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# Association of Demographic Characteristics of Construction Workers and Work Environments to Workplace Accident in High Building (Hotel) Construction

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## Abstract

**Introduction:** Until now construction sector is still dominant contributors on workplace accident (WA) in Indonesia. However, there is a limited report analysing the causal factors. Demographic characteristics and work environment are suspected factors to be responsible on this condition.

**Objectives:** This study aimed to analyse the factors associated with WA occurrence on high building (hotel) construction.

**Method:** This research has been conducted on 105 workers at a high building construction in Samarinda by one of Indonesian largest construction company. Factors observed were age, working experience, level of education, working time, adherence to a standard operating procedure, health and safety knowledge, health and safety attitude, level of noise, lighting at a workplace, and work fatigue. Cramer's V test and odds ratio were applied to see an association between the WA occurrence and the factors as well as their level.

**Results:** During the 11 months construction, 58 WA occurrence were recorded. It is about 55.2% of the whole number of workers. Age ( $p=0.000$ ), working experience ( $p=0.000$ ), working time per day ( $p=0.001$ ), adherence to SOP ( $p=0.000$ ), lighting exposure ( $p=0.03$ ) and health and safety knowledge ( $p=0.000$ ) showed significance correlation on the WA occurrence.

**Conclusions:** Construction sector is still high risk work sector in Indonesia. Demographic characteristic (age, working experience and health safety knowledge) and working environment (working time, adherence of SOP, lighting exposure) are essential factors need to be considered to overcome the WA occurrence in high building construction.

**Keywords:** High building, hotel, workplace accident, work environment, Samarinda.

## Introduction

Construction sector plays an essential role in the economy of a country because its significant contributions to the gross domestic product.<sup>1-3</sup> However, it belongs to a high-risk job in developing countries cause of its high

rate of workplace accident (WA) contribution.<sup>4-6,7</sup> The construction WA are quite high in Malaysia,<sup>4</sup> Thailand,<sup>8</sup> Uganda<sup>9</sup> and Iran.<sup>6</sup> Similarly, the construction sector in Indonesia is the highest contributors to WA with the number of 32% compared to other sectors.<sup>10</sup> Manufacturing, transportation, forestry, mining industries, and other sectors, were accounted for 31.6, 9.3, 3.8, 2.6, and 21%. Several factors related to WA in construction are an inadequate in providing resources for safety and operational procedure, unsafe act, failures in constructed site management, age of workers, work experience, gender, length of service, work location, and climatic zones, workers' negligence, failure to obey work

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procedures, work at high elevation, operating equipment without safety devices, poor site management, harsh work operation, low knowledge and skill level of workers, failure to use personal protective equipment and poor workers attitude about safety, and poor safety culture.<sup>8,11</sup> construction factors associated necessary to reduce the WA occurrence in the construction sector in developing countries, including Indonesia. This study aimed to analyse the factors associated with WA in construction factors associated with WA in construction sector. This finding is advantageous to overcome the problem by identifying and evaluating the parameters associated with WA in high building construction.

### Material and Method

This research was conducted from Dec 2017 until Oct 2018 at a high building (hotel) construction in Samarinda by one of the largest Indonesian construction companies. Proportional random sampling was applied to get a total of 105 respondents with various duties of work. The hotel has 12 floors, one semi-basement, 174 rooms, five meeting rooms, a ballroom, a town hall restaurant, a swimming pool, a gym, and a spacounter.

Age, working period, education level, working time, occupational health and safety (OHS) knowledge and attitude were measured by questionnaires.<sup>17,18</sup> Work fatigue was measured by IFRC's Subjective feelings of fatigue.<sup>19,20</sup> The adherence of standard operating

procedure standard operating procedure (SOP) and WA was measured by interview and direct observation. The level of noise exposure and lighting at the workplace were measured by sound level and lux meter, respectively. Cramer's V and odds ratio<sup>21,22</sup> were applied to analyse the correlation and the association level between the WA occurrence and its related factors.

### Results

The construction workers are most young (17-41 years, 82.80%). Senior and Secondary High School (70%) are the dominant education background level of the workers. Many workers (63.81%) has working experience of 1-8 years (Table 1).

Number of workers (62.86%) have working time of more than 8 hours per day, 65.71% adhered to SOP, 16.19% exposed to noise above threshold limit value 85 dB, 69.52% work with illumination <100lux, 56.19% have good OHS knowledge, 86.67% showed favourable OHS attitudes and 69.52% experienced moderate fatigue (Table 1).

During this study, number of WA occurrence accounted at 55.2%, in which most occurred during the day (37%). WA types often took place were hit by were hit by hammer and punctured by spikes with the number of 20.0 and 17.1%, respectively (Table 2.)

**Table 1: Related factors associated with workplace accident(WA) of construction workers (N=105) in high building (hotel) construction in Samarinda, Indonesia**

Variable	Workers		Workplace Accident			p***	Odd ratio****
	Σ	%	Σ	%*	%**		
1	2	3	4	5=4/2	6=4/n	7	8
<b>Age (Year)</b>						<b>0.000</b>	<b>1.962</b>
17-29	48	45.71	33	68.75	31.43		
>29-41	39	37.14	19	48.72	18.10		
>41-53	14	13.33	4	28.57	3.81		
>53-63	4	3.81	2	50.00	1.90		
<b>Working Experience (Years)</b>						<b>0.000</b>	<b>3.817</b>
1-8	67	63.81	47	70.15	44.76		
>8-16	25	23.81	9	36.00	34.29		
>16-26	13	12.38	2	15.38	1.90		
<b>Education</b>						<b>0.270</b>	
Elementary school, not graduated	8	7.62	2	25.00	1.90		
Elementary school (graduated 6 <sup>th</sup> class)	27	25.71	15	55.56	14.29		

Variable	Workers		Workplace Accident			p***	Odd ratio****
	Σ	%	Σ	%*	%**		
1	2	3	4	5=4/2	6=4/n	7	8
Secondary high school (graduated 9 <sup>th</sup> class)	33	31.43	21	63.63	20.00		
Senior high school (graduated 12 <sup>th</sup> class)	37	35.24	20	54.05	19.05		
<b>Working time</b>						<b>0.001</b>	<b>1.580</b>
≤ 8 hours	39	37.14	24	61.54	22.86		
> 8 hours	66	62.86	34	51.52	32.38		
<b>Adherence of SOP</b>						<b>0.000</b>	<b>12.290</b>
Adherence	69	65.71	52	75.36	65.71		
No Adherence	36	34.29	6	16.67	34.29		
<b>Noise exposure</b>						<b>0.835</b>	
≤ 85 dB	88	83.81	49	55.68	46.67		
> 85 dB	17	16.19	9	52.94	8.57		
<b>Lighting exposure</b>						<b>0.038</b>	<b>1.530</b>
≤ 100 lux	73	69.52	37	50.68	35.23		
> 100 lux	32	30.48	21	65.63	20.00		
<b>OHS knowledge</b>						<b>0.000</b>	<b>6.230</b>
Less	28	26.67	24	14.29	22.86		
Enough	18	17.14	17	94.44	16.19		
Good	59	56.19	17	28.81	16.19		
<b>OHS attitude</b>						<b>0.465</b>	<b>1.176</b>
Unfavourable	14	13.33	9	64.29	8.57		
Favourable	91	86.67	49	80.33	46.67		
<b>Work Fatigue</b>						<b>0.932</b>	
Normal	22	20.95	12	54.55	40.00		
Mild	73	69.52	41	56.16	39.05		
>14-Intermediate	10	9.53	5	50.00	4.76		

**Note:** Data were collected during 11 months of construction. Total WA was 58 (55.24%). WA calculated as workers occurred one or more accidents. \*) Partial percentage (calculated by number of workers related to the specific level of variable), \*\*) Absolute percentage (calculated by all number of workers), \*\*\*) Correlation by Cramer's V test, \*\*\*\*) Mantel-Haenzel test, the level was changed to two level prior analysis, 17-14 and >14-63 years for age, 1-16 and >16-24 years for working experience, low and high for OHS knowledge.

**Table 2: Time occurrence and type of workplace accident in high building (hotel) construction in Samarinda, Indonesia (N=105)**

Time occurrence and type	Work accident		
	Σ	%*	%**
<b>Time occurrence</b>			
Morning	3	5.17	2.85
Day	39	67.24	37.14
Night	16	27.58	15.23
<b>Type</b>			
Punctured nails	18	31.03	17.14
Pinched	9	15.51	8.57
Hit by a hammer	21	36.20	20.00
Others (crushed by scaffolding, slipped, punctured by wire and sliced by grinding shards)	10	17.24	9.52

**Note:** Referred to note in Table 1.

## Discussion

**Association between demographic characteristics and WA:** Age and working experience are often used as hypotheses in analysing of WA, several studies reported different results on young and elder workers of dimensions of incidence, severity, type of accident and type of injury. In this study, which the worker is dominated by young workers shown that age and working experience were significantly related to WA. This result is inline with previous studies.<sup>13,14,20,23,24</sup>

By levelling of age and working experience to 2 categories (young workers: 17-41 years and elder workers: > 41-63 years; Low work experience: 1-16 years and high work experience: > 16-26 year), the young workers and low working experience workers have twice and 3 times higher on WA risk compared to those elder and high work experience workers, respectively. This study are in accordance with previous study, which reported that young workers were found to be accidents due to carelessness and lack of experience, although physically have a higher reaction and agility.<sup>24</sup> The working time of > 8 hours per day run the WA risk of 1.5 times higher than the less working time. Long working time will lead to work fatigue and will have an impact on occupational accidents.<sup>25,26</sup>

Level of workers education affects the perceptions of workers' OHS, which later affected on OHS behaviour and incidence of occupational accidents.<sup>27</sup> However, in this study, the education level of workers isn't associated with the WA.

### Association between the working environment and WA

**Adherence to the SOP:** The results prove that workers compliance to SOP associated with WA. This result emphasises the previous study that the most significant contributor to the cause of the WA is risky behaviour. One type of unsafe behaviour in the workplace is ignoring SOP.<sup>28</sup> The workers who disobey work procedures have a risk of experiencing WA 12 times more than SOP-compliant workers.

**Noise exposure and lighting at the workplace:** In this study, most respondents (83.3%) were exposed to noise but still below the threshold limit value (TLV) (85 dB for 8 hours per day). Many studies have concluded that noise exposure reduces the listening ability, lowers alertness and ultimately increases hearing loss and

occupational injury risks.<sup>29,30</sup> However, in this study, noise exposure isn't significantly related to occupational accidents; this is probably due to only a small proportion (16.2%) of respondents exposed to noise over the threshold value.

It is found that lighting in the workplace is significantly related to WA. The results of this study reinforce previous research that concluded physical factors at the workplace such as noise, vibration, light, thermal climate and radiation are not merely mean that it will only affect an individual physically but can also have a significant impact on wellbeing and comfort, performance and the risk of an accident.<sup>31</sup> The workers, who didn't expose to light at the TLV have risk to WA 1.5 times higher than those exposed to light at TLV.

**OHS knowledge and attitude:** Respondents' knowledge of OHS was mostly good (56.2%), and statistically significant with workplace accidents. This result reinforces previous research that the knowledge of OHS has a significant effect on safety performance. Knowledge are variables that need to be analysed in work behaviour because of its powerful influence on work behaviour, which can affect individual perception, risk assessment, and decision making.<sup>32,33</sup> The workers with low OHS knowledge are at risk of WA experiencing 6 times higher than those with high OHS knowledge.

Attitudes of workers toward OHS at work mostly favourable (86.7%), but no associated with the occupational accident. As revealed previously, the attitude was one part of the individual factors influencing risky behaviour and accidents on construction sites. Workers who have been trained and have proper knowledge of his work but still decided to commit unsafe acts, won't be free of workplace accidents unless they change their attitude.<sup>34-36</sup>

**Work Fatigue:** Most construction workers experienced mild work fatigue (69.5%), but statistically wasn't related to workplace accidents. Previous research concluded that occupational fatigue is a potential hazard in the workplace that affects the decreased ability to think logically and decrease the response to danger, and this can lead to workplace accidents,<sup>25,35,37</sup> but in this study, it wasn't proven yet.

## Conclusions and Recommendations

WA in high building construction in Indonesia, was high as 55.2% of workers had experienced with WA.



62.9% of the WA occurred during the night shift. Age, working experience, working time, adherence of SOP, lighting in the workplace, and knowledge of OHS were associated significantly to the WA incidents. These findings highlight that construction management should give more attention to demographic characteristics and work environment to improve the safety work in high building construction in Indonesia.

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