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Fatal Occupational Injuries among Non-governmental Employees in Malaysia

Adinegara bin Lutfi Abas, MBBS, MPH¹, Datuk Abd. Razzak B. Mohd Said, MD, MPH, AM², Mohammed Azman B. Aziz Mohammed, MBBS, LFOMRCP, CIME, MBA³, and Nalini Sathiakumar, MD, DrPH, MSPH⁴

¹Department of Community Medicine, Melaka Manipal Medical College, Jalan Batu Hampar, Bukit Baru, 75150 Melaka

²Pro Vice Chancellor & Chief Executive, Melaka Manipal Medical College, Jalan Batu Hampar, Bukit Baru, 75150 Melaka

³Social Security Organization (SOCISO), Menara Perkeso, 281, Jalan Ampang, 50538 Kuala Lumpur

⁴School of Public Health, University of Alabama at Birmingham. 1665 University Blvd, Birmingham, AL. 35294-0022

Abstract

Background—In Malaysia, surveillance of fatal occupational injuries is fragmented. We therefore analyzed an alternative data source from Malaysia’s Social Security organization, the PERKESO.

Methods—We conducted a secondary data analysis of the PERKESO database comprised of 7 million employees from 2002 to 2006.

Results—Overall, the average annual incidence was 9.2 fatal occupational injuries per 100,000 workers. During the five-year period, there was a decrease in the absolute number of fatal injuries by 16% and the incidence by 34%. The transportation sector reported the highest incidence of fatal injuries (35.1/100,000), followed by agriculture (30.5/100,000) and construction (19.3/100,000) sectors. Persons of Indian ethnicity were more likely to sustain fatal injuries compared to other ethnic groups.

Conclusions—Government and industry should develop rigorous strategies to detect hazards in the workplace, especially in sectors that continuously record high injury rates. Targeted interventions emphasizing worker empowerment coupled with systematic monitoring and evaluation is critical to ensure success in prevention and control measures.

Keywords

occupational injuries; fatal; transportation; agriculture; Malaysia

Corresponding author. Adinegara bin Lutfi Abas, MBBS, MPH, Professor, Department of Community Medicine, Melaka Manipal Medical College, Jalan Batu Hampar, Bukit Baru, 75150 Melaka, Phone: +6062925849 (office), Fax: +6062817977.

Conflict of Interest Statement:

We hereby submit the manuscript titled “Fatal Occupational Injuries among Nongovernmental Employees in Malaysia” for publication in *American Journal of Industrial Medicine*.

We wish to state here that there are no known conflicts of interest associated with this publication.

We also wish to state here that the manuscript is original and has never been published elsewhere.

INTRODUCTION

Globally, occupational injuries account for 100 million cases per year [Leigh et al., 1999]. Such injuries contribute up to 350,000 deaths [Concha-Barrientos et al., 2005] with developing countries having the highest injury fatality rate [Herbert et al., 2000; Takala 1999]. In United States (US), incidence of total work injuries in 2009 was 3.5 fatal work injuries/100,000 workers, down from 3.7 in 2008 [Bureau of Labor Statistics, U. S. Department of Labor, 2011]. Countries differ with regard to the most hazardous industry. Commercial fishing remains one of the most hazardous occupations in the US with an annual fatality rate of 129 deaths per 100,000 fishermen in 2008, while the average occupational fatality rate of 4 per 100,000 for all US workers [Lincoln et al., 2010]. The Republic of Korea reported an average fatality rate of 34 per 100,000 [Takala, 1999] with mining, agricultural industry and construction sectors being the most hazardous [Ahn et al., 2004]. With regard to cause, the Council of Labor Affairs in Taiwan noted that falls were the leading cause of work-related fatalities, and were higher among men compared to women (men, 7.4 per 100,000; women, 0.9 per 100,000) [Lin et al., 2008].

In Malaysia, a country undergoing rapid industrialization, there is no comprehensive surveillance system for fatal occupational injuries. We therefore undertook to examine an alternative data source that contained information on occupational injuries (fatal and non-fatal) and occupational diseases notified by non-governmental employees in seeking security and benefits.

We have previously analyzed the PERKESO (Malaysia's Social Security Organization) data on non-fatal occupational injuries and occupational diseases. Our study of non-fatal injuries found that the agricultural sector reported the highest incidence (24.1/1000), followed by the manufacturing sector subcategories of wood-product manufacturing (22.1/1000) and non-metallic industries (20.8/1000) [Abas et al., 2011]. Our study of occupational diseases found that workers in the non-metallic manufacturing had the highest incidence of hearing impairment and musculoskeletal diseases, compared to all other industries [Abas et al., 2008]. The aim of this study was to identify and calculate the incidence of fatal occupational injuries by year of occurrence, type of industry, sector, cause and other demographic variables.

METHODS

Study Population

We conducted a secondary data analysis using the PERKESO nationwide database from 2002 to 2006, the period for which computerized data were available. The study population comprised 7 million employees, which forms 68% of the country's total workforce [Department of Statistics Malaysia, 2006]. The residual 32% of the country's workforce who were PERKESO-ineligible were self-employed persons (16%) including workers in the informal sector, government employees (8%), and foreign employees (8%) [Department of Statistics Malaysia, 2006].

Socioeconomic Security

Malaysia's Social Security Organization, Pertubuhan Keselamatan Sosial (PERKESO), was first set up in 1971 to provide socioeconomic security for non-governmental employees working in the country [PERKESO, 2002]. Under the Malaysia's Employees' Social Security Act of 1969, it is mandatory for employers to insure their employees for workplace diseases or injury by contributing to PERKESO [PERKESO, 2010]. To qualify for employer contributions to PERKESO, an employee needs have a monthly wage of 3,000 or less Malaysian ringgits ([RM]; US\$850) [PERKESO, 2010]. Under the First Schedule of the

Act, employees who have been registered with PERKESO are mandated to continue their contributions even if they later start earning more than the RM 3,000 threshold [PERKESO, 2010]. Employees earning more than RM3,000 and those who have never been registered with PERKESO have an option to contribute; however most (90%) do not exercise this option. Four groups of employees are exempted by the Social Security Act: self-employed, foreign workers, government employees and domestic servants [PERKESO, 2002]. Self-employed are usually engaged in small businesses such as food peddling in urban areas, and in agriculture or fishing in rural areas. Foreign workers are primarily engaged in the manufacturing industry, food service, agriculture or domestic service. Government workers receive medical benefits including hospitalization for work-related injuries or diseases; however, these data are not reported to PERKESO.

We classified fatal occupational injury as death of an employee in the workplace as a result of any employment injury. The definition of fatal occupational injuries included also deaths outside of the workplace while on official duties. Fatal occupational injuries as a result of commuting accidents were excluded by definition. In the event of a fatal injury at the workplace, the deceased employee's next of kin is required to complete a specific form, known as "Form 21," which is then submitted to the nearest PERKESO office along with a certified copy of the death certificate issued by the attending hospital. A high proportion of workplace deaths can be expected to be notified through Form 21 as this is a required process prior to receiving monetary benefit for the next of kin. The data are then entered into the PERKESO national database by data entry clerks at any one of the PERKESO's 45 branches nationwide. Monetary benefits amounting to 90% of the deceased worker's salary is paid as monthly payments to the next of kin [PERKESO, 2010].

Data Collection

Prior to commencement of the study, two of the authors based in Malaysia (AA and AS) visited the PERKESO headquarters located in Jalan Ampang, Kuala Lumpur, to inspect and review their data stored in Microsoft Excel format. Form 21 was reviewed and contained the following variables: demographic information including name, age, gender, and ethnicity; employment-related information including the names of employers and types of industry; and occupational injury information, including cause of accidents, types of injury, locations of injury, causative agents, time of accident and place of reporting. Beginning in 2002, data from Form 21 have been entered into the PERKESO database; prior to 2002, paper copies were retained.

Classification Schemes of PERKESO

PERKESO classifies industries into sectors as follows: manufacturing; service sector (business services, rental and leasing services, health, social and related community services, recreational and cultural services, and personal and household services); trading; transportation; finance and insurance; agriculture; mining and quarrying; construction; utility services (electricity, gas, water and sanitary services); and hotels and restaurants (Table 1). Manufacturing is further subclassified into: machinery and metal; chemical, non-metallic, wood product; food and beverage; textile; and paper and printing [PERKESO, 2002]. Accident agents' classification includes machines, materials and substances, transport and lifting equipment, and working environment. Working environment refers to the actual working conditions that the worker is exposed to such as the working surfaces, confined quarters, stairs and floor. Causes of accidents are classified into: falls, being struck by falling objects and overexertion in lifting objects [PERKESO, 2002]. Types of injuries include fractures, dislocations, sprains and concussions [PERKESO, 2002].

Data Analysis

We conducted descriptive analysis on fatal occupational injuries using the available demographic and work-related variables. Crude incidence of selected fatal occupational injuries per 1,000 workers were computed by sector, manufacturing sub-categories, gender, ethnicity and age, as well as by injury characteristics according to calendar year. Incidence were calculated by dividing the number of injury cases for a specific category in a year by the number of employed persons for that category in that year, and multiplied by 100,000. Further, sector or sub-category incidence averages were calculated by first averaging the number of injury cases and the number of employees over the five years and then applying the formula to the averages. We obtained the denominator data for these computations from the PERKESO annual reports [PERKESO, 2002; PERKESO, 2003; PERKESO, 2004; PERKESO, 2005; PERKESO, 2006]. We used estimates from the employment data from the Labour Force Survey Report for the denominator data to compute age-, gender-, and ethnicity-specific incidence [Department of Statistics Malaysia, 2006]. To compute relative risks, we selected the industry with the highest incidence and compared to all other industries with regard to demographic, types of injury and other variables. Data were analyzed using Epi Info version 3.4.3 (US Centers for Disease Control and Prevention, Atlanta, Georgia, USA).

Ethical approvals—Ethical approvals were obtained from both the Institutional Ethics Committee of Manipal University, Manipal, India, and from the Institutional Review Board of University of Alabama at Birmingham, USA.

RESULTS

A total of 7,015,578 employees were registered with PERKESO by the end of 2006 (Table I). There was a 28% increase in the total number of employees from 5,482,698 in 2002 to 7,015,578 in 2006. From the year 2002 to 2006, most were employed in the manufacturing sector (26% to 28%), followed by the service sector (25% to 27%), and trading (14% to 16%). Two-thirds of all employers were in service, trading, and manufacturing (service sector: 33% to 34%; trading: 21% to 23%; manufacturing: 13% to 14%).

General Injury Patterns

Table II provides descriptive characteristics and average incidence for the overall group and for subgroups by year. From the year 2002 to 2006, the PERKESO data contained reports on 2,822 fatal occupational injury cases with an average incidence of 9.2 per 100,000 workers. The annual number of fatal occupational injury cases reduced by 16% from 2002 to 2006 (from 611 to 514). The incidence decreased by 34% from 2002 to 2006 (from 11.2 per 100,000 workers to 7.4 per 100,000 workers). This downward trend was noted in all subgroups pertaining to age, ethnicity, and industry. There was a decrease in the incidence for males (16.5 per 100,000 in 2002 to 10.7 per 100,000 in 2006), with slight reduction among female workers (1.5 per 100,000 in 2002 and 1.2 per 100,000 in 2006). The 19 to 49 year age group contributed 8% of cases (mean age at the time of death, 38 years). The annual average incidence increased with age. The 60+ years group had the highest annual average incidence (10.4 per 100,000) followed by the 50 to 59 year-old age group (4.9 per 100,000). An important note is that data on age were not available for 53% of cases.

Of 2,822 deaths, 95% were male and 5% were females. The annual average fatal occupational incidence was twelve-fold higher in men compared to women (men, 13.8 per 100,000; women, 1.2 per 100,000). Among the different ethnic groups, Malays comprised 47% of the total number of cases, followed by Chinese (25%), Indians (15%) and other

(12%). However, Indians had a higher annual average incidence (17.6 per 100,000), about a two-fold increase compared to Malays (8.7 per 100,000) or Chinese (8.1 per 100,000).

With regard to industries, the highest average incidence of fatal occupational injuries for 2002 through 2006 was in the transportation sector (35.1 per 100,000), followed by agriculture (30.5 per 100,000) and construction industry (19.3 per 100,000). The non-metallic products (11.2 per 100,000) industry had the highest rates within manufacturing subcategories.

Service sector contributed 24% of the cases during the five-year period, followed by manufacturing (16%) and trading (15%) sectors. Other sectors with high number of fatal occupational injuries included transportation, construction, and agriculture sector (14%, 14%, and 12% of total cases, respectively).

The distribution of cases by type, cause of injury and accident agents is displayed in Table III. The most common types of injuries were fractures (15%), unspecified wounds (8%), concussion and internal injuries (6%) and contusions and crushings (4%). The main causes of injuries were falling from height (28%), being struck by moving objects (17%) and struck by falling objects (9%). The main accident agents noted were transport and lifting equipments (53%), working environment (22%) followed by machines (5%).

Injury Patterns for Most Hazardous Sectors

Further results focus on the top three sectors ranked according to incidence of fatal occupational injuries: transportation (35.1 per 100,000); agriculture (30.5 per 100,000); and construction (19.3 per 100,000). For these three sectors, Table IV displays number and incidence of fatal injuries by demographic and injury-related factors, and Figure 1 displays the trend in incidence during the time period of the study. Table V provides relative risk for fatal injury in the transportation sector.

Transportation Sector—From 2002 to 2006, there was a 15% decrease in the number of fatal occupational injury cases (86 cases in 2002 to 73 cases in 2006) (Table IV). As displayed in Figure 1, in the same time period, the annual average incidence decreased by 34%, from 41.9 per 100,000 workers in 2002 to 27.5 per 100,000 workers in 2006. Employees in the 50 to 59 year-old age group and the 40 to 49 age group had the highest annual average incidence (24.4 per 100,000 and 21.8 per 100,000). However, the 40 to 49 year-old age group in the transportation sector had the highest relative risk (4.9) of incurring fatal occupational injury in comparison to the same age group in other industries (Table V). With regard to gender, men had about a 41-fold higher magnitude in annual average incidence of fatal occupational injuries compared to women (men, 53.7 per 100,000; women, 1.3 per 100,000). Men in the transportation sector had a relative risk of 3.9 of incurring fatal occupational injury as compared to men in other industries. Indians had the highest annual average incidence (98.9 per 100,000 workers) of occupational injury deaths as compared to Malays or Chinese (33.4 per 100,000 and 23.7 per 100,000, respectively). Further, Indians in the transportation sector were 5.7 times likely to incur fatal occupational injury when compared to Indians in other industries. Fractures (15%) and concussions and other internal injuries (4%) were the main types of injuries incurred. The main causes of accidents were falling from heights (33%), followed by being struck by moving objects (21%). When compared to other industries, falling from heights and being struck by moving objects in this sector had relative risks of 4.4 and 4.8 respectively when compared to all other industries (Table V). Transport and lifting equipments (69%) was the main accident agents followed by working environment (16%). Transport and lifting equipments had the highest relative risk of 4.9 in the transportation industry compared to other industries.

Agriculture Sector—From 2002 to 2006, the total number of fatal occupational injury cases declined by 36%, from 83 cases to 53 cases (Table 1V). Similarly, the annual average incidence also declined by 43%, from 40.1 per 100,000 workers to 23.0 per 100,000 workers (Figure 1). With regard to age, the 60+ had the highest incidence of 59.4 per 100,000 followed by the 30–39, and 50–59 age groups (30–39, 17.7 per 100,000; 50–59, 17.5 per 100,000). Similar to the transportation sector, workers of Indian ethnicity had the highest average annual incidence (29.4 per 100,000 workers) followed by Chinese and Malays (16.3 and 20.3 per 100,000 workers, respectively). Men had a 29-fold higher annual average incidence (46.4 per 100,000) as compared to women (1.6 per 100,000). Fractures (20%) were the main type of injury followed by concussion and internal injuries (6%). Falling from height (23%) and falling objects (22%) were the main causes of accidents. Similar to the transportation sector, transport and lifting equipments (37%) followed by working environment (20%) were the main accident agents.

Construction Sector—From 2002 to 2006, there was a 14% decline in the number of fatal cases, from 77 cases in 2002 to 66 cases in 2006 (Table 1V). The annual incidence reduced by 37%, from 22.0 per 100,000 in 2002 to 13.9 per 100,000 in 2006 (Figure 1). With regard to age, we noted a high average annual incidence among the 60+ and 50–59-year age groups (23.2 and 11.4 per 100,000, respectively). Among ethnic groups, both Malays and Chinese had an annual incidence of 17.7 per 100,000 and 17.1 per 100,000 respectively followed by the Indians with 16.3 per 100,000. Men had a 36-fold higher rate in annual average incidence compared to women (men, 29.0 per 100,000; women, 0.8 per 100,000). Fractures (19%), concussion and internal injuries (5%) were the main type of injuries in this sector. Fall from heights (30%) followed by struck by falling objects (16%) were the main causes of accidents. Similar to the previous findings, transport and lifting equipments (41%) and the working environment (28%) were noted as the main accident agents.

DISCUSSION

This is the first study of patterns of fatal occupational injuries among non-governmental employees using the PERKESO database which covers 68% of the total workforce in Malaysia [Department of Statistics Malaysia, 2006]. During the 2002–2006 time period, we noted a general trend of decline in both the annual number and annual incidence of fatal occupational injuries. Older workers in the 60+ and 50–59 age groups had higher annual incidence as compared to younger age groups. Men had higher annual average incidence compared to women. Employees working in the transportation sector had the highest rate of work-related fatal injuries, followed by the agriculture and the construction sectors. Within the transportation and the construction industries, the Indian ethnic subgroup had higher incidence compared to Malays or Chinese.

The main strength of this study is that two-thirds of the country's workforce was examined through the PERKESO database. Since PERKESO provides socioeconomic security to working Malaysians, the data captured are more comprehensive compared to the data received by Malaysia's Department of Safety and Health [Department of Safety and Health Malaysia, 2006]. However, some limitations are noted. First, the PERKESO data are structured for tracking and monitoring benefit claims and not for surveillance. Second, the data do not include information on selected categories of workforce who may be at high risk for occupational injuries such as foreign employees who may typically be employed in low-level jobs or self-employed workers engaged in farming. Third, certain PERKESO categories have the potential to be misclassified. For example, for classification of injuries by type, we noted 47% of total cases (8% as unspecified wound and 39% as unspecified injury) were classified in the unspecified category. In addition, only one entry is allowed in

the database for classification of injuries even if the worker had died of multiple injuries. For instance, a worker with contusion, fractures and superficial injuries might have only contusion entered for that variable. Finally, the data are not representative of certain industries such as mining and quarrying which are primarily operated by the government.

The annual average incidence of 9.2 per 100,000 workers noted in the study was higher than that reported in the US and Great Britain. The US Bureau of Labor Statistics reported an incidence of 4.0 per 100,000 [US Bureau of Labor Statistics, 2006a] while the Health Safety Commission of Great Britain recorded an even lower incidence of 0.71 per 100,000 [Health and Safety Executive UK, 2006]. Studies by Herbert et al [Herbert et al., 2000] and Takala [Takala, 1999] have noted higher incidence of fatal occupational injuries in developing countries (36.3 per 100,000 in Pakistan; 34.0 per 100,000 in Korea) as compared to developed countries. Developing countries may be vulnerable to hazards at workplace since they lack safeguards, expertise and public pressures to help in reducing injuries to the workers [Baram, 2009]. Our personal communication with PERKESO indicated that these factors might be a reason for high fatalities in Malaysia as well. The high rate of fatal occupational injuries in Korea may be further attributed to differences in surveillance system and employment estimation methods. [Ahn et al., 2004].

Our finding of decline in the incidence of fatal occupational injuries during the five-year period is consistent with the downward trend noted in other studies. Britain for instance, noted a decline in the incidence of fatal occupational injuries from 0.88 per 100,000 [Health and Safety Executive UK, 2002] in 2001/2002 to 0.71 in 2005/2006 [Health and Safety Executive UK, 2006]. Mustard et al., suggested that improved work organization and increased attention to safety and health at workplaces play a major role in the reduction of occupational injuries [Mustard et al., 2003]. The increased enforcement of regulatory requirements at workplaces by the Malaysia's Department of Safety and Health is an example of such effort. For instance, a strategic plan involving the provision of RM56 million (Ringgit Malaysia) under the 9th Malaysia Plan was drawn up to increase enforcement activities involving several sectors principally agriculture, offshore and public sectors [Department of Safety and Health Malaysia, 2006].

In this study, we observed that men had a twelve-fold higher magnitude of incurring fatal occupational injuries compared to women. Studies in the US [Stout et al., 1996; Bailer et al., 1998] and in Taiwan [Lin et al., 2008] have similarly found a higher risk of fatal occupational injuries among males compared to female workers. In general, men are more likely to have jobs that entail activities that are at high risk for occupational injuries and deaths.

We found that the transportation sector had the highest annual incidence of fatal occupational injuries, followed by the agriculture and construction sectors. The US Bureau of Labor Statistics reported high incidence of fatal occupational injuries in crop production, mining, transportation and warehousing, and construction sector (29.0, 23.5, 16.3, and 11.2 per 100,000, respectively) [US Bureau of Labor Statistics, 2006b]. The United Kingdom (UK) Labour Force Survey Report indicated that the agriculture, hunting, forestry, and fishing industries had the highest average incidence of fatal occupational injuries, with an incidence of 4.6 per 100,000 workers in 2006 [Health and Safety Executive UK, 2006]. This was followed by the construction sector and extractive and utility supply industry with incidence of 3.5 per 100,000 and 2.5 per 100,000, respectively [Health and Safety Executive UK, 2006].

Working in the transportation sector is known to be one of the most hazardous occupations [Mulloy et al., 2007]. Our study noted that falling from heights was the main cause of

accident in the transportation sector. This may occur because of movement and operation (such as loading and unloading) on and around the transportation vehicles or trucks [Shibuya et al., 2010]. Poor work practice, unsafe environment and lack of effective devices may contribute to the high fatality in this sector.

Our study also observed high incidence of fatal injuries in the agricultural sector, which is similar to the findings in the US [US Bureau and Labor Statistics, 2010] and the UK [Health and Safety Executive UK, 2006]. We noted falling objects and falling from heights as the main causes of accidents in this sector. In a study in the UK, Solomon reports that fatal accidents involving machineries, falling from heights and electrocution as the main causes of agriculture-related deaths [Solomon, 2002].

The construction sector had the third highest incidence of fatal occupational injuries in our study. Similarly, both the US [US Bureau of Labor Statistics, 2010] and the UK [Health and Safety Executive UK, 2006] reported a high incidence of fatal injuries involving construction workers. Some studies found that lack of safety training [Wong, 1994] and inadequate experience [Salminen, 1994] as factors that increase the risk of incurring accidents in this sector. We noted falling from heights as the main cause of accidents in this sector. Another study reported that falls account for a growing proportion of fatalities among construction workers and these hazards are often misjudged by workers [Huang et al., 2003].

We noted that workers of Indian ethnicity to have the highest incidence of fatal occupational injuries, specifically in the transportation and agriculture industries. Our previous studies also noted a higher occurrence of occupational diseases [Abas et al., 2008] and non-fatal occupational injuries [Abas et al., 2011] among Indian employees in Malaysia compared to other ethnic groups. It appears that Indians might be at a greater risk of occupational injuries as they are more likely to hold low-level high-risk jobs. It was noted in the Labour Force Survey report of 2006 that 25.7% of the Indian workforce was employed as machine operators or assemblers compared to 8.4% of the Chinese workforce and 15.2% of the Malays [Department of Statistics Malaysia, 2006]. Substantial ethnic disparities in incidence and outcome in traumatic occupational injuries were noted in Illinois, US [Friedman et al., 2008].

Prevention and Recommendation

Despite a general decline in the incidence of fatal occupational injuries from 2002 to 2006, certain sectors still record high rates of fatalities at the workplace. Rigorous strategies should be adopted to detect hazards in all industries, especially sectors that continuously record high injury rates such as the transportation, agriculture and construction sectors. Once these hazards are recognized, appropriate control measures should be implemented to eliminate these hazards where possible, by substitution and application of engineering modifications to the source of these hazards. For instance, transport and lifting equipments have been noted to be the primary agent involved in the industries with high fatal occupational injury rates (transportation, agriculture and construction industry). Operating procedures for appropriate handling of these equipments should be made readily available for all concerned workers. There should also be proper maintenance of these equipments. Other control measures include administrative policies such as rotation of workers in hazardous work areas and the implementation of rules pertaining to the use of personal protective equipments, where applicable.

In order to ensure safety in workplaces, Malaysia's Occupational Safety and Health Act was first enacted in 1994 [Occupational Safety and Health Act, 2006]. The purpose of this Act was to formulate safety and health policies at the workplace by requiring preventive and control measures at these sites. As mentioned earlier, rigorous measures should be

implemented at sectors with high risk of fatal injuries such as the transportation, agriculture and construction sectors. For instance, occupational injuries in transportation sector can be reduced by improving procedures involving loading and unloading on trucks and improving truck maintenance [Shibuya et al., 2010]. In the agriculture industry, there may be a need to evaluate and improve the design of farm tools used by farmers [Gite et al., 2000]. Falls account for a high proportion of fatalities in construction sites. Therefore, implementation of safety practices such as planning and organizing work in advance, ensuring that only competent workers are working at height, selecting appropriate equipments and ensuring walkways are free of obstructions would aid in the reduction of fatalities at these sites [Health and Safety Executive UK, 2010]. Enforcement activities would go a long way in ensuring implementation of safety practices in work sites are in place. In fact from the year 2005 to 2006, the regulatory body in Malaysia (The Department of Safety and Health) had further increased enforcement activities in several sectors including the agriculture and transportation sectors by 143% and 24% respectively [Department of Safety and Health Malaysia, 2006].

Moreover, employers can play a role in minimizing fatalities at the workplace, by ensuring suitable design and work processes for their employees. Training staff and regularly educating them on safety practices can further reduce occupational injuries. In the absence of a national surveillance system, the PERKESO database would prove useful in monitoring and tracking the number and rate of fatal occupational injuries. However, the database needs to be improved with all variables entered adequately so as to ensure precise and accurate reporting of fatal injuries in the country. For instance, the classification of the types of injuries may have to be improvised to minimize reporting of unspecified categories. Multiple entries for types of injuries should be allowed for subjects who died with multiple injuries. Data on the time of death from the time of accident were not available, thus depriving us of potential information on survivability of patients. These additional variables, if incorporated into the existing database would prove useful in both primary and secondary prevention of fatal occupational injuries. We also recommend that future projects or studies specifically looking at reasons of issues discussed be conducted to further improve our knowledge on fatal occupational injuries in this country.

Implementation of a national injury surveillance system would further ensure higher precision of reporting fatal occupational injuries in the country. This injury surveillance system, which includes players from both government and non-governmental sectors is essential for monitoring of occupational injury prevention programs.

CONCLUSION

We observed a general decline in both the annual number and annual rates of fatal occupational injuries reported to the PERKESO for the years 2002 to 2006. Workers in the transportation sector had the highest incidence of fatal injuries followed by employees working in the agriculture and the construction sectors. Falling from heights were the main causes of fatal accidents in the transportation and the construction sector while falling objects were noted as the main causes in the agriculture industry.

Results from this study should assist relevant stakeholders from both government and non-governmental sectors in the development of strategies that would see the reduction of fatal occupational injuries.

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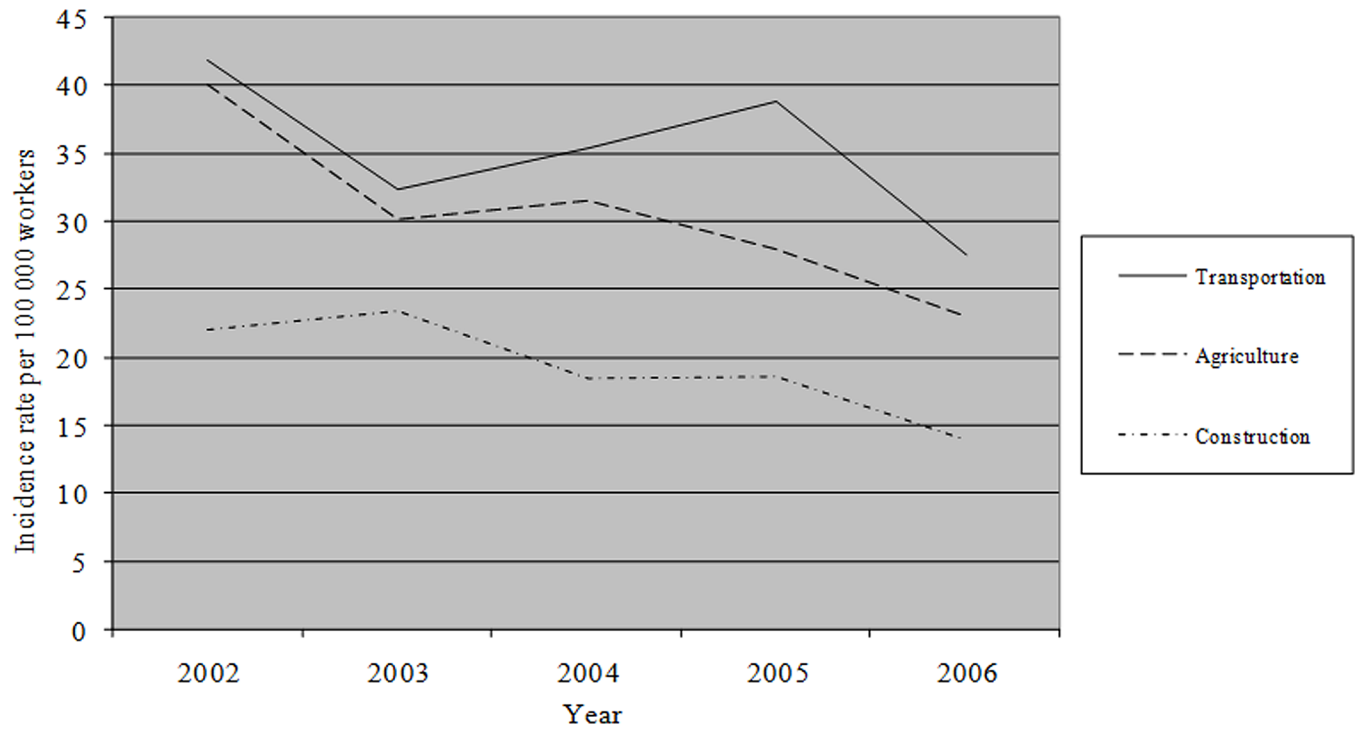


Figure 1.
Incidence rate of fatal occupational injuries in selected industries by year

Table I

Number of employees and employers in the PERKESO database, by year

	2002 N (%)	2003 N (%)	2004 N (%)	2005 N (%)	2006 N (%)
Employees					
Total	5482698 (100)	5706446 (100)	5977473 (100)	6472340 (100)	7015578 (100)
Manufacturing industry *	1541713 (28)	1584068 (28)	1633371 (27)	1725708 (27)	1853110 (26)
Machinery & metal	498506 (9)	507511 (9)	524513 (9)	547979 (8)	585645 (8)
Chemical	218440 (4)	226340 (4)	230569 (4)	244192 (4)	256737 (4)
Non-metallic	49612 (1)	48274 (1)	49876 (1)	50749 (1)	52590 (1)
Wood product	174419 (3)	177171 (3)	180508 (3)	193964 (3)	206249 (3)
Food & beverage	83962 (2)	88286 (2)	91399 (2)	95545 (1)	107191 (2)
Textile	162750 (3)	166294 (3)	168371 (3)	177705 (3)	182152 (3)
Paper & printing	106601 (2)	107847 (2)	111296 (2)	112622 (2)	123755 (2)
Service sector	1381322 (25)	1451711 (25)	1548981 (26)	1705898 (26)	1892698 (27)
Trading	775479 (14)	824215 (14)	887554 (15)	987103 (15)	1121287 (16)
Transportation	205261 (4)	216488 (4)	226097 (4)	247629 (4)	265018 (4)
Finance & insurance	208682 (4)	232026 (4)	210221 (4)	247696 (4)	242869 (3)
Agriculture	207082 (4)	202298 (4)	209340 (3)	229249 (4)	230838 (3)
Mining & quarrying	55119 (1)	55419 (1)	58035 (1)	60055 (1)	61061 (1)
Other †	1108040 (20)	1140221 (20)	1203874 (20)	1269002 (20)	1348697 (19)
Employers					
Total	477150 (100)	507853 (100)	542629 (100)	578390 (100)	612953 (100)
Manufacturing industry *	66640 (14)	69693 (14)	73383 (14)	75998 (13)	78839 (13)
Service sector	159006 (33)	170423 (33)	181679 (33)	195470 (34)	208386 (34)
Trading	101831 (21)	109750 (21)	119925 (22)	129980 (22)	139493 (23)
Transportation	17839 (4)	18314 (4)	19407 (4)	20501 (4)	21545 (4)
Finance & insurance	10891 (2)	11342 (2)	12009 (2)	12493 (2)	13062 (2)
Agriculture	13525 (3)	13876 (3)	14364 (2)	14888 (2)	15331 (2)
Mining & quarrying	2873 (1)	2941 (1)	3036 (1)	3097 (1)	3171 (1)
All other	104545 (22)	111514 (22)	118826 (22)	125963 (22)	133126 (22)

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* Manufacturing industry includes machinery & metal, chemical, non-metallic, wood product manufacture, food & beverage, textile, paper & printing and all other (residual).

† Includes construction, forestry, communications, hotel and restaurants and fishing.

Source: PERKESO Annual Report, Kuala Lumpur, 2002–2006

Table II

Distribution and rate* of fatal occupational injury cases reported to PERKESO by demographic characteristics and industry according to year

	2002		2003		2004		2005		2006		Average Rate	
	N (%)	Rate	N (%)	Rate	N (%)	Rate	N (%)	Rate	N (%)	Rate		
Total	611 (100)	11.2	570 (100)	10.0	589 (100)	9.8	538 (100)	8.3	514 (100)	7.4	2822 (100)	9.2
Age group (years)												
Unknown	310 (51)		310 (54)		320 (54)		278 (52)		266 (52)		1484 (53)	
15-18	10 (2)	3.2	1 (0)	0.4	7 (1)	3.0	3 (1)	1.4	5 (1)	1.8	26 (1)	2.0
19-29	103 (17)	4.5	82 (14)	4.1	70 (12)	2.9	69 (13)	2.5	69 (13)	2.7	393 (14)	3.3
30-39	74 (12)	4.3	67 (12)	3.9	82 (14)	4.5	67 (12)	3.2	49 (10)	2.3	339 (12)	3.6
40-49	56 (9)	4.4	56 (10)	3.9	62 (11)	4.2	69 (13)	4.2	62 (12)	3.8	305 (11)	4.1
50-59	42 (7)	6.2	41 (7)	5.4	26 (4)	3.5	38 (7)	4.7	43 (8)	4.7	190 (7)	4.9
60 and above	16 (3)	11.9	13 (2)	7.3	22 (4)	11.9	14 (3)	9.1	20 (4)	11.9	85 (3)	10.4
Mean ± sd	36.4 ± 12.8		37.9 ± 12.8		37.7 ± 13.0		38.7 ± 12.3		39.4 ± 13.6		38.0 ± 12.9	
Median	34		36		36		38		40		37	
Gender												
Male	583 (95)	16.5	548 (96)	15.1	557 (95)	14.6	521 (97)	12.5	484 (94)	10.7	2693 (95)	13.8
Female	28 (5)	1.5	22 (4)	1.1	32 (5)	1.5	17 (3)	0.8	30 (6)	1.2	129 (5)	1.2
Ethnicity												
Malay	296 (48)	10.7	280 (49)	9.6	270 (46)	8.9	265 (49)	8.0	219 (43)	6.1	1330 (47)	8.7
Chinese	166 (27)	10.6	138 (24)	8.6	124 (21)	7.2	126 (23)	6.9	152 (30)	7.7	706 (25)	8.1
Indian	83 (14)	18.2	90 (16)	19.3	103 (17)	21.3	81 (15)	15.2	78 (15)	13.6	435 (15)	17.6
Other [†]	66 (11)	9.6	62 (11)	8.7	92 (16)	12.4	66 (12)	8.2	65 (13)	7.4	351 (12)	9.3
Industry												
Manufacturing	96 (16)	6.2	99 (17)	6.2	91 (15)	5.5	79 (15)	4.6	78 (15)	4.2	443 (16)	5.4
Machinery & metal	34 (6)	6.8	41 (7)	8.1	38 (6)	7.2	35 (7)	6.4	31 (6)	5.3	179 (6)	6.8
Chemical	16 (3)	7.4	13 (2)	5.7	13 (2)	5.7	4 (1)	1.6	7 (1)	2.7	53 (2)	4.6
Non-metallic	8 (1)	16.1	6 (1)	12.4	4 (1)	8.0	6 (1)	11.8	4 (1)	7.6	28 (1)	11.2
Wood product	22 (4)	12.7	17 (3)	9.5	15 (3)	8.3	14 (3)	7.2	15 (3)	7.3	83 (3)	9.0
Food & beverage	8 (1)	9.5	10 (2)	11.3	12 (2)	13.2	9 (2)	9.4	9 (2)	8.4	48 (2)	10.4

	2002		2003		2004		2005		2006		Average Rate	
	N (%)	Rate	N (%)	Rate	N (%)	Rate	N (%)	Rate	N (%)	Rate		
Total	611 (100)	11.2	570 (100)	10.0	589 (100)	9.8	538 (100)	8.3	514 (100)	7.4	2822 (100)	9.2
Textile	3 (0)	1.8	6 (1)	3.6	3 (1)	1.8	8 (1)	4.5	3 (1)	1.7	23 (1)	2.7
Paper & printing	5 (1)	4.8	6 (1)	5.6	6 (1)	5.4	3 (1)	2.7	9 (2)	7.3	29 (1)	5.1
Service sector	137 (22)	9.9	136 (24)	9.4	156 (26)	10.0	117 (22)	6.9	137 (27)	7.2	683 (24)	8.8
Trading	99 (16)	12.8	86 (15)	10.4	93 (16)	10.4	74 (14)	7.5	75 (15)	6.6	427 (15)	9.5
Transportation	86 (14)	41.9	70 (12)	32.3	80 (14)	35.4	96 (18)	38.8	73 (14)	27.5	405 (14)	35.1
Finance & insurance	5 (1)	2.5	3 (1)	0.1	7 (1)	3.3	7 (1)	2.8	3 (1)	1.2	25 (1)	2.3
Agriculture	83 (14)	40.1	61 (11)	30.2	66 (11)	31.5	64 (12)	27.9	53 (10)	23.0	327 (12)	30.5
Mining & quarrying	12 (2)	21.8	8 (1)	14.4	6 (1)	10.3	5 (1)	8.4	7 (1)	11.5	38 (1)	13.2
Utility services (electricity, gas, water and sanitary services)	7 (1)	13.0	4 (1)	7.3	6 (1)	10.7	4 (1)	6.5	13 (3)	18.9	34 (1)	11.4
Construction	77 (13)	22.0	86 (15)	23.4	73 (12)	18.4	80 (15)	18.6	66 (13)	13.9	382 (14)	19.3
Hotels & restaurants	1 (0)	0.1	6 (1)	3.8	4 (1)	2.4	3 (1)	1.5	1 (0)	0.5	15 (1)	1.7
Communications	5 (1)	3.8	6 (1)	4.6	3 (1)	2.1	6 (1)	5.1	2 (0)	1.6	22 (1)	3.5

* Per 100,000 workers.

[†] Includes Eurasian, ethnic group of Sarawakian origin, ethnic group of Sabahan origin, Malaysian of other national origin

Table III

Distribution of fatal occupational injury cases reported to PERKESO by type of injury, cause of accident and accident agent according to year

Characteristics	2002 N (%)	2003 N (%)	2004 N (%)	2005 N (%)	2006 N (%)	Total N (%)
Total	611 (100)	570 (100)	589 (100)	538 (100)	514 (100)	2822 (100)
Type of injury						
Unspecified wounds	55 (9)	54 (9)	34 (6)	41 (8)	36 (7)	220 (8)
Superficial injuries	8 (1)	5 (1)	12 (2)	13 (2)	8 (2)	46 (2)
Fractures	94 (15)	71 (12)	76 (13)	96 (18)	77 (15)	414 (15)
Sprains and strains	5 (1)	5 (1)	4 (1)	4 (1)	8 (2)	26 (1)
Concussions & internal injuries	47 (8)	35 (6)	33 (6)	28 (5)	27 (5)	170 (6)
Contusions and crushings	21 (3)	16 (3)	24 (4)	25 (5)	29 (6)	115 (4)
Other [†]	381 (62)	384 (67)	406 (69)	331 (62)	329 (64)	1831 (65)
Cause of accident						
Struck by moving objects	103 (17)	83 (15)	83 (14)	102 (19)	108 (21)	479 (17)
Struck against stationary objects	12 (2)	20 (4)	15 (3)	22 (4)	23 (4)	92 (3)
Fall from height	218 (36)	177 (31)	137 (23)	151 (28)	103 (20)	786 (28)
Falling objects	52 (9)	50 (9)	62 (11)	38 (7)	42 (8)	244 (9)
Caught in between objects	25 (4)	30 (5)	28 (5)	33 (6)	39 (8)	155 (5)
Other [‡]	201 (33)	210 (37)	264 (45)	192 (36)	199 (39)	1066 (38)
Accident agent						
Working environment	161 (26)	122 (21)	123 (21)	113 (21)	107 (21)	626 (22)
Machine	23 (4)	37 (6)	31 (5)	16 (3)	37 (7)	144 (5)
Materials & substances	24 (4)	30 (5)	35 (6)	25 (5)	17 (3)	131 (5)
Transport and lifting equipments	321 (53)	298 (52)	317 (54)	302 (56)	268 (52)	1506 (53)
Hand tools	7 (1)	5 (1)	6 (1)	7 (1)	4 (1)	29 (1)
Other #	75 (12)	78 (14)	77 (13)	75 (14)	81 (16)	386 (14)

[†]Includes dislocations (1% of the grand total), amputations (1%), burns (2%), multiple injuries of different nature (13%), effects of electric current (1%), effects of radiation (0.035%), unspecified injuries (41%)

[‡]Includes stepping on objects (0.177% of the grand total), contact with hot substances (1%), over-exertion (1%), collapse slides and cave-ins (1%), exposure to heat (0.425%), strenuous movements (1%), exposure to radiation (0.106%), exposure to electric current (1%), unknown (25%)

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Includes other unspecified equipment (4% of the grand total), pressure vessels and furnaces (1%), ladders and mobile ramps (1%), refrigerating plants and installations (1%)

Table IV

Number, percent and rate* of reported fatal occupational injury by year, age group, ethnicity, gender, type of occupational injury, cause of accident and accident agent according to the agriculture industry, wood product industry and non-metallic industry

	Transportation		Agriculture		Construction	
	N (%)	Rate	N (%)	Rate	N (%)	Rate
Total	405 (14)	35.1	327 (12)	30.5	382 (14)	19.3
Year						
2002	86 (21)	41.9	83 (25)	40.1	77 (20)	22.0
2003	70 (17)	32.3	61 (19)	30.2	86 (23)	23.4
2004	80 (20)	35.4	66 (20)	31.5	73 (19)	18.4
2005	96 (24)	38.8	64 (20)	27.9	80 (21)	18.6
2006	73 (18)	27.5	53 (16)	23.0	66 (17)	13.9
Age group (years)						
15-18	0 (0)	0.0	3 (1)	7.5	5 (1)	6.8
19-29	31 (8)	8.5	39 (12)	11.5	57 (15)	9.0
30-39	60 (15)	18.2	54 (17)	17.7	44 (12)	7.6
40-49	57 (14)	21.8	39 (12)	16.1	39 (10)	8.6
50-59	33 (8)	24.4	22 (7)	17.5	27 (7)	11.4
60+	5 (1)	18.4	15 (5)	59.4	11 (3)	23.2
Ethnicity						
Malay	198 (49)	33.4	112 (34)	20.3	183 (48)	17.7
Chinese	78 (19)	23.7	50 (15)	16.3	98 (26)	17.1
Indian	94 (23)	98.9	26 (8)	29.4	27 (7)	16.3
Others	35 (9)		139 (43)		74 (19)	
Gender						
Male	400 (99)	53.7	321 (98)	46.4	376 (98)	29.0
Female	5 (1)	1.3	6 (2)	1.6	6 (2)	0.8
Type of injury						
Fractures	61 (15)	5.3	66 (20)	6.1	73 (19)	3.7
Sprains and strains	4 (1)	0.3	1 (0)	0.1	4 (1)	0.2
Concussions & other internal injuries	18 (4)	1.6	21 (6)	2.0	19 (5)	0.9
Superficial injuries	9 (2)	0.8	2 (1)	0.2	7 (2)	0.3

Cause of accident	Transportation		Agriculture		Construction	
	N (%)	Rate	N (%)	Rate	N (%)	Rate
Fall from heights	132 (33)	11.4	74 (23)	6.8	113 (30)	5.6
Falling objects	18 (4)	1.6	71 (22)	6.6	60 (16)	3.0
Struck by moving objects	86 (21)	7.4	27 (8)	2.5	47 (12)	2.4
Struck against stationary objects	14 (3)	1.2	3 (1)	0.3	11 (3)	0.5
Caught in between objects	21 (5)	1.8	14 (4)	1.3	22 (6)	1.0
Accident agent						
Machine	8 (2)	0.7	17 (5)	1.6	24 (6)	1.2
Transport & lifting equipment	281 (69)	24.6	121 (37)	12.0	156 (41)	7.6
Materials & substances	7 (2)	0.6	37 (11)	3.4	29 (8)	1.5
Working environment	66 (16)	5.7	66 (20)	6.1	108 (28)	5.1

* Per 100,000 workers.

Table V

Incidence rates* of reported fatal occupational injury and relative risks in transportation industry and other industries by age group, ethnicity, gender, type of occupational injury, cause of accident and accident agent

	Transportation				Other industries			
	Injuries	Average population at risk	Incidence rate	Injuries	Average population at risk	Incidence rate	Relative Risk	95% Confidence Interval
Age group (years)								
15-18	0	8503	0.0	26	218095	2.4	0.0	0.0 - 4.9
19-29	31	73117	8.5	362	1859590	3.9	2.2	1.5 - 2.9
30-39	60	65789	18.2	279	1672936	3.3	4.7	3.7 - 5.9
40-49	57	52187	21.8	248	1326041	3.7	4.9	3.9 - 6.2
50-59	33	27055	24.4	157	685357	4.6	4.6	3.4 - 6.2
60 and above	5	5429	18.4	80	138035	11.6	1.6	0.7 - 3.6
Ethnicity								
Malay	198	118346	33.4	1132	3008694	7.5	3.9	3.5 - 4.5
Chinese	78	65761	23.7	628	1671911	7.5	2.9	2.4 - 3.6
Indian	94	19009	98.9	341	483296	14.1	5.7	4.8 - 6.9
Gender								
Male	400	149030	53.7	2293	3788830	12.1	3.9	3.6 - 4.3
Female	5	82997	1.3	124	2110050	1.2	1.0	0.4 - 2.4
Type of injury								
Fractures	61	232027	5.3	353	5898880	1.2	3.9	3.1 - 4.9
Sprains and strains	4	232027	0.3	22	5898880	0.1	4.1	1.7 - 10.0
Concussions & other internal injuries	18	232027	1.6	152	5898880	0.5	2.8	1.8 - 4.3
Superficial injuries	9	232027	0.8	37	5898880	0.1	5.2	2.9 - 9.3
Cause of accident								
Fall from heights	132	232027	11.4	654	5898880	2.2	4.4	3.8 - 5.2
Falling objects	18	232027	1.6	226	5898880	0.8	2.0	1.3 - 3.0
Struck by moving objects	86	232027	7.4	393	5898880	1.3	4.8	3.9 - 5.8
Caught in between objects	21	232027	1.8	134	5898880	0.5	3.6	2.4 - 5.3
Accident agent								

	Transportation				Other industries				95% Confidence Interval	Relative Risk
	Injuries	Average population at risk	Incidence rate	Injuries	Average population at risk	Incidence rate	Injuries	Average population at risk		
Machine	8	232027	0.7	136	5898880	0.5	1.5	0.8 – 2.9		
Transport & lifting equipment	281	232027	24.6	1225	5898880	4.2	4.9	4.4 – 5.5		
Materials & substances	7	232027	0.6	124	5898880	0.4	1.4	0.7 – 2.9		
Working environment	66	232027	5.7	560	5898880	1.9	2.8	2.2 – 3.5		

* Per 100,000 workers.