Journal of Forensic and Legal Medicine 29 (2015) 25–29

Contents lists available at ScienceDirect

Journal of Forensic and Legal Medicine

journal homepage: www.elsevier.com/locate/jflm

Review

Occupational fatalities in Jordan

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ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form
1 November 2014
Accepted 4 November 2014
Available online 13 November 2014

Keywords:
Fatalities
Accident
Occupational
Jordan

ABSTRACT

Objective: Occupational fatalities are a worldwide problem. Certain occupations pose a greater risk than others. Recent statistics on global occupational injuries and diseases that might lead to temporary or permanent disability and even worse might lead to death, are staggering. The purpose of this study was to estimate the death rates from occupational injuries in Jordan over a period of four years; to estimate occupational fatality rate that results from accidental injuries and identify the most risky concurrent occupations with the type of injuries, the age and nationality of the victims.

Method: A total of 88 work related fatalities were admitted to three hospitals in Amman through 2008–2012 and were examined by a forensic (occupational) physician at the time. They were categorized according to, age, nationality, occupation, type of injury and were all tested for toxic substances.

Results: The occupation with the most fatalities was construction (44%); falling from a height was the commonest type of accident (44%) and head injuries were the leading injury type (21.6%); 9.1% of the deaths were positive for alcohol. Moreover, 22.7% of deaths were between ages of 25–29. Consequently, the mean occupational fatality rate was 2 per 100.000 workers during 2008–2012.

Conclusion: Constructions and other types of occupations are more extensive problems than what is usually anticipated, especially when safety precautions are not effective or implemented. They may cause injuries and death, which will have a socioeconomic burden on families, society, governments and industries. Not to mention the grief that is associated with the death of a worker at his work site to all concerned parties.

1. Introduction

Occupational injuries and fatalities have become a major interest for countries and companies especially in the last decade, due to the cost of such accidents and the subsequent loss of 4% of the gross domestic product worldwide; as well as the socioeconomic burden that results from work related diseases and injuries.[1,2]

According to the ILO (International Labor Organization), an occupational accident is an incident that occurs in the course of work and results in a fatal or non-fatal injury. Among the world's 2.7 billion workers at least 2 million deaths per year are attributable to occupational diseases and injuries; meanwhile, the WHO (World Health Organization) estimated that occupational injuries result in approximately 330.000 deaths per year per 2.7 billion workers.[3–5]

In the Middle East and in developing countries, mortality rates tend to be higher.[5]

Work-related injuries are frequently separated into three groups, injuries that occur in traffic incidents, injuries that occur while traveling to or from work (commuting injury) and injuries that occur in the course of work.[1,2,4]

The ILO leading causes of occupational deaths are obstructive pulmonary diseases followed by unintentional injuries and lung cancer. Some sectors or occupations like agriculture and construction, are more hazardous than others, being responsible for 8.8% of the global burden of mortality.[5,6] One of the determinants in occupational hazards is age, especially with young and inexperienced workers at greater risk when training and supervision are inadequate, but also among elderly workers who sustain greater risks than their younger peers because of decline in physical and cognitive abilities. Hazards are magnified among migrants in some countries.[5–7]

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http://dx.doi.org/10.1016/j.jflm.2014.11.001
1752-928X/

According to Jordanian Law, all occupational fatalities are considered as medico-legal deaths and a full autopsy and toxicological screen should be done. This is a necessary procedure either to determine the responsibility of the employer or because the insurance or social security compensation depends on it. In an earlier period, 1980–1993, the Jordanian occupational fatality rate was 25 per 100.000 per year from a study mainly relying on social security figures.[8]

However, in our study we aim to:

1) review all cases of occupational fatalities that were registered in the forensic laboratory in three hospitals in Amman to determine the type of occupational fatalities and their occurrence and see whether the mortality rate has changed due to the change in the Jordanian industrial advancement,
2) Describe the major pattern of injuries that caused the death. We believe that work place fatal and non-fatal injuries produce a tremendous load on workers, their families and society when few resources exist for injury prevention, treatment and rehabilitation.

After all, occupational health should be achieved by the endorsement and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations, by providing safe working conditions for each worker in his or her work site.

2. Methods

This study was conducted through February 2008–November 2012 and relied on the forensic entries for deaths in three major Hospitals in Amman, these were Jordan University Hospital (JUH), Prince Hamzeh Hospital (PHH) and Prince Faisal Hospital (PFH) respectively. These three hospitals had reported a total of 1676 traumatic injury deaths that were examined by forensic physicians in that five year period; out of these deaths a total of 88 deaths were identified as occupational deaths resulting from accidents; none of the deaths were due to occupational diseases. Fatality ages ranged between 15 and 50 years. Cases were examined according to age, gender, leading cause of death, injury pattern, type of occupation as well as nationality of the deceased. Toxicological tests were carried out in all deaths to see whether these deaths had occurred due to drug abuse or alcohol intake during the course of work. Gas Chromatography/flame ionization detector (GC/FID) was used to test alcohol levels; Gas Chromatography/Mass spectroscopy (GC/MS) was used to test drug levels in biological samples obtained.

Data on the annual average estimate of the Jordanian work force was obtained from the ministry of labor. Exclusion criteria: all deaths included in this paper were medico-legal cases related to work. Permission to report the results was approved by the Institutional Review Board, Ethics Committee of JHU (J IRB/2014/1).

3. Statistical analysis

This was a descriptive modeling study. The required data were collected on the basis of research purposes using a checklist. The list of variables in the study included report number, gender, age, date of death, nationality, occupation, type of death, consequence of the death, cause of death, and laboratory reports. Data were analyzed using “SPSS 17”, descriptive statistics, Chi-square and Trend analyses were used as appropriate.

4. Results

This study investigated characteristics of occupational fatalities in Jordan during the period 2008 to 2012. Upon forensic examination, 99% of the deaths were males (Table 1) and the leading age group was 25–29 years (22.7%), followed by 35–39 years (18.2%) and 18–24 years (17.0%). However, the average age of occupational fatalities was 33.08 years (Table 2).

Table 1
Upon forensic examination, 99% of the deaths were males.

Gender	*n* (%)
Male	87 (98.86)
Female	1 (1.14)
Total	**88 (100)**

The highest rate of fatality was in August (10.2%), followed by October (9.1%).

However, in 37 cases (42.0%), there was no data of the month available (Table 3A and Table 3B).

Construction workers in addition to governmental, military, security and police force workers constituted the two major groups in this study, with 44.3% and 17%, respectively (Table 4). The highest cause of death was falling from a height (44.3%), followed by electrocution (17%), falling objects directly on the victim (17%), being hit by a vehicle and collapse of soil dumps (5.7%) (Table 5).

Head injury was the commonest type of injury among occupational fatalities (21.6%), followed by thoracic and abdominal organ injuries (18.2%) of the cases examined. Moreover, 17% of deaths were caused by multiple injuries and electrocution. Pulmonary thromboembolism was the cause of death in (4.5%) of fatalities (Table 6).

The percentage distribution of laboratory investigation toxicology reports showed that alcohols and potential poisons were negative in 54.5% of the death. There was no sample sent in 21.6% of cases.

The presence of ethyl alcohol/poison was detected in 9.1% (Table 7).

Occupational fatality rate is defined as the number of occupational fatal death per 100000 persons employed in all sectors.

$$[= (\text{No of fatal death}/\text{total workers})*100000]$$

$$= (88/4431794)*100000 = 1.99$$

Through the study period from 2008 to 2012 from the three hospitals the mean calculated occupational fatality rate was 2 per 100,000 (Table 8).

Table 2
Age of occupational fatalities. The leading age group is 25–29 years (22.7%), followed by 35–39 years (18.2%) and 18–24 years (17.0%). However, the average age of occupational fatalities was 33.08 years old.

Age interval	*n* (%)
<18	1 (1.1)
18–24	15 (17.0)
25–29	20 (22.7)
30–34	14 (15.9)
35–39	16 (18.2)
40–44	11 (12.5)
45–49	9 (6.8)
50 and above	5 (5.7)
Total	**88 (100)**

Table 3A
The highest rate of fatality was in August (10.2%), followed by October (9.1%).

Month	*n* (%)
January	4 (4.5)
February	1 (1.1)
March	5 (5.7)
April	2 (2.3)
May	7 (8.0)
Jun	4 (4.5)
July	6 (6.8)
August	9 (10.2)
September	4 (4.5)
October	8 (9.1)
November	1 (1.1)
December	0 (0.0)
Total	51 (58.0)
Missing	37 (42.0)
Total	**88 (100)**

Table 3B

Week	*n* (%)
First	13 (14.8)
Second	10 (11.4)
Third	12 (13.6)
Fourth	16 (18.2)
Total	51 (58.0)
Missing	37 (42.0)
Total	88 (100)

5. Discussion

Over the last 100-years, both occupational accidents and fatal work related diseases have increased; 960.000 workers are injured each day and 5330 people die because of work related diseases.[1] According to the ILO, there were 25,864 work related deaths including 20,395 work-related diseases in the Arab World in 2003.[9] There were also 5,141,097 accidents that caused at least 4 days absence in that year.[9]

The best estimates of the annual number of deaths of workers arising from occupational exposure worldwide is 2 million comprising about 350,000 injury deaths and about 1.65 million disease deaths; this estimate doesn't include commuters and relate to the beginning of the 21st century (2000–2005).[4,12,13] While others estimated that 1.1 million work-related deaths occurred annually comprising deaths from occupational, commuting accidents and work related diseases.[1] Two hundred and sixty three million occupational accidents occur annually that result in at least four days of absence from work.[1,12,13]

The two major types of deaths usually encountered at job sites are accidents and natural deaths. Moreover, occupational accidents which result from lethal injuries, could be either fatal accidents or accidents causing at least four days of absence from work.[1,10] And some of these accidents result from the lack of precautionary measures or employee's lack of caution, long working hours, constant change in working shifts, bad physical well-being, cognitive impairment due to influence of drugs of abuse including alcohol.[10,11] This study revealed that ethyl alcohol was detected in 9.1% of the cases, and different poisons/medications were reported

Table 4
Occupation distribution of occupational fatalities. Constructions workers and 'governmental, military and security or police force worker's were the major group with 44.3% and 17%, respectively.

Occupation	*n* (%)
Construction	39 (44.3)
Mechanical repairing and maintenance	14 (15.9)
Electricity field	10 (11.4)
Mining	2 (2.3)
Governmental, military and security or police force	15 (17.0)
Medical	1 (1.1)
Other fields like restaurants servants, building watchers	7 (8.0)
Total	**88 (100)**

Table 5
The higher rate of death caused by falling from a height (44.3%), then electrocution (17%) and falling objects directly on the victim (17%), hit by a vehicle and collapse of soil dumps (5.7%).

Type of death	*n* (%)
Falling from a height	39 (44.3)
Falling object directly of the victim	15 (17.0)
Hit by a vehicle	5 (5.7)
Electrocution	15 (17.0)
Collapse of soil dumps	5 (5.7)
Accidental gun shot	2 (2.3)
Explosions	3 (3.4)
Fire (Medical ether)	1 (1.1)
Machinery pelt	2 (2.3)
Suffocation	1 (1.1)
Total	**88 (100)**

Table 6
Head injury was the higher rated type of injury among occupational fatalities by (21.6%) and thoracic and abdominal organs injuries were in 18.2% of the cases examined. Moreover, 17% of the deaths were caused by multiple injuries and electrocution. Pulmonary thromboembolism was in (4.5%) of the fatalities.

Cause of death	n (%)
Multiple injuries	15 (17.0)
Thoracic and abdominal organs injury	16 (18.2)
Head injury	19 (21.6)
Electrocution	15 (17.0)
Multiple injuries and asphyxia	1 (1.1)
Asphyxia	3 (3.4)
Burns	1 (1.1)
Abdominal organs injury	2 (2.3)
Pelvic organs injury	2 (2.3)
Pulmonary thromboembolism	4 (4.5)
Cardiac tamponade	2 (2.3)
Gun shot	2 (2.3)
Septicemia and pneumonia due to multiple injuries	1 (1.1)
Bomb explosion	1 (1.1)
Traumatic asphyxia	2 (2.3)
Neurogenic shock due to massive laceration	1 (1.1)
Hemorrhagic shock due to lower limb injury	1 (1.1)
Total	**88 (100)**

Table 7
Toxicological screen results. The percentage distribution of laboratory investigation toxicology report showed that alcohols and potential poisons were negative in 54.5% of the deaths, it was followed by not sent in 21.6%, the presence of ethyl alcohol/poison negative 9.1%.

Laboratory investigation report	*n* (%)
Alcohol poisons negative	48 (54.5)
The presence of ethyl alcohol/poison negative	8 (9.1)
Phenobarbital positive	2 (2.3)
Not sent	19 (21.6)
The presence of metronidazole/alcohol negative	2 (2.3)
The presence of paracetamol	2 (2.3)
The presence of atracurium, atropine, phenobarbital, thiopental/alcohol negative	1 (1.1)
The presence of phenytoin/toxins negative	1 (1.1)
Carboxyhemoglobin/alcohol toxins negative	2 (2.3)
The presence of ketamine and atracurium.	1 (1.1)
The presence of pentobarbital	2 (2.3)
Total	**88 (100)**

Table 8
Through the study period from 2008 to 2012 from the three hospitals the mean calculated occupational fatality rate was 2 per 100,000. Number of employees, occupational fatalities, fatality rate and corresponding mean in Jordan between 2008 and 2012.

Year	Employees	Fatal death	Fatality rate
2008	783,156	16	2.04
2009	830,225	19	2.29
2010	876,539	20	2.28
2011	951,469	16	1.68
2012	990,405	17	1.72
Total	4,431,794	88	1.99

in 13.8% of the cases, which could be the reason of the accident in first place.

In another study in the US between 2005 and 2009, only 69% underwent toxicology tests. Younger workers had greater odds of being tested. Of the 280 cases with toxicology tests completed, 22% ($n = 61$) were found to have positive toxicology testing. Commonly identified drug classes included cannabinoids and alcohols.[21]

In this study, job related deaths fall into main categories: falls or falling objects in a construction site, motor vehicle accidents, machinery related events and electrocutions. Head injury was the most prominent type of injury causing deaths.

Work related hazards are especially severe in the developing countries, the occupational fatality rate in advanced industrial countries such as the USA is approximately 5.5 per 100.000 workers, Latin America and the Caribbeans have an occupational fatality rate of 13.5 per 100.000, while the Korean republic has 34 per 100.000.[6]

According to our findings through 2008–2012 from the three hospitals, the mean calculated occupational fatality rate that resulted from accidents was 2 per 100.000 workers.

Review of the available information indicates that injury death rates vary according to sex and age groups; males represent more than 99% of the deaths and a steady rise in the risk from the youngest age groups to about 64 years.[15] In our study the percentage distribution of gender were as follows: Males formed the major group with 98.86% ($n = 87$), there was only one female case, a 28 year old from Indonesia working as a house maid, the cause of death was falling from a height due to the difficulty arising in certain occupations where women usually don't have the experience or don't fit in place in such occupations. The leading age group was 25–29 years (22.7%).

In a similar study in the U.S between 2003 and 2008, fatality rate was 0.8 per 100,000 workers per year. The leading causes of occupational death were as follows: motor vehicle (31%); falls (29%); assaults and violent acts (20%); and contact with objects/equipment (18%). Fatality rates were 15 times higher in men compared with women. Workers aged 65 years experienced the highest fatality rate of all age groups.[19]

Another study investigated characteristics of occupational accidents in Turkey between 1997 and 2005. It was found that the fatality rate was 15.6 per 100,000. Furthermore it was established; 1) 96.1% of injured persons were males, 2) the leading age group was 25–29 years old (24.3%), 3) the highest cause of injury was 'falling objects' (16%).[20]

While the numbers of worldwide work place injury, illness and deaths are overwhelming; there is considerable evidence that these reported rates underestimate of the actual numbers of injuries and illnesses. Under reporting occurs both at individual and organizational levels. Under reporting occurs for several reasons, the injury or illness is minor, the reporting procedures are erroneous, the organizations discourage the reporting of injuries or illnesses and the criteria of defining accidents injuries and illnesses are confusing. Under reporting of occupational injuries ranges from 10% in the United States to 85% in rural Africa.[14,15]

Little concern is shown for safety issues because of low marginal profits, and the majority of the labor force in some sectors are immigrants, labor is plentiful anywhere and its replacement cost is low, a high portion of the real cost of the injury and illness will not be borne by the employer, in our study we found that 37.5% of the deaths recorded in Jordan were not Jordanian of which 33% were Egyptian.

Injuries at work are largely preventable by improvements to make work safer and healthier, improved engineering controls, administrative policies of health and safety information. Education and awareness strategies on health life style can be used to promote safety attitudes and behaviors and are needed worldwide.[14] In one study, Obesity, smoking and musculo-skeletal disorders were associated with injury risk in workers aged more than 45 years old. Smoking was also an injury risk factor for workers aged less than 30 years old.[11] Therefore, surveillance data must be improved and developed to provide the basis for targeting preventive measures towards high risks work groups, including drug abusers and alcoholics.

In this study the highest rates of deaths were occurred in August and October with 10.2% and 9.1%, respectively. The death rate in May was 8% and in July 6.8%, The death rate reduction in other months may be explained by the fact that 'hours worked per day' (which generally goes up in summer and down in winter) is positively correlated with the occurrence of work place fatalities in all industries, which means that more hours worked per day are related to more work related fatal incidents.

Companies' prevention activities focus more often on occupational accidents than on work related diseases, where current exposures usually lead to ill health. This is so because either the level of exposure is underestimated or the risk posed by exposures (single or combination) is not properly recognized.[1] Moreover, cost effectiveness research on occupational health topics is rare.[2,16]

The majority of work place deaths are preventable and the technology exists to prevent the majority of other work related fatalities.

6. Conclusion

Workers around the world, despite the vast differences in their physical, social, economic and political environments face virtually the same kinds of chemical, biological, physical and psychosocial work place hazards. Ironically, more than 80% of the world's work force inhabit the developing world and bear more than 80% of the global burden of occupational diseases and injuries. They face unregulated and unreported exposure to known hazards such as silica and asbestosis.[2] Ultimately; working conditions in these countries seldom meet the minimum standards required by international agencies.[18]

Key elements in improving worker health and safety include: regulatory and enforcement framework, enhancement of workers, employers and health professional's education. Implementation of adequate surveillance and reporting systems for accidents and diseases at work place. Dissemination and implementation of best work related practices.[2]

Conversely, in developed countries there are compelling economic incentives for employers to control risks for injuries and illness on the job. Especially that result in demonstrable near term lost work or function, these include high cost of medical care, the burden of worker compensation payments, high replacements cost of the labor, risk of litigation and liability and business consequences of publicity.[17]

Organizations are being increasingly held liable for contributing to unsafe or unhealthy work places, failing to address known work place hazards and failing to inform employees of these hazards.[18]

Conflict of interest

There were no financial or other relations that could lead to a conflict of interest.

Funding

None.

Ethical approval

Permission to report the results was approved by the Institutional Review Board, Ethics Committee of JHU (J IRB/2014/1).

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