

Occupational injury in the United Arab Emirates: epidemiology and prevention

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Background	The United Arab Emirates (UAE) is developing rapidly, with many foreign construction, farm and industrial workers.
Aims	To assess the epidemiology of occupational injury hospitalizations using a trauma registry.
Methods	Surgical admissions from March 2003 to April 2005 were recorded in the registry at the main trauma hospital in Al Ain city (population 348 000). Prevention-related variables were analysed using SPSS and severity was quantified by injury severity scores (ISS).
Results	There were 614 occupational injury hospitalizations, an incidence of ~136/100 000 workers/year. Males accounted for 98% of injuries, the 25–44 age group for 69% and non-nationals for 96%. External causes included falls 51%, falling objects 15%, powered machines 11%, animal-related 7% and burns 6%. Median ISS was 4 for all six main external causes. Extremities were most frequently injured, followed by chest, head and neck, abdomen and face. Mean hospitalization duration was 9.4 days, with 36% hospitalized for >1 week.
Conclusions	The main external causes were proportionately much more frequent than in industrialized countries. Effective countermeasures are needed to reduce the incidence and severity of occupational injury among vulnerable migrant workers in the UAE.
Key words	Burns; camels; epidemiologic factors; falls; incidence; occupational; prevention and control; protective devices; safety; wounds and injuries.

Introduction

The United Arab Emirates (UAE) is rapidly developing with high revenues from oil exports. The desire of the leadership to diversify the economy has led to many fast-paced construction sites, farms, factories and workshops, together with supporting infrastructure, employing many foreign workers. In 2003, the population was estimated at 4 million, with 78% non-nationals [1,2].

Unintentional ('accidental') injuries, at 27 per 100 000 population, were the second most frequently reported cause of death in the UAE during 2004, after

cardiovascular disease (36/100 000) and ahead of cancer (12/100 000) [3]. In 2007, improved death reporting showed injury to be the leading cause in the largest Emirate, Abu Dhabi, accounting for 23% of fatalities [4].

The rapid development of projects employing large numbers of expatriates has often outstripped the ability of education, health and labour ministries to train and deploy adequate numbers of industrial hygienists and safety inspectors to protect workers' health and safety. Considering that so many workers are in hazardous occupations, surprisingly little has been published on epidemiology and prevention of occupational injuries.

Al Ain is the second largest city in Abu Dhabi Emirate and dispersed over about 30 × 20 km. Buildings over four stories are not allowed. While it is a rapidly growing university and government city, it is also agricultural with several large active date palm oasis farms, differing from Dubai or Abu Dhabi where there are more major construction projects involving much higher buildings. Because a trauma registry was established in Al Ain, data were used to assess external causes, risk factors and severity of hospitalizations for occupational injuries with a view to improving their prevention.

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Methods

The Al Ain Trauma Registry was established in 2003, recording data on all injured patients admitted for >24 h to surgical wards of the main general and trauma hospital, as well as on in-hospital trauma deaths. Fatalities at the trauma scene or during transport were not included. During the study, Al Ain Hospital treated >80% of severe trauma cases in Al Ain, a modern desert city of ~348 000 people, the fourth largest in the UAE. Data were available for 26 months of hospitalizations, from March 2003 to April 2005 inclusive.

The Ethics Committee of Al Ain Health District approved data collection for all trauma patients admitted to Al Ain Hospital, including injured workers. This study used non-nominal data.

Using the appropriate variables, occupational injuries, defined as injury during work-related activity, were selected. The data file was reduced by restricting fields to prevention-oriented variables including external causes and type of incident; personal factors of age, sex, nationality and marital status; time of day; occupation and place of injury where available; nature of injury including anatomical location and severity score, and hospitalization duration. Data on the industries in which injuries occurred and on any safety measures employed were not available, nor could traffic injuries during work be reliably distinguished from other occupational injuries.

The number of injuries by injury severity score (ISS) region was calculated for each main external cause. Category six, superficial injury (external in ISS), was excluded. As another indicator of severity for falls, the number of spinal injuries was assessed together with calcaneus fractures of the foot.

ISS was calculated manually using the Abbreviated Injury Scale handbook [5]. ISS provides a single aggregate score for all bodily injuries. It is derived from the Anatomical Injury Score (AIS), which divides the body into six anatomical regions, assigning each a severity score between 1 and 5. The ISS is calculated as the sum of squares

of the three highest AIS scores from different regions and ranges between 1 and 75 [6].

Data analysis used SPSS; after reviewing frequencies, cross-tabulations and figures were prepared. To enable calculation of a crude occupational injury admission incidence rate, the 2003 population of Al Ain as 8.6% of the UAE total of 4.04 million was used to determine the proportion of the UAE workforce of 2.42 million likely to be present in Al Ain region, i.e. 207 862 [1]. UAE nationals represented 29% of the population in Al Ain compared with only 19% in Abu Dhabi city. Only 49% of nationals were aged ≥20, and few worked as manual workers in these sectors. Since non-nationals accounted for 97% of deaths from falls in the 20–64 age range [3], the true proportion of non-citizen workers in trades and agriculture may have been nearly 100%.

Results

There were 614 occupational injury admissions, averaging 283 annually. Of all trauma registry admissions, ~30% were occupational. With an estimated 207 000 workers in the Al Ain region, the annual incidence of occupational injury hospitalizations was estimated at 136 per 100 000 person-years. The demographic profile of injured workers showed that 37% were aged 25–34, 32% 35–44, 14% 45–54, 8% 20–24, 4% were >55, 3% 0–14, 2% 15–19 and in 0.2% (one) age was unknown; 98% were males. Nationalities included Pakistani 27% (166), Indian 24% (148), Bangladeshi 19% (116), Egyptian 7% (42), other Arab 9% (56), other non-Arab, 6% (38), Afghan 4% (24) and Emirati 31% (24).

Falls were the main external cause of admissions, accounting for 51%, followed by being struck by falling objects, injuries by machinery and power tools, animal injuries and burns (Figure 1). Since 31% of animal-related injuries resulted from falls, falls actually represented 53% of admissions. For non-animal-related falls, 29% (90/314) were from considerable heights, although the estimated

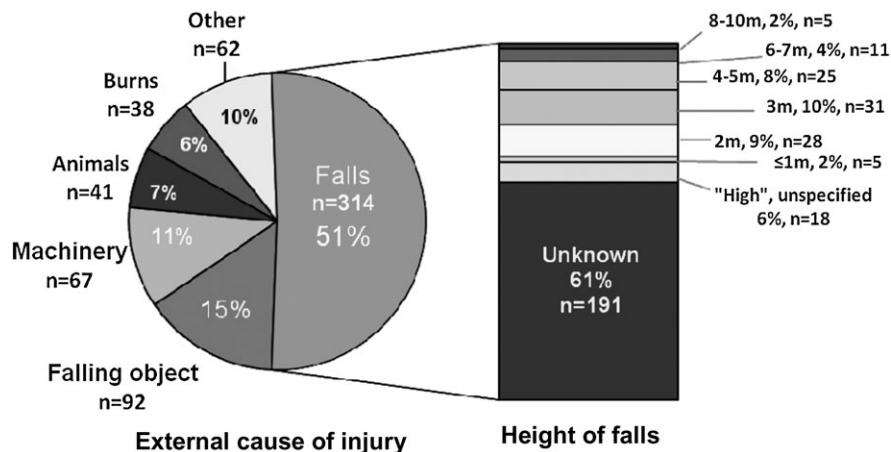


Figure 1. Work-related injury hospitalizations by external cause and height of falls [Al Ain, UAE, 2003–05 (n = 614)].

height of falling was available for only 39% (Figure 1). Of these, at least 59% (72/123) were high energy, defined as falling from >3 m. The most frequently specified machinery was electric saws. Animal injuries included hits, falls and bites; 85% (35/41) involved camels (Table 1).

While falls were most frequent among non-nationals, for nationals, 50% of injuries were due to road crashes, including six motorcycle and four vehicle incidents. Falls accounted for 67% (16/24) of admissions of Afghan workers, compared with 38% (9/24) among UAE nationals, 39% (9/56) among other Arabs and 52% (267/510; range 48–55%) among other nationalities.

Severity of injury assessed by ISS showed a median score of 4 for all external causes, with a higher mean and range for machine-related injury (Table 2). The ISS was ≥12 in 6% of admissions. The median score for falls was 4 for nationals and non-nationals. The mean duration of hospitalization was 9.4 days (SD 11.8), with 14% hospitalized for >14 days, 22% for 8–14 days, 30% for 4–7 days, 26% for 2–3 days, 4% for 1 day and 4% unknown; 4% (22) were admitted to intensive care and 1% (5) died after admission.

The distribution of injury by ISS region for the five main external causes was as follows: extremities 55%, chest 13%, head and neck 12%, abdomen 11% and face 9% (Figure 2). Four of 614 patients had only superficial injuries (ISS region 6, external). While extremities were most frequently injured in falls, many falls also affected head and neck, chest and/or abdomen. Of all hospitalizations, 83/614 (14%) had head and neck injuries, while 31/614 (5%) had a Glasgow Coma Score (GCS) <15 and of those 8 (26%) had a GSC of <9 (severe) (15 is normal).

In illustration of the severity and long-term consequences of falls, 14% (44/314) of patients had head and/or neck injuries, 15% (42) had spinal fractures and >10% (32) had single or bilateral fractures of the calcaneus bone of the foot, a potentially severely disabling injury.

Most falling objects struck extremities or the head. Machinery injuries nearly all affected extremities. Animal injuries involved extremities, head/face, abdomen and chest and burns affected extremities, face and/or head and neck. The predominant mode of transport to hospital was by private car (85%); only 12% arrived by ambulance.

Discussion

In this study, occupational injuries were frequent, with two-thirds of hospitalizations resulting from falls or falling objects. Prolonged hospitalization was common, and the direct costs of medical care and lost work together with human capital costs of lost future employment resulting from disability would have been considerable.

The strengths of this study include the fact that most hospitalizations for occupational injury in the region are believed to have been included, the use of a standardized data entry form and of specific inclusion criteria, data col-

Table 1. Occupational injury hospitalizations by details of external causes (excluding falls and falling objects), Al Ain, UAE, 2003–05 (*n* = 208)

External cause	%
Machinery/power tools (<i>n</i> = 67)	
Saw	22
Grinder	5
Cutter	3
Unknown	70
Animal-related (<i>n</i> = 41)	
Type of injury	
Hits/kicks	40
Falls	31
Bites	17
Unknown	12
Type of animal	
Camel	85
Horse	5
Cow	5
Sheep	2
Unknown	1
Burns (<i>n</i> = 38)	
Fire	50
Oil	21
Electrical	13
Hot water	8
Unknown	8
Other injuries (<i>n</i> = 62)	
Road traffic	42
Assault	11
Unknown	47

Table 2. Number of occupational hospitalizations by external cause of ISS, Al Ain, UAE, 2003–05^a

External cause of injury	<i>n</i>	Injury severity score			
		Mean	SD	Median	Range
Falls	313	4.3	4.0	4.0	1–29
Falling objects	92	4.9	3.8	4.0	1–21
Machinery	67	6.8	7.6	4.0	1–34
Animals	41	4.2	4.7	4.0	1–25
Burns	38	3.6	2.5	4.0	1–10
Other	62	5.9	6.8	4.0	1–36
Total	613	4.8	4.9	4.0	1–36

^aData missing for one fall.

lution assisted by a software system and interviews by a doctor trained in research. Limitations include that specific occupation, industry and details of incidents were seldom recorded, so there is a likelihood of recording bias. Details of victims dead at the scene or on arrival were not included and the number of these resulting from workplace injury is unknown. Since population data on workers were limited, calculating a crude injury admission rate involved extrapolation from 2003 estimates. The true population of Al Ain could have been as high as 450 000.

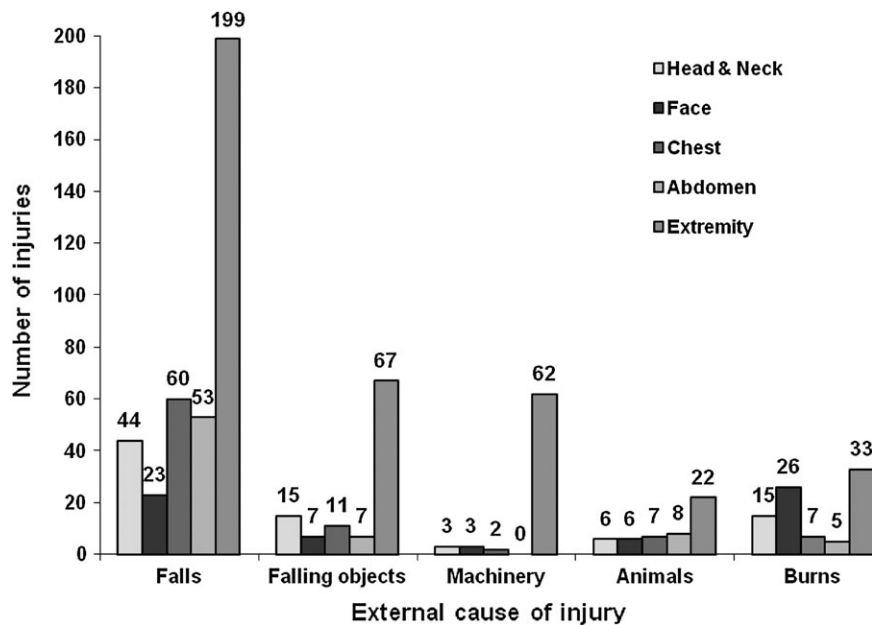


Figure 2. Number of occupational injury hospitalizations by external cause by anatomical regions [Al Ain, UAE, 2003–05 ($n = 614$)*]. Note: *some patients had more than one injury.

Our study showed some differences and some similarities when compared to other studies of injury surveillance. The Canadian Trauma Registry reported 677 admissions for occupational injuries for the year 2002–03 [7], which, based on labour force numbers [8], equated to an admission rate of 4.3 per 100 000 workers, much less than in Al Ain. However, this registry included only the small minority of severe cases with ISS ≥ 12 , reporting 10% in-hospital mortality for occupational admissions [7], much higher than the 1% in our study. In addition to inclusion criteria, disparities between this study and ours may also be related to differences in pre-hospital care and rapid access. There could have been a greater proportion of pre-hospital deaths in the UAE since ambulance services were still developing and only 12% of workers arrived by ambulance.

In a more comparable study, annual workplace injury hospitalizations in New South Wales, Australia, averaged 357 per 100 000 population (aged 15–64 years) for males and 76 per 100 000 for females during 1998–2005 [9]. In the UK, the injury, disease and dangerous occurrence reporting regulations recorded an annual incidence of 535 self-reported non-fatal work injuries per 100 000 employees in 2006–07 [10]. In the UK Labour Force Survey (LFS) for the year 2006–07, 1000 per 100 000 employees reported an occupational injury, with 6 million lost workdays [11].

The main external causes of injury varied and may be an indicator of severity. Canadian occupational hospitalizations with ISS ≥ 12 , while not comparable in severity to the Al Ain registry, nonetheless emphasize the importance of falls as a source of severe occupational injury. External causes were proportionately relatively similar to our data, including unintentional falls 42%, motor vehicle

collisions 20%, falling objects or persons 14% and machinery 5% [7].

For hospitalizations in New South Wales, the most frequent causes of occupational injury were overexertion and repetitive movements (10%), machinery (9%), falling objects (5%), being caught between objects (5%), striking an object (4%), fall on the same level from tripping or slipping (4%) and powered hand tools (4%) [12]. Our data differed strikingly with falls representing 51% of cases, falling objects 15%, machinery 11%, animals 7% and burns 6%, although the Al Ain registry excluded repetitive movement disorders.

The UK LFS data on self-reported major injury during 2003–04 to 2006–07 cited slipping and tripping as the most frequent cause of major injury (38%), followed by handling, lifting or carrying (15%), falling or moving objects (12%) and falling from height (12%) [11]. If in the LFS, slipping and tripping is taken as a fall and combined with falls from heights, falls were the main cause (at 50%) of self-reported injury in the UK.

With respect to the nature of injuries, in Bahrain, another Middle East setting [13], the most common anatomical site of occupational injuries was the extremities, followed by head/face, chest and abdomen, consistent with Al Ain findings. As for long-term disability, at least 10% of Al Ain fall victims, representing 5% of all trauma hospitalizations, suffered potentially permanently disabling injury to the calcaneus.

Implications of the study findings for occupational practice and policy need to be considered. Cultural change and appropriate health and safety practices, particularly those relevant falls from height or falling objects, need general implementation [14,15].

In addition, the use of child labour requires consideration. Children should not be employed, especially on or around large animals. When migrant child workers were used as camel jockeys, injuries were frequent [16]; more recent substitution of robots for child riders represents a major safety improvement in the UAE and elsewhere in the region. International efforts helped end such unsafe child labour practices [17] and could likewise lead to improvements in adult safety for non-unionized hazardous workplaces [18].

The ministries of health and labour should ensure that they have adequate means to monitor and enforce safe systems of work and training. Access to occupational health services for all employees should be considered.

Profound changes in cultural norms and accountability among employers and employees are required such that occupational injuries are considered preventable and therefore unacceptable, rather than unavoidable consequences of worker errors, destiny and other factors [19].

Since there remain many unanswered questions, future research should provide details of the main external causes of injury such as falls and falling objects, including the type of industry, occupations of workers, tasks, location and equipment from which falls occur, the use or otherwise of safety equipment and the prevalence, nature and costs of long-term disability for survivors. Much research could be accomplished at minimal cost by addition of several data fields to the trauma registry, enhancing its value for the analysis of factors determining the type and severity of injury and hence assisting future prevention; however, funding is needed to ensure the sustainability of such registries. Death notification forms in all Emirates should include data fields to identify occupational fatalities. Studies of the timeliness and appropriateness of treatment and transport for injured workers are also required.

In conclusion, given the enormous economic and infrastructural expansion within the UAE, together with the predominance of vulnerable migrant workers from low-income countries, prevention of occupational injury is an urgent imperative. Prevention of injury from falls and falling objects, including use and evaluation of appropriate safety equipment and other measures, should be priorities.

Key points

- This study showed high levels of severe occupational injuries among migrant workers in the United Arab Emirates.
- Falls and falling objects represented a major cause of hospitalization and mortality in the working age population.
- Improved data collection on occupational injury is needed, together with access to occupational health services and rigorous enforced adherence to good health and safety practice.

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Conflicts of interest

None declared.

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