Original Article

The Epidemiology of Hospital-Referred Injury in Iran-2016: a hierarchical model

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ARTICLE INFO   ABSTRACT

Introduction: Accidents and their injuries are one of the major public health problems and have long been considered as a very destructive and deadly factor for humans in the world. The extensive damage caused by accidents in Iran is significant.

This is an ecological study that was conducted with the aim of determining the trend and epidemiological pattern of injuries caused by accidents in victims who referred to the emergency department of Iranian hospitals in 2016.

Methods: This study was performed based on secondary analysis of existing data. In order to collect the necessary information, all reports of the Iranian Ministry of Health and Medical Education on accidents and deaths in 2016 were used. Excel, SPSS and GIS software were used to analyze the results. Also, hierarchical analysis was used to cluster the provinces.

Results: The highest frequency was related to the age group of ≥20 years (74%). Also, out of the total cases, 5013 people died and 358 were disabled. Out of 1483425 cases in 2015, 68.6% were men. The scene of the most accident was at home (36%), followed by the street (32%). The highest rate of accidents per 100 000 population was related to trauma (598.72) followed by traffic accidents (570.53). Highest incidence rate per thousand population was related to Qazvin (46.30) and Kermanshah (38.10) provinces and Sistan and Baluchestan province had the lowest incidence rate (2.9 per thousand).

Conclusion: Organized policy-making and decision-making to prevent accidents can be one of the important health priorities and a necessary factor in promoting safety in Iran.

Introduction

Accidents and injuries are the main and preventable causes of morbidity and mortality in most countries of the world. Injuries caused by accidents are projected to be the second leading cause of disability and death by 2020 in developing countries and the third leading cause of death and disability worldwide. Injuries account for 12% of the total burden of disease and the highest number of deaths from unintentional accidents in the world.[1]

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The present decade has been called the decade of accident prevention.[2] Accidents represent a major epidemic of non- communicable disease[3, 4] and nowadays it is no longer considered accidental, but recognized as a part of the price that man pays for the costs of new developments in technology.[5] Accidents are one of the most important causes of disability in developed countries of the world.[6] The costs and expenses caused by accidents are not only very staggering, but also related disabilities cause the loss of valuable human resources along with millions of useful working hours.[7] Regarding leading causes of death in children under 6 y of age in Iran in 2008, about 21% are related to accidents (intentional and unintentional), of these, 43% are home related accidents and 42.8% are due to traffic accidents.[8] Iran is one of the countries with the highest mortality of accidents in the world. Accidents include all types of road, home, industrial, burn and falls related events.[9] Injuries caused by accidents are one of the most important leading causes of disability and death in developed countries. In 2005, there were only about 173,000 injury deaths in the United States.[10] According to research studies in Iran, 28% of all disabilities are due to accidents and the highest death rate was between the ages of 5 and 44.[11] The economic damage caused by accidents not only is significant, but also has a significant psychological impact on victims and their families.[12] According to previous research conducted over the past 27 years, accidents have been the second leading cause of death in Iran.[13] Knowing the patterns of accidents is useful for principled planning to reduce mortality and its possible complications. Therefore, this study tries to investigate the pattern of accidents in Iran during 2016.

Methods

This is an ecological study. After obtaining institutional review board (IRB) and ethical approval (Ethical Code: IR.KAUMS. NUHEPM.REC.1399.036) this study was conducted in Kashan University of Medical Sciences (KAUMS) following the collection and re-analysis of existed data from accident registration information of all Medical Universities' affiliated hospitals in Iran, which was sent to the Ministry of Health and Medical Education (MOHME). In this study, all accidents in the country in 2016 were considered using the information of the national accident registration system. This information is registered in the Emergency Medical Management Center of Iran that is affiliated to the MOHME. This registration system is designed following the national program for the prevention of accidents and injuries by the Center for Disease Control and Prevention, MOHME (Iran) in the Excel software and is approved in terms of reliability and validity of information. The information include: demographics of victim (e.g. age, sex) area and the location of the accident, the type of accident, the month and year of the accident, the consequences of the accident and the names of the registrar center. Also, the demographics of the whole country and the provinces in 2016 were extracted based on the detailed results of the population census available in the Statistics Center of Iran. After extracting all the information about the accidents and the population of the country, the frequency and incidence of accidents, deaths and their occurrence were calculated. The hierarchical classification method and the dendrogram diagram were used to cluster the events. In the hierarchical classification, out of 31 provinces of

the country, based on the incidence of 1483425 accidents, the hierarchical classification algorithm was used. Euclidean distance between provinces was used for this purpose.

$$d_{i,j} = \sqrt{\sum_{k=1}^{n} (x_{kj} - x_{kj})^2},$$

Where $d_{i,j}$ is the Euclidean Distance between the provinces i and j. n is the number of events in each province and di and i are calculated for each pair of provinces. C (A, B) is also calculated. To determine the distances between provinces in two separate classes,

$$C(A,B) = \{d_{i,j}\}$$
$$i \epsilon A, j \epsilon B$$

were taken.[14]

GIS software was also used to display the highest number of accidents by province. The Pareto chart was used to find the most incidences and showing cumulative incidence, using Excel software.

Results

Of the 14, 834,25 accident cases in 2016, 31.4 percent were women. Also, the highest frequency was found in the age group of 20 years and more (74%). Of the total cases, 5,013 accounted for death and 358 for disability. The highest number of accidents occurred at home (36%), followed by the streets (32%) (Table 1). The highest number of accidents was related to trauma (including penetrating and blunt trauma) with 478532 cases followed by traffic accidents with 456000 cases. Drowning has the lowest number of accidents with 947 cases, followed by electric shocks with 4746 cases, which was the second lowest frequency. In terms of accidents incidence rate (per 100,000) in 2016, the highest incidence was related to

trauma (597.7) followed by traffic accidents (570.5) and the lowest was related to drowning (1.2) and electric shock (5.94). However, the highest mortality rate per 10000 accidents was related to drowning (1378.9), and electric shock (178.2). The lowest mortality per 10000 was related to trauma (3.55), followed by scorpion bites (5.68) (Table 2).

Table 1. Distribution of injury based on age, place, region, and outcome

Variable	N (%)
Sex	
Female	465863(31.4)
Male	1016562(68.6)
Age Group	
>5	99259(6.7)
5-19	286761(19.3)
20>	1095163(74)
Result of accident	
Treated	1477065(99.6)
Death	5013(.34)
Disability	358(0.02)
location	
City	1214787(82)
Rural	165273(11)
Other	102365(7)
Total	1482425

Based on the incidence of accidents, all provinces of the country were divided into 6 categories, in which 9, 8, 7, 4, 2 and 1 provinces are in the first level, respectively. Since Qazvin province has the highest rate of accidents, this province was on one class and Kermanshah and South Khorasan provinces were on the other class (Figure 1).

The highest incidence of accidents (per hundred thousand populations) in 2016 was related to Qazvin (46.30) and Kermanshah (38.10) provinces. Tehran province is ranked ninth regarding accidents among provinces with an incidence rate of 21.30 (per thousand populations) and Sistan and Baluchestan
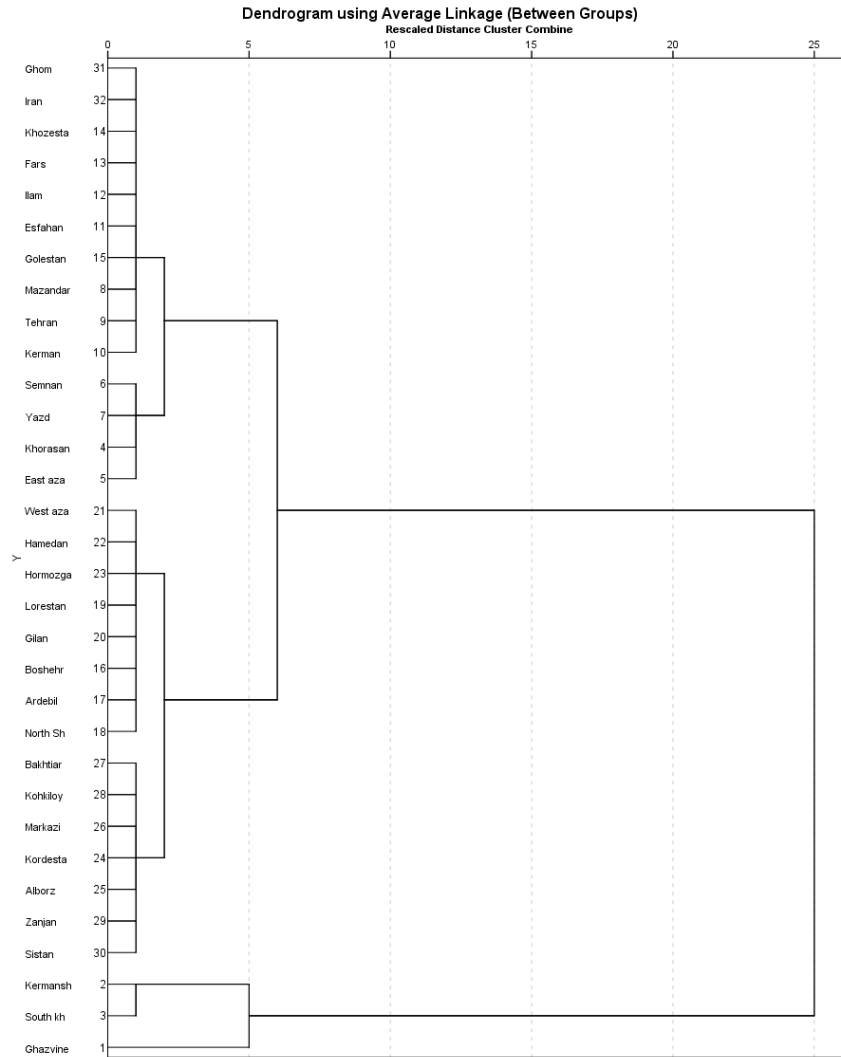
Figure 1. Dendrogram for hierarchical clustering based on Iran provinces

Table 2. Number of accidents, incidence and Case Fatality ratio according to the type of accident in the country during 2016

Cause of accident	Number of accident	Incidence($\times 10^5$)	Case Fatality ratio($\times 10^4$)
Animal Attack	26882	33.6	8.04
Scorpion bites	23670	29.6	5.68
Burns	68757	86.0	17.45
Drowned	947	1.2	1378.9
Electrocution	4746	5.94	178.2
Fall	203523	254.64	23.3
Trauma[*]	478532	598.72	3.55
Poisoning	70661	88.41	30.41
Violence	92045	115.16	13.87
Suicide	37595	47.04	118.6
Traffic accidents	456000	570.53	43.32
Other	496366	621.03	57.3
Total	1483425	1855	29.89

[*]Including penetrating and blunt trauma

province has the lowest with 2.9 (Figure 2). According to the results of the hierarchical analysis, the provinces of South Khorasan, Kermanshah and Alborz had the highest incidence rate of accidents, while the provinces of Sistan and Baluchestan, Kohkilouyeh and Boyer Ahmad, Chaharmahal and Bakhtiari, Markazi, Alborz, Zanjan and Kurdistan had the lowest incidence rate (Figure 1 and 2).
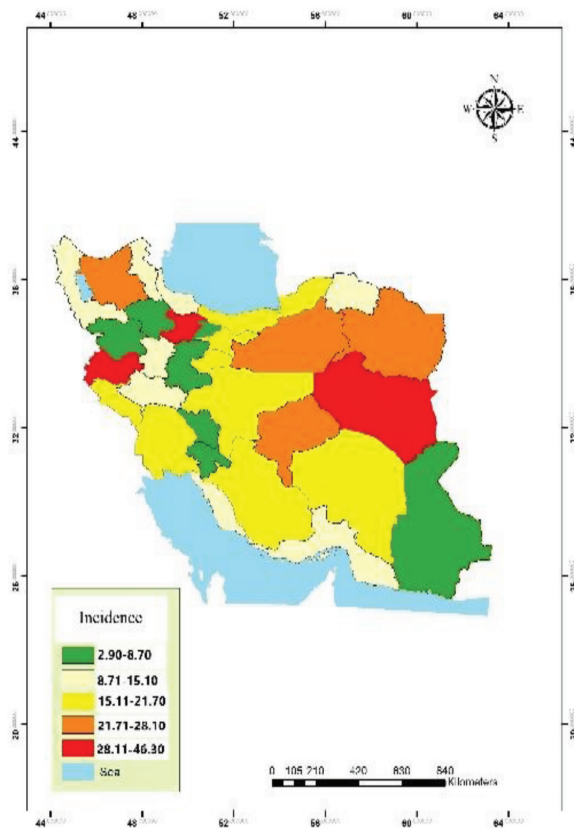

Figure 2. The GIS map of Incidence of injury in Iran

Discussion

In this study, the highest incidence rate of accidents was observed in Qazvin and Kermanshah provinces, while Sistan and Baluchestan had the lowest incidence rate, which could be underestimated due to the incompleteness registration. According to this

model, also the central provinces generally had fewer accidents rates, may be due to better education and easier access to the health care system.

This study produced results which corroborate the findings of a great deal of the previous work in this field. In the present study, 1483425 accident cases were recorded, of which 68.5% were male. In the Abdolvand et al. study also, 67.7% of the injured cases were men.[15] In the study of Khazaei et al., 78.51% of the accidents victims were men, accord with the present study and other studies that show the incidence of accidents in men is higher than women.[1] In the Ntaji study on Nigerian people, 38.7% of men and 31.1% of women were involved in traffic accidents, and the injuries caused by these accidents were 60.7% in the women's group and 58.6% in men.[16] Comparing with females, the reasons for the higher rate of accidents in males could be due to behavioral, occupational, cultural and other socioeconomic factors.[17] Suicide rates in Iran are 47 per 100000, higher in women than in men, maybe due their fragility in stressful situations that indicates the importance of mental health education in this vulnerable group. In terms of the type of accident, the most common accidents are traumas, car accidents and falls, respectively. In a study by Soodejani et al. (2015), the highest number of accidents was related to road traffic accidents (41%), poisoning (18%) and fall (10.1%), respectively.[18] According to the study by Kandary-Al et al (2015), road traffic accidents was by far the most prevalent cause of death (64.6%) followed by fall from height (13.1%).[19] In the present study, car accidents and trauma in both groups of men and women were accounted for the largest share of injuries which shows in this area we need continuous intersectoral collaboration and basic training

in addition to improvements in traffic law enforcement as a part of an integrated road safety policy. The results of our study showed that almost half of hospital referrals in Iran are related to accidents, much higher than Saudi Arabia (20%). Possibly, this increase of injury incidence can be considered as a result of population growth and an uncontrolled increase in motor vehicles, and warns of the need to implement a comprehensive accident prevention plan in the community. The results of this study showed that the highest rate of accidents was occurred among the age group of 20-40 years, in other words two thirds of the victims were under 30. This finding is in agreement with a great deal of the previous work in this field, who reported similar results.[21] Cohen, M.J., et al (2010) during a study in Canada found that the highest proportion of casualties (75%) was belonged to the age group of 18-37 years old.[14] Akinmoladun (2014), also reported the most injuries caused by accidents were observed in the age group of 21-30 years[20](22). In the study by Gupta et al.[21] and Zimmerman (2015)[22] the mean age of the casualties was reported 32.6 and 27 years respectively. Comparing these results, it can be seen that younger people are more at risk than the other age groups. This may be due to a variety of reasons including, being more employed and higher risk-taking in this age group, and more mobility and dynamism of them compared to other age groups. Probably, this can be attributed to the demographic structure of Iran, which is mostly young people, and the increase of casualties in this group. The highest proportion of casualties in all age groups in this study was related to road traffic accidents, which is similar to the results of a study conducted in China in 2010.[23] Casualties due to road traffic accidents in different parts of the urban area were almost twice the number

of rural victims, which is consistent with the studies of Abdolvand et al. (96.3%)[15] and Musazadeh et al. (70.6%).[24] Perhaps the reason for this difference is the use of more vehicles in the city as well as the traffic of cars and vehicles in urban areas. Based on the present study, the most common place of accident is home. Therefore, education about home accidents is important considering that vulnerable people in the community such as children and infants, the elderly, the sick and the disabled, spend most of their time at home. Another finding of this study was the higher incidence of accidents in spring and summer. Factors such as favorable weather, more vacations and crowded public places in these seasons can be the reasons.

Fortunately, cases leading to death and disability involve a small proportion of the injured, which can be the result of timely transfer of the casualties and the efficiency of the urban health care system.

The highest mortality rate per 10000 accidents in Iran was related to drowning (1378.9). Considering that drowning had the highest incidence and the number of years of life lost (YLL) in the age group of 10 to 19 years and the lowest number of mortalities, it seems that these features should be regarded in planning and designing interventions. Young people and adolescents should be given more information about the dangers and causes of drowning and the danger of swimming outside the protected area. On the other hand, swimming training and strengthening the lifeguard system can greatly reduce the incidence of drowning.

Assuming that the rate of injuries caused by the accident in this study that require medical care can be a reasonable estimate in Iran, the identification of risk factors including, environmental, psychological, behavioral and social determinants, would be able to facilitate

and accelerate the reduction of injuries. Determining the risk factors, their interactions and also their relationship with injuries may create a new hypothesis, especially causality association and eventually lead to the development of new interventions to prevent injuries. Public education campaigns using mass media to teach driving regulations and strengthening police monitoring systems is essential especially in reducing road traffic accidents in the society. Success in applying accident prevention programs such as using "safe society" model will not be possible without the cooperation and participation of all organizations.

Our findings in this report are subject to some limitations. First, obtaining information from hospital sources is one of the main limitations of this study, which leads to underreporting of accidents because it does not include minor injuries that are treated at home or in primary health care centers. The present study also did not include injuries that resulted death at the scene.

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