Awareness of Personal Protective Equipment Compliance in Shipyard Industry

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Abstract

This research is conducted to assist management to improve of Personal Protective Equipment (PPE) compliance among shipyard workers by emphasizing on contributing factors that influence PPE compliance among shipyard workers. The purpose of this research is to investigate the factors on awareness of PPE compliance among workers in shipyard industry in order to suggest the improvements on shipyard workers' PPE compliance to prevent future occupational accidents. Quantitative online survey questionnaire was conducted among 61 workers in Pasir Gudang shipyard by simple random sampling. The instruments of questionnaire were adapted and adopted from existing questionnaire from previous literatures. A pilot test was conducted to measure the reliability of the questionnaire for all contributing factors by assessing Cronbach's Alpha acceptable value and questionnaire's validity is assessed by experts. Then, the questionnaire was disseminated via online survey to all respondents to assess their awareness on the PPE compliance in shipyard. The data collection from the respondents was collected and analyzed using IBM Statistical Package for Social Science (SPSS) version 26 and Microsoft Excel version 16. The results shown high awareness of PPE compliance among shipyards workers in Pasir Gudang influenced by attitudes and beliefs, demographic characteristics, supervision and training. Training, supervision and attitude and belief are the strong positive significant factors on awareness on PPE compliance. Management team can improve PPE compliance among workers by improving PPE attributes and establishing reward systems as well as implementation of continuous training dan supervision to influence safety attitude among shipyard workers.

Keywords: personal protective equipment (PPE) compliance, awareness, shipyard workers

1.0 Introduction

Shipyard is a high-risk and heavy engineering workplace when the core activities of ship building or construction, ship repair and ship breaking or breaking are taken place (Ferris & Heimann, 1976). High-risk jobs such as welders, painters, riggers and pipe fitters are available in the shipyards. Shipyards workers are exposed to the potential hazards and risks at workplace by doing construction works such as welding, grinding, cutting, and painting as well as blasting during core activities in workshops or on-board ships or vessels in the shipyards.

For these specific reasons, the protection of workers in terms of safety and health are a great concern for all related parties such as governments, employers, workers and public (Wanjiku, 2017). In the shipyards, usually engineering controls are already be implemented to isolate workers from potential hazards and administration controls has

applied to improve the way work performed as part of hazard-control methods in order to minimize the potential hazards and risks at workplace.

Inevitably, occupational incidents, accidents and health diseases are still occurring in the shipyards. In Malaysia shipyards, falls from height, fires and explosions are the most commons accidents (Othman et al., 2018) which are mutual with the accidents in Turkey shipyards. Electric shock, struck by objects, caught in between and drowning are frequently happened in shipyards (Barlas and Izci, 2018). From previous examples of occupational incidents, accidents and health diseases, it is shown that workers are suffered from minor and major injuries, permanent and non-permanent injuries, work-related health problem (Ferris and Heimann, 1976) and fatalities (Barlas and Izci, 2018).

Risk-exposed workers in unsafe workplaces is a classic problems that has increased the interest of Malaysia government to establish two legal acts, in order to shield employees against threats, the Occupational Safety and Health Act (OSHA) 1994 and the Factory and Machinery Act (FMA) 1967 continue to foster a healthy working atmosphere that fits the physiological and psychological needs of workers.

In order to cater above matters, the use of Personal Protective Equipment (PPE) can reduce the severity of potential hazards and risks. PPE such as helmets, face shield and safety shoes are very effective in preventing various body parts from the exposure of chemicals, hot particles and radiation (Wanjiku, 2017). PPE is compulsory to be used and worn by workers in shipyard as the last line of protection. The usage of PPE among workers is compliance with the OSHA 1994 and FMA 1967. Different types of PPE depend on the types of jobs and hazards. However, the use of PPE cannot eliminate the hazards but PPE is believed to be able to reduce the incidence of risk.

PPE compliance of the workers may be influenced by individual influence such as demographic characteristics and attitude and belief (Wanjiku, 2017). Demographic characteristics such as working experience (Wanjiku, 2017 and Zgambo, 2015), age (Tamara, 2018; Ulang et al., 2014 and Wanjiku, 2017) and education (Hashim and May, 2018; Wanjiku, 2017 and Zgambo, 2015) are important determinants of PPE compliance among shipyard workers. Attitude and belief are also a key aspect on PPE compliance among workers in terms of perceptions (Tamara, 2018 and Ulang et al., 2014), self-efficacy (Hashim and May, 2018; Tamara, 2018 and Wanjiku, 2017) and barrier to PPE (Wanjiku, 2017). In addition, employer influence is also one of the key components of PPE compliance among workers (Wanjiku, 2017). Training (Alemu et al., 2020; Hashim and May, 2018; Wanjiku, 2017 and Tamara, 2018) and supervision (Hashim and May, 2018 and Tamara, 2018) can play a significant role in ensuring workers' PPE compliance.

The vulnerability of the workers at workplace in terms of lack of awareness in safety will lead to PPE non-compliance (Hashim and May, 2018). Workers must be knowledgeable on mandatory PPE in order to improve PPE compliance among workers (Tamara, 2018). High awareness of PPE compliance (Hashim and May, 2018) can offer protection to workers at workplace against potential hazards and risk in order to forestall future

accidents at workplace. Therefore, awareness of PPE compliance is one of the ways to control risk in preventing occupational accidents in any companies or organizations. This paper is written to investigate the awareness of PPE compliance among shipyard workers.

1.1 Problem Statement

There are 100 shipyards with 35 000 workers in Malaysia in shipbuilding industries which contribute estimated RM6.4 billion in revenue annually. In Malaysia, many employers and workers still do not care about the importance of PPE even the usage of PPE at high-risk workplace can save lives. Accidents is still happening in shipyard from time to time due to low priority on safety, health and environment matters (Othman et al., 2018).

Table 1: National Occupational Accident and Fatality Rate from 2014 – 2018

Year	2014	2015	2016	2017	2018
Accident Rate	3.10	2.81	2.88	2.93	2.40
Fatality Rate	4.21	4.84	4.84	4.90	4.14

The National Occupational accident and fatality rate since 2014 until 2018 is shown in Table 1 with regards to the occupational death rate is per 100 000 employees and the occupational injury rate is per 1 000 employees. The accident rate is decreasing in trend from 2014 to 2018 but fatality rate is increasing from 2014 until 2015. It shows that the occupational accidents are getting less but the occupational accidents that happen might be the major accidents because the fatality rate is increasing. Fatality rate and accident rate can be decreased and prevented by proper PPE usage.

Due to above statement, this research benefits the management of the company to cater the problem regarding PPE non-compliance in shipyards as one way to prevent occupational accidents' occurrence

1.2 Objectives

This paper is written to investigate the awareness of PPE compliance among shipyard workers. The specific objectives are:

i. To identify the contributing factors of PPE compliance among shipyard workers.
ii. To analyze the level of awareness of PPE compliance and its factors among shipyard workers.
iii. To suggest the improvements on PPE compliance among shipyard workers.

1.3 Conceptual Framework

Figure 1 shows the independent variables are divided into main components; individual and employer influence (Wanjiku, 2017). All selected variables; demographic characteristics, attitude and belief, training and supervision are chosen from past literatures that has shown the relationship with dependent variables, awareness of PPE compliance.

With the conceptual framework, the research has become clearer and more focus (Adom et al., 2018).

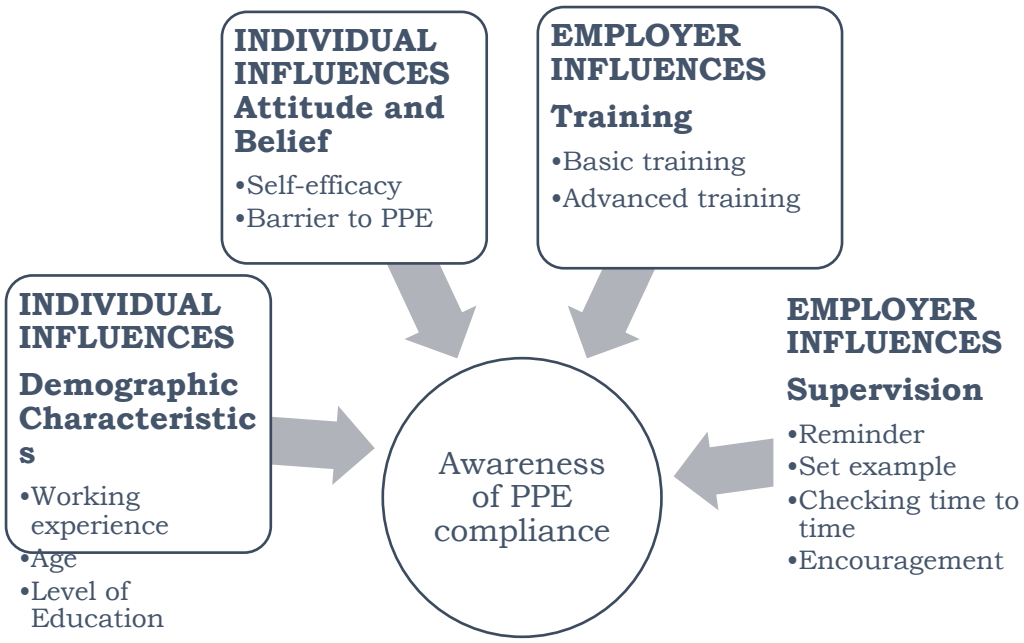

Figure 1: Conceptual Framework

1.4 Hypotheses

In order to analyze awareness with its independent variables, the hypothesis is evaluated for this research as follows:

H01: There is no significant correlation between demographic characteristics (i.e. age, working experience and level of education) of workers and awareness of PPE compliance among shipyard workers.

H02: There is no significant correlation between attitude and belief of workers and awareness of PPE compliance among shipyard workers.

H03: There is no significant correlation between supervision and awareness of PPE compliance among shipyard workers.

H04: There is no significant correlation between training and awareness of PPE compliance among shipyard workers.

2.0 Literature Review

PPE may be described as specialized clothing and equipment to protect employees from safety and health threats in the workplace, depending on job descriptions (e.g. welders) or hazards (e.g. sharp edges). PPE such as safety helmet, and safety google must be worn at all times in shipyards especially when doing construction works in ship repairs.

PPE is the lowest rank in hierarchy of hazard control below engineering and administration controls in terms of effectiveness as PPE cannot eliminate the hazards but still PPE is effective to minimize the risk and severity of the occupational accidents and illness. The advantage of PPE is well recognized as shielding employees from hazards and reducing the risks and severity of accidents and disease (Tamara, 2018 and

Wanjiku, 2017). Unfortunately, majority of workers underestimate the benefit of PPE (Ulang et al., 2014).

2.1 Contributing Factors on PPE Compliance

2.1.1 Demographic Characteristics

Demographic characteristics are included in individual influence on PPE compliance. Past researchers have discovered that certain demographic characteristics has significant impact and essential for PPE compliance among workers which are experienced (Wanjiku, 2017), age (Wanjiku, 2017) and level of education (Ulang et al., 2014). Referring to past research, older age workers have high working experience to gain more information on PPE compliance and being motivated to wear PPE at work. On contrary, younger age workers care less about safety in terms of PPE compliance (Tamara, 2018 and Ulang et al., 2014) as they do not wear PPE due to lack of information on safety aspect of PPE.

Alongside with age, longer working experience is a key determinant of PPE compliance among workers. Perception of risks are increasing in experienced workers as they are working. The perception to save themselves from risks drives experienced workers to wear PPE at work (Wanjiku, 2017). Previous researchers found out that longer working experience is associated with PPE compliance (Wanjiku, 2017 and Zgambo, 2015). Other than age and working experience, level of education also plays vital role in determining the PPE compliance among workers. In a past study of welders in Lambia, higher education has shown significant different with the PPE in contrast with no education workers (Zgambo, 2015).

2.1.2 Attitude and Belief

Attitude and belief are crucial predictor in PPE compliance. Workers' belief and attitude through perception of hazards and risks influence PPE practices (Alemu et al., 2020) and in decision making process of the workers to comply with PPE (Tamara, 2018). Positive attitude and belief of workers on the offering of protection from work-related hazard as well as reducing hazards exposure by PPE use has led to high compliance of PPE at work (Wanjiku, 2017). Data from several studies suggest that attitude and belief have effect on PPE compliance. In Egypt, a past study among health care workers has reported that majority of them have agreed that the use of PPE can reduce the hazards at highly risk work, but unfortunately, most of them have not used PPE all the times. Regarding above literatures, positive attitude and belief will produce PPE compliance among workers.

2.1.3 Training

Training by employers is subdivision of employer influence on PPE compliance at work (Wanjiku, 2017). Training plays a fundamental role in fostering PPE compliance (Alemu et al., 2020; Hashim and May, 2018 and Tamara, 2018) should be done by safety officers (Othman et al., 2018). Extensive research suggest that training is significant influenced in PPE compliance. The lack of training by employers can affect PPE compliance

in negative manners (Ulang et al., 2014). A number of studies have explored the need of training by employer as the key in promoting PPE compliance among workers.

2.1.4 Supervision

Employers play a pivotal role in the promotion of PPE compliance at work. Supervision is a part of employer influence in protecting workers at work through PPE compliance (Wanjiku, 2017). Supervision is found to be influencing PPE compliance has been explored in several studies. It is found that supervision is related to put enforcement on workers to wear PPE during work (Alemu et al, 2020; Hashim and May, 2018 and Tamara, 2018). Improper use of PPE among shipyard workers is considered as a source of risks for workplace accidents and eventually lead to more serious injury, illness and even fatality (Barlas and Izci, 2018).

2.1.5 Awareness of PPE Compliance

A number of researchers have found an association between awareness and PPE compliance among workers. Several studies have identified occupational accidents and health diseases in shipyard all around the world. A considerable amount of literature has been published on awareness that can elevate PPE compliance among workers (Hashim and May, 2018; Tamara, 2018 and Zgambo, 2015) to govern risks. Additional awareness through risk perception that given to the workers can also escalate PPE practices and utilization (Ulang et al., 2014). Four contributing factors which are demographic characteristics, attitude and belief, training and supervision influence conceivably on awareness of PPE compliance.

3.0 Methodology

This research was conducted to investigate the awareness of PPE compliance among shipyard workers. The researcher chose a descriptive quantitative research as the research design in order to gather data for research purposes. Online survey questionnaire was conducted among 62 workers in Pasir Gudang shipyard by simple random sampling (Krejcie and Morgan, 1970). The instruments of questionnaire were adapted and adopted from existing questionnaire from previous literatures. A pilot test was conducted to measure the reliability of the questionnaires by assessing Cronbach's Alpha acceptable value and questionnaire's validity is assessed by experts. Overall Alpha Cronbach's for pilot test is 0.937. The questionnaire was disseminated via online survey to all respondents to assess their awareness on the PPE compliance in shipyard. The data collection from the respondents was collected and analyzed using IBM Statistical Package for Social Science (SPSS) version 26. For descriptive analysis and inferential statistical tests.

4.0 Results & Discussion

4.1 Respondents' Profile

All respondents are male respondents. Malay respondents comprise the majority of respondents, contributing about 88.7%. Chinese ethnic

groups are the minority with only 11.2%. Majority of the respondents are from the age group 41-45 years old, with 30.6% and the minority of respondents fell within the range 26-30 years old with 6.5%. Majority of respondents are working about 8-9 years. Majority of respondents have certificates as their highest education with certificates with 92% and is followed by those with diploma with 8%.

4.2 Reliability Test

Table 2 displays the reliability test. The justifications for reliability size for all variables are very good for current research (Zikmund, 2000). Overall Alpha Cronbach's for pilot test is 0.933. The internal consistency of items of instruments are very good and reliable.

Table 2: Reliability test of Instrument in Current Research

Variables	Number of items	Alpha Cronbach's	Justification of Reliability Size
Attitude & Belief	10	0.816	Very Good
Supervision	10	0.823	Very Good
Training	10	0.845	Very Good
Awareness	9	0.805	Very Good
Overall	39	0.933	Very Good

4.3 Normality Test

Normality of the collected data can be deduced from Skewness and Kurtosis tests. Skewness is an asymmetrical measure of distribution while Kurtosis is a measure of peaked height of distribution. Test values within the -2 to +2 range for the Skewness test and -3 to +3 for the Kurtosis test are defined within the normal range (Sekaran and Bougie, 2013). Table 3 indicates the normality test for variables. The values for Skewness and Kurtosis tests for age, working experience, attitude and belief, supervision, training and awareness is calculated within acceptable range to be considered as normal distributions so further test for all these variables will use parametric technique. Only level of education is not within the acceptable range, further test for this variable will use non-parametric techniques.

Table 3: Normality Test for Variables

Variable	Skewness		Kurtosis	
	Statistic	Std Error	Statistic	Std Error
Age	-.445	.304	-.450	.599
Working Experience	-.717	.304	-.207	.599
Level of Education	3.157	.304	8.232	.599
Attitude & Belief	.024	.304	-.926	.599
Supervision	-.722	.304	.731	.599
Training	-1.414	.304	.724	.599
Awareness				

4.4 Mean Score of Contributing Factors

Mean scores of contributing factors in the Table 4 can be interpreted by using interpretation scale for mean score (Fong et al., 2018). Mean scores for supervision and attitude and belief are considered very high meanwhile awareness and training have high mean scores. The high and very high mean scores can be interpreted as awareness, attitude and belief, supervision and training contribute to PPE compliance among shipyard workers in Pasir Gudang, as mean scores reflect the center of the results. Objective 1 is achieved.

Table 4: Mean Score of Contributing Factors to PPE Compliance

Descriptive Statistics

	N	Max	Min	Mean	SD
Awareness	62	3.22	4.67	**4.1505**	.36276
Attitude & Belief	62	4.00	5.00	**4.5032**	.32991
Supervision	62	3.30	5.00	**4.4935**	.34635
Training	62	3.10	4.50	**4.0532**	.41001

4.5 Correlation

Pearson's correlation which is parametric technique to find the relationship between two variables of collected data with normally distributed. From normality tests at above, all variables are normally distributed except for level of education. Correlation of contributing factors in the Table 5 is be interpreted by Rule of Thumb (Hair et al., 2014). Training has a very strong significant positive association with awareness ($r = 0.878$, $p<0.01$). Attitude and belief have a strong significant positive association with awareness ($r= 0.778$, $p<0.01$) and supervision also has a strong significant positive association with awareness ($r=0.614$, $p<0.01$) respectively. H01 is accepted (Age and Working Experience) meanwhile H02, H03 dan H04 are rejected. There are significant correlations between attitude and belief, training and supervision with awareness.

Table 5: Pearson's Correlations

Correlations

		Awareness	Age	Working Experience	Attitude & Belief	Supervision	Training
Awareness	Pearson Correlation	1	.003	-.213	**.614****	**.778****	**.878****
	Sig. (2-tailed)		.981	.096	.000	.000	.000

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

Spearman's Rho Correlation is used to examine the association between two variables with non-normal distribution. It is a non-parametric test to calculate the association between two variables or at least one ordinal data. Table 6 shows level of education has a weak significant positive association ($r = 0.334$, $p<0.01$). H01 (level of education) is rejected.

Table 6: Spearman's Rho Correlation

Correlations

			Awareness	Level of Education
Spearman's rho	Awareness	Correlation Coefficient	1.000	**.334****
		Sig. (2-tailed)	.	.008

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

4.6 Multiple Linear Regression

Table 7 shows model summary of regression analysis. Based on the table, the value of R square is 0.900, indicates all independent variables are contributed 90% factors to awareness. Another 10% factors of awareness are obtained by other factors which is not measured in this research. This suggests a very strong relationship between independent and dependent variables (Hair et al,2014).

Table 7: Multiple Linear Regression Analysis – Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.948[a]	**.900**	**.889**	.12107

a. Predictors: (Constant), Training, Age, Level of Education, Attitude & Belief, Supervision, Working Experience

b. Dependent Variable: Awareness

According to Table 8, the largest beta coefficient is 0.577 that implies training variable. It means, when training is increased, awareness on PPE compliance of the shipyard workers is also increased. Training is the independent variable that has strongest factor to explain the awareness. All three variables are significant as p is 0.000 which is below significant level of 0.05 ($p < 0.05$). The multiple regression equation is $\gamma = -0.445 + 0.511$ (Training) + 0.312 (supervision) + 0.271 (attitude and belief). Objective 2 is achieved.

Table 8: Coefficients of Regression Analysis

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	**-.445**	.265		-1.681	.099
	Age	.010	.021	.038	.495	.623
	Working Experience	-.021	.022	-.079	-.967	.338
	Level of Education	-.040	.079	-.030	-.505	.616
	Attitude	**.271**	.066	**.247**	4.122	**.000**
	Supervision	**.312**	.061	**.298**	5.124	**.000**
	Training	**.511**	.054	**.577**	9.533	**.000**
a. Dependent Variable: Awareness						

4.7 PPE Compliance Improvement

Table 9 show frequency and percentage analysis for respondents' responses. 24% of the respondents stated that PPE attributes should be improved. 24% of respondents suggested the employer to establish reward system for PPE compliance among shipyard workers. Therefore, they will feel motivated to comply with PPE at work. The researcher concludes that by improving PPE attributes and reward systems, PPE compliance among shipyard workers can be improved. Objective 3 is achieved.

Table 9: Frequency and Percentage Analysis

Themes	**N**	**%**
Administrative Control	6	10%
PPE Training	8	14%
Attitude	9	15%
Supervision	8	14%
PPE Attributes	14	24%
Reward Systems	14	24%
TOTAL	**59**	**100%**

5.0 Conclusion

High awareness increases PPE compliance among shipyard workers at work. It is decided that all other contributing factors (i.e. awareness, attitude, supervision and training) are contributed towards PPE compliance. Training is the utmost factor to influence awareness of PPE compliance among shipyard industry and is followed by supervision and attitude and belief. The improvements on PPE compliance are established by respondents' responses includes implementation of reward systems and improvement in PPE attributes. The management can improve PPE

compliance of shipyard workers through continuous PPE training, supervision and safety attitude empowerment.

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