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UTM Razak School of
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Advanced Technology

Proceedings of the 1st Master Project Symposium on Occupational Safety & Health

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MASTER PROJECT SYMPOSIUM
ON OCCUPATIONAL SAFETY
AND HEALTH**

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About Master Project Symposium

The 1st Master Project Symposium was held on 13-15 December 2016 for Semester 1 Session 2016/2017 at Menara Razak, Universiti Teknologi Malaysia (UTM) Kuala Lumpur. This symposium is organized every semester by Master Project Committee, UTM Razak School of Engineering and Advanced Technology to fulfil the requirement of Masters of Occupational Safety and Health.

This symposium aims to provide a platform for students to share their research processes and outcomes among UTM Razak School members and at the same time receive inputs from the audience to improve their research. Students are exposed to various Occupational Safety and Health management issues by identifying the current issues in their workplaces and addressing the issue through their research.

The papers presented in the symposium are compiled into proceedings to share the research conducted by the students and findings that related to the current practices of many of the industries in Malaysia. An index of keywords from all papers is included at the end of the proceedings. All participants and readers can enjoy reading the proceedings and gain inspirations for further research and application into education and practice.

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Towards the Development of a Standardized HIRARC Guidelines for Royal Malaysian Navy Ships' Galley

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Abstract – *This study addressed the issue of accidents and injuries among the Cooks working in the Royal Malaysian Navy (RMN) ships' galley. Now, there are no standard guidelines published by RMN management in terms of Occupational Safety and Health (OSH) for that specific compartment. Cooking in the galley aboard a ship is different compared to in a normal land-based kitchen in terms of workplace environment and nature of work. This is because RMN ships' galleys are sway platform, often small with limited access and operate 24/7. This result in accidents and injuries related to OSH aspect in the ship's galley occurring regularly. Over the period of 2010 – 2015, a total number of 61 accident and injury cases were recorded during food preparation among Navy Cooks. Hence this study undertook to identify the possible hazards and associated risks pertaining to cooking activities by conducting Hazard Identification, Risk Assessment and Risk Control (HIRARC) process published by Malaysian Department of Safety and Health (DOSH). It sought to investigate the trends of most common accidents and injuries in the galley including scald and burn, body part pain, slips, trips and fall, cuts and stabs, food poisoning, fire and smoke suffocation. By conducting proper HIRARC, key hazards were identified and their associated risks were assessed so that appropriate risk control can be determined to manage risks accordingly. It is anticipated that the findings of this study will provide invaluable information to recommend and develop a standard HIRARC Guidelines that can be practically and effectively used for every squadron of RMN ships' galley. Navy Cooks are also expected to directly benefit as a more comprehensive safety precaution aboard will improve their safety and produce a conducive work environment in the galley.*

Keywords: Royal Malaysian Navy, OSH, Galley, HIRARC

1.0 INTRODUCTION

A 'galley' is a naval term referring to a specific compartment on board ship which is used for cooking and preparing food daily. Therefore, a galley is a kitchen, which is designed in compact and typical style with longitudinal units and overhead cabinets to make the best use of limited space on board ships. Galleys are also

designed to cater for the rolling and heaving (sway) nature of the ship, making them more resistant to the movement effects of the ship. It can be considered as one of the most hazardous workplace aboard, after the engine room and ammunition store. Hazard in a galley can come from many sources such as workplace environment, energy, manual handling, biological and chemical factors.

Cooking activity aboard a floating vessel is different compared to in a normal land-based kitchen. This is because ships are unstable moving platform, and every activity is affected by the motion of the ship. There are many concerns on the potential of occupational hazards that arise in the galley such as pots and pans sliding on the stove and counter, and items that slip and fall causing bruising and injuries. Workers lifting unstable loads are at greater risk of back injury compared to workers lifting stable loads [1]. Occupational health is influenced by individuals, tasks, and other people in the workplace [2].

According to Jeong [3], accidents during food preparation are caused mainly by machine and tools (86.7%), and most victims were injured in the forms of getting caught in and between objects (45.7%) or with cuts, amputations and punctures (43.9%). Furthermore, cooking utensils and caldron are behind 55.4% of the accidents and 73.3% of the accidents during heated cooking processes revealed problems with abnormal temperature. Also, accidents during handling or storing ingredients and serving are most commonly in the forms of slips and falls. Furthermore, scalds and burns are also common injuries that happen in the galley. Burns are defined as tissue reaction to injury due to heat, chemicals, or radiation and are commonly encountered in forensic practice [4].

Currently, there is no standard guideline that practised in the RMN ships' galley. This is probably due to the fact that the Malaysian Armed Forces (including the Royal Malaysian Navy) is excluded from the OSHA 1994 (Act 514). However, throughout the years of 2010-2015, many accidents and injuries related to OSH aspects have been reported in RMN ships' galley. An accident is an unplanned event that causes some kind of harm [5]. The accidents statistics are shown in the Table 1 below:

Hence, every RMN ship's galley should have an applicable references related to the OSH requirement. This researcher believes that it can be fulfilled by developing a standard guideline that may be applied and practised by the Navy Cooks in the galley. In order to develop the guidelines, there must be a proper approach for the process by conducting Hazard Identification, Risk Assessment and Risk Control (HIRARC) process. With HIRARC, one will be able to identify possible hazards associated to cooking activities in the galley, analyze and assess their associated risks and apply suitable control measures.

Table 1: Galley accident and injury cases among RMN ships' Cooks from 2010-2015

No	Cases	Year						Total
		2010	2011	2012	2013	2014	2015	
1.	Scald and burn	4	1	3	2	-	1	11
2.	Slips, Trips and Fall	3	2	1	3	1	2	12
3.	Body Part Pain	2	-	1	-	-	-	3
4.	Cuts and Stabs	3	5	4	7	3	2	24
5.	Poison	-	-	1	3	-	4	8
6.	Fire	-	-	1	-	-	-	1
7.	Suffocate	-	1	-	-	1	-	2

2.0 METHODOLOGY

There are 4 main stages involved in this study whereas, (i) Initiation, (ii) Data Collection, (iii) Data Analysis, and (iv) Final stage. Each stage describe as below.

2.1 Initiation Stage

This stage described the problem statements and development of research objectives. In order to achieve the research objectives, research question were developed:

- (i) What are possible hazards that exist in the galley?
- (ii) What is the magnitude of potential likelihood and severity for each hazard?
- (iii) What are the measures to prevent eliminate and control the hazards?

2.2 Data Collection

Data were obtained through interviews with Subject Matter Experts (SME) and via distribution of questionnaire survey to related respondents. The selected SMEs were supervisors and persons-in-charge of the galley, while questionnaire respondents were the Cooks. The purpose of the interview was to obtain information that will resolve a problem or prevent a new problem [6]. Based on the observation and interview, each hazard and associate risks in the galley was identified and a questionnaire was developed. This was a crucial step as the questionnaire intended to gather vital data from the perspective of the hands-on users in the RMN ships' galleys – the Cooks - in order to conduct risk assessment. Demographic data, responses regarding policy and procedure, risk severity, risk likelihood and respondents' suggestions were obtained using the questionnaire which consisted of 44 statements. To assess risk, 12 statements including severity and likelihood required the respondents to choose the best answer to describe their experience in the galley.

2.3 Data Analysis

In order to calculate the risk, the formula $L \times S = \text{Relative Risk}$ was used where L = Likelihood and S = Severity as in Table 2 below:

Table 2: The result of Risk Assessment as determined through Risk Matrix

	Severity (S)				
	Negligible (1)	Minor (2)	Serious (3)	Fatal (4)	Catastrophic (5)
Most Likely (5)	5	10	15	20	25
Possible (4)	4	8	12	16	20
Conceivable (3)	3	6	9	12	15
Remote (2)	2	4	6	8	10
Inconceivable (1)	1	2	3	4	5

Legend: Risk description	
	High
	Medium
	Low

2.4 Final Stage

In practical terms, a risk assessment is a thorough look at the workplace to identify things, situations, processes that may cause harm, particularly to people. After identification has been determined, an evaluation on how likely and severe of the risk is made. Finally, decision on what measures should be in place to effectively prevent or control the harm from happening.

3.0 RESULTS AND DISCUSSION

All Cooks working on board RMN vessels need a basic understanding of risk if the ship's safety culture is to be sustained. A HIRARC Guideline by DOSH Malaysia (2008) is used to establish the foundation for the management of risk that include risk identification, risk assessment, and risk control. An essential skill is being able to define or estimate how probable and severe an event might be [7].

3.1.1 Hazard Identification

Hazards were identified by the researcher via observations and by interviewing the Marine Engineering Officer (MEO) of KD PAHANG, Lt Cdr Ahmad Azhari RMN. He was appointed as the engineering officer on board and is responsible for technical safety of the ship. During the interview, he stated that common injuries among Cooks in the galley were scalds, lacerations, bruises, dislocations, food poisoning, cuts and smoke inhalation.

3.1.2 Risk Assessment

Based on the risk assessment conducted, the hazards were rated and classified into three levels of Low, Medium and High. The result is shown in Table 3 below:

Table 3: Risk assessment in the galley

Ranking	Hazards	Classifications	Rating	Risk Description
1.	Skin contact to extreme temperature	Work Environment	20	High
2.	Sharp objects or knife-related injury	Energy (Kinetic)	20	High
3.	Falls, trips and slips	Energy (Gravity)	16	High
4.	Hygiene	Biological	10	Medium
5.	Lifting, carrying or putting objects	Manual Handling	10	Medium
6.	Toxic	Chemical	6	Medium
7.	Pressure systems	Energy (Kinetic)	6	Medium
8.	Electrical	Energy (Electrical)	5	Medium
9.	Fire	Energy (Explosion)	4	Low
10.	Trapped by moving machines	Mechanical	4	Low
11.	Smoke suffocation	Work Environment	2	Low
12.	Dehydration	Work Environment	1	Low

Based on the Risk Assessment process in Table 3, all 12 major hazards that exist in the galley has been prioritized. Three types of hazards fell into the High-Level category, five in the Medium Level, and four in the Low-Level category. Skin contact to extreme temperature, knife- related, and fall, trip and slip were the highest risk that needs more precaution; while fire, trapped by moving machine, smoke suffocation and dehydration are low risk.

3.1.3 Risk Control

Suitable Risk Control recommendations in terms of elimination, control and preventive action are put forward as shown in Table 4. The stated risk above is the vital points to be included in the forthcoming Standard HIRARC Guideline for RMN ships' galley.

Table 4: Risk control recommendation

No	Hazards	Control Measure	Risk Control
1.	Skin contact to extreme temperature	<ul style="list-style-type: none"> • Administrative control 	<ul style="list-style-type: none"> • Display appropriate signage
2.	Sharp objects or knife-related injury	<ul style="list-style-type: none"> • Administrative control 	<ul style="list-style-type: none"> • Educate Cooks on proper knife handling • Permit only authorized and trained employees to use knives
3.	Falls, trips and slips	<ul style="list-style-type: none"> • PPE • Engineering control • Administrative control 	<ul style="list-style-type: none"> • Footwear • Maintenance of floor surface • Housekeeping
4.	Hygiene	<ul style="list-style-type: none"> • Administrative control 	<ul style="list-style-type: none"> • Adhere to established hand hygiene practices
5.	Lifting, carrying or putting objects	<ul style="list-style-type: none"> • Engineering control • Administrative control 	<ul style="list-style-type: none"> • Utilize mechanical aids • Redesigning individual tasks
6.	Poisonous	<ul style="list-style-type: none"> • Isolate • Administrative control 	<ul style="list-style-type: none"> • Storage isolation • Procedure of handling
7.	Pressure systems	<ul style="list-style-type: none"> • Administrative control 	<ul style="list-style-type: none"> • Thorough examination by qualified person
8.	Electrical	<ul style="list-style-type: none"> • Administrative control 	<ul style="list-style-type: none"> • Regular inspection on cables, plugs and socket
9.	Fire	<ul style="list-style-type: none"> • Administrative control 	<ul style="list-style-type: none"> • Regular inspection on fire hydrant and fire extinguisher
10.	Trapped by moving machines	<ul style="list-style-type: none"> • Administrative control • Isolate • Administrative control 	<ul style="list-style-type: none"> • Operating instruction • Machinery suitably guarded • Spot defect and reporting
11.	Smoke inhalation	<ul style="list-style-type: none"> • Engineering control 	<ul style="list-style-type: none"> • Ventilation fan
12.	Dehydration	<ul style="list-style-type: none"> • Administrative control 	<ul style="list-style-type: none"> • Job rotation system

4.0 CONCLUSION

This study provides the basis for the eventual development for sound practice guidelines via the application of HIRARC process. This is because HIRARC is an integrated tool to identify, assess and control hazard and risk of any workplace and its activities. Main factors that contribute to the accident and incident cases in the galley are because of lack of authoritative information, references and guidance in term of OSH requirement for all RMN ships' galley. By identifying and rating possible risks that typically occur during food preparation and knowing appropriate

risk control, a proper standardized guideline can be developed accordingly for use in the galley.

Related with this, it seems that HIRARC process is the best risk management practice for RMN to adopt. By applying HIRARC to the context of RMN, particularly to RMN ships' galley, it is possible to put in place measures that will improve on concerns relating to OSH. It is anticipated that the stated risks identified will be the vital points to be included into the Standard HIRARC Guideline for ships' galley that this researcher thinks the RMN should have. Its strict implementation may help to reduce and even eliminate the possibility for accidents occurring during food preparation on board RMN ships.

Hence, it is timely that RMN management considers upgrading the existing SOP (Standard Operating Procedure) it is currently using by introducing HIRARC process, and eventually developing a Standard HIRARC Guidelines for RMN ships' galley.

REFERENCES

- [1] Pinto, V.J., et al. "Assessment of engineering controls designed for handling unstable loads: An electromyography assessment". *International Journal of Industrial Ergonomics*, 2013. 43(2): p. 181-186.
- [2] Brown, L.W. and J.C. Quick Workplace Health, in *Encyclopedia of Mental Health (Second Edition)*, H.S. Friedman, Editor. 2016, Academic Press: Oxford. p. 387-394.
- [3] Jeong, B.Y. "Cooking processes and occupational accidents in commercial restaurant Kitchens". *Safety Science*, 2015. 80: p. 87-93.
- [4] Ong, B.B. and N. Milne. Injury, Fatal and Nonfatal: Burns and Scalds, in *Encyclopedia of Forensic and Legal Medicine (Second Edition)*, J. Payne-James and R.W. Byard, Editors. 2016, Elsevier: Oxford. p. 173-181.
- [5] Schudel, D., J.E. McLaughlin, and C.M. Selavka, HEALTH AND SAFETY Including Risk Assessment A2 - Siegel, Jay A, in *Encyclopedia of Forensic Sciences*. 2000, Elsevier: Oxford. p. 1041-1048.
- [6] Baker, B.D. and B.P. Gilbride, 32 - Interviewing, in *Security Supervision and Management (Fourth Edition)*. 2015, Butterworth-Heinemann. p. 411-423.
- [7] Crutchfield, N. and J. Roughton, Chapter 10 - Risk Management Principles, in *Safety Culture*. 2014, Butterworth-Heinemann: Oxford. p. 199-212.

Physical Disorder among Network Operation Center Workers at Telekom Malaysia in Cyberjaya

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Abstract - Physical Disorder have been common complaints among workers involved in static work or tasks requiring the repetitive motion of the upper limbs and prolonged computer work. Call Center working environment workers are the one group which may impact on chronic physical disorder problems. Therefore, the aim of this study was to assess physical disorder risk in work environment among Network Operation Center (NOC) workers. This was a survey study conducted among 50 workers and ROSA assessment among 44 workers in NOC Telekom Malaysia, Cyberjaya. NOC workers who had experience jobs more than 1 year, working time at 8 hours to 12 hours per days. Data were collected by using following methods which are observation, questionnaire and Rapid Office Strain Assessment (ROSA) which measured the sitting posture, workstation (chair height, pan depth, armrests, and back support), computer (monitor, mouse and keyboard), telephone and duration of spending time for each posture or activity. From ROSA, there were 4 levels of ergonomics risk classification (low, medium, high, very high). The results of this study showed that the NOC workers at 2 level of risk (high and very high). This study was done to determine the prevalence of physical disorder and associated factors among NOC workers.

Keywords: Physical Disorder, Call Center, Work Environment, Network Operation Center (NOC), ROSA

1.0 INTRODUCTION

Network Operation Centre known as NOC is responsible for maintaining network elements, systems and security which all network services and products rides on. NOC is not only responsible of the network elements but also all the services and systems that are interconnects. NOC play the crucial role to perform technical analysis of system issues and outages as they occur across customer enterprise networks. This individual then performs research to troubleshoot and resolve the issue or depending upon complexity escalates the issue to higher level systems administrators and network engineers. The NOC workers must be able to prioritize

remediation of issues in 24 x 7 environments with curial uptime requirement. Located in Cyberjaya Selangor, NOC is operate for 24 hours daily with 150 employees and divided into group with 50 employees for every shift. The working environment similar as call centre which the daily routine interfacing with computer and telephone whilst simultaneously using display screen equipment. In the various positions, associated employees are required to spend a large amount of time interfacing with computers, as well as on the telephone whilst simultaneously using display screen equipment, while seated at their table. Some of the more common office related physical disorders are Shoulder, Neck, Carpal Tunnel Syndrome, tennis elbow and lower back strain. Such disorders are often aggravated further with the office desk and chair set-up and design. The discipline of ergonomics is designed to address, and hopefully mitigate such issues by examining the relationship between humans and their work.

2.0 METHODOLOGY

A. Study Design: Cross sectional design was adopted to study the prevalence of Physical Disorder among the Network Operation Center (NOC) workers in Cyberjaya which working in call center environment.

B. Subjects: The NOC Workers (N=50) working at Telekom Malaysia located in IDC Complex of Cyberjaya formed the population of this study.

C. Inclusion Criteria: The criterion for including the samples in to this study includes: Age (20-55 years), duration of working hours (8 to 12 hours daily), working experience (1 to 32 years) and those who are willing to participate in the study.

D. Methodology: A Questionnaire was designed by keeping in view of the nature of call center work environment and its work-related potential to get physical disorder problems. With respect to the Musculoskeletal Health Problems, only the primary musculoskeletal complaints of the subjects were taken into consideration for the purpose to this study. Questionnaires were distributed to 50 participants and ROSA assessment done for 44 participants. All the data was analyzed with SPSS software ver. 22 using appropriate statistical tests. P-value of less than 0.05 was taken as significant.

3.0 RESULTS AND DISCUSSION

Demographic for this study shows 50 NOC workers were male 62% and female 38% were between the ages of 25-52 years old. All NOC workers had work experience

between 1-32 years and work duration of 8 hours per day (78%) and 12 hours per day (22%) as shown in Table 1.

Refer to Table 2, most common physical disorder associated to Network Operation Center (NOC) which working in call center environment were back pain (52%) followed by neck pain (20%), knee (8%) wrist (8%), legs (6%), shoulder and elbow (4%). Specifically, back pain is the most frequently reported physical disorder problem among the samples of this study whereas; it is significantly associated ($p < 0.05$) with office ergonomic as result shown in Table 3.

Table 1: Demographic Data

Category	Group	Frequency (f)	Percentage (%)
Age	20 - 24	0	0
	25 - 29	9	18.0
	30 - 34	15	30.0
	35 - 39	18	36.0
	40 - 44	4	8.0
	45 - 49	0	0
	50 - 54	3	6.0
	55 - 60	1	2.0
Gender	Male	31	62
	Female	19	38
Years of Service	1-10 years	39	78
	11-20 years	10	20
	21-30 years	0	0
	31-40 years	1	2
Working Hours (Daily)	< 8 Hours	0	0
	8 Hours	39	78
	12 Hours	11	22
	> 12 Hours	0	0
Total (N)		50	100

Several analysis have been done on other factors may contribute to physical disorder risk. No significant differences by gender in the prevalence of symptoms in NOC where no meaningful relation between back pain and male/female ($p > 0.05$). Furthermore, there is no significant relation between back pain and years of service for working at NOC ($p > 0.05$) and the same finding also resulted that, back pain was no significantly associated with daily working hours ($p > 0.05$). The summary is shown in Table 4.

Table 2: Result generated from Body Discomfort survey

Body Part	Frequency	Percent
Back	26	52.0
Neck	10	20.0
Knee	4	8.0
Wrist/Hand	3	6.0
Legs	3	6.0
Shoulder	2	4.0
Elbow	2	4.0
Total	50	100.0

Table 3: t-Test for Ergonomic Risk of Physical Disorder on Back Pain versus Office Ergonomic (Chair)

Contributed Factors			Physical Disorder on Back Pain						
			Yes		No		Total		p-value
Office Ergonomic Survey	Chair provide support for lower back	Yes	14	42.42%	19	57.58%	33	100%	0.025
		No	12	70.59%	5	29.41%	17	100%	
	Able to seat without feeling pressure	Yes	3	12.50%	21	87.50%	24	100%	0.000
		No	23	88.46%	3	11.54%	26	100%	
	Armrests allow to get close to workstation	Yes	26	56.52%	20	43.48%	46	100%	0.03
		No	0	0%	4	100%	4	100%	

Table 4: t-Test for Ergonomic Risk of Physical Disorder on Back Pain versus Gender, Years of Service and Daily Working Hours

Contributed Factors			Physical Disorder on Back Pain						
			Yes		No		Total		p-value
D e m o g r a p h i c	Gender	Male	16	51.61%	15	48.39%	31	100%	0.946
		Female	11	57.89%	8	42.14%	19	100%	
	Years of Service	1-10 years	25	64.10%	14	35.90%	39	100%	0.707
		11-20 years	8	80%	2	20%	10	100%	
		31-40 years	0	0%	1	100%	1	100%	
	Daily Working Hours	8 Hours	28	71.79%	11	28.21%	39	100%	0.631
		12 Hours	5	4.55%	6	95.45%	11	100%	

4.0 CONCLUSION

This study aimed to evaluate the presence of risk factors for physical disorder in an office of Network Operation Center (NOC) in Telekom Malaysia Cyberjaya using the questionnaire and Rapid Assessment Office Strain method (ROSA). Analysis from the questionnaire by using SPSS, the significant factor associated with back pain risk were office ergonomic furniture on chair provide lower back support, able to seat without feeling pressure and armrest allows to get close to workstation. Finding from ROSA, this study showed that most of the NOC workers were exposed to a high ergonomics risk. For prevention of physical disorders risk, there should be ergonomics training for workers to be aware of ergonomics factors in the office workplace.

The training must be provided by the management. Besides that, the design of the workstations should be improved based on the ergonomics principles since the main factors contributed to physical disorder risk is on office ergonomic furniture especially chairs. Finally, to expose employees on the importance of take short break and simple exercise while working at workstation.

ACKNOWLEDGEMENTS

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REFERENCES

- [1] ANSI Z-365. "Control of work-related cumulative trauma disorders: part 1 upper extremities"- working draft, New York, NY, ANSI, 1994.
- [2] Bhuyar P, Banerjee A, Pandve H, Patil A, Rajan S, Chaudhury S. Mental, physical and social health problems of call centre workers. *Ind Psychiatry J.* 2008;17:21–5.
- [3] ANSI Z-365. Control of work-related cumulative trauma disorders: part 1 upper extremities- working draft, New York, NY, ANSI, 1994.
- [4] Bhuyar P, Banerjee A, Pandve H, Patil A, Rajan S, Chaudhury S. Mental, physical and social health problems of call centre workers. *Ind Psychiatry J.* 2008;17:21–5.
- [5] Carpal Tunnel Syndrome Fact Sheet. Retrieved April 2011, from National Institute of Neurological Disorders and Stroke:http://www.ninds.nih.gov/disorders/carpal_tunnel/detail_carpal_tunnel.htm

- [6] Chaffin, D.B. and Park, K.S. "A longitudinal study of low back pain as associated with occupational lifting factors." American Industrial Hygiene Association Journal. 34: 513-525, 1973.
- [7] Hannif, Z., & Lamm, F. Precarious Employment in the New Zealand Call Centre Industry. Labour, Employment and Work in New Zealand, 2004. 14.
- [8] Hannif, Z., & Lamm, F. Occupation Health and Safety in the New Zealand Call Centre Industry ESC Working Paper No 2005/8 Retrieved 3rd March, 2006, Hignett S, McAtamney L. Rapid Entire Body Assessment (REBA). 2005
- [9] Hoekstra E, Hurell J, Swanson N Evaluation of work-related musculoskeletal disorders and job stress among teleservice centre representatives. *Applied Occupational and Environmental Hygiene*. 1995 10: 812-817.
- [10] Hoekstra E, Hurell J, Swanson N. Evaluation of work-related musculoskeletal disorders and job stress among teleservice centre representatives. *Applied Occupational and Environmental*, 1995
- [11] Isabelle Imbard, Dominique Ardiet, Alain Bergeret. Working conditions in call-centers, the impact on employee health: a transversal study. Part II; International Archives Occupational Environmental Health; 2009, 82:pp 747–756.
- [12] Kumar S. Theories of musculoskeletal injury causation. *Ergonomics* 4: 17–47. 2004
- [13] *Hygiene* 10: 812-817. Khalil, T.M., Abdel-Moty, E.M., Rosomoff, R.S., & Rosomoff, H.L. *Ergonomics in Back Pain: A guide to prevention and rehabilitation*. New York, NY.: Van Nostrand Reinhold. 1993.
- [14] Leino P & Magni G. Depressive and distress symptoms as predictors of low back pain, neck shoulder pain and other musculoskeletal morbidity: A 10-year follow-up of metal industry employees. *Pain*, 1993, 53 (1): 89-94.
- [15] McAtamney L, Corlett EN. RULA: a survey method for the investigation of work-related upper limb disorders.
- [16] Montante, J. Cumulative Trauma Disorders. *National Safety News*, March, 46. 1994.
- [17] Putz-Anderson, V. *Cumulative Trauma Disorders: A Manual for Musculoskeletal Diseases of the Upper Limbs*. Bristol, PA.: Taylor and Francis Inc. 1988.
- [18] Sprigg, Christine A., Phoebe R. Smith, and Paul R. Jackson. *Psychosocial Risk Factors in Call Centres: an Evaluation of Work Design and Well-being*. 2003.
- [19] Smith MJ & Bayehi AD "Do ergonomic improvements increase computer workers' productivity? An intervention study in a call center" *Ergonomics* 46(1-3), pp3-18. 2003.
- [20] SPSS Base System User's Guide SPSS Inc, Chicago, Illinois. 1990
- [21] Suri S, Rizvi S. Mental health and stress among call center employees. *J Indian Acad Appl Psychol*. 2008;34:215–20.

- [22] Sudhashree VP, Rohit K, Shrinivas K. Issues and concerns of health among call centre employees. *Int J Occup Environ Med.* 2005;9:129–32.
- [23] Tayyari, F., Smith, J. L. *Occupational Ergonomics.* New York, NY.: Chapman & Hall. 1997.
- [24] Taylor P, Bain P. An assembly line in the head: Work and employee relations in the call centre. *Ind Relat J.* 1999; 30:101–17.

Risk of Musculoskeletal Disorder for General Durability Test Driver

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Abstract – *Prevalence of Musculoskeletal Disorder (MSD) is common among occupational driver, including General Durability (GD) test drivers. The most common MSD problem for occupational drivers is on low back and upper extremity such as neck and shoulder. In PROTON, there were severe MSD recorded among GD test drivers. There were also verbal complaints on minor MSD among GD test drivers. Therefore, the risk of MSD among GD test drivers must be evaluated and methods to control the risk should be identified. This study implemented Hazard Identification, Risk Assessment and Risk Control (HIRARC) process in addressing the issue. Hazards that could contribute MSD to GD test drivers were identified using qualitative and quantitative methods. There were four main hazards which are whole body vibration, long hour driving, seat feel and support and strenuous work. The dominant factor for the prevalence of MS is whole body vibration with 14 GD test drivers (82.4%) relate whole body vibration with MSD that they had. Risk assessment had been done for seat feel and support criteria. It is measured by using Body Pressure Measurement and Nordic Musculoskeletal Questionnaire. Risk control methods had been constructed for all four types of hazards that were identified by using Hierarchy of Risk Control. Among the listed control measures, administrative control methods do seem as viable options due to cost effective, no conflict on design and test requirement and easy to deliver.*

Keywords: Musculoskeletal Disorder, Body Pressure Measurement, Nordic Musculoskeletal Questionnaire, Hazard Identification, Risk Assessment, Risk Control, Automotive Seat

1.0 INTRODUCTION

Occupational driver is a person employed or self-employed person which requires the employee to drive a vehicle as part of his work such as forklifts, car, truck, bus, race car or etc. [1]. Occupational driving is known to be a high-risk activity. Apart from the risk of fatalities resulted from the vehicle accident; the occupational drivers also have the possibility of disabling injury such as Musculoskeletal Disorder (MSD). The most common MSD for Occupational Drivers are on Low Back and Upper Extremity such as neck and shoulder [2-4].

In PROTON, there is 1 case on the prevalence of severe MSD (low back pain) recorded among General Durability test drivers. Meanwhile, there are also few verbal complaints on the prevalence of MSD (minor aches and pain) received from GD test drivers. Prevalence of MSD on GD test drivers can be caused by various factors. Therefore, there is a need to evaluate the risk of Musculoskeletal Disorder for General Durability test drivers and propose methods to control it.

General Durability (GD) test is a complete vehicle test. The testing program was done by driving activity towards specific test distance and performed by the test drivers. According to PROTON Test Standard, General Durability test accumulate driving mileage up to 100,000 kilometres which approximate to 6 months test duration. General Durability test were done in public road and PROTON's proving ground which involve driving activities done by the GD test drivers.

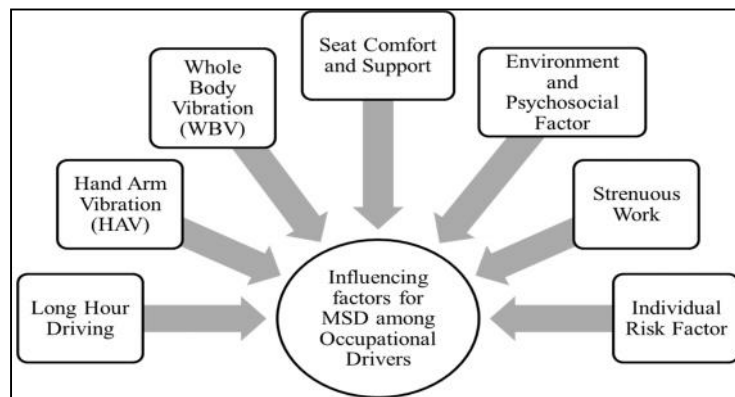


Figure 1: Influencing factors for MSD among occupational drivers

As described in Figure 1, there are 7 influencing factors that could contribute to MSD among occupational drivers. 6 of it are occupational factors. This research will identify influencing occupational factors for MSD among GD test drivers through hazard identification process. Then assess the risk that arises from an influencing factor, which is on seat comfort and support criteria. And finally propose control methods to reduce risk of MSD among GD test drivers.

2.0 METHODOLOGY

2.1 Hazard Identification

Qualitative research method such as interview and observation will be used on Hazard Identification for GD test drivers work activities. Types of hazards are

identified based on Figure 1, which are Influencing Factors for MSD among Occupational Driver. Assessment of the hazards purposely to justify the existence of the hazards within work activity of GD test drivers that could contribute to prevalence of MSD. Only occupational hazards will be assessed, which represents identification of workplace hazards for GD Test Drivers. Among occupational hazards that will be identified are long hour driving, whole body vibration, seat comfort and support and, strenuous work.

2.1.1 Interview Method

A structured interview will be conducted with close response answers. The interview is conducted on 17 members of Durability Group which actively involved in GD testing activity. Analysis of data will be using Quasi-Statistical method. Interviews data are analyzed using descriptive analysis which calculates frequency of selections for respective answers.

2.2.2 Observation Method

Observation method does include workplace inspection, work activity observation and work instrument (vehicle) evaluation. Workplace inspection inspected road surfaces that are used for GD test. Work activity observation observed for any strenuous works or manual works that were done by GD test drivers. Work instrument evaluation includes evaluation of seat support and comfort parameter and vehicle ride comfort between three different car models which are; Proton Iriz, Perodua Myvi and Volkswagen Polo.

2.2 Risk Assessment

Risk assessment will be using semi qualitative approach. The construct of semi-qualitative risk assessment is by using Likelihood and Severity Rating to obtain risk rating and risk level. Likelihood rating will be determined using experimental method which is Body Pressure Measurement. Severity rating will be determined using quantitative method which is Nordic Musculoskeletal Questionnaire.

2.2.1 Body Pressure Measurement

Sample size of 10 test subjects was selected among PROTON staff to be measured their body pressure distribution. Measurement will be done for each anthropometric group of 50th percentile female (155.9 cm) and 99th percentile male (183.5cm) based on stature height [5] Body pressure measurement is conducted using Body Pressure Measurement System (BPMS) provided by Tekscan Inc. Measuring equipment consist of two pressure mat placed respectively on seat cushion (lower mat) and also seat back (upper mat). Make and model of the pressure mat is Tekscan Comformat.

There are a total of 1024 pressure sensels. Each pressure sensel is in 1 X 1 cm size and combined in a 32 X 32 cm sensor area for each pressure mat.

Lower and upper mat were placed respectively on seat cushion and seat back. Measurements were taken with the test subjects in driving posture. The test subject is allowed to do slight adjustments on the tested seat to allow for seating in their most comfortable posture [6]. Measurement will be done on PROTON Iriz driver's seat with synthetic leather upholstery.

Recording and processing of the data will be done by ConforMat Research 7.20 software. Data that will be extracted are values of Contact Pressure (P_{ave}) and Peak Contact Pressure (P_{peak}). Recorded data will be viewed in Two Dimensional (2-D) contour with Fixed Area Averaging displays [7]. Extracted data are classified by different body parts as per Figure 2 [8]. Pressure scale is set at 0 to 60 mmHg. As described in Table 1, there are 5 characteristics of seat comfort and support that will be tested based on evaluation of seat comfort and support for seat cushion and seat back design.

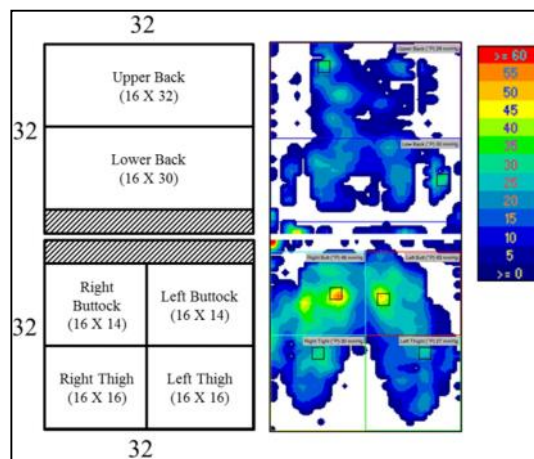


Figure 2 : Box size for body pressure data analysis

2.2.2 Nordic Musculoskeletal Questionnaire (NMQ)

Respondents for NMQ consist of 17 GD test drivers. NMQ will be used to obtain history of MSD problem among GD test drivers. The questions are constructed with Single Response set of answers. Questionnaires data are analysed using descriptive analysis which calculates frequency of selections for respective answers.

Table 1 : Design characteristics based on Body Pressure Measurement data

Criteria	Description	Design Criteria	
		Seat Back	Seat Cushion
1	Peak Contact Pressure for entire body contacted surface is < 60 mmHg		
2	Peak Contact pressure at Lumbar (Lower Back) 18.75 mmHg		
3	Contact Pressure at Lower Back is Higher than Upper Back		
4	Contact Pressure at Buttock Higher than Thigh		
5	Peak Contact Pressure is beneath Buttock (Tuberosity) only		

2.2.3 Risk Rating Matrix

Two risk rating matrix is derived for Seat Back and Seat Cushion design. Risk rating matrix is adapted from Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC) which was published by DOSH, Malaysia [9]. Likelihood rating matrix as Table 2 is self-developed and severity rating matrix as Table 3 is adopted from Guideline for HIRARC. Likelihood rating is evaluated from Body Pressure Measurement. While Severity rating for seat back and seat cushion design is determined by most severe MSD symptom on Upper and Lower Back, and Hip or Thigh respectively.

Table 2 : Likelihood rating matrix for Seat Back and Seat Cushion design evaluation

Likelihood (L)	Definition	Rating
Most Likely	All 99th percentile Male & 50th percentile Female not meet all design criteria	5
Possible	All 99th percentile Male not meet all design criteria	4
Conceivable	All 99th percentile Male meet at least 1 criteria	3
Remote	All 99th percentile Male meet at least 2 criteria	2
Inconceivable	All 99th percentile Male & 50th percentile Female meet all design criteria	1

Table 3 : Severity rating matrix

Severity (S)	Definition	Rating
Catastrophic	Numerous fatalities, irrecoverable property damage and productivity	5
Fatal	Approximate one single fatality or major property damage if hazard is realized	4
Serious	Non-fatal injury, permanent disability	3
Minor	Disabling but not permanent injury	2
Negligible	Minor abrasion, bruises, cuts or first aid type injury	1

3.0 RESULTS AND DISCUSSION

3.1 Hazard Identification

From interview data, 17 GD test drivers (100%) had experienced MSD during their work. 16 (94.1%) relate it with occupational factor. The respondents relate MSD problem with long driving hour (9, 52.9%), whole body vibration (14, 82.4%), seat comfort and support (2, 11.8%) and strenuous work (3, 17.6%).

Findings from interview data are supported by observation data. A GD test driver required to drive continuously for 1 hour in test track before driver change. And, 8 hour of driving or sitting on passenger side for public road driving. GD test drivers especially technician level are required to perform strenuous work such as lifting dummy weight, tear down activity and vehicle servicing. GD test drivers were exposed on whole body vibration while driving through impacted surface such as Belgium pavement, Washboard and Speed Hump. Seat comfort and support evaluations on 3 vehicles provide different level of seat comfort and support.

3.2 Risk Assessment

For Seat Back design, only 1 design criteria (Design Criteria 1) was fulfilled on group of 50th percentile Female, while 2 design criteria (Design Criteria 2 and 3) were fulfilled on group of 99th percentile Male. For Seat Cushion, only 1 design criteria (Design Criteria 1) was fulfilled on group of 50th percentile Female, while none of design criteria was fulfilled on group of 99th percentile Male. Therefore, Likelihood rating for Seat Back design is rating 2 and for Seat Cushion design is rating 4.

Table 4 : Prevalence of MSD among GD test drivers

Body Part	MSD Experienced Past 12 months		Severe MSD Experienced Past 12 months	
	Frequency, N (%)		Frequency, N (%)	
Upper Back	10	58.8%	0	0.0%
Lower Back	17	100.0%	2	11.8%
Hip or Thigh	12	70.6%	0	0.0%

From Table 4, 2 GD test drivers perceive severe MSD trouble on Lower Back, with one of them was diagnosed with Herniated Vertebral Disc and was recommended for Light Duty work. Therefore, Severity rating for Seat Back design is rating 3 and for Seat Cushion design is rating 1. Calculated Risk rating for seat cushion is 4 with Low risk level and for seat back are 6 with Medium risk level.

3.3 Risk Control

3.3.1 Seat Comfort and Support

From Figure 3, 3 main problems were addressed. First problem is 4 out of 5 test subjects (50th percentile female) had peak contact pressure, P_{peak} at thigh higher than buttock area. Reach of right foot to accelerator pedal is a little bit farther compared to left foot when rested on foot rest. Therefore require redesign location of Accelerator pedal slightly to the left and reduce Seat Cushion length. Second problem is 4 out of 5 test subjects (50th percentile female) had contact pressure, P_{ave} at lower back area lower than upper back. This indicates high lumbar support height for smallest size test subjects. Therefore, height of lumbar support should be reduced to accommodate smallest size population. Third problem is all test subjects had high concentrated pressure on contact area between seated body and Cushion Bolster or Seatback Bolster. Seat bolster does affect the perception of comfort in a good way [10]. But the concentrated pressure outside tuberosities is contradicted with design criteria on body pressure. Therefore, the result had to be reconfirmed with Subjective Discomfort evaluation.

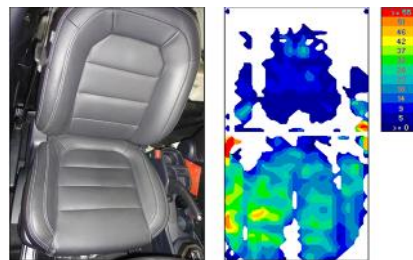


Figure 3 : Body pressure data for 50th percentile female on Proton Iriz seat

3.3.2 Whole Body Vibration

Risk of MSD from whole body vibration can be reduced by lowering exposure time by reducing driving time. Besides that, optimum vibration isolation from suspension system had to be designed and tuned to prioritize on comfort level. Finally, seat design need to utilize advance seat cushion materials which have higher vibration dampening properties and also other innovative solution on seat design such as floating seat system [11-12].

3.3.3 Long Driving Hour and Strenuous Work

To reduce risk of MSD from long driving hour and strenuous work, Administrative Control methods is the most viable. Among administrative control methods that were suggested are training and briefing to promote awareness on correct work posture, reduce driving time and suggest for short periodical break within long driving time, promote healthy lifestyle and perform light stretching prior start of work and during periodical break.

4.0 CONCLUSION

HIRARC process had been completed for GD test drivers work activities. Four main types of hazard that would contribute to MSD among GD test drivers were obtained through hazard identification which is long hour driving, Whole Body Vibration, inadequate seat comfort and support, and strenuous work. Highest responses indicate prevalence of MSD may result from Whole Body Vibration. Risk assessment had been done in term of inadequate seat comfort and support hazard and found out that the tested seat (Proton Iriz) have Medium Risk level of MSD from Seat Back design and Low Risk level of MSD from Seat Cushion design. Risk control method had been developed to reduce risk of MSD among GD test drivers. Only options of Administrative Control method is possible to be implement immediately.

REFERENCES

- [1] Newnam, Sharon A., and Barry Watson. "Work-Related Driving Safety in Light Vehicle Fleets: A Review of Past Research and the Development of an Intervention Framework." *Safety Science*, (2011) 49 (3): 369–381.
- [2] Akinpelu, A. O., O. O. Oyewole, A. C. Odole, and R. O. Olukoya. "Prevalence of Musculoskeletal Pain and Health Seeking Behaviour among Occupational Drivers in Ibadan, Nigeria." *African Journal of Biomedical Research* 14 (May 2011): 89–94.
- [3] Alperovitch-Najenson, Deborah, Yoav Santo, Youssef Masharawi, Michal Katz-Leurer, Diana Ushvaev, and Leonid Kalichman. "Low Back Pain

- among Professional Bus Drivers: Ergonomic and Occupational-Psychosocial Risk Factors.” The Israel Medical Association Journal : IMAJ 12, 1. (2010): 26–31.
- [4] Bawa, MukeshSuresh, and Manissha Srivastav. “Study the Epidemiological Profile of Taxi Drivers in the Background of Occupational Environment, Stress and Personality Characteristics.” Indian Journal of Occupational and Environmental Medicine, (2013), 17 (3).
- [5] Karuppiah, Karmegam, Mohd Sapuan Salit, Mohd Yusof Ismail, Napsiah Ismail, Shamsul Bahri Mohd Tamrin, Mohana Krishnan Gobalakrishnan, Seetha Palanimuthu, and Thiyagu Palaniandy. “Anthropometry of Malaysian Young Adult”. Journal of Human Ergology, (2011), 40 (1-2): 37–46.
- [6] Chae, Songyi, Gyouhyung Kyung, and Kyunghyun Nam. “Measuring Drivers’ Dynamic Seating Experience Using Pressure Mats.” In Design, User Experience, and Usability: Part 2, edited by A Marcus (Ed.), 368–75. 2011.
- [7] Kyung, Gyouhyung. “An Integrated Human Factors Approach to Design and Evaluation of the Driver Workspace and Interface: Driver Perceptions, Behaviors, and Objective Measure.” Virginia Polytechnic Institute and State University. 2008.
- [8] Kyung, Gyouhyung, and Maury A. Nussbaum. “Driver Sitting Comfort and Discomfort (Part II): Relationships with and Prediction from Interface Pressure.” International Journal of Industrial Ergonomics, 2008, 38 (5– 6): 526–38.
- [9] Department of Occupational Safety and Health Malaysia. 2008. Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC).
- [10] Coelho, Denis A, and Sven Dahlman. “A Pilot Evaluation of Car Seat Side Support: Leading to a Redefinition of the Problem.” International Journal of Industrial Ergonomics, 1999, 24: 201–10.
- [11] Wada, Hiroshi, Yoshinori Toyota, Akio Horie, Takayuki Sasaki, Chitoshi Suzuki, and Hiroki Fukuda. “Automotive Seating Foams with Excellent Riding Comfort Prepared by a Novel Polypropylene Glycol.” Polymer Journal, 2008, 40 (9): 842–45.
- [12] Yabe, Kengo, Toru Inagaki, and Takashi Kondo. “Adoption of Floating Seat in a Vehicle to Reduce Seat Vibration.” In SAE 2015 World Congress & Exhibition. 2015.

Level of Parents' Awareness on Children's Safety at Public Playground Taman Tasik Titiwangsa

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Abstract – *Playground is one of the best places in providing the essential experiences for children's physical activities, health and growth as it provides adequate facilities and play opportunities. Since most public playgrounds are developed on open space, parents should be concerned on the surrounding environment and should aware on the safety and health of their children. Thus, the aim of this study is to determine the level of parents' awareness on children's safety and health at the public playground in relation to the physical environment, social environment, and safety and security. The methodology adopted in this study is via distribution of survey questionnaires to 220 participants and observation on the behaviour of the parents and children at the playground. The focus is to parents with children under 15 years old visiting the public playground at Taman Tasik Titiwangsa, Kuala Lumpur. The data is analysed via quantitative analysis using IBM SPSS software. The results of the study revealed that majority of parents, regardless of gender and ethnic background, are aware about the safety and health of their children at the playground and they are satisfied with the conditions of the facilities provided. Although parents are aware of safety and health at public playground, the study also reveals that there is no safety management system establish by the park management which could provide safety guidance and safety precautionary measures to the parents' visiting the playground with their children. The authority concerned should also develop a safety policy that provides regulations and guidelines to enhance parents' awareness and conscientiousness towards safety and health at the public playground.*

Keywords: Public Playground; Parents; Children; Safety Awareness; Guidelines

1.0 INTRODUCTION

Playgrounds are great assets for many communities in Malaysia. The place provides a gathering place where children can have fun and parents alike can get opportunity to socialise amongst them. If there are children in the playground we often see laugh and cry, climb and fall, running and swinging, playing tag and hide-and-seek, where a few bruises and scratches will be part of the scenario. According to S.A.F.E. Research, playground injuries are the leading cause of injury to children

ages 5 to 14 years old [1]. It is estimated that one-third of playground-related deaths and 75 percent of playground equipment-related injuries occur on public playground. In Malaysia, it is estimated that the Emergency and Trauma Departments has treated around 10,000 to 15,000 children ages 14 and younger for playground injuries annually, half of these injuries are severe resulted in hospitalisation and costs millions for medical, legal and liability, pain and suffering, and work loss expenses [2].

There are issues related to safety and no matter how happy the children are enjoying their play, they are still vulnerable to the unsafe conditions of the playground [3]. If we spent just one hour on the playground, there is a good chance that we will see a child cry. Unknowingly, accident can happen and the children can become hurt or severely injured. One of the main reasons for injuries at the playground is the lack of active surveillance by the children's parent [4]. Parental concerns about a child's safety have been recognized as one of the major reasons why parents restrict their child's independent mobility [5]. Safety concern is more in parents with younger children than parents with older children. Parents have to be more vigilant, supervise their children and be aware of safety and security related issues at playground. Parents should elevate their awareness about safety and should have positive attitude towards accident prevention. Parents can also help to avoid any untoward incidents that can cause harm to their children by highlighting the safety and security issues to the relevant authorities.

The objectives of this study are, this study was to investigate the level of parents' awareness on safety of their children at the public playground. This study is to gauge the level of parents' awareness on the physical aspect of the playground, how they feel about the condition of the facilities provided, how comfortable are the parents on the maintenance and servicing of the equipment, housekeeping of the surrounding areas, condition of barricades, walkways, waterways, ponds, etc. The second objective is to examine the level of awareness among genders and among different main ethnic groups in Malaysia on how they perceive safety at the playground and whether the parents are comfortable with the safety aspect at the playground. Finally, to propose a guide on safety awareness that could help prevent children injuries at playground. By having the guidelines we could impress parents to be more passive towards child safety and to create the playground environment as a good place to play and enjoy without harm and worry. In addition, the government should step in to develop a policy on safety awareness that could help prevent children injuries at playground. This presents a clear message to governments for widespread support of additional investment in child accident prevention.

2.0 LEVEL OF PARENTS AWARENESS ON CHILDREN SAFETY

In this research, three issues related to safety at public playground were identified, such as, physical environment, social environment, and, safety and security.

2.1 The Physical Environment

In B.E. Saelens research, mentioned that the presence of good physical environment i.e. playground features are the factors that parents rate as important condition in determining parents' satisfaction when they bring their children to the public playground [6]. Being children, they like to do all kinds of activities and they do not know whether the equipment provided at the playground is safe to use. Howard A.W. also mentioned that majority of accidents happen at public playgrounds, often due to compromised safety standards by both the manufacturer of playground equipment and those responsible for constructing and maintaining the playground [7].

2.2 The Social Environment

Public playgrounds not only help develop quick problem solving ability in children, but also increase their interaction both physically and socially. In the past few decades, social fears have been pervasive and this explains the restriction of movement of children by their parents [8]. Because of the exposure to anti-social behaviour, such as fear of drug addiction, kidnapping and rape and also concern about strangers, parents would not permit their children to go alone to the local playground [9]. Valentine G. and McKendrick J. state that 70% of parents, who have eight to eleven years old children, were worried about social problem and road traffic as major restrictions for children's active free-play [10]. If a child is seen using the playground facilities unsupervised and in a dangerous manner, others should cast an eye to take a look out and warn the child of the child unsafe act. Other parents should not take a blind bit of notice that nothing untoward would happen.

2.3 Safety and Security

Yeen O. I., in the Star Online report, mentioned that whilst the park playground provides a place to have fun, to do physical exercise and recreational activities, the park can be a dangerous place to children if safety is ignored [11]. Gill Valentine and John McKendrick, in their research conducted in North-West England, was concluded that the most significant influence on children's access to independent play is not the level of public provision of play facilities but parent anxieties about children's safety [10]. Children tend to play everywhere and play with everything without thinking about safety when unsupervised. There are parents

that are not fear of letting their children play unsupervised. They seemed not wary about issues relating to safety and security such as fears of ‘stranger danger’ i.e. about cases of child abduction [12].

3.0 RESEARCH FRAMEWORK

The Conceptual Framework used in this research is based on the following variables i.e. the independent variables relating to physical environment, social environment, and safety and security. The dependent variables are the parents of children gender and parents of children ethnic groups. The conceptual framework of this study is demonstrated in the following Figure 1.

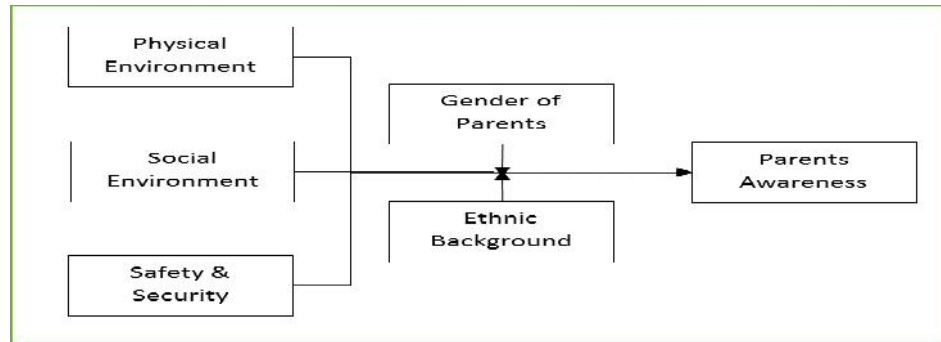


Figure 1: Conceptual Framework

4.0 METHODOLOGY

The research methodology approach will be based on survey questionnaires method for primary data collection and analysed using Quantitative Research method. A set of survey questionnaires are designed based on previous studies conducted journals, and websites. The questionnaires will be distributed during weekends, on a Saturday and Sunday amongst parents of children visiting the public park playground. The weekend were chosen as this will be the time where parents are free of office duties and they would normally take their children for play activities at the Taman Tasik Titiwangsa public playground.

A total of 220 survey questionnaires forms will distributed to parents of children below the age of 15 years old. Parents complete the questionnaires and the completed survey forms will be collected on the spot. The data collected will be analysed using descriptive statistical analysis software, Statistical Package of the Social Sciences (SPSS) IBM version 21, to determine the data frequency. T-test and One-Way ANNOVA statistical analysis model will be used to explore

perceived environment based on the physical environment, social environment, and safety and security issues to determine the level of parents' awareness with respect to children safety at public playground. The survey result will be presented in the form of tables, pie charts, bar charts etc.

5.0 RESULTS AND DISCUSSION

The study involved the descriptive statistical analysis based on the opinions and views obtained from parents or guardians at the public playground Taman Tasik Titiwangsa, Kuala Lumpur. The methodology adopted in this study is via distribution of survey questionnaires to 220 participants and observation on the behaviour of the parents and children at the playground.

The focus is on parents with children under 15 years old visiting the public playground with their children. The data is analysed via quantitative analysis were performed using the Statistical Package IBM SPSS Version 21. Data analysis by inferential involves the use of statistical methods mean i.e. Independent T-test to compare gender differences and ANOVA tests to determine the relationship and differences between the variables based on hypotheses and the research questions. Reliability test was applied on the three independent variables i.e. Physical Environment, Social Environment, and Safety and Security using the Cronbach's Alpha Coefficient. The test will show the relationship between the three independent variables and how the variables would agree with one another.

Based on the results computed, the Cronbach's Alpha for overall reliability of the instrument used to determine the Parent's Safety Awareness exceeds $\alpha = 0.70$ which is an acceptable reliability level. The reliability of the questionnaires used in the research was Excellent. The findings also reveal that parents' awareness on children safety with respect to each independent variable at the public playground was high. Based on the overall results of the statistical analysis in relation to the three independent environmental factors, the findings show that overall parents' safety awareness was at Medium High level.

As derived from the data analysis, the three elements of environmental issues as well as the overall parents' awareness on safety are all equally satisfying. Each of the environments share the same concern on the safety at the public playground. Although there are some things where parents have control and can take protective measures (for example, watching their children climbing, and the like), however, there are several other reasons why parents may feel helpless to protect their children.

Based on Objective No. 2, the researcher analysed the relationship and determine the level of parents' awareness on children safety at the children's playground based on gender and race. A hypothesis to determine whether there is a significance difference between the parents' awareness on children safety at the children's playground based on gender showed that there is no significant difference between genders relating to parents' awareness on children safety. Further, the study proceeded to determine the level of parents' awareness on children safety at the children's playground in respect of differences among ethnic group. Using One-way analysis of variance, i.e. One-way ANOVA test, reveals that the hypothesis fails to reject as there is no significant difference regarding parents' awareness on children safety between the ethnic groups.

Findings of the study reveal that the level of parents' awareness on children's safety at public playground is above the mean value and parents are seemed to be aware of the safety and security issues. They display concern on their children's safety and they take note of the physical environment, social environment and safety and security issues at the public playground. Most parents feel comfortable when they are in the vicinity of well-maintained public playgrounds and the play equipment is in good and well-kempt condition. They seemed to be comfortable with the safety and security of the surroundings and their child could venture around the playground safety as there are also other parents and children at the playground. However, in reality, some parents confess that they are not able to keep a watchful eye on their children all the time whilst they are at the public playground. This is the most common response when asked why some parents may find it hard to protect their children at all times in order to prevent accidental injury to their children. Lack of awareness or knowledge about the causes of accidents is the frequent response given to prevent accidental injury.

Safety awareness among manufacturers of playground facilities is evident in the improvement of the design and provisions for safety of the equipment as can be seen from the many equipment at Taman Tasik Titiwangsa. The park management also needs to undertake various initiatives to improve the facilities and enhance the surrounding landscape. The park management also needs to be aware about the need for safety surfacing of the playground flooring, and improve the depth required to adequately cushion the impact of a child's fall to the surface as evident from the current situation of the public playground. It appears that the playground is no longer safer than ever. In 2008, the Kuala Lumpur City Council (DBKL) has initiated a master development blueprint to reorganize and improve the conditions of recreational parks in Kuala Lumpur in order to enhance livelihood of city dwellers with good recreational park.

6.0 CONCLUSION

This paper presents the importance of safety at playground and outlined that majority of parents are satisfied with the adequacy of public play opportunities for their children through which the children can develop physically, mentally and socially. Based on the research findings about safety at the public playground Taman Tasik Titiwangsa, most parents' level of awareness about safety of their children were more than satisfactory. The results of the study revealed that majority of parents, regardless of gender and ethnic background, are satisfied with the facilities provided and they are aware about safety and health of their children at the playground.

The study and observation notes revealed that parents perceive the elements of good maintenance of the playground facilities, good housekeeping of the green space, adequate sign board, adequate separation and effective physical barriers in the form of hedges between the playground boundary and the lake in the park in protecting children from accidents and injuries.

The priority concerns of safety awareness among parents with regards to safety of their children at the public playground should be increased rather than being moderately satisfied with what are provided. Parents' level of awareness on safety of the play facilities, condition of the equipment and the maintenance, as well as housekeeping at the playground should be given due concerned and not just being satisfied with whatever that is available if there is a playground and the children can enjoy. There are parents who claimed that they find it difficult to watch and protect their children all the time when they are at the public playground.

Lack of safety and health awareness or knowledge about the causes of accidents on the public playground is some of the identified responses given by the parents in preventing accidental injury. Parents seem unaware of hazards at public playground especially when using the play equipment but they show more concern with the children safety and security being kidnapped rather than getting injured. However, this has yet to be ascertained and can be pursued in future research.

Most importantly, parents should increase their awareness about safety at the children playground and should have a positive attitude towards accident prevention. Having a positive attitude among parents, no matter what gender they are and whichever race they belong to, most injuries involving children can be avoided.

Manufacturer of playground equipment should be responsible to design the playground facilities with the characteristics of child safety in mind and the management of the playground must ensure safety regulations apply to all

playgrounds. This role should be taken seriously by the manufacturer and playground management in ensuring the instructions on the safety of children is clear.

In spite of parents' awareness on children safety at public playground, the authority concerned should also develop a policy that provides guidelines to enhance parents' awareness and conscientiousness towards safety and health at the public playground. Safety of children is not only the responsibility of parents, but it is also the responsibility of non-governmental organizations (NGOs) and government agencies involved in child safety initiatives. Government should step in to develop a policy on safety awareness that could help prevent children injuries at playground. This presents a clear message to governments for widespread support of additional investment in child accident prevention. With proper guidelines, would enable parents to take safety and health issues seriously.

REFERENCES

- [1] S.A.F.E. Research, *Safe at Play*. Par . 2. <http://www.safeatplay.or/research.html> 2016.
- [2] Chan Li Jin,. Make Sure the Children are Safe When They're Having. *The Star Online*. June 8, 2011: par 11 <http://www.thestar.com.my/lifestyle/features/2011/06/08/2011>
- [3] European Consumer Safety Association.. Parents' Perceptions of Child Safety – A 14 Country Study. *European Child Safety Alliance*, P.O Box 75169, 1070 AD Amsterdam, The Netherlands
<http://www.childsafetyeurope.org/publications/info/200>
- [4] PPj, P.P. Certified Playground Safety Inspector. *Certified Playground Inspector Course*. <http://www.ppj.gov.my/CPSI-2015.pdf>. 2015.
- [5] Veitch, J., S. Bagley, K. Ball and J. Salmon,. Where do children usually play? A qualitative study of parents' perceptions of influences on children's active free-play. *Health and Place*, 12(4): 383-393. 2006
- [6] Brian E. Saelens, et.al Measuring Physical Environments of Parks and Playgrounds: EAPRS Instrument Development and Inter-Rater Reliability". *Journal of Physical Activity and Health*, 2006, 3, Suppl 1, S190-S207.
- [7] Howard, A.W. Keeping children safe: Rethinking how we design our surroundings. *CMAJ: Canadian Medical Association Journal = Journal De L'association Medical Canadienne*, 2010. 182(6), 573-578.
doi: 10.1503/cmaj.080162
- [8] Prezza, M., F.R. Alparone, C. Cristallo and S. Luigi, Parental perception of social risk and of positive potentiality of outdoor autonomy for children: The development of two instruments. *Journal of Environmental Psychology*, 2005, 25(4): 437-453.

- [9] Blakely, K., Parent's conception of urban danger and relationship to children's access to their neighborhood. Unpublished doctoral dissertation, City University of New York, Graduate School and University Center. 1993
- [10] Gill V. and John M. Children's Outdoor Play: Exploring Parental Concerns About Children's Safety and the Changing Nature of Childhood. *Geoforum*, Vol. 28, No. 2 pp. 219-235, 1997
- [11] Oh Ing Yeen, More should be done to make our playgrounds safer. *The Star Online*, May 2014.
- [12] Stokes, M. A., Stranger Danger: Child Protection and Parental Fears in the Risk Society. *Amsterdam Social Science*, 2009, Vol. 1(3): 6-24.

Evaluation of Musculoskeletal Disorders among Computer Users

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Abstract –In the modern era of computer usage, prevalence of work-related musculoskeletal disorders (MSDs) have become the common ergonomic problems among computer users. Evaluation of musculoskeletal disorders (MSDs) among computer users can create action to reduce musculoskeletal disorders. As continuity of previous researches on musculoskeletal disorders (MSDs), the aim of the research was to evaluate risk factors of musculoskeletal disorders (MSDs) among computer users by Nordic questionnaire and Rapid Office Strain Assessment (ROSA) methods. This research was conducted among 246 computer users in Universiti Sains Islam Malaysia (USIM). The data were analysed in Statistical Package for Social Sciences (SPSS) version 21. The results of Nordic questionnaire showed that the most prevalence of musculoskeletal disorders (MSDs) among computer users in the case study area were in the body regions of neck (19.9%), upper back (19.5%), and shoulder (17.4%) respectively more than in other body regions. Based on the results of ROSA, 77.2% of the computer work stations in the case study area were at medium risk level, which was acceptable but serve as notification to improve the work stations.

Keywords: Computer User, Musculoskeletal Disorders, Nordic Questionnaire, Rapid Office Strain Assessment

1.0 INTRODUCTION

The amount of computer use has increased dramatically in the past 2 decades. It has become common tool especially in office environment. Nowadays, many companies depend on computer technology to complete many tasks with fewer employees and time (1). Computer is used frequently by user to complete tasks like minimize documentation, storage big data, create proper filing and so on. In relation to computer use and ergonomic, previous researches have shown that most computer users are likely to experience musculoskeletal discomforts. Some parts of the body can be affected during or after working with computers, especially neck, shoulder, back, hands and wrists. Musculoskeletal disorders, muscle disorders, tendons, peripheral nerves, joints, bones, ligaments and blood vessels are the result of

unsuitable posture, repetitive motion and others related. These disorders can lead to the symptoms such as pain, tingling and numbness. These symptoms among computer users at office can reduce time effective work and production costs and increase compensation for work (2). A combination of ergonomic risk factors such as workstation design, awkward posture, repetitive movements, static postures, working long hours without rest breaks and psychological factors are linked to musculoskeletal disorders (MSDs).

In this matter, ergonomic risk assessment can effectively help to identify the most important computer use risk factors. Two main methods used for ergonomic risk assessment in the field of computer workstation ergonomics are Nordic questionnaire and Rapid Office Strain Assessment (ROSA). Nordic questionnaire was developed from a project funded by the Nordic Council of Ministers. The aim was to develop and test a standardized questionnaire methodology allowing comparison of low back, neck, shoulder and general complaints for use in epidemiological studies (3). ROSA is a method developed by academicians from universities at Canada, which is a picture-based postural targeting screening tool for quantifying exposure to risk factors for office worker (4). In research of MSDs and computer workstation ergonomics, both methods can be used as risk assessment to determine action for change based on related problems. Ergonomic interventions such as computer workstation redesign, occupational gym programs, and computer workstation ergonomics guideline can help to solve these problems. With the ergonomic interventions, risk factors of MSDs among office workers can be reduced and computer workstation ergonomics can be achieved.

2.0 METHODOLOGY

This cross-sectional study was conducted on 246 computer users, among 687 administrative staff in Universiti Sains Islam Malaysia (USIM). The number of participants to participate was considered according to the formula (5) below:

$$S = \frac{X^2NP(1-P)}{d^2(N-1) + X^2P(1-P)}$$

S = Required Sample size

X = Z value (e.g. 1.96 for 95% confidence level)

N = Population Size

P = Population proportion (expressed as decimal) (assumed to be 0.5 (50%))

d = Degree of accuracy (5%), expressed as a proportion (.05); It is margin of error

Data collection tools were standardised Nordic questionnaire and Rapid Office Strain Assessment (ROSA) checklist. Section A of Nordic questionnaire comprises

demographic profile of respondents which are work department, gender and age. Section B is on respondents' profile related to computer use such as computer use time, rest break, work experience related to computer use, and physical exercise. Section C is on musculoskeletal disorders (MSDs), or musculoskeletal complaints in body regions. In section C, respondents choosing 'Yes' rather 'No' participated in question of the prevalence of MSDs in the past 12 months. Severity and frequency level of pain for body regions which were neck, shoulder, arm, elbow, hand and wrist, upper back, lower back, hip, thigh, knee and feet were each divided into 3 categories to be ticked by the respondents. Severity level of pain was 1=Mild pain (barely noticeable, without interrupting with work activities), 2= Moderate pain (without interrupting work activities), and 3= Severe pain (interrupting work activities). Frequency level of pain was 1=1-2 times per year, 2=1-2 times per month (certain months), and 1-2 times per week/everyday (certain weeks/days). Then, body discomfort level, which represented MSDs, was produced by severity level multiplied with frequency level. Body discomfort level 3,4,6, and 9 were considered and included in the final analysis of the prevalence of MSDs.

Rapid Office Strain Assessment (ROSA) checklist, an ergonomic risk assessment method to quantify exposure of risk factor related to computer workstation, was used to attain score for each subsection of computer workstation, which were subsection A-Chair, subsection B- Monitor and Telephone, subsection C-Mouse and Keyboard, and ROSA final score. In subsection A-Chair, total score of Chair Height and Pan Depth are combined, and matched with total score of Arm Rest and Back Support, based on ROSA scoring chart, to receive score of subsection A-Chair. A score of -1 will be assigned if the worker spends less than 1 hour a day in the chair throughout the day. If the worker spends 1-4 hours a day the duration score is 0. If the worker spends more than 4 hours a day in the chair, the duration score will be +1. Duration score is added to score of the chair score to receive final subsection A-chair score. In subsection B-Monitor and Telephone, total score of monitor is added to duration score, and then matched with total score of telephone and duration score. In subsection C-mouse and keyboard, total score of mouse is added to duration score, and then matched with total score of keyboard and duration score. Subsection B and C are matched to receive total score of peripherals and monitor. Finally, subsection A-chair is matched with peripherals and monitor to receive final ROSA score. Score from 1 to 2 is considered as low risk and acceptable. Score from 3 to 5 is considered as moderate risk, still tolerable but serve as notification area. Score of higher than 5 is considered as high risk and need ergonomic intervention in term of computer workstation.

3.0 RESULTS AND DISCUSSION

246 respondents filled the Nordic questionnaire, and were assessed by Rapid Office Strain Assessment (ROSA) method. Demographic and work characteristics

of respondents are shown in Table 1. The participants included 116 (47%) men and 130 (53%) women. Most respondents which were 98 (40%) respondents are 30 to 39 years old, and 84 (34%) respondents are 20 to 29 years old. Most respondents which were 142 (87.8%) respondents reported that they use computer more than four hours per day. 76 (30.9%) respondents take a rest break after every 1 hour of working on a computer. About 107 (43.5%) respondents have less than 5 years of work experience related to computer, and 89 (36.2%) respondents do physical exercises 1 time per week.

Table 1: Demographic information and work characteristics of the respondents
(n=246)

Characteristics	Grou	No.	%
Gender	Male	116	47
	Female	130	53
Age	20 to 29 years old	84	34
	30 to 39 years old	98	40
	40 - 49 years old	52	21
	50 years old above	12	5
Computer use time	Less than 1 hour	20	8.1
	1 to 4 hours	84	34.1
	More than 4 hours	142	57.7
Rest Break	Every 30 minutes	30	12.2
	Every 1 hour	76	30.9
	Every 2 hours	40	16.3
	More than 2 hours	69	28
	Never	31	12.6
Work experience related to computer use	Less than 5 years	107	43.5
	5 to 15 years old	97	39.4
	More than 15 years old	42	17.1
Physical exercise	Always(2 times per week)	72	29.3
	Sometimes(1 time per week)	89	36.2
	Seldom(1 time per month)	78	31.7
	Never	7	2.8

In Figure 1, the prevalence of musculoskeletal disorders (MSDs) in different body regions of the respondents in the past 12 months are shown. In the past 12 months, the prevalence of musculoskeletal complaint of the neck, shoulder, arm, elbow, hand and wrist, upper back, lower back, hip, thigh, knee, and feet were 8.1%, 6.5%, 5.2%, 2.5%, 7%, 7.3%, 4.1%, 4.8%, 4.8%, 5.3%, and 5.7% for men, respectively. For women, the prevalence of musculoskeletal complaints of the neck, shoulder, arm, elbow, hand and wrist, upper back, lower back, hip, thigh, knee, and feet were 11.7%, 10.9%, 9.8%, 4.8%, 5.6%, 12.2%, 9.3%, 4.4%, 5.3%, 6%, and 6%, respectively. Based on the figure, the prevalence of MSDs was higher among women than men. The body regions of upper back (12.2%), neck (11.7%), and shoulder

(10.9%) recorded the highest prevalence of MSDs among women. In total, the most prevalence of musculoskeletal disorders (MSDs) of the computer users in the case study area, for men and women were in the neck, upper back and shoulder regions.

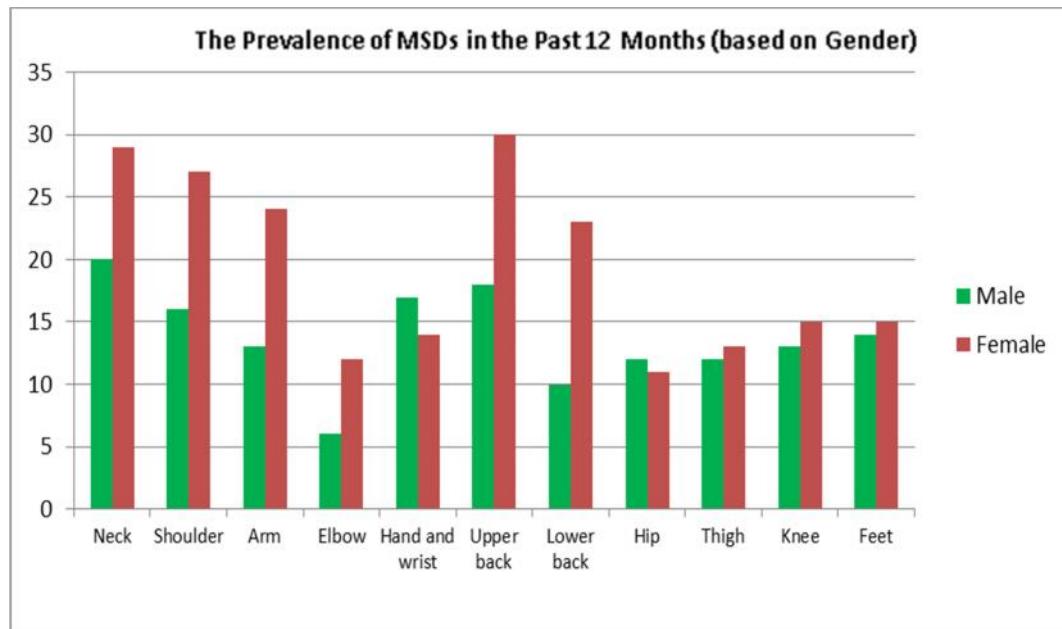


Figure 1: The prevalence of musculoskeletal disorders (MSDs) in the past 12 months (based on gender)

The results of ergonomic risk assessment are shown in Table 2. The mean of ROSA final score was 3.85 ± 1.32 . This score indicates medium risk for the studied respondents and workstations. The mean of scores for chair, monitor and telephone, and mouse and keyboard were 3.39 ± 1.23 , 2.22 ± 0.86 , 3.08 ± 1.32 , respectively.

Table 2: Rapid Office Strain Assessment (ROSA)

Section	Mean	Standard Deviation (SD)
Chair	3.39	1.23
Monitor and Telephone	3.02	0.86
Mouse and Keyboard	3.08	1.32
ROSA Final Score	3.85	1.32

In Figure 2, Rapid Office Strain Assessment (ROSA) result by risk groups was identified. 77.2% of the respondents or computer workstations recorded ROSA final score 3,4 and 5. While, the mean ROSA final score was 3.85 as shown in Table 2. This indicates that the computer workstations in the case study area were at medium risk level, thus need monitoring and future improvement by office management. In term of workstation risk factor in ROSA analysis, long pan depth of

the chair, high monitor screen which causes neck extension, far placement of telephone from computer users, holding telephone between neck and shoulder, and placement of mouse and keyboard on different surfaces, were identified as the highest workstation risk factors which caused high body discomfort level among the computer users in the case study area. High workstation risk factors have to be reduced with ergonomic interventions.

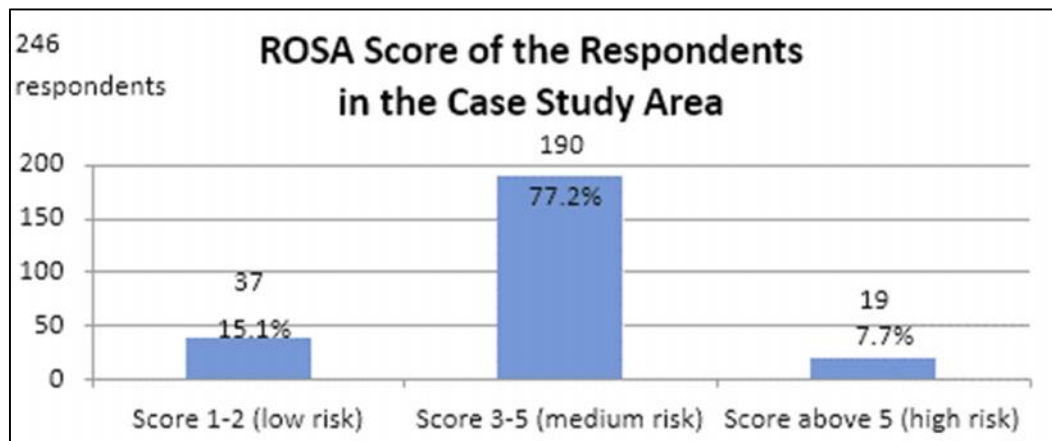


Figure 2: Rapid Office Strain Assessment (ROSA) score of the respondents in the case study area

Nowadays, in the time of globalization and modern technology, computer usage has increased significantly around the world especially in office based area. Computer usage contributes a lot to computer users in term of completing work tasks and getting information from internet. However, prevalence of musculoskeletal disorders (MSDs) or musculoskeletal complaints have become common situation among computer users who mostly are not educated or informed about risk factors of musculoskeletal disorders (MSDs), and computer workstation ergonomics. While there is no single "correct" posture or arrangement of components that will fit everyone, there are basic instructions, some of which are shown in posture figure, to be considered and followed when performing computer-related tasks.

In this research, evaluation of MSDs among computer users was based on Nordic questionnaire and Rapid Office Strain Assessment (ROSA) checklist. According to results of Nordic questionnaire, the prevalence of MSDs was high in the body regions of neck, upper back and shoulder. This finding is similar to previous researches in which the prevalence of MSDs among computer users occurred most on shoulder, upper back, lower back, neck and then in other body regions. Other similar finding is prevalence of MSDs was higher among women than men, though not by much in this research. In a research by Hupert (6) on college students, female students recorded more prevalence of neck and shoulder pains than male

students. Similarly, office workers in China encountered the highest prevalence of MSDs in the neck (7). More prevalence for women is due to the different physical and physiological body of women. Small size body and low muscle mass women are common causes of more cases of MSDs in women ratio to men. Related to all risk factors, model summary in the regression analysis indicates that combination of risk factors of gender, age, computer use time, rest break, computer work experience, physical exercise as well as computer workstation cause 31.8% or 1/3 of the prevalence of MSDs of the computer users in the case study area. Other 2/3 of the prevalence of MSDs was arguably from other external factors like pregnancy for women, sport activities, illness, diseases and others related.

In term of Rapid Office Strain Assessment (ROSA) method, while there were respondents who recorded scores higher than 5, which are at high risk level, as a whole ROSA scores were from 3 to 5 which are at medium risk level. This finding indicates computer workstations in the case study area were in notification level, in which ROSA score and MSDs could increase if no proper action taken by related management. Management can take initiative like changing damaged workstation, or encouraging employees to exercise for health aspect. Ergonomic intervention like changing computer workstation is not a must for ROSA score at medium risk level, but prevention is better than cure.

4.0 CONCLUSION

This research paper presents an analysis on evaluation of musculoskeletal disorders (MSDs) among computer users at office area, by using Nordic Questionnaire and Rapid Office Strain Assessment (ROSA) checklist. A number of previous researches available shows that the field of musculoskeletal disorders (MSDs) is wide spread and has positive prospect in the development of future research on evaluation of musculoskeletal disorders and how to reduce it. ROSA method is quite new in recent years and in the future with modern technology available nowadays, there could be new and sophisticated method to counter musculoskeletal disorders (MSDs). In the case study area which was Universiti Sains Islam Malaysia (USIM), the prevalence of musculoskeletal disorders (MSDs) was at medium level. Ergonomic interventions such as office ergonomics training, computer workstation redesign, provision of

guidelines are not compulsory for medium risk level, but can be considered by management to prevent potential increased musculoskeletal disorders (MSDs) in the future, and are supposed to be conducted for several number of high risk workstations immediately.

REFERENCES

- [1] Alexis Writing The Advantages of Organizational Skills 2016.
<http://smallbusiness.chron.com/advantages-organizational-skills-276.html>.
Chron.
- [2] Amit Bhattacharya, James D. McGlothlin Occupational Ergonomics: Theory
and Applications. CRC Press; 2008. 3(2):210-12, 2011.
- [3] Joanne O. Crawford The Nordic Musculoskeletal Questionnaire
Occupational Medicine, 2007, 300–301
- [4] Michael Sonne, Dino L. Villalta, David M. Andrews Development and
Evaluation of an Office Ergonomic Risk Checklist : Rapid Office Strain
Assessment (ROSA). Applied Ergonomics 2012. 43(1), 98-108
- [5] Robert V. Krejcie and Daryle W. Morgan Determining Sample For Research
Activities 1970.
- [6] Hupert N, Amick BC, Fossel AH, et al. Upper Extremity Musculoskeletal
Symptoms and Functional Impairment associated with Computer Use
among College Students. 2004 Work: 23: 85-93
- [7] Wu S, He L, Li J, et al. Visual display terminal use increases the prevalence
and risk of work-related musculoskeletal disorders among Chinese office
workers: a cross-sectional study. J Occup Health: 5434-43. 2012

Sharp Injury Awareness among Cleaners at Tuanku Mizan Military Hospital

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Abstract – *Sharp Injuries are one of major risk factors for blood-borne pathogen infections (BBPs) at Tuanku Mizan Military Hospital. The study examines the prevalence of sharp injury among cleaners at Tuanku Mizan Military Hospital doing the cleaning and collecting sharps wastes from the dressing areas, wards and further more look into awareness understanding among cleaners and developing a Standard Operating Procedures for cleaners while handling sharp objects for preventing these injury. Using a descriptive cross sectional study was conducted between Jun and September 2016. A self-administered questionnaire was distributed to 80 respondent cleaners from different wards at the hospital who were selected proportionate to the sample frame. A checklist was used to observe medical sharps wastes management practices at the hospital. Focus group discussions were held with healthcare workers to obtain in-depth information on the root causes of medical sharps injuries at the hospital. Data were entered into Microsoft Software Access database and analysis was done by use of Statistical Package for Social Sciences (SPSS), version 16. It was found that 76.6% of the cleaners were aware sharp injury hazards. 1(1.2%) cleaner out of the 80 cleaners had needle prick injury. Needle Prick injuries are common risk factors among the cleaners in Tuanku Mizan Military Hospital. For the effective prevention of these injuries, holding workshops, trainings and increasing cleaners' awareness and skills to face these risks can be effective in mitigating the risk of injuries and also reporting of needle prick injury & sharp injury will help to review the handling procedures from time to time.*

Keywords: Needle Stick, Sharp Injuries, Awareness, Cleaning Work

1.0 INTRODUCTION

Injuries caused due to needles are very common in hospitals. Needles accidentally puncture the skin, leading to blood borne pathogenic diseases. The cleaners who are in hazardous environment are those who are injured in disposing of activity or collecting the clinical waste from wards, labs and mortuary. The contaminated needles and sharps handling involves in tying up and carrying plastic bags disposal to the clinical waste bins, moving the clinical waste bins to the collection point & cleaning up clinical waste spillage. The needles that have been disposed in

clinical bins and at times needles have been thrown in the plastic bags which can cause needle stick injuries. Needle injuries are important and common occupational injury that occurs among cleaners and have an impact to the cleaners via transmission of blood borne pathogens (BBP) [1, 2].

Syringes used in hospitals are sharp and commonly used once [3]. Even though doctors, nurses, health care auxiliaries, hospital maintenance team and patients are the main concern, but cleaners are the last person that is never looked in [4]. Medical sharps injuries have been recognized as one of the occupational hazards among health care workers. Needle prick injuries is one of the most reported events at Tuanku Mizan Military Hospital. An average of two accidental sharps injuries among health care workers have been reported every month (Incident statistic 2012-2015). A great deal of anxiety (often out of proportion) can arise and at the same time the rights of the patient who was the source of infection should not be compromised.

Table 1: Number of the Accidents among cleaners in Tuanku Mizan Hospital from 2012 – 2015

HOSPITAL TUANKU MIZAN		
No	Type of Accident	Year 2012 -2015
1	Needle Prick	41
2	Slip & Fall	7
3	Hit By Vehicle	3
4	Lifting Heavy Large Waste Disposal Bins	1

Sharps injury may cause a number of potentially fatal infections with blood-borne pathogens. Stringer stated that when infected by needles, the risk can be high depending on the quantity of virus present in the blood of the source person at the time of the injury, the depth of the injury and the volume of body fluids breaching the cutaneous barrier. Stringer et al, (2001). He further mentioned that the donning of gloves may reduce the amount of solution introduced into the wound because the needle may lose half its volume on the glove surface. Occupational exposures should be considered urgent medical events to ensure timely administration of post exposure prophylaxis. Unfortunately, some of the cleaners in Tuanku Mizan Military Hospital do not report their injuries to their supervisors. It is either because they do not know where to report or are just ignorant to the dangers of the injury and fear of disciplinary action for negligence on the part of the health care workers.

Sharps injuries are preventable and under the Occupational Safety and Health Act 1994 (OSHA), employers, employees and self-employed persons have a duty to care towards their own safety and health, and that of others in their workplace. The

cleaners working in a hospital environment are exposed to various sharp hazards. Some of these sharp objects may be contaminated and pose a serious threat to health or even life. However, all sharp hazards, whether contaminated or not, need to give serious attention and all cleaners must be made aware of such hazards and take proactive actions to avoid injuries. All cleaners are given proper training before they are employed at Tuanku Mizan Military Hospital. They are given a comprehensive Occupational, Safety, Health and Environment training. Due to the so called human factor, the cleaners become complacent and from time to time they need to be made aware of these hazards and ensure that they are always paying attention to their safety especially from sharp injuries. The purpose of this study is to investigate the understanding of sharp injury awareness among cleaners at Tuanku Mizan Military Hospital.

2.0 METHODOLOGY

Tuanku Mizan Military Hospital was selected as the area of research to perform the study and the target population is those who are prone to acquire Sharp Injury. Based on the demographic data obtained from the hospital, the categorization of staff is done. In this descriptive research questionnaire is used as the tool for data collection; and 80 samples were selected by using probability sampling technique in which stratified simple random technique is used. A questionnaire was distributed among the cleaners. This was a descriptive cross sectional study design conducted by means of pretested, structured, self-administered questionnaires, focus group discussions, key informant interviews and observation checklist.

In this study, Tuanku Mizan Military Hospital was taken for the study site and the cleaning workers at the hospital, being the study among the healthcare workers. The study focused on the occupational risks of exposure to medical sharps, the frequency and severity of the medical sharp injuries, the factors that contribute to the occurrence of the medical sharp injuries and the measures the hospital has put in place to control and manage the sharps injuries. The questionnaire addressed aspects related to the research objective. The actual questionnaire that will be used in this study consists a total of 26 questions which is divided into 5 parts (Part A, Part B, Part C, Part D & Part E) and content of open and closed ended question. The questionnaire is in two languages that is in English and Bahasa Melayu. The question revolved around:

- Demography data
- Awareness on Needle prick/Sharp injury occurrence as occupational hazard
- Causes & determinants of needle prick/ Sharp injury
- Needle prick /sharps injury and related hazards.
- Preventive Measures on sharp Injury Hazards

3.0 RESULTS

A total of 76.6% of the cleaners had good knowledge status while 24.4% indicated a poor knowledge status. Table and Figure 4.1 showed that most of the respondents which were 63.8% (n=51) have working experience between eleven to fourteen years, followed by respondents who had worked less than one year, which is 3.8% (n=3) also 26% (n=26) of respondents who worked for more than six years to ten years. The main respondents totalling 69 (86.2%) were female cleaners, while 11 (13.8%) were male. Most of the cleaners were educated up to SPM level. A total of 64 (80%) of the respondents worked for 5-8 hours daily. All the 80 respondents have attended Safety induction and cleaning induction training during their first day of work. The last part of respondents demographic data shows that out of the 80 respondents, 1 (1.2%) had been pricked and suffered needle prick or sharp injury. To assess the respondents' current state of awareness, there are a total of 3 items that needed to be answered. Seventy eight (97.5%) of the cleaners responded that the type of sharp object that they handle during cleaning in their daily job were used needles. All the respondents are aware on the common diseases associated with the needle prick /sharp injury.

All the 80 respondents are aware of HIV/AIDS disease. As for Hepatitis (HBV), 63 (78.8%) respondents knew about this disease and 17 (21.2%) respondent did not know about HBV disease. Similarly for Hepatitis (HCV), 70 (87.5%) respondents knew about this disease and 10 (12.5%) respondent did not know about HCV disease. Most of the respondents 51 (63.8%) had attended their training within 1 to 3 years ago and remainder respondents 29 (36.2%) replied that they had received their training 1 year ago.

The identification of the colour code of the sharp injury, in which all the 80 respondents answered the yellow bin and this shows that the respondent is aware of type of bins. There are three shifts; (Morning, Evening and Night) as shown in figure 4.5. All the 80 respondents were involved in Shift works. Total of 20 (52%) respondents complained of sleep disturbance in the night due to extra shift work for overtime. Total 40 (42%) respondents had responded respectively that exhaustion in night (16), evening (12) & morning (12). Total of 17 (3%) had responded General distress, respectively 15 in morning, 1 in night and 1 evening. All the 66 (82.5%) respondents had responded yes that they are aware of the risk from a sharp injury, especially needle prick and they are aware of the magnitude of the risk being high. Fourteen (17.5%) had responded that they are not aware of the risk of the sharp injury. About 66% thought they were at risk of getting infected from sharp injury during daily cleaning work at the Hospital. The Needle prick is the highest percentage of respondents 65% had responded. The most common work carried out is handling garbage sharp bin as responded. Following staff training programmes on injection and sharp safety was the common available measures (84%) taken by

the cleaners. Up to 86.3% of the injured respondents took immediate action after sharp injury by cleaning the site with antiseptic.

4.0 DISCUSSION

In the present study, 82.5% cleaners knew that sharp injuries result in transmission of blood- borne diseases through the passage of Hepatitis B virus (HBV), Hepatitis C virus (HCV) and HIV, the participants believed that Hepatitis B carries the greater risk of transmission. In general, the analysis of cleaners indicates that they have a fairly good level of knowledge about needle stick injury. Regarding the awareness of cleaner's management of sharp injury, the overall average percentage of correct answer was 1.6%. From the feedback from 80 respondents, 29/80 (56%) respondents believed that most of the injuries occurred during disposal a garbage bags. The study also showed that cuts from sharp objects and needle stick injuries were high among cleaners. The overall awareness of cleaners is high as per knowledge management of needle stick. The result of this study shows two- third of the cleaners acquired good knowledge status on indication for sharp injury, however, one- third of the cleaners still needs to gain more information or knowledge about appropriate handling needles and sharps. Sharps injuries are preventable and under the Occupational Safety and Health Act 1994 (OSHA), employers, employees and self-employed persons have a duty of care towards their own safety and health, and to that of others in their workplace. Therefore, comprehensive programs should be implemented to reduce these injuries.

The result may be due to the system of mentor mentee practices in Tuanku Mizan Hospital. Cleaners who have never attended any training on needle prick and sharp injury awareness can learn from their supervisors who have attended training and more knowledge in the prevention of needle stick and sharp injury. As a responsible organization that is doing the cleaning services at Tuanku Mizan Military Hospital, the company is responsible to ensure the safety and health of its workers who is doing the cleaning work. As the type of needle pricking effect is chronic, in the short run the organization may not be dealing with a legal suit, however, in the long run the organization may be responsible to deal with the problem raised

by the affected workers' health of having HIV, Hepatitis B & C. Cleaning services business in the hospital has a very stringent process in evaluating the Health, Safety and Environment (HSE) of any contractors providing a service in this sector. This becomes one of the critical evaluation criteria during the evaluation process. One fatality enough to make a company HSE performance merit behind the competitors which will result to be disqualified in any bidding participated. During the work phase as stipulated in the HSE contract, the HSE requirement has been put as the first priority before executing any job.

5.0 RECOMMENDATION

The cleaning agency which is doing cleaning at Tuanku Mizan Military Hospital need to review the effectiveness of the existing induction training conducted to the workers. This includes the content, frequency of training and refresher course. The content conducted should emphasize on a few of past accident cases and how those can be prevented if a few steps could have been taken. The workers should also be aware of their responsibility to take care of safety and this not lies on the safety officer at site. The frequency of training should be reviewed in term of the nature of the job involved by the workers and risk associated with it's the nature of the cleaning hospital work, this task is conducted by trained cleaner worker; Cleaning as with other areas of health and safety requires a good management system to:-help identify the problem area; aid decision making on what to do; how to act on the decisions made; and to check that the steps taken have been effective. An effective management system should include: Procedures for maintenance of floors and equipment for guidance. Training and supervision to be given all new workers. To increase awareness among cleaners about importance of needle prick and sharp injury, it is suggested cleaner to report any accidents or incidents to their supervisors. It is also good have review programs to validate the effectiveness of effectiveness of control programs put in place. The review programs generally will be conducted annually and after any accident/incident. This would be tool used by the management in displaying its commitment on safety and health. This will be undertaken after a proper investigation is done. The effectiveness will be measured though.

6.0 CONCLUSION

This study can be concluded that needle prick and sharp injuries are important and continuing cause of exposure to serious and fatal diseases among cleaners. Greater collaborative efforts by all stake holder are needed to prevent needle stick and sharp injuries as they can cause serious injuries.. This research was administered among 80 cleaners who are doing cleaning work at cleaning the ICU, Mortuary and Wards; therefore, one could argue that the findings are not necessarily a generalization of all cleaners' level of awareness and knowledge about the same. There should be continuing development and evaluation, proper method of needle devices have safety features and also proper method of disposing needle and sharps. Monitoring systems such as key performance index (KPI) are also needed to provide accurate information on the magnitude of needle prick and sharp injuries and trends over time, potential risk factors, emerging new problems and effectiveness of interventions in all healthcare settings. There should be an essential need for further continuous training and awareness to improve and update the knowledge of the needle prick and sharp injury. It is duty of the cleaning company management to host well design seminars for its supervisors, safe work method practices during cleaning and

disposal, clinical wastes and workshops for upper management staff to lead by example and make sure safety of its cleaners during carry their daily work activity in a hospital. It can be seen that even in the cleaning industry, though on the surface it may seem an easy to handle industry, it certainly has its own hazards which can have direct consequences. The most important thing is to identify these hazards and find ways and means to eliminate or control these hazards. The risks must be assessed and appropriate control measures introduced. These control measures must be constantly and continuously reviewed for their continued effectiveness. The top management must be fully committed in Safety & Health and the workers to safeguard their own Safety & Health.

REFERENCES

- [1] Pruss-Ustun A, Rapiti E, Hutin Y: Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *Am J Ind Med* 2005, 8(6):482–490.
- [2] National Institute for Occupational Safety and Health: NIOSH Alert: preventing needlestick injuries in health care settings [DHHS (NIOSH) Publication No. 2000–108]. Cincinnati, OH: U.S. Department of Health and Human Services; 1999.
- [3] Ilyas M: Hospital and Biomedical Waste Management. *Community Medicine & Public Health*. 5th ed. Karachi: Time Publishers; 2000:621–623.
- [4] Park K: Hospital Waste Management. *Park's Textbook of Preventive and Social Medicine*. 18th ed. India: Banarsidas Bhanot; 2007:596.
- [5] Yacoub R, Al Ali R, Moukeh G, Lahdo A, Mouhammad Y, Nasser M: Hepatitis B vaccination status and needlestick injuries among healthcare workers in Syria. *J Glob Infect Dis* 2010, 2(1):28–34.
- [6] Sharps injury information. [<http://www.isips.org/sharps.shtml>]
- [7] Adams, D. Needlestick and sharps injuries: practice update. *Nursing Standard*, 2012. 26(37), 49-57.
- [8] Azadi, A., Anoosheh, M., & Delpisheh, A. Frequency and barriers of under reported needlestick injuries amongst Iranian nurses, a questionnaire survey. *Journal of Clinical Nursing*, 2011. 20(3-4), 488-493
- [9] Cho, E., Lee, H., Choi, M., Park, S. H., Yoo, I. Y., & Aiken, L.H. Factors associated with needlestick and sharp injuries among hospital nurses: A cross-sectional questionnaire survey. *International journal of nursing studies*, 2013. 50(8), 1025-1032.
- [10] Elverson, C. A., & Samra, H. A. Overview of Structure, Process, and Outcome indicators of Quality in Neonatal Care, *New born and Infant Nursing Reviews*, 2012. 12(3), 154-161.
- [11] Hoffmann, C., Buchholz, L., & Schnitzler, P. Reduction of needle stick injuries in healthcare personnel at university hospital using safety devices.

- JOccup Med Toxicol, 2013. 8(8), 20.
- [12] Lee, J. J., Kok, S. H., Cheng, S. J., Lin, L. D., & Lin, C. P. Needle stick and sharps injuries among dental health care workers at a university hospital. Journal of the Formosan Medical Association, 2014. 113, 227-233.
- [13] Ng YW, Hassim IN. Needle sticks injury among medical personnel in Accident and Emergency Department of two teaching hospitals. Med J Malaysia. 2007;62(1):9–12.
- [14] Mehdi Jahangiri 1, Akbar Rostamabadi 2, Naser Hoboubi 3,*, Neda Tadayon Ali. Soleimani Needle Stick Injuries and their Related Safety Measures among Nurses in a University Hospital, Shiraz, Iran. March 2016 Volume 7, Issues 1, p1-88.

Health Impact of Long Hours Driving on MINDEF Drivers

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Abstract – This paper discusses the health impact of long hours driving on Malaysia Ministry of Defence (MINDEF) driver. The work environment for the profession as military driver poses many challenges including driving long hours, often under tight working schedules and all weather conditions. The majority of the driver face challenges such as long hours worked on the driving due to tight working schedules, and short-time spent at home that can increase major health problems obesity, low work performance and life balance and also workplace health injuries. The contributing factor of this parameter is tight working schedule, repetition schedule, medical report, shortage number of driver, number of accident, high driver turnover. The questionnaire (statistical analysis) and interview (thematic analysis) techniques were applied in this study. The Pearson-correlation coefficient was used for the analysis and the result shows that exercise, nutrition, stress, social relationship and family, ergonomic and workplace injuries attribute has a significant positive relationship with long hours driving health impact to MINDEF Driver. Therefore, Malaysia Armed Forces should be included fitness to drive policies in the organization overall Occupational Health Policy. The interaction of the nature of military driver and tight working schedule, long hours driving and health impact are presented as well in this study.

Keywords: Long Hours Driving, Obesity, Workplace Injury, Work and Life Balance, Health Impact, Transportation.

1.0 INTRODUCTION

Health problem due long hours driving is common phenomena, especially in the transportation sector. In response to this issue, Occupational Safety and Health Act 1994 Section 17 (1) have the principal objective of providing for the prevention of harm to employees at work. The requirement of long hours driving schedule of military drivers in MINDEF makes difficult for the drivers to obtain a good quality of life and health care. The immediate result of long working hours is fatigue, which will affect individual productivity and quality assessment.

The concept of fatigue is difficult to define and measure, however it generally could be determined by self-report [1]. Generally, the correlation technique is applied for

this study to understand the relationship between variables [2] [3]. The objective of this study is to identify the health impact of long hours driving on MINDEF drivers on the existing daily routine schedule and to evaluate the relationship between the driving daily routine and long hours driving. The outcome of this research is to propose an efficient drivers driving daily routine schedule to the Fleet Management on the drivers.

2.0 MATERIALS AND METHODS

2.1 Study design

This study combined both qualitative and quantitative research in order to draw meaningful results from large data and information [4]. In this study, the obesity, work and life balance and workplace injuries is segregated into six variable known as exercise, nutrition, stress, social relationship and family, ergonomic and body posture attribute.

Drivers participating in this study accumulated substantially higher volumes of daily sitting on workdays than that seen in office workers [5]. The initially pilot test will be carried out to confirm the virility and reliability of each questionnaire. This questionnaire survey will be distributed to 80 respondents who represent 80% of the quantitative analysis. The sample of an interview is 20, representing 20% of the qualitative data analysis. The researcher collects detailed personal information from the selected driver based on their driving experience using oral questions.

2.2 Respondent

The population sample to be used in this study consists of the driver from the most senior rank Warrant Officer and junior rank Private driver from Transport Fleet MINDEF located at Jalan Padang Tembak, 50634 Kuala Lumpur.

2.2.1 Respondent Background

Basic demographic data the study involved 80 respondents in the Fleet Transport MINDEF. The statistically will be divided into four main years of experience. By random distribution as per shown in Table 1, the highest data is from a rank of 11-15 years (25 respondents,) followed by 16 years above services (25 respondents), 6-10 year services (14 respondents), and 1-5 years (10 respondents). It can be concluded that majority of the driver from the population has worked for more than 11 years and experience more health impact due to long hours driving. The majority of the respondent drove 7-10 hours per day (45 respondents) followed by 3-6 hours driving hours per day (32 respondents) and only 3 respondents for less than 2 hours. Therefore, it can be concluded that 45 % of the respondent drove from 7-10 hours per

day in their daily routine. The long period of driving is considered contribute direct impact to driver health. In overall, most of the driver is require fulfilling the job requirement to drive longer period of driving due to shortage number of personnel in the department and the requirement of the job.

2.3 Statistical Analysis

Statistical analyses were conducted using SPSS version 23. The Cronbach's Alpha reliability coefficient is computed to measure internal consistency. The reliability coefficient of .70 or higher is considered "acceptable" in most social science research study area [7].

The Pearson-correlation coefficient is used to determine the relationship between two paired sets of data. The correlation coefficient is a number between -1 and 1. The closer to 1, the more confident a positive linear correlation and vice versa while for the correlation coefficient close to zero means there is no evidence of any relationship. Apart from the correlation efficient, the *p*-value has also been looked at to measure the significance of then analysis in which the range are between 0 and 1 to represent the probability that the data would have arisen if the set null hypothesis were true [8]. In psychological research, Cohen's convention is used to interpret the effect size of statistical tests on correlation coefficients. Table 2 indicates the strength of the relationship according to Cohen's guideline

Table 5: Respondent Background

Demographic Characteristics	Percentages (%)
Working Experience	
1-5 year	6.3
6-10 year	12.5
11-15 year	43.8
16 year above	15.0
Average Driving Hours	
Less than 2 hours	4
3-6 hours	40
7-10 hours	56
N = 80	

Table 5: Cohen's Guidelines

Effect Size Cohen	
.10	Small
.30	Moderate
.50	Large

2.4 Thematic Analysis

Thematic analysis can be described as an independent qualitative descriptive method. The thematic analysis assists the researcher for recognizing, analyzing and reporting patterns (themes) information collected [6]. The feedback from the respondent will be studied and categorized according to the three main themes. The group of drivers was interview face to face to gather opinions and information on their previous experience long hours driving impact on their health. The three main themes as follows:

- i. Themes 1 : Obesity.
- ii. Themes 2 : Work and Life Balance.
- iii. Themes 3 : Workplace Injuries.

3.0 RESULTS AND DISCUSSION

The relationship between six variables of exercise, nutrition, stress, social relationship and family, ergonomic and body posture with long hours driving is studied using correlation analysis. Prior to correlation analysis, the Cronbach's Alpha reliability coefficient is computed and found as .843, suggesting relatively high internal consistency. The strong outcome of Cronbach Alpha indicates a significant result of correlation.

According to Cohen's Guidelines in Table 2, the correlation test for all six variables of exercise, nutrition, stress, social relationship and family, ergonomic and body posture attribute are positive. Figure 1 shows the correlation results. It is found that the stress has a highest relationship to long hours driving ($r = .800$). The result shows that majority of the driver feel sleepy or drowsy during driving because of non-adequate amount of sleeping hour every night. They drive more than 8 hours daily, sometimes without break and with additional of pressure due to the road traffic condition. Previous study shows that stress was rated as the third most important health risk factor among drivers [9]. Driver has been deployed 24 hours and assigned for the same task could cause stress among them.

From the thematic analysis, the result also demonstrates that obesity and overweight were found as very high from the population. These become as health risk factor to the driver in Transport Fleet, MINDEF. The potential health impact of obesity among the driver includes heart disease, diabetes mellitus, hypertension, high cholesterol and sleep apnea. Previous studies shows that only 20.8% of truck drivers were found to have a healthy weight [10] and more than 60% were either overweight or obese.

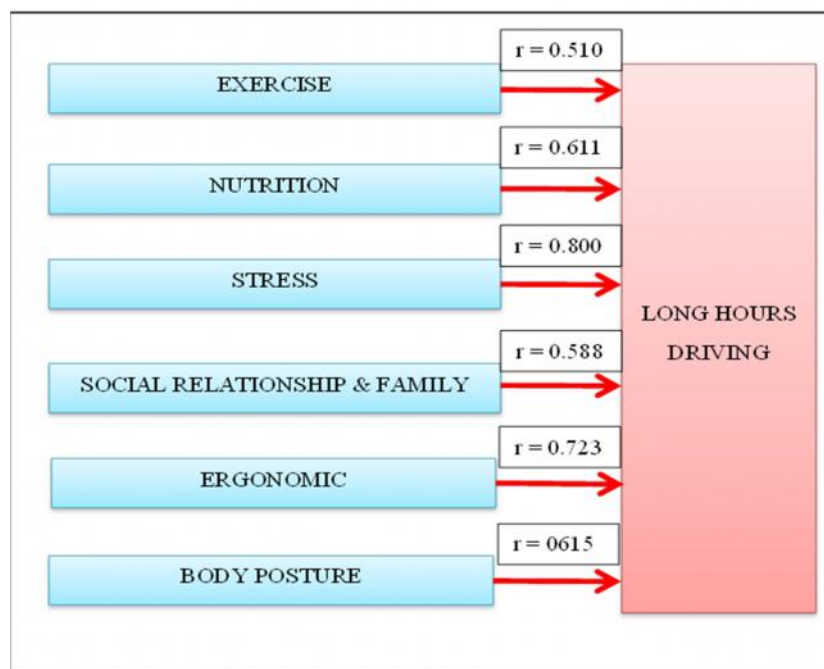


Figure 4: Correlation of exercise, nutrition, stress, social relationship and family, Ergonomic and body posture with long hours driving

For the work and life balance Fleet Transport MINDEF, the driver facing less time for their family and less time to spend to socialize with their friends. They don't have time to think about their hobbies and to have a better life. The military driver who deploys in work long hours driving can experience considerable disruption of family and social activities as many of these rhythms of the general population are oriented around the day. Shift work can thus lead to social marginalization. Family and marital responsibilities can be severely disrupted by shift work or long hours. Childcare, housework, shopping, and leaving a partner alone at night can all lead to marital strain and family dysfunction.

In workplace injuries, the overall driver was exposed workplace hazards and experience higher workplace injury because of the period of time spent in the vehicle cabin. Long periods of time driving placed significant stress on the driver back and

neck where the driver need to focus on the driving. In addition, the findings of this study suggest that factor leading to whole body vibration, back pain, upper extremities, arms and knees pain. The driver accumulated a substantially higher volume of daily sitting on daily routine compared to office workers [11]. These findings show that the impact of long hours driving on the driver has largely been overlooked by the Fleet management. Therefore, Malaysia Armed Forces should be included fitness to drive policies in the organization overall Occupational Health Policy.

4.0 CONCLUSION

This study highlighted the health impact of long hours driving. A significantly high correlation is shown on exercise, nutrition, stress, social relationship and family, ergonomic and workplace injuries with long hours driving health impact to MINDEF driver. This shows a clear relationship between long hours driving and driver health especially in the transportation fields. The findings indicate that obesity, work and life balance and workplace injuries will lead to lack of safety aspect and may cause an accident. The profession as military driver can be described as a most high risk job where most of the driver experience health problem due to the work culture. The requirement to fulfill the working schedules and workloads pressure make the driver difficult to gained better health quality. As the stress shows a highest correlation, further studies are needed to assess the impact of stress on driver safety.

REFERENCES

- [1] Anne Spurgeon, J. M. H., Cary L Cooper. Health And Safety Problems Associated With Long Working Hours: A Review Of The Current Position. 1997.
- [2] Sparks, K., Cooper, C., Fried, Y., & Shirom, A. The effects of hours of work on health: a meta analytic review. *Journal of occupational and organizational psychology*, 1997. 70(4), 391-408.
- [3] Faragher, E. B., Cass, M., & Cooper, C. L. The Relationship Between Job Satisfaction and Health: A Meta-Analysis. *Occupational and Environmental Medicine*, 2005 .62(2), 105-112.
- [4] Diane P.Keating, B. S. T. H.. The Development Survey Methodology. 2010
- [5] Morris, J. N., & Crawford, M. D. Coronary heart disease and physical activity of work. *British Medical Journal*, 1958. 2(5111), 1485.
- [6] Vaismoradi, M., Turunen, H., & Bondas, T. Content Analysis and Thematic Analysis: Implications For Conducting A Qualitative Descriptive Study. *Nursing & Health Sciences*, 2013. 15(3), 398-405.
- [7] Gliem, R. R., & Gliem, J. A. *Calculating, Interpreting, And Reporting Cronbach's Alpha Reliability Coefficient For Likert-Type Scales*. 2003.

- [8] Fenton, N., & Neil, M. *Risk Assessment and Decision Analysis With Bayesian Networks*: CRC Press. 2012.
- [9] Krueger, G. P., Belzer, M., Alvarez, A., Knipling, R., Husting, E., Brewster, R., & Siebert, J.. Health and Wellness Of Commercial Drivers. *The Domain Of Truck And Bus Safety Research*, 2007 117, 58-91.
- [10] Sangaleti, C. T., Trincaus, M. R., Baratieri, T., Zarowy, K., Ladika, M. B., Menon, M. U., Bortolotto, L. A. Prevalence Of Cardiovascular Risk Factors Among Truck Drivers In The South Of Brazil. *BMC Public Health*, 2014.14(1), 1.
- [11] Smith, L., Hamer, M., Ucci, M., Marmot, A., Gardner, B., Sawyer, A., Fisher, A. Weekday and weekend patterns of objectively measured sitting, standing, and stepping in a sample of office-based workers: The Active Buildings Study. *BMC Public Health*, 2015.15(1), 1.

Prevalence of Computer Visual Syndrome among Employee in Malaysian Software Testing Board

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Abstract – *The expanding use of visual display terminal (VDT) unit has raise a concerning issues on the potential health effects. Major issues related to the VDT includes the effect of prolonged visual interaction with display content in terms of eye and other muscular fatigue and deterioration that emanates from VDTs. The study revealed the most prevalence symptoms was found to be neck, back and shoulder pain followed by eye strain, glare light sensitivity, overall bodily fatigue or tiredness, dry or watery eyes, headache during or after working at the computer, night vision worsen after computer use, difficulty focusing (far to near), blurred near vision, burning eyes, burning, itching or red eyes (distant to near and back), ‘halos’ appear around object on the computer screen and double vision. On average, 72% of respondents spending 5 to 8 hours on computer at work and almost 90% of them are having uninterrupted use of computer for more than one hour. However, on general, most of respondents takes breaks every 1 to 2 hours (83%). Therefore, based on the response on action taken to overcome the symptoms experienced, indicates that they do practiced all of the actions that may help in reducing the CVS. Yet considering the lack of awareness among majority of the respondents age ranging between 25 to 36 years, it can be concluded that much emphasis is required to expose them to the risk of CVS and steps in reducing the risk. It is suggested to integrate the existing action and precautions with current developing technologies such as the implementation of automatic computer use break system and a schedule stretching reminder on computer apart from having the workspace area to be redesign.*

Keywords: Computer Visual Syndrome, Visual Display Terminal Unit, Software Professionals, Visual Fatigue

1.0 INTRODUCTION

Around 45 to 70 million people spend lots of time facing the VDT unit on a daily basis. VDT unit also known as computer screen has become common in today's society. However, over the time, studies have found there are several health related symptoms associated with the use of computers [1]. Million new cases of people

suffering from Computer Vision Syndrome (CVS) were identified annually and 60 million were diagnosed with CVS globally. Although the usage of computer is only limited for three hours per day, the risk of experiencing Occupational Overuse Syndrome (OOS) and CVS still exist. These eye related symptoms were reported as most common health problem among VDT user. The CVS symptoms can be categorised into four categories ; (i) asthenopic - eye strain, tired eyes, sore eyes, (ii) ocular surface related - watering, irritation, dry eye, (iii) visual - blurred vision, slowness of focus change, double vision, and (iv) extraocular - neck pain, back ache, shoulder pain. All these are influenced by several factors such as individual visual problems, inappropriate work habits or inadequate and poor workplace conditions [2] and [3]. Below is the comparison of the frequency (%) of the common CVS symptoms reported in literature based on recent studies.

Table 1: Comparison of frequency (%) of common CVS

Symptoms	Akinbilu & Mashalla (2013)	Gupta R et al. (2014)	Reddy SC et al. (2013)	Gauri S S et al. (2010)	Jyothi T et al. (2014)
Headache	30.94	82.10	19.7	13.3	-
Eye Strain	30.94	83.60	16.4	-	43
Tired Eyes	-	-	-	12.5	-
Sore Eyes	-	-	-	8.6	-
Redness	4.31	-	-	-	43
Watery Eyes	10.97	-	4.3	6.7	-
Irritation	-	-	-	7.8	39
Dry Eye	-	66	13.6	-	27
Slowness of Focusing Distance	-	56	-	-	-
Double Vision	12.95	-	0.3	1.2	-
Blurred Vision	10.07	-	10.2	8.4	36
Neck Pain	-	-	9.9	8.2	-
Back Ache	-	-	6.8	8.6	-
Shoulder Pain	-	-	5.2	6.6	-

The severity of the symptoms may be affected by the duration of time spend using the VDTs [4]. Studies done demonstrated that the CVS is likely be led by the use of computer for three hours daily. [4]. In Rossignol et al studies, it was found that those

spending time more than four hours daily working on VDT are more prevalent of CVS. Complaints on eyestrain and sore eyes are the most common [5].

Stella et al and Cole in their studies concluded that the screen contrast, duration of work in front of computers, computer work place illumination, viewing distance and angles, reflection on screen and workplace ergonomics have significant effect in causal of CVS symptoms to VDT user [6]. The improper eye level between computer screen and VDT users have influence a complaints on asthenopia also known as eye strain [7]. Reddy SC et al. study agreed to the importance of having a proper eye level in between computer screen and VDT users since they found the significant there was significant reduction in symptoms of CVS between students who viewed the computer screen below eye level than those who viewed the screen at or above the eye level [8].

2.0 METHODOLOGY

2.1 Materials and Method

The strategy chosen to integrate different component in this research scope is by identifying the relation between the CVS at MSTB. This is to ensure the research problem is address effectively. Essentially, the design is done by developing understanding of the prevalence of the CVS among software professionals and preparing plan for some intervention process. This research will be conducted quantitatively whereby data from survey will be collected. Through survey conducted, the questions will reflect the prevalence of the CVS apart from obtaining the respondents awareness on the health problem faced by them as consequences of prolong exposure of VDT unit. This quantitative method is chosen to collect data due to its flexibility to gain result regardless differences in demographics background.

2.1.1 Population and sample

The study population included both male and female adults (18 to 60 years) working at MSTB. Based on Sample Size Determination Using Krejcie and Morgan Table, the research will be conducted to 44 people. They are consists of employee in Project and Operations group, Internal Technical Group, Finance and Admin, Quality Assurance and Capability Development. The questionnaires will be distributed to all targeted respondents whereby all of them works on a normal working hours and roughly spend time in front of the VDT not less than 5 hours per day. A pilot study was conducted among 20 of the sample population and the questionnaire will be edited for easy understanding by the respondents for real survey to be conducted.

2.1.2 Questionnaires

A structured questionnaire was developed. Questions on symptoms of CVS were adapted from a previous study done by Gangamma et al. This is to ensure all the critical area to be considered in order to get the right answer for issue is captured during the survey such as presence of pain in and around the eyes, headache, blurred near vision, blurred distant vision, dry eyes, sore/irritated eyes, red eyes, excessive tearing, double vision, symptoms of CVS. The questionnaires were structured into 3 different parts as follow;

- i. Part 1 – Sociodemographic demographic data of respondents (Age, Gender, Role), Occupational history (Duration of employments, working hours)
- ii. Part 2 –Effects of prolongs exposure towards VDT unit and improper working conditions. (Symptoms of visual problem, duration of computer use)
- iii. Part 3 – Awareness on the importance of ergonomics working environment and perspective on managing the risk of CVS

The symptom scores were ranked on intensity rating as 0 = none or asymptomatic, 1 = very mild, 2 = mild, 3 = moderate, 4 = intense, and 5 = very intense. The subjects were asked to state the occurrence of symptom and specify the hours at which they did VDT work, performed other work, or took breaks. Symptoms were entered in to statistical analysis using this intensity rating scale.

2.1.3 Data Analysis

Data was analyzed using Statistical Package for Social Science (SPSS) Software, version 20. Descriptive data were presented as percentage, frequency or as mean \pm deviations. Significance of association was tested using Chi square for categorical variables and t-test for continuous variables.

3.0 RESULTS AND DISCUSSION

The strategy chosen to integrate different component in this research scope is by identifying the relation between the CVS at MSTB. A total of 44 respondents consisting of 22 males and 22 females participated in the survey conducted for this study. Most of the respondents were from the group age of 26 to 35 years. The study reveals quite a low level of awareness of CVS whereby only 31% of the respondents are aware of the term CVS itself despite of all of them experiencing most of the CVS symptoms. The most common symptoms recorded was neck, back and shoulder pain with a mean of 3.64 followed by eye strain (3.45), glare light sensitivity (3.54), Overall bodily fatigue or tiredness (3.41), Dry or watery eyes (3.14), Headache during or after working at the computer (3.11), Night vision worsen after computer use (3.02), Difficulty focusing (far to near) (2.61), Blurred

near vision (2.59), Burning eyes (2.48), Burning, itching or red eyes (distant to near and back) (2.43), 'Halos' appear around object on the computer screen (2.34) and double vision (1.98).

Table 2: Common CVS Symptoms

Symptoms	Mean
Neck, back and shoulder pain	3.64
Sore or tired eyes (eye strain)	3.45
Glare (light) sensitivity	3.45
Overall bodily fatigue or tiredness	3.41
Dry or watery eyes	3.14
Headache during or after working at the computer	3.11
Night vision worsen after computer use	3.02
Difficulty focusing (far to near)	2.61
Blurred near vision	2.59
Burning eyes	2.48
Burning, itching or red eyes (distant to near and back)	2.43
'Halos' appear around object on the computer screen	2.34
Double vision	1.98

The relationship between longest hours of uninterrupted used of computer with frequency of them taking breaks was measured using Pearson product-moment correlation coefficient. There was quite strong correlation between those two variables whereby the $r=.583$, $n=44$, $p=<0.005$. This indicates a positive correlation between them. When they take longer hours of uninterrupted used of computer, they tend to take breaks frequently.

The relationship between the symptoms and average hours spend on computer at work was investigated using same method. The preliminary analysis was performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There is quite weak relationship for most of the CVS symptoms. The only strong correlation is between neck, back and shoulder pain ($r=0.92$, $n=44$, $p=>0.5$). Based on the symptoms experienced, most of them are having the average hours of 6-8 hours spend on computer on a daily basis.

Table 3: Correlation between longest hours of uninterrupted used of computer with frequency of them taking breaks

		1	2	3	4
Hourswork (1)	Pearson Correlation Sig. (2-tailed) N	1 44	.118 .446 44	-.115 .456 44	.204 .185 44
Longestuninterrupt (2)	Pearson Correlation Sig. (2-tailed) N	.118 .446 44	1 .145 44	.223 .145 44	.583** .000 44
Hourshome (3)	Pearson Correlation Sig. (2-tailed) N	-.115 .456 44	.223 .145 44	1 44	.220 .152 44
Often (4)	Pearson Correlation Sig. (2-tailed) N	.204 .185 44	.583** .000 44	.220 .152 44	1 44

** . Correlation is significant at the 0.01 level (2-tailed).

4.0 CONCLUSION

Majority of the respondents (68%) were found to be unaware of CVS despite of having to experience the symptoms of CVS collectively. The most prevalence symptoms in the study was found to be neck, back and shoulder pain followed by eye strain, glare light sensitivity, overall bodily fatigue or tiredness, dry or watery eyes, headache during or after working at the computer, night vision worsen after computer use, difficulty focusing (far to near), blurred near vision, burning eyes, burning, itching or red eyes (distant to near and back), 'halos' appear around object on the computer screen and double vision. On average, 72% of

respondents spending 5 to 8 hours on computer at work and almost 90% of them are having uninterrupted use of computer for more than one hour. Based on the correlation analysis, the longer duration of the uninterrupted use of computer, the more frequent they take breaks. However, on general, most of respondents takes breaks every 1 to 2 hours (83%). Therefore, based on the response on action taken to overcome the symptoms experienced, indicates that they do practiced all of the actions that may help in reducing the CVS.

REFERENCES

- [1] J., Akinbinu T. R. and Mashalla Y. Impact of computer technology on health: Computer Vision Syndrome (CVS). Medical Practice and Review, Vol. 5(3). 2014. doi:10.5897/mpr.2014.0121
- [2] F Mocci, A Serra, G A Corrias. Psychological factors and visual fatigue in working with video display terminals. Occup Environ Med. 2001.
- [3] Courtin, R., Pereira, B., Naughton, G., Chamoux, A., Chiambaretta, F., Lanhers, C., & Dutheil, F. Prevalence of dry eye disease in visual display terminal workers: a systematic review and meta-analysis. BMJ Open, 2016. 6(1), e009675. doi: 10.1136/bmjopen-2015-009675
- [4] Bali, Jatinder, Neeraj, Naveen, & Bali, RenuThakur. Computer vision syndrome: A review. Journal of Clinical Ophthalmology and Research, 2014. 2(1), 61. doi: 10.4103/2320-3897.122661
- [5] Mark Rosenfeld, Regina Gurevich, Elizabeth Wickware, Marc Lay, Computer Vision Syndrome: Accomodative & Vergence Facility. Journal of Behavioural Opthamology. 2010.
- [6] Stella C. Chiemekwe Member, IAENG, Allen E. Akhahowa and Olajire B. Ajayi. Evaluation of Vision-Related Problems amongst Computer Users: A Case Study of University of Benin, Nigeria. Proceedings of the World Congress on Engineering 2007
- [7] Helland, M., Horgen, G., Kvikstad, T. M., Garthus, T., & Aaras, A. Will musculoskeletal, visual and psychosocial stress change for visual display unit (VDU) operators when moving from a single-occupancy office to an office landscape? Int J Occup Saf Ergon, 2008. 14(3), 259-274. doi: 10.1080/10803548.2008.11076765
- [8] Reddy SC, Low CK, Lim YP, Low LL, Mardina F, Nursaleha MP. Computer vision syndrome: a study of knowledge and practices in university students. Nepal J Ophthalmol, 2013. 5

Occupational Safety Training Framework for Illiterate Migrant Working at Construction Site

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Abstract –*The number of illiterate migrant workers in Malaysia is increasing by numbers and this offer challenges to construction industry. Unable to understand the safe work procedures can cause unwanted incident. The major factor of this problem is that these workers did not receive the appropriate training in order for them to perform their work safely. Occupational safety training is important to help them understand standard operating procedures, potential hazards, appropriate protective measures and proper responses to unplanned, and undesired events. The objectives of this study is to investigate the issues among the construction site workers for not compliance to the safety procedures; to identify what is the weaknesses in the existing safety training and to propose the safety training framework for the site workers in the construction industry. Data collection of study is based on quantitative method such as close ended format questionnaires. This study provides enhancement in occupational safety training framework to illiterate workers.*

Keywords: Construction Industry, Occupational Safety Training, Civil and Structure, Illiterate Migrant Worker

1.0 INTRODUCTION

In Malaysia, construction industry plays important role in the development of a country and also a career opportunity for the people. However, construction industry contributes to the highest fatality of construction worker which is recorded by Department of Occupational Safety and Health, compare to other sector [1]. Lack of knowledge, training, and supervision can cause accident at the workplace due to the error of judgement and carelessness during perform work task [2]. The number of illiterate migrant workers in the construction industry faced challenges such as increase in work related injuries and fatalities [3]. The factor of work injuries is due to lack of understanding of the training given to them for example recognise the

safety and health signage(s) [4]. This is where, education and training has a significant role to the attitude of occupational safety.

In Malaysia, increasing numbers of migrant workers is caused by shortage of labour and poor participation from local people. Therefore, the construction industry has to depend on foreign manpower to meet the demand of the country. Foreign labours who came to work here, did not attend formal training when they arrived in Malaysia and this is another factor that contributes to accidents on site [5]. Common safety problems at the most construction site are often related to less training of the job task. Studies showed that workers who lacked opportunities to receive relevant training had limited knowledge of occupational safety [10] and will not comply to work safety. Effective training involves changing perception, attitudes, and behaviours and consequently the way people conduct themselves at work [11]. In conducting the training for the workers, consideration must be made such as the content of learning, the goal of learning, the methods and location of learning and the subsequent certification processes [12]. Effective safety training can lower accident rates, but there are several challenges associated with safety training that need to be overcome by construction companies. The major challenge is the language barrier experienced by non-English speaking workers which lead to not fully understand the training procedures given to them[13].

2.0 METHODOLOGY

The research is based on quantitative research. Questionnaires are conducted at the working site. The target populations are the site workers at the civil construction site with the total number 196 site workers.

2.1 Data Collection

The constructed questionnaires questions are distributed to the targeted group (civil & structure workers). The respondents are assisted by the foreman and supervisor in translating the questionnaires especially to the illiterate workers.

2.2 Instrument and Data Analysis

The survey questionnaires include Bipolar, Dichotomous, Likert and Rating Scale questions especially for the closed ended questions. To maximise the understanding of respondents the survey was intentionally kept brief and simple.

2.2.1 Descriptive analysis

SPSS software was applied in determining the number of demographic data about the workers. All analysis is descriptive (mode/mean/frequency).

3.0 RESULTS AND DISCUSSION

Table 1 is the demographic data of the respondents. It shows that the majority of the respondents are male between ages of 20-29 years old. More than 50% of the respondent are from Philippines and received non-formal education.

Table 1: Demographic data of respondents

	Choices	N	(%)*	Accumulative
Gender	Male	193	98.5	98.5
	Female	3	1.5	100
	Total	196	100	
Age	20 – 29 Years	90	45.9	45.9
	30 – 39 Years	81	41.3	87.2
	40 – 49 Years	25	12.8	100
	Total	196	100	
Education Level	Non-formal education	115	58.7	58.7
	None	81	41.3	100
	Total	196	100	
Trade	Carpenter	90	47.4	47.4
	Bar bender	74	36.7	84.2
	Concreting	28	14.3	98.5
	Other	3	1.5	100
	Total	196	100	
Nationality	Philippines	113	57.7	57.7
	Indonesian	73	37.2	94.9
	Other	10	5.1	100
	Total	196	100	

3.1 Factors Affecting the Understanding of the Safety Training

In this study there are eight factors that can be considered affecting the understanding of the training which are as the following:

- i. Training content too wordy
- ii. No demonstration during the training session.
- iii. Less photos or pictures in the presentation slides.
- iv. Inadequate experience of trainer
- v. Time Constraint
- vi. Less accurate Training content
- vii. Training Delivery Method
- viii. Language proficiency

From Figure 1 shows that average response for the first factor is 2.83 which the training content is too wordy. This indicates that only few respondents consider this as the main factor. This factor might affect few or any particular worker; depending on the perception of each individual those take part on training. Second factor is less or no demonstration during the training. Based on collected data, the average response is 4.43 which most of the respondent agreed that this factor affects the understanding of their training. The demonstration method can provide them knowledge on the correct method and procedures in doing their job safely and harmless.

Third factor is less photo or pictures in the presentation slides. Figure 1 shows that the average response is 2.81. However, this data can be considered not major contribution to the training given. The fourth factor is about the trainer itself does not have experience on the related field. The average response is 3.57 which are more than half of the respondent scale it "Agree" and "Strongly Agree". According to the workers they answered it "Agree" or "Strongly Agree" because they could see that the trainer itself does not have his own personal experience regarding the job. They said that *"we know better about our job more than the trainer. So, this factor might affect effectiveness of the training"*.

Time constraint is the fifth factor which shows the average response of 3.58. Some of the workers might prefer shorter training time while some preferred longer period. However, it is depend on the type of training delivered to the workers. It indicates that time is really important and affects the safety training. Sixth factor is training content is less accurate. The respondent answered it based on their experience and opinion. Most of the respondents say *"we do not know the training content is accurate or not because we did not go to school but if the training content is wrong we might get the wrong information"*.

Seventh factor is training delivery method. According to the collected data the average response is 3.59 which most of the respondent agreed it affect training. Last factor is language proficiency; from Figure 1 it indicates that most of the respondents agreed that this factor affect the understanding of the training. This is due to participants did not understand the training content. According to the Indonesian worker *"Trainer prefers speak in English and all the training content is in English. We do not understand."*

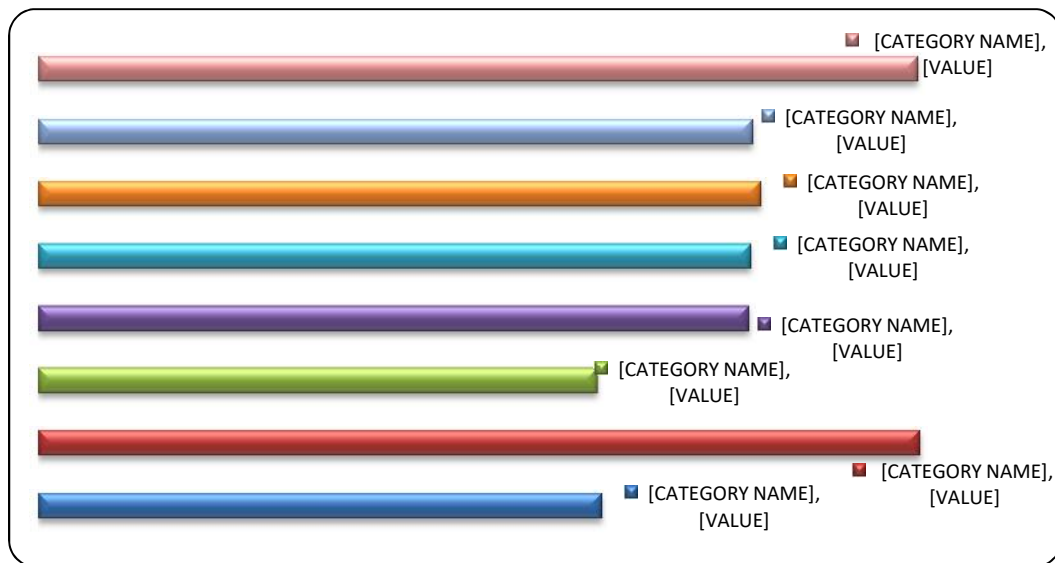


Figure 1: Average response for not fully understanding the training

Figure 2 is the average response on questionnaires about the training evaluation. Most of respondents agreed that training is important to improve safety compliance. Respondents scale the effectiveness of the two-way communication; feedback and dialogue is important to enhance the safety knowledge of the workers. Evidently, average response is 4.43 which most of the respondents agreed that a two-way communication is important to enhance knowledge. Respondents also preferred more animation in the presentation slides which can enhance understanding of the participants. This agreed with the average response of 4.43 from the respondents which, they strongly agreed that animation can make them understand better of the training content. In understanding the content of the training lead to developing safety culture such as changing perception, attitude and behaviours of the workers.

Last question is language barrier among non-Malay speaking worker could intervene the safety learning during the training. Based on collected data, average response is 4.23 which respondents agreed that non Malay speaking worker may difficult to understand the training content. However, some of the Filipino workers those stay more than 5 years in Sabah could understand and speak Malay language. They just could not able to read and write.



Figure 2: Average response of training evaluation

3.2 Characteristics of Effective Training Practices

The data given in Figure 1 and Figure 2 can be short listed to three major factors in not fully understanding the occupational safety training which are:

- i. More demonstration on the content training topics.
- ii. Provide more animation on the content
- iii. Conduct two-way communication during the training session

Studies showed that incorporating examples into the training module will help to facilitate the learning concept and enhance skills in particular field [6]. The examples are referred to objects, events and illustrations that can elaborate more about the specific impression to make the participant understand better about the training module [7]. This statement agreed to most of the respondents said that less demonstration during the training will result in less understanding of the training content.

It is important the training content with more illustrations in order for the trainer to understand its affects safety related performances [8]. Figure 2 the average responses of the respondents agreed that animation will enhance their understanding. As an example, during the bar bending activity, workers are involved with machineries (bar bender machine). It is important to animate the moving machine and show what happen to the worker if not following the correct steps such as, 'what will happen if the fingers are trapped between the moving parts of machine?' This can make the workers be more careful during bending iron bar. Another incident can be also animated showing the exploding machine. This incident can show to the worker how to respond during the accident and teach them to use suitable Personal Protective Equipment (PPE). Illiterate worker may difficult to understand wordy content of learning modules so it is important to show them moving picture. Showing videos or

animated pictures is another teaching method and learning experience from verbal skill to performance skill [9].

Apart from hands-on demonstration and animated training, two way communications between trainer and participants play important role. Two way communications are critical factor in influencing the transferability of the training content. The participants have the opportunity to showcase their ability and understanding [14]. Two-way communications promote productive dialogue and improve relationship between trainer and participants. Consequently, participants can foster genuine conversation among each other [15].

3.3 Occupational Safety Training Framework

Figure 3 is the proposed framework of the safety training for illiterate worker. Safety training is required whenever the work activity is risky [16]. It is very important for the management to establish training program whether the training should be held annually or based on workers' need. Employers are required to provide safety program inclusive training program based on Guidelines on Occupational Safety and Health Management System (DOSH Guidelines).

On occupational safety training module, the trainer should be concise with objectives or goals of the training that to be achieved [17]. Safety training module is based on workers' need. As mention in paragraph 3.1, language proficiency is another main reason for not fully understands the safety training. Therefore, management should provide translator to those illiterate migrant workers. As mention in paragraph 3.2 the teaching method such as hands-on demonstration, animation and dialogue could enhance the understanding of the worker regarding the training. Lastly from the framework are the implementation of training and eventually the continuous improvement of the safety training.

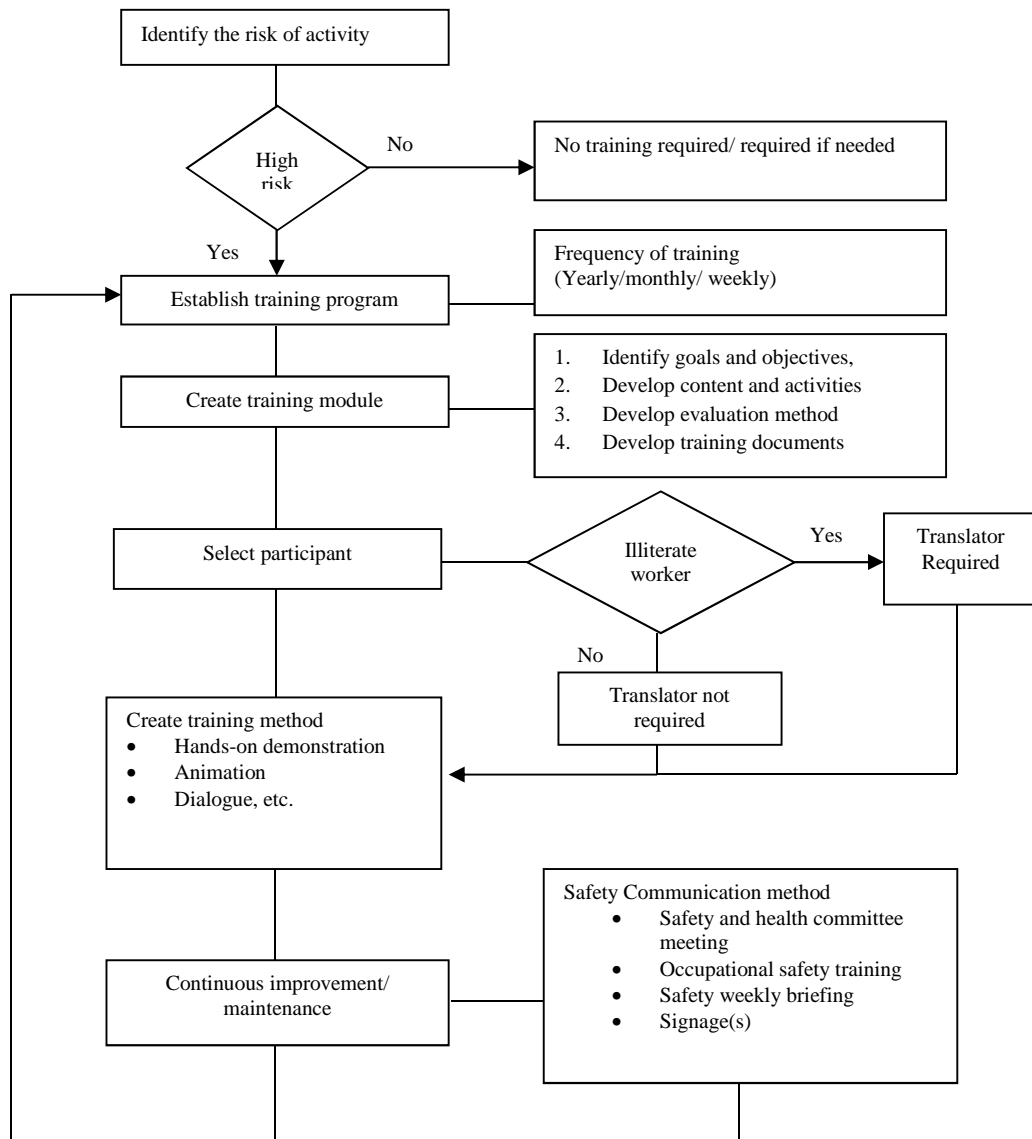


Figure 3: Proposed Occupational Safety Training Frameworks for Illiterate Worker

4.0 CONCLUSION

Formal training for new worker is important to enhance their understanding on safety knowledge and procedures. Demonstration and animation are most effective methods to enhance the safety understanding during training. The framework can be enhanced the training session and strengthening the safety culture among the workers.

REFERENCES

- [1] Department of Occupational Safety and Health Malaysia, 2016.
- [2] Sawacha, E., Naoum, and Fong, D., 1999. Factors Affecting Safety Performance on Construction Site. *International Journal of Project Management* 17(5), pp. 309-315.
- [3] Vazquez, R. F. and Stalnaker, C. K., 2004. Latino Workers in the Construction Industry: Overcoming the Language Barrier Improves Safety. *Professional Safety* 24, pp. 12-134
- [4] Hinze, J. W., 2006. *Construction Safety*. New Jersey: Prentice Hall.
- [5] Ahmad Z, S., Mohamed, S. F., and M. Yusuf, Z., 2012. Construction Skilled Labour Shortage-The Challenges in Malaysia Construction Site. Ontario International Development Agency. *OIDA International Journal of Sustainable Development* 04 (05), pp. 99-107.
- [6] Taylor, M. A., Wirth, O., Olvina, M. and Alvero, A. M., 2016. Experimental Analysis of using Examples and Non-examples in Safety Training. *Journal of Safety Research* 59, pp. 97-104.
- [7] Merrill, M. D., Tennyson, R. D., and Posey, L. O., 1992. *Teaching Concept*. Second Edition. Engle-wood, Cliff, Nj: Educational Technology Publications.
- [8] Wan, M., 2014. *Incidental Trainer: A Reference Guide for Training Design, Development and Delivery*. 1st Edition. Taylor & Francis Group. Boca Raton, Florida.
- [9] Blume, B. D., Ford, J. K., Baldwin, T. T. and Huang, J. L., 2010. Transfer of Training: A meta-analytic Review. *Journal of Management*, 36, pp. 1065-1105.
- [10] Fu, C., Zhu, M., Yu, T. S. I., and He, Y., 2013. Effectiveness of Participatory Training on Improving Occupational Health in small and Medium Enterprises in China. *International Journal of Occupational and Environment Health* 19 (02), pp. 85-90.
- [11] Cordova, M., 2003. Effectiveness of Training Employees on OSHA's new Recording Requirement to Avoid Liability: Employment Law Update. *Engineering Construction and Architectural Management* 3, pp. 232-245.
- [12] Noone, S. M., 2005. *Voluntary versus Mandatory Adult Learners: Implications for Trainers*. New York. Engel LTd.
- [13] Demirkesen, S. and Arditi, D., 2015. Construction Safety Personnel's Perception of Safety Training Practices. *International Journal of Project Management* 33, pp. 1160-1168.

- [14] Huang, Y., Strawderman, L., Babski-Reeves, K., Ahmed, S., and Salehi, A., 2014. Training Effectiveness and Trainee Performance in a Voluntary Training Program: Are Trainees Really Motivated?
- [15] Besley, J. C., Dudo, A. D., Yuan, S. And Ghannam, N. A., 2016. Qualitative Interview with Science Communication Trainers about Communication Objectives and Goals. *Science Communication*. Vol. 39(3), pp. 356-381
- [16] OSHA, 2015. Training Requirements in OSHA Standards. Occupational Safety and Health Administration.
- [17] Wilkins, J. R., 2011. Construction Worker's Perceptions of Health and Safety Training Programmes. *Construction Management and Economics* 29, pp. 1017-1026.

Radiation Safety Awareness among Workers in Battery Manufacturer Company

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Abstract – Radiation is the process in which energy is emitted as particles or waves, transmitted through an intervening medium and can be absorbed by another body. As a batteries manufacturer company, a number of x-ray machine had installed to detect any defects encountered during their production process. These machines however transmitted radiation to the employees who are handling the machineries, directly or indirectly. As such, only authorized and trained workers are allowed to handle these machineries. In Malaysia, requirement on radiation safety training was stipulated in regulation 15(6) and 15(8) by Atomic Energy Licensing Act 1984 under Atomic Energy Licensing, Basic Safety Protection Radiation Protection, Regulations 2010. This paper addresses the issue on radiation safety awareness among workers and suggested on developing the awareness training. This research is using a quantitative data through the questionnaire and had been distributed to 59 respondents out of 60 radiation workers in the company. Once the data collected, it being processed and analyzed using the following statistic: frequency, percentage and the SPSS paired T-test. To examine reliability of the scale, Cronbach's α was used. Based on the result, it can be concluded that training is strongly required for the radiation workers in this company and the radiation exposure elements on the regulatory requirement, types of radiation, exposure level, dose rate, personal protective equipment (PPE) and STD principles (shielding, time and distance) needs to be addressed and highlighted with weak point accounted on exposure level, dose rate, training requirement and shielding elements

Keywords: Radiation safety awareness, radiation exposure element

1.0 INTRODUCTION

Radiation may be defined as energy traveling through space. An x-ray also known as x-radiation and travels through a medium or space. It was discovered by Wilhelm Conrad Röntgen on 1895 and received the first Nobel Prize in Physics for his discovery. In general, there are number of regulations, consensus safety standards, and radiation protection guidelines governing the performance and use of radiation equipment. Only authorized and trained individuals are allowed to operate radiation-generating equipment and they must be adequately exposed and trained in radiation

safety. No proper training with limited knowledge level on the radiation exposure will put the worker's lives in danger.

This study proposes radiation safety awareness among workers at battery manufacturer company, namely XYZ Company. XYZ Company produced 3 types of battery which commonly used in computer, power tool, smartphone, electronic devices etc. 28 of x-ray machines installed by the company to support production. The machines are complied with the requirement and registered with Atomic Energy Licensing Board (AELB). Currently, there are about 60 radiation workers involve in handling and operating the x-ray machines in the factory. However, due to high turnaround number of employees and time constraint, there were no proper introductory or training being presented to the new workers and this has contributed to less awareness on radiation safety among the workers. Therefore, the radiation safety awareness among the workers in this company is critical and this study proposes the effective training contents based on elements that being ignored or less concern by the workers in the radiation safety.

2.0 BACKGROUND OF STUDY

Radiations used in the factory are hazardous to workers and member of public as it is able to penetrate the body [1]. In Malaysia, AELB was established in 1985 to ensure safety, security and safeguarding peaceful on nuclear activities [2]. In addition, radiation protection in industrial radiography activities are governed by The Atomic Energy Licensing Act 1984 (Act 304), and Regulations [3]. Only authorized and trained individuals are allowed to operate radiation-generating equipment. They also need continuous education and update on radiation safety [4]. With safety awareness in place, it may encourage the workers to be more alert which lead to avoidance of accidents and incidents and minimize the impact (if happens).

3.0 METHODOLOGY

3.1 Operational Framework

Figure 1 shows the operational framework of the study that describes the sequence of work to develop awareness training content on radiation exposure among radiation workers in XYZ Company.

3.2 Data Acquisition

This study is using quantitative research through the questionnaires. The Nominal Scale (A, B, C, D) is used for Part A which is on demographic data. Part B of the questionnaires is using the Dichotomous Scale (Yes or No) to measure the variables

under investigation. To measure the internal consistency of variables selected, this study is using the Cronbach's Alpha coefficient. Ideally, the Cronbach's Alpha coefficient of a scale should be above .7 [5]. The results from questionnaires were processed and analyzed using the following statistic: frequency, percentage and the SPSS paired T-test. The conclusion will be based on data analysis generated from the program. Finally, a proper and relevant training contents on radiation exposure can be developed by the parties concerned based on the weaknesses identified.

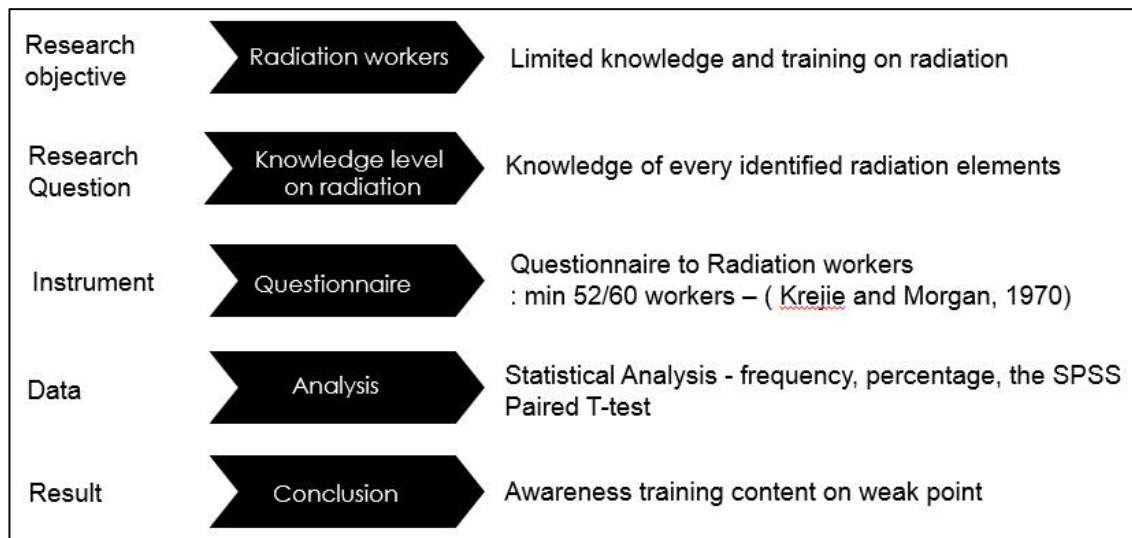


Figure 1: Operational framework of the research

4.0 RESULTS AND DISCUSSIONS

Quantitative methods were being used to emphasize the objective measurements and analysis of data collected through questionnaires. Descriptive statistics is used to summarize the data collection.

4.1 Reliability Statistics

As indicated in Table 1, the Cronbach's Alpha for all the questions (excluding demographic part) found to be good and reliable at .922

Table 1: Reliability statistics

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.922	.927	34

4.2 Demographic Data Analysis

Demographic data analysis was conducted for the 59 respondents in XYZ Company. Five categories were examined which are gender, age, education level, working experience and daily exposure to radiation by the workers.

4.3 Radiation Safety Awareness Analysis and Result

In preparing the results analysis, researcher had used the following statistic-Frequency and Percentage Analysis and SPSS paired T-test.

4.3.1 Radiation Exposure Knowledge Level

Two analyses were done to explore the level of radiation exposure knowledge among the radiation workers. The first analysis was based on total radiation safety elements against the knowledge level, without taking into accounts the training attendance. Table 2 shows that overall, time elements had showed the highest percentage in term of knowledge ability (51%). On technical knowledge such as exposure level, dose rate, training requirement and shielding elements, the knowledge ability percentage was less than 30%. On the other elements such as basic regulatory requirement, types of radiation, PPE and distance elements, the percentage was average at 37%.

The second analysis was done based on total radiation safety elements against the knowledge level, taking into accounts the training attendance. Table 3 shows that only 13 respondents (22%) had attended the training and 46 respondents (78%) did not attend any training on radiation safety. Overall more than 50% respondents, who had attended the training, had answered “Yes” to the questions on radiation safety elements and vice versa. It shows that the radiation exposure knowledge level among the radiation workers is statistically very low if they did not attend the training.

Table 2: Frequency and percentage analysis on radiation knowledge exposure

Radiation Safety Elements	Yes		No		Total Respondents
	n	%	n	%	
Basic Regulatory	22	37%	37	63%	59
Type of Radiation	20	34%	39	66%	59
Exposure Level	17	29%	42	71%	59
Dose Rate	14	24%	45	76%	59
Time	30	51%	29	49%	59
PPE	21	36%	38	64%	59
Distance	25	42%	34	58%	59
Shielding	11	19%	48	81%	59
Training Requirement	14	24%	45	76%	59

Table 3: Frequency and percentage analysis on radiation knowledge exposure
(training attended & training not attended)

Radiation Safety Elements	Training Attended				Training Not Attended			
	Yes		No		Yes		No	
	n	%	n	%	n	%	n	%
Basic Regulatory	9	68%	4	32%	13	29%	33	71%
Type of Radiation	8	64%	5	36%	12	25%	34	75%
Exposure Level	7	56%	6	44%	10	21%	36	79%
Dose Rate	6	49%	7	51%	8	17%	38	83%
Time	8	59%	5	41%	22	48%	24	52%
PPE	9	69%	4	31%	12	27%	34	73%
Distance	8	62%	5	38%	17	37%	29	63%
Shielding	7	55%	6	45%	4	9%	42	91%
Training Requirement	9	67%	4	33%	5	10%	41	90%

4.3.2 Radiation Safety Elements Ignorance

Frequency analysis and paired T-test were used to identify what are the elements that being ignored or less concern by the worker in the radiation safety. Frequency analysis indicates respondent's answers on "Yes" and "No" to the questions on radiation safety elements knowledge. While a paired T-test evaluates whether there is significant difference between training attended and not attend to the radiation safety elements. Table 4.5 shows that most of the p -value less than .05. It can be concluded that respondent who attended the training have significantly more knowledge on radiation safety elements particularly in basic regulatory, type of radiation, exposure level, dose rate, STD principles (Shielding, Time, Distance), PPE and training requirement, than respondent who didn't attend the training.

Table 4.5: Radiation Safety Elements Awareness Analysis

	Yes		No		p value
	n	%	n	%	
Regulatory Requirement					
Aela 1984	22	37%	37	63%	0.028
Aelb authority	22	37%	37	63%	0.028
License required	29	49%	30	51%	0.000
Clean area	25	42%	34	58%	0.002
Type of category	20	34%	39	66%	0.090
Control area	30	51%	29	49%	0.000
Meter calibration	8	14%	51	86%	0.096
Type of Radiation					
Radiation type	25	42%	34	58%	0.004
Radiation term	13	22%	46	78%	1.000
Atom basic	22	37%	37	63%	0.038
Exposure Level					
Pel for worker	6	10%	53	90%	0.007
Body level sensitive	29	49%	30	51%	0.001
Radiation level genera	16	27%	43	73%	0.443
Dose Rate					
Standard unit	3	5%	56	95%	0.001
Have knowledge	29	49%	30	51%	0.001
Type dose limit	11	19%	48	81%	0.532
PPE					
Osl as dosimeter	11	19%	48	81%	0.597
Ppe required	32	54%	27	46%	0.000
Distance					
Duty of worker	33	56%	26	44%	0.000
Safe distance	29	49%	30	51%	0.000
Std principle	15	25%	44	75%	0.597
Near level increase	23	39%	36	61%	0.024
Shielding					
Thickness shield	17	29%	42	71%	0.159
Different penetrate	16	27%	43	73%	0.443
Gama higher alpha	12	20%	47	80%	0.742
Component x ray	3	5%	56	95%	0.001
Safety feature x ray	8	14%	51	86%	0.058
Training requirement					
Organize training	7	12%	52	88%	0.013
Trianing important	21	36%	38	64%	0.031
Safe element	12	20%	47	80%	0.709
Time					
Longer expose	20	34%	39	66%	0.090
Impairment	34	58%	25	42%	0.000
Gen effect	35	59%	24	41%	0.000

Interaction effect was determined using a frequency analysis model and paired T-test model.

4.3.3 Radiation Training Contents

For the development of effective training contents, all questions were examined using the frequency and percentage analysis and SPSS paired T-test. Result from the study had shown that almost all the elements had more than 50% “No” answered. However, more emphasizing should be on elements that had more than 70% “No” answered such as Exposure Level (71%), Dose Rate (76%), Training Requirement (76%) followed by Shielding elements (81%). Details of the finding can be found in the above discussion (Table 4.3, Table 4.4 and Table 4.5).

5.0 CONCLUSION

This study proposes the effective training contents based on elements that being ignored or less concern by the workers in the radiation safety. Based on the analysis, safety elements are needed to be highlighted when preparing the training contents to the workers. The result showed more than 50% of the radiation workers had limited knowledge on radiation safety elements. Lack in knowledge subsequently reduced the awareness level among the workers. Furthermore, AELB has outlined standard syllabus on Radiation Safety Awareness Training and most of the investigation variables were emphasized in the syllabus. However, focus should be given more on

exposure level, dose rate, training requirement and shielding elements as those elements had showed the lowest knowledge ability among the others.

For the training attendance, this study also revealed that only 13 respondents (22%) had attended the training and 46 respondents (78%) had never attended any training on radiation safety. This is against the requirement by Atomic Energy Licensing Act (AELA) 1984 which requires an appropriate training to be given to each of radiation worker.

REFERENCES

- [1] Ismail Bahari et al., Managing Radiation Safety : Guide For Radiation Protection Officers. Mc Graw Hill, 2007 : 28
- [2] Zul Helmi Bin Ghazali. “Sustainable Management of Disused Sealed Radioactive Sources.” IAEA International Workshop 11 – 15 October 2010. Lisbon, Portugal, 2010, 2-3
- [3] Code of Practice on Radiation Protection In Industrial Radiography. LEM/TEK/33 Rev. 1, 02 December 2008, Malaysia 2008 : 3
- [4] E. Kiguli-Malwadde et al., “Radiation Safety Awareness Among Workers and Clientele at Mulogo Hospital, Kampala, Uganda”. East and Central African Journal of Surgery, 2006 : 49-51
- [5] Julie Pallant, “A step by step guide to data analysis using IBM SPSS : SPSS Survival Manual, 5th Edition”, Mc Graw Hill, 2013 : 101

Immediate Effects of Outdoor Military Firing Exercise

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Abstract – *This study concerned the immediate effect of a military firing exercise using three types of firearms: an assault rifle, a hand gun and a general purpose machine gun on soldiers' daily activities. Located at Kem Batu 3 firing range, twenty army personnel from were involved in this study and as a comparison, half of them were not equipped with hearing protector. The shooters were stationed one meter apart from each other. Noise levels were measured at 0.5 meters and 1 meters distance from the shooter. Each soldier was then interviewed on his or her difficulties when performing daily activities due to the immediate effect of firing exercise. Obtained results showed that measured noise peak values ranged from 119 dB, 126.1 dB and 128 dB for the respective firearms mentioned earlier. Adverse immediate effects of firing exercise on daily activities were more apparent to soldiers not using hearing protectors. This finding will contribute to the improvement of existing Outdoor Firing Range Safety Instructions.*

Keywords: Safety, Noise Exposure, Firing Range

1.0 INTRODUCTION

Military firing exercises exposed soldiers to high sound pressure level transmitted in milliseconds known as impulse noise. Coles *et al.* [1] reported that the intensity of peak impulsive noise were proportional to caliber size and gunpowder quantity. Repeated exposure to multiple weapons without proper hearing protection resulted temporary and permanent hearing loss [2]. Noise exposure to weapon fire was cited by Smoorenburg [3] as one of the causes of noise-induced hearing loss. High level, short duration exposure exceeding more than 140 dB can cause direct damage to supporting and sensory cells located in inner ear tissues [4]. Assessment conducted by Rezaee *et al.* [5] revealed even impulse noise exposure lower than permissible levels may lead to acoustic trauma during military shooting practice. Hearing affects a soldier performance during training. Usage of hearing protection devices is one of common solutions to prevent noise-induced hearing loss. Nakashima [6] pointed out that noise exposure knowledge particularly impulse noise and communication in specific operational environment are the requirements when choosing hearing protective devices. The objective of this study is to evaluate the immediate effect of a

military firing exercise using three types of firearms: an assault rifle, a hand gun and a general purpose machine gun on soldiers' daily activities.

2.0 METHODOLOGY

The firing exercise was held for five consecutive days. Twenty soldiers were chosen using three types of firearm in this firing exercise. Their personal data and usage of hearing protectors were recorded prior to firing exercise. Ten soldiers were without hearing protector with the purpose of comparison with soldiers using hearing protectors. During the firing exercise, the soldiers were arranged in standard distance of 0.5 meters and 1 meter apart from each other. A portable noise tester was located in the same distance; 0.5 and 1 meter from the shooter as shown in Figure 1. An interview encompassed after-effects was conducted daily involving all participating soldiers prior and after firing exercise.



Figure 1: Arrangement of Soldiers and Location of Portable Noise Tester

3.0 RESULT & DISCUSSION

Table 1 shows measured noise level for all types of firearms tested in this study. Located portable noise tester indicates noise level reduction ranged between 2.3-5.7 percent as distance doubled. The intensity of peak impulsive noise measured were proportional to caliber size as in agreement to Coles *et al.* [1] conclusion.

Table 1 : Noise level produced by types of firearm measured from distance of 0.5 meter and 1 meter

Firearm type	Noise level (dB)		Noise Reduction (%)
	Measured distance = 0.5 m	Measured distance = 1 m	
5.56 mm M4 Carbine assault rifle	119.9	113.1	5.7
7.62 mm General Purpose Machine Gun (GPMG)	126.1	123.2	2.3
9 mm Pistol	128.8	122.8	4.7

Results obtained from interviews conducted for both group of respondents; without and with hearing protection device (HPD) are depicted in Figure 2(a) and Figure 2(b) respectively. Soldiers without HPD experienced high level of difficulty resting (80%), conversing (75%) and sleeping (70%) as major immediate effects of the five days firing exercise. Reduction of difficulty level were found to be experienced by soldiers wearing HPD as shown in Figure 2(b) for the same daily activities.



(a) Without HPD



(b) With HPD



Figure 2: Level of difficulty experienced by soldiers when performing daily activities.

4.0 CONCLUSION

The principal conclusion from this research indicates that there is a necessity to amend the current Standard of Procedure particularly in the usage hearing protection devices. This necessity is highlighted from results obtained from measured noise and the immediate effect experienced by the soldiers involved in the firing exercise. Proposed appropriate hearing protection device should abide guidelines by DOSH, Malaysia and does not interfere a soldier's performance during firing. This study will benefit all Army personnel in the 33rd Royal Artillery Regiment.

5.0 REFERENCE

- [1] Coles, R.R.A., G.A. Garinther, G.C. Hodge, and C.R. Rice. *U.S. Army Technical Memorandum 13-67 Criteria for Assessing Hearing Damage Risk from Impulse-Noise Exposure* (AMCMS Code 5011.11.84100). Aberdeen Proving Ground, Md.: Human Engineering Laboratories, 1967.
- [2] Plomp, R., D.W. Gravendeel, and M.A. Bouman. *Hearing losses induced from Small Arms*. Report No. WW 1956-9. Soesterberg, The Netherlands: Institute for Perception RVO-TNO, 1967.
- [3] Smoorenburg, G.F. Damage risk criteria for impulse noise. In *New Perspectives on Noise-Induced Hearing Loss*, New York: Raven Press, 1982. pp. 471–490.
- [4] Slepecky N. Overview of mechanical damage to the inner ear: noise as a tool to probe cochlear function. *Hear Res.* 1986;22:307–21.
- [5] Rezaee, Maryam, Mojtahed, Mohammad, Ghasemi, Mohammad, Saedi, Babak. *Assessment of Impulse Noise Level and Acoustic Trauma in Military Personnel*, *Trauma Mon.* 2012;16(4):182-187.
- [6] Nakashima, Ann. *Comparison of different types of hearing protection devices for use during weapons firing*, *Journal of Military, Veteran and Family Health.* 2015;1(2): 43-51.

Long Evacuation Time during Fire Drill among Workers at Menara TM

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Abstract – *The study purpose is to address Long evacuation time during fire drill among workers at Menara TM. The objective of this study is to identify the level of knowledge and awareness among workers, to determine factors of long evacuation time during the fire drill at Menara TM and to propose an improvement plan on reducing the evacuation time. A major issue with conducting pre-announced fire drills is that occupant or employees know that drills are not a real emergency alert and they have no sense of urgency to evacuate the building. Occupants are still able to remain calm at their workplace and often to do not use the designated emergency exits. This type of drill may put employees in harm's way should they forget to use the designated emergency exits instead use the main entrances, which may not be the quickest and safest evacuation if real fire emergency happen. Review of the literature was done to identify the long evacuation factors. The contributing factors of this study parameter are knowledge and awareness, human behaviour and guidance. The qualitative and quantitative parameter was applied in this study. The results of correlation shows that knowledge awareness, human behaviour and guidance attribute have a significant positive relationship with Long Evacuation Time during Fire Drill among Workers at Menara TM.*

Keywords: High-rise building, fire awareness, safety knowledge, Fire Drill, evacuation guidance, human

1.0 INTRODUCTION

Menara TM is a tall building which required more than 45 minit to evacuate the building. Fire Drill or Evacuation Drill is known as planned, schedule and expected to employee with no element of surprise. Menara TM conducting 2 drills activity in a year. The previous study shows the reasons that contribute to long evacuation time which is due to the lack of awareness with no sense of urgency. Besides, the occupant are able to still remain calm and often do not use the designated emergency exits during the fire drill. In addition, lack of information on fire drill such as unfamiliar occupant or visitors and limited physical condition such as disabled

person, handicapped and pregnant lady also contribute to long evacuation time during fire drill.

Facilitating employee relocation to a safe place is the primary strategy for the safety of building occupants in emergency especially fires (Richard W. Bukowski, 2014). Escape routes in high-rise buildings are an essential element for emergency escape. Escape stairs are commonly designed with intermediate landing floors to connect two staircases between the floor levels. Evacuation from building fire is essential and has to be initiated as soon as the fire alarm is sounded or fire clues have been detected. They are two strong influences of important elements at the time of evacuation which is occupant's characteristics and building characteristic (Yahya Mohamad Yatim, 2008). The objective of this research is to identify the level of knowledge and awareness among workers on during fire drill at Menara TM, to determine factors of long evacuation time and finally to propose improvement plan of effective fire drill among workers on at Menara TM.

2.0 MATERIAL AND METHOD

2.1 Study design

This study combined both qualitative and qualitative research that attempt to accumulate the existing data (Diane P. Keating, 2010). At the end of the fire drill activities, fire drill information such as date, time and other particular such as any problem encountered and those corrected or needing correction, alarm monitoring service, answering service and the Fire Department were notified that drill activity had concluded must be documented and keep on file (Jason D. Averill, 2010). The initially pilot test was carried out to confirm the reability of each questionnaire. The questionnaire survey distributed to n=120 which represent 96% the qualitative analysis. The sample of the interview is n=5 cover 4% of the quantitative data analysis.

2.2 Respondent

The population sample to be used in this study consist of the respondents selected from a different level and different department from the upper level, middle level and lower level include TM workers and other tenants with total of 125 respondent located at Menara TM, Jalan Pantai Bharu, Kuala Lumpur.

Table 1: Respondent Background

Demographic Characteristic	Percentage %
Office Level	
Lower Ground – Level 18	36
Level 19 - Level 37	45
Level 38 - Level 55	19
N=120	

Base on demographic data, the study involve 120 respondents at Menara TM. The statistical analysis divided into three floor categories as per shown in Table 1. The highest respondent is at Level 19 – Level 37 of Menara TM with 45% (54 respondents) follow by Lower Ground – Level 18 are 36% (43 respondents) and lastly Level 38 - Level 55 are 19% (23 respondents). Based on the demographical statistic, the study can conclude that office levels contribute to the long evacuation time during fire drill among workers at Menara TM.

2.3 Statistical Analysis

Statistical analysis was conducted using SPSS data analysis. The Cronbach's alpha reliability coefficient shows a good relationship with the value of reliability for the 44 is 0.882, suggesting that the item have relatively high internal consistency. The reliability coefficient of 0.70 or higher is considered acceptable in most social science research study area (Gliem & Gliem, 2003).

Pearson's correlation coefficient (r) is defined as statistical measure using the strength of a linear relationship between more than one data which is $-1 \leq r \leq 1$. Positive answer show positive linear correlation and the negative values show negative linear correlation. Zero value (0) shows no relationship of correlation. However, stronger relationship exists if the value is to 1 or -1 . Apart from the correlation efficient, the p -value has also been looked at to measure the significance of then analysis in which the range are between 0 and 1 to represent the probability that the data would have arisen if the set null hypothesis were true (Fenton & Neil, 2012).

In psychological research, Cohen's (1988) are used in conventions to interpret effect size. Statistical test on correlation coefficients, they are the descriptive statistic that indicate the strength of the relationship. Table 2 statistical test below show whether the correlation is significantly different from zero, the absolute value of the correlation coefficient is an effect size that summarizes the strength of the relationship.

Table 2: Cohen's Guidelines

Effect Size Cohen	
0.10	Small
0.03	Moderate
0.05	Large

3.0 RESULTS AND DISCUSSION

3.1 Result

All four modified hypotheses of Long Evacuation Time during Fire Drill at Menara TM have been tested with correlation analysis test. The outcomes indicate that correlation test that has been done to all the four components of knowledge, awareness, human behaviour and guidance attribute to positive associated with Long Evacuation Time during Fire Drill at Menara TM (Figure 1).

3.2 Discussion

3.2.1 Relationship between Long Evacuation Times with Occupant Knowledge & Awareness

In recent study, 58% of the respondents are lack of knowledge on fire drill and emergency response preparedness. Proper and ongoing training is important to gain more knowledge and enhance awareness among Menara TM occupant on fire drill. All the maintenance program, training or evaluation initiative that conducted by TM BHD OSHE Committee is to comply with current applicable Occupational Safety, Health and Environmental (OSHE) legislation. The company also takes proactive steps towards protecting the safety and health of TM employees and interested parties who may be affected by TM business activities. They also take every reasonable and practicable step to prevent and eliminate work related losses, ill health, diseases, property and environmental damage and near misses. The entire program conducted continuously from time to time as a maintenance program to prevent risk and at the same time to create the awareness among employees.

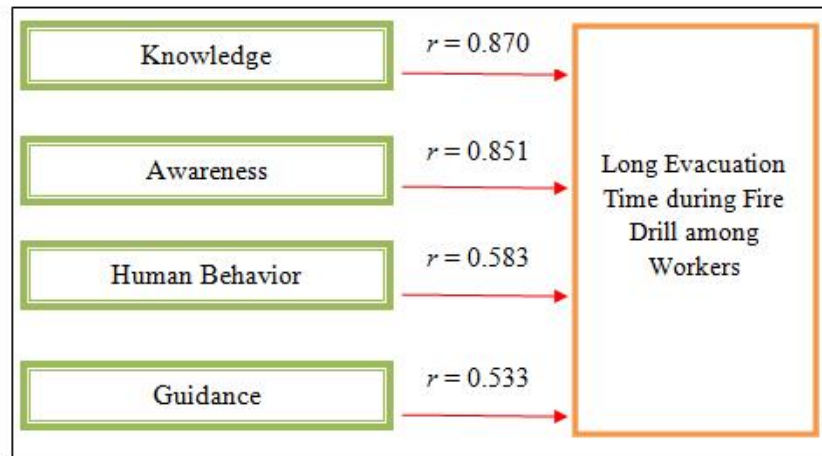


Figure 1: Evaluated Model Based on Correlation Result

3.2.2 Relationship between Long Evacuation Times with Occupant Behaviour

Human behaviour, human capability and human factor are much related to person knowledge and awareness. There are several factors that influences human behaviour act include attitude, perception, environment, genetics, culture, society. Human behaviour is defined as the range of actions and behaviours exhibited by humans at certain stages of development. In a recent study, shows that most of the respondents are lack of knowledge and lack of awareness that resulted to their low attitude, low act and low behaviour. They are also taking for granted on the fire drill alarm because they know fire drill is planned, schedule and expected with no element of surprise.

3.2.3 Relationship between Long Evacuation Times with Guidance

Evacuation guidance is the direction, instruction and information provided by the company to ease the occupant to evacuate the building during emergency. Guidance are related to assistance provided by company such as competent, expert and experience floor marshal, exit door, fire extinguisher, clear exit signage, emergency lift, emergency stairs and proper ventilation during the evacuation. Recent study shows that 65% of the respondents agreed with the guidance statement. Based on the result, the building are having complete facilities with fire alarm device including sirens, strobes, public address (PA) system and mass notification system are properly operate. Emergency routes and exits signs mark are very clear. Every floor is label and provided with floor plan.

4.0 CONCLUSION

This study has highlighted that long evacuation time during fire drill among workers at Menara TM is due to low knowledge, lack of awareness, human behaviour and guidance factors. The company should focus and highlight on important of the training requirement. Safety and health training especially in fire safety was important to prevent fires in the workplace and also concentrate on the basic essential of fire prevention and protection. The finding indicates that most of the workers are low knowledge and also lack of awareness on fire safety. This is very crucial to company and they should take preventive action to overcome the issue. By giving continuous training and monitoring on fire safety to workers in order to gain more awareness and enhance their fire knowledge.

The outcome of this research is to propose an improvement plan on reducing evacuation time during fire drill at Menara TM. This research conducted to increase the level of awareness on fire safety among occupant at Menara TM by given necessary training and safety info. This research also conducted to set up safety working environment in order to enhance employee health, safety and performance of work at Menara TM.

Objective one of the research which is to identify the level of knowledge and awareness among workers during fire drill at Menara TM was achieve. The research has found out that high response on low knowledge and low awareness level based on the answer given from the questionnaires. 58% of the respondent is agreed and another 21% strongly agree that they are still lack of awareness on fire safety. Hence, 44% of the respondent agrees that they are still low knowledge and another 23% strongly agrees with lack of knowledge statement.

The second objective of the research which is to determine factors that affected to long evacuation time during fire drill among workers at Menara TM also achieve. To answer second research objective, correlation analysis is use to evaluate the relationship between long evacuation time and factor. All four factors which are knowledge, awareness, human behaviour and guidance show positive result of relationship among them.

The third and last objective of the research which is to propose some improvement plan on to reduce long evacuation time during fire drill among workers at Menara TM was recommended. The company should implement ongoing safety training and educational program to create awareness and enhance knowledge among workers. These include Meet and Greet among safety team and workers, online training and include a lot of quiz on safety to give some safety foundation to all workers and also regular safety team building, safety workshop and monthly safety training. Otherwise, the company should train and select competence Marshall Floor to ease

the evacuation. Marshall Floor is one of the important team in order to direct and giving info to the occupant to ease the evacuation during a fire drill. Marshall Floor selected must be well train and competent person. Finally company should strengthen company regulation by forcing the workers on to follow safety standard procedure.

REFERENCES

- [1] Yatim YM. An Analysis of The Effect of Staircase Intermediate Landing Floor on The Evacuation Time. Jurnal Alam Bina. 2008;3(12).
- [2] Tharmarajan PAL. The Essential Aspects of Fire Safety Management in High-Rise Buildings: Universiti Teknologi Malaysia; 2007.
- [3] Song JDAW. Accounting for Emergency Response in Building Evacuation: Modeling Differential Egress Capacity Solutions. NAtional Institiute of Standards Technology. 2007.
- [4] M. Arja-Liisa Siikonen HH. Efficient Evacuation Methods In Tall Building. 2002.
- [5] Goverment DfCL. Fire and Rescue Authorities Operational Guidance: TSO (The Stationery Office); 2014.
- [6] Chow NCWK. Fire Safety Requirements On Lift System For Evacuation in Supertall Buildings. International Journal on Engineering Performance-Based Fire Codes. 2011;10(2):17-23.
- [7] NFZ et all. A Study on Problems Arises in Practicing Fire Drill in High Rise Building in Kuala Lumpur. Perak, Seri Iskandar University Teknologi MARA; 2014.
- [8] MII et all. The Effectiveness of Emergency Response Plan in Speciality Chemicals Company in Malaysia: University Teknologi Malaysia; 2014.
- [9] ES et all. Fire Protection for High Rise Buildings. Victoria, Australia 2000.
- [10] AU et all. Development of Fire Risk Assesment Procedure For The University Students' Hostel Building In Nigeria. The International Journal Of Engineering And Science (IJES). 2014;3(8):18-21.
- [11] Akhter MS. Firefighters' view on Improving Fire Emergency Response: A Case Study of Rawalpindi. International Journal of Hunanities and Social Science. 2014;4(7)(1).
- [12] Chu, J. and Yeh, C. (2012). Emergency Evacuation Guidance Design for Complex Building Geometries, J.Infrastruct. Syst., 10.1061/(ASCE)IS.1943-555X.0000080, pp.288-296.

Penilaian Mengenai Isu Beg Sekolah Berat Dalam Kalangan Guru

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Abstrak - Beg sekolah adalah komponen utama untuk membawa keperluan pelajar ke sekolah. Namun sedemikian, beg sekolah boleh memudaratkan pelajar yang membawanya sekiranya beg tidak diuruskan dengan betul dengan mengambil kira berat dan cara membawa beg sekolah. Berat beg sekolah sering menjadi isu di media massa. Tujuan kajian ini dijalankan adalah untuk mengenalpasti faktor-faktor dan tindakan yang diambil oleh guru terhadap isu berat beg sekolah. Kaedah penyelidikan yang dijalankan adalah kaedah tinjauan dimana set soal selidik telah dibangunkan dan diedarkan kepada 120 orang guru di sekolah sekitar Pasir Gudang, Johor. Bagi menjelaskan lagi kewujudan isu beg sekolah berat ini, berat beg sekolah bagi pelajar sekolah sekitar Pasir Gudang direkodkan dengan menggunakan alat penimbang elektronik EXCEL berketepatan ± 0.01 kg untuk mengukur berat beg dan isi kandungannya yang dibawa oleh pelajar ke sekolah. Terdapat penemuan dimana julat berat beg beserta isi kandungan adalah 2.55 kg – 5.73 kg dengan kadar purata 4.30 kg bagi pelajar yang berusia sekitar tujuh hingga sembilan tahun yang mempunyai berat badan diantara julat 16.9 kg – 37.7 kg dengan purata berat badan adalah 27.20 kg. Berat badan pelajar diukur dengan menggunakan penimbang OMRON berketepatan ± 0.1 kg. Nisbah berat beg pelajar yang ditemui adalah 8.80% hingga 30.3% berbanding berat badan mereka. Berat beg pelajar tidak boleh melebihi 15% daripada berat badan mereka. Dapatan kajian menunjukkan 57.26% peratus pelajar membawa berat beg melebihi 15% daripada berat badan mereka. Hasil daripada kajian ini, dicadangkan kepada semua pihak yang terlibat; pelajar, ibu bapa, guru dan pengurusan sekolah untuk memainkan peranan dan bekerjasama untuk mengatasi masalah beg sekolah berat bagi menjamin tiada kesan kesihatan yang tidak diingini. Pihak Kementerian Pendidikan Malaysia (KPM) dicadangkan untuk menetapkan satu had berat beg sekolah yang mesti dipatuhi oleh semua pihak yang terlibat.

Kata kunci: Berat beg sekolah; Nisbah berat; Kementerian Pendidikan Malaysia

1.0 PENGENALAN

Apabila fasa persekolahan hampir bermula, perkara utama yang dibayangi oleh ibu bapa dan pelajar adalah beg sekolah. Beg sekolah adalah komponen utama untuk melengkapkan satu hari sesi persekolahan dimana didalam beg sekolah akan terisi

segala keperluan sepanjang pelajar berada di sekolah. Ibu bapa disaran agar memilih beg yang bersesuaian dan meneliti jadual waktu dan memastikan anak-anak membawa buku yang dijadualkan sahaja. Kebanyakan ibu bapa tidak mengambil tahu tentang berat beg sekolah anak mereka, isi kandungan beg sekolah dan bagaimana anak mereka mengangkat, membawa atau memakai beg [1-2]. Guru menjadi sasaran responden kajian kerana mereka adalah lebih dekat dengan pelajar sekolah dan guru adalah contoh terbaik kepada pelajar yang membawa beg sekolah dimana ia merupakan aktiviti harian bagi kebanyakan kanak-kanak.

Penyelidikan berkaitan beg sekolah berat di Malaysia telah dijalankan dalam usaha untuk mengenal pasti had berat beg yang selamat, namun masih tiada kata sepakat mengenai garis panduan berat beg [3-5]. Membawa beg sekolah berat telah menimbulkan kesan sampingan yang berpanjangan dikalangan kanak-kanak yang sedang bersekolah [6]. Antara kesan membawa beg berat, ia akan mempengaruhi gaya berjalan, kesihatan dan ketidakselesaan [7]. Sebahagian buku teks juga telah dibahagikan kepada dua jilid agar tidak terlalu tebal dan berat untuk dibawa ke sekolah. Sekurangnya-kurangnya pihak yang berwajib bersikap responsif kepada permasalahan ini. Terdapat peningkatan kepada saiz dan berat beg yang dibawa oleh kanak-kanak apabila mereka membawa buku teks, buku rujukan, buku kerja, buku latihan dan kamus [8]. Kebanyakan pelajar membawa beg sekolah yang melebihi 15% daripada berat badan mereka, meletakkan mereka kepada risiko untuk sakit belakang dan kemudaratan. Berat beg sekolah yang melebihi 15% daripada berat badan pelajar sekolah haruslah dielakkan [9].

Malaysia perlu mencontohi sepertimana yang dilaksanakan oleh negara India dan negara-negara lain yang memainkan peranan dalam membantu mengurangkan penggunaan buku bercetak selari dengan peredaran teknologi dan maklumat [10]. Cabaran baru di era teknologi maklumat dan komunikasi memerlukan penglibatan guru dan aktiviti pembelajaran sepenuhnya yang menjurus ke arah pengajaran dan pembelajaran yang efektif serta menyokong persekitaran hijau[11].

2.0 KAEDAH KAJIAN

2.1 Pengukuran Berat Badan dan Berat Beg Sekolah Pelajar Tahap Satu di Sekolah Sekitar Pasir Gudang

Pelajar tahap satu yang terlibat dikenalpasti untuk diambil data berat badan dan berat beg sekolah mereka. Sekolah yang terlibat ialah sekolah kebangsaan di sekitar Pasir Gudang iaitu Sekolah Kebangsaan Kampung Kopok (SKKK), Sekolah Kebangsaan Taman Cahaya Masai (SKTCM), Sekolah Kebangsaan Taman Cendana (SKTC), Sekolah Kebangsaan Taman Scientex (SKTS) dan Sekolah Kebangsaan Taman Bukit Dahlia (SKTBD).

2.1.2 Penimbang berat

Alat penimbang berat yang digunakan adalah jenama EXCEL untuk menimbang berat beg, manakala alat penimbang jenama OMRON digunakan untuk menimbang berat badan pelajar.

2.2 Edaran soal selidik kepada guru di Sekolah sekitar Pasir Gudang

Sebanyak 120 set soal selidik telah diedarkan kepada guru sekolah tahap satu, namun hanya 96% (n=115) yang dipulangkan semula kepada pengkaji. Jumlah keseluruhan guru yang mengajar tahap satu untuk kelima buah sekolah ini adalah 120 orang. Pecahan bilangan guru yang menjawab soal selidik adalah terdiri daripada 80 wanita dan 35 lelaki dengan purata umur 29.87 tahun.

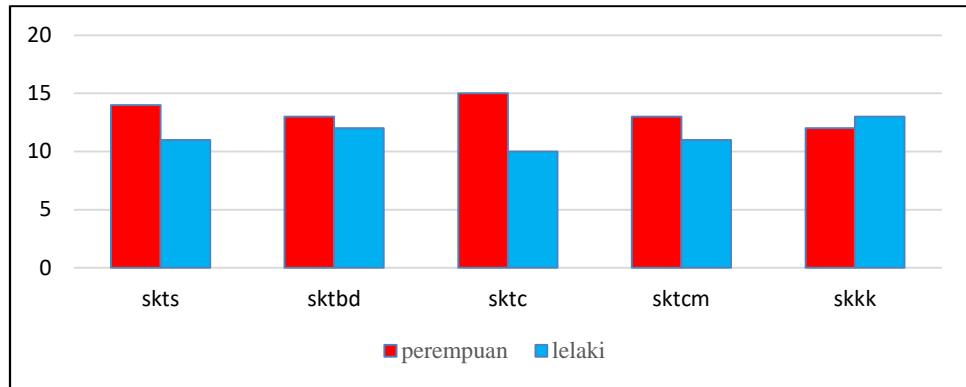
2.2.1 Soal Selidik

Soal selidik diedarkan kepada guru tahap satu di sekolah terlibat adalah untuk menjawab objektif kajian iaitu mengenalpasti faktor-faktor yang menyumbang kepada berat beg sekolah dan mengenalpasti tindakan yang diambil oleh guru terhadap isu berat beg sekolah. Soal selidik terdiri daripada lima bahagian termasuk demografi, faktor yang menyumbang kepada berat beg sekolah, tindakan yang diambil oleh guru terhadap faktor yang menyumbang beg sekolah dan pendapat guru bagi mengatasi beg sekolah berat.

3.0 KEPUTUSAN DAN PERBINCANGAN

3.1 Analisis Berat Beg Sekolah

Keseluruhan pelajar yang terlibat dalam proses mengumpulkan maklumat berat badan pelajar dan berat beg sekolah adalah 124 orang yang terdiri daripada lima buah sekolah. Berikut adalah hasil dapatan yang menunjukkan SKTS terdiri daripada (n=25) 14 pelajar perempuan dan 11 pelajar lelaki, SKTBD terdiri daripada (n=25) 13 pelajar perempuan dan 12 pelajar lelaki, SKTC terdiri daripada (n=25) 15 pelajar perempuan dan 10 pelajar lelaki, SKTCM terdiri daripada (n=24) 13 pelajar perempuan dan 11 pelajar lelaki, dan SKKK terdiri daripada (n=25) 13 pelajar perempuan dan 12 pelajar lelaki dengan julat umur antara tujuh hingga sembilan tahun. Rajah 1 menunjukkan graf bar perbandingan bilangan pelajar perempuan dan pelajar lelaki yang terlibat dengan kajian.



Rajah 1: Graf bar menunjukkan perbandingan bilangan pelajar perempuan dan pelajar lelaki yang terlibat dengan kajian

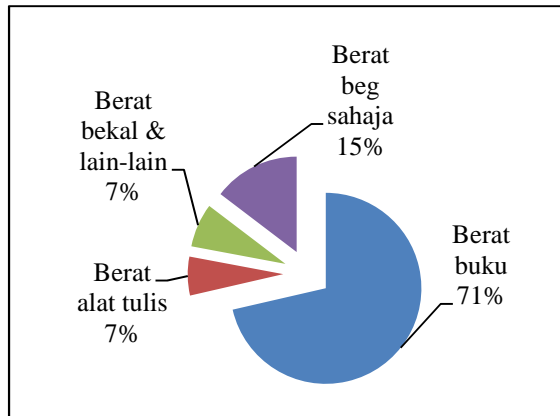
3.1.2 Faktor Yang Menyumbang Kepada Berat Beg Sekolah

Faktor secara langsung yang menyumbang kepada berat beg sekolah seperti Jadual 1 dan pecahan faktor yang menyumbang kepada berat beg secara purata diilustrasi seperti Rajah 2.

Jadual 1: Jadual menunjukkan analisis secara deskriptif bagi berat beg sekolah dan isi kandungannya

	N	Julat	Minima	Maksima	Purata	Sisihan Piawai
Berat buku	124	2.07	1.93	4.00	3.07	0.3994
Berat alat tulis	124	0.25	0.14	0.40	0.28	0.0492
Berat bekal dll	124	0.29	0.16	0.45	0.32	0.0553
Berat beg sahaja	124	0.57	0.32	0.89	0.63	0.1106
Jumlah berat beg	124	3.18	2.55	5.73	4.30	0.6144

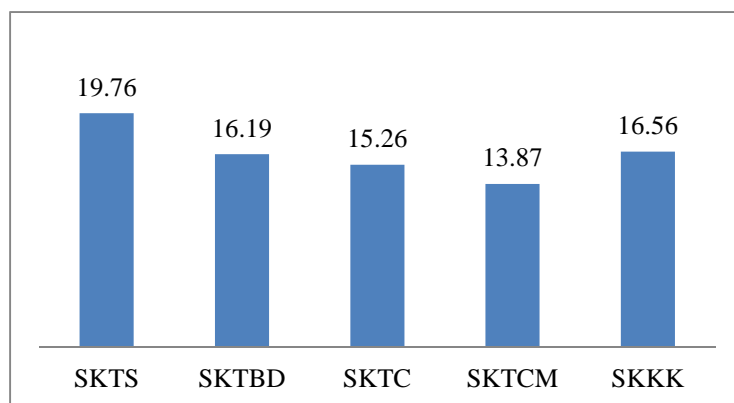
Pelajar lelaki membawa berat beg diantara julat 2.55 kg – 5.48 kg manakala pelajar perempuan membawa beg diantara julat 3.14 kg – 5.73 kg. Secara keseluruhan SKTS mencatat purata bacaan berat beg paling tinggi iaitu 5.10 kg manakala SKTCM mencatat purata berat beg paling rendah iaitu 3.49 kg seperti Jadual 2.



Rajah 2: Carta pai menunjukkan pecahan faktor secara purata yang menyumbang kepada berat beg dalam peratusan

Jadual 2: Jadual menunjukkan purata berat badan dan purata berat beg serta nisbah berat beg berbanding berat badan dan bentuk peratus

SK	Purata berat badan pelajar (kg)	Purata berat beg (kg)	% berat beg berbanding berat badan
SKTS	26.70	5.10	19.76
SKTBD	27.60	4.35	16.19
SKTC	28.80	4.29	15.26
SKTCM	26.20	3.49	13.87
SKKK	26.60	4.25	16.56



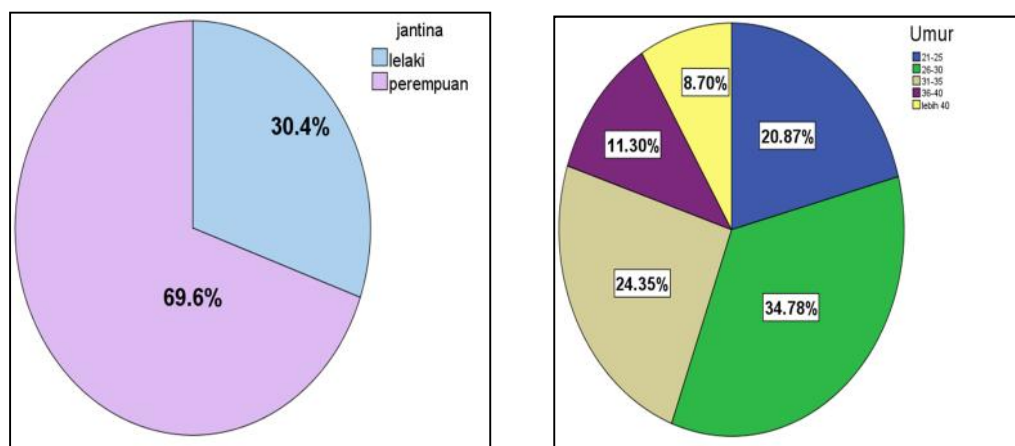
Rajah 3: Graf bar menunjukkan peratus berat beg berbanding berat badan pelajar mengikut sekolah

3.2 ANALISIS SOAL SELIDIK

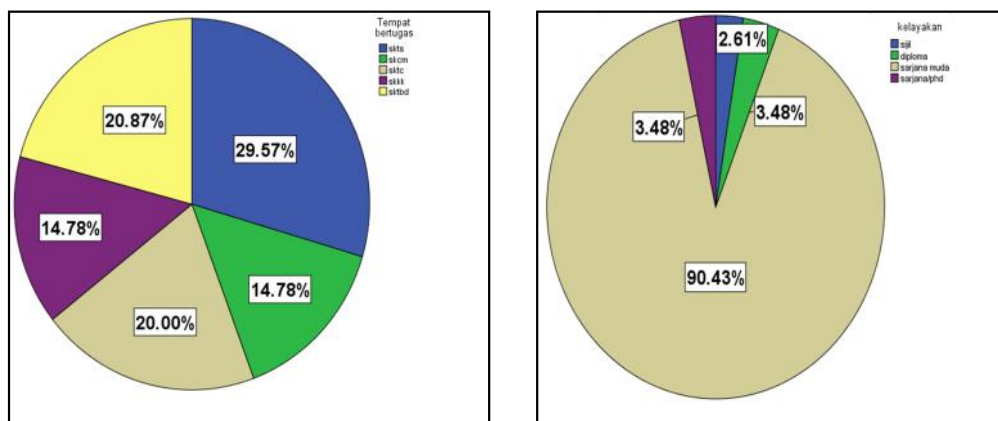
Hasil daripada kajian rintis yang dijalankan kepada sampel sebanyak 15 orang guru, prosedur *Cronbach' Alpha coefficient* di gunakan untuk mengukur darjah kebolehpercayaan instrumen, dan nilai skala yang diperolehi adalah 0.773. Analisis demografi dilaksanakan untuk mengenalpasti kumpulan responden mengikut pecahan berikut:-

3.2.1 Analisis demografi responden

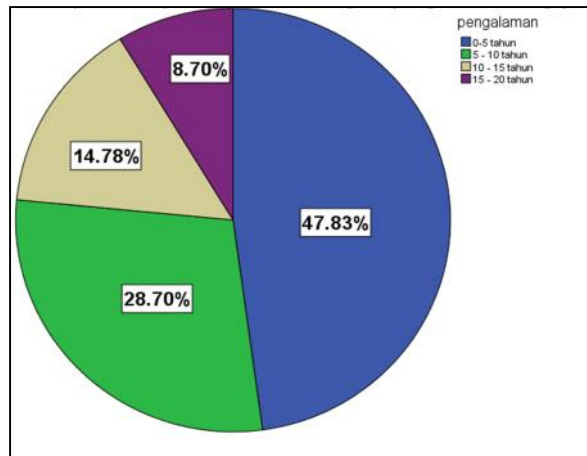
Analisis demografi responden adalah seperti Rajah 4 hingga Rajah 6.



Rajah 4: Carta pai menunjukkan pecahan responden mengikut jantina dan umur



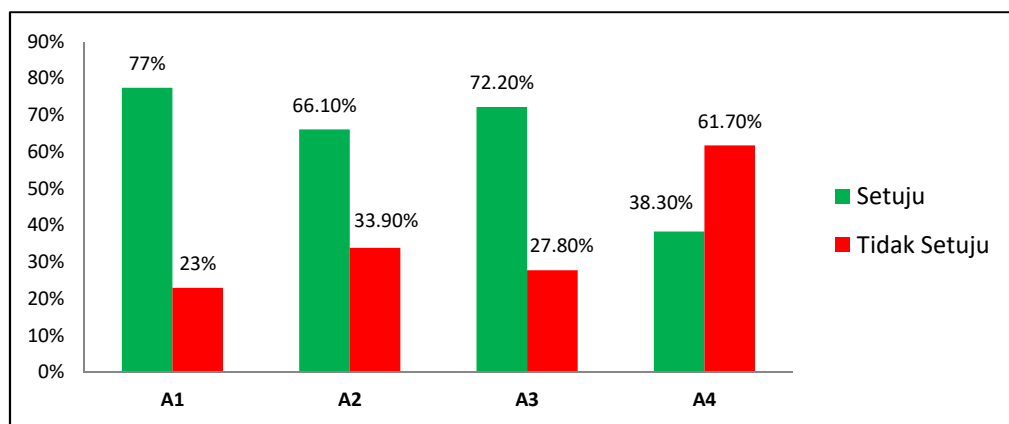
Rajah 5: Carta pai menunjukkan pecahan responden mengikut tempat bertugas dan kelayakan



Rajah 6: Carta pai menunjukkan pecahan responden mengikut pengalaman mengajar

3.2.2 Bahagian A: Faktor secara tidak langsung yang menyumbang kepada berat beg

Hasil analisis soal selidik yang diedarkan kepada guru-guru yang mengajar tahap satu didapati antara faktor-faktor yang menyebabkan beg berat adalah harapan guru kepada pelajar untuk membawa semua buku berkaitan subjek yang diajar dengan yang mencatat peratusan tertinggi iaitu 77%, diikuti dengan 72.2% guru bersetuju pelajar didapati membawa buku, mainan atau peralatan yang tidak sepatutnya di dalam beg sekolah mereka, 66.1% guru bersetuju yang pelajar tidak dibenarkan meninggalkan buku di dalam kelas diikuti dengan 38.3% guru bersetuju mendenda pelajar jika mereka tidak membawa buku yang hendak digunakan.



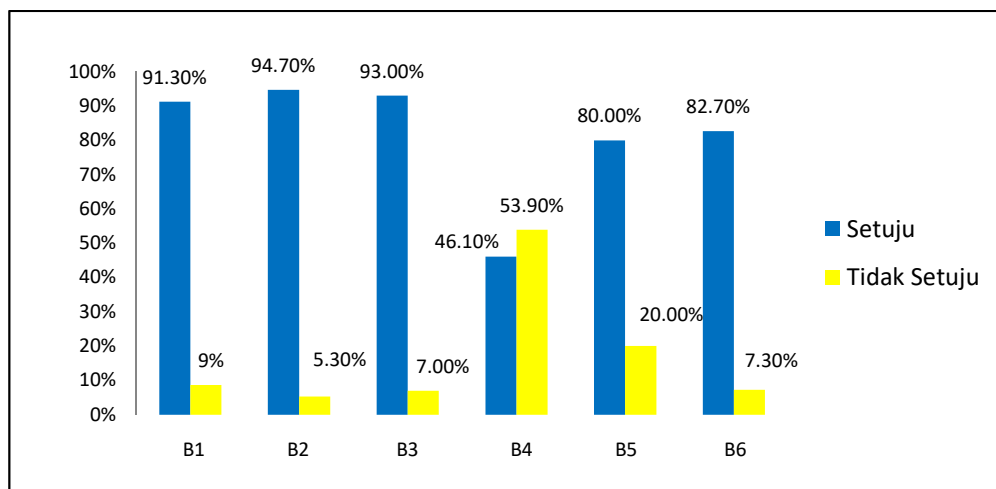
Rajah 7: Graf bar menunjukkan faktor secara tidak langsung yang menyumbang kepada berat beg sekolah

3.2.3 Bahagian B: Tindakan yang diambil oleh guru terhadap faktor yang menyumbang berat beg sekolah

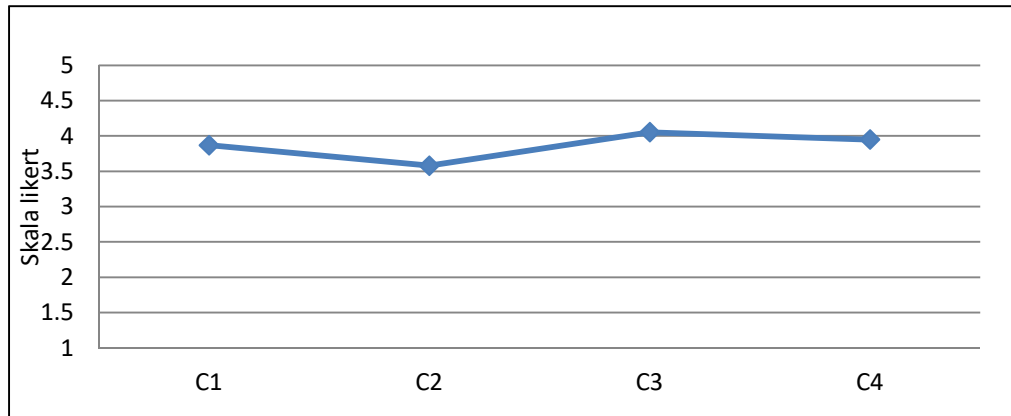
Keseluruhannya, 99% guru sedar jika pelajar membawa beg yang berat akan memudaratkan pelajar tersebut dimana 91.3% meluahkan rasa bimbang, 94.7% guru menasihat pelajar supaya tidak berlari ketika membawa beg, 93% guru pernah membantu pelajar mengangkat beg sekolah mereka kerana terlalu berat, 46.1% guru pernah mengutarakan isu berkaitan beg sekolah kepada pihak sekolah, 80% guru sedia melibatkan diri jika terdapat program berkaitan kesedaran isu beg sekolah berat, dan 83.7% guru akan merampas buku, alatan permainan yang tidak ada perkaitan dengan pembelajaran di sekolah.

3.2.4 Bahagian C: Keperluan garis panduan untuk mengatasi isu berat beg sekolah

Guru bersetuju untuk diajukan kepada KPM untuk menetapkan had berat beg sekolah (C1), wajar diwujudkan akta berkaitan beg sekolah dinegara ini (C2), wajar mengadakan kempen kesedaran berkaitan isu beg sekolah (C3), dan guru bersetuju isu beg sekolah berat dapat diatasi sekiranya KPM mengeluarkan garis panduan yang wajib dipatuhi oleh ibu bapa, guru dan pelajar (C4).



Rajah 8: Graf bar menunjukkan tindakan yang diambil oleh guru



Rajah 9: Rajah menunjukkan taburan min responden

4.0 KESIMPULAN

Isi serta berat beg sekolah dikalangan pelajar pada ketika ini sudah berada didalam zon kritikal. Manakala kesedaran yang tidak memadai sekiranya tiada tindakan yang tegas oleh pihak sekolah ataupun dalam menangani isu ini. Keseluruhan keputusan tinjauan pula menunjukkan responden setuju sekiranya KPM mewujudkan garis panduan berkaitan isu beg sekolah berat untuk dipatuhi oleh semua pihak dalam usaha membantu mengurangkan berat beg sekolah pelajar supaya beg ia berada dalam julat berat beg selamat iaitu kurang daripada 15% daripada berat badan mereka. KPM juga disaran untuk bekerjasama dengan Kementerian Kesihatan Malaysia supaya ia dapat dipantau secara berterusan dan dipatuhi bagi menjamin keselamatan pelajar sekolah ketika membawa beg sekolah.

RUJUKAN

- [1] Forjuoh SN, Schuchmann JA, & Lane BL. "Correlates of heavy backpack use by elementary school children." *Public Health*. 2004;118:532–538.
- [2] Shasmin HN, Abu Osman NA, Razali R, Usman J, Wan Abas, WAB . "A preliminary study of acceptable load carrying for primary school children." *1FMB Proceeding*. 2007;15(6): 171-174.).
- [3] Tamrin SBM, LP Ai, Hamzah R, Abdullah MY & Hanafi SS. " Berat beg sekolah dan kesannya kepada otot tulang belakang dan sakit bahagian bawah belakang di kalangan pelajar sekolah rendah di Malaysia. " *Malaysia Journal of Medical Health Science*. 2005;1(1): 21-31
- [4] AI Syazwan, MN Mohamad Azhar, AR Anita. "Poor sitting posture and a heavy schoolbag as contributors to musculoskeletal pain in children: an

- ergonomic school education intervention program. *Journal of Pain Research* 2011;4 287–296
- [5] American occupational Therapy Association. “Backpack Awareness: One of Many Ways That Occupational Therapists Serve Students.” 2009 Available from: <http://www.aota.org/News/Consumer/Backpack08.aspx> [Dicapai 6 April 2016].
- [6] Jing X. L., Youlian H. and Robinson P.D. “The Effect of load carriage on movement kinematics and respiratory parameters in children during walking.” 2003 Springer-Verlag.
- [7] JavadiVala, Z., Allahverdipour, H., Dianat, I. and Bazargan, M. “Awareness of Parents about Characteristics of a Healthy School Backpack.” *Health Promotion Perspectives*. 2012, 2,(2): 166-172.
- [8] Barkhordari A., Ehrampoush M.H., Barkhordari M., Derakhshi F., Barkhoradri M., Mirzaii M. “Assessment of School Backpack Weight and Other Characteristics in Elementary Schools, Yazd, Iran.” *Journal of Community Health Research*. 2013; 2(1):2- 7.
- [9] Khalil Al-Qato, A. “The Influence of Backpacks on Students backs A Cross-Sectional Study of Schools in Tulkarm District , An-Najah National University”.2012.
- [10] M. Marzuki, C. D. M. Asyraf, R. N. Ahmad B.L. “Effects of Backpack’s Weight on School Children – a Review.” *National Symposium on Advancements in Ergonomics and Safety* 2009, 33-37, Perlis, Malaysia.
- [11] Ambigapathy, P. Dan Shanti, B. “Technological Literacy for Adults: Insights from Malaysia. dalam Kell, P., Shore, S. dan Singh, M. (ed).” *Adult Education 21st Century*, New York, 2004.

Occupational Stress Effect On Job Satisfaction in Department of Orthopaedic and Traumatology, Hospital Kuala Lumpur

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Abstract – Occupational stress exists in all professions, but the health care workers appear to experience more stress at work compared to other professions. Various stressors used as variables in this study coping of stressful conditions at the workplace that may cause declination of job satisfaction among healthcare workers. This research investigated the effects of occupational stress on healthcare workers' job satisfaction in Department of Orthopaedics and Traumatology, Hospital Kuala Lumpur (HKL), Malaysia. A survey was conducted through the distribution of questionnaires to 250 respondents who were working in Department of Orthopaedics and Traumatology, HKL. Statistical Package for the Social Sciences (SPSS) version 20 was used to analyse the gathered data via t-test, mean, frequency, ANOVA, correlation and linear regression techniques. The results indicated that the highest mean of the facet of stressor was job autonomy. Age, the current level in profession and years of experience were statistically significant with occupational stress and job satisfaction level. There was also a statistically significant negative impact of occupational stress on job satisfaction. For conclusion, this research contributed to the body of knowledge with the findings on the impact of occupational stress on job satisfaction. The essential improvements could be taken through a revision on the organisation's policy regarding occupational stressors in the department. By giving more attention towards the main contributing stressor (role in the organisation), the management team might mitigate the impact of occupational stress on healthcare workers' job satisfaction.

Keywords: Occupational stress, job satisfaction, orthopaedics, traumatology, healthcare workers

1.0 INTRODUCTION

Stress is not something new to the global community. Normally, stress will occur when someone is in particular circumstances with an unpleasant state of feeling.

They tend to focus on the undesirable state of mind and emotions. Hans Selye began using the term stress and became a pioneer in conducting a study of psychological stress in the 1950s [1]. Stress also has significant effects on individuals' attitudes, behaviour, and interpersonal relationships and it is shaped by the combination of numerous factors [2]. In health care professions, the adverse effects of work stress not only cause harsh complications for the state of workers' well-being but also disturb the quality of patient care. The background of the occupational stress concept for healthcare workers which has various indicators such as substantial workload, poorly resourced work, conflicting patient care, conflicting administrative responsibilities, and heavy emotional demands [3].

According to Rosenthal and Alter [4], the demands of the workplace comprise both occupational-related and human-related variables. Occupational-related variables include work schedules (shift work or irregular hours, rotating schedules), time constraints, machine-paced work, repetitive-routine or tedious goings-on; interaction with the public; introvert or cooperative tasks; and manageable or unmanageable tasks. Healthcare workers also embrace hierarchical status; diverse responsibility for each level; autonomy and decision-making power; and status. Stress contributor factors may arise from unhealthy relationships with co-workers or superiors; unfair and conflicting management traits; inconsistent job demands; and extreme burdens prior to their position or under stimulation although support from colleagues or superiors may relieve their stress. A study carried out by Ulrich, Quan, Zimring, Joseph and Choudhary [5] found that the physical conditions and the environment in the health institution itself such as poor lighting levels and auditory or visual distractions could also affect healthcare workers effectiveness while performing critical tasks such as dispensing medical prescriptions. Job satisfaction became one of the most popular topics in psychology scholars and has been measured as a critical factor at hospitals in the provision of superior performance and high-quality services [15]. The main objective of this study is to examine the impact of occupational stress on job satisfaction of the healthcare workers in Department of Orthopaedic and Traumatology, HKL.

2.0 LITERATURE REVIEWS

2.1 Occupational Stress

For the purposes of this review, stress can be defined as a real or perceived disproportion between environmental requirements for survival and an individual's capability to acclimatize to these demands [6-8]. In addition, Mateescu and Chraif [9] mentioned that acclimatization or adaptation is the challenge to deal with the problem itself or with stressful emotions that are caused by the problem. In a recent study conducted by Rosenthal and Alter [4], the two main variables related to occupational stress were occupational-related and human-related variables. In a study

carried by Kyriacou [10], he defined that occupational stress as the experience of adverse emotional state such as frustration, worry, anxiety, and depression ascribed to the occupational-related stressor. Healthcare workers are exposed to various stress factors; role conflict [11]; role ambiguity [12]; work overload [13, 14]; lack of job autonomy [15, 16]; and career development stress [17]. Individual level stressors, which are the obvious variables of stress is one of the stressor components of the Organizational Stress Research Model of Ivancevich and Matteson [18]. These stressors include work overload, role conflict, role ambiguity, career goal discrepancy, and responsibility for people.

2.2 Job Satisfaction

The basic assumption made by Fiori, Bollmann and Rossier [19] is that employees who are more likely to experience positive reactions (eustress) may better appreciate their carrier and have better job satisfaction. Similarly, employees who are more likely to experience negative reactions (distress) may approach their place of work with negative motivations and prone to be less job satisfaction. Scientific attention has focused on the toxic impacts of stress towards brain function, mental and physical health [20]. Any form of change in an individual's life involving stress will give either positive or negative impact. Even though there is an indication that excessive stress of everyday life is a better predictor of human mental health and their well-being, previous studies pre- dominantly focused on traumatic events or major life incidents [8, 21].

Generally, employees' physical and mental well-being can be recognized through their job satisfaction level. Assessing employee satisfaction towards the job is a crucial element in retaining competent healthcare workers. Many healthcare providers feel unfulfilled and unconvinced in jobs they anticipated in order to find satisfaction. They have time constraints to do a quality job for patient care; continually expected to deliver fast and best service as they could, but have a lack of authority to overcome the undesirable circumstances; feel unappreciated and underused of their skills. These factors lead to discouragement, staff turnover, and overall disenchantment with career development in healthcare service [22].

3.0 METHODOLOGY

The variables for this study were derived from Organisational Stress Model of Ivancevich and Matteson [18]. The intra-organisation stressors were included into research instrument which was adapted from Stress Diagnostic Survey (SDS). Adapted SDS instrument [18] consists 20 questions where can be divided into five (5) individual stressor namely work environment; professional and competence development; role in the organisation; job autonomy; and interpersonal relationship. Each stressor consists four (4) items. Job Satisfaction Survey (JSS) were used in

order to assess workers' satisfaction. The JSS was developed by Spector [23] based on the respondents from healthcare service background [24]. It consists of 36 items with nine individual subscale (facets) and each facet consists 4 items. The instrument was a Likert-scale from 1 (disagree very much) to 6 (agree very much).

A pilot test was conducted to 30 samples (11 medical doctors, 16 nurses and 3 medical assistants) after Consent for Investigator Initiated Research (IIR) was obtained from Medical Research Ethics Committee (MREC) and Clinical Research Centre (CRC), HKL. Based on the pilot study data, the Cronbach's alpha was 0.89 for SDS and 0.92 for JSS respectively. A full survey was commenced in November 2016. The distribution of questionnaires to 250 respondents and 213 was returned made the response rate of 85.2%.

However, only 202 questionnaires were valid for data analyses, thus reduced the response rate to 81%. All respondents were provided with questionnaire set consists of demographic survey, SDS [18], JSS, and written Participant Information Sheet (PIS) and Informed Consent Form (ICF) for this study. Respondents comprehended and volunteered to participate. A computer software program (SPSS version 20) was used as a tool to analyse acquired data with various analysis techniques. Respondents' profile and contributing stressors were analysed via descriptive statistical analyses of frequency, mean, t-test, ANOVA, correlation and regression techniques. Linear and multi-regression analyses were conducted in order to analyse the impact of occupational stress on job satisfaction.

4.0 DATA ANALYSES

The analysed respondents' profile for this study showed various findings. The respondents for this study were male (32%) and female (68%). There were four (4) groups of current level in profession; specialist (1%); medical doctor (16%); nurse (72%); and medical assistant (11%). For the age group, the majority of the respondents were in 26-35 years old (N=96, 48%) followed by 18-25 years old (N=66, 33%); 36-45 years old (N=28, 14%); and 46-55 years old (N=12, 6%). Regarding years of experience among workers, it was divided into three (3) categories which were <5years (N=116, 57%); 6-10 years (N=46, 23%); and >10 years (N=40, 20%).

There were three (3) categories occupational stress level of workers in the department; low stress (N=1, 0.5%); moderate stress (N=196, 97%); and high stress (N=5, 2.5%). The majority of workers experience moderate occupational stress level and female workers were found to experience higher stress (Mean=73.93) compared to male workers (Mean=71.12). The data shows the job autonomy stressor became the highest mean compared to others (Mean=16.32). It was found that there were statistically significant differences between occupational stress level and age ($F_{(3, 198)}$)

=5.02, $p=0.00$.); years of experience ($F_{(2, 199)}=10.41$, $p=0.00$.); and current level in the profession ($F_{(3,198)}=8.76$, $p=0.00$).

The study divided job satisfaction into three categories which were satisfied ($N=49$, 24%), ambivalent ($N=137$, 68%) and dissatisfied ($N=16$, 8%) with their job. Male workers reported slightly higher satisfaction (Mean=134.45) compared to female workers (Mean=131.45). Another significant differences were found between job satisfaction level and age ($F_{(3, 198)}=4.02$, $p=0.01$); years of experience ($F_{(2, 199)}=9.14$, $p=0.00$); and current level in profession ($F_{(3, 198)}=10.15$, $p=0.00$). It had been proven through correlation analysis, there was a significant negative relationship between occupational stress and job satisfaction ($r=-0.95$). Through linear regression analysis, the occupational stress level was found to have a significant negative impact on job satisfaction. ($r = -0.95$, $p<0.01$).

5.0 DISCUSSION

Occupational stress variables used in the study were coherent with the study conducted by several studies on occupational stress (Arekkuzhiyil, 2014; Caponetti, 2012; Hassan Danial Aslam, Rossilah Jamil, & Tariq, 2014; Parker, 1983; Shahzad, Azhar, & Ahmed, 2013). On the other hand, job satisfaction variables used in the study also in line with several studies on job satisfaction dimension (Fesharaki et al., 2012; Gumus & Sahin, 2015; Skitsou et al., 2015; Watson, Thompson, & Meade, 2007).

The results derived from this study found that the majority of respondents experienced moderate occupational stress level. This result might be influenced by nurses with less than 5 years of experience within age group of 18-35 (the majority respondents for the study). Through mean comparison analysis, it was found that female workers were experienced higher stress level compared to male. A statistically significant difference was found between occupational stress level and age, years of experience and current level in the profession. The study indicated that younger workers with less working experience and lower rank in their profession were prone to the higher stress level. This result is consistent with a study done by Balakrishnamurthy and Shankar [25] in term of correlation between experience and stress level.

However, they found that age was not significantly affects stress level, which contradicts with the result of this study. The scoring key in SDS was ranged from 40 to 99, indicates moderate stress level. When interpreting the data on moderate stress level group, there were several respondents who have a tendency to fall into higher stress level group. If the scoring key ranged between 40 to 90 for moderate stress level, the numbers of workers with high-stress level would increase from 5 to 26 workers. In other words, the moderate stress level group consists of workers who

have a tendency towards high-stress level. Job autonomy was found to be the highest mean. This result is consistent with findings from Areekkuzhiyil (2014) but contradicts with results found in a study done by Pisljar (2011), where job autonomy has no evidence of interaction with occupational stress. The management now should consider this stressor in planning new plan to promote lower stress level in the workplace and stimulate their workers for higher job satisfaction. Other stressors also contributed to the level of occupational stress. In other words, the result of this study gave a better view for determining the contributing stressor to healthcare workers' stress level.

Regarding healthcare workers' job satisfaction, the study highlighted that male workers were more satisfied with their job compared to female workers. Respondents' age group of 18 to 45 years-old were ambivalent about their jobs and only those who were in age group of 46 to 55 years-old were found to satisfied. Specialists and medical assistants were found satisfied instead of medical doctors and nurses who were ambivalent about their job. The study also indicates that the workers with longer working experience were more satisfied compared to those with less experienced workers. In other words, the older workers with longer years of experience tend to be satisfied with their job. Furthermore, there were statistically significance differences were found between job satisfaction level and age, years of experience and current level in the profession.

Results from the study pointed out that there was a statistically significant negative impact of occupational stress levels on job satisfaction among healthcare workers in Department of Orthopaedics and Traumatology, HKL (Beta = -0.95, $p < 0.01$). A significance negative correlation was also found between occupational stress and job satisfaction ($r = -0.95$, $p < 0.01$). This result designates that respondent who experienced higher levels of occupational stress normally would experience a lower level of job satisfaction. The finding of this research supported by Alexopoulos et al. (2014) as they concluded that high-stress levels have an insightful negative effect on job satisfaction. The job satisfaction was most affected by workers' role in organisation stressor (Beta= -0.34, $p < 0.01$). The analysis results revealed that all stressors used in this study have significant negative impacts towards job satisfaction. Chung and Chun (2015) also stated in their study that workplace stressors were identified as the main element caused the declination of job satisfaction. When a worker perceived significantly less stress, their perception of job satisfaction was high [26].

6.0 CONCLUSION

Occupational stress level was found to have a significant negative impact on job satisfaction. The stressors of role in organisation appeared as the most affecting factors on workers' job satisfaction level. Furthermore, the job autonomy stressor

was found the highest mean compared to the other stressors. However, the findings showed that majority of healthcare workers in the department were experienced moderate stress level and ambivalent about their job satisfaction. The overall finding of occupational stress and job satisfaction level might be influence by middle-aged nurses with less working experience.

The implication of the findings might contribute to the organisation in order to review and improve their workers' job satisfaction. The result of the study also might contribute to the body of knowledge, being a reference for future study and for the department itself, in order to lessen occupational stress and to promote higher job satisfaction. The Department of Orthopaedic and Traumatology, HKL could create awareness on the workers' role in the organisation and by giving more autonomy to the workers. The management also might organise a systematic training on managing stress among the young and less experienced workers as they are more prone to the high occupational stress.

Regarding the limitation of the study, it did not investigate on the extra-organisational stressors that might influence the level of stress. There might be a time constraint for respondents to answer questionnaires as they were busy with their routine duties. Data gathered should have better results by giving more time for respondents to give their most accurate answers. The answers might be manipulated by the respondents due to their busy job function and working environment.

For the future study, it is recommended for the researchers not to be too particular with respondents' personal details. This requirement sometimes can create anxiety phenomenon among respondents. Thus, they might manipulate the answers. For MREC, it is suggested to waive the requirement for ICF to be signed by respondents for future study if there is neither requirement for clinical nor experiments on human subjects.

REFERENCES

- [1] S. Szabo, Y. Tache, and A. Somogyi, "The legacy of Hans Selye and the origins of stress research: A retrospective 75 years after his landmark brief "Letter" to the Editor# of Nature," *Informa Healthcare*, vol. 15, no. 5, pp. 472–478, 2012.
- [2] K. Boyacı, F. ensoy, K. D. Beyda , and M. Kıyak, "Stress and Stress Management in Health Institutions," *Procedia - Social and Behavioral Sciences*, vol. 152, pp. 470-475, 10/7/, 2014.
- [3] T. Pisljar, T. Van Der Lippe, and L. Den Dulk, "Health among hospital employees in Europe: A cross-national study of the impact of work stress and work control," *Social Science & Medicine*, vol. 72, no. 6, pp. 899-906, 3//, 2011.

- [4] T. Rosenthal, and A. Alter, "Occupational stress and hypertension," *Journal of the American Society of Hypertension*, vol. 6, no. 1, pp. 2-22, 1//, 2012.
- [5] R. Ulrich, X. Quan, C. Zimring, A. Joseph, and R. Choudhary, *The Role of the Physical Environment in the Hospital of the 21st Century: A Once-in-a-Lifetime Opportunity*, Health Design, 2004.
- [6] M. Laal, "Job Stress Management in Nurses," *Procedia - Social and Behavioral Sciences*, vol. 84, pp. 437-442, 7/9/, 2013.
- [7] C. N. Othman, R. A. C. Lamin, and N. Othman, "Occupational Stress Index of Malaysian University Workplace," *Procedia - Social and Behavioral Sciences*, vol. 153, pp. 700-710, 10/16/, 2014.
- [8] S. Sur, and E. S. Ng, "Extending Theory on Job Stress: The Interaction Between the "Other 3" and "Big 5" Personality Traits on Job Stress," *Human Resource Development Review*, vol. 13, no. 1, pp. 79-101, March 1, 2014, 2014.
- [9] A. Mateescu, and M. Chraif, "The Relationship between Job Satisfaction, Occupational Stress and Coping Mechanism in Educational and Technical Organizations," *Procedia - Social and Behavioral Sciences*, vol. 187, pp. 728-732, 5/13/, 2015.
- [10] C. Kyriacou, "Teacher Stress: Directions for future research," *Educational Review*, vol. 53, no. 1, pp. 27-35, 2001/02/01, 2001.
- [11] S. Sharma, "Occupational stress in the armed forces: An Indian army perspective," *IIMB Management Review*, vol. 27, no. 3, pp. 185-195, 9//, 2015.
- [12] Y. Chung, and J. Chun, "Workplace stress and job satisfaction among child protective service workers in South Korea: Focusing on the buffering effects of protective factors," *Children and Youth Services Review*, vol. 57, pp. 134-140, 10//, 2015.
- [13] J. Graham, A. J. Ramirez, S. Field, and M. A. Richards, "Job Stress and Satisfaction Among Clinical Radiologists," *Clinical Radiology*, vol. 55, no. 3, pp. 182-185, 3//, 2000.
- [14] D. Prosser, S. Johnson, E. Kuipers, G. Szmukler, P. Bebbington, and G. Thornicroft, "Perceived sources of work stress and satisfaction among hospital and community mental health staff, and their relation to mental health, burnout and job satisfaction," *Journal of Psychosomatic Research*, vol. 43, no. 1, pp. 51-59, 7//, 1997.
- [15] P. Trivellas, P. Reklitis, and C. Platis, "The Effect of Job Related Stress on Employees' Satisfaction: A Survey in Health Care," *Procedia - Social and Behavioral Sciences*, vol. 73, pp. 718-726, 2/27/, 2013.
- [16] A. Al-Meerza, S. F. Y. Al-Sayegh, L. M. Al-Sayrafy, E. M. Alkoot, M. K. El-Shazly, and M. I. Kamel, "Comparison of sources and expressions of stress among hospital and primary health care physicians," *Alexandria Journal of Medicine*, vol. 48, no. 4, pp. 367-371, 12//, 2012.

- [17] M. C. Santos, L. Barros, and E. Carolino, "Occupational stress and coping resources in physiotherapists: a survey of physiotherapists in three general hospitals," *Physiotherapy*, vol. 96, no. 4, pp. 303-310, 12//, 2010.
- [18] J. M. Ivancevich, and M. T. Matteson, *Stress and work: A managerial perspective*, Tucker, GA: Scott, Foresman and Company, 1980.
- [19] M. Fiori, G. Bollmann, and J. Rossier, "Exploring the path through which career adaptability increases job satisfaction and lowers job stress: The role of affect," *Journal of Vocational Behavior*, vol. 91, pp. 113-121, 12//, 2015.
- [20] C. Blair, and C. C. Raver, "Poverty, Stress, and Brain Development: New Directions for Prevention and Intervention," *Academic Pediatrics*, vol. 16, no. 3, Supplement, pp. S30-S36, 4//, 2016.
- [21] P. Schönfeld, J. Brailovskaia, A. Bieda, X. C. Zhang, and J. Margraf, "The effects of daily stress on positive and negative mental health: Mediation through self-efficacy," *International Journal of Clinical and Health Psychology*, vol. 16, no. 1, pp. 1-10, 1//, 2016.
- [22] S. A. Yafe, "Assessing Job Satisfaction Level Of Employees In A Tertiary Care Hospital: A Tool For Talent Retention," *International Journal of Multidisciplinary Research*, vol. 1, no. 2, pp. 494-507, 2011.
- [23] P. E. Spector, "Measurement of human service staff satisfaction: Development of the Job Satisfaction Survey," *American Journal of Community Psychology*, vol. 13, pp. 693-713, 1985.
- [24] M. Astrauskaite, R. Vaitkevicius, and A. Perminas, "Job Satisfaction Survey: A Confirmatory Factor Analysis Based on Secondary School Teachers' Sample," *International Journal of Business and Management*, vol. 6, no. 5, pp. 41-50, 2011.
- [25] C. Balakrishnamurthy, and S. Shankar, "Impact of Age And Level of Experience On Occupational Stress Experienced By Non-Gazetted Officers of The Central Reserve Police Force," *Industrial Psychiatry Journal*, vol. 18, no. 2, pp. 81-83, 2009.
- [26] S. Gandhi, G. Sangeetha, N. Ahmed, and S. K. Chaturvedi, "Somatic symptoms, perceived stress and perceived job satisfaction among nurses working in an Indian psychiatric hospital," *Asian Journal of Psychiatry*, vol. 12, pp. 77-81, 12//, 2014.

Musculoskeletal Disorders Concerns in Workers Handling Drinking Water Dispensers at the Fabrication Yard

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Abstract – Assessment of the ergonomic risk factors as well as identification of the types of Musculoskeletal Disorders (MSDs) amongst workers are crucial in identifying and implementing the appropriate ergonomic intervention program which includes management and engineering design to overcome this issue at the workplace. This research is conducted on the workers handling drinking water dispensers at the fabrication yard whom are exposed to MSDs risks due to performing tasks without proper ergonomic guidance and work instructions. The objectives of this research are to identify the work-related MSDs amongst workers through Nordic Musculoskeletal Questionnaire (NMQ) and to assess the ergonomic risk factors associate with their activities using Quick Exposure Check (QEC). The outcome of this research is to propose an ergonomic program which includes management and engineering designs to overcome the MSDs at the work site. Through these findings and proposed intervention programs, a decrease in occupational injuries and absenteeism amongst workers have anticipated as well as an increase in the efficiency of the workers handling drinking water dispensers at the workplace.

Keywords: Musculoskeletal Disorders, Ergonomic Risk Factors, Nordic Musculoskeletal Questionnaire, Quick Exposure Check

1.0 INTRODUCTION

Before the 18th century, MSDs were not recognized as having etiologic factors. Nevertheless, it was not until the 1970's that occupational factors were examined using epidemiologic methods, and the work-relatedness of these conditions began appearing regularly in the International Scientific literature [1]. Since then, the awareness has increased dramatically and though more than 6000 scientific article addressing ergonomics in the workplace have been published [1].

Work-related MSDs amongst workers are the most common indicators leading to occupational injuries and illnesses at the workplace. MSDs are defined as impairments of the bodily structures, such as intervertebral discs, muscles, joints, tendons, ligaments, nerves, or the localized blood circulation system, in the back, wrists, elbows, arms, shoulders, neck, abdomen (e.g. hernia), hips, knees and legs, which are caused or aggravated primarily by the performance of work and by the effects of the immediate environment in which work is carried out [2].

According to previous similar studies, workers performing industrial repetitive task are highly exposed to the risk of MSDs problems [3,4,5,6]. MSDs related illnesses results in low workers' productivity and has the potential to cause lost time amongst workers [7,8]. The objectives of this research are to identify the MSDs during repetitive Manual Material Handling (MMH) activities associated with handling drinking water, to assess the level of risk exposure to work-related MSDs risks during repetitive activities, and to propose an interventional ergonomics program to reduce the work-related MSDs risks exposure. The findings of this research will guide the development of an effective ergonomic program at the workplace to minimize the exposure to the workers.

2.0 METHODOLOGY

There are many data collection methods that are available to determine the workplace ergonomic risk factors such as through interviews, medical records, self-administered questionnaires, physical examinations and video recordings. However, for this research purpose, the data instruments which will be used for data collection are the standardized NMQ and QEC.

2.1 Data Sampling

Forty selected workers and supervisors were gathered into smaller groups for each data collection session. Workers whom were illiterate or require translation on the NMQ and QEC questionnaires were assisted by their supervisors and translators. Afterwards, data is compiled and analysed to determine the types of MSDs and level of intensity on the MSDs which are currently exposed to the workers. These workers voluntarily participated in the exercise after they were informed of the aims and improvement for their work nature. Workers previously affected by disease or accident to the musculoskeletal system were dismissed from the exercise. The assessed workers' nationality was 55% Bangladeshi, 25% Pakistan, 10% Nepalese and 10% Malaysian.

2.1.1 Nordic Musculoskeletal Questionnaire

The Standardized NMQ was developed from a project funded by the Nordic Council of Ministers [9]. The aim was to develop and test standardized questionnaires on general, low back and neck/shoulder musculoskeletal complaints for use in epidemiological studies [9].

For this research, the standardized NMQ were distributed to forty workers that were tasked to handle 2000 units of water dispensers daily from the beginning of shift at 6.30 am until the end of shift at 6.30 pm. The process of handling water dispenser as per their job description involves the MMH tasks such as pushing, pulling, stretching, and bending as well as manually distributing the water dispensers at designation locations throughout the fabrication yard.

2.1.2 Quick Exposure Check

The QEC is used to assess the physical exposure of MSDs towards the workers through determining the risk factors and the level of intensity towards MSDs [10]. The QEC questionnaires were given concurrently with the NMQ during the sessions with the selected workers. Through the assessment and findings of the ergonomic risk factors, this should lead to improvements of the workstations, working tools and equipment as well as an ergonomic work instruction to perform the tasks effectively. The QEC is also used to re-assess and determine the effectiveness of the workplace improvements in minimizing the work-related MSDs amongst workers.

2.2 Data Analysis

Once research data and information have been obtained through the NMQ and QEC methods, data obtained is transferred for statistical analysis using a statistical program SPSS version 22 to assess the frequency of the variables in determining work-related MSDs symptoms and its ergonomic risk factors.

Through the data analysis, the prevalence rates of the MSDs symptoms and risks, as well as exposure levels in the different parts of body regions of the workers, were able to be identified and assessed. The types of MMH acts which contribute to the highest number of MSDs were also determined. Thus, it is beneficial in determining the proper, appropriate and immediate recommendations to overcome this matter.

2.2.1 NMQ Analysis

The NMQ is categorised into 2 sections, where the first section is focused on general questionnaires of items identifying areas of the body causing musculoskeletal problems. It is aided by body map to indicate nine symptoms sites – neck, shoulders,

upper back, elbows, low back, wrist/hands, hip/thighs, knees and ankles/feet [9]. This section also assesses whether respondents had any musculoskeletal trouble in the last 12 months up to the last seven days.

The second section provided additional questions relating to the neck, shoulders and lower back focusing on functional impact at home and work as well as the duration of the problem. This section assesses whether respondents had any musculoskeletal trouble within the last seven days.

2.2.2 QEC Analysis

The QEC uses checklist and score sheet that is completed by both the Assessor and Workers. The Exposure level (E) is then calculated as percentage rate between the total exposure score (X) and the maximum total score (Xmax) [11]. The Action Levels (AL) as shown in Table 1 for the exposure score is determine to enable corrective/ preventive actions to be implemented.

$$E (\%) = (X/X_{\max}) * 100\%$$

Table 1: Action Level Indicators

Action Level (AL)	Indications
AL 1 (E ≤ 40%)	Indicates acceptable musculoskeletal loading
AL 2 (41% < E < 50%)	Further investigation is needed and changes may be required
AL 3 (51% < E < 70%)	Investigation and changes required soon
AL 4 (70% ≤ E)	Investigation and change immediately required

3.0 RESULTS AND DISCUSSION

Based on the data collection and analysis through NMQ it was determined that the most prevalence of work-related MSDs amongst workers handling water dispensers were in the regions of wrists/ hands (92.5%), shoulders (90%) and lower back (87.5%) as shown in Figure 1.

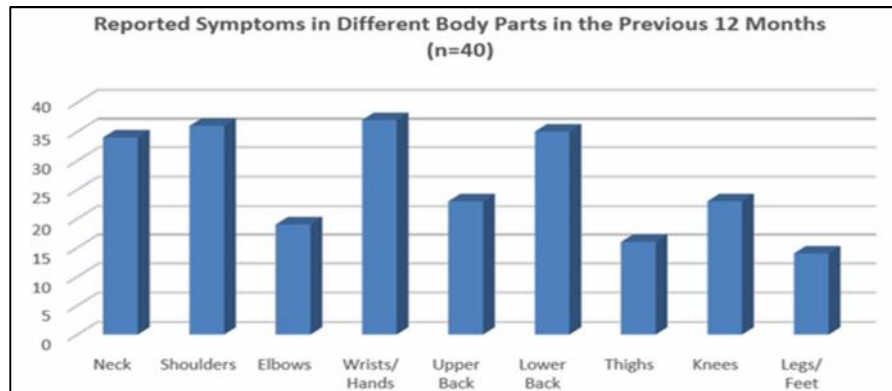


Figure 1: Reported symptoms in different body parts in the previous 12 months (n=40)

This result is consistent with exposure to MMH ergonomic risk factors such as, the duration of repetitive tasks, speed of performing the task, interval recovery periods, and additional elements during the process of cleaning, refilling, lifting, lowering and positioning of 2000 units of 5-gallons drinking water dispensers at the fabrication yard work sites. This finding is also supported by other authors [12, 13, 14, 15] in their studies where the findings were consistent with the prevalence of MSDs in the lower back, neck and shoulder regions on the subject matters due to their nature of hard labour requiring mainly MMH activities. In the study by Bao, et al (2010) reported that 76% of workers complain of lower back pain, 60% complaint on shoulder-neck pain and 82% of the workers' claim on knee region pain. In another study by Saidu et al., (2011) lower back complaints had the highest prevalence (85.71%), followed by upper back pain (40.71%), and shoulder complaints (37.14%) in a study to determine the MSDs and other related occupational hazards among factory workers in his research paper. In assessing the workers' level of exposure to the risk of MSDs through QEC, it was found that 10% of those affected by the risk falls under AL 2, 32.5% falls under AL 3, and 57.5% falls under AL 4 as per Table 2.

Table 2: Assessment of the workers' level of exposure to risk of MSDs by QEC method

Exposure Level	No.	%
AL 1 (E = 40%)	0	0
AL 2 (41% < E < 50%)	4	10
AL 3 (51% < E < 70%)	13	32.5
AL 4 (70% < E)	23	57.5
TOTAL	40	100

As the results of the study in assessing workers handling drinking water dispensers through the MMH processes of pushing, pulling, lifting, lowering and stretching, the most prevalence work-related MSDs were observed in the body regions of the shoulders, wrists/hands and lower back. This is in line with most studies on manual handling with similar work scope which reported a similar prevalence of body regions MSDs. Looking at the data where 32.5% and 57.5% of the assessed workers has an ergonomic risk factors of AL 3 and AL 4 respectively, this finding illustrate that there is a crucial need for an ergonomic risk factor interventions program and technological advancement to assist the workers during their daily activities in handling the drinking water dispensers at the fabrication yard in preventing further escalation of this matter.

3.1 Recommendations

3.1.1 Administrative Improvements

When discussing administrative improvements, it refers to the change or alteration in the work process and the manner it is being performed. To ensure the effectiveness of the of the administrative improvements implemented at the workplace, continuous monitoring is required by the management of the organization. Besides that, response and feedback from the workers on the effectiveness and efficiency of the improvement are also crucial in determining its functionality and practicality. Amongst the suggested administrative improvement for this matter are;

- i. Provide work instructions incorporating ergonomic methods of performing the task.
- ii. Provide variety in jobs to eliminate or reduce repetition.
- iii. Adjust work schedules, work pace, or work practices.
- iv. Provide recovery time (e.g., short rest breaks).
- v. Rotate workers through jobs that use different body parts.
- vi. Training on manual handling processes to affected workers.

3.1.2 Engineering Improvements

Workers' exposure to ergonomic risk factors can be minimized through administrative improvements as discussed earlier. However, workers may still be physically exposed to the risk factors which may lead to occupational injuries during the job. Thus to overcome this matter, a more effective method is to entirely change the work practices and methods which contribute to the ergonomic risk factors. This can be materialized through putting in place appropriate engineering controls and improvements on the method of performing the tasks such as rearranging, modifying, redesigning, providing or replacing tools, equipment, workstations, packaging, parts, processes, products, or materials.

Based on the results of this study, for the engineering improvements, it is recommended for the use of gate lift truck (Figure 2) and scissors lift (Figure 3) to ease the activities of workers during lifting, lowering, pushing and pulling of the water dispensers during loading, unloading and distribution process at the fabrication yard.



Figure 2: Gate lift Truck



Figure 3: Scissors Lift

4.0 CONCLUSION

This paper and study provides an insight view on the topic and concern of work-related MSDs amongst workers handling water dispensers at the fabrication yard. Through the results and findings of this study, the types of MSDs and its ergonomic risk factors were able to be determined and appropriate interventions such as administration and engineering improvements shall be proposed to the management of the fabrication yard in promoting a safe and healthy work culture. This in return will be able to increase the effectiveness and efficiency of the workers in performing their daily activity of handling and transporting water dispensers throughout the work areas in an ergonomic manner.

REFERENCES

- [1] Rosenstock, L. (1997). A Foreword to the book – Musculoskeletal Disorder and Workplace Factors: A Critical Review of Epidemiologic Evidence for Work Related Musculoskeletal Disorders of the Neck, Upper Extremity and Low Back. United States Department of Health and Human Services, Public Health Service, Centres for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH).

- [2] Girish, N., Ramachandra, K., Arun, G. M., & Asha, K. (2012). Prevalence of musculoskeletal disorder among cashew factory workers. *Archives of Environmental & Occupational Health*. 2012; 67(1):37-42. Doi:10.1080/19338244.2011.573020. PMID 22315934.
- [3] Chung, M. K., Lee, I., and Kee, D. (2005). Quantitative postural load assessment for whole body manual tasks based on perceived discomfort. *Ergonomics*, 48(5), 331–341.
- [4] Kumar, S. (2001). Theories of musculoskeletal injury causation. *Ergonomics*, 44(1), 17– 47.
- [5] Moore, A. & Wells, R. (2005). Effect of cycle time and duty cycle time on psychophysically determined acceptable levels in a highly repetitive task. *Ergonomics*, 48(7), 859-873.
- [6] Punnett, Laura, & Wegman, D. H. (2004). Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. *Journal of electromyography and kinesiology: official journal of the International Society of Electrophysiological Kinesiology*, 14(1), 13–23. doi:10.1016/j.jelekin.2003.09.015.
- [7] Xu, Z., Ko, J., Cochran, D. J., & Jung, M. (2012). Design of assembly lines with the concurrent consideration of productivity and upper extremity musculoskeletal disorders using linear models. *Computers & Industrial Engineering*, 62(2), 431–441. doi:10.1016/j.cie.2011.10.008.
- [8] Finneran, A. & O’Sullivan, L. (2010). Force, posture and repetition induced discomfort as a mediator in self-paced cycle time. *International Journal of Industrial Ergonomics*, 40(3), 257–266. doi:10.1016/j.ergon.2010.01.004.
- [9] Kuorinka, I. (1987). Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Applied Ergonomics*, 18(3), 233–237.
- [10] Choobineh, A., Tabatabaei, S. H., & Behzadi, M. (2009). Musculoskeletal Problems Among Workers of an Iranian Sugar-Producing Factory, *International Journal of Occupational Safety and Ergonomics*, 15:4, 419-424, DOI: 10.1080/10803548.2009.11076820.
- [11] Brown, R. & Li. G. (2005). The Development of Action Levels for the “Quick Exposure Check’ (QEC) System. *Ergonomics*, 43, 357-361.
- [12] Bao, S., Winkel, J., & Shahnava, H. (2010). Prevalence of Musculoskeletal Disorders at Workplaces in the People's Republic of China. *International Journal of Occupational Safety and Ergonomics*, Vol. 6, No. 4, 557-574.
- [13] Mirmohammadi, S., Yazdani, J., Etemadinejad, S., & Asgarinejad. (2015). A Cross- Sectional Study on Work-Related Musculoskeletal Disorders and Associated Risk Factors among Hospital Health Cares. 6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015.
- [14] Tomita, S., Arphorn, S., Muto, T., Koetkhilai, K., Naing, S. S., & Chaikitiporn, C. (2010). Prevalence and Risk Factors of Low Back Pain among Thai and

- Myanmar Migrant Seafood Processing Factory Workers in Samut Sakorn Province, Thailand. *Industrial Health*, 2010, 48, 283–291.
- [15] Saidu, I. A, Utti, V. A., Jaiyesimi, A. O., Rufa'i, A. A., Maduaqwu, S. M., Onuwe, H. A., & Mohd Jajere, A. (2011). Prevalence of Musculoskeletal Injuries Among Factory Workers in Kano Metropolis, Nigeria, *International Journal of Occupational Safety and Ergonomics*, 17:1, 99-102

Safety Awareness during Energy Audit at Main Switchboard Room

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Abstract - Arc flash is one of the workplace accidents happened in most manufacturing industry due to electric fault. Electric arc fault can occur if a person is interacting at very close proximity with the equipment in such a manner. The explosion of thermal temperature can cause injuries like damage hearing or brain, eyesight and burn. Therefore, this study is to identify the potential hazard during energy audit at main switchboard (MSB) and measure the level of safety awareness that has been practiced by the employees of Company A. The aim of the study is to propose effective safety program that can be implemented to increase safety awareness among electrical employee. Questionnaires were developed and distributed to the energy auditors in Company A. The results of the study showed that 49% of the employees did not received any safety and health training due to their job scope.

Keywords: Arc flash, energy audit, electrical hazards

1.0 INTRODUCTION

Arc flash is one of the workplace accident happened in most of manufacturing industry. An arc flash hazard is known as “A hazardous condition associated with the possible release of energy caused by an electric arc” [1]. The release of electrical energy with high voltage exists across gap between conductors known as arc flash [2]. Furthermore, any of these conditions of electrical fault can cause an explosion likes employee is working very near with the energized conductors or circuits, moves near or contact the equipment or equipment failure occurs. An explosion of thermal temperature can exceed more than 5000 degrees [2]. The pressure waves from explosions can cause injuries like damage hearing and brain malfunction while a flash can damage eyesight and exposed to burn.

There are a few accidents due to an arc flash accident and it happened at Brookhaven National Laboratory (BNL) on April 14, 2006 where in electrical panel an explosion

was happened during an electrical engineer closing a fused-disconnect switch. He was injured due to an arc flash [3]. The report state that an electrical engineer was not wearing appropriate PPE and his face and body was burned at first and second degree of burn. The National Fire Protection Association (NFPA) is Standard for Electrical Safety Requirements has been describing widely requirements in electrical equipment, Personal Protective Equipment (PPE), Lockout/Tagout system and safety training to protect worker from hazards but the employer cannot depend on protective equipment only because it does not take a proper safety. Therefore, OSHA was enforces NFPA 70E under the 'General Duty Clause' which needs employers to prepare a workplace that is safe and free from any hazards that can cause serious physical hazards or death [4]. According to this, training is needed and important. Generally the training needs to focus on skills of technical, instrumentation, procedures of safe operating and personal protective equipment, instruction on organizational behaviour or individual that can influence workers and workers attitude [5]. There is a group of research shows that can influence on safe behaviour and the occurrence of accident is job and organizational level factors [6].

In this research study, energy auditors in company A are exposed to the arc flash hazard. An energy audit involves the process of inspection, survey and analysis of energy flows for energy conservation over a building. The technical auditors need to take energy load at Main Switch Board (MSB) and Sub-Switch Board (SSB) to know the energy flows. The chances of arc flash hazard are high due to limited space between each 3 phase cable. Arc accident also can occur due to various causes such as poorly installed equipment, natural aging of equipment, bad condition and faulty connection due to corrosion [7].

1.1 The Importance of Awareness

An Occupational Safety and Health Act were established on 24th February 1994 [6]. The objective of this act are to provide an occupational environment which is adapted to persons physiological and psychological needs, to secure the safety, health and welfare against risks to safety or health arising from activities of person at work and other persons also [8]. it provides the framework rules to persuade and promote high standards for occupational safety and health to ensure that for establishing a safe work environment are responsibility of employer and employees [9]. The safety management system combines all elements in workplace that need concentration to ensure a safe working environment and the level of security can be measure by safety policy, program safety, training, accident investigation and equipment personal protective. Besides that, unsafe acts, unsafe conditions or a combination of both are the factors that can causes of accident in the workplace. Therefore, Employer has to provide safe work procedures for each work activity.

Human factors are the highest percentage which is more than 90% that contribute to the workplace accident and this has been done thru a research [8]. Human factors

defines as personal, occupational, environment and organizational. The factors of workers that can causes into personal injuries are careless, apathy, boredom, temperament flirt and fight and not sensitive to the risk of accidents [6]. Meanwhile occupational factors are machines that are not maintained periodically, poor design, lack of prevention equipment, not smooth in working environment, lights not in good conditions, levels of noise very high, expose to the smoke and dust [6]. Another factors is failure of management that cause from employers the level of supervision of the accident is unsatisfactory, working hours excessive, insensitive to worker fatigue, do not provide an adequate training in the handling of equipment and machines, not enforce the rules, insensitive to the complaints of employee, considers trivial to safety and health job and are not willing to provide for the safety program and occupational health [8].

1.1.1 Understanding The Electrical Hazards

Electricity has been known to give a serious workplace hazards such as electric shock, burns, fire and explosion. Thus, in the following discusses on the workplace hazard that were addressed by the OSHA

A) Electrical Shock

Electrical shock is the physiological reaction or injury caused by electrical current. It is happening when the current path completes by the person's body. The difference in potential will allow the current to flow from one part of the body to another. The severity of effects depends on several factors:

- Major factors of resistance are body resistance whether wet or dry skin
- Circuit voltage
- The quantity of current flowing through the body (determined by the body resistance and system voltage)
- Path of Current to the body
- Area of electrical shock contact
- Duration of contact

Burns are most common shock related injury although the majority of electrocutions are the result of ventricular fibrillation [10]. The immediate effects are muscle contraction, vital organs, pain, breathing, disorientation and death meanwhile for long term the person who injured by electrical shock will have memory loss, nervous disorders, chemical imbalances, damage to vital organs and sometimes fatal.

B) Electrical Arc Flash

The electrical arc flash produces light and heat and supplied with sufficient electrical energy. Various studied are shows that burns due to arc flash are the serious

electrical injuries where they have a large number of records. The arc temperature or flash flame, the incident energy and the pressure developed by the arc or blast is the three different causes due to arc flash. The flash flame and ignition of clothing are the main focus that dealing with the arc temperature whiles the concentration more on burning of skin. Refer to the Code of Federal Regulation, Occupational Safety and Health (OSHA) state that safety related work practices should apply to prevent electrical shock or other injuries either indirect or direct electrical contacts. This refer to the Arc Flash requirement that contained in NFPA 70E. The requirement in the NFPA 70E are switchboards, panel boards, industrial control panels and motor control centres that are require examination, adjustment or maintenance should have done by qualified persons.

C) Electrical Arc Blast

An electrical arc blast is the expansion of the rapid air caused by an electrical arc. The pressures from an arc are developed from two sources which are the expansion of the metal in boiling and vaporizing and the heating of the air by passage of the arc through it. Fragmented metal can be fly at high speed and molten causing from it is due to the pressure from expanding copper vapor, where can injure or kill anyone who standing nearby. Besides that, it can because burn injuries due to molten metal ignite clothing.

2.0 METHODOLOGY

In this section, the methodology of the study is discussed. A survey was done to the employer and the employee of Company A in order to discover the awareness level. The survey was based to their awareness of the following sub-section

2.1 Electrical Hazard Analysis

In NFPA 70E, the Standard for Electrical Safety in the Workplace contains the requirements for performing the analysis where include the Shock Hazard Analysis and the Flash Hazard Analysis. Arc flash hazard analysis will assist in identifying the approach boundaries to understand the electrical shock and the electrical arc flash hazard protection. The Electrical Hazard Analysis is used to determine the Limited, Restricted and Prohibited Approach Boundaries.

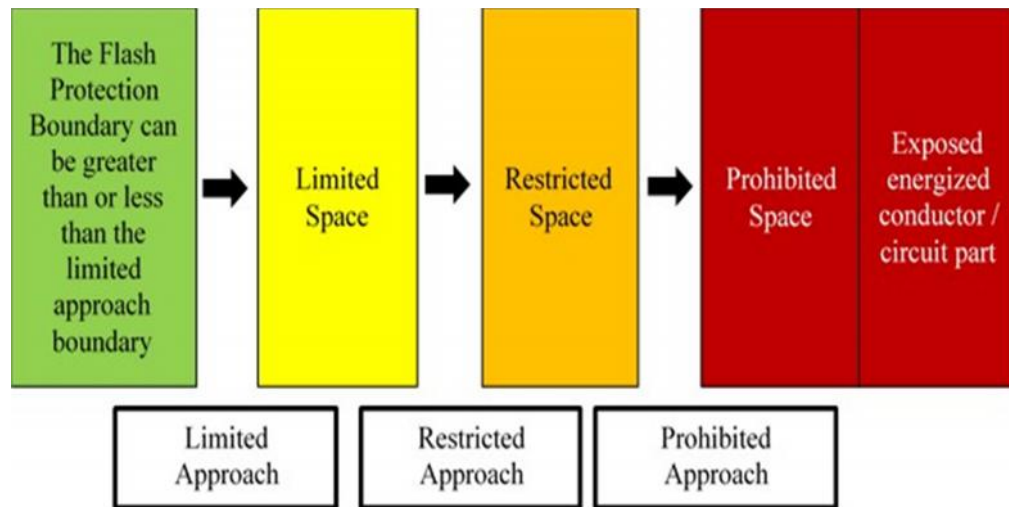


Figure 1: Electrical Hazard Boundary

2.1.1 Limited Approach Boundary

This boundary where minimum permitted distance for unqualified personnel and unprotected personnel may approach a live component. A suitable qualified person must use appropriate PPE and be trained to perform the work. Supervision from qualified person is needed for unqualified person. In this boundary electrical shock hazard exists.

2.1.2 Restricted Approach Boundary

In this approach limit of distance there is an exposed to the live part where the risk of shock was increased. Electrical arc combined with inadvertent movement will increase risk of shock. Personnel need to have knowledge in shock protection techniques, wearing the correct and proper PPE and the plan at work site have been written and approved.

2.1.3 Prohibited Approach Boundary

At this boundary the work is same as making contact with live parts. No worker should cross or enter this zone unless responsible authority has carried out the risk assessment with full.

- Documented and fully established of work on live equipment must be carried out.
- To work on live equipment, the qualified worker must have been trained
- The worker must wear an appropriate PPE. The protection as they would wear must be suitable for direct contact with the live equipment.

2.1.4 Flash Protection Boundary

This approach limit an electrical arc flash can occur and the person would receive a second degree of burn. Establish these boundaries is an important step in protecting personnel from arc flash and ensure that personnel used the correct equipment and procedures while working with live equipment.

2.2 Survey Question

The primary data will be data from the questionnaires survey forms, which will be given to the staff of Company A. It will design based on the information gathered from literature review. The questionnaires survey form will be divided into five main parts. The first part will be related more towards the background and general information of the respondent. The second part will be on the feedback of safety and health information that given from employer. Part three regarding working procedure in the MSB room. Part four to know the commitment of employer regarding safety and health of employees and part five regarding history of accidents at the work place. Questionnaires have been sending out about 35 copies and the questionnaire has been design in a user-friendly multiple-choice format based on the Likert's Scale. There are 5 multiple choice answers which are strongly disagree, disagree, undecided, agree and strongly agree.

3.0 RESULT AND DISCUSSION

Questionnaires survey was developed and distributed to the 35 energy auditors in Company A. Most of the workers who are participating in questionnaires are those doing energy audit and taking load at MSB panel. The respondents were included of engineers, assistant engineers, charge man, technicians and wireman. In this group, 33 of the respondents were male (94.3%) while 2 (5.7%) of respondents were female and it is shown in Table 1.

Table 1: Gender of the respondent

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	33	94.3	94.3	94.3
	Female	2	5.7	5.7	100.0
	Total	35	100.0	100.0	

The analysis shows that the respondents did not practice the awareness during working. This can be showed in Figure 2 where 51% claimed that they did not wearing glove during working with energized equipment. While 37% respondents

agree and 12% respondents were undecided. The reason for not wearing the gloves is because they had never attended any safety training. Meanwhile in Figure 3 shows that 57% said they did not wear a long sleeve shirt during working. This also another finding which showed that the employee did not follow the OSH procedure.

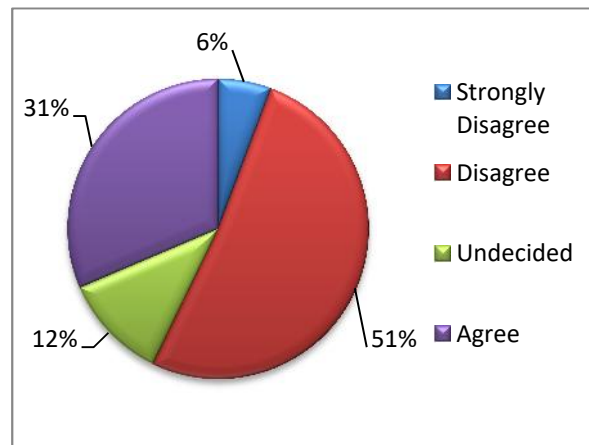


Figure 2: Wearing glove during working

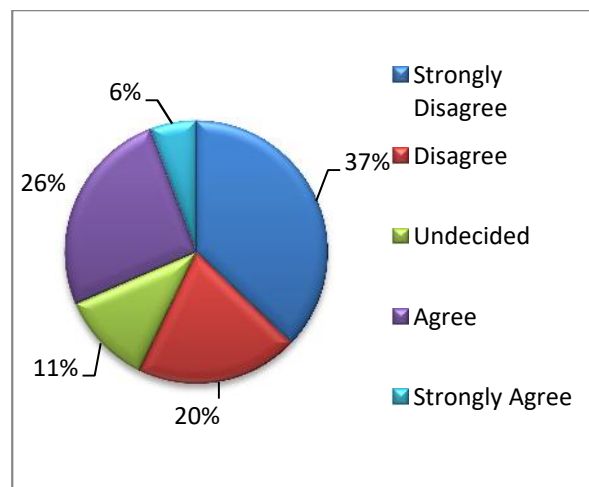


Figure 3: Using long sleeve during working

Another result of safety awareness implementation is shown in Figure 4 which showed that 60% of respondents did not used the face shields when working in Main Switchboard (MSB) room. OSHA has determined that PPE a good way to protect employees because the arc flash incident can result from human error and also from equipment that not functions in good and accident also can arise related to human behaviour. However, this has not being implemented by the employee in the Company A.

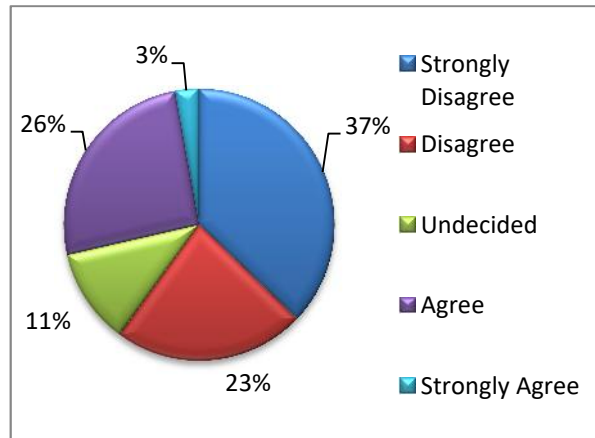


Figure 4: Used face shield in MSB

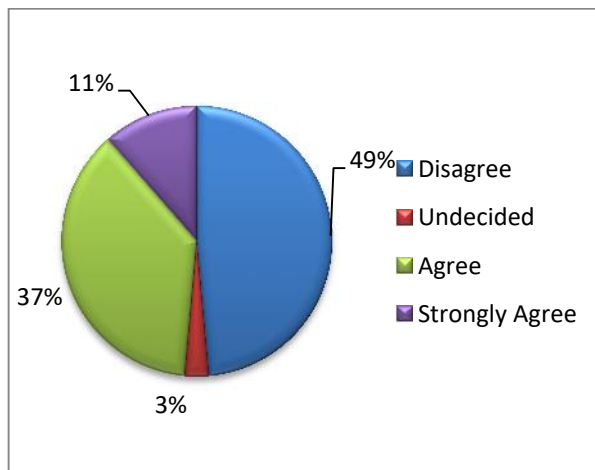


Figure 5: Safety and Health training

The result of the safety and health training either has been implemented or not is shown in Figure 5. The results from the data analysis shows that 49% respondents disagree with safety training that have been given to the employee. While 37% respondents agree. This shows that the management is still not aware with those who has not been given a safety and health training. The employees whom agree that they have been given a safety and health training claimed that the gained it from their previous employer.

According to standard for protecting workers against the hazards of an arc flash in NEC 2002 (National Electric Code), requirement of arc flash PPE in work practice is

important as it the most protective PPE requirements in the world and it also state in IEEE Standard 1584, OSHA and NFPA 70E (National Fire Protection Association). all workers must exposed to the training of potential arc flash or hazards of electrical shock. Workplace accidents and injuries can often be prevented through proper training and basic personnel awareness. This training will be developing proactive safety that leads to a reduction of accidents and injuries by identify risk behaviour in workplace, reduce risks that can lead to injury and provide employees the education needed to improve safety practices and behaviour.

4.0 CONCLUSION

All the workers are exposed to hazards in the workplace and it is depending on the work tasks they are performing. In this case a qualified person would require in doing work of electrical hazards of arc flash. In OSHA 1994 Section 15 (12) (c), management must prepare and provide information, instruction, training and supervision of occupational safety and health to the employees. Knowledge of safety awareness among employees can be gain through training and training should be at the core of every safety program.

The main objective of this study is to propose effective safety program that can be implemented to the company A. This was accomplished by distribute the questionnaire survey to the employees who are working as energy auditor in company A. According to the questionnaire there are several training program can be provided for example basic occupational First Aid. This training the employees will teach response to medical emergencies in safely manner and perform basic first aid skills. Besides, the employer also can provide behavioural based safety training which is develop and create a proactive health and safety culture in workplace. This training can develop a proactive safety that leads to a reduction of accidents and injuries by identify risk behaviour in workplace, reduce risks that can lead to injury and provide employees the education needed to improve safety practices and behaviour. Other training is electrical safety program. This program is to provide an overview of aspect on electrical safety and information on codes and standards which regulate with the electrical work is performed.

Employer must ensure that the working environment is safe and follow all the regulation when working with life equipment. Workplace accidents can often be prevented through proper training and basic personnel awareness. In OSHA 1994 Section 15 (12) (c), management must prepare and provide information, instruction, training and supervision of occupational safety and health to the employees. This is because the workers did not know the risk they face while working.

REFERENCES

- [1] Divinnie, M.D., J.K. Stacy, and A.C. Parsons, *Arc Flash Mitigation Using Active High-Speed Switching*. IEEE Transactions on Industry Applications, 2015. 51(1): p. 28-35.
- [2] Tinsley, H.W. and M. Hodder, *A practical approach to arc flash hazard analysis and reduction*. IEEE transactions on industry applications, 2005. 41(1): p. 144-154.
- [3] Gov, E., *Type B Accident Investigation Reports Of The Arc Flash At Brookhaven National Laboratory*. 2006, Office Of The Association Under Secretary For Environment, Health, Safety and Security.
- [4] Kowalski-Trakofler, K. and E. Barrett, *Reducing non-contact electric arc injuries: An investigation of behavioral and organizational issues*. Journal of safety research, 2007. 38(5): p. 597-608.
- [5] LCKuan, K.K., *Arc Fault Pressure Detector in Low Voltage Switchboard*. International Journal of Scientific and Research Publications, 2013: p. 30.
- [6] Idrus, D., et al., *Level Of Awareness Of UTM Staff On Occupational Safety And Health At The Work Place*, in *Fakulti Pengurusan dan Pembangunan Sumber Manusia*. 2004, Universiti Teknologi Malaysia.
- [7] Rafiin, M.A., *Keselamatan Dan Kesehatan Di Malaysia - Kajian Pemuatan Peraturan Di Syarikat Terpilih*. 2005, Universiti Teknologi Malaysia: Fakulti Kejuruteraan Awam.
- [8] Talib, M.F., *Keprihatinan Pensyarah Terhadap Terhadap Amalan Keselamatan Bengkel Di ADTEC Batu Pahat*, in *Fakulti Pendidikan Teknikal Dan Vokasional*. 2014, Universiti Tun Hussein Onn Malaysia Batu Pahat, Johor.
- [9] Neitzel, D.K. *Controlling electrical hazards through effective risk management*. in *Petroleum and Chemical Industry Conference (PCIC), 2011 Record of Conference Papers Industry Applications Society 58th Annual IEEE*. 2011. IEEE.
- [10] Thaker, M.N., B.N. Phadke, and P.D. Patel, *The Effects of Electrical Hazards*. Perception. 1: p. 369-374.

Occupational Stress on Military Personnel in Boat Squadron, Semporna Sabah

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Abstract - We conducted a survey about the occupational stress on Military Personnel in Boat Squadron which based in Semporna Sabah. This study will show about the stress that the military personnel have been affected. The purpose of this study is to find the best practice on how to handling the stress at work place. The management has to play the main role in how to manage the stress. Base on title the area of study will be in Boat Squadron located in Semporna Sabah. Semporna is one of area in the East Sabah Security Zone which known as ESSZone and a busy area with operational activities are being done at the sea.

Keywords: Occupational Stress, Military, Stress Management

1.0 INTRODUCTION

Joint Task Force 2 Headquarter is the main joint task force that base in East Sabah. It's responsible for East Sabah operations for Malaysia Armed Forces. Its main role is to keep the territory of East Sabah waters are save from any intruders or kidnappers and terrorist from making any unauthorized activities that will jeopardize the country and law. Joint Task Force 2 Headquarter is command by one-star general from Royal Malaysian Navy while Boat Squadron is command by an officer from Royal Malaysian Navy with rank Lieutenant Commander which responsible to advice and help in boats operations. Every detachment will have one officer rank Captain Malaysian Army or Lieutenant Royal Malaysian Navy and directly responsible on manning the detachment working smoothly with the boats operations and staff administrative.

Occupational stress has become major area of concern in the field of Human Resource Management in today's competitive era. Apart from the stressors outside the organization, such as family-related stressors and individual stressors, there are various stressors affecting an employee, which are associated with the organization itself [1]. Base on the statement over any work that we do will give stress. The

organization must assume their part in utilizing the best technique or approach to keep any anxiety to the staff. Same at Boat Squadron, doing diligent work in East Sabah will offer anxiety to the staff. The everyday routine at Boat Squadron is about the operations matters. Some of staff grumbled that they are pushed by their work.

2.0 METHODOLOGY

2.1 Research Design

The research will be conducting questionnaire among the military personnel. It will involve not only other rank staff but also the officer or higher authorities. For the Research Objectives, the instruments that will use to get the information's are by observation and then provide questionnaire.

2.2 Operational Framework

The framework will go about answering the research questions that has been set by the researcher. In the other words, operational framework is maps that give routes or steps for conducting the research.

Base on the operational framework, the research will begin by understanding and to get input from the literature review which related to the research study. Find any information's, journals and articles that related to military operation areas and personnel. After study has been done on the literature review, we can relate with the organization of Boat Squadron on factors that contributing stress and the management routines that affect the stress. To find the data next operation is to do the data collecting by observation and questionnaire and. In this research the sample that will use are only from the Boat Squadron in Semporna, Sabah. There will 40 samples for the questionnaire and survey.

3.0 RESULTS AND DISCUSSION

3.1 Response Rate

Response rate is referring to the percentage of participants whom had answered the survey questionnaires in relation to the number of military personnel in the sample size. During the data collection, 40 military personnel in Semporna have been participating in this research about the occupational stress. Out of this number, only 36 participants have returned the questionnaires that constitute of 90% response rate as shown in the Table 1.

Table 1: Response Rate

Study	Number of questionnaire distributed	Response received	Percentage	Response not received	Percentage
Main Study	40	36	90%	4	10%

3.2 Demographic Data

Table 2: Statistical Summary of Questionnaire Respondents

Attributes	Attributes	Frequency (N = 36)	Percentage
Age	26 – 33 years	14	39%
	34 – 41 years	13	36%
	42 – 49 years	7	19%
	Above 50 years old	2	6%
Race	Bajau	11	31%
	Melayu	9	25%
	Dusun	4	11%
	Iban	3	8%
	Melanau	2	6%
	Murut	2	6%
	Bugis	1	3%
	Kadazan	1	3%
	Cina	1	3%
	Rungus	1	3%
	Jawa	1	3%
Gender	Male	36	100%
Married Status	Married	32	89%
	Not Married	4	11%
Position	Coxswain	20	56%
	Navigator	5	14%
	Technician	5	14%
	Section Leader	4	11%
	Clerk	1	3%
	Store man	1	3%

Rank	Corporal	20	56%
	Leading Hand	6	17%
	Able Seaman	4	11%
	Lance Corporal	3	8%
	Chief Petty Officer	1	3%
	Petty Officer Sergeant	1	3%
Service Period	10 Years	8	22%
	15 Years	9	25%
	18 Years	12	33%
	21 Years	7	19%
Origin	Sabah	22	61%
	Sarawak	6	17%
	Perak	4	11%
	Melaka	1	3%
	Johor	1	3%
	Kedah	1	3%
Total		36	100%

All the demographic data are correlated with the research that I have done which can contribute stress at workplace. The increasing of age can give more fatigue to the person while doing any tasking and this will make them felt more pressure to do the jobs that have been ordered. According to the tasking and operational area, Boat Squadron is more suitable for male military personnel because of the nature and strength of the male gender than the female gender. Majority respondents are married and with this information we will know that they will have to leave the family behind and priority the work as military personnel. The position of coxswain and navigator are the most important position in the Boat Squadron and these positions are filled up by the rank of Corporal which from the results showed this rank are the highest respondents answered. These two positions play the main role in manning the boat for operational. These positions will have more tasking than the others positions and can give them more fatigue and stress to the jobs.

The origin where the respondents come from and the race are not the critical influence to the stress at workplace. Each of military personnel will have a period to serve outside their origin and after that they will transfer another unit to gain another knowledge and experience. The respondents service periods showed that majority of them have served almost 18 years in the armed forces. This can tell that they only got 3 more years to go before finish the service in armed forces and when they finished the positions are empty and it takes too long to fill up back their positions. This is the factors that related to the less of man power which contribute to stress at workplace.

4.0 CONCLUSION

This paper had discussed the Occupational Stress on Military Personnel in Boat Squadron Semporna, Sabah. On the results the organization can use this research to help the organization on handling the stress problems among the military personnel. Besides that, the best practice that had been provided in this research can be done instantly and can get more feedback about the best practice that has been provided in this research. Base on Chapter 4 the best practice is more welfare activities for less stress at workplace. The top management can conduct more activities related to welfare for example family day for every quarter a year, organize sport activities more frequent for high level of health and fitness and special appreciation or acknowledgement ceremony for the staff as a reward for them.

4.1 Future Works

Future Works for this paper is research continues on ergonomic awareness that can contribute stress on military personnel. Boat Squadron working area are related to the sea area which can affect the ergonomic problems addition with the accommodation of the boat, sea state and the weather.

REFERENCES

- [1] Luthans, F. 2002. Organizational behaviour. McGraw Hill, Irwin.
- [2] Braunsberger, K., and Gates, R. 2009. Developing Inventories for Satisfaction and Likert Scales in a Service Environment. *Journal of Service Marketing*, 23(4), 219-225.
- [3] C.R.Khotari. 2004. Research Methodology Methods & Techniques. India: College of Commerce, University of Rajasthan, Jaipur.
- [4] Cameron, R., and Molina-Azorin, J.F. 2011. The Acceptance of Mixed Method in Business and Management Research. *International Journal of Organizational Analysis*, 19(3), 256-271.
- [5] Cooper, D. R., and Schindler, P.S. 2006. Business Research Methods. McGraw-Hill Irwin.
- [6] Kumar, R. 2011. *Research Methodology : A Step by Step Guide for Beginners* (3rd ed.): SAGE Publications Ltd.
- [7] Ng, S. T., Skitmore, R. M., & Leung, T. K. C. 2005. Manageability of stress among construction project participants. *Engineering, Construction and Architectural Management*, 12(3), 264–282.
- [8] Zeffane, R., & McLoughlin, D. 2006. Cooperation and stress: Exploring the differential impact of job satisfaction, communication and culture. *Management Research News*, 29(10), 618–631.
- [9] National Institute for Occupational Safety and Health. Stress...at work. Centre for Disease Control and Prevention, DHHS (NIOSH) Publication

Number 99–101. 1999. <<http://www.cdc.gov/niosh/docs/99-101/>> Accessed 21.12.11

Risk of Insecticides Exposure on Foggers in Jabatan Kesihatan Negeri Kedah

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Abstract - Since the past few years, dengue cases has been increasing and becoming fearful, while, at the same time the Ministry of Health, Malaysia is also working to completely eliminate malaria cases in Malaysia. To achieve this target, the Public Health Division is playing a big role to ensure that these diseases could be controlled are not spreading to the community. In order to achieve this target, one of the main activities is to control the transmission of the diseases by the vector i.e. mosquitoes. Thus, the primary aim of this study is to investigate the risk of insecticides exposure used in the vector control specifically in controlling dengue and malaria among staffs in Jabatan Kesihatan Negeri Kedah. The common insecticides used in the field were gathered and the effects of the insecticides to the human were reviewed. The effects were indicated by the level of cholinesterase measured in each foggers and non-foggers after exposure to the insecticides especially type organophosphate by accumulating the cholinesterase data from each district taken in 2014 and 2015. The cholinesterase levels of all vector unit staff in 2015 were compared with the 2014, as the baseline to determine the reduction of the cholinesterase level. Among all the respondents, only 7 person out of 167 samples (4.19%) who had significant reduction in cholinesterase level in which between 15-50% with p-value of 0.766. For further analysis, among those who had significant reduction of 15-50%, a qualitative method by using telephone interview was performed. The results revealed that foggers who had significant reduction in cholinesterase level between 15-50% were not wearing proper personal protective equipment (PPE) outlined in the guidelines and they are also not certified and registered as a pesticide handlers.

Keywords: Fogger, Non-Fogger, Cholinesterase, Insecticide, Organophosphate, Pyrethroids

1.0 INTRODUCTION

Dengue is one of the fearful disease that lumbering Malaysian health. The numbers of cases keep increasing annually and become one of the public health issues concerned. In 2015, there are 120,836 cases reported in Malaysia compare to 108,698 cases reported for the same period in 2014. There is an increment of 11.2%

or 12,138 cases. For the same period, there are 336 death compared to 215 death in 2014, which is 56.3% increment (121 death). Dengue outbreak occurs almost every day in most of the state in Malaysia. The most affected state with dengue outbreak is the state of Selangor that took more than 60% of the total outbreak in Malaysia (Ministry of Health Malaysia). This number do not include the outbreak of Zika virus which is also caused by Aedes mosquitoes In 2015, there were 120,836 cases reported in Malaysia compared to 108,698 cases reported for the same period in 2014. There is an increment of 11.2% or 12,138 cases. For the same period also, there were 336 deaths compared to 215 deaths in 2014, which is 56.3% increment (121 deaths). In Kedah, there are 1,000 registered cases in 2015 compared to 1,006 registered cases for the same period in 2014. There is a decrement of 0.6% (6 cases) with 14 mortality cases in 2015 compared to 6 mortality cases in 2014.

As for the other mosquito-borne Flaviviruses, treatment for the uncomplicated Zika virus infection focuses on symptoms. No Zika virus vaccine exists; thus, prevention and control measures center on avoiding mosquito bites, reducing sexual transmission, and controlling the mosquito vector. Potentially effective methods of prevention that are focused on reducing infections among pregnant women include avoiding unnecessary travel to areas of ongoing Zika virus transmission, avoiding unprotected sexual contact with partners who are at risk for Zika virus infection (Update: Interim Guidelines for Health Care Providers Caring for Pregnant Women and Women of Reproductive Age with Possible Zika Virus Exposure — United States, 2016) and using mosquito repellent, permethrin treatment for clothing [1], bed nets [2], window screens [3] [4] and air conditioning [5] [6].

The most effective *A. aegypti* vector control relies on an integrated approach that involves elimination of *A. aegypti* mosquito breeding sites, application of larvicides, and application of insecticides to kill adult mosquitoes applied to most vector borne diseases. However, each of these approaches has substantial limitations. Communities are often mobilized to reduce *A. aegypti* breeding sites, but this strategy often fails, in part because of inconsistent participation among households and the presence of cryptic breeding sites in modern urban settings [7] [8]. Dengue control programs make extensive use of peridomestic insecticide spraying during outbreaks, but little evidence supports its efficacy as a single control intervention [9]. The application of larvicides [10] and indoor residual spraying [10] [11] has been effective in some settings. Given these limitations, an integrated prevention and vector-control approach combined with timely detection of illness, communication of up-to- date and correct information, and development of a rapid response that involves the community are recommended [12]. Thus, main goal of this study is to see the reduction of cholinesterase level of staffs after exposure to insecticides in 2015 from the baseline reading in 2014 among foggers.

2.0 METHODOLOGY

2.1 Data collection

Cholinesterase levels of the staffs are requested through state vector control unit. Yearly cholinesterase level taken by each district from all vector control unit staff in the district as a yearly screening. Data on the cholinesterase levels taken in 2014 and 2015 were requested from each district. The cholinesterase level of 2014 was taken as the baseline.

2.2 Cholinesterase

Plasma cholinesterase is a liver acute-phase protein that circulates in the blood plasma. It is found in central nervous system white matter, the pancreas, and the heart. It can be affected by many factors, including pregnancy, infection, and medical illness. Additionally, a patient's levels can vary up to 50% with repeated testing.

Overexposure to organophosphate and carbamate insecticides can result in cholinesterase inhibition. These pesticides combine with acetylcholinesterase at nerve endings in the brain and nervous system, and with other types of cholinesterase found in the blood. This allows acetylcholine to build up, while protective levels of the cholinesterase enzyme decrease. The more cholinesterase levels decrease, the more likely symptoms of poisoning from cholinesterase inhibiting pesticides are to show. The cholinesterase reduction was evaluated after being exposed to the insecticides used in fogging activity by looking at the percentage reduction from the baseline reading.

2.3 Reduction percentage of cholinesterase

In this study, the formula to determine the percentage of cholinesterase reduction is shown as the following:

$$\text{Percentage Reduction} = \frac{\text{Cholinesterase 2015} - \text{Cholinesterase 2014}}{\text{Baseline (Cholinesterase 2014)}} \times 100$$

The foggers who had reduction between 15-50% are considered fall into significant reduction. Further analyses using a qualitative method through telephone interview were performed.

3.0 RESULTS AND DISCUSSION

3.1 Common Insecticide Usage

The commonest insecticides usage by vector control unit in Jabatan Kesihatan Negeri Kedah falls into the groups of organophosphate and pyrethroids. Organophosphate poisoning can be measured using cholinesterase level which is related to this study where the cholinesterase level is reviewed to see the percentage of the reduction from the baseline reading.

3.2 Effects of Insecticide

The effects of insecticides usage in vector control are birth defects in pregnant lady [13], weakened the immune system [14], Alzheimer Disease [15], reproductive problem [16] and reduce birth weight [17]. From the analysis, the data shown in Table 1 tabulates the number of foggers with reduction more than 15% are insignificant, with the *p* value of 0.766.

Table 1: *p* value among the fogger and non-fogger

Factors	Group frequency		χ^2 stat (df)	* <i>p</i> value
	Reduction <15% or increase n = 160	Reduction > 15% n = 7		
Occupation				
Non-fogger	30 (18.8)	1 (14.3)	0.088 (1)	0.766
Fogger	130 (81.2)	6 (85.7)		

*Pearson Chi-square

Several considerations such as the awareness and importance of PPE simultaneously with the certification and registration of the pesticide handler need to be done in the future for the safety of foggers and non-foggers.

4.0 CONCLUSION

This paper presents an inclusive review on the common insecticides use in fogging activities with their side effects. The results do not indicate the clear picture of reduction of cholinesterase among foggers. Annual screening is not suitable since it does not show the real level after exposure to cholinesterase. Pre and post exposure level of cholinesterase would be more practical and acceptable to demonstrate the real representation of current work practice. Constant supervision is needed to make sure that each and every personnel comply the standard operating procedure. As part of continuous improvement, there are still room of improvement in monitoring the

exposure of insecticides among foggers. Pre and post exposure of insecticide screening among foggers is needed. Certification and registration of the foggers to handle any insecticide is mandatory. This will ensure that the foggers will undergo proper training and well-versed regarding their jobs and the type of insecticides they are dealing with. Continuous training and retreat courses should be given periodically to assure that their knowledge is always updated.

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REFERENCES

- [1] Banks SD, Murray N, Wilder-Smith A, Logan JG. "Insecticide-Treated Clothes for the Control of Vector-Borne Diseases: A Review on Effectiveness and Safety". *Med Vet Entomol* 2014;28:Suppl 1:14-25
- [2] Lenhart A, Orelus N, Maskill R, Alexander N, Streit T, McCall PJ. "Insecticide-Treated Bednets to Control Dengue Vectors: Preliminary Evidence from a Controlled Trial in Haiti." *Trop Med Int Health* 2008;13:56-67
- [3] Manrique-Saide P, Che-Mendoza A, Barrera-Perez M, et al. "Use of Insecticide-Treated House Screens to Reduce Infestations of Dengue Virus Vectors, Mexico." *Emerg Infect Dis* 2015;21:308-311
- [4] Che-Mendoza A, Guillermo-May G, Herrera-Bojórquez J, et al. "Long-Lasting Insecticide-Treated House Screens and Targeted Treatment of Productive Breeding- Sites for Dengue Vector Control in Acapulco, Mexico". *Trans R Soc Trop Med Hyg* 2015;109:106-115
- [5] Brunkard JM, Robles López JL, Ramirez J, et al. "Dengue Fever Seroprevalence and Risk Factors, Texas-Mexico border, 2004". *Emerg Infect Dis* 2007;13:1477-1483
- [6] Reiter P, Lathrop S, Bunning M, et al. "Texas Lifestyle Limits Transmission of Dengue Virus." *Emerg Infect Dis* 2003;9:86-89
- [7] Heintze C, Velasco Garrido M, Kroeger A. "What Do Community-Based Dengue Control Programmes Achieve? A Systematic Review of Published Evaluations." *Trans R Soc Trop Med Hyg* 2007;101:317-325
- [8] Barrera R, Amador M, Diaz A, Smith J, Munoz-Jordan JL, Rosario Y. "Unusual Productivity of *Aedes aegypti* in Septic Tanks and its Implications For Dengue Control". *Med Vet Entomol* 2008;22:62-69
- [9] Esu E, Lenhart A, Smith L, Horstick O. "Effectiveness of Peridomestic

- Space Spraying with Insecticide on Dengue Transmission; Systematic Review.” *Trop Med Int Health* 2010;15:619-631
- [10] Vazquez-Prokopec GM, Kitron U, Montgomery B, Horne P, Ritchie SA. “Quantifying the Spatial Dimension of Dengue Virus Epidemic Spread Within a Tropical Urban Environment.” *PLoS Negl Trop Dis* 2010;4:e920-e920
- [11] Paredes-Esquivel C, Lenhart A, Del Río R, et al. “The Impact of Indoor Residual Spraying of Deltamethrin on Dengue Vector Populations in the Peruvian Amazon.” *Acta Trop* 2016;154:139-144
- [12] Adalja AA, Sell TK, Bouri N, Franco C. “Lessons Learned During Dengue Outbreaks in the United States, 2001-2011”. *Emerg Infect Dis* 2012;18:608-614
- [13] D. Lindhout. “Human Birth Defect Suspected from Malathion.” *Department of Clinical Genetics, Erasmus University, Rotterdam. Department of Child Neurology, University Hospital, Utrecht. Teratology*, 1987, vol.36, p.7 (3).
- [14] K E Rodgers, M H Grayson, C F Ware. “Inhibition of cytotoxic T lymphocyte and natural killer cell-mediated lysis by O,S,S,-trimethyl phosphorodithioate is at an early postrecognition step”. *Journal of Immunology* 1988: vol.140, p.564
- [15] Hayden, K.; Norton, M.; Darcey, D.; Ostbye, T.; Zandi, P.; Breitner, J. , E. A. ; Welsh- Bohmer, K. A. “Occupational exposure to pesticides increases the risk of incident AD”. *Neurology* 74 (19): 1524–1530. (2010)
- [16] Howard, P.H. (ed.) *Handbook of environmental fate and exposure data for organic chemicals. Volume III. Pesticides*. Chelsea, MI 1991: Lewis Publishers.
- [17] Rauch SA "Associations of Prenatal Exposure to Organophosphate Pesticide Metabolites with Gestational Age and Birth Weight," *Environmental Health Perspectives*, July 2012, Vol. 120, No. 7, 1055-1060.

Falls from Vehicle Associated with Slip and Trip Hazards at the Fuel Distribution Terminal

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Abstract – Current statistic of falls from height (FFH) accidents in fuel distribution terminal shows the oil and gas industry is unsafe workplace. Falls from height accident are caused by unsafe act, unsafe conditions, and lacks of procedures, training, monitoring and enforcement. Based on literature review, there are six elements that caused FFH associated with slip and trip hazard (STH) among truck driver in distribution terminals. Questionnaire forms were used in the survey to obtain data from respondents who are mainly truck drivers. The questionnaire was verified through a pilot test. Level of safety awareness was determined using the statistical package of SPSS and the result shows that two from the six factors showed the high mean score. They are identified as personal protective equipment (PPE), loading platform condition (LPC), weather condition (WC) and law and order (LO). The correlation between standard operation procedure (SOP) with FFH factors shows that the elements of LPC, VPA and WC need further revision and should be highlighted in new guideline compared to the other two elements that showing no correlation with SOP. The new guideline must be implemented in the selected fuel distribution terminal to avoid more risk on truck driver regarding the STH of FFH.

Keywords: Fall from height, Unsafe workplace, Slip and trip guideline, Oil distribution terminal, Oil and gas industry

1.0 INTRODUCTION

Oil distribution terminals, which also called tank farms, installation terminals or oil terminals, can be defined as an industrial facility for storage of oil and or petrochemical products. These products are usually transported to end users or further storage facilities. Falls from height (FFH) are the one of the biggest causes of workplace fatalities and major injuries [1-2]. The problems still occurred even though drivers followed the standard operation procedure (SOP) and properly used recommended personal protective equipment (PPE) for working at height.

According to Health and Safety Executive (HSE), UK [3], during working at height, truck drivers may fall due to slip and trip accident. Slips happen where there is too little friction or traction between the footwear and the walking surface. Normal reason for slips are wet or slick surfaces, intermittent spills, weather hazards, free unanchored rugs or mats, flooring or other walking surfaces in which all zones are not at the same level. While trips happened when foot collides (strikes, hits) an object and caused a person lost the balance and suddenly fall. Regular causes of tripping are obstructed view, poor lighting, mess in your direction, wrinkled covering, revealed links, base drawers not being shut, uneven (strides, limits) walking surfaces.

About one third of workplace transport accidents caused by falls from vehicles in a wide range of industries. An analysis of HSE accident data for 'goods type vehicles' [4] suggested that at least one third of these accidents are initially caused by slip or trip. In the study, a total of 448 accident reports were examined. Slipping before fall has been identified causing at least 124 accidents, while a trip before the fall has caused 16 accidents. This suggests that at least 31% of falls from vehicles (140 accidents) were caused by a slip or trip. Walker also emphasised that 9% of incidents happened when drivers were using steps. Furthermore, Mirza et al. [5] claimed that fall at petrol station during cleaning from height, fall from wooden ladder, slippery conditions at filling gantry due to minor leakages, fall from roof, oil spillages, water leakages, snakebite cases, minor damages, maintenance issues, natural disasters/wind storms, law and order situation.

The aim of this research is to strengthen the existing guideline of working at height among truck drivers at fuel distribution terminals. The study plans to recommend an improved guideline of FFH associated with slip, trip and fall (STF) hazards to minimize accidents among professional drivers at fuel distribution terminals.

2.0 METHODOLOGY

The methodology starts with identifying the reported incidents in a fuel distribution terminal located in Klang Valley. Then the researcher observed on fuel truck driver working routine during filling activities at the platform area. Based on the previous study by Health and Safety Executive (HSE) [6] and Mirza et al. [5] as well as the initial observation, six factors of the FFH associated with STF hazards at the fuel terminal have been identified to be included in the questionnaire elements. The factors are personal protective equipment and footwear (PPE), loading platform condition (LPC), vehicle platform activities (VPA), trip and driving shift (TDS), weather condition (WC) and law and order (LO). These six elements were included in the questionnaire with five choices of answer from strongly agree to strongly disagree Likert scale. At the beginning, 20 samples were collected as a pilot test to get reliability of the questions. After achieving more than 0.7 Cronbach's alpha value, the questionnaire were distributed to 175 respondents as a recommended

sample size by Krejcie and Morgan [7] since the total population (i.e., truck drivers) were 320.

The returned questionnaire forms were analysed using the Statistical Package for Social Science (SPSS) software. The analysis was set to identify level of safety awareness on FFH precautions that among fuel truck drivers using the six identified factors. The results were then used to assess the slip and trip hazard of falls from vehicle among the fuel truck drivers. Figure 1 shows overall operational framework of the methodology. An improved guideline to minimize the FFH associated with STF hazards was planned as the outcome of the study.

3.0 RESULTS AND DISCUSSION

The result shows that the value of Cronbach's alpha is more than 0.7 (0.76), which is within acceptable value [3], while the total returned questionnaire is 63. With that 36% respondents (i.e., more than 30%), the collected data was considered valid [7]. The profiles of respondents were categorised by the numbers of trips have been taken by the truck drivers and their years of working experience.

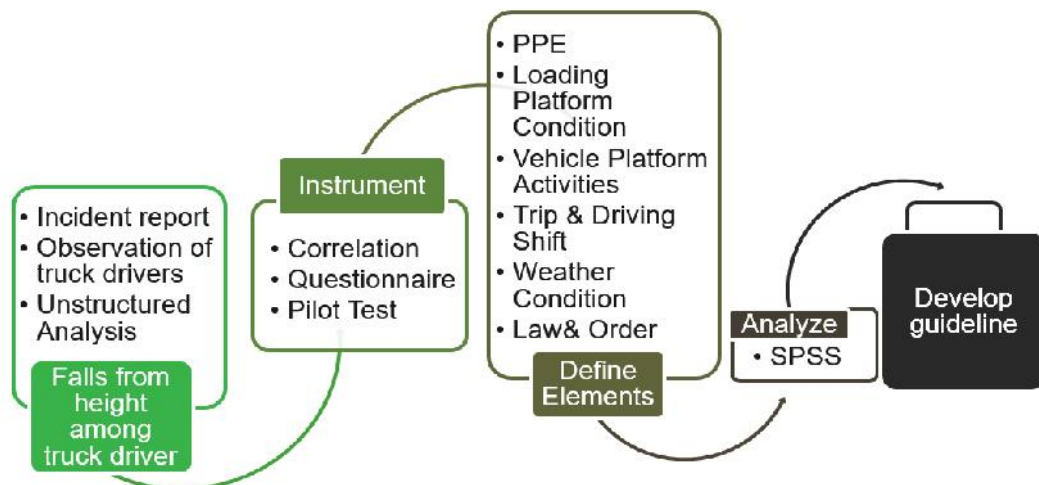


Figure 1: Operational framework used in the methodology

Table 1 shows the mean score, level of mean score and percentage of the six FFH factors. The results indicate that the highest mean score for the FFH factors among the truck drivers is VPA with mean score of 3.90 (18.39%). The high mean score followed by TDS which is 3.79 (17.87%). These two conditions were seen as factors of FFH that highly regarded as causes of injuries of falls from vehicle among the truck drivers. During the observation, they were seen always worked at more than 2 m height from the floor. The results also clearly shown that even though the truck

drivers were trained before entering the terminal, they kept slacking and lost focus when doing the filling activities. For these reason, it is recommended that the truck drivers must adhere to additional requirement on PPE such as wearing safety body harness when working at height. Every truck driver has been trained to use this PPE but some drivers did not fully understand on how to properly use the safety body harness. At the same time, some drivers also seen wearing torn or worn out PPE especially their footwear. Based on the questionnaire, the drivers were mostly bought the footwear by themselves as their company did not provide it. As a result, they kept using the safety shoes until the shoes lost its grip base to the floor. The findings have proven that the truck drivers in the terminals had low level of awareness towards the importance of PPE.

Table 1: The results of mean score for six factors of FFH used in questionnaire

Dimension	Mean Score	Level of Mean Score	Percentage (%)
Vehicle Platform Activities (VPA)	3.90	High	18.39
Trip and Driving Shifts (TDS)	3.79	High	17.87
Personal Protective Equipment and Footwear (PPE)	3.64	Moderate	17.16
Loading Platform Activity (LPC)	3.42	Moderate	16.12
Weather Condition (WC)	3.37	Moderate	15.89
Law and Order (LO)	3.09	Moderate	14.57
Total	3.54	Moderate	100

In addition, Table 2 indicates correlation coefficient between Standard Operation Procedure (SOP) with factors of FFH. The LPC, VPA and WC have shown significant correlation with all results of significant value (p) less than 0.01. No significant relationship for PPE and TDS. The relationship between SOP and LPC ($r = 0.346$, $p = 0.005$) and between SOP and VPA ($r = 0.404$, $p = 0.001$) were considered weak and moderate, respectively. For all the three factors, a better relationship was found between SOP and WC ($r = 0.646$, $p = 0.000$). The results has shown that poor correlation occurred between SOP and PPE and TDS. The findings suggest that the SOP requires further revision and a new guideline is necessary to avoid more injuries regarding the falls from vehicle associated with STF hazards among truck drivers in the distribution terminal.

From the results and observation, the guideline should include revision on the SOP related to PPE, LPC, VPA and WC. The first element proposed to improve the safety guideline is the PPE including the proper footwear. Even though some of the drivers complaint on the late delivery that can cause by safety body harness implementation, emphasis on properly worn harness may save their lives from the FFH accidents. Highlighting the safety issue and regular monitoring by the safety manager may inculcate awareness to the truck drivers.

For the second element, all truck drivers must aware on hazards exists at the LPC. As the loading platform design is already standardized to all the distribution terminals and strictly followed the design guideline, the truck drivers should know every inch of the workplace and must always focus on the job done at the LPC.

Table 2: Correlation between SOP with factors of FFH

Factor of FFH	Standard Operation Procedure		
	No. of Respondent	r (correlation value)	p (significant value)
Personal Protective Equipment & Footwear (PPE)		-0.013	0.922
Loading Platform Condition (LPC)	63	0.346	0.005
Vehicle Platform Activities (VPA)		0.404	0.001
Trip & Driving Shift (TDS)		0.230	0.070
Weather Condition (WC)		0.646	0.000

The filling activities are considered main routine task of the truck drivers for the third element involving VPA. This routine involved lifting, bending and working on the top of the vehicle platform. Every routine can cause FFH if they do not have a proper guideline. The guideline must explains how to organize their filling activities, minimize the FFH accidents and control hazards during the filling activities.

The WC is the last element that received little attention by the terminal manager. Working in bad weather condition in any place has also hazard potential for the truck drivers. By preparing a good delivery schedule, they may stop the work and try to get good rest before continue the delivery after the rains stopped and avoid wetted condition during the VPA.

There are a number of HSE publications which discuss the prevention of falls from vehicles, for example, Avoiding falls from vehicles [8], Workplace transport safety [9], Health and safety in road haulage [10], Safe unloading of steel stock [11] and Workplace transport safety in food and drink premises [12]. The HSE [13] discusses a hierarchy of control in preventing falls from vehicles. This hierarchy described that avoid the need for people to go up high on a vehicle. For example, mechanical sheeting devices speed up unsheeting and negate the need for people to climb onto the load area. However, if access to height is unavoidable, on-vehicle fall prevention systems should be provided such that the safeguards travel with the vehicle, for example, guard railed platforms and harness systems using on-vehicle anchor points. And, if on-vehicle solutions are not feasible, off-vehicle safe access can be provided such as fixed or portable platforms/ gantries. Off-vehicle fall prevention/ restraint systems using harnesses fixed to anchor points in the roof space may also be used.

External duty holder may face problems in guaranteeing such equipment at sites. The harness systems have to rely on good training, instruction and supervision. Smaller scale practical measures as described in HSE [13] have to consider the following requirement:

- (1) Keep vehicle beds tidy to prevent trips (and slips).
- (2) Provide non-slip footwear to drivers.
- (3) Provide adequate steps to the cab and load area.
- (4) Use three points of contact when climbing up or down from vehicles.
- (5) Provide supervision to ensure fall precautions are actually taken.

Prevention of slip and trip also rely on good housekeeping, quality of flooring (walking surfaces), selection of appropriate footwear, and proper pace of walking are critical for preventing fall accidents.

4.0 CONCLUSION

As a conclusion, four elements of the guideline of falls from vehicle associated with STF hazards in distribution terminals have given priorities to be improved. The guideline should be continually reviewed and updated. The common hazards of fall from vehicle used in the FFH study was the working condition more than 1.8 m height. The safety of truck drivers working at height focuses on filling the manhole with oil on top of the vehicle. By implementing the new improved guideline regarding working at heights the truck drivers are expected to be more aware on the FFH associated with STF hazards and they are educated to keep good safe working environment in the fuel distribution terminal. In the future, this study could benefit the organization while attracting all the truck drivers to adhere to the new improved guideline.

REFERENCES

- [1] Lipscomb, Hester J., Judith Glazner, Jessica Bondy, Dennis Lezotte, and Kenneth Guarini. "Analysis of text from injury reports improves understanding of construction falls." *Journal of occupational and environmental medicine* 46, no. 11, 2004: 1166-1173.
- [2] Al-Thani, Hassan, Ayman El-Menyar, Husham Abdelrahman, Ahmad Zarour, Rafael Consunji, Ruben Peralta, Mohammad Asim, Hany El-Hennawy, Ashok Parchani, and Rifat Latifi. "Workplace-related traumatic injuries: insights from a rapidly developing Middle Eastern country." *Journal of environmental and public health* 2014 .
- [3] Larson-Hall, Jenifer. "A guide to doing statistics in second language research using SPSS and r." Routledge, 2015.
- [4] Deborah Walker. Major accidents involving falls from goods vehicles. HSE Field Operations Division, Safety Unit 2004.

- [5] Ahmed, Mirza Munir, S. R. M. Kutty, Mohd Faris Khamidi, Idris Othman, and Azmi Mohd Shariff. "Hazard contributing factors classification for petrol fuel station." *World Academy of Science, Engineering and Technology, International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering* 6, no. 12, 2012: 1103-1114.
- [6] Anita Scott, Mary Miller, and Kevin Hallas. "The underlying causes of falls from vehicles associated with slip and trip hazards on steps and floors." Health and Safety Executive, HSE Books 2006.
- [7] Krejcie, Robert V., and Daryle W. Morgan. "Determining sample size for research activities." *Educational and psychological measurement* 30, no. 3, 1970: 607-610.
- [8] Health and Safety Executive. "Workplace transport topic inspection pack." HSE Safety Unit 2004a.
- [9] Health and Safety Executive. "Workplace transport safety: Guidance for employers." HSG136. HSE Books 1995.
- [10] Health and Safety Executive. "Health and safety in road haulage." INDG379, 2003.
- [11] Health and Safety Executive. "Safe unloading of steel stock." INDG313 2000.
- [12] Health and Safety Executive. "Workplace transport safety in food and drinks premises." Food Information Sheet No.21 1999.
- [13] Health and Safety Executive. "The assessment of pedestrian slip risk." The HSE Approach. Slips and Trips 1 2004b.

Perception of Wearing Hearing Protection Device among Maintenance Personnel in MiG-29 Jet Fighter Fleet

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Abstract – Maintenance personnel in MiG-29 jet fighter fleet are exposed to noise level greater than 85 dB(A) which come from activities of aircraft taxiing, taking off, ground power unit and aircraft engines during start up. Consequently, the risk of prevalence of Noise-Induced Hearing Loss (NIHL) disease among the maintenance personnel had increased. However, NIHL can be prevented if Hearing Protection Device (HPD) is wear consistently and effectively. Nevertheless, the consistency and effective use of HPD are depending on the perception of wearing HPD. This research investigated the perception of wearing HPD based on the influencing factors; demographic, knowledge, perceived benefits, perceived barriers, self-efficacy and interpersonal influence. Data from 91 samples were collected by using questionnaires and document review was used to analyses the 5 years recent record of safety programs in the Safety Log Book. The analysis of questionnaires via Social Package for Social Science (SPSS) revealed that overall perception level of wearing HPD was very high ($M = 4.60$, $SD = 0.67$) with percentage of 92%. There was no dominant factor that leads to the prejudice of perception as all of the five influencing factors (excluding demographic) have high mean score and percentage (M more than 4, percentage more than 80%). Based on t -test analysis, there is a statistically significant difference between educational background (MCE and Diploma) for perceived benefits. Other than that, there is also a statistically significant difference between years of service (0 to 7 years and more than 7 years) for self-efficacy and interpersonal influence. Overall, although the maintenance personnel had a good level of perception in wearing HPD but yet hearing conservation programs are still required to be implemented in the fleet as required by Occupational Safety and Health (2002).

Keywords: Hearing Protection Device, Noise-Induced Hearing Loss, Noise, Perception

1.0 INTRODUCTION

From the list of occupational hazards, noise is listed on the top three ranking in various kind of working environment [1]. Any sound that has a sound pressure level greater than 85 dB (A) can be classified as noise for instance sound of aircraft take-off, construction and mining explosions

in a quarry site [2]. Many countries have their own maximum noise legislation. For instance, in United Kingdom (UK), the Control of Noise at Work Regulations has sets the Permissible Exposure Limit (PEL) of noise exposure to be at 85 dB (A) and Hearing Protection Device (HPD) must be provided when noise level reaches 80 dB (A). The United States (US) Occupational Safety and Health Act (OSHA) has sets the PEL of noise exposure to be at 90 dB(A), but hearing conservation program is still required when the noise level has reaches 85 dB(A) [1]. In Malaysia, the Occupational Safety and Health Act and Regulations has stated that the PEL of noise exposure is 85 dB(A) and HPD should be provided when noise level reaches 80 dB(A) [3]. In the MiG-29 jet fighter fleet, noise from aircraft activities such as during engine start-up, aircraft take-off and taxiing is the main risk of Noise Induced Hearing Loss (NIHL) disease. However, it is almost impossible to eliminate the noise source from Royal Malaysian Air Force (RMAF) aircrafts. Any modification on buildings and facilities in order to block the noise source is very costly and can jeopardize the RMAF operations [4]. Therefore, wearing HPD is being implemented in the noisy working environment of the MiG-29 jet fighter fleet as this method is cost effective.

HPD such as ear plug and earmuff should be used temporarily until more effective measures against noise exposure are established [5]. By wearing an earplug, noise exposure level will be reduced by 25 dB to 35 dB whereas wearing an earmuff can reduce noise exposure level by 34 dB to 45 dB. However, it is recommended to wear both earplug and earmuff as by wearing both it can reduced noise exposure level by another 3 dB to 5 dB [6]. In addition, HPD also must be wear correctly and consistently in order for the HPD to protect the workers from NIHL disease [7]. NIHL can be described as a condition where the inner ear is permanently loss of auditory acuity, particularly in the high-frequency range [8]. In pathological study, NIHL can be described as the loss of auditory sensory cells in cochlea [1]. In India Air Force (IAF) base, 1000 personnel of various trades, age and exposure groups were audio metrically surveyed. The result revealed that 229 of 1000 IAF members (22.9%) were affected by NIHL. This included 199 personnel of technical trades (19.9%) and 30 personnel of non-technical trades (3%) [9]. In year 2014, a study of noise hazard in No 20 Squadron of RMAF has found that 26 maintenance personnel (41.2%) from the total of 63 maintenance personnel were affected by the NIHL disease [4]. These studies have shown that maintenance personnel in the air force base are affected with NIHL disease.

The risk of getting NIHL is influenced by the perception of wearing HPD where it determines worker's behavior towards the use of HPD [10]. Several factors had been listed to influence the perception of using HPD. A study had summarized the influencing factors into three categories which are knowledge about the risk and possible hazards produced by noise exposure, attitudes, beliefs and feelings with regards to the use of HPD and perceived safety culture and subjective norm [7].

Other researchers had stated that there are two factors that influenced the perception of wearing HPD which are modifying and cognitive-perceptual factors. The modifying factors comprised of demographics and interpersonal factors. Demographics is a characteristics of the population which include gender, age, marital status, level of education, work type, years of working in noisy environment, ear conditions and results of hearing examination. Meanwhile, interpersonal factors are an individual's assumptions on other people's attitudes such as perception towards supervisor or co-workers in regards with the use of HPDs [6]. The cognitive-perceptual factors comprised of benefits, barriers and self-efficacy [6]. Perceived benefits can be described as the faith of gaining positive results, as a consequence from the use of HPD and perceived barriers can be described as imaginations or perceptions of inconvenience or difficulties of an action. On the other hand, self-efficacy can be described as an evaluation of ability to organize and carry out an action [11].

Based on those facts, this research studies the overall perception of wearing HPD among maintenance personnel in MiG-29 jet fighter fleet. This research also attempts to investigate the dominant factor that leads to the prejudice of perception towards the use of HPD. In addition, document review on the recent 5 years of safety programs which were recorded in the Safety Log Books was also performed to determine the requirement of improving the wearing of HPD based on the guideline of OSHA [13]. However, this paper will only discuss the perception of wearing HPD among maintenance personnel in MiG-29 jet fighter fleet.

2.0 METHODOLOGY

A quantitative approach had been used to investigate the perception of wearing HPD among maintenance personnel in MiG-29 jet fighter fleet. A sound level meter had been used to collect noise data from noise sources and the noise data were plotted on a map used to portray noisy areas. A questionnaire set had been developed based on the noise mapping to assess the maintenance personnel knowledge and other influenced factors such as demographic, perceived benefits, perceived barriers, self-efficacy and interpersonal influence.

2.1 Sample Description

There are a total of 101 maintenance personnel who are involved directly and day-to-day in the maintenance works of MiG-29 jet fighter aircraft. The size of the population of the maintenance personnel were taken only from the shift workers who are exposed to high level of noise and required to use HPD during their normal shift routine. Based on the population, the research only required at least 80 samples to answer the questionnaire sets [12].

2.2 Instrumentation

The instrumentation that was used to conduct this research was the closed type 5-Likert scale questionnaire. The questionnaire required an inclusion of noise map as it is a part of the questions that need to be answered by the samples in order to obtain the required data for analysis. Therefore, a noise map was first developed before the questionnaire set was constructed.

2.2.1 Noise Mapping

The noise data of engines start up activity was collected during Engine Ground Run (EGR) activity in the duration of 40 minutes. The EGR activity was performed at a dedicated bay for EGR activity, located at the centre of all buildings. The noise data for the EGR activity had been collected by using handheld method via Sound Level Meter (Part No: BK 817) with the range of measurement from 30 dB (A) to 150 dB (A). In order to ensure the noise data were obtained accurately, the Sound Level Meter was held at arm's length and at the side of the body with the microphone pointed towards the source of the noise, thus reducing noise reflection [4]. In addition, the Sound Level Meter was calibrated before the noise data were collected. The noise was measured and locked at 8 points from the noise source once a steady reading of 85 dB (A) were obtained. The data then were plotted on the map that was taken from Real-Time Google Earth Satellite Imagery (refer to Appendix A).

2.2.2 Questionnaire

A closed type 5-Likert scale questionnaire was used to measure the six categories of influencing factors namely; demographic, knowledge, perceived benefits, perceived barriers, self-efficacy and interpersonal influence. The questions for the first influencing factor which is demographic required the respondents to give written answers. The questions for the other five influencing factors required the respondent to answer based on the rating scale as 1 for strongly disagree, 2 for disagree, 3 for not sure, 4 for agree and 5 for strongly agree.

3.0 RESULTS AND DISCUSSION

A total of 101 questionnaires set were distributed to the overall population of 101 maintenance personnel in MiG-29 jet fighter fleet. However, only 91 questionnaire sets were returned back. Analysis was then carried out by using Statistical Package of Social Science (SPSS). The result for demographic factor is as shown in Table 1.

Table 1: Demographic of Respondents

Category	Group	Frequency (f)	Percentage (%)
Educational Level	MCE	82	90.1
	Diploma	9	9.9
	Degree	0	0.0
	Master	0	0.0
Rank	SNCO	34	37.4
	NCO	57	62.6
Years of Service	0-7 years	42	46.2
	> 7 years	49	53.8
Total		91	100

For educational level, 82 respondents (90.1%) hold a Malaysian Certificate of Education (MCE) qualification, 9 respondents (9.9%) hold a Diploma qualification and none of the respondents hold a Degree or Master qualification. For rank, the first group was Senior Non Commissioning Officer (SNCO) that represents the rank of Sergeant until Air Warrant Officer I and the second group was the Non Commissioning Officer (NCO) that represents the rank of Airmen until Corporal. Based on both groups, 34 respondents (37.4%) were from SNCO rank and 57 respondents (62.6%) were from NCO rank. For years of service, this research had divided the category of experience into two groups that was based on Skill Level Monitoring System (SLMS) in RMAF. The first group was the maintenance personnel with working experience of 0 to 7 years and the second group was the maintenance personnel with working experience of more than 7 years. The data indicated that, 42 respondents (46.2%) had years of service up to 7 years and 49 respondents (53.8%) had years of service of more than 7 years.

The analysis was then continued with determining the mean of the five perception influencing factors namely; knowledge, perceived benefits, perceived barriers, self-efficacy and interpersonal influence. The result is as shown in Table 2.

Table 2: Mean of the Five Influencing Factors and Overall Mean

Factor	Mean	Percentage (%)	Standard Deviation
Knowledge	4.63	92.6	0.58
Perceived Benefits	4.75	95.0	0.50
Perceived Barriers	4.48	89.6	0.84
Self-Efficacy	4.63	92.6	0.56
Interpersonal Influence	4.49	89.8	0.85
Overall	4.60	92.0	0.67

Based on Table 2, the overall mean and percentage is high with the mean of 4.6 (SD = 0.67) and percentage of 92%. Based on the scores, it can be stated that the overall perception of wearing HPD among maintenance personnel in MiG-29 jet fighter fleet is very high. This indicates that the maintenance personnel have no prejudice of perception in wearing HPD and are able to wear HPD consistently and effectively while working at noisy areas. In addition, no dominant factor that leads to the prejudice of perception is found as all of the five perception influencing factors have a high mean as well as high percentage. The lowest score is perceived barriers factor with mean of 4.48 (SD = 0.84) and percentage of 89.6%.

Subsequently, a t-test analysis was performed to compare the factors of knowledge, perceived benefits, perceived barriers, self-efficacy and interpersonal influence scores with the three demographic factors namely; educational level, rank and years of service. The result indicates that there is a statistically significant difference between maintenance personnel that hold qualification of MCE (M = 4.77, SD = 0.41) and Diploma (M = 4.51, SD = 0.62; $t(89) = 1.721$, $p = 0.027$) for perceived benefits. The result is shown in Table 3.

Table 3: Comparison between Perception Influencing Factors with Educational Level

Perception Influencing Factors	Educational Level						Degree of Freedom (Df)	t- value	t-test (p/Sig)
	MCE			Diploma					
	Mean (M)	Standard Deviation (SD)	Population (N)	Mean (M)	Standard Deviation (SD)	Population (N)			
Perceived Benefits	4.77	0.41	82	4.51	0.62	9	89	1.721	0.027*

***Significant at $p < 0.05$**

It also can be observed that there is a statistically significant difference between maintenance personnel that have years of service 0 to 7 years (M = 4.53, SD = 0.54) and more than 7 years (M = 4.71, SD = 0.45; $t(89) = -1.797$, $p = 0.010$) for self-efficacy. In addition, there is also a statistically significant difference between maintenance personnel that have years of service 0 to 7 years (M = 4.44, SD = 0.65) and more than 7 years (M = 4.53, SD = 0.69; $t(89) = 1.419$, $p = 0.013$) for interpersonal influence. The result is shown in Table 4.

Table 4: Comparison between Perception Influencing Factors with Years of Service

Perception Influencing Factors	Years of Service						Degree of Freedom (Df)	t- value	t-test (p/Sig)
	0-7 Years			> 7 Years					
	Mean (M)	Standard Deviation (SD)	Population (N)	Mean (M)	Standard Deviation (SD)	Population (N)			
Self- Efficacy	4.53	0.54	42	4.71	0.45	49	89	- 1.797	0.010*
Interpersonal Influence	4.44	0.65	34	4.53	0.69	57	89	1.419	0.013*

*Significant at $p < 0.05$

4.0 CONCLUSION

As a conclusion, based on the result of overall mean, maintenance personnel in general have no prejudice of perception in wearing HPD and are able to wear HPD consistently and effectively while working at noisy areas. In addition, there is no dominant factor that leads to prejudice of perception in any of the five perception influencing factors thus supporting the fact that they have a good perception in wearing HPD. It can be observed that educational background has effect on perceived benefits where maintenance personnel that hold MCE qualification have better perceived benefits in wearing HPD. Other than that, years of service has effect on self-efficacy and interpersonal influence where maintenance personnel that have years of service for more than 7 years have better self-efficacy and interpersonal influence in wearing HPD. Although the result indicates that the overall perception level of wearing HPD is very high and there is no dominant factor that leads to the prejudice of perception, hearing conservation programs such as noise mapping, audiometric testing, HPD inspection and fitting, training and record keeping are still necessary to be implemented as required by OSHA [13].

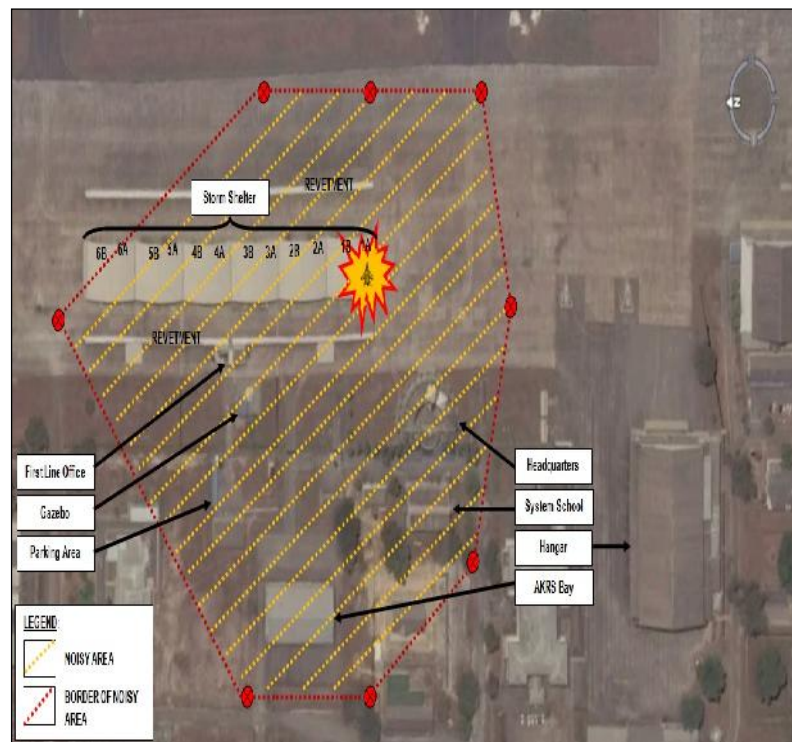
REFERENCES

- [1] Meira, T. C., Santana, V. S., & Ferrite, S. (2015). Gender and other factors associated with the use of hearing protection device at work.
- [2] Basner, M. et al. (2014). Auditory and non-auditory effects of noise on health, 383, 1325–1332.
- [3] *Occupational Safety and Health Act and Regulation 2014* (Mal).
- [4] Aziz, A. R. (2014). *Risk Assessment on Noise Hazard in No 20 Squadron, Subang Air Base of Royal Malaysian Air Force (RMAF)*. (Unpublished Master's Thesis) Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia.
- [5] Arezes, P. M., & Miguel, A. S. (2013). Assessing the use of hearing protection in industrial settings: A comparison between methods. *International Journal of Industrial Ergonomics*, 43(6), 518–525.

- [6] Kim, Y., Jeong, I., & Hong, O.-S. (2010). Predictors of Hearing Protection Behavior Among Power Plant Workers. *Asian Nursing Research*, 4(1), 10–18.
- [7] Bockstael, A., De Bruyne, L., Vinck, B., & Botteldooren, D. (2013). Hearing protection in industry: Companies' policy and workers' perception. *International Journal of Industrial Ergonomics*, 43(6), 512–517.
- [8] Guest, M. et al. (2010). Hearing impairment in F-111 maintenance workers: The study of health outcomes in aircraft maintenance personnel (SHOAMP) general health and medical study. *American Journal of Industrial Medicine*, 53(11), 1159–1169.
- [9] Nair, S., & Kashyap, R. (2009). Prevalence of noise induced hearing loss in indian air force personnel. *Medical Journal Armed Forces India*, 65(3), 247–251.
- [10] Arezes, P. M., & Miguel, A. S. (2008). Risk perception and safety behaviour: A study in an occupational environment. *Safety Science*, 46(6), 900–907.
- [11] McCullagh, M. C., Ronis, D. L., & Lusk, S. L. (2010). Predictors of use of hearing protection among a representative sample of farmers. *Research in Nursing and Health*, 33(October), 528–538.
- [12] Krejcie, R. V., & Morgan, D. W. (1970). ACTIVITIES. *Educational and Psychological Measurement*, 38, 607–610.
- [13] OSHA 2002 (Mal), Hearing Conservation, Vol. 2002.

APPENDIX A

Noise Map of No 17 Squadron



Occupational Safety Awareness among Science Centre Employees

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Abstract – *This study was conducted to assess the level of awareness on occupational safety among employees of a science centre in Kuala Lumpur. The centre is deemed to be vulnerable to safety issues as it engages many part-timers as part of its manpower. This is because most of the part-timers are teenagers or young people who are generally viewed to have less experience, knowledge and training on recognizing hazards and safe work practices than their older full-time counterparts. In order to address this concern, a survey to assess the level of awareness regarding safety at the workplace was conducted on 97 respondents which included full time and part time employees. Data was collected using a 25-item Safety Awareness Measure which assessed respondents' knowledge and awareness on occupational safety based on the dimensions of policy and procedure, training, tools and equipment, commitment and attitude, and working environment. The composite scores were then categorised into 3 levels of High (25-17), Intermediate (16-8) and Low (7-0) and analysed to determine the respondents' level of awareness towards occupational safety. There is no significant difference in level of awareness between the two groups on overall awareness. However, there was a significant difference in awareness levels for the dimensions (sections) of tools and equipment, and working environment with the part-timers earning lower total section score. Analysis for gender difference against the 5 sections showed that female employees scored lower in tools and equipment. Further analysis also showed that the number of safety training attended made a difference with regard to the level of awareness and knowledge concerning tools and equipment. Thus, it can be concluded the management of the science centre should increase or customise safety training to cater the needs of the part-timers and female employees. The customized program should allow the employees to be more hands-on on the use of tools and equipment. The organization should also make it compulsory for its part-timer employees who return to work after more than 6 months away to attend refresher courses.*

Keywords: Occupational Safety, science centre, Policy & Procedure, Training, Tools & Equipment,

Commitment & Attitude, Working Environment, Full timers, Part timers,

1.0 INTRODUCTION

The awareness on Occupational Safety and Health (OSH) plays an important role in the prevention of accidents and injuries at the workplace. Awareness of safety practices is an important matter to both employers and employees in order to ensure safety and reduce risk of accidents in the workplace. As such, when workers are made aware of the hazards in their workplace, this will – in part – likely serve as a motivator for them to pay attention to safety matters. According to Expert Advisory Panel on Occupational Health and Safety [1] increased knowledge of legislated rights and responsibilities related to occupational safety among employees is an important factor driving management and workers collaborations to improve safety and reduce injuries. It is well accepted that workplaces that have positive safety culture and climates have mechanisms in place to ensure that safety-related information are available and well-communicated to their employees so that they are aware and alert of safety practises [2].

Yet, reports from Department of Occupational Safety and Health Department (DOSH) [3] have shown otherwise. Although OSHA 1994 has existed in Malaysia for more than ten years, awareness of OSH remains relatively poor and there is still a need to promote OSH knowledge and principles among all employees and professionals [4]. Safety incidents at the workplace can happen at any time, and it can happen quickly and is often difficult to manage [5]. While in reality it is difficult to achieve a no-accident target because of existing safety culture practices in the communities in Malaysia [6], risk can be reduced through effective preventative measures such as by investing on safety equipment, appropriate training, and educating stakeholders on matters relating to safety. Theoretical models in health behaviour researches have shown that awareness is a key component of motivation to engage in health enhancing behaviours (or avoid unhealthy behaviours) [7]. It is said that the main causes of injuries in workplace are attributable to unsafe behaviour by some individuals who are not aware of the danger or risk of an injury [5].

2.0 THE STUDY

The present study was conducted at a popular discovery centre that emphasises to educate the public about the science and technology. The science centre receives many visitors who are interested to learn about the science of the petroleum industry in an interactive and hands-on way daily. Its emphasizes on the excitement of learning by engaging visitors to explore, test, experiment, and discover the creativity and application of science around them. Hands-on exhibits and science

demonstrations are generally used to stimulate interest in science and technology, in particular in conceptual science. These mini demonstrations include activities that present potential hazards involving heat or pressure, corrosive materials, volatile or flammable chemical or mechanical devices and objects. As a result, safety is paramount and the staff at the centre need to be knowledgeable not only in performing their duties, but also be aware of safety issues related to their tasks, such as safe use of demonstration apparatus, and handling of chemicals. The science centre has always considered safety as an imperative matter, especially because its parent company has a zero tolerance safety policy. This is not just essential for the safety of employees and visitors to the centre, but also in safeguarding the reputation and image of a government-link corporation.

Accidents may be rare and are preventable; however they can happen due to human error, ignorance or negligence. They can happen when the employees do not take care of what they are doing, are not alert of what might go wrong, have not taken proper safety precautions, or are not aware of what to do during an incident. As many staff at the centre are involved in hands-on participation in science demonstration, it is thus imperative that they are aware and alert of safety issues involved when handling these potentially hazardous activities.

Other than employing 150 full-time staff, the centre also employs many part-time employees. Currently, the ratio of full-time to active part-time staff at the science centre is 3:1. The part-timers are typically young adults in their early 20s and with some as young as 18 years old. Other than to assist in some administrative work, they are generally employed to engage with visitors that come to the centre. Their tasks vary from assisting the movement of the visitors to performing mini science demonstrations which often involve some element of risk to safety.

Considering how important the issue of safety is, there is a valid concern that the science centre may be exposed to 'delinquency' of the young part-time staff that it regularly employs. Generally, young adults or teenagers are often viewed as easy going, carefree and immature and are prone to careless acts due to their lack of experience and knowledge in life. Younger employees tend to be less experienced than their older counterparts and have less job knowledge, training, and skills. Young workers may also be less likely to recognize hazards and are less alert to unexpected changes that may jeopardise safety and health.

In a study that examined the safety and health awareness, there appears to be evidence that there is a difference in the awareness level between categories of science laboratory users. Baizura et al [8] found a difference in the level of safety awareness between the staff (adults) and students (teenagers) where awareness among students is lower compared to the staff. It concluded that the adult staff members have more experience in handling the equipment safely and are more aware and alert of safety

compared to the students.

It is therefore worthwhile to examine on their level of awareness on occupational safety. Conclusively, this study set out to assess the level of awareness of occupational safety and health in terms of policy & procedure, training, tools & equipment, commitment & attitude, and working environment of both part-time and full-time employees at the centre. The studied variables were picked after critical assumption based on similar studies [8, 2, 9], with consideration on the nature of operation at this particular science centre. Because of the variety of the employees' background, the study also looked into whether employees' demography has an influence on awareness of occupational safety.

3.0 METHODLOGY

A 25-item instrument was utilized to assess knowledge and measure awareness regarding safety and health issue at the centre based on five dimensions adapted from Ima Ilyani's Safety in the Office questionnaire [13]. The instrument was developed with the assistance the science centre's Health, Safety and Environment (HSE) officer and was referred to as the Safety Awareness Measure. It consists of Section A (respondents' demographic data) and Section B to Section F. Section which elicit responses from questions on Policy & Procedure, Training, Tools & Equipment, Commitment & Attitude and Working Environment. The questions asked were aimed to measure level of knowledge regarding safety as well as harnessing the level of awareness related to it.

The Safety Awareness Measure, which was developed using Google Forms was distributed electronically to 150 part-time and full-time employees in the organization via email and WhatsApp application. Completed response was collected from 97 active employees, and therefore analysis is based on the 65% returned response. A response rate of 56% from part-time, and 46% from full-time employees. The response rate achieved was already considered good given the medium of distribution. Independent sample T-Test was run, and Levene's Test was conducted to ensure that the imbalance distribution of response from full-time and part-time staff, which are 69 and 28 respectively, did not have any significant impact on the result of the study.

Employees' level of awareness on safety is determined based on the composite score achieved based on total number of correct responses from the 25-item measure (Table 1).

Table 6: Level of Awareness according to Correct Responses on Safety Awareness Measure

Correct Response	Percentage (%)	Level of Awareness
17-25	67-100	High
8-16	33-66	Intermediate
0-7	0-32	Low

In terms of employees' overall level of awareness and knowledge of occupational safety and health matters for all 5 dimensions, the mean score stood at 14.5 (N=97) or 58% of the total possible score. Only 22 or 23% of respondents scored higher than 17 correct responses in the measure, thus belonging to the high awareness level group. A big majority of respondents (74 out of 97 or 76%) were categorized at the intermediate level of awareness, while only 1 respondent belonged to the Low level of awareness category, with a dismal score of 6 correct responses. Overall, the employees at the organization has only intermediate level of awareness based on the points scored in total (M= 279.8, SD= 47.65).

Data were further analysed according to correct responses for knowledge and awareness according to individual sections representing the dimensions of policy & procedure, training, tools & equipment, commitment & attitude and working environment. Figure 1 shows total points scored for each section. Possible full points for each section is 485, and it shows here that overall employees' awareness on Policy and Procedure is lowest compared to other sections. With a total of 198 points, the employees at the organization as a whole only garnered 40.8% of level of awareness. However, the employees are shown to have a good mind-set towards occupational safety and health matters. For the section on commitment and attitude, their awareness is at high level, with a total score of 347, thus earning 72% score for this dimension.

The study also sought to determine if there is any association between employee demographic factors and their occupational safety awareness. The demographic factor in focus was job category; whether the employee is part time or full time staff. Analyses were conducted to determine whether there is an association between respondents' category of employment status (whether full-time or part-time) and age with level of workplace safety awareness. The age of full-time employees ranged from 20 to 57 years (M= 35.46, SD= 8.76), while for the part-time employees, it ranged from 18 to 30 (M= 22.07, SD= 2.97). Mean score for full-timers stood at 14.9 while the mean score for part-timers was 13.8. Through a series of independent sample T-Test analyses, it was concluded that there was no significant relationship

between categories of employment to awareness of occupational safety. Levene's test also proved that the difference in total number of respondents between full timers (59) and part timers (28) participating in the survey did not have significant impact on the results pertaining to the occupational safety awareness. From Levene's Test for Equality of Variances, in the significant column, there were no figure which is lower than 0.05. P value of Levene test are more than 0.05, indicates that the variances between two groups' full-time and part-time employees are equal across the awareness of occupational safety factors.

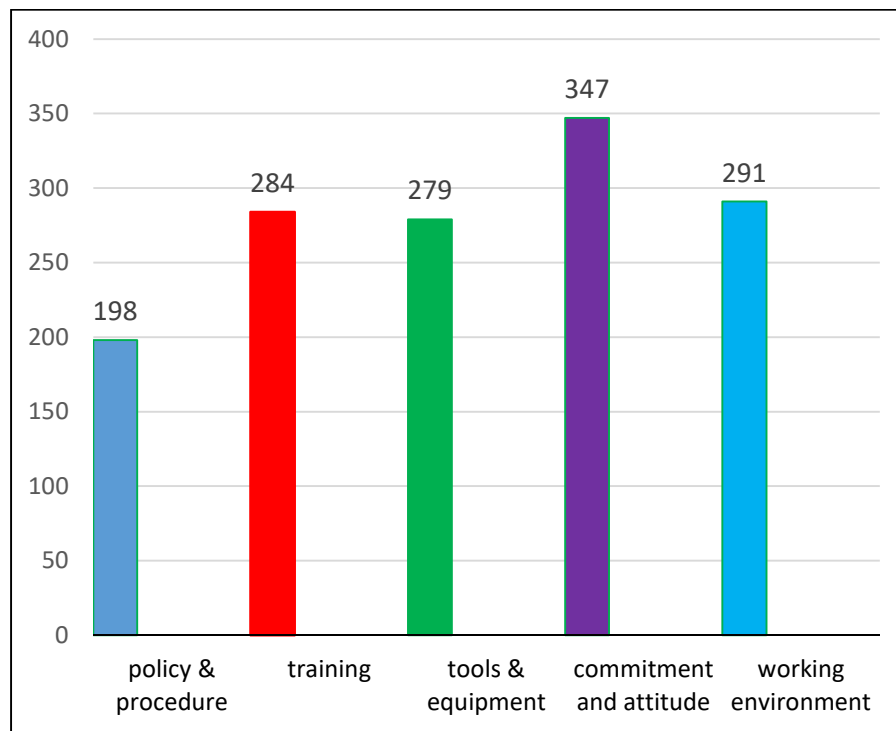


Figure 1: Total Points Scored according to Sections

Based on Table 2, there is no significant difference of mean score for all of the factors between full time and part time since the significance value are above p-value 0.05.

Table 7 Comparison of mean scores between full time and part time employees

Variable	Mean		t-test	df	Sig (2- tailed)
	Full Time	Part Time			
Policy Procedure	0.4029	0.4143	-.210	95	.834
Training	0.5913	0.5643	.539		.591
Tools Equipment	0.5942	0.5286	1.384		.170
Commitment Attitude	0.7159	0.7143	.038		.970
Working Environment	0.6290	0.5286	1.853		.067

Comparison of awareness by individual sections also shows that the scores were not significantly different between full-time and part-time employees as shown in Figure 2 below except for Tools & Equipment and Working Environment.

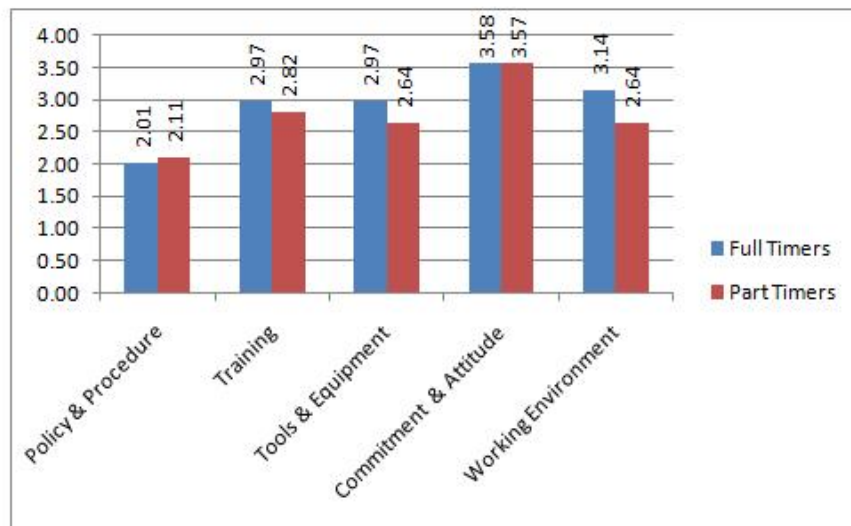


Figure 2: Mean score achieved by employment category based on sections

When we look at the result from T-Test of Gender for all of the science centre employees in Table 3, it shows a significant difference in terms of Tools & Equipment. The sig (2 tailed) value is .015 which is lower than 0.05. It shows here that there are discrepancies in the level of occupational safety awareness on the aspect of tools and equipment between genders. It was further found from individual result analysis that the female staffs (full-time and part-time combined) have lower occupational safety awareness on tools and equipment as compared to the opposite sex. The mean score for male respondents was 3.16 (N=45) while female respondents' mean score was 2.63 (N=52), from which 37 respondents were full timers and 15 were part timers. The female full timers gained a mean score of 2.84 while the part timers gained 2.13 for Tools & Equipment section. In other words, more emphasis in training on Tools & Equipment should be focused on the needs of female part-timers.

The findings concluded that the awareness area that garnered the highest points from the science centre employees on the overall is Commitment and Attitude. It is followed by Working Environment (291points), Training (284), Tools and Equipment (279). The lowest point with furthest big difference is Policy and Procedure (198 points).

Tools and Equipment and Working Environment sections were respectively have difference in mean score of 0.33 and 0.5 between the full timers and part timers with the rest of the sections have lower difference in mean score. By looking at t-test results testing whether demographic factors would have significant effect on the level of occupational safety, there is significant value when it comes to Tools & Equipment between Male and Female respondents.

Table 8 : t- Test of Gender Difference

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Policy Procedures	0.278	0.599	0.778	95	0.438	0.03821	0.04908	-	0.13565
			0.776	91.573	0.44	0.03821	0.04925	-	0.13603
Training	1.347	0.249	1.415	95	0.16	0.06393	0.04517	-	0.1536
			1.402	88.42	0.164	0.06393	0.04559	-	0.15452
Tools & Equipment	0.19	0.664	2.47	95	0.015	0.10419	0.04219	0.02044	0.18794
			2.467	92.638	0.015	0.10419	0.04223	0.02033	0.18805
Commitment& Attitude	0.306	0.581	0.619	95	0.538	-0.0247	0.03992	-	0.05455
			0.614	89.266	0.541	-0.0247	0.04024	-	0.05524
Working Environment	0.029	0.865	0.165	95	0.869	0.00829	0.05013	-	0.1078
			0.165	92.897	0.869	0.00829	0.05014	-	0.10786

4.0 CONCLUSION

The analysis of overall awareness level shows that the science centre employees are at an intermediate level of awareness on matters regarding occupational safety. The full-timer staff scored generally higher because they are better informed on the safety matters because of the higher number of safety training they have attended, and because they are better-acquainted with the environment and the tools and equipment used in the premises. The scores for part-timer staff were slightly lower due to their lack or smaller amount of presence in the premises given they only come in during their semester break or weekends, as many are either students or are fully employed elsewhere. The full-time staffs also have more specific training for handling some safety related equipment such as the automated external

defibrillator (AED). However, the part-timers scored higher on awareness of Policy & Procedure, probably due to recent employment when the study was conducted. All part-time staffs are required to attend the first and major safety briefing during their orientation program which exposes them to the Safety & Health Policy.

Because the organization is pursuing zero accidents and aspires to achieve high level of awareness in terms of occupational safety, it therefore falls to the HSE Officer to conduct regular monthly briefing especially on matters related to Policy & Procedure with all employees. It would also be good to have a clearer and more comprehensive Safety and Health Policy posted at more visible places throughout the premises. The current ones are less noticeable, to the point of being almost hidden. Safety training programs would be ones that allow the employees to be more hands-on on the use of tools and equipment in the science centre for female employees, especially if they are female part-time staff. Refresher courses should be made compulsory for part-timers who return to work after more than 6 months absence. Currently, the science centre only requires part-time staff to attend refresher training only if they had not been active at the science centre for more than 12 months.

REFERENCES

- [1] National Institute of Occupational Safety and Health. *Occupational Safety and Health Act and Regulations Edition 2011*, MDC Publisher Sdn .Bhd., Kuala Lumpur, 2011.
- [2] Ima Ilyani Ibrahim, Sarina Muhamad Noor, Noraini Nasirun and Zulaiha Ahmad. Safety in The Office: Does It Matter to The Staff?. *Procedia - Social and Behavioral Sciences* no 50, pp. 730 – 740, 2012.
- [3] DOSH. Laman Web Jabatan Keselamatan dan Kesihatan Pekerjaan. 1998. Retrieved from <http://www.dosh.gov.my>
- [4] Lugah V, Ganesh B., Darus A, Retneswari M, Rosnawati M R, Sujatha D. Training of occupational safety and health: knowledge among healthcare professionals in Malaysia. *Singapore Medical Journal*, Vol 51, no 7, pp. 586-592, 2010.
- [5] Mohd Fairuz B Talib, *Keprihatinan Pensyarah Terhadap Amalan Keselamatan Bengkel Di ADTEC Batu Pahat*. Masters dissertation, Universiti Tun Jussein Onn Malaysia, 2014.
- [6] Siti Naqiah Mohd Shaain, Noor. Raudhiah Abu Bakar and Azharuddin Hashim, Faktor-Faktor Yang Mempengaruhi Kesedaran Pekerja Terhadap Amalan Keselamatan Pekerjaan: Kajian Kes Di Sebuah Syarikat Logistik. 2015. Retrieved from <http://www.kuis.edu.my/icommm/2nd/download/IC%20016.pdf>
- [7] Peter M. Smith, Ron Sunders., Marni Lifshen, Ollie Black, Morgan Lay and

- F. Curtis Breslin, Anthony D. LaMontagne and Emile Tompa. The Development of a Conceptual Model and Self- Reported Measure of Occupational Health and Safety Vulnerability. *Accident Analysis and Prevention*, no 82, pp. 234-243, 2015.
- [8] Baizura Zubir, Fazidah Saad, Wan Faradiana Wan Maidin, Mohd Riduan Jamaludin, Safety and Health Awareness among Staff and Students in Workshop and Laboratory of an Engineering Technology University Campus. *International Journal of Engineering Research & Technology (IJERT)*, Vol 5, no 3, 2016.
- [9] Hapriza bte Ashari, Durrishah Idrus, Fadilah Binti Zaini, Hamidah bte Abd Rahman, Rossilah bte Jamil, Syaharizatul Noorizwan bte Muktar. Kajian Kesedaran Staf UTM Terhadap Keselamatan Dan Kesihatan Di Tempat Kerja, *Jurnal Teknologi*, Penerbit Universiti Teknologi Press, No 47, Dis. 2007.

Community Preparedness and Response towards Disaster in Iskandar Puteri Johor

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Abstract – *Community preparedness is vital to reduce the impact post-disaster. The aim of this study is to gauge level of awareness on preparedness and response from community in Iskandar Puteri Johor. In this study, quantitative survey method was used. Participants was recruited using convenience sampling with response rate 71% (n=107). Study in the Iskandar Puteri Johor indicates that majority of the populations in Taman Nusa Bayu were not ready when a disaster strike. Both gender and education level did not play a role in awareness towards disaster preparedness. The Malaysian community are not exposed to disaster preparedness training and less support from various agencies, thus, a program to improve awareness and to make community resilience is required.*

Keywords: Disaster, Community, Preparedness, Response, DRR, CBDRM

1.0 INTRODUCTION

Iskandar Puteri is a new township development area in state of Johor which has similar blue-print as Putrajaya. The new township contributes to socio-economy development to its state and nation. It hosts the state new administration office, education hub and tourism facilities like the Legoland Malaysia and the Hello Kitty Town [1]. This economic region is currently being developed until the year 2025 [2]. Most of natural disasters in Malaysia are resulted from the heavy rain [3]. Flood is the major natural disaster in Malaysia which many communities that live along the rivers face this problem [4]. As Iskandar Puteri is not surrounded by river, flood is not a common threat to the community. Nevertheless, every year residents of the Iskandar Puteri face with severe monsoon season as well as haze from neighboring country. Economic development in Iskandar Puteri however, could cause flash flood. Rapid economic development couples with climate change, alter the physical structure of the earth and may cause flood to occur anywhere without warning [5].

Community awareness is defined community that has information and knowledge on particular subject that will enhance skills and behavior. Level of awareness can be categorized in the level of socio-economy, education, political surrounding and so on. According to Buckland & Rahman, community that had an experience with disaster will be prepared to face new disaster [6]. Nevertheless, social media and newspaper reported that the community response to flood in Kelantan was bad whereby the community will wait until last minute to evacuate.

Awareness on disaster to the community will allow community to independently response to any warning [7]. The challenge is the level of awareness in disaster in industrial sector in some part of Malaysia is deteriorating, that might implicate to the awareness in that community. Three objective of this study, to identify community perception on disaster risk, investigate the community awareness on preparedness and response during disaster and lastly to develop Community Emergency Response Team.

2.0 METHODOLOGY

The area of the study is at Taman Nusa Bayu. This area is a newly development housing estate. The population live here is estimated to 500 houses in phase A, B and C. The community is a middle income and educated background. This study is performed by using quantitative survey method and the sampling strategy is using the convenience sampling.

2.1 Instrument

A survey questionnaires was used to collect data for this study. The questionnaires were adapted from Federal Emergency Management Agency [2]. It was purposely developed to survey the American households on disaster preparedness since 2007. Originally, the questionnaire consists of 16 sections including demographic information.

For the purpose of this study, the amended version was reduced into 7 sections with a total of 46 items. Section A, is about demographic information (3-items); section B on perceive risk (4-items); section C perceive severity (4-items); section D motivators/ barriers (13-items); section E able to respond (7-items); section F community plans (7-items), and section G household preparedness (8-items).

2.2 Statistical Analysis

Descriptive statistic was used to determine the level of community awareness and disaster preparedness. Chi-square test were performed to determine the correlation of disaster preparedness and independent variables. Consequently, a Phi Cramer's V

test were performed to identify the strength of correlation that have been found from chi-square test. All statistical analysis were performed using SPSS V.22.0.

3.0 RESULTS AND DISCUSSION

The survey has yield 71.2% response rate with total of 107 participants. The majority of participants in this study are middle age between 25 to 44 years old, high educated and not equally represented by gender.

The first objective of this study is to identify the community perception towards disaster risk that will affect to residents at Taman Nusa Bayu. Therefore, section B of the questionnaire has addressed on the participants' perception on the risk of disaster in their community. The frequency table (Table 1) describing on the participants' perception on several disasters risk in Taman Nusa Bayu community.

Table 9: Disaster risk perception

Questionnaire Items Related to Disaster Risk	Mean	SD
Perceive Risk		
Natural disaster will occur	3.26	0.87
Terrorism will occur	1.72	0.68
Hazardous materials accident will occur	2.36	0.69
Contagious disease outbreak will occur	3.31	0.98
Perceive Severity		
A natural disaster, such as an earthquake, a hurricane, a flood	3.32	0.78
An act of terrorism, such as biological, chemical, radiological, or explosive attack	1.50	0.60
A hazardous materials accident, such as a transportation accident or a power plant accident	1.84	0.80
A highly contagious disease outbreak, such as a H1N1 flu epidemic (In 2009, text was changed from "bird flu epidemic" to "H1N1" during fielding due to the H1N1 outbreak)	3.53	1.0

Based on data presented in Table 1, the participants perceive that contagious disease outbreak is the highest risk in the community among other types of disaster (mean = 3.31, SD = 0.98). On the other hand, terrorism indicate the lowest risk perceived by the participants with mean value 1.72 (SD = 0.68). The same pattern of response was identified when referring to the severity of disaster. Contagious disease outbreak was indicated the most severe with mean score at 3.53 (SD = 1.0) among other types of

disaster. An act of terrorism attack was indicates the less severe with mean score 1.50 (SD = 0.60). In short, the disaster risk and severity perceived by participants can be rank from the highest to the lowest as follow; contagious disease outbreak, natural disaster, hazardous material accident and act of terrorist.

The correlations between level of preparedness and independent variables have been investigated. As the data collected in this study is nominal data, chi-square test is appropriate to determine correlation between variables. The results of chi-square test were presented in Table 2.

Table 10: Chi-square test (X²)

Variables	Respondent n (%)	Well prepared n (%)	X ²	p Value	Phi Cramer's V
Gender			0.209	0.648	0.044
Male	75 (71.1)	22 (29.3)			
Female	32 (29.9)	8 (25.0)			
Age			2.232	0.693	0.144
<25	6 (7.8)	5 (83.3)			
25-34	30 (39.0)	9 (30.0)			
35-44	30 (39.0)	12 (40.0)			
45-54	9 (11.7)	3 (33.3)			
>55	2 (2.6)	1 (50.0)			
Qualification			5.652	0.342	0.230
Secondary school	8 (10.4)	2 (25.0)			
Certificate	3 (3.9)	2 (66.7)			
Diploma	27 (35.1)	13 (48.1)			
Degree	35 (45.5)	9 (25.7)			
Masters	3 (3.9)	3 (100.0)			
PhD	1 (1.3)	0			
Perceive Risk			16.51	0	0.393
Low	67 (87.0)	15 (22.4)	8		
High	10 (13.0)	10 (100.0)			
Perceive Severity			1.025	0.311	0.098
Low	61 (79.2)	21 (34.4)			
High	16 (20.8)	9 (56.3)			
Motivators/Barriers			6.763	0.009	0.251
Low	71 (92.2)	22 (31.0)			
High	6 (7.8)	6 (100.0)			
Able to Respond			22.88	0	0.462
Low	69 (89.6)	14 (20.3)	3		
High	8 (10.4)	8 (100.0)			
Community Plans			10.97	0.002	0.320
Low	68 (88.3)	18 (26.5)	0		
High	9 (11.7)	9 (100.0)			

There were no significant different relationship between participant disaster preparedness and demographic variables that include gender, age and qualification. For independent variables, there are significant different relationship with disaster preparedness for variables including participants' perceive risk ($p = 0$), motivators/barriers ($p = 0.009$), able to respond ($p = 0$) and community plans awareness ($p = 0.002$). Only participants' perceive severity of disaster risk indicates no significant different relationship with disaster preparedness ($p = 0.311$).

Further, the strength of significant relationship found among variables was referred at phi Cramer's V test. The interpretation was made using scale as follow; small = 0.01, medium = 0.30, large = 0.5. With the range between 0 and 1, the larger the value will indicate the stronger the relationship between two variables. Therefore, participants' ability to respond has a stronger relationship with their disaster preparedness ($\phi = 0.462$) while motivator/barrier indicate the weakest relationship ($\phi = 0.251$).

Based on the result of this study, in order to gain awareness and preparedness to response towards disaster. Teams of community emergency response team need to be established. Commonly, all of newly housing estate has their own JKKK (*Jawatan Kuasa Keselamatan Kampung*) or Village Development and Security Committee. In order to get some initiative of allowance from the government, JKKK must be register to Registry of Society (ROS) beforehand. These are the normal process for new JKKK to be recognized. The suggestion is to put extra process on getting the approval from ROS (Figure 1). JKKK is to establish Community Emergency Response Team (CERT) by adding a structure of CERT committee. Before going to ROS, a new JKKK must come with a list of their own structure on CERT along with the structure of JKKK before getting approval by ROS. This procedure required cooperation and hands-to-hands work between ROS and NADMA which is the agency of disaster management in Malaysia. In this scenario, NADMA to give a guideline to ROS on the simple structure of CERT. This will encourage each community that plan to have JKKK to do extra work by getting extra team like CERT from their own community.

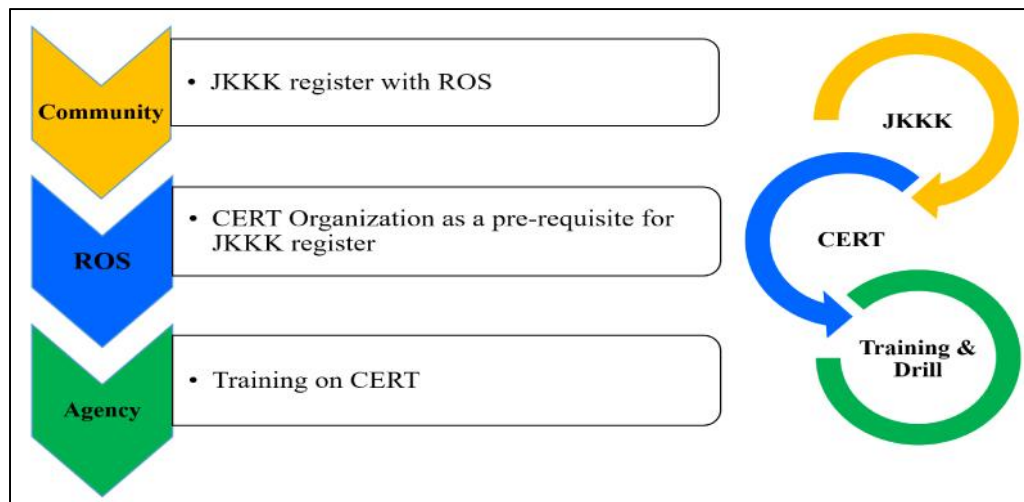


Figure 5: Development of CERT by JKKK

4.0 CONCLUSION

This paper presents a result of community in Iskandar Puteri towards disaster. They perception on disaster risk is most on pandemic not on natural disaster like flood, earthquake, hurricane or other disaster like terrorism nor industrial disaster. The test proven that the population in Taman Nusa Bayu is low in level awareness for the preparedness and response during disaster. They are not well prepared. Further study on disaster preparedness need to be conducted to community in all of the peninsular state in Malaysia. This is inclusive to all area whether the area is disaster-prone or not. The awareness should be instill start from school level to population in the entire nation. Malaysia is not isolated from disaster although we are leaving out of Pacific Ring of Fire.

REFERENCES

- [1] Khalil, R. A. A., Johar, F., & Sabri, S. 2015. The Impact of New-build Gentrification in Iskandar Malaysia: A case study of Nusajaya. *Procedia - Social and Behavioral Sciences*, 202, 495–504. <https://doi.org/10.1016/j.sbspro.2015.08.192>
- [2] Osman, M. M., Bachok, S., & Rabe, N. S. 2015. Local Residents' Perception on Socio-economic Impact of Iskandar Malaysia: An Example of Urban Regeneration Program in Malaysia. *Procedia - Social and Behavioral Sciences*, 170, 58–69. <https://doi.org/10.1016/j.sbspro.2015.01.015>
- [3] Shaluf, I. M., & Ahmadun, F. R. 2006. Disaster types in Malaysia: an overview. *Disaster Prevention and Management*, 15(2), 286–298.

- <https://doi.org/10.1108/09653560610659838>
- [4] Zahari, R. K., & Ariffin, R. N. R. 2013. Community-Based Disaster Management in Kuala Lumpur. *Procedia - Social and Behavioral Sciences*, 85, 493–501. <https://doi.org/10.1016/j.sbspro.2013.08.378>
 - [5] Elias, Z., Hamin, Z., & Othman, M. B. 2013. Sustainable Management of Flood Risks in Malaysia: Some Lessons from the Legislation in England and Wales. *Procedia - Social and Behavioral Sciences*, 105, 491–497. <https://doi.org/10.1016/j.sbspro.2013.11.052>
 - [6] Buckland, J., & Rahman, M. 1999). Community-based disaster management during the 1997 Red River Flood in Canada. *Disasters*, 23(2), 174–191.
 - [7] Shiwaku, K., Shaw, R., Kandel, R. C., Shrestha, S., & Dixit, A. 2006. Promotion of disaster education in Nepal: The role of teachers as change agents. *Int J Mass Emerg Disasters*, 24(3), 403.

Occupational Stress Management among SU-30MKM Maintenance Personnel in Gong Kedak Air Base

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Abstract: *In the Royal Malaysian Air Force, Engineering Department at Gong Kedak Air Base is responsible for operating and maintaining the fighter aircraft Su-30MKM. The aim of this study is to determine the level of stress and causes that contribute to the occupational stress problem among Su-30MKM maintenance personnel in Gong Kedak Air Base. The scope of this study involved the maintenance personnel from No 11 Squadron and Cawang Kejuruteraan in Gong Kedak Air Base. The questionnaires for the survey and interview were conducted and will be the main instruments as to gather information and as to identify either those said variables are correlated or not correlated. The secondary information was collected from books, journals, magazines, and a few others. This study involved 132 Su-30MKM maintenance personnel consisting of various ranks, age, gender, marital status, working experiences, education backgrounds, and incomes (gross and nett). The result of the study will determine the level of occupational stress among Su-30MKM maintenance personnel and further identify the most important factors which can lead to the occupational stress among aircraft maintenance personnel in Gong Kedak Air Base. There are some methods due to contributing factors proposed in order to reduce the occupational stress among Su-30MKM maintenance personnel.*

Keywords: Occupational, stress management, maintenance

1.0 INTRODUCTION

The purposes of this paper are to evaluate the stress level and to identify the factors that contributed to the occupational stress among Su-30MKM maintenance personnel in Gong Kedak Air Base. Gulab & Sandhya Mehta, [1] in their study has identified certain contributing factors for stress. They are classified under three categories; socio-economic including familial reasons, environmental/organisational, and medical/ psychological causes. The causes of stress are known as stressors and there

are few categories of stress such as physical stressors, psychological stressors, and physiological stressors. Nonetheless, there are a few ways to handle stress physically, psychologically, and additional recommendations. This paper will describe and identify the stress level and contributing factors which lead to the stress problem among Su-30MKM maintenance personnel in aviation working environment. The aim for this study is to suggest several methods in stress management to ensure these maintenance personnel can cope with their stress during working environment. Stress management is crucial for aviation personnel in order for them to be working in a stress-free environment and later produce an optimum quality of work.

The project objective is to identify the current stress level and contributing factors that lead to the stress problem among Su-30MKM maintenance personnel in Gong Kedak Air Base. The goal for this study is to reduce the occupational stress level among maintenance personnel by proposing methods in stress management. The objectives of this paper are as follows; 1. To evaluate the occupational stress level on Su-30MKM maintenance personnel. 2. To identify the most factors that contributed to the occupational stress among Su-30MKM maintenance personnel. 3. To propose methods in reducing the occupational stress among Su-30MKM maintenance personnel.

2.0 METHODOLOGY

2.1 Population

The population of a research as the study of a large group is concern in which a research is relevant and related. Significantly, the sample for this project is 132 out of the 213 Su-30MKM maintenance personnel which is the target population for this particular project. The unit of analysis for this research is the maintenance personnel who are involved only in aircraft launching, rectification, and servicing at Gong Kedak Air Base.

2.2 Data Collection

According to the research framework, after determining the area of work study which is selected at No 11 Squadron and Cawang Kejuruteraan in Gong Kedak Air Base, this paper will be carried out in order to find out why stress happens among the personnel and how to counter and reduce it. The result shows that two significant factors faced by the top of the management in Gong Kedak Air Base are verbal complaints about stress and bad pattern of human resources depletion in term of early retirement among personnel.

2.3 Observation

Observation will be carried out at No 11 Squadron and Cawang Kejuruteraan in Gong Kedak Air Base. This observation method will focus more on daily activities. Aircraft launching, rectification, and servicing are some of the instances of the daily activities done by the personnel. The main objective through this observation is to find out the main factors that contributes to the occupational stress problems among maintenance personnel.

2.4 Questionnaire

The questionnaire will be divided into two types in order to fulfill the first and second research objectives. First type of questionnaire is adapted from ISMA Stress Questionnaire (International Stress Management Association 2013) in order to measure the stress level among personnel. Second objective will be achieved by developing the questionnaire which focuses more on the factors that lead to the occupational stress problem. The maintenance personnel will first be briefed about the research objective, the purpose of the project and also the requirements of the assessment before conducting the questionnaire. All the respondents must be explained especially in term of the aims of this project which are to find out the stress level and contributing factors that lead to the stress problem among Su-30MKM maintenance personnel. Other than that, this questionnaire will hopefully be able to trigger suitable methods in order to manage the stress.

2.5 Data Analysis

Analysis is a research technique of making replicable and valid references from data to their context. As mentioned previously, data obtained from the questionnaire will be analysed by using SPSS (version 17) software. Tables, drawing graphs, and also output are going to be used as a mean of data analysis. Apart from that, representations like charts, pie charts, and others will be used and applied to confirm easy and quick interpretation of data. Responses will also be conveyed in percentages.

3.0 RESULTS

3.1 Stress Level among Personnel

The first phase of this paper is to identify the current stress level among maintenance personnel in Gong Kedak Air Base. Questionnaires on stress level were distributed to 132 personnel and based on the results; most are exposed to high level of stress.

Table 1: Stress level among Su-30MKM maintenance personnel

Score	Level of stress	Number of respondent	Total Number of respondent	Percentages
4	Low stress	2	132	1.6%
5 - 13	Moderate stress	46		34.8%
≥ 14	High stress	84		63.6%
Total		132		100%

The total of 63.6% of maintenance personnel are exposed to high stress, 34.8% personnel are exposed to moderate stress, and only 1.6% of maintenance personnel are exposed to low stress.

3.2 Demographic Characteristic

The questionnaires were completed by 132 aircraft maintenance technician with total response rate was 100%. From the data collection, majority (96.2%) of the respondent were male while (3.8%) females, majority of them age group between 20 – 29 years old (67.4%) while (32.6%) 30 – 49 years old., Education level at least High School certificate (68.9%), had length of experience within 2 - 5 years.

3.3 Cause Factor lead to the Stress

Analysis on probable cause has been carried out based on four sub topics regarding to the occupational stress problem among maintenance personnel in Gong Kedak Air Base. The four sub topics are management, environment, human, and financial. in order to identify the most probable cause that leads to the occupational stress problem, both descriptive statistics on frequency, percentage, mean, and standard deviation are used and applied to each response under the sub topic.

A. Management Sub topic

Table 2: Variable factor under Management

Variables	Mean	Standard Deviation
1. Heavy workload	2.17	0.70
2. Unschedule task	2.24	0.67
3. High customer's expectation	2.26	0.66
4. Secondary duties	2.30	0.89
5. Lack of social hours	2.30	0.70
6. Inadequate breaktime	2.30	0.72
7. Unfair distribution of work	2.33	0.62
8. Poor supervision	2.34	0.63
9. Repetitive/boring work	2.53	0.69
10. Shiftwork	2.57	0.91
Average value of Mean:	2.33	

B. Environment Sub topic

Table 3: Variable factor under Environment

Variables	Mean	Standard Deviation
1. Poor maintenance of equipment	2.24	0.77
2. Noise	2.26	0.85
3. Excessive heat	2.54	0.66
4. Poor/inadequate lighting	2.56	0.71
5. Dust of fumes	2.67	0.60
6. Poor ventilation	2.77	0.66
7. Overcrowding	2.76	0.68
8. Excessive cold	2.81	0.57
Average value of Mean:	2.58	

C. Human Sub topic

Table 4: Variable factor under Human

Variables	Mean	Standard Deviation
1. Health problem	2.33	0.70
2. Poor relations with supervisor	2.34	0.77
3. Lack of knowledge and skill	2.43	0.85
4. Poor relations with workmates	2.50	0.67
5. Lack of communication with management	2.53	0.76
6. Impersonal treatment	2.57	0.71
7. Harassment /discrimination	2.62	0.77
8. Working with the public	2.62	0.67
Average value of Mean:	2.50	

D. Financial Sub topic

Table 5: Variable factor under Financial

Variables	Mean	Standard Deviation
1. You are underpaid	2.41	0.88
2. You are undervalued	2.55	0.80
3. Not receive appreciation for good work	2.59	0.84
4. No salary increment / rank	2.70	0.85
Average value of Mean:	2.56	

Based on the total mean scores for each of sub topic, Management factor is the most probable cause that leads to occupational stress problem among maintenance personnel in Gong Kedak Air Base followed by the Human factor, Financial factor, and Environment factor. There are some methods in stress management proposed in order to reduce the stress level among Su-30MKM maintenance personnel in Gong Kedak Air Base. All the maintenance personnel involved either directly or indirectly already knew their current stress level and they will manage themselves in order to practice and apply all the methods proposed by the researcher.

Table 6: Four Main Sub Topic based on the Average Value of Mean Scores

Main of Sub Topic	Average Mean Score	Ranking
Management	2.33	1
Human	2.50	2
Financial	2.56	3
Environment	2.58	4

All the variables factor under each of the sub topics were be analysed based on frequency, means, and standard deviation in order to know the most sub topic that contributed to the occupational stress problem among maintenance personnel in Gong Kedak Air Base. Based on the result analysis, management sub topic indicated for the most probable cause compared with the others sub topics regarding to the mean score resulted. Table 6 above shows the ranking of four main sub topic based

on the average value of mean scores. The management factor triggered for the most sub topic that contributed to the occupational stress problem among maintenance personnel in Gong Kedak Air Base which mean score ($M = 2.33$).

The interview between high stress level personnel was carried out in order to confirm and support the result by the quantitative method from the questionnaires. Based on this result, the answers from the respondents (60%) revealed the management is the main factor that contributed to the high stress level in the organisation. The result shows that personnel at average age 18 – 29 years old are highly exposed to the high stress in the work place. The result also shows that majority of personnel agree with the early retirement among Su-30MKM maintenance personnel has related to the occupational stress problem in the organisation.

Table 7: Result of the interview with the high stress level respondents

INTERVIEW WITH THE SU-30MKM MAINTENANCE PERSONNEL (AGE 18 – 29 YEARS OLD)				
RESPONDENT (High stress level)	RANK	SYMPTOM ‘KEY WORD’	PROBABLE CAUSE	EARLY RETIREMENT RELATED
1	KPL	‘Work load’	Management	Yes
2	KPL	‘Less of Senior Rank’	Management	Yes
3	KPL	‘Not enough rest time’	Management	Yes
4	KPL	‘Lack of communication’	Human	Yes
5	KPL	‘Additional tasking’	Management	Not sure
6	LUK	‘Salary not enough’	Financial	Yes
7	LUK	‘Less of man power’	Management	Not sure
8	LUK	‘Gap with the senior’	Human	Yes
9	LU	‘Lack of cooperation’	Human	Not sure

10	LU	'Less of leave'	Management	Not sure
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4.0 DISCUSSION

The third objective of this paper is to propose method in reducing the occupational stress among Su-30MKM maintenance personnel. In order to achieve the third objective of this paper, a survey was conducted to the five of experience 1st line personnel from the others rank and two of 1st line Engineering Officer due to Management factor that lead to the occupational stress problem in Gong Kedak Air Base.

Table 8: Methods in Reducing the Occupational Stress Level

MANAGEMENT	
Variable Factor	Method to Reduce The Occupational Stress
Heavy workload	<ul style="list-style-type: none"> Prioritize the task
Unscheduled task	<ul style="list-style-type: none"> Get organised and stick to the plan
High customer's expectation	<ul style="list-style-type: none"> Competency and maintenance skill level
Secondary duties	<ul style="list-style-type: none"> Dare to delegate the task
Lack of social hours	<ul style="list-style-type: none"> Create social activity
Inadequate break time and mealtime	<ul style="list-style-type: none"> Allow flexi time and remote working time
Unfair distribution of work	<ul style="list-style-type: none"> Set boundaries and stick to them
Poor supervision	<ul style="list-style-type: none"> Lead by example
Repetitive and boring work	<ul style="list-style-type: none"> Get up and moving
Shift work	<ul style="list-style-type: none"> Minimise working on continuous night shift

Base on the present study by Charanjev Singh et.al., [2] depicted the stress levels of nursing students which resulted as severe stress (2.3%), moderate stress (63.6%) and mild (34.1%). The total of 63.6% of maintenance personnel exposed to the high stress, 34.8% exposed to the moderate stress, and only 1.6% of maintenance personnel exposed to the low stress. This two findings show the different pattern of the results which indicated that aircraft maintenance personnel in Gong Kedak Air Base are at high risk of suffering from work stress in the organisation due to the percentage of high stress level.

A previous survey of 1,299 employees from 37 organizations was conducted by David Lee [3] in order to find out the causative factors that lead to the stress among employees in the Article of Maine Employers' Mutual Insurance Company. In that survey, the result shows that management and employees being rigid and unsupportive management were the main probable causes that contributed to the stress problem among the employees. In this paper, Management sub topic (M = 2.33) triggered as a most contributing factor that lead to the stress problem among the aircraft maintenance personnel.

A survey by Sakshi Sharma [4] through questionnaire to the 415 Indian Army soldiers found the occupational stressors in the Indian Army are due to the lack of control at work, role conflict, and also workload and job pressure. Heavy Workload triggered as a most aggravating factor contributed to the occupational stress problem among the aircraft maintenance personnel in Gong Kedak Air Base. Dixit [5], stress among soldiers can be triggered even by the slightest change in their workplace whether in their workload or everything surrounding them. The best way to reduce the work stress is by keep workload under control, communicate, and ask for help [6,7].

In this paper, there are 10 methods are proposed in reducing the stress level among the maintenance personnel regarding to the variable factors under the Management sub topic. All the stress methods are Prioritize, Get organised and stick to the plan, Improve competency and maintenance skill level, Delegate the task, Create social activity, Allow flexi time and remote working time. Set boundaries and stick to them, Lead by example, Get up and moving, Minimise working on continuous night shift.

4.1 Suggestion on method in managing stress

The survey was conducted after the result analysis and findings were carried out as stated in Chapter 4. Based on the answer from all of respondents in the survey, there are several suggestion that have been proposed due to the occupational stress problem in Gong Kedak Air Base. All the suggestions are as below:

- a. Manager in the Engineering Department must have a flexible working time for personnel who have higher workload where they must be given an off-day whenever there is less maintenance activity.
- b. Management must practice a balanced work life as a way to manage stress of the maintenance personnel where there is scheduled time for them to engage in sport activity, religious program, and other social activities. As current practice, Engineering Department at Gong Kedak Air Base has already practised giving the rewards to the maintenance personnel who show high working commitment every month in the name of 'Best Airman of the Month'.

- c. The management could organise and slot a talk session on how to control stress at workplace. This is the way to give exposure to the maintenance personnel about the importance of stress management and can also change their mentality to be stronger in facing all the tasks and workload.
- d. The number of manpower must be increased in order to cover all the tasks and workload either in the shift time or normal time. All the duties could be delegated when the number of maintenance personnel increased.
- e. The secondary duties could be given for those who are not involved directly to the aircraft maintenance activities.
- f. The management must assign an experienced supervisor in order to monitor all the schedule turn in shift and make sure all the process of duties delegated are going well.
- g. The management must build up monitoring system team led by an experienced Engineering Officer and supervisor by trade as a member in order to manage the fresh technician and tackle complex tasks. It will become a heavy workload to fresh personnel if this issue is not countered.
- h. One issue highlighted on the unbalanced task distribution which is not proper due to different trades of personnel. The load of work depends on the level of problem and what system and trade personnel to be involved. Some of the problems can just be solved by single trade personnel and sometimes, the problem can only be solved by the combination of multi trade personnel depending on the related system.
- i. The management must ensure all the personnel upgrade their skill level to a higher standard in order to ensure all the tasks can be fairly distributed to any maintenance personnel in the organisation. Normally, only the skilful personnel do a lot of jobs compared to the other personnel and this situation will contribute to the occupational stress problem among the group of skilful personnel.
- j. Improve communication between management and maintenance personnel in order to listen and identify the current problem faced by the personnel. Management must know their men and be fair with all personnel while giving yearly evaluation marks or any promotion. It is a positive reward and morale to the skilful and hardworking personnel in the organisation.

4.2 Constraint and Limitation

There is some limitation to be described in this paper. This project is limited in gathering data like medical report on stressed personnel due to RMAF policy itself as a government sector. Other than that, the time to complete this paper is also a limitation for the researcher due to personal position as a 1st line Engineering Officer in the organisation and is always involved with the detachment or exercise outside the parent Air Base.

4.3 Application

This paper is suitable to be applied in other agencies and workplace area related with the system management in the organisation such as in construction, engineering application, and of course in the aviation field. All the finding methods in this paper can be practiced and applied to suit the system management in the organisation. Management in the work organisation can be used as a guidance and reference in order to prevent and manage the stress level among employees in the organisation.

5.0 CONCLUSION

The methods in reducing the stress level among the maintenance personnel has been proposed and discussed in this paper such as prioritize, get organised and stick to the plan, improve competency and maintenance skill level, delegate the task, create social activity, lead by example and so on. The others issue that related with the occupational stress and work organisation has also been discussed which are in the section significance of this paper.

In the application, there are few steps had been developed in order to avoid the stress among the maintenance personnel in the working environment. Furthermore, there are few information can be implemented and practiced by the organisation in order to make sure their personnel feel happy and enjoy on the task given. Ultimately, it will reduce the verbal complaint about the stress problem and also early retirement among the Su-30MKM maintenance personnel and at the same time can increase the organisation productivity.

Contribution of this project can be fully mentioned as well after all of the stress methods are applied in the work organisation. The quality of life and work life balanced among the management personnel will be managed and ensured by the management in the organisation. All the methods in managing the occupational stress will be endorsed and published to the Management of Engineering Department in Gong Kedak Air Base.

REFERENCES

- [1] Gulab and Sandhya Mehta (2015). A Review of Stress Management in Indian Air Force. International Journal of Science Technology and Management, Vol. No. 4, Special Issue No. 01, November 2015, page 275.
- [2] Charanjeet Singh, Sunita Sharma, Ravinder Kumar Sharma (2011). Level of Stress and coping strategies used by nursing interns, Nursing and Midwifery Research Journal, 152-155.
- [3] David Lee (2000). Managing Employee Stress and Safety - A guide to minimizing stress related cost while maximizing employee productivity. Article of Maine Employers' Mutual Insurance Company, 7.
- [4] Sakshi Sharma (2015). Occupational Stress in the Armed Forces: An Indian Army Perspective. Journal of IIMB Management Review, 187.
- [5] K C Dixit (2016). Addressing Stress-Related Issues in Army. IDSA Occasional Paper No. 17. Institute for Defence Studies and Analysis, New Delhi, 6
- [6] Jeremy Stranks (2005). Stress at Work, Management and Prevention. Book as a guide for managers, 142-143.
- [7] Jain, A. K., & Cooper, C. L. (2012). Stress and Organisational Citizenship Behaviour in Indian Business Process Outsourcing Organisations. IIMB Management Review, 24, 155-163.

Factors Influencing Sharp Injury Reporting Among Healthcare Workers in Hospital Melaka

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Abstract - Prevalence of sharp injury is high in Hospital Melaka, with 25 per 1000 healthcare worker being affected each year. However, according to World Health Organization, surveillance data tend to underestimate true rate of sharp injuries between 18% and 70%. Various factors affecting reporting behaviour can be divided into organizational factors and health belief. The objective of the study is 1) to determine the level of awareness and compliance on sharp injury reporting among healthcare workers in Melaka, 2) To identify the relationship between awareness on reporting, organizational factors and health belief with sharp injury-reporting behaviour among healthcare workers, 3) To determine the impact of awareness on reporting, organizational factors and health belief with sharp injury reporting behaviour among healthcare workers. HCWs who reported sharp injury between 2011 and 2015 were invited to answers questionnaires pertaining these factors. Descriptive statistics, mean scores and multiple logistic regression were used for the analysis.

Keywords: sharp injury reporting, healthcare workers, health belief, organization safety climate

1.0 INTRODUCTION

Sharp injury is a significant occupational hazard among healthcare workers. The risk control has shifted from personal approach to a complex integration safety engineering and administrative organizational approach. In system-based approach, prevention of prevent sharp injuries among healthcare workers relies on reported data but often hampered by underreporting of cases among the healthcare workers [1]-[6]. Surveillance data tend to underestimate true rate of sharp injuries between 18% and 70% [7]. Healthcare workers who tend to not report their sharp injury, often emphasized on negative aspects of reporting without undergoing the process of reporting itself [8].

Pfeiffer proposed a psychological framework of antecedents to healthcare worker motivation to report or not to report a sharp injury. Psychological antecedents are

divided into individual factors, organizational factors and reporting system itself [9]. There are fewer total accidents reported and lesser underreporting in a good safety climate [10]. Similar emphasis was seen in the presence of supervisor enforcement of safety [10], good co-worker support and positive peer pressure [11]-[14], minimal workload or less production pressure [2] [11] [15]. Boden combining all these 3 factors: organization safety practice, staff adequacy and co-worker support in his study reported that good perception of safety practice is a predictor for reporting sharp injuries. Coworker support and staff adequacy has only substantial correlation [16]. The authors suggest that the other factors might have a complex interplay in stages of injury reporting.

Health Belief Model predicts factors at individual level and does not integrate other external factors [4]. In magnet hospitals where all organizational factors are favourable, decision to report relies on healthcare workers' perception barrier [17]. Tabak reported that compliers have high level of knowledge on blood borne infection, higher perception on susceptibility of contracting disease, severity of disease and benefit of reporting compare to non-compliers. Perception to reporting efficacy has greatest compliance with duty to report [18].

The authors address the importance of reporting sharp injuries as the vital component in promoting sharp safety among healthcare workers. Determining factors that affect a sustained injury to be reported is essential to encourage participation of healthcare workers to contribute their opinion, insight and experience in tailoring the prevention program. This study is designed to study organizational factors and health belief factors that influence healthcare workers to report a sustained sharp injury.

2.0 METHODOLOGY

2.1 Data

The questionnaire-based survey was conducted between September 2016 and November 2016. Name, age, gender, working duration, department and contact number were extracted from 329 OHU/SIS-II forms in Hospital Melaka. All 329 subjects were contacted based on contact number given in the OHU/SIS-II form and invited to participate in this survey. Only 189 were contactable and 82 responded. All 82 questionnaires were complete and included in the analysis. This is a 43.3% response rate representing 24% of total available data for reported cases. Respondents were allowed to choose between paper-pencil and online questionnaire.

2.2 Instruments and Measurements

Instrument was measured by Likert scale where 1= strongly disagree and 5= strongly agree. The safety practice was an 8-item scale adapted from Organizational Policies and Practice Questionnaire measuring safety measures and management at work place [19].

Perceived staff adequacy measurement was a 5-item scale based on the Revised Nursing Work Index by focusing on staff availability, adequate time to discuss cases, skills nurturing and the need to cover duty out of job scope [20]. Perceive co-worker support measurement was a 5-item scale based on Job Content Questionnaire measuring relationship and team works between doctors and nurses and availability of colleague support when needed [21]. Health belief measurement was adapted from Rosenstock's Health Belief Model (1959). This section consists of 24 questions divided into 5 subtopics: perceived susceptibility of disease, perceived severity of disease, perceived benefit of reporting, perceived disadvantage of reporting, and overall maintenance of health [22]. The compliance to report a sustained sharp injury in the future was measured by level of compliance. This section consists of seven-item statements to assess workers compliance to duty to report a sustained sharp injury in the future adopted from Haridi [23]

2.3 Data Analysis

Reliability of the construct is assessed using Cronchbach Alpha Coefficient. Descriptive analysis was applied to characterize the frequency of distribution of variables. Demographic data and frequency tables were compiled from the returned questionnaires. Level of awareness and compliance is described using mean score, percentage divided in categories "Good", "Moderate" and "Poor". Using inferential statistics, the relationships between independent factors (awareness, organizational safety practice and health belief) with dependent variable (level of compliance) were analysed by correlation and regression analysis at significant level $p < 0.05$. Frequency analyses and correlations are conducted using The Statistical Package for the Social Science (SPSS) Version 23.

3.0 RESULTS AND DISCUSSION

3.1 Demography

Female healthcare workers reported more sharp injuries (68.7%) compared to 32.7% male healthcare workers (Table 1). Those age less than 30 years old make up 79.3% the reported group. Doctors report most injuries (80.5%)

followed by staff nurses (14.6%) and other occupations (2.44%) (Table 1). HCWs with less than a year and 1-5 years working experience have about the same percentage of reporting, 40.2% and 43.9% respectively. Despite being the busiest department in the hospital, most sharp injuries came from Medical Wards, followed by Emergency department and Orthopaedics. Interestingly, we found no report came from surgical department.

Table 1: Demographic data of respondents

Variables	Percentage (%)
Gender	
Male	31.7
Female	68.7
Age	
20-25 years old	36.6
25-30 years old	42.7
31-40 years old	15.6
41-50 years old	4.90
Occupation	
Doctor	80.5
Nurse	17.1
Others	2.40
Working Duration	
Less than 1 year	40.2
1-5 years	43.9
6-10 years	11.0
More than 10 years	4.90
Departments	
Medical	41.5

Orthopaedic	17.0
Accident & Emergency	13.4
Obstetrics & Gynaecology	8.50
Paediatric	3.70
Operation	2.40
Theatre /ICU / HDU	2.40
Anaesthesiology	11.0
Others	0.10

3.2 Level of Awareness and Compliance to Sharp Injury Reporting

There is a high level of awareness to sharp injury reporting (mean = 4.3 SD= 0.540) (Table 2) similar to previous studies [2] [15] [16]. These HCWs were aware that reporting system exist, the person to report the injury, the risk of blood borne infection and the importance of post injury prophylaxis. There is a shifting trend among healthcare workers from poor knowledge to universal precaution and blood borne infection [25] [26] [24] to fair to high knowledge and practice of universal precaution and blood borne infection [1] [27].

91.5% respondents agree to report any future sharp injury (mean 4.45, SD= 0.538), which is higher than other study, Tabak had compliance rate of 63.6%, [18], Cutter had a compliance rate of 54.9% [2]. This may be because of selection bias in the sample. Positive reporting attitude is characterized the feeling of responsibility and seeking prophylactic treatment and to contribute to improvement program. This finding is consistent with Probst and Graso, who reported that individual with positive reporting attitude despite getting injured less frequently, they are more likely to report their injury [15].

Table 2: Descriptive characteristics of variables

Variables	Mean Score	Standard Deviation	Mean Score Percentage (%)		
			Poor (1.00-2.33)	Moderate (2.34-3.66)	Good (3.67-5.00)
Awareness to Sharp Injury Reporting	4.3	0.540	0	6.1	93.6

Compliance to Sharp Injury Reporting	4.45	0.538	0	8.5	91.5
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3.3 Relationship between Awareness, Organizational Factors and Health Belief with Compliance to Sharp Injury Reporting

Referring to Table 3, level of awareness ($r = 0.278$ $p < 0.05$), perception on organization safety practice ($r = 0.265$ $p < 0.05$), staff adequacy ($r = 0.459$ $p < 0.05$), co-worker support ($r = 0.276$ $p < 0.05$), susceptibility of infection ($r = 0.224$ $p < 0.05$), severity of infection ($r = 0.391$ $p < 0.05$), benefit of reporting ($r = 0.254$ $p < 0.05$) and overall health motivation ($r = 0.377$ $p < 0.05$) have a low to moderate correlation with compliance to sharp injury reporting. Perception to barrier of reporting ($r = -0.79$ $p < 0.05$), has no correlation to compliance to report.

Table 3: Correlation between independent variables with compliance to sharp injury reporting

Independent Variables	Compliance to Sharp Injury Reporting	
	Pearson Correlation	Sig (2-tailed)
Awareness to Sharp Injury Reporting	0.278	0.012
Perception on organization safety practice	0.265	0.016
Perception on staff adequacy	0.459	0.000
Perception on co-worker support	0.276	0.012
Perception on susceptibility of infection	0.224	0.043
Perception on severity of infection	0.391	0.000
Perception on benefit of reporting	0.254	0.021
Perception on barriers of reporting	-0.79	0.479

Overall Health Motivation	0.377	0
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This study explored a model for predictor for sharp injury reporting. Using multivariable logistic regression, it was showed that this model contributes 30% to level of compliance to sharp injury reporting ($R^2 = 0.306$) (Table 4). The F-test value is 4.9777 ($p < 0.05$) signifies the model is best fit to the population sampled to predict compliance to sharp injury reporting (Table 5).

Staff adequacy ($B = 0.280$, $p < 0.05$) give the most contribution to compliance to sharp injury reporting, followed by overall motivation of health ($B = 0.239$, $p < 0.05$) and perception to severity of infection ($B = 0.231$, $p < 0.05$) (Table 5). This further clarified earlier findings from previous study and confirm that awareness or organizational factors or health belief alone does not contribute to sharp injury reporting, rather there is a complex interplay between these factors.

Table 4: Model Summary

Model Summary				
Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	0.619 ^a	0.384	0.306	84

Table 5: ANOVA

Anova					
Model	Sum of Squares	df	Mean	F	Sig.
Regression	8.984	9	0.998	4.977	0.000 ^b
Residual	14.440	72	0.201		
Total	23.425	81			

This study proved findings of previous study that awareness to reporting alone do not influence sharp injury reporting [25]. Tabak found that likelihood of contracting infectious disease, severity of infection and efficacy of reporting mostly contributed to compliance to report. Those who reported sharp injuries had higher health belief scores than those who do not, and that non-compliers tend to emphasize on negative aspect of reporting [18]. Reporting barrier mostly concerned with interference of duty [17]. Tabak also noted that perceived efficacy of reporting has the greatest contribution to compliance to report than perceive severity of injury, this population is vice versa [18]. This is particularly true in this study. Barrier to reporting had no significant relationship or contribution to compliance to

reporting sharp Injury. This means, healthcare workers with good attitude of reporting do not perceive reporting as a problem to comply.

Table 6: Multivariable logistic regression analysis of organizational factors and health beliefs as predictors of compliance with the duty to report needle stick injury

Model	Standardize Coefficients Beta	T	Sig.
Awareness to Sharp Injury Reporting	0.009	0.084	0.933
Perception on organization safety practice	0.116	1.066	0.290
Perception on staff adequacy	0.280	2.215	0.030
Perception on co-worker support	0.017	0.149	0.882
Perception on susceptibility of infection	0.084	0.809	0.421
Perception on severity of infection	0.231	2.084	0.041
Perception on benefit of reporting	0.058	0.545	0.587
Perception on barriers of reporting	-0.039	-0.395	0.694
Overall Health Motivation	0.239	2.245	0.028

In contrary to this findings, Boden reported a significant association between age and safety practice with compliance to report while diminishing effect of coworker support and staff adequacy. This may be attributed to Boden's small sample size and based on self-reported population [16].

4.0 CONCLUSION

Complete reporting of sharp injuries is a prerequisite for the identification of risky procedures and to ensure optimal treatment of the affected healthcare workers. It is a complex interplay between awareness, organizational factors and health belief. The

main purpose of this study is to determine the factors that influence sharp injury reporting among healthcare workers. The research study was focusing mainly whether level of awareness, organizational factors and health belief have direct effect on compliance to reporting. There were positive relationships between independent variables (awareness, organizational factors and health belief) and dependent variable (compliance to reporting) based on the correlation and regression analysis. Staff adequacy, perception to severity of blood borne infection and overall health motivation influence sharp injury reporting in this study. Ensuring adequate staffing, strengthening safety policy and committee and educating healthcare workers on sharp injuries as occupational hazard will help to improve rate of reporting.

REFERENCES

- [1] Bhardwaj A, Sivapathasundaram N, Yusof MF, Minghat AH, Swe KMM, Sinha NK, “The Prevalence of Accidental Needle Stick Injury and their Reporting among healthcare Workers in Orthopaedic Wards in General Hospital Melaka, Malaysia”, Malaysia Orthopaedic Journal, 2014, Vol8, No.2.
- [2] Cutter, J and S. Jordan, “The systems approach to error reduction: factors influencing inoculation injury reporting in the operating theatre”. J Nurs Manag, 2013. 21(8): p. 989-1000.
- [3] Heiko Himmelreich, Holger F.Rabenau, Matthias Rindermann, Christoph Stepahn, Markus Bickel, Ingo MARzi, Sabine Wicker, “The Management of Needlestick Injuries”, Deutsches Arzteblatt International 2013; 110 (5): 61-7.
- [4] Monica Galizzi, Petra Miesma, Laura Punnet, Craig Slatin, “Injured Workers Underreporting In Healthcare Industry: An Analysis Using Quantitative, Qualitative and Observational Data”, Industrial Relations 49, No.1, 2010.
- [5] Mohammad Tahir Yousafzai, Amna Rehana Siddiqui, Naveed Zafar Janjua, “Health Belief Model to Predict Sharps Injuries Among Health Care Workers at First Level Care Facilities in Rural Pakistan”, American Journal of Industrial Medicine, 2014.
- [6] K Vaz, D McGrowder, R Alexander-Lindo, L Gordon, P Brown, R Irving, “Knowledge, Awareness and Compliance with Universal Precautions among Health Care Workers at the University Hospital of the West Indies, Jamaica”, The International Journal of Occupation and Environmental Medicine, Vol 1 No.4 October (2010).
- [7] Elisabetta Rapiti, Annette Priuss-Ustun, Yvan Hutin,, “Sharp Injuries; Assessing the Burden of Disease From Sharp Injuries To Healthcare Workers at National and Local Levels”, World Health Organization Protection of Human Environment Geneva 2005.

- [8] Tahira M. Probst, Claudio Barbaranelli and Laura Petitta, "The Relationship between Job Insecurity and Accident Underreporting: A test in Two Countries", *Work & Stress* 2013, Vol.27, No. 4, 383-402. <http://dx.doi.org/10.1080/-2678373.2013.850756>.
- [9] Y Pfeiffer, T Manser, T Wehner, "Conceptualising barriers to incident reporting: a psychological framework", *Qual Saf Health Care* doi:10.1136/qshc.2008.030445
- [10] Tahira M. Probst, "Organizational Safety Climate and Supervisor Safety Enforcement: Multilevel Explorations of the Causes of Accident Underreporting", *Journal of Applied Psychology* 2015, Vol 100, No. 6, 1899-1907.
- [11] Derek R. Smith, Mutsuko Mihashi, Yukimi Shouyama, Fusayo Mouri, Nuriko Ishibashi, Tatsuya Ishitake, "Organizational Safety Climate and Its Relationship with needlestick and Sharp Injuries among Japanese Nurses", *American Journal of Infection Control*, September 2009, doi: 10.1016/j.ajic.2008.11.004
- [12] Glenn Pransky, Terry Snyder, Allard Dembe, Jay Himmelstein, 1999,"Under- reporting of Work Related Disorders in The Workplace: A Case Study and Review of the Literature", *Ergonomics*, 1999, Vol 42, no. 1, 171- 182
- [13] Lenore S. Azaroff, Charles Levenstein, David H. Wegman, "Occupational Injury and Illness Surveillance: Conceptual Filters Explain Underreporting", *American Journal of Public Health*, September 2002, Vol 92, No 9.
- [14] Sean Tucker, Dayla Diekrager, Nuck Tuner, E. Kevin Kellaway, "Work Related Injury Reporting Among Young Workers: Prevalence, Gender Differences and Explanation For Underreporting", *Journal of Safety Research* 50 (2014): 67-73.
- [15] Tahira M. Probst, Maja Graso, "Pressure to Produce = Pressure to Reduce Accident Reporting", *Accident Analysis & Prevention*, Volume 59, October 2013, Pages 580-587.
- [16] Boden LI, Petrofsky YV, Karen Hopcia, Gregory R. Wagner, Dean Hashimoto, "Understanding the Hospital Sharps Injury Reporting Pathway", *American Journal of Industrial Medicine* 58:282-289 (2015)
- [17] Sharon Osborne, "Perceptions that Influence Occupational Exposure Reporting", *AORN Journal*, 2003. 78(2): p. 262-272.
- [18] Tabak, N., A.M. Shiaabana, and S. Shasha, "The health beliefs of hospital staff and the reporting of needlestick injury". *J Clin Nurs*, 2006. 15(10): p. 1228-39
- [19] Abdullah Aliff AW, Azhar MS, Zulraini J, Farhana Adila S, "Occupational Sharp Injury among Healthcare Workers in Hospital Melaka 2013 - 2015:A Descriptive Study", *Malaysian Journal of Public Health Medicine*, Vol. 16 (Suppl 4) 2016, 8th National Public Health Conference 2016, Managing Society in Combating Public Health Challenges, 2-4 August 2016, pg43.

- [20] Aiken LH1, Patrician PA, “Measuring organizational traits of hospitals: the Revised Nursing Work Index”, *Nurs Res.* 2000 May-Jun;49(3):146-53.
- [21] Kah Lee and Noor Hassim, 2005, “Implication of the Prevalence of needlestick Injuries in a General Hospital in Malaysia and Its Risk in Clinical Practice”, *Environmental Health and Preventive Medicine* 10, 33-41, January 2005.
- [22] Ng and Noor Hassim, “Needlestick Injury among Medical Personnel in Accident and Emergency Department of Two Teaching Hospitals”, *Medical Journal Malaysia*, Vol 62 No 1, March 2007.
- [23] Hassan Kasim Haridi, Abdalmohsen Saud Al-Ammar, Moazzy Ibraheim Al-Mansour, 2016, “Compliance with infection control standard precautions guidelines: a survey among dental healthcare workers in Hail Region, Saudi Arabia”, *Journal of Infection Prevention* April 27, 2016 1757177416645344, doi: 10.1177/1757177416645344.
- [24] Santhna L.P, and Samsiah M, and Raja Lexshimi RG, and Ho S.E, and Roshdinom R, and Hamidah H, “Sharps injury in Hospital Universiti Kebangsaan Malaysia (HUKM): Experiences of health care workers and students”. *Medicine & Health*, 2 (1). pp. 86-92. ISSN1823-2140
- [25] Hui-Ling Kerr, Nicola Stewart, Alistair Pace, Sherief Elsayed, “Sharps injury reporting amongst surgeons”, *Ann R Coll Surg Engl* 2009; 91: 430–432 doi 10.1308/003588409X432194
- [26] Muhammad Hanafiah Juni, Amir Aiman, Asma Nabilah, Ng J.H., Wong S.J, Faisal Ibrahim, “Perception Regarding Needle Stick and Sharp Injuries among Clinical Year Medical Students”, *International Journal of Public Health and Clinical Sciences* e-ISSN: 2289-7577. Vol. 2: No.1 January/February 2015
- [27] Kavitha Nagandla, Krishna Kumar, Amit Bhardwaj, Devalagan a/l Muthalagan, Chan Yhmin, Lee Wei Lun, Weng Wei Shi, Nurul Izzati B. Abd Razak, “Prevalence Of Needle Stick Injuries And Their Underreporting Among Healthcare Workers In The Department Of Obstetrics And Gynecology”. *International Archives of Medicine*, 2015, Vol.8 No.181, doi: 10.3823/1780.

Work-Related Low Back Pain among Maintenance Technician of Fighter Jet

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Abstract - In Malaysia, the Royal Malaysia Air Force (RMAF) is responsible for operating all jet fighters. It is maintained by the RMAF itself with the collaboration from a company called MRO such as Aerospace Technology System Corporation Sdn Bhd (ATSC). The safety of a fighter jet is under the care of aircraft maintenance technicians, where they need to handle different kind of components. The aim of this study was to identify the frequency of WRLBP and analyze the risk factors that contribute to WRLBP as well as develop a control measures towards reducing the risk factor among maintenance technicians. Eighty technicians were evaluated using modified Nordic Musculoskeletal Questionnaires (NMQ), modified Dutch Musculoskeletal Questionnaire (DMQ) and Social Demographic Questionnaire (SDQ) and control measures questionnaire. Results of NMQ indicate the lower back as the most affected body region during 12 month with 58.8%. The most aggravating related factors: awkward posture, lifting and forceful movement, heavy physical work and years of working. Getting someone to help when handle a heavy task/ component, system of work rotation and modify procedure of work task were the top three control measures and should be considered for implementation.

Keywords: Work-related low back pain, Maintenance technician, Control measure, Physical risk factor, Personal risk factor, Ergonomic.

1.0 INTRODUCTION

A fighter aircraft is a military aircraft designed primarily for air-to-air combat against other aircraft, [1] which the main mission is to attack ground target, as opposed to bombers and attack aircraft. The speed, manoeuvrability, and its small size relative to other combat aircraft are the hallmark of a fighter. The main job of these personnel is to ensure the pilots are flying safely. Thousands of planes, jets and helicopters are flown all over the world every day, and the aircraft maintenance personnel are responsible of the aircrafts' safety and performance. Their demanding job, which involved heavy physical work; lifting and forceful movement; awkward posture; repetition and static work posture; and many more in a long run can affect their health and exposed them to WRLBP.

The considerable impact of WRLBP on the working force is it can interfere with productivity and lead to absenteeism which can lead to chronic occupational disabilities and significantly cause a financial burden to employers, decreased productivity and social disadvantages for both workers and society [2]. MSDs are the most common problem among aircraft maintenance. According to the Ethiopian Airlines annual reports on ill-health morbidity statistics from 2009 to 2011, after upper respiratory tract infections, MSDs were the second most frequent reason for clinic visits by workers, [3]. The reports further highlight that, in 2011, the number of workers from the Ethiopian Airlines diagnosed with MSDs increased to 3879 from 3254 in 2010 and 2954 in 2009 respectively [3].

Kemp P.A found that handling aircraft components, boxes, and furniture were the activities that most frequently caused injury to workers (33%) in the civilian and military U.S Air Force (USAF) [4]. It resulted in a high number of absences and in addition, the back injuries are most frequently reported. Sukhoi Technical Centre (STC) is a part of ATSC Sdn Bhd, and the company provided 2nd line technical servicing for the Royal Malaysian Airforce's fighter aircraft Sukhoi Su-30MKM for every 200 flying hours. On a normal basis, it has about 100 employees with the majority of male workers who work from Monday to Friday, with a working hour from 8.00 a.m to 5 p.m. There have been some complaints from the maintenance's personnel to the top management regarding lower back pain at workplace in STC. At the same time, the admin department also reported a number of absenteeism among ATSC's maintenance personnel.

1.1 Conceptual Framework

This research project will focus on identifying the WRLBP issues among maintenance technicians of jet fighter Su-30MKM and analysing the risk factors that contribute to WRLBP. The main concern of WRLBP to the maintenance technicians are occupational injuries, absenteeism and lose of work time. In addition, WRLBP will affect the maintenance activity at workplace and add on additional workload to their colleagues who are performing the similar maintenance activity. The conceptual framework is shown in Figure 1.

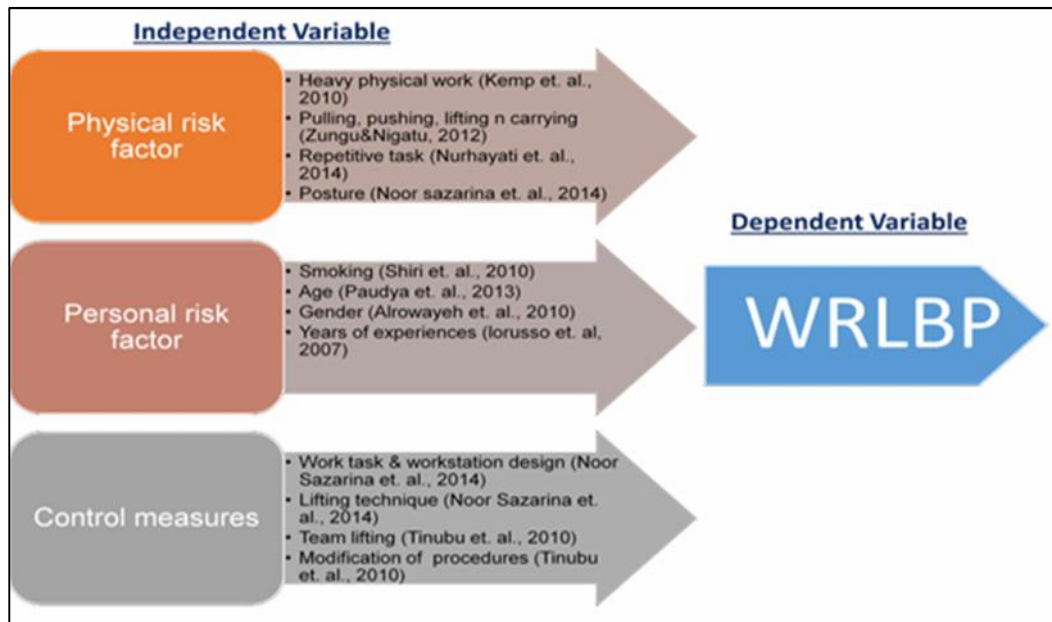


Figure 1 : Conceptual Framework

2.0 METHODOLOGY

2.1 Subjects

A questionnaire based was carried out among ATSC maintenance personnel in Gong Kedak Airbase. Subjects eligibility criteria were as follows: worked no less than 12 months, still actively performing maintenance activity and never had an accident involving low back region. All subjects who met the eligibility criteria were selected.

2.2 Questionnaire

In this study, the data were obtained with questionnaire based on modified Nordic Musculoskeletal Questionnaires (NMQ), modified Dutch Musculoskeletal Questionnaire (DMQ), Social Demographic Questionnaire (SDQ) and control measure towards reducing WRLBP and the actual situation of aircraft maintenance technician task.

A five section questionnaire was employed as a survey instrument. Section A are Demographics Questionnaire (SDQ), which covered question of age, gender, level of education, numbers of working experience as maintenance personnel , numbers of hours worked per day and how many days a week they worked. This section is designed to give information on the background of the respondent and their job. This information is important in order to know the respondent better.

Section B was a modified version of the Nordic Musculoskeletal Questionnaires (NMQ) was used to assess the prevalence in WRLBP in the past 12 month, which was validated by Barros and Alexandre, 2003 and consisted of questions referring to nine body areas. These are 3 upper limb segments (Shoulders, elbows, wrists/ hands), 3 lower limb segments (Hips/thighs, knees, ankles/feet), and 3 trunk segments (Neck, upper back and lower back) The NMQ recorded whether operators had experienced ache, pain or discomfort in their low back in the past 12 months .

Section C was on physical risk factor, which evaluated through questionnaire that being divided to six sub-sections according to the WRLBP physical risk factors as heavy physical work, lifting and forceful movement, awkward postures, repetitions and static work postures. Question is scale in was characterized with a 'No' or 'Yes', in order to make the aircraft maintenance technicians to easily make a stand or decision regarding the questions asked. While section D was on personal risk factors. Respectively it based on Modified standardized Dutch Musculoskeletal Questionnaire (DMQ) which has been used in ergonomic analysis by Occupational Health service [5]. Section E gleaned data on control measure toward reducing the risk factor of WRLBP among maintenance technicians. The questionnaire was adapted from previously validated questionnaire on WMSDs among nurses in Nigeria [6].

2.3 Data Analysis

Analysis of the data was performed with IBM SPSS software version 17. Descriptive analyses were conducted for demographic characteristics, LBP prevalence rates, physical risk factor, and personal risk factor and control measures. Association between risk factors and WRLBP was conducted by using the Chi-square test with the $p < 0.05$ was significant risk factor. Using 2×2 contingency tables, odds ratios (OR) and upper and lower 95% confidence intervals (CI) were calculated to estimate the relative risk of WRLBP.

3.0 RESULTS

3.1 Demographic characteristic

The questionnaires were completed by 80 aircraft maintenance technician with total response rate was 100%. . From the data collection, all of the respondent were male (100%), majority of them age group between 20 -29 years old (41.3%) education level at least certificate (87.5%), had length of experience within 11 – 15 years (32.5%) and work between 8 – 10 hours per day (52.5%).

Table 1: Descriptive information of respondents

Information	Variables	Percentage (%)
Gender	Male	100.0
Age	20-29 years old	41.3
	30-39 years old	30.0
	40-49 years old	21.3
	50-59 years old	7.5
Level of education	Certificate	87.5
	Diploma	11.3
	Degree	1.3
Years of working	1-5 years	21.3
	6-10 years	28.8
	11-15 years	32.5
	Over 15 years	17.5
Hours of working	5-8 hours	42.5
	8-10 hours	52.5
	10 hours and above	5.0

Table 2: Body part survey symptom

Body Region	Frequency	Percentage (%)
Low back	47	58.8
Shoulder	34	42.5
Neck	30	37.5
Upper back	30	37.5
Knees	24	30.0
Feet	21	26.3
Hips/Tights	20	25.0
Elbow	19	23.8
Wrists/hands	17	21.3

3.2 Prevalence of WRLBP

According to questionnaire that being distribute to 80 aircraft maintenance personnel, the prevalence of Work-Related LBP during last 12 month was 59% (47/80) as shown in table 2.

3.3 Physical risk factor

Table 3 showed the association of physical risk factor with WRLBP problem. . For physical

risk factor there is evidence to awkward posture (daily work required you to mild forward bending ($>20^\circ$) (OR = 3.17, 95% CI 1.13-8.90, $P < 0.05$) and kneeling while performing task (OR = 3.17, 95% CI 1.13-8.90, $P < 0.05$); lifting and forceful movement (heavy components lifted without the assistance of a mechanical device (OR = 0.32, 95% CI 0.12-0.88, $P < 0.05$) and pulling rather than pushing routinely used to move an object (OR = 0.23, 95% CI 0.09-0.59, $P < 0.05$) and heavy physical work (the tools size is not comfortable to hold/use (OR = 0.28, 95% CI 0.11-0.75, $P < 0.05$) towards WRLBP problem.

Table 3: Physical risk factor or WRLBP among maintenance technicians

No	Risk Factor	No of personnel	OR	(95% CI)	p-value
HEAVY PHYSICAL WORK					
1	Does the tools weight is too heavy?				0.698
	No	22	1		
	Yes	25	0.84	0.34-2.05	
2	Does the tools size is not comfortable to hold/use?				0.010
	No	25	1		
	Yes	22	0.28	0.11-0.75	
3	Are heavy components carried manually for a long distance?				0.638
	No	26	1		
	Yes	21	1.24	0.50-3.07	
4	Does the weight of power tools create additional force?				0.075
	No	28	1		
	Yes	19	0.44	0.18-1.10	
5	Does extra usages of force are required in completing the task/work?				0.584
	No	9	1		
	Yes	38	1.35	0.46-3.97	
LIFTING AND FORCEFUL MOVEMENT					
6	Are very heavy components lifted without the assistance of a mechanical device?				0.024
	No	38	1		
	Yes	9	0.32	0.12-0.88	
7	Is pulling rather than pushing routinely used to move an object?				0.020
	No	36	1		
	Yes	11	0.23	0.09-0.59	
8	Does the working condition involve lifting/lowering activities?				0.161
	No	8	1		
	Yes	39	2.12	0.73-6.14	
9	Does the working condition involve pushing/pulling activities?				0.292
	No	7	1		
	Yes	40	1.83	0.59-5.67	
AWKWARD POSTURES					
10	Does your daily work required you to mild forward bending (>20°)?				
	No	8	1		

No	Risk Factor	No of personnel	OR	(95% CI)	p-value
	Yes	39	3.17	(1.13-8.90)	0.025
11	Does your daily work required you to severe forward bending (>45°)?				
	No	16	1		0.463
	Yes	31	0.83	(0.44-2.81)	
12	Does your daily work required you to backward bending (>20°)?				
	No	28	1		0.858
	Yes	19	0.92	(0.37-2.27)	
AWKWARD POSTURES					
13	Does your daily work required you to twisting or lateral bending (>20°)?				
	No	14	1		0.151
	Yes	33	1.96	(0.78-4.97)	
14	Does the job required perform task that involves long reaches with arms above shoulder height?				
	No	10	1		0.359
	Yes	37	1.61	(0.58-4.46)	
15	Working surfaces is too high/ low				
	No	12	1		0.862
	Yes	35	1.09	(0.40-3.00)	
16	Does the task require kneeling while performing it?				
	No	8	1		0.025
	Yes	39	3.17	(1.13-8.90)	
17	Does the task require squatting while performing it?				
	No	11	1		0.071
	Yes	36	2.41	(0.92-6.33)	
R					
18	Does the job require doing the same motion over and over again?				
	No	8	1		0.091
	Yes	39	2.44	(0.85-6.97)	
19	Do aircraft personnel perform motions constantly without short pause or break in between task?				
	No	34	1		0.586
	Yes	13	0.77	(0.29-2.01)	
STATIC WORK POSTURES					
20	Do routine task involve sitting for a long time?				
	No	25	1		0.510
	Yes	22	1.35	(0.55-3.34)	
21	Do routine task involve standing for a long time?				
	No	17	1		
	Yes	30	1.47	(0.59-3.64)	
22	Are routine task done without change the position of the work style?				
	No	27	1		0.405
	Yes	20	1.48	(0.59-3.74)	

3.4 Personal risk factor

Personal risk factors are presented in Table 4. There is evidence to conclude that there are significant influences of years of working as aircraft maintenance personnel towards WRLBP problem.

Table 4: Personal risk factor or WRLBP among maintenance technicians

No	Risk Factor		No of personnel	OR	(95% CI)	P-value
1	Age group	20 – 29 years old	2	-	-	0.671
		30 – 39 years old	17			
		40 – 49 years old	1			
		50 – 59 years old	1			
2	BMI	< 24.3	3	-	-	0.684
		24.4 – 27.3	1			
		> 27.3	1			
3	Smoking habit	No	1	1	(0.44-2.81)	0.830
		Yes	3	1.11		
4	Exercise	No	2	1	(0.52-3.24)	0.578
		Yes	2	1.30		
5	Years of working	< 1 years	0			0.019
		1 – 5 years	9			
		6 – 10 years	2			
		11 – 15 years	1			
		Over 15 years	1			
6	Hours of working in a day	5 – 8 hours	1	-	-	0.319
		8 – 12 hours	2			
		12 hours and above	2			
7	History of LBP	No	4	1	(0.12-16.36)	0.776
		Yes	2	1.42		

3.5 Control measure towards reducing WRLBP

Table 5 showed the percentage indicating the coping strategies of the respondents toward reducing the risk factor for development of WRLBP. For each item of the coping control measures of the questionnaire section, the percentages that indicate the most appropriate response were summarized. Getting someone to help when handle a heavy task/ component, system of work rotation and modify procedure of work task were the top three control measures and should be considered for implementation.

Table 5: The coping strategies of the respondents towards reducing WRLBP

No	Strategies	Percentage
1	I get someone to help me handle a heavy task/component	5
2	There are the systems of work rotation	4
3	I modify my procedure of work task in order to avoid injury	4
4	I stop my task if it cause or aggravate my discomfort	4
5	I warm up and do some stretching before performing my task	3
6	I select techniques that will not aggravate or provoke my discomfort	3
7	I adjust the chair/table so I can stretch	3
8	I use different part of my body to ease in administering my task procedure	2
9	I take a break regularly so I can stretch and change posture	2
10	I use a back brace while performing the task	2

4.0 DISCUSSION

In this study among the maintenance technicians has revealed the prevalence of WRLBP was 58.8% in the past 12 months. Similar findings (a prevalence of 59%) were also reported in a Nigerian study which has been conducted on the industrial workers in the private sector [7]. The prevalence is higher compared to study conducted on the aircraft technicians in Ethiopian Airlines which was 47.1% in the past 12 months [8] while the percentage is 45.2% in the study on the employees of the aircraft maintenance during last 12 months [9]. Higher prevalence of 65% LBP has been reported among maintenance technicians in Colombian commercial airlines [10] and the study on the railway workers by [11] has showed that the prevalence of LBP among Malaysian railway workers was 69%. These findings showed that maintenance technicians of the fighter jet Sukhoi 30MKM were at the high-risk of suffering from WRLBP.

There have been several studies from around the world that found significant association between the physical risk factors (heavy physical work, lifting and forceful movement, awkward postures, repetition, and static work) and WRLBP. Based on this study, the result showed that the maintenance technicians of the fighter jet Sukhoi 30MKM working in the awkward postures (daily work required technicians to mild forward bending ($>20^\circ$) (OR = 3.17, 95% CI1.13-8.90, $P < 0.05$) and kneeling while performing task (OR = 3.17, 95% CI1.13-8.90, $P < 0.05$) were suffering from WRLBP than those who did not. This study also supported the previous findings which highlighted that the awkward postures were associated with LBP [12]. Similarly, Vandergrift et al., [13] has found that awkward back postures (prevalence ratio (PR) 1.12, 95% CI1.07-1.17) is the risk factor associated with LBP in the automobile manufacturing workers. All the finding are consistent with this study.

In addition, the lifting and forceful movement (heavy components lifted without the assistance of a mechanical device (OR = 0.32, 95% CI0.12-0.88, $P < 0.05$) and

pulling rather than pushing routinely used to move an object (OR = 0.23, 95% CI 0.09-0.59, $P < 0.05$) are often associated with LBP. As reported in previous study by (Kemp P.A, 2010), the most common sources of injury among the civilian and military U.S. Air Force (USAF) were lifting the aircraft components, boxes and furniture. In similar cases, the study on the railway workers by [11] showed that lifting and lowering heavy loads was the most important workplace risk factor to caused LBP in Malaysian railway workers, while [8] in their study on the aircraft technicians in Ethiopian airlines also reported that there were statistically significant associations between LBP and job activities that involved lifting a heavy object (OR=1.90; 95% CI 1.01-3.60), pulling and pushing heavy loads (OR=3.17; 95% CI 1.49-6.74) and carrying heavy loads (OR=2.02; 95% CI 1.15-3.57). Furthermore, the forced movements that include lifting and pushing can also lead to WRLBP among aircraft technicians in the aviation industry according to this study.

This study has also found an association between the heavy physical work (the tools size is not comfortable to hold/use (OR = 0.28, 95% CI 0.11-0.75, $P < 0.05$) and WRLBP problem. While in similar case, Baiduri Widanarko et al., [14] from the New Zealand Electoral Roll has also concluded that respondent with heavy physical workloads are at higher prevalence of the body regions pain compare than those with light physical workloads. This shown that the heavy physical works can be associated with WRLBP. In addition, there were also significant influences of years of working as the aircraft maintenance personnel towards WRLBP problem in this study.

The study has listed the suggestions on how to reduce the risk factors of the awkward postures, lifting and forceful movements and heavy physical works using the hierarchy of control. Based on the questionnaires that have been distributed to the respondents, the top three most acceptable coping strategies towards reducing the risk factor of WRLBP are by getting the assistance or support from other technicians to handle a heavy task or component, using the systems of work rotations, and the modification of work task procedures as these factors are known to avoid stressing any injuries. However, the most important thing in order to reduce the risk factors is the understanding of the ergonomics aspects of the work. By understanding this aspect, the maintenance technicians can perform the task with minimum injury [15]

In future studies, it is recommended a large sample size of maintenance technician being study for ensuring the generalization of the study. Secondly, this study only investigate man sample, which may not represent the association of gander with WRLBP. In addition, it is recommended to study the psychosocial and environmental risk factor that will establish the combination of casual association of WRLBP problem.

5.0 CONCLUSION

It can be concluded that WRLBP appears to be a serious problem among maintenance technicians and become a major health concern for them. Furthermore, the study has shown that there were associations of physical risk factors for heavy physical work, lifting and forceful movements and awkward postures with WRLBP problem. However there were no correlations of physical risk factors for repetition and static postures with WRLBP problem. In addition, the study has shown that there was an association of personal risk factor for the years of working with WRLBP prevalence while there are no correlation of personal risk factors for age, BMI, smoking habits, exercise routine, and working hours in a day with WRLBP problem. Lastly, this study has showed the coping control measures based on the questionnaire answered by the respondents. Getting someone to help when handle a heavy task/ component, system of works rotation and modify procedure of work tasks were the top three control measures suggested by them. In addition, the important thing in order to reduce the risk factor is the understanding on the ergonomics. By understanding it, maintenance technicians can perform the task with minimum injury.

REFERENCES

- [1] Dictionary, M.W., *Fighter —Definition and More from the Free Merriam Webster Dictionary*, in *Merriam Webster Dictionary*. 2011: Encyclopædia Britannica.
- [2] Pinder, A., et al., *Work related musculoskeletal disorder: back to work report*. European agency for safety and health at work. Belgium, 2012.
- [3] Profile, E.A., *Ethiopian Airlines Profile*. 2012: <http://www.ethiopianairlines.com/en/profile>.
- [4] Kemp, P.A., et al., *Injuries to air force personnel associated with lifting, handling and carrying object*. American journal of preventive medicine, 2010. **38**(1): p. 148-155.
- [5] Alrowayeh, H.N., T.A. Alshatti, and S.H. Aljadi, *Prevalence, characteristics, and impacts of work- related musculoskeletal disorders: a survey among physical therapists in the State of Kuwait*. BMC Musculoskeletal Disorders, 2010. **11**(116).
- [6] Tinubu, B.M., et al., *Work-related musculoskeletal disorders among nurses in Ibadan, South-west Nigeria: a cross-sectional survey*. BMC Musculoskeletal Disorders, 2010. **11**: p. 12-20.
- [7] Sanya, A. and O. Ogwumike, *Low back pain prevalence amongst industrial workers in the private sector in Oyo State, Nigeria*. Afr J Med Med Sci., 2005. **3**: p. 245-249.
- [8] Zungu, L.I.a.N., E.S, *A comparative study of the prevalence and risk factors of lower back pain among aircraft technicians in Ethiopian Airlines*. Occupational Health Southern Africa, 2015. **21**(2).
- [9] Nogueira, H.C., et al., *Musculoskeletal disorder and psychosocial risk factor among workers of aircrraft maintenance industry*. Research gate, 2013. Work 41: p. 4801-4807.

- [10] Fajardo, R., et al., *Characterization of Low Back Pain in Pilots and Maintenance Technicians on a Commercial Airline*. Aerospace Medicine and Human Performance, 2016. **87**(9): p. 795-799(5).
- [11] Ganasegeran, K., et al., *Psycho-behavioural risks of low back pain in railway workers*. Occupational Medicine, 2014. **64**: p. 372-375.
- [12] McGaha, J., et al., *Exploring physical exposures and identifying high-risk work tasks within the floor layer trade*. Appl Ergon. 2014 Jul, 2014. **45**(4): p. 857-864.
- [13] Vandergrift, J., et al., *Physical and psychosocial ergonomic risk factors for low back pain in automobile manufacturing workers*. Occup Environ Med, 2011. **68**: p. 45-52.
- [14] Baiduri Widanarko, et al., *Prevalence of musculoskeletal symptoms in relation to gender, age, and occupational/industrial group*. International Journal of Industrial Ergonomics, 2011. **41**(5): p.561-572.
- [15] Baird, M.Z., *MANAGING ERGONOMICS RISK FACTORS ON CONSTRUCTION SITES* in Faculty of Civil Engineering. 2007, Universiti Teknologi Malaysia.

The Influences of Safety Behaviour and Safety Practice at Klang Valley Construction Site

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Abstract - Construction industry is known as one of the most hazardous activities. The accident rate is very high when compared to other industries. The accidents occur are due to management and workers who lack safety awareness, cut corners to work and perform unsafe behaviour at work. In addition, most of construction workers are lack on a proper or formal education thus, they have not received proper safety training and trade skill training in the construction field. This study is conducted to investigate the influence of safety behaviour and safety practice at construction site. The data collection is gain from questionnaires which is was distributed to construction site workers. The above study was carried out by choosing randomly workers in construction site around Klang Valley area. In the present study, questionnaire survey was carried out in these any project site areas using a standard checklist and a detailed developed questionnaire. The questionnaire comprised the general information with 31 safety behaviour statements on a 1-4 Likert scale which was distributed to 100 construction workers. The findings of the present study revealed invaluable indications to the construction workers especially in improving the attitude towards safety, health and environment and hence good safety behaviour in the construction site.

Keywords: Construction, Safety, Site, Behaviour, Attitude

1.0 INTRODUCTION

Malaysian construction industry recorded a GDP growth of 1.6% in the fourth quarter of 2008 and continued to improve as it achieved a positive growth of 0.6% in the first quarter of 2009 (CIDB, 2010). Although this industry has contributed significantly to Malaysian's economy, this does not mean Malaysia can settle down comfortably. Often known as "dirty", "dangerous" and "difficult", this industry has been plagued by a high number of fatality rates on construction sites. Construction

sites itself is commonly known as the most hazardous workplace. Figure 1 shows that the construction sector have been sustained at the top five highest for the period of four years (2012-2015) which causes to the occupational accidents of death.

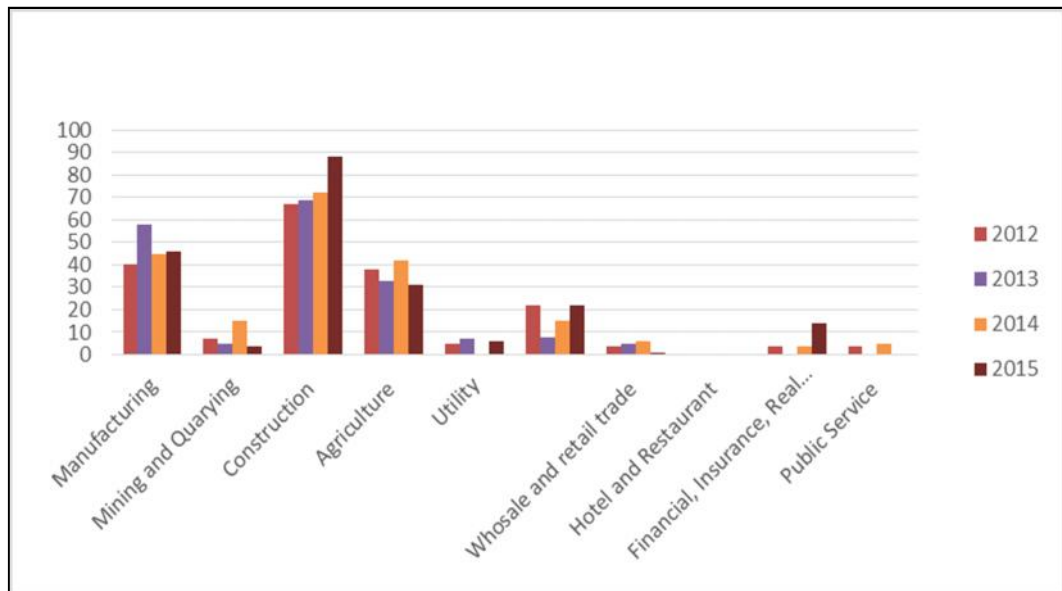


Figure 1: Statistic of Occupational Accident by Sector 2012-2015[1]

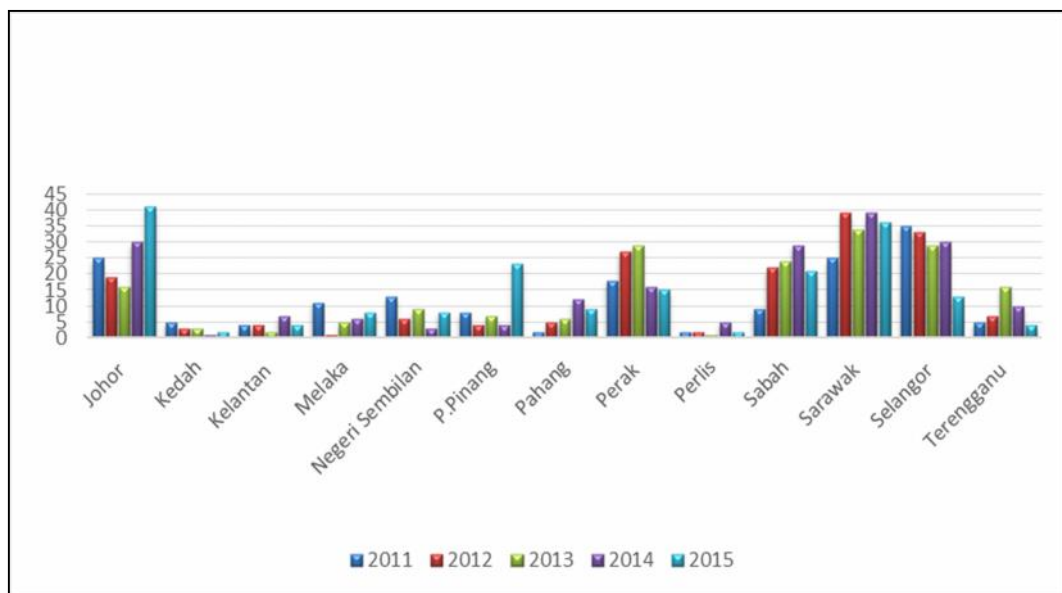


Figure 2: Statistic of Occupational Accident by State 2011-2015 [1]

Statistic taken from the Department of Occupational Safety and Health (DOSH) Malaysia in the year ranging from year 2011 until year 2015, is shown in Figure 2. Selangor have been sustained at the top five highest for the period of four years (2011-2015) which causes to the occupational accidents of death.

2.0 LITERATURE REVIEW

Many researchers have studied the critical factors that influence safety performance in construction projects. From the literatures, 4 major factors in safety behaviour which is leadership, management commitment, resources allocation and training are relevant to the workers performance. Safety behavior refers to any behavior mode that mitigates the probability of human error [2] (Glendon & Litherland, 2001). Safety behavior, as a dependent variable, is supposed to consists of actual behaviors performed by individuals at the workplace to the extent to which their actions comply with safety procedures [3]. Seungjun Ann (2014) in [4] also stated that safety behavior and engagement has a great impact on construction project. Chritian, Bradley Wallace and Burke (2009) in [5] note that safety performance is often considered in one of two way first as an organizational metric of safety outcomes such as incidents, injuries and near misses and second as an individual metric related to safety behaviors of employees. Measuring performance has been identified as being important in maintaining and improving the health and safety operation of a company (HSE, 2000).

Performance can be measured in a number of ways. First, measuring near miss occurrences with investigation of accidents or near miss occurrences provide useful lessons for organizations. However if, they are conducted with the intention of apportioning blame this may lead to a worker failing to report accidents or near misses. Secondly, accident data collection it shows that many safety climate dimensions are measured against the accident injury data of a company [2] (Glendon and Litherland, 2001) then, measuring behavior it can be measured using behavioral sampling which involves randomly sampling worker behavior such as manual handling and personal protective equipment practices. After that, safety performance is often measured using worker self- reported methods. However, major drawbacks of this method are that they are subject to social desirability biases [6].

3.0 METHODOLOGY

The questionnaire was examined with samples of engineers, managers, workers and supervisor. The population of respondent for each site consists of 80% workers in construction site. Data collected from the different sites were analysed by using the Statistical Package for Social Science (SPSS) software. This study were conducted

quantitatively where data will be collected through questionnaires that will be distributed directly to the workers at construction site.

In this research, safety behavior was reflected on four factors: Management Commitment, Leadership, Resources Allocation and Training and performance on worker measured in the aspects of Productivity, Safety and Quality. As some of the instrument is self-developed, it would first be pilot test.

This research study were using descriptive and inferential statistic to analyze the data. Descriptive statistic will be using to analyze the demographic data and all independent and dependent variables. Frequency measures such as percentage, mean and standard deviation will be used at this point. The mean is a measure of central tendency that gives a general description in a data set. Hence, for this research study, the mean score that is acceptable will be between 3.00 (Moderately Agree) to 4.00 (Strongly Agree) Descriptive analysis on the range (minimum and maximum score) is also being used in the analysis

4.0 RESULTS AND DISCUSSION

Hundred questionnaires were sent out by hand, but only 80 questionnaires were accepted. All of the questions were answered by the workers in construction site. Table 1 presents the demographic characteristic of the respondent.

Perception level of the respondents were divide into two groups only, high and low level. The majority of respondents in this study were in the age range of 26-30 years. As for the gender, majority respondents in this study were male (83.8%) compared to female (16.3%). In the table also show majority respondents were married (57.5%) then single (41.3%). Since most of the respondents were taken from the construction site, (31.3%) of respondents get Diploma certificate and the remaining of the respondent possess a Master (15.0%), Degree (30.0%) and SPM (23.8%). As for position held, majority of respondents were from Supervisor (43.8%) followed by Engineer (21.3%), Manager (16.3%) and Workers (18.8%). As for work experience, majority of the respondents has been working at construction site for range five years (51.2%)

Table 11: Demographic characteristic on questionnaire respondents

Demographic Variables	Frequency	Percentage (%)
Age		
20-25	23	28.7%
26-30	24	30.0%
31-35	14	17.5%
36 and above	19	23.8%
Gender		
Male	67	83.8%
Female	13	16.2%
Marital Status		
Married	46	57.5%
Single	34	42.5%
Education Background		
Master	12	15.0%
Degree	24	30.0%
Diploma	25	31.2%
SPM	19	23.8%
Job Position		
Manager	13	16.3%
Engineer	17	21.3%
Supervisor	35	43.8%
Worker	15	18.8%
Working Experienced		
0-5 years	41	51.2%
6-10 years	19	23.8%
11-15 years	9	11.3%
More than 15 years	11	13.8%

4.1 Finding Analysis

The finding shows that there are significant relationships between safety behavior characteristic and safety practices. Based from the data analysis, it was observed that all the safety behavior factors, leadership, management commitment, resource allocation and training have significant relationship with safety practices.

From Pearson Correlation Analysis as shown in Table 2, the result perceived shows that there were significant relationship between leadership ($r= 0.667$), management commitment ($r=0.321$), resources allocation ($r= 0.472$) and training ($r=0.701$). Since the value of Pearson Correlation Co-efficient (r) for training is the top of highest, this item have high correlation with safety practices. Leadership also are found range about 0.6 therefore these item have high correlation with safety practices. Whilst, the management commitment and resources allocation only have low correlation with safety practices.

Table 2: Safety behavior factors on safety practices using Pearson Correlation

Factors	Pearson Correlation
Leadership	0.667
Management Commitment	0.321
Resource Allocation	0.472
Training	0.701

5.0 CONCLUSION

The study has showed that the safety practices have positive moderate level of safety behavior characteristic in their workplace. Findings have shown that the company has clearly stated that behavior also important in the daily operation of the company and all their workers have been given clear information on the safety matters or issues. Furthermore, training is provide for workers are also practical. Thus, employees are keen and willing to follow the safety procedures smoothly. Other findings indicated that there are significant relationships between safety behavior characteristic and safety practices on construction site. The dependent variable (safety behavior characteristic) was influence positively by independent variable (safety practices). Finally, the findings showed that training have the highest and important impact on safety practices followed by leadership and resource allocation. Whilst the management commitment have found medium significant influenced on workers performance in the construction site.

REFERENCES

- [1] <http://www.dosh.gov.my/index.php/en/archive-statistics/2015/1713-occupational-accidents-statistics-by-sector-until-december-2015>
- [2] (Glendon & Litherland, 2001)
- [3] Griffin, MA & Neal, A. (2000). Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge and motivation, Journal of Occupational Health Psychology, Vol.5, No.3, 347-358 Company.
- [4] Seungjun Ann (2014)
- [5] Chritian, Bradley Wallace and Burke (2009)
- [6] Cooper, M. D. (2000). Towards a model of safety culture. Safety Science, 36(2),

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