



Economic Burden of Road Traffic Accidents; Report from a Single Center from South Eastern Iran

Aliyeh Sargazi¹, Atefeh Sargazi², Prigil Kumar Nadakkavukaran Jim³, Hosein Ali Danesh⁴, Forough Sargolzaee Aval⁵, Zohre Kiani⁶, Amir Hosein Lashkarinia⁷, Zahra Sepehri^{8*}

¹Medical Student, Zabol University of Medical Sciences, Zabol, Iran

²Civil Engineering Student, Sistan and Baloochestan University, Zahedan, Iran

³IT Engineer, Linlithgow, UK

⁴Zahedan University of Medical Sciences, Zahedan, Iran

⁵Medical Student, Shahid Beheshti University of Medical Sciences, Zahedan, Iran

⁶Medical Student, Kerman University of Medical Sciences, Kerman, Iran

⁷Medical Student, Zahedan University of Medical Sciences, Zahedan, Iran

⁸Zabol University of Medical Sciences, Zabol, Iran

*Corresponding author: Zahra Sepehri

Address: Assistant Professor, Zabol University of Medical Sciences, Zabol, Iran.

Tel: +98-54-32230768; Fax: +98-54-3223-0770

e-mail: sepehri_z@yahoo.com

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► ABSTRACT

Objective: To determine the economic burden of road traffic accidents (RTAs) in patients admitted to a single center in south eastern Iran.

Methods: This cross-sectional study was conducted in Amir-Al-Momenin hospital of Zabol affiliated with Zabol University of Medical Sciences during a 12-month period from April 2012 to April 2013. All the RTAs patients who were admitted to our emergency department were included. The direct expenses of hospital care were recorded according to their medical charts and the accountant registration information. Data are presented according to different RTAs characteristics.

Results: Overall 1155 patients were included in the current study with mean age of 36.7±5.14 years among whom there were 673 (58.3%) men and 482 (41.7%) women. The annual incidence of RTAs were calculated to be 288 per 100,000 population. The RTAs economic burden in our center was 589,448.49 USD which accounted for 10.4% of total hospital expenses during the study period. The money spend on RTAs in our center was 130 times more than gross national income per capita. Cost of each patient in road traffic was 15 times more than cost of an average patient of the hospital in other sections.

Conclusion: With considerable high ratio of accidents in Zabol, proper intervention is needed for controlling and preventing RTAs in order to decrease its injuries, impact and the associated economic burden.

Keywords: Road traffic accidents (RTAs); Economic burden; Healthcare Expenses; Iran.

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Introduction

Road traffic crashes (RTAs) are major but neglected public health problems that are associated with high rates of mortality and morbidity worldwide [1-4]. RTAs are currently considered the 10th cause of mortality worldwide, 7th in middle income countries and 2nd in Iran [5,6]. Worldwide, an estimated 1.2 million people die in RTAs each year and as many as 50 million are injured [7,8]. Nearly 2,700 people die on Iran's roads every year and about 70 people are injured or disabled every day [9,10]. The death rate related to RTAs in Iran (44 per 100,000) is the highest worldwide [11]. Children, pedestrians, cyclists and the elderly are among the most vulnerable groups [12-14]. The RTAs impose and economic burden to healthcare system and thus require concerted efforts for effective and sustainable prevention [15,16]. Approximately the economic burden of RTAs in Iran is 1.4% of Gross Domestic Product (GDP) [17,18]. In Iran, the victims of RTAs do not have to bear the costs of treatment as the government carries their all economic burden. These expenses are covered by insurance companies. Therefore, studying on the RTAs and related cost in each area is a way to make policy decisions easier. RTAs economic burden contain direct and indirect costs same as loss of family, mental problems, loss of ability or work, property damage, hospitalization and funeral costs [19-21].

Zabol is an area with population of 374,143 according to the recent Iran national census located in south east of Iran [22]. All Zabol area traffic cases are referred to trauma section of the only educational hospital of Zabol University of Medical Sciences called Amir-Al-Momenin Hospital. Generally the hospital bears all their expenses. The aim of the current study was to determine the economic burden of RTAs in a single center in Zabol, south eastern Iran.

Materials and Methods

Study Population

This retrospective cross-sectional study was conducted in Amir-Al-Momenin hospital, a secondary healthcare center affiliated with Zabol University of Medical Sciences during a 1-year period from April 2012 to April 2013. We have included all the patients who were admitted to our emergency department with primary diagnosis of trauma due to RTAs. The patients were transferred to our center by the public emergency medical service (EMS) or by the patients themselves. We did not included patients with other mechanism of trauma such as assault or falling. The study protocol was approved by either the institutional review board (IRB) and medical ethics committee of Zabol University of Medical Sciences. As it was a retrospective study and the data was collected of the medical and cashier records, no informed written consents were required.

Study Protocol

Data was gathered from census of all road traffic emergency incoming cases in Amir-Al-Momenin Hospital during the study period. We recorded the demographic information including age and gender, mechanism of injury, Hospital Information System (HIS), informatics, financial, accountancy and insurance data. All the mentioned data were achieved from the medical records. The information were entered in a data gathering form and were further entered into a computer database. The whole hospital economic burden was calculated using hospital financial records in one year period. Total hospital cost includes direct and indirect treatment expenses. Direct hospital expenditure includes cost of patient transportation with ambulance to hospital (Pre hospitalization cost), minor treatment for superficial injuries and major treatment for multiple-trauma, operations, medications, postoperative care and hoteling. Indirect costs included utilities, services and hospital care providers salary [23]. For estimating these costs we used hospital financial documents and traffic section recorded expenses in a one year period. All services which are provided in trauma ward are free of charge in Amir-Al-Momenin hospital of Zabol for RTAs victims.

Statistical Analysis

All the data were entered into a computer database for further analysis. All the statistical analyses were performed using statistical package for social sciences (SPSS Inc., Chicago, IL, USA) version 18.0. Data are presented as mean±SD and proportions as appropriate. The Pearson correlation test was used for estimating the linear correlation between injury and cost. The total RTAs expenses were compared to total hospital expenses in the same period of time.

Results

We recorded a total of 1155 RTA victims admitted to our center during the study period. The mean age of the patients was 36.7±5.4 (ranging from 4 to 68) years. Among the patients there were 673 (58.3%) men and 482 (41.7%) women. The incidence of RTAs was found to be 288 per 100,000 annually. Approximately about 2.1% (1155 out of 55,000) of emergency patients and 7% (1155 out of 165,000) of hospitalized patients were RTAs victims. The most common mechanism of injury was Motor vehicle collision recorded in 897 (77.6%) followed by Motorcycle accidents in 201 (17.5%). The baseline characteristics are summarized in Table 1. Of the 1155 patients, 107 (9.3%) received minor treatment, 1029 (89.1%) underwent operation and 19 (1.6%) died. Out of 73 patients who received supportive care in intensive care unit (ICU), 54 cases were suffered from long bone fracture, 10 cases were suffered from traumatic brain injury and 9 cases were mortal. Only

Table 1. The baseline characteristics of 1155 victims of road traffic accidents admitted to our center during a 1-year period.

Variable	Value
Age (years)	36.7±5.14
Gender	
Men (%)	673 (58.3%)
Women (%)	482 (41.7%)
Mechanism of Injury	
Motor vehicle collision (%)	897 (77.6%)
Motorcycle accidents (%)	201 (17.5%)
Pedestrian (%)	57 (4.9%)
Type of injury	
Superficial (%)	77 (6.7%)
Long bone fractures (%)	1048 (90.7%)
Traumatic brain injury (%)	10 (0.9%)
Amputation (%)	1 (0.1%)
Mortality (%)	19 (1.6%)
Treatment	
Minor treatment (%)	107 (9.3%)
Operation (%)	1029 (89.1%)
Supportive care at ICU (%)	73 (6.3%)

77 cases (6.7%) had superficial injuries and 1078 cases (93.3%) had severe injuries including long bone fractures, traumatic brain injury (TBI) and amputations (Table 2).

The RTAs total treatment cost was 589,448.49 USD which accounted for 10.4% of total hospital expenses during the same period of time. Out of total hospital direct treatment costs (5,665,971.8 USD), the RTAs accounted for 589,448.49 USD. With considerable utility cost, the RTAs economic burden was calculated to be 666,666.7 USD which accounts for 7.4% of total hospital expenditure. Out of total hospital cost that was 9 million USD, 666,666.7 USD was RTAs portion and 8,333,333 USD was other sections portion. The Cost of each patient in road traffic section was 11 times more than an average patient in the other sections in hospital. There was significant linear correlation between accident severity based on severity score and the treatment related expenses ($p=0.037$; $r=0.606$).

Discussion

Although several studies have reported the epidemiological characteristics of RTAs from Iran previously [24,25], the economic burden has been addressed well. The aim of the current study was to determine the economic burden of RTAs in south eastern Iran. According to the results of the current study the incidence of RTAs are 288 per 100,000 of population annually in Zabol. The annual incidence of RTAs has been reported to be 34 per 100,000 in Iran [4]. Salimi and colleagues reported 671 RTA injuries in Ahwaz city [29], Khalaji *et al.* reported 350 RTA injuries in Qazvin city [30] and Tavanania *et al.* reported 611 RTA injuries in Qom city [26-28]. Similar studies in Sri Lanka and Italy showed 28 per 100,000 and 457 RTA cases respectively [29,30]. The RTA mortality were about 5 and 44 per 100,000 in Zabol and Iran respectively [31]. Highest RTAs related mortality was in Tehran province with 3,221 and Khorasan province with 2,469 mortal cases. Lowest RTAs related mortality was in Kohgiluyeh and Boyer-Ahmad Province with 165 and Ilam province with 173 mortal cases in Iran [32]. According to Mohamadfam's and Tavanania's studies, fatal outcomes were 251 and 298 in Hamedan and Qom cities respectively [28,33]. The RTA related injuries in Zabol were 8 times more than Iran average and RTA related deaths in Zabol were 0.11 times more than Iran average in April 2012-2013. Out of all reported injuries, more than 93% were severe injuries [31].

The RTAs includes 1-2% of Gross National Product (GNP) in low and middle income countries and accounts for about 65 billion USD annually [34]. Luke showed road accidents contained 2.3% of Australia GDP which was equal to 17 billion USD in 2003 [35]. A same study has been done by Gracia in Barcelona. In this study Barcelona RTAs cost calculated approximately about 489 USD in 2003 [36]. Elvik demonstrated that road accidents cost is about 0.3-2.8% of GNP without considering valuation of lost quality of life and is about 0.5-5.7% of GNP with considering valuation of lost

Table 2. Economic burden of road traffic accidents in those admitted to our center during a 1-year period according to the trauma severity, mechanism of injury and received therapies.

	Number of patients	Expenses (USD)
Trauma severity		
Minor trauma	107 (9.3%)	14,478.473 (2.5%)
Major trauma	1048 (90.7%)	574,970.023 (97.5%)
Total	1155 (100%)	589,448.496 (100%)
Treatment		
Minor treatment (%)	107 (9.3%)	14,478.473 (2.5%)
Operation (%)	1029 (89.1%)	557,670.023 (94.6%)
Supportive care at ICU (%)	73 (6.3%)	17,300.000 (2.9%)
Mechanism of injury		
Motor vehicle collision (%)	897 (77.6%)	341,148.880 (59.3%)
Motorcycle accidents (%)	201 (17.5%)	140,292.686 (24.4%)
Pedestrian (%)	57 (4.9%)	93,528 (16.3%)

quality of life in twelve different countries [37]. Our study showed that the average cost of each patient in hospital accident section is 11 times more than a patient in other sections. Nine by ten of injured patients are with severe injuries that could be the reason for the heavy costs in accidents. The money spent in RTAs in only one hospital in Zabol was about 589,448,496 i.e. 140 times more than gross national income per capita in Iran. High rate of RTAs has induced heavy economical burden. Proper intervention is needed for controlling and preventing road traffic accidents in order to reduce the injuries, impact and the associated economic burden.

In this study we considered whole Zabol area's population and not Zabol city population for calculating RTAs rate. Zabol area is containing Zabol city and 3 other cities and villages around it. Although there are two hospitals in this area that RTA cases refer to, we considered only Amir-Al-Momenin hospital's RTA data, because most of accidents in this area are referred to Amir-Al-Momenin hospital and this is the only educational hospital in the area. Therefore the real RTA rate was bit more than what we reported for Zabol area.

Limited resources and high treatments cost has forced managers to limit accesses to resources.

References

- Gonzalez-Luque JC, Rodriguez-Artalejo F. The relationship of different socioeconomic variables and alcohol consumption with nighttime fatal traffic crashes in Spain: 1978-1993. *Eur J Epidemiol.* 2000;**16**(10):955-61.
- Petridou E, Moustaki M. Human factors in the causation of road traffic crashes. *Eur J Epidemiol.* 2000;**16**(9):819-26.
- Bener A, Rahman YS, Mitra B. Incidence and severity of head and neck injuries in victims of road traffic crashes: In an economically developed country. *Int Emerg Nurs.* 2009;**17**(1):52-9.
- Bakhtiyari M, Delpisheh A, Monfared AB, Kazemi-Galougahi MH, Mehmandar MR, Riahi M, et al. The road traffic crashes as a neglected public health concern; an observational study from Iranian population. *Traffic Inj Prev.* 2015;**16**(1):36-41.
- Krug EG, Sharma GK, Lozano R. The global burden of injuries. *Am J Public Health.* 2000;**90**(4):523.
- Montazeri A. Road-traffic-related mortality in Iran: a descriptive study. *Public Health.* 2004;**118**(2):110-3.
- Kopits E, Cropper M. Traffic fatalities and economic growth. *Accident Analysis & Prevention.* 2005;**37**(1):169-78.
- Li K, Fan X, Yin Z. Pedestrian injury patterns and risk in minibus collisions in China. *Med Sci Monit.* 2015;**21**:727-34.
- Ferreira SL, Harmse AC. The social carrying capacity of Kruger National Park, South Africa: policy and practice. *Tourism geographies.* 1999;**1**(3):325-42.
- Soori H, Royanian M, Zali AR, Movahedinejad A. Road traffic injuries in Iran: the role of interventions implemented by traffic police. *Traffic Inj Prev.* 2009;**10**(4):375-8.
- Bhalla K, Naghavi M, Shahraz S, Bartels D, Murray CJ. Building national estimates of the burden of road traffic injuries in developing countries from all available data sources: Iran. *Inj Prev.* 2009;**15**(3):150-6.
- Rifaat SM, Tay R, de Barros A. Effect of street pattern on the severity of crashes involving vulnerable road users. *Accid Anal Prev.* 2011;**43**(1):276-83.
- Leden L, Garder P, Johansson C. Safe pedestrian crossings for children and elderly. *Accid Anal Prev.* 2006;**38**(2):289-94.
- Yunus SS, Ngeow WC, Ramli R. Pediatric craniomaxillofacial injuries after road traffic crashes: characteristics of injuries and protective equipment use. *Am J Emerg Med.* 2015;**33**(9):1253-7.
- Haghparast-Bidgoli H, Hasselberg M, Khankeh H, Khorasani-Zavareh D, Johansson E. Barriers and facilitators to provide effective pre-hospital trauma care for road traffic injury victims in Iran: a grounded theory approach. *BMC Emerg Med.* 2010;**10**:20.
- Fraga AM, Fraga GP, Stanley C, Costantini TW, Coimbra R. Children at danger: injury fatalities among children in San Diego County. *Eur J Epidemiol.* 2010;**25**(3):211-7.
- Akbari ME, Naghavi M, Soori H. Epidemiology of deaths from injuries in the Islamic Republic of Iran. *East Mediterr Health J.* 2006;**12**(3-4):382-90.
- Darabi Golshani AM, Nikraz H. Socio-Economic Costs Associated to Road Traffic Accidents in the Islamic Republic of Iran. In: *Policing and Education conference.* Edited by Research ARS: Austroads; 2009. p. 864.
- Pukalskas S, Pečeliūnas R, Sadauskas V, Kilikevičienė K, Bogdevičius M. The methodology for calculation of road accident costs. *Transport.* 2015;**30**(1):33-42.
- Bastida JL, Aguilar PS, Gonzalez BD. The economic costs of traffic

Besides, policies should guide society behavior. It seems while hospitals carry all RTA's financial burden, people are encouraged to take risk. Although accidents in Zabol were not always fatal, they were severe enough to be considered as a significant problem. The high burden of major injuries could be related to low car safety. Nowadays modern cars have high safety for passengers and pedestrians, so we suggest changing policies to introduce more modern cars to Iran roads. Free treatment cost is inversely proportionate to the import of modern cars and improving road safety.

In conclusion, RTAs in Zabol is associated with high economic burden equal to 10.4% of all healthcare expenditure. With considerable high ratio of RTAs in this area, proper intervention is needed for prevention in order to decrease its injuries, impact and the associated economic burden.

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- accidents in Spain. *J Trauma*. 2004;**56**(4):883-8; discussion 8-9.
21. Rezaei S, Arab M, Karami Matin B, Akbari Sari A. Extent, consequences and economic burden of road traffic crashes in Iran. *J Inj Violence Res*. 2014;**6**(2):57-63.
 22. Khammar GA, Bonjar AM: Analyzing and studying the role of Zabol city in regional development. *American Journal of Engineering Research (AJER)*. 2015;**4**(3):88-94.
 23. al-Masaeid HR, al-Mashakbeh AA, Qudah AM. Economic costs of traffic accidents in Jordan. *Accid Anal Prev*. 1999;**31**(4):347-57.
 24. Gholipour C, Vahdati SS, Ghaffarzade E, Zonouzi KK: Characteristics of Fatal Occupational Traumatic Injuries; Drama in East Azerbaijan Province of Iran. *Bull Emerg Trauma*. 2015, **3**(1):27-31.
 25. Modarres SR, Shokrollahi MH, Yaserian M, Rahimi M, Amani N, Manouchehri AA: Epidemiological Characteristics of Fatal Traumatic Accidents in Babol, Iran: A Hospital-Based Survey. *Bull Emerg Trauma*. 2014;**2**(4):146-50.
 26. Salimi J ZM: Epidemiological Study of Trauma Patient Reffer to Ahvaz Hospital. *Payesh*. 2008;**7**(2):115-20.
 27. Khalagi K, Madjdzadeh R, Eshraghian M, Motevalian A, Holakouei NK. Risk Factors of Road Traffic Accidents in Ghazvin –Loshan. *Iranian Journal of Epidemiology*. 2006;**1**(3):27-35.
 28. Tavanania M AZ: An epidemiologic survey on road traffic accidents in Qom province. *Qom Medical Sciences University Journal*. 2012;**2**(5):90-5.
 29. Wickramanayake I, Gunasena G, Wickramanayake H, Goonasekera C. The Prevalence of Known Risk Factors for Road Traffic Accidents (RTA) in Kandy Police Administrative Area. *Peradeniya University Research Sessions Purse 2007 Volume 12 Part I-Agricultural, Biological and Medical Sciences Editorial Board*. 2007:129.
 30. Chini F, Farchi S, Ciaramella I, Antoniozzi T, Giorgi Rossi P, Camilloni L, et al. Road traffic injuries in one local health unit in the Lazio region: results of a surveillance system integrating police and health data. *Int J Health Geogr*. 2009;**8**:21.
 31. Naghavi M, Shahraz S, Bhalla K, Jafari N, Pourmalek F, Bartels D, et al. Adverse health outcomes of road traffic injuries in Iran after rapid motorization. *Arch Iran Med*. 2009;**12**(3):284-94.
 32. Shabani S RH, Nabil M: Cluser Analysis of Road Traffic Accidents Victims. *Pajouheshname Hamlonaghl*. 2009;**6**(2):193-203.
 33. Mohamadfam I SG: Epidemiological Study of Road Traffic Accident. *Iranian Journal of Law Medicine*. 2000;**6**(2):5-11.
 34. Khajuria B, Sharma R, Verma A. A profile of the autopsies of road traffic accident victims in Jammu. *J ClinDiagn Res*. 2008;**2**:639-42.
 35. Connelly LB, Supangan R. The economic costs of road traffic crashes: Australia, states and territories. *Accid Anal Prev*. 2006;**38**(6):1087-93.
 36. Garcia-Altes A, Perez K. The economic cost of road traffic crashes in an urban setting. *Inj Prev*. 2007;**13**(1):65-8.
 37. Elvik R. How much do road accidents cost the national economy? *Accid Anal Prev*. 2000;**32**(6):849-51.