Prevalence, source and severity of work-related injuries among "foreign" construction workers in a large Malaysian organisation: a cross-sectional study

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> Received November 19, 2017 and accepted January 26, 2018 Published online in J-STAGE February 2, 2018

Abstract: Malaysian construction sector is regarded as critical in the field of health because of the high rates of accidents and fatalities. This research aimed to determine the prevalence, sources and severity of injuries and its association with commitment to safety among foreign construction workers. A cross-sectional study was conducted among 323 foreign construction workers from six construction projects of a large organization in Malaysia, using a simple random sampling method. Data was collected using a structured questionnaire to assess work-related injuries and safety commitment. The collected data was analysed by SPSS 22.0 using descriptive statistics and χ^2 test. The prevalence of work-related injuries in a one year period was 22.6%, where most of the injuries were of moderate severity (39.7%) and falls from heights represented the main source (31.5%). The majority of the foreign construction workers had perceived between moderate and high safety commitment, which was significantly associated with work-related injuries. The results also showed a significant association of work-related injuries with the company's interest in Safety and Health, Safety and Health training, and safety equipment. Thus, the implementation of new procedures and providing relevant trainings and safety equipment; will lead to a decrease in injury rates in construction sites.

Key words: Injuries, Construction, Foreign workers, Safety, Health

Introduction

The construction sector is one of the largest sectors in many parts of the world, playing a fundamental role in the development process of a country¹). The vast contributions of the construction sector to Malaysia's economy have made it a very important sector, where research based on

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statistics has shown a strong positive correlation between the construction sector and the economic growth of Malaysia by a correlation coefficient of 0.65^{2}). However, the full potential of economic growth that can be achieved by the construction industry is inhibited by occupational risks and high rates of accidents and injuries³). The construction sector has been described as one of the most hazardous industries of all sectors, as measured by injury and fatality rates⁴). Accidents in the construction sector occur at a substantially higher rate than in most other sectors and with severe consequences, both for the workers and the

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public⁵⁾. Based on the statistics issued by Social Security Organization (SOCSO) Malaysia, Chong & Low have found that the number of fatality and permanent disabilities caused by falls from heights in high-rise building projects is one of the highest rates as compared to other sectors⁶, due to the nature of construction work: work is done outside under the hot sun or in the rain; workers are required to climb to high places such as roofs, ladders, and scaffolding; and the use of dangerous tools, heavy materials, hazardous machinery and dangerous equipment also increases the risk to workers' safety and health. All these inherent hazards, and the nature of the jobs performed by workers, made the Malaysian construction sector contribute to total highest death cases in 2016 (106 cases) and the third highest rate of non-permanent disability (135 cases) as compared to other sectors⁷).

The factors influencing the occurrence of construction accidents and injuries have been pointed out in the construction engineering and management literature⁸⁾. Many studies have classified the contributing causes of construction accidents into human and physical factors $^{8, 9)}$. While there are various sources, accidents result from a combination of contributing causes from the workers, the company or both sides¹⁰. The causes behind accidents in the Malaysian construction sector were reviewed, and findings revealed that the two major causes of accidents were management failure in implementing and maintaining a high safety management system at the company, and incorrect work procedures by the employees resulting in unsafe methods¹¹). In fact, commitment to safety is represented through good site management, where the workers' perception of safety commitment from the company is a major factor that influences the occurrence of injuries in the workplace¹²⁾. Management commitment remains an important element to be investigated in safety research, where a high level of safety commitment from management reduces the rate of workplace accidents and injuries^{13, 14)}. The two most important determinants in workforce satisfaction with regard to safety and a low accident rate are commitment to safety and the organizational support provided by management¹⁵⁾. Moreover, research showed that management is the responsible for improving working conditions and preventing accidents or incidents from occurring¹⁶⁾. Therefore, this study intended to test the hypothesis of the existence of a significant association between safety commitment and work-related injuries.

The Department of Statistics in Malaysia has shown that the construction industry directly employed approximately 1,214,000–12,116,600 workers, thereby taking up 10% of the country's total employment, where around 70-80% are occupied by foreigners, excluding illegal labourers¹⁷⁾. Poor monitoring of foreign employment requirements and procedures by the authorities has contributed to the flow of foreign labourers in the construction sector, where many employers choose to hire foreign workers due to their willingness to work under harsh conditions for lower salary¹⁸⁾. Most of studies on construction Safety and Health in Malaysia were conducted among general construction workers. Hence, the novelty of this project is in the specificity of the population being investigated by only selecting "foreigners" construction workers. Therefore, the study intended to determine the 12-month prevalence, source and severity of work-related injuries among foreign construction workers and to assess the association between the workers' perception of their employer's safety commitment and the prevalence of work-related injuries.

Subjects and Methods

Study design, location and period

A cross-sectional study was conducted to determine the prevalence and sources of work-related injuries among foreign construction workers in the Klang valley. Klang Valley is the area in central Selangor, Malaysia, which has the largest growing economy during the last five years, thus this area was chosen to conduct the study. Four construction organisations have been contacted for data collection, but only one large organisation approved our request to conduct this study among the construction workers. The organisation is committed to be leading conglomerate by providing an outstanding Safety and Health standards and practices to create a safe and healthy workplace for its employees. Six high-rise construction projects were accommodated in this study. Data was collected between June 2016 and September 2016.

Sampling population

All male foreign workers who had been involved with the construction organisation in the previous year were included in the study until the required sample size was obtained. The organisation declared that a total of 2,040 skilled and unskilled construction workers were working on their construction sites performing different tasks (Framing, Roofing, Plumbing, Electrical, Flooring, and Painting) at that time. There was no female worker at the selected construction sites, and workers who were absent or refused to participate in the study were excluded.

Sample size and sampling procedure

The required sample size was determined by using one population proportion formula. For the calculation, 95% confidence level, 5% marginal error and 50% injury prevalence, in order to maximize the sample size, were assumed. The sample size was adjusted according to the total population size¹⁹⁾. Based upon the locations of the construction sites, the study populations were stratified into six different sites. The number of samples from each site was determined by using a proportional allocation formula. Finally, a simple random sampling technique was employed to select a total of 323 respondents from the six construction sites.

Data collection method

Data was collected through a self-reported survey from June to September 2016, where a structured questionnaire in both English and Malay languages was used. Questionnaire was developed based on the main elements of NO-SACQ-50 on Safety Climate²⁰⁾, and the questionnaire used in the study conducted Choudhry²¹⁾. The questionnaire on socio-demographic characteristics, injury prevalence and safety commitment were extracted and discussed with academics and researchers and modified to be suitable for our target population (Appendix 1). Pilot study was conducted before data collection. The researchers had conducted an early visit to each site to make further arrangements with the project managers. Data collection occurred across two sessions per day for a total of 30 sessions along the data collection, in which 10-12 participants were involved for each session to achieve the required sample size. Indonesian and Bangladeshi language translators were available during all the sessions of the data collection process. Each question was explained separately to allow workers to answer the questions properly, and participants spent 10 to 12 min filling out the questionnaire.

Pilot study

The questionnaire was constructed in English and translated to the Malay language based on the guidelines provided by the international organization, Consensus Group. "Forward" and "backward" translations were performed on the questionnaire for the English version²²⁾. Indonesian and Bangladeshi translators participated throughout the data collection process. Translators were bilingual and trained to translate the questions and assist the respondents with filling out the questionnaire, based on their nationality and their understanding. The face validity of this questionnaire was ensured by a focus group discussion (FGD), where specialists and experts from different companies in the safety field had gathered, and the questionnaire was discussed with the researchers and academics. A test-retest method was used on 30 workers in a construction project which had similar characteristics, to ensure the understanding of the questionnaire and to evaluate its reliability. The reliability of this study was evaluated by calculating the internal consistency of the scales using the Pearson correlation coefficient with an interval of one week²³⁾. The results showed that most of the correlation coefficient values were between 0.839 and 1.00, which demonstrated a strong association that reflects a good reliability levels test-retest.

Ethical consideration

The study was carried out with the approval of the Ethical Committee for Research Involving Human Subjects of University Putra Malaysia. Permission to conduct the research at the construction sites was granted by the management committee of the construction organisation. Respondents were given a subject information sheet and consent form in order to obtain their voluntary participation in this study.

Data analysis

The data collected was coded and analysed using the Statistical Package of Social Science (SPSS for Windows, Version 22.0, 2016). Descriptive statistics were used to summarize and explain the characteristics of the variables as frequency and percentage. The χ^2 test/Fisher's exact test was used to assess the association between safety commitment variables and work-related injuries.

Results

Socio-demographic characteristics

A total of 323 questionnaires were distributed to the six construction sites in Klang Valley. The researcher ensured that all of the questionnaires were answered, and workers who did not wish to participate in the study were replaced by other respondents to achieve the target of 100% response rate.

The age of the majority of the respondents was between 20 and 40 yr old (89.2%, n=288) and 47.1% were married (n=152). The foreign construction workers were mainly from Bangladesh (48%) and Indonesia (39%). Their education levels ranged from not having attended school to tertiary education where 39.9% had achieved secondary education and 52.7% had less than secondary level educa-

Socio-demographic characteristics	Frequency n (%)
Age (yr)	
<20	9 (2.8)
20-40	288 (89.2)
>40	26 (8)
Marital status	
Single	117 (36.2)
Married	152 (47.1)
Divorced/Windowed	54 (16.7)
Nationality	
Indonesian	126 (39)
Bangladeshi	155 (48)
Pakistan	25 (7.7)
Nepal	11 (3.4)
China	6 (1.9)
Education level	
Not attending school	50 (15.5)
Primary education	120 (37.2)
Secondary education	129 (39.9)
College or higher	24 (7.4)
Working Experience in Malaysia	
1–2 yr	44 (13.6)
2–3 yr	127 (39.3)
3–5 yr	67 (20.7)
More than 5 yr	85 (26.3)
Qualification	
Yes	274 (84.8)
No	49 (15.2)

 Table 1.
 Socio-demographic characteristics of the foreign construction workers (N=323)

tion. Overall, the respondents had worked in Malaysia for between two and three years (39.3%). Most of the workers (84.8%) had a qualification in their current work. Table 1 shows the socio-demographic characteristics among foreign construction workers.

12 months prevalence of work-related injuries

12 months prevalence of work-related injuries was 22.6% (n=73), of which 85.1% (n=63) were reported to the organisation. Majority of work-related injuries were between moderate (39.7%) and minor (42.5%). Table 2 shows the prevalence and severity of work-related injuries among foreign construction workers.

Sources of work-related injuries

Falls from heights (6 feet or more above lower level) were recorded as the highest source of work-related injuries (31.5%) followed by lifting and handling (24.7%). Figure 1 shows bar chart of sources of work-related inju-

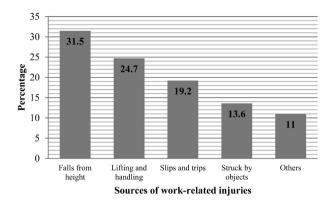


Fig. 1. Sources of work-related injuries reported by foreign construction workers.

ries reported by foreign construction workers.

Falls from heights were the first source of serious and moderate work-related injuries by 69.2% and 40.6% successively, while slips and trips were the first source (39.3%) for minor injuries. Table 3 shows the sources and severity of work-related injuries reported by foreign construction workers.

Safety commitment and work-related injuries

The perception of workers on the attitudes and practices performed by the organisation's management reflects the best dimensions of safety commitment. Respondents differentiated between low, moderate and high levels of safety commitment by the organisation. A χ^2 test was performed and, according to the results presented in Table 4, workers who assumed that the company's safety commitment was at a high level had a lower number of injuries, and there was a statistically significant association between safety commitment and work-related injuries $(\chi^2=6.726, p=0.035)$. Furthermore, the details showed that work-related injuries were significantly associated with the company's interest in Safety and Health (χ^2 =10.896, p=0.001), Safety and Health training ($\chi^2=12.007, p=0.001$) and Safety equipment ($\chi^2 = 11.051$, p = 0.001). On the other hand, there was no significant association between workrelated injuries and tools and machinery.

Discussion

The rate of injuries among construction workers is becoming an important issue in the Malaysian construction sector because of the high number of accidents, low awareness of workers and low commitment to safety from some companies. This study revealed that out of 323 par-

Work-related injuries	Frequency (n)	Percentage (%)
Yes	73	22.6
No	250	77.4
Total	323	100
Reported (n=73)		
Yes	63	85.1
No	10	14.9
Severity (n=73)		
Serious	13	17.8
Moderate	29	39.7
Minor	31	42.5

 Table 2. Prevalence of work-related injuries among foreign construction workers

Table 3.	Sources and severity of work-related injuries reported by
foreign c	onstruction workers

Sources	Frequency n (%)			
Severity	Serious	Moderate	Minor	Total
Falls from height	9 (69.2)	13 (40.6)	1 (3.6)	23 (31.5)
Lifting and handling	2 (15.4)	11 (34.4)	5 (17.9)	18 (24.7)
Slips and trips	1 (7.7)	2 (6.3)	11 (39.3)	14 (19.2)
Struck by objects	1 (7.7)	5 (15.6)	4 (14.3)	10 (13.7)
Others	0 (0)	1 (3.1)	7 (25)	8 (11)

 Table 4. The association between safety commitment and work-related injuries

X7 · 11		Work-related injuries		2	
Variables		No	Yes	$-\chi^2$	<i>p</i> value
Company interest to Safety and Health	No	7 (43.8)	9 (56.3)	10.896	0.001**
	Yes	243 (79.2)	64 (20.8)		
Safety Equipment	No	14 (58.3)	10 (41.7)	11.051	0.001**
	Yes	239 (79.4)	62 (20.6)		
Tools and machinery	No	12 (57.1)	9 (42.9)	2.341	0.126
	Yes	238 (78.8)	64 (21.2)		
Safety and Health trainings	No	15 (51.7)	14 (48.3)	12.007	0.001**
	Yes	235 (79.9)	59 (20.1)		
Safety commitment	Low	3 (42.9)	4 (57.1)	6.726	0.035**
	Moderate	90 (82.6)	19 (17.4)		
	High	157 (75.8)	50 (24.2)		

**Significant at 0.05 level.

ticipants, 22.6% of the foreign construction workers had experienced work-related injuries at least once in the previous one-year recall period. This finding was similar to the study done in India, where the prevalence rate of injury among construction workers was 22.92%²⁴⁾. However, this result was higher than the study in Egypt $(18.4\%)^{25}$ and lower than the study in Ethiopia (38.3%)²⁶⁾. This inconsistency in the prevalence of work-related injuries might be related to the differences between countries in the degree of development, quality of workforce, power of the Occupational Safety and Health laws, diversity of work tasks and complexity of the working conditions. Another reason might be linked to the study population in terms of education level and nationality of the workers; the respondents in this study were all foreign workers, as the Malaysian construction sector is represented by 69% of foreign workers from the total workforce in this industry 27 .

22.9% prevalence of injuries found in this study can be

considered moderate in regards to the reputation of the organisation in terms of safety and health by ensuring a successful implementation of the Occupational Safety and Health Management System (OSHMS). Therefore, the organisation is working to establish a sustainable safety culture at every level among employees and other relevant stakeholders. Moreover, the organisation is making an effort to build a strong safety culture and awareness about hazards among workers by enforcing training requirements and conducting a daily safety toolbox before the start of the day's work. The organisation is also conducting a lot of campaigns aiming to share fundamental messages, which are to "Plan ahead to get the job done and keep safety first", "provide the right equipment" and "train everyone to use the equipment". The construction sites also include posters and safety signboards showing pictures of possible hazards in each working area to constantly remind and warn the workers of the dangers that could befall them

should they not be vigilant enough. All these efforts from the organisation contribute to a moderate prevalence rate of work-related injuries among their workers.

The findings also show that the majority of the workers who experienced work-related injuries had reported these injuries to the organisation, with only 10 out of 73 respondents not reporting them to the organisation. This finding is congruent with another study in Canada that showed different reasons that may lead workers to neglect to report accidents. The reasons could be related to the concept that employees accept and believe that injuries are part of their job because injuries happen frequently and are of low severity, or it may be because of the fear of losing their job or damaging their reputation²⁸⁾.

The results showed that falls from heights were the main source of work-related injuries by 31.5%, followed by lifting and handling (24.7%); these two sources were the main contributors to serious and moderate work-related injuries. These results agreed with the statistical data on accidents in the Malaysian construction sector, where falls from heights were the most critical cause of accidents, with an annual average of 1,042 cases⁶⁾. The findings were also similar to many other statistics and studies all over the world: in the USA, fall accidents are considered as the first cause of work-related injuries and fatalities in the construction industry throughout time, where falls from scaffolds, roofs, and ladders represent a major part of fall accidents in the US construction industry^{29, 30)}. A recent study with similar findings showed that falls from heights had contributed to more than half of the serious injuries (requiring hospitalization) and being struck by objects was ranked as the second cause of serious and moderate injuries³¹⁾.

Additionally, these findings were consistent with other studies in different countries: in South Korea, it was found that falls from heights comprise the most common source of injuries and death among construction workers³²; in South Africa, it was revealed that most of the reported fatalities and injuries were as a result of falling from heights³³; and in the USA, similar findings show that falls from high levels are the first cause of injuries and death, followed by being struck by objects, and finally, being caught in or between objects³⁴. Ultimately, in the Malaysian construction sector, falls remain as the source of the highest source of accidents and injuries, despite a gradual decline in occupational accidents.

Based on the results, the safety commitment scores varied according to the respondents' perceptions, with the majority of them showing moderate and high scores for safety commitment. The results justify the efforts of the organisation's management in providing a safe workplace, and keeping safety as a priority on all construction sites. Furthermore, the results revealed a significant association between safety commitment and work-related injuries where workers who perceived a high safety commitment did not experience any work-related injuries. These findings were accordant with another study that found that workers who perceived a high commitment to safety from their management had a lower accident rate¹⁵). The management's commitment to safety is significantly associated with the occurrence of injuries over time¹². Consequently, these findings supported other studies that showed a significant effect of management's commitment to safety in reducing the number of workplace accidents and injuries³⁵⁾. The hypothesis in this study suggesting a significant association between safety commitment and work-related injuries is true.

In addition, the results also showed that safety equipment was associated with work-related injuries, which supports the study conducted in Malaysia showing that the lack of personal protective equipment (PPE) is considered as one of the main causes of construction accidents¹¹⁾. These results were in accordance with similar studies conducted in the USA, Thailand and Uganda, proving that the lack of safe equipment is considered as a contributing factor to accidents and injuries in construction, as some employers do not provide their workers with the sufficient and correct equipment necessary to minimize hazards^{12, 36, 37)}.

Inversely, this study did not find any significant association between work-related injuries and tools and machinery, as the findings were in disagreement with two studies in the USA and Indonesia that found the availability of tools and machinery can be a predictor of occupational injuries and a contributing factor to safety performance^{38, 39)}. This variance in the findings might be explained by the differences in commitment of the companies to providing all the tools and machinery necessary to perform the work safely and create safe working conditions. Other reasons might be related to the financial status of each organisation and the types of subcontractors hired to complete specific parts of the project.

Study Limitation

There are some limitations to this study. Firstly, the study had focused on "Foreign" construction workers of one organisation in Malaysia; therefore, the results were unable to be generalized to all construction sites in Malaysia. Future studies on different companies and different locations are needed to support or refute our findings. Secondly, the measurement of safety commitment was based on self-reported questionnaire validated by academicians and construction safety experts, thus, the accuracy of this research relies on the honesty and perception of respondents in answering the questions. Lastly, this study relied on self-reported data; thus, bias might exist as well. Information bias might have occurred when filling up the questionnaire due to deferent understanding of the respondents based on their perception and judgment. However, the research team did huge effort to deliver the accurate meaning of each question to the respondents by explaining and using trained translators.

Conclusion

Injuries among construction workers occur at a substantially higher rate rather than in other sectors. This study conducted among foreign construction workers in six construction sites of a large organisation in Malaysia; revealed that the 12 months prevalence of work-related injuries was 22.6%, where the majority of injuries were between minor and moderate severity. Falls from heights was recorded as the highest source of injuries followed by lifting and handling, and safety commitment was found to be a significant determinant of injury rates at the workplace. These findings could be used by other organisations as a reference to compare number and sources of injuries among foreign construction workers in different locations. Moreover, the further implementation of new procedures and provide relevant trainings and safety equipment will lead to a decrease in accident and injury rates at the workplace. Lastly, there is limited research on this topic and more studies are necessary to reduce the rates of injuries in this sector; therefore, future research could be directed to investigate the contributing factors of injuries among foreign workers.

Acknowledgments

The authors would like to express their sincere gratitude to RMC and greatly appreciate the cooperation given by the representatives of the organisation in facilitating the data collection process. Authors would like also to thank all safety experts and academicians that have participated in developing and validating the questionnaire.

Funding

This study is a part of Master research project that was approved by the ethical committee and was funded by the Research Management Centre (RMC), University Putra Malaysia.

Conflict of interest

The authors declare that there is no potential conflict of interests.

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	A. SOCIO-DEMOGRAPHIC CHARACTERISTICS <i>A. CIRI-CIRI SOSIO-DEMOGRAFIK</i>		
1	Age / Umur:		
2	Marital Status / Taraf Perkahwinan:		
	 Single / Belum berkahwin Married / Berkahwin Divorced - Widow / Bercerai - Duda 		
3	Nationality / Warganegara:		
	 Indonesian / INDONESIA Bangladeshi / BANGLADESH Nepalese/ NEPAL Pakistani / PAKISTAN Others / Lain-lain Specify : 		
4	Educational Level / TarafPendidikan:		
	 Not attending / Tidak Ber Sekolah Primary education / Sekolah Rendah Secondary education / Sekolah Merengah College - Higher / Kolej - Institusi pengajian tinggi 		
5	How long have you been working in this company? Berapa lamakah anda telah bekerja di sektor pembinaan?		
	1. 1 - 2 years / 1 - 2 tahun		
6	Do you have any qualification on your current work? Adakah anda mempunyai apa-apa kelayakan bagi pekerjaan sekarang? 1. Yes/Ya 2. No/Tidak		
	B. SAFETY COMMITMENT B. KOMITMEN KESELAMATAN	YES Ya	NO Tida k
7	Do your supervisors and senior managers show an interest to Safety and Health in the construction site? Adakah pegawai atasan atau penyelia anda menunjukkan minat terhadap hal-hal berkaitan keselamatan dan kesihatan di tapak pembinaan?		
8	Does the management of your company provide you with all the safety equipment? <i>Adakah pengurusan syarikat anda menyediakan semua peralatan keselamatan?</i>		
9	Does your company provide you with all the necessary tools and machinery to fulfil your work safely? <i>Adakah syarikat anda menyediakan semua peralatan keselamatan dan sebarang mesin yang perlu bagi memastikan anda bekerja dalam keadaan selamat?</i>		
10	Did the company provide you Health and Safety trainings for your job? Adakah syarikat anda menyediakan latihan Kesihatan dan Keselamatan untuk anda?		

Appendix 1. Questionnaire used in the study

C. WORK-RELATED INJURIES C. KECEDERAAN BERKAITAN PEKERJAAN				
Have you experienced any accidents that cause injury to your body in the previous one year? Adakah anda mengalami sebarang kemalangan yang menyebabkan kecederaan kepada badan anda?				
If YES, please continue to answer the following questions: <i>Jika YA, sila terus menjawab soalan-soalan berikut:</i>				
Did you report it to your company? Adakah anda melaporkannya kepada syarikal	1?			
How serious was your injury? Bagaimanah tahap kecederaan anda?				
1. Serious (Received hospital treat <i>Teruk (menerima rawatan hospital)</i>	ment)			
2. Moderate (involving at least a day's work lost) Sederhana (melibatkan sekurang-kurangnya hilang satu hari tidak bekerja)				
3. Minor (needed immediate treatment but did not influence work) Kecil (memerlukan rawatan segera tetapi tidak mempengaruhi kerja)				
What was the cause of the accident? (please select one) Apakah punca kemalangan berlaku?(sila pilih satu)				
1. Slips and Trips <i>Tergelincir dan terjatuh</i>				
2. Lifting and Handling Mengankat dan pengendalian				
3. Falls from Height Jatuh dari ketinggian				
4. Struck by Objects Terpukul objek				
5. Others Lain-lain				