collapsed while being demolished killed at least 7 Indonesian labourers and injuring a number of people.	Beh (2009)
6 June 2013	Second Penang Bridge collapse killed one person and injured two persons, burying a car and two motorcycles in the debris.	Bernama (2014)
18 August 2013	Two general workers of a tyre factory in Miri died after a truck's rim from tyres flipped out of control and crushed them.	Borneo Post (2013)
24 March 2014	A crane operator at Langkawi was crushed to death by the vehicle when he lost control due to a faulty brake.	New Strait Times (2014)
15 April 2014	A crane operator was crushed to death after the crane he was operating fell from the construction site.	Camoens (2014)

The WHO (1948) defined health as a state of complete physical, mental, and social wellbeing, and not merely the absence of disease or infirmity. The ultimate goal of occupational safety and health is not just to make sure workers are free from occupational disease and accidents, but also to ensure that workers are able to maintain good health physically, mentally, and able to socialize. Therefore, to access the overall wellbeing of workers, an integrated study that considers the physiology, psychology, and environmental factors is needed to represent the condition of workers holistically. Industrial operators' health is one of the key factors to determine the survival of an industry and thus it is important for the stakeholders and the workers to understand the health status of the workers population, the effect of environment towards their health and thus formulate policies that can help to improve the health status and the productivity of the company.

1.3 Problem statement

Recent research has suggested that physiological and psychological stress at work is a major public health concern. Occupational diseases and injuries cover a wide range of human ill health. Predominant work related diseases and symptoms among workers include musculoskeletal disorder (MSD) in workers who suffer repetitive trauma (Dasguptaa, Fulmer, & Kuhnb, 2014; van Rijn *et al.*, 2010; Widanarko *et al.*, 2011; 2012); hypertension in workers subject to high stress (Rosenthal & Ariela, 2012; Thayer, *et al.*, 2010); lung cancer and mesothelioma in asbestos workers and leukaemia in workers exposed to benzene (Zhang, Lan, & Rothman, 2012); chronic bronchitis in workers exposed to dusts (Miller & MacCalman, 2009; Nordby *et al.*, 2011); chronic kidney disease in workers exposed to lead and solvents (Soderland *et al.*, 2010); heart disease in workers exposed to carbon monoxide (Kampa & Castanas, 2008; Zanobetti, Baccarelli, & Schwarts, 2011); workplace violence in jobs with public access (AbuAlRub & Al-Asmar, 2013); and traumatic death due to construction (Susan, Buskin, & Paulozzi, 2007). Such illnesses and injuries afflict thousands of workers in the world. Psychological problems at work are also associated with substantial economic consequences, including increased absenteeism (Kazi & Haslam, 2013), increased worker turnover

(O'Neill & Davis, 2011; Jou, Kuo, & Tang, 2013), and associated with decreases in worker productivity (Yahya, et al., 2012).

Occupational health of workers is interrelated with the individual characteristics and working environment. However, few studies have directly investigated the effects of the individual factors and work environment on physiological and psychological health outcomes to date. It is important to have a clear understanding of the interactions between occupational health factors and subsequent strain that contributes to physiological and psychological stress to the workers which leads to high accident, morbidity and mortality rates that have plagued the field of industrial operators (Nenonen, 2013; Widanarko *et al.*, 2012; Zheng *et al.*, 2014). Rapid economic growth via industrialization has given not only a significant impact in terms of income distributions and quality of life (QoL), but also resulted in an increasing number of accidents at the workplace. In Malaysia, a total of 1426 cases of occupational disease and poisoning have been reported to DOSH in 2010 compared with 791 cases reported in 2009. The most frequent occupational disease investigated were noise induced hearing loss, followed by occupational skin diseases and occupational lung diseases. The manufacturing sector recorded the most number of cases of occupational disease and poisoning in 2010 with a total of 393 cases (59.3%), followed by the convenience sector with 157 cases (23.7%) and public service sectors by a total of 49 cases (7%). Psychosocial problem due to job stress is noted by DOSH as an issue that should be taken seriously (DOSH, 2014b).

Industries in Malaysia continue to face many challenges both traditionally and new challenges. One of the many challenges that industries face is the high rate of workplace accidents which may badly reflect on how safety and workers' wellbeing are being handled by Malaysian company (Surienty, Khoo, & Kee, 2011). In Malaysia there are 12 million labour forces with 1.3 million working in agriculture, forestry, livestock and fishing industry, followed by 3.6 million working in manufacturing industry and the rest in various other sectors (Economic Planning Unit and MOHR, Malaysia, 2012). In 2013, there were 535 occupational accidents in the agricultural, forestry, fishing and logging sector, after manufacturing sectors (1655 cases) as presented in Figure 1.5 (DOSH, 2014a). This makes agricultural, forestry, fishing and logging sector the second highest risk sector among the 9 categories of industry defined under OSHA (Laws of Malaysia, 2010). Ship maintenance activities are classified under heavy physical job because of the frequent occurrence of poor working postures and highly dynamic working environment (van Wendel de Joode, Burdorf, & Verspuy, 1997). However, literature information on the working conditions and the related disease is sparse. The ship maintenance work is specific and the number of people involved is relatively small, which explains the lack of knowledge on stressors in the ship maintenance industry. There were numerous studies addressing the issues of physiological and psychological health and wellbeing in different population, for example physicians and psychiatric patients (Hasanah, Naing, & Rahman, 2003); students (Shamsuddin, et al., 2013); and factory workers (Edimansyah *et al.*, 2008; Noor & Abdullah, 2012). However, there are limited studies focusing on agricultural and ship maintenance industry in Malaysia.

With this in mind, a comprehensive study which investigates the physiological and psychological health of the workers was conducted. The results of this study could provide potentially useful information in order to improve the physiological and psychological health among industrial operators. This study primarily interested on how individual factors, physiological and psychological work related factors directly and indirectly affect the health and wellbeing of workers. The relationship between physiological and psychological health among industrial operators were also investigated in the current study.

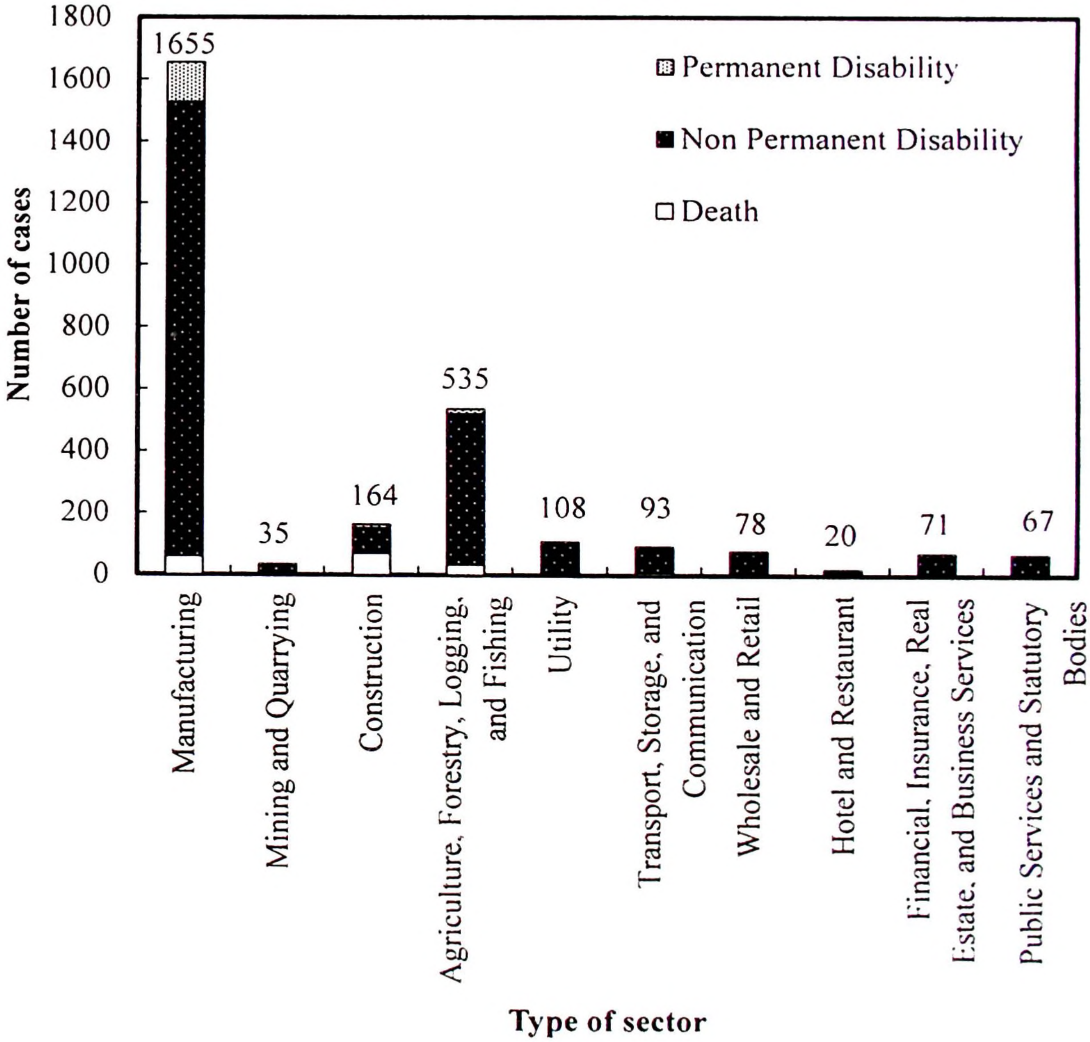

Figure 1.5: Occupational accidents statistics according to the type of sector in 2013 (DOSH, 2014a)

1.4 Objectives

1.4.1 General objective

To investigate the occupational health status of industrial operators via physiological and psychological approach.

1.4.2 Specific objectives

a) To determine the demographic and work profile among the agricultural and ship maintenance operators.

b) To examine the effects of individual factors and work related factor on the physiological health status among the agricultural and ship maintenance operators.

c) To investigate the effects of individual factors and work related factor on the physiological health status among the agricultural and ship maintenance operators.

d) To evaluate the relationship between the physiological health status and psychological health status among the agricultural and ship maintenance operators.

1.5 Conceptual framework

Agricultural and ship maintenance industrial operators can be considered as a high strain job. It is a high demand job with heavy manual handling workload, exposed to dangerous hazard, and low reward. The job control of the industrial worker is low as they have to carry out any orders from the management within the limited period. The work stress of industrial operators is believed to be high. High environmental stress and high manual handling demand increases the physiological and psychological stress of workers. Workplace bullying may also contribute to psychosocial hazard in work place. What is the current condition of the physical and psychosocial environment of the heavy industrial work setting? High strain job is associated with psychological stress and psychological symptom. Is the situation similar in Malaysia's industrial operators? What is the prevalence of sickness, stress, physiological and psychological health status among industrial operators in Malaysia? Is there any relationship between individual and work related factors on the health outcome of the industrial operators? Based on the above, we hypothesize that the prevalence of physiological stress and mental health symptom of the agriculture and ship maintenance operators was high. We expect that individual factors and work related factors have impact on physiological, psychological and psychological health of the workers.

1.6 Hypothesis

To answer the objectives, the following hypotheses are stated:

H1: There is relationship between individual and work related factors on physiological health status.

$H1_0$: There is no relationship between individual and work related factors on physiological health status.

H2: There is relationship between individual and work related factors on psychological health status.

$H2_0$: There is no relationship between individual and work related factors on psychological health status.

H3: There is relationship between physiological health status and psychological health status.

$H3_0$: There is no relationship between physiological health status and psychological health status.

CHAPTER TWO

LITERATURE REVIEW

2.1 Occupational health among industrial operators

The ILO estimated that 6,300 people die daily as a result of occupational accidents or work-related diseases, with more than 2.3 million deaths per year. An estimated of 4 per cent of global Gross Domestic Product are lost every year due to the accidents caused by poor occupational safety and health practices (ILO, 2014c). The hazards may vary, depending upon the occupation, safety, and health conditions, workplace, and position (ILO, 2014c). Hazard is defined as a source or situation with potential harm in terms of human injury, illness, damages to property, environment, or the combination (DOSH, 2008). The health hazards in the workplace include chemical, biological, physical, ergonomics, and psychological factors (Occupational Safety & Health Administration, 2014). Example of the common type of health hazard is given in Table 2.1.

The ergonomic hazard at the workplace is a major contributing risk factor for the above mentioned occupational safety and health problems. The increasing rate of MSD is caused by manual handling (Abedini, Choobineh, & Hasanzadeh, 2014), exposure to vibration (Grenier, Eger, & Dickey, 2010), postural stress (Goswami, Pal, & Dhara, 2013), awkward position (Evangelista, et al., 2012), stereotyped and repetitive tasks (Ferguson *et al.*, 2013), and various environmental factors (Magnavita *et al.*, 2011). In addition, psychosocial factors such as psychological stresses, high levels of role conflict, low job control, less commitment from management in the safety aspect, job dissatisfaction, and complex social problem such as compensation laws and disability system are said to be associated with the increase of MSD (Eatougha, Waya, & Chang, 2012; Ghaffari, 2007; Reid et al., 2010).

Table 2.1: Typical examples of occupational health hazards

Type of health hazard	Example	Reference
Chemical	Asbestos	Baumann, Ambrosi, & Carbone (2013)
	Benzene	Hong (2011)
Biological	Tuberculosis	Baussano *et al.* (2011)
	Hepatitis	Noppakunwong *et al.* (2013)
Physical	Noise	Stockholm *et al.* (2013)
	Excess heat	Jackson & Rosenberg (2010)
Ergonomics	MSD	Jones *et al.* (2013)
Psychosocial	Stress	Rosenthal & Ariela (2012)
	Workplace bullying	Chipps *et al.* (2013)

Other than illnesses and injuries, working environment can also affect the health of workers. Worker's body will change in response to hot and humid conditions. Physiological parameters such as heart rate (HR), body core temperature (T_c), blood pressure (BP) and sweat production will change in response to the working environment (Lu & Zhu, 2007). In hot and humid environment, heat needs to be dissipated, and if the heat fails to dissipate efficiently, the core body temperature will rise (Brotherhood, 2008; Pantavou, Theoharatos, & Mavrakis, 2011). The heat insult will cause cramps, heat stroke, heat exhaustion, and even deteriorates any other underlying co-morbidity conditions such as renal failure and intravascular coagulation (Jackson & Rosenberg, 2010).

Psychosocial environment might induce work stress to the workers. The workplace psychosocial risk factors include high psychological demands, low reward and benefits, ethical conflict, and job insecurity (Murcia, Chastang, & Niedhammer, 2013). Study shows that poor psychosocial environment would induce distress, depression, and post-traumatic stress disorder (Boschman *et al.*, 2012). These unwanted stressors may lead to physical illness and psychological disorders, causing chronic fatigue, depression, insomnia, anxiety, migraines, emotional upset, stomach ulcers, allergies, heart attacks, accidents, and even suicide (DOSH, 2001).

2.2 Physiological changes among industrial operators

Physiological changes in different parameters such as BP, HR, and T_c would be enhanced during physical activities (Dey & Sharma, 2013; Das, Ghosh, & Gangopadhyay, 2012; 2013; Gangopadhyay *et al.*, 2012; Ljubičić *et al.*, 2014). Force exertion will enhance systolic blood pressure (SBP) and HR (Das, Gosh, & Gangopadhyay, 2012). Heart will beat faster to supply more blood to the muscles in order to provide oxygen during physical exertion. The contraction of muscles also causes muscle vasoconstriction, which restricts the blood flow followed by increased systolic blood pressure (Das, Gosh, & Gangopadhyay, 2012). On the other hand, the enhanced diastolic blood pressure (DBP) is affected by erect, rigid body posture, and blood pooling in body parts (Das, Gosh, & Gangopadhyay, 2012). Table 2.2 shows the compilation of different studies on worker's BP, HR, and T_c change before and after work.

Table 2.2: BP, HR, and T_c change of workers in different studies

Study population	Location	Change of physiological parameters			Reference
		SBP	DBP	HR	
Child agriculture workers	Tarakeswar, West Bengal, India	35.0 ± 3.3	7.0 ± 2.2	81.5 ± 6.8	Das, Ghosh, & Gangopadhyay (2013)
Female prawn seed collectors**	Sunderbans, West Bengal, India	47.5	14.8	8.9	Das, Ghosh, & Gangopadhyay (2012)
Bus conductor**	Kolkata, India	17.0	17.0	14.0	Gangopadhyay *et al.* (2012)

*Data are presented in mean ± SD.

*Change of parameter refers to the difference between before and after work.

*SBP = Systolic Blood Pressure; DBP = Diastolic Blood Pressure; HR = Heart Rate.

**Information derived from data provided in reference.

2.2.1 Hypertension

The relationship between BP and the risk of cardiovascular disease (CVD) events is continuous, consistent, and independent of other risk factors. The higher the BP of a person, the higher the risk of suffering a heart attack, heart failure, stroke, and kidney disease. The heart and blood vessels in major organs such as the brain and kidneys can be damaged due to high BP (WHO, 2013a). According to WHO (2013c) the worldwide prevalence of raised BP among adult aged 25 years and above among male is 34.6%, and female 28.3%. In Malaysia, 28.8% of male and 24.6% of female adults are in the state of raised BP (WHO, 2013c). Table 2.3 shows the prevalence of hypertension in different studies.

The presence of additional risk factors such as smoking, diabetes and high cholesterol levels increases the CVD risk from hypertension (Chobanian *et al.*, 2003; WHO, 2013b). In Malaysia, this is compounded by the fact that the prevalence of current smokers for Malaysians aged 15 years and above is 50% in males and 2% in females (WHO, 2013c). A review on researches of relationship between occupational stress and hypertension (Rosenthal & Ariela, 2012) has found enormous amount of evidence on the relationship between job stress and hypertension. Job strain, decision latitude and demands could influence the result, adding organizational influence to the task-level decision latitude producing a stronger association between hypertension and job strain.

Table 2.3: Prevalence of hypertension in different studies

Study population	Location	Prevalence	Reference
Worldwide general population	Worldwide		WHO (2013c)
Male		34.6	
Female		28.3	
Malaysia general population	Malaysia		
Male		28.8	
Female		24.6	
Garage workers in automobile industry	Kumasi, Ghana	12.0	Amidu *et al.* (2012)
Male industrial workers	Chennai, Tamil Nadu, and Visakhapatnam, Andhra Pradesh, India	55.5	Jagannathan, *et al.* (2014)
Industrial workers	United States		Davila *et al* (2012)
Farm and nursery workers		10.5	
Mechanics and repair		28.4	
Rubber-glove-factory worker	Central province of Thailand	4.0	Sein *et al.* (2010)

*Data are presented in %.