Epidemiology and cost-analysis of emergency department patients treated following traffic accidents in Iran: A retrospective cross-sectional study

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ABSTRACT

Introduction: Epidemiological analysis of traffic accidents can provide information for future plans to lower the cost and burden of road traffic accidents (RTAs). This study was aimed to determine the epidemiological characteristics of patients with RTAs.

Methods: We conducted a retrospective cross-sectional study of RTA patients presenting in 2016 to the Emergency Department at Shahid Bahonar Medical Education Center in Kerman, Iran. A checklist including variables such as age, sex, month, in which the patient referred, final outcome, overall cost and the site of injury used to collect data. The diagnostic criteria were in accordance to ICD 10.

Results: Of the total of 3277 patients who were studied, 2713 (82.78%) were men and 564 (16.66%) were women. Most of the accidents occurred at the age group of 16–30 years and the average cost of treatment in the hospital was 2152.45 USD. The most affected area was the lower limb. The majority of accidents occurred in spring and summer. The mortality rate was (2.74%).

Discussion: Injuries and deaths due to RTAs are a major public health problem, especially in young age groups. Therefore, more preventive programs targeting young adults should be considered to reduce the burden of RTAs.

Conclusion: Epidemiology and cost analysis of results showed that men caused more accidents and costs burden for both health system and society. Considering they have a more share of activity, economy and workforce, it will cause more damage and adverse consequences for economy and social life of the society.

Key Words: Cost analysis, emergency, epidemiological, traffic accidents

INTRODUCTION

Today, people use various means of transportation, such as roads, railways, airways, and sea. The most common transportation method is the road. However, road traffic and accidents represent an issue of global impact. Traumatic injuries represent a growing and neglected health crisis in the world, with > 75.5 million Disability-Adjusted Life Years reported all over the world in 2010. Globally, 1.2 million people die annually in road traffic accidents (RTAs), and the rate is rising with low-and-middle income countries (LMIC).
experiencing a greater burden.\textsuperscript{[4]} The rate of RTAs in Iran exceeds the global average, with associated costs in 2013 reaching 6\% of total gross domestic product (GDP).\textsuperscript{[5]}

This study aimed to evaluate the epidemiology and costs of the medical care of patients admitted following an RTA.

### METHODS

#### Design

The study was a retrospective cross-sectional study of patients admitted for injuries sustained in RTA who presented between March 2016 and March 2017 to Shahid Bahonar Medical Education Center (SBMEC) affiliated with Kerman University of Medical Sciences in Kerman, Iran. Data were obtained from a census of all records. The complete records were extracted from the Health Information System at (SBMEC).

#### Data collection

A checklist was used to collect data from Inpatient documents, and it was designed by the researchers and verified by experts (a group of 14 specialists included general surgeon, neurosurgeon, orthopedic surgeon, emergency medicine specialist, thoracic and pulmonary surgeon, maxillofacial surgeon, health-care management specialist, health policy specialist, health economist, the head of the nursery, the head of the intensive care unit, the chief of hospital, a representative of clinical and a representative of public health deputies of university). This checklist contains various demographic and epidemiological information such as age, sex, type of traumatic injury, total cost expenditures, and emergency department disposition (death, admission, discharge, etc.).

In this study, the site of injuries is categorized into nine groups: head and neck, face, chest, abdomen and pelvis, spinal cord, upper limb and lower limb, other injuries, not specified, and multiple injuries. Age was stratified into five categories: (please list the categories).\textsuperscript{[6]} To estimate the overall cost of each patient from the providers’ prospective (the hospital), all direct hospital costs recorded in the patient’s file, including radiography costs, medications in the department, surgeries, specialists visit, and laboratory tests. Human resource costs were excluded due to the inability to accurately quantify these costs per patient in this health-care system.

#### Data analysis

Data entry and statistical analysis were performed using International Business Machines (IBM) Statistical Package for the Social Science (SPSS) V22.0 (IBM, Armonk, USA).

Regarding the normal distribution of data, researchers used parametric \( t \)-test for comparing the mean of binominal variables and ANOVA test for comparing average costs in different groups while using its \textit{post hoc} tests, Tuckey and Bonferroni, to find out if there is any significant relationship between the two groups of variables, separately. Hence, there was a significant relationship of costs among different groups of sex, age, the month of visit, site of injury, and the patient’s outcome \((P < 0.05)\).

### RESULTS

In this study, a total of 3277 patients were investigated. The patients’ age range was between 3 and 37 years old with a mean age of (30.13), standard deviation (16.33). As for gender, 2713 (82.78\%) of patients were male and 564 (16.66\%) were female [Table 1].

The lowest and the highest costs of health-care services were 26.65 and 67,301USD, with a mean cost of 2152.45 USD, totally. The mean costs were 2231.80 USD for men and 1770.76 USD for women. The \( t \)-test results showed

| Table 1: Distribution of accidents based on age, injury region, age group, referral month, and final outcome for the patient |
|-----------|---------|---------|---------|---------|
| n (%)     | Total   | Age     | Region of injury |
|           |         |         | Head and neck   |
|           |         |         | Face            |
|           |         |         | Thorax          |
|           |         |         | Abdomen and pelvic |
|           |         |         | Spine           |
|           |         |         | Upper limb      |
|           |         |         | Lower limb      |
|           |         |         | Other or unspecified |
|           |         |         | Multiple trauma (≥2 of above) |
| Total     | 3277 (100) | Age     | Region of injury |
|<15        | 468 (14.28) | Age     | Region of injury |
|16-30      | 1504 (45.89) | Age     | Region of injury |
|31-45      | 762 (23.25)  | Age     | Region of injury |
|45-60      | 332 (10.13)  | Age     | Region of injury |
|>61        | 211 (6.43)   | Age     | Region of injury |
|Months     |          | Age     | Region of injury |
|January    | 233 (7.11)  | Age     | Region of injury |
|February   | 176 (5.37)  | Age     | Region of injury |
|March      | 289 (8.81)  | Age     | Region of injury |
|April      | 277 (8.45)  | Age     | Region of injury |
|May        | 303 (9.24)  | Age     | Region of injury |
|June       | 291 (8.88)  | Age     | Region of injury |
|July       | 331 (10.10) | Age     | Region of injury |
|August     | 359 (10.95) | Age     | Region of injury |
|September  | 290 (8.84)  | Age     | Region of injury |
|October    | 260 (7.93)  | Age     | Region of injury |
|November   | 226 (6.89)  | Age     | Region of injury |
|December   | 242 (7.38)  | Age     | Region of injury |
|Output     |          | Age     | Region of injury |
|Patient death | 90 (2.74) | Age     | Region of injury |
|Discharged to the doctor’s order | 3102 (94.65) | Age | Region of injury |
|Discharged AMA | 85 (2.59) | Age | Region of injury |

\textit{AMA: Against medical advice}
a significant difference of costs among men and women groups ($P = 0.002$).

The lowest and the highest rate of accidents were reported in the >60 years (211 patients) and 16–30 years (1504 patient) age-groups, respectively. Tukey’s test results for comparing hospital costs between different age-groups are presented [Table 2]. The ANOVA test showed a significant difference of hospital costs among different age groups. In contrast, the results of Tukey’s test demonstrated more details as a significant difference between costs in age-Group 1 (<15 years), age-Group 3 (31–45 years) and the age-Group 4 (45–60 years) ($P = 0.003$).

The rates of injury patterns are displayed in Table 1, with lower limb injuries accounting for the greatest injury burden (34.26%), while abdomen and pelvic trauma accounted for the least (1.15%).

Overall, (3201) patients were discharged home, 85 (2.59%) patients signed out of the hospital against medical advice (AMA), (3277) patients were admitted to the hospital, and 90 (2.74%) died.

The results of the ANOVA test, including Tukey and Bonferroni, showed a significant difference between the hospital costs in patients with different outcomes ($P < 0.0001$) except for the group that was discharged with personal consent [Table 3]. Using the ANOVA test, there was a significant difference between sites of injuries ($P < 0.0001$) [Table 4]. The frequency of patients based on the site of injuries is shown in [Table 1]. Most injuries were in the lower limb (34.26%) and the lowest damages related to the abdomen and pelvic (1.15%).

| Table 2: Tukey test results for the costs between different age groups |
|--------------------------|--------------------------|--------------------------|--------------------------|
| (I) age | (J) age | Mean difference (I–J) | SE | $P$ |
| 1.00 | 2.00 | –15,875,220.584 | 7,274,294.758 | 0.18 |
| 3.00 | 3.00 | –29,283,281.833* | 8,071,168.755 | 0.00 |
| 6.00 | 6.00 | –37,587,238.916* | 9,861,371.260 | 0.00 |
| 5.00 | 5.00 | –30,975,416.968 | 11,396,067.613 | 0.05 |
| 2.00 | 2.00 | –15,875,220.584 | 7,274,294.758 | 0.18 |
| 3.00 | 3.00 | –13,408,061.248 | 6,111,007.733 | 0.18 |
| 4.00 | 4.00 | –21,712,018.331 | 8,333,504.279 | 0.07 |
| 5.00 | 5.00 | –15,099,926.383 | 10,103,019.720 | 0.56 |
| 3.00 | 3.00 | –29,283,281.833* | 8,071,168.755 | 0.00 |
| 2.00 | 2.00 | –13,408,061.248 | 6,111,007.733 | 0.18 |
| 4.00 | 4.00 | –8,303,957.083 | 9,037,460.617 | 0.89 |
| 5.00 | 5.00 | –1,691,865.135 | 10,691,090.137 | 1.00 |
| 4.00 | 4.00 | –37,587,238.916* | 9,861,371.260 | 0.00 |
| 2.00 | 2.00 | –21,712,018.331 | 8,333,504.279 | 0.07 |
| 3.00 | 3.00 | –8,303,957.083 | 9,037,460.617 | 0.89 |
| 5.00 | 5.00 | –6,612,091.948 | 12,099,681.251 | 0.98 |

DISCISSION

The financial burden of health-care services dedicated to traffic accidents in Iran consumes a large share of GDP, and if the loss of workforce and financial opportunities is factored in this equation, this figure would be more exorbitant.

According to the WHO estimates, RTAs costs 1% of GDP in low-income countries,[7] while in average and high-income countries, they account for 1.5 and 2% of GDP, respectively.[8] However, studies conducted in Iran show that the cost of RTAs equaled 7% of GDP in 2007.[9] Men are more likely to be involved in traffic accidents. Most of the patients who referred to the SBMEC ED due to RTAs were men (82.87%). Considering that men play a more significant role in the transportation system, it is natural for men to suffer more from traffic accidents. In a study by Nguyen, 25% of subjects were female and 75% were male.[6] Furthermore, according to the WHO report in 2004, men are three times more likely than women to suffer from traffic accidents.[8] Another main study in Iran showed 73% of dead were men and the rest were women too.[7] These reports are consistent with our results. The remarkable rate of male involvement in traffic accidents could be due to the fact that men drive carelessly and aggressively. In addition, cultural issues such as restriction of riding motorcycle by women in Iran can contribute to the growing rate of accidents by male.

Our results showed that the hospital costs of male patients were significantly higher than female ones. Since men play an important role in the national economy and Gross National Product of Iran, the accident-induced damages inflicted on this group can have adverse consequences for the economy and social dimensions in future.

In some countries like Iran, Men are more responsible for the livelihood of the family than women, they are more physically active in society, and of course they drive more and cause more accidents and therefore more costs. Culturally, men drive faster than women and cause more serious accidents and more physical injuries. As noted above, men are more likely to incur high costs to the health-care system due to severe accidents, and because they make up the bulk of the workforce, they ultimately cause more damage to the community’s economy.

Another study revealed RTA injuries and deaths increased from 1997 to 2005 among both males and females.[10] Men/women ratio for RTA fatalities was 4.2/1 in Iran, which is comparable to previous studies.[11] Gender differences in RTA show that men cause higher risks.[12] The distribution of global RTA deaths by gender shown that men are responsible for more deaths than women (27.6 versus 10.4 per 100 000 populations, respectively).[13]
Table 3: The Tukey test results for the costs of outcomes for each patient

| (I) Patient disposition                  | (J) The final outcome for the patient | Mean difference (I − J) | SE        | P        |
|----------------------------------------|--------------------------------------|-------------------------|-----------|----------|
| Patient death                          | Discharged to the doctor’s order     | 206,207,735.096*        | 14,275,639.674 | <0.00    |
|                                        | Discharged AMA                       | 160,802,987.201*       | 20,192,709.362 | <0.00    |
| Discharged to the doctor’s order       | Patient death                        | −206,207,735.096*      | 14,275,639.674 | <0.00    |
|                                        | Discharged AMA                       | −45,404,747.895*       | 14,678,002.584 | <0.00    |
| Discharged AMA                         | Patient death                        | −160,802,987.201*      | 20,192,709.362 | <0.00    |
|                                        | Discharged to the doctor’s order     | 45,404,747.895*        | 14,678,002.584 | <0.00    |

*Tukey test results showed a significant difference between the groups. SE: Standard error, AMA: Against medical advice

Table 4: The Bonferroni test results for the costs in the site of injuries

| (I) Site of injury                        | (J) Site of injury                        | (I) Site of injury                        | (J) Site of injury                        | P  |
|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|----|
| Head and neck                            | Face                                     | 0.00                                     | spine                                    | 0.00|
|                                          | Thorax                                   | 0.00                                     | Head and neck                            | <0.00|
| Abdomen and pelvic                       | Abdomen and pelvic                       | 0.00                                     | Thorax                                   | <1.00|
| Spine                                    | Spine                                    | 0.00                                     | Abdomen and pelvic                       | <1.00|
| Upper limb                               | Upper limb                               | 0.00                                     | Lower limb                               | <0.00|
| Lower limb                               | Lower limb                               | 0.00                                     | Other or unspecified                     | <0.00|
| Other or unspecified                     | Other or unspecified                     | 0.00                                     | Multiple trauma (≥2 of above)            | <0.00|
| Multiple trauma (≥2 of above)            | Multiple trauma (≥2 of above)            | 0.00                                     | Head and neck                            | <0.00|
|                                         |                                         |                                         | Face                                     | <0.08|
| Face                                     | Head and neck                            | 0.00                                     | Face                                     | <0.08|
| Thorax                                   | Thorax                                   | 0.00                                     | Abdomen and pelvic                       | <0.00|
| Abdomen and pelvic                       | Abdomen and pelvic                       | 0.00                                     | Thorax                                   | <0.00|
| Spine                                    | Spine                                    | 0.08                                     | Abdomen and pelvic                       | <0.01|
| Upper limb                               | Upper limb                               | 0.08                                     | Spine                                    | <0.00|
| Lower limb                               | Lower limb                               | 1.00                                     | Other or unspecified                     | <0.20|
| Other or unspecified                     | Other or unspecified                     | 1.00                                     | Multiple trauma (≥2 of above)            | <1.00|
| Multiple trauma (≥2 of above)            | Multiple trauma (≥2 of above)            | 0.00                                     | Head and neck                            | <0.00|
|                                         |                                         |                                         | Face                                     | <1.00|
| Thorax                                   | Thorax                                   | 0.00                                     | Abdomen and pelvic                       | <0.17|
| Abdomen and pelvic                       | Abdomen and pelvic                       | 1.00                                     | Thorax                                   | <0.00|
| Spine                                    | Spine                                    | 1.00                                     | Abdomen and pelvic                       | <0.00|
| Upper limb                               | Upper limb                               | 0.00                                     | Spine                                    | <0.00|
| Lowr limit                               | Lower limb                               | 0.00                                     | Other or unspecified                     | <0.20|
| Other or unspecified                     | Other or unspecified                     | 0.00                                     | Multiple trauma (≥2 of above)            | <1.00|
| Multiple trauma (≥2 of above)            | Multiple trauma (≥2 of above)            | 0.00                                     | Head and neck                            | <0.00|
|                                         |                                         |                                         | Face                                     | <1.00|
| Thorax                                   | Thorax                                   | 0.00                                     | Abdomen and pelvic                       | <0.00|
| Abdomen and pelvic                       | Abdomen and pelvic                       | 1.00                                     | Thorax                                   | <0.00|
| Spine                                    | Spine                                    | 1.00                                     | Abdomen and pelvic                       | <0.00|
| Upper limb                               | Upper limb                               | 0.00                                     | Spine                                    | <0.00|
| Lower limb                               | Lower limb                               | 0.17                                     | Other or unspecified                     | <0.20|
| Other or unspecified                     | Other or unspecified                     | 0.09                                     | Multiple trauma (≥2 of above)            | <1.00|
| Multiple trauma (≥2 of above)            | Multiple trauma (≥2 of above)            | 0.03                                     | Head and neck                            | <0.00|
|                                         |                                         |                                         | Face                                     | <1.00|
| Thorax                                   | Thorax                                   | 0.00                                     | Abdomen and pelvic                       | <0.00|
| Abdomen and pelvic                       | Abdomen and pelvic                       | 0.03                                     | Thorax                                   | <0.00|
| Spine                                    | Spine                                    | 0.00                                     | Abdomen and pelvic                       | <0.00|
| Upper limb                               | Upper limb                               | 0.00                                     | Lower limb                               | <0.20|
| Lower limb                               | Lower limb                               | 0.00                                     | Other or unspecified                     | <0.17|
| Other or unspecified                     | Other or unspecified                     | 0.00                                     | Multiple trauma (≥2 of above)            | <0.00|

There are different reports on RTA which showed men/women ratio in the world including 9.6/1 in Thailand’s rural areas, [14] 2.4/1 in the USA, [15] 2.1/1 in Addis Ababa and Ethiopia. [16]

Patients were categorized in different age groups. The highest number of accidents was observed in group two (16–30 years). Police reports in Iran reveal that men aged 26–33 have the highest rate of accidents while women of the same age have the lowest rate of traffic accidents. [17] Aygencel reported a mean age of 35.5 years for admitted patients. Furthermore, in the study of Cetinoglu and Marmor, a mean age of 25 and 27 years were reported, respectively. [18–20] In a study in England, men aged 16–34 are at a higher risk for RTAs. [21] These reports are consistent with our results which demonstrate the significant effect of accidents on the young and productive classes of society, along with the fact that devastating health and medical costs reduce the workforce and social activities of this group in the society. On the other hand, the high rate of accidents in this age group could be ascribed to their greater involvement in the workforce while they drive more alone and are more likely to drive faster or recklessly which point to their lack of familiarity with driving rules, the importance of useful use of young age, feeling of being responsible for their own’s health and so the society, which demands further emphasis on proper trainings for the youths. There was
a significant difference between the age groups in terms of treatment costs so that subjects in group 1 (<15 years), group 3 (31–45 years) and group 4 (45–60 years) paid the highest costs for traffic accidents.

It could be justified by that adults may suffer from more severe injuries and require greater health cares in comparison to individuals under the age of 15 years. It also imposes heavier costs on the health system. It seems that adults are more likely to drive and more likely to drive faster and then more likely to be traumatized.

The highest rate of injuries induced by traffic accidents was recorded in the summer, especially in August [10.95%; Table 4]. In the same vein, Sehat et al. showed that the highest rate of accidents belonged to August (17.9%).[22] Furthermore, Karadanas revealed that this figure was especially high during summer (May, June, July).[23] It may be due to larger number of road trips during summer, which naturally leads to more accidents. Therefore, greater attention to roads traffic through making rules, penalties or any kind of regulation for public transportation during these risky months can help gain more control over transportation and prevent more accidents.

From a pathological standpoint, the results showed that the most damages were related to the lower extremities (34.26%) [Table 4]. Similarly, Nguyen et al. reported the most severe injuries (44%) were observed in lower limbs,[20] but in Parkinson’s study, damages were common in the upper limbs.[24] In other study,[25] head injury was cited as the most frequent injury, whereas in the present study, it was ranked sixth. The anatomical condition of hands and feet make them more susceptible to injuries, though the site of injury is depended on the type of accident and the vehicle.

In the present study, most of the patients were discharged by the order of the physician that suggests most patients stayed in hospital until the end of their treatment period, at the same time Devos showed 5.6% of patients who referred to the emergency medicine ward died because of accident and 94.4% survived.[26] Furthermore, another study results showed that 72.5% of referred patients were discharged and 12.7% were discharged AMA, 10.2% admitted to related hospital wards and 4.7% of them died.[27]

In Iran, according to Article 37 of the 5th Development plan law, the Ministry of Health and Medical Education is required to take the necessary measures for the immediate and unconditional treatment of injured people in accidents and accidents in all governmental and nongovernmental healthcare facilities as well as on the route of deployment To the specialized centers and to the next necessary visits, although this article emerged under Article 92 from the 4th Development Plan law in Iran since 2005, resulted in the fact that every patient had sufficient evidence of an accident brought to the hospital without need to pay, to be admitted and to receive health care as soon as possible.[28] It seems that such article’ law may reinforce the attitude of citizens to be not only more careful about your health but also more careless in every aspect of their traffic behavior including driving, respecting to traffic rules and so on unconsciously, which could be because of the health-care services which may need in result, were free of charge for the patients themselves.

According to the WHO 2002 report, around 1/183/000 people died in RTAs and RTAs were the eighth leading cause of death. According to 2016 report, RTAs have caused the deaths of 1/350/000 people around the world and remained the eighth leading cause of death for all age groups, and the first cause of death for children and young adults (15–29).[8]

Figure shows the difference in fatalities due to traffic accidents in Iran and 18 countries based on the number of deaths per 100,000 that compares traffic accident casualties in Iran and other countries [Table 5]. The incidence of traffic accidents in LMICs is three times higher than in developed and high-income countries, and unfortunately, there has been no decrease in the number of traffic accidents in LMICs since 2013. The comparative study findings that are presented below show the number of people killed in traffic accidents in 18 selected countries according to their net per capita income and population, as well as the type of country by income (high-, middle-, and low-income countries) which obviously shows LMICs have very high rates of traffic fatalities, significantly more than high-income countries [Table 5].[29]

According to a 2018 World Health Organization report, traffic accident deaths in six areas are depicted in [Table 5]. Analogous to the legal efforts of the greater international community to reduce RTAs, Iran has similarly introduced legislation mandating helmet use for those on motorcycles and seat belt use by all vehicle occupants, installation of speed enforcement cameras, prohibitions of driving while intoxicated guidelines for the replacement of older model vehicles, and standards for compensation for victims of fatal RTAs. Even so, RTA rates continue to rise in Iran highlighting the need for further government attention and resource allocation [Figure 1].

A multifactorial approach is needed to curb the surge in Iran’s RTA epidemic. Beyond simple law enforcement measures and legal statute modifications, improvements in transportation infrastructure and driver training are also needed.
### Table 5: The comparative statistics of traffic accident casualties in high, middle and low income countries based on the number of deaths per 100,000 populations

| Country/area | Population numbers for 2016 | GNI per capita for 2016 in US dollars | Income level | Reported number of road traffic deaths | Estimated road traffic death rate per 100,000 population |
|--------------|----------------------------|--------------------------------------|--------------|---------------------------------------|--------------------------------------------------------|
| Afghanistan  | 34,656,032                 | 580                                  | Low          | 1565                                  | 15.1                                                   |
| Iraq         | 37,202,572                 | 5430                                 | Middle       | 4134                                  | 20.7                                                   |
| Iran (Islamic republic of) | 80,277,424               | 6530                                 | Middle       | 15,932                                | 20.5                                                   |
| United States of America | 322,179,616           | 56,180                               | High         | 35,092                                | 12.4                                                   |
| Canada       | 36,289,824                 | 43,660                               | High         | 1858                                  | 5.8                                                    |
| Brazil       | 207,652,864                | 8840                                 | Middle       | 38,651                                | 19.7                                                   |
| Japan        | 127,748,512                | 38,000                               | High         | 4682                                  | 4.1                                                    |
| Australia    | 24,125,848                 | 54,420                               | High         | 1296                                  | 5.6                                                    |
| Singapore    | 5,622,455                  | 51,880                               | High         | 141                                   | 2.8                                                    |
| Morocco      | 35,276,784                 | 2850                                 | Middle       | 3785                                  | 19.6                                                   |
| Nigeria      | 185,989,632                | 2450                                 | Middle       | 5053                                  | 21.4                                                   |
| Ghana        | 28,206,728                 | 1380                                 | Middle       | 1802                                  | 24.9                                                   |
| Germany      | 81,914,672                 | 43,660                               | High         | 3206                                  | 4.1                                                    |
| Netherland   | 16,987,330                 | 46,310                               | High         | 621                                   | 3.8                                                    |
| France       | 64,720,688                 | 38,950                               | High         | 3477                                  | 5.5                                                    |
| Philippines  | 103,320,224                | 3580                                 | Middle       | 10,012                                | 12.3                                                   |
| Thailand     | 68,863,512                 | 5640                                 | Middle       | 21,745                                | 32.7                                                   |
| India        | 1,324,171,392              | 1680                                 | Middle       | 150,785                               | 22.6                                                   |

GNI: Gross national income

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**Figure 1:** The rates of road traffic death per 100,000 population by the WHO regions

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**Limitations**

In this research, cost data were not completely obtained and researchers could not analysis of indirect cost and financial burden from the perspective of the patient.

**Acknowledgment**

Authors need to appreciate to School of Management and Medical Information Sciences, Kerman University of Medical Sciences, School of Health, Bam University of Medical Sciences, SBMEC in the city of Kerman and special thanks to Dr. Sajjad Khosravi, who coordinated data collection process and arranged the necessary permissions and improvements.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

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**Research quality and ethics statement**

This study was approved by the local Institutional Review Board / Ethics Committee. The authors followed applicable EQUATOR Network (http://www.equator-network.org/) guidelines, during the conduct of this research project.

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