



## Review Article

### Economic Burden of Road Traffic Injuries in Iran: A Mini-systematic Review

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#### Abstract

**Purpose:** Due to the high economic burden of Road Traffic Injuries (RTIs) in Iran and the ambiguities in this field, the aim of this study was to mini systematic review about the economic burden of RTIs in Iran.

**Material and Methods:** Required data in this mini systematic review study were collected through searching the following key words: "road traffic injuries", "road traffic accidents", "road traffic crashes", "road traffic collision", "economic\*", cost and Iran. The following databases were used: Google Scholar, PubMed, Scopus, MagIran, Iranian scientific information (SID) databases and IranMedex. Some of the relevant journals and web site searched manually. Reference lists check of the selected articles also was conducted. In final stage of literature review we also conducted search of gray literature and experts contact.

**Results:** The results of the 11 studies examined show that the Human Capital (HC) approach is used more than other cases among different approaches to calculating the cost of RTIs. Using the willingness to pay (WTP) approach, the total cost of RTIs in Iran in 2013 was reported to be 6.64% of the GNP. Using the HC approach, the share of RTIs costs in the whole of Iran has been reported to be 1.4% and 2.1% of GNP, respectively. Health care costs of RTIs have been more explored, compared to other types of RTIs costs. The costs of vehicles were higher than other types of expenses.

**Conclusion:** Economic burden of RTIs in Iran are high. Hence, more planning and attention to preventing RTIs, and increasing the safety of roads and vehicles are essential.

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#### Introduction

Today, Road Traffic Injuries (RTIs) are considered as the main cause of disability and mortality worldwide [1]. It's estimated that 1.2 million people are killed and 50 million are injured by RTIs in each year [2]. According to projections, it is expected that these figures will increase by about 65% over the next 20 years [3].

The High socio-economic costs of RTIs, is one of the major important problems that have challenged the authorities and policy makers of countries [4, 5]. The economic burden of accidents may comprise all costs resulting from accidents or arising from accidents [6]. It is estimated that the global RTIs is

about \$ 518,000 billion each year, of which \$ 65,000 billion is a share of Low and Middle Income Countries (LMICs). It is also estimated that the cost of RTIs in countries with low, moderate and high incomes, is equal to 1, 1.5 and 2 percent of the Gross National Product (GNP) of those countries [7, 8].

In Iran RTIs are the main cause of injury and the second cause of mortality [10] and RTIs prevalence is four times higher than High Income Countries (HICs) [9]. The economic burden of RTIs in Iran was evaluated comprehensively, for the first time in 2001, equal to 6170.6 billion Rial's [11]. According to a study by Ainy et al. (2014), using the willingness to pay (WTP) approach, it was estimated that the costs of traffic accidents include 6.46% of Iran's Gross Domestic Product (GDP) [12].

Several studies have been conducted on the economic burden of RTIs, with different approaches, in Iran in recent years [13-15]. However, there is no detailed information on the actual costs of RTIs. It is expected that systematically review the results of studies conducted in this field, can provide accurate and useable information for policy-makers in Iran. Therefore, the aim of this study was to mini systematic review the economic burden of RTIs in Iran.

## Material and Methods

This mini systematic review study was conducted in 2016, using the approach of systematic review adopted from the book entitle “*A Systematic Review to Support Evidence-Based Medicine* [16]”.

### Eligibility criteria

The inclusion criteria for the study were: cross- sectional studies on the RTIs cost or economic burden in Iran, articles published from 1 January 2005 to 25 March 2016, articles published in Persian and English language.

Exclusion criteria included: studies that conducted before 1January 2005, conference presentations, case reports, interventional and qualitative studies.

### Information sources

Required data were collected searching following key words: “road traffic injuries”, “road traffic accidents”, “road traffic crashes”, “road traffic collision”, “economic\*”, cost and Iran. The following databases were used: Google Scholar, PubMed, Scopus, MagIran, Iranian scientific information (SID) databases and Iran Medex. Some of the relevant journals and web site searched manually. Reference lists check of the selected articles also was conducted. In final stage of literature review we also conducted search of gray literature and experts contact.

### Review process

In the first phase of review process, an extraction table was designed included following items: first author name, study published year, costing year (Year Calculation of Costs), sample and sample size, setting, data collection methods, cost type, costing approach, cost as % of GNP/capita and overall results. Validity of the data extraction table was confirmed by experts, and it was conducted pilot study (with 3 articles) for further improvement of extraction table. Two authors (A-AS and N.D) that had enough experience and knowledge were responsible for independently extraction of data.

In first phase of articles selection, articles with non-relevant titles were excluded. In the second phase, the abstract and the full text of articles were reviewed to include those articles that were matched with the inclusion criteria. Reference management (Endnote X7) software was used for organizing and assessing the titles and abstracts, as well as for identify of duplication studies.

### Quality Assessment

Two reviewers evaluated the reporting quality of articles according to the checklist of strengthening the Reporting of

Observational Studies in Epidemiology (STROBE) [17-19]. Controversies cases between these reviewers were referred to a third author.

### Data analysis

In this study due to existing defriends in report of studies results and some methodological issue, we cannot conduct quantitative analysis (Meta-Analysis methods). Data was analysis manually.

## Results

In this study, out of 369 articles, finally 11 articles were included (Figure 1).

The results of extracted data from entered articles are summarized in Table 1.

Out of 11 reviewed articles, 3 articles included mortality costs and traumatic accidents in the entire country. Five papers were taken at the hospital, and 3 papers are also on the road. Among reviewed studies, six papers had noticed the overall cost of RTIs, and five papers had paid to the hospital costs of RTIs. Human Capital (HC) approach was used in 7 papers. The Willingness To Pay (WTP) approach was used in two papers. Also, calculation of approaches was not mentioned in 2 other articles.

In a study that was done by Ainy, E et al. 2014, according to the WTP approach, the cost of RTIs was estimated at 6.64% of GDP [12]. Also, in another study that was done by Ainy, E et al. 2015, the cost of 410 drivers of public vehicles, was used as a WTP, and the cost of RTIs was estimated at 1.2% of GDP [14]. In two studies, that HC approach, and accounted for the share of RTIs costs from the GNP, respectively, RTIs costs included 1.4 and 2.1 percent of GNP Study results Sargazi, A et al. 2016, which used gross national income per capita, showed that RTIs costs were 130 times higher than that of gross national income per capita [20].

## Discussion

The results of this study showed that the health costs of RTIs have been more studied compared with other types of costs.

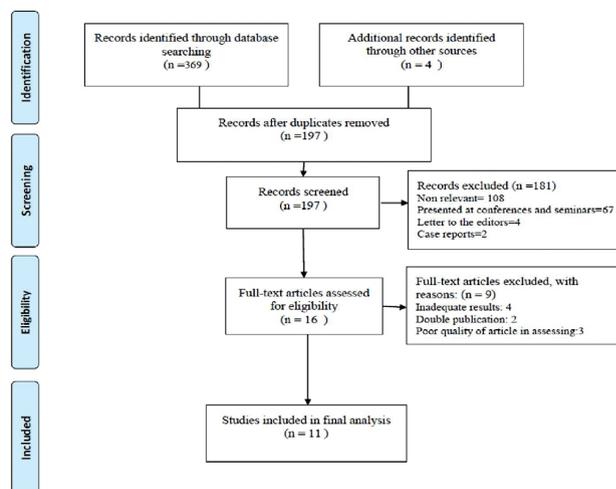


Figure 1. Bibliographical searches and inclusion process

**Table 1. Characteristics of the included studies**

Author: year	Costing year	Samples	Setting	Data collection	Cost type	Approach	Cost as% of GNP/capita	Overall results
Ainy, E et al. 2014 [9]	2013	846 randomly selected road users	Urban road (Tehran city)	questionnaire	Total estimated cost	Willingness to pay (WTP)	6.64 of GNP	The total estimated cost of injury and death cases was 39,048,341,074\$ Mean WTP was 2,612,050 Iranian rials (IRR).
Ahadi and Razi-Ardakani 2015 [13]	2009	806,922 RTIs and 22,974 deaths	Overall for Iran	Iran's road safety statistics, corresponding values in other related studies in Iran, assumptions provided in credible international related material	Total estimated cost (Property damage cost, administrative costs, medical costs, lost output costs, human costs)	Human capital (HC)	1.41 of GNP	Total cost of road Traffic crashes= 114,455.19* Property damage cost= 42,191.42 Administrative costs= 7,025.33 Medical costs= 14,419.50 Lost output costs= 32,296.66 Human costs= 18,522.29
Sargazi, A et al. 2016 [20]	April 2012 to April 2013	1155 RTAs patients	Hospital	Medical records	Medical costs	HC-hospital cost	130 times more than gross national income per capita	The RTAs economic burden was 589,448.49 USD which accounted for 10.4% of total hospital expenses. Cost of each patient in road traffic was 15 times more than cost of an average patient.
Ainy, E et al. 2015 [14]	2013	410 drivers of public vehicles	Urban road (Tehran city)	Questionnaire	Total estimated cost	WTP	1.25 of GNP	Mean WTP was 3,337,130 IRR. injury and death cases cost came to 226,606,472,346,449 IRR
Rezaei, S et al. 2014 [21]	Between 20 March 2009 and 20 March 2010	806,922 RTIs and 22,974 deaths	Overall for Iran	400 medical Records (for severity and medical costs), current evidence, expert opinion	Total estimated cost (medical, production lost, property damage, rehabilitation intangible, funeral and administration costs)	HC	2.19 of GNP	The total cost of RTCs was about 72,465 billion rials. Medical (2,952.3), production lost (24,785), property damage (28,708.9), rehabilitation intangible (12,513.7), funeral (114.8) administration (3,390.7)
Hejazi, R et al. 2013 [22]	2007	121 fatal accidents and 827 injury accidents	Tehran-chalus road	Police Records, 2006	Total estimated cost	HC	-	Traffic accident costs were US\$2.2 million in 2007
Kavosi, Z et al. 2015 [23]	2009 to 2013	279 brain injuries deaths due to traffic accidents	Hospital	Medical records, telephone calls	Total estimated cost (hospital costs, productivity lost, productivity lost per capita)	HC	-	Total estimated cost= 513 hospital costs (6.2), productivity lost(506), productivity lost per capita (1.8)
Manouchehrfar, M et al. 2014 [24]	August 2008 to August 2009	200 patient injured in traffic accidents	Hospital	Medical records	Hospitalization cost	HC	-	The mean hospitalization cost was estimated at 1622.1\$

(contd...)

**Table 1. (Continued)**

Author: year	Costing year	Samples	Setting	Data collection	Cost type	Approach	Cost as% of GNP/capita	Overall results
Rezaei, S et al. 2013[25]	2009	806,922 RTIs and 22,974 deaths	Overall for iran	Iran's ministry of health and medical education, forensic medicine organization, 400 medical records	Hospital costs and other health services	HC	-	The total healthcare costs = 2952 Hospital costs (87%) Pre-hospital costs (12%) Rehabilitation costs (1%)
Sayed Moallemi and Dadkhah [26]	2010	125 injured motorcyclists	Hospital	"Form 92", a registration form of motorcyclists	Hospital costs	-	-	The mean of hospital costs was about 9,000,000 rials
Torabi, A et al. 2009 [27]	22 Juan 2005 to 22 Juan 2006	375 injured motorcyclists	Hospital	Questionnaire	Hospital costs	-	-	Total hospital cost of persons was 981572746 rial (101194 \$)

\*Billion Iranian Rials

Among the different approaches to calculating RTIs costs HC approach, it is most used in calculating the cost of RTIs. Using the WTP approach, the total cost of RTIs in Iran was reported to be 6.64% of GNP in 2013. According to the HC approach, the share of RTIs costs in the whole of Iran from GNP has been reported accordingly 1.4 and 2.1%.

In recent years, different approaches have been used to estimate the cost of RTIs. The most important of these approaches are life insurance approach, court award, compensation method, implicit public sector valuation, gross output, HC, WTP [4, 28-32]. Only two approaches, HC and WTP, were used. The findings of the HC approach are a robust and reliable method that is used in many economies and health studies in the world. In this approach, the specific age and sex of the average income, in combination with the expected production trends, are used to calculate the individual's income during a lifetime. In this approach, it is assumed that the value of money lost from production, as a result of a person's inability or early death, is equal to a person's wages before disability and death. In order to calculate the cost of lost production due to disability, the number of disability and disability days is multiplied by the average of the person's daily wage, and the amount obtained is considered to be the monetary value of the lost production [33, 34]. In recent years, this method has been used in numerous studies to calculate the costs of RTIs [35-38]. The WTP method is based on basic assumptions, and suggests that the decisions taken in the public sector, about resource allocation, should be based on the citizens' preferences and desires [39, 40]. In recent years, this method has been used to calculate the costs of RTIs [41-44]. In the present study, RTIs costs were estimated to be higher in studies that used the WTP method, compared with the HC approach. One of the main reasons for this could be to provide less than actual number of deaths and injuries from RTIs by the relevant organs. Also, in the HC method, things like lost time, reduced quality of life, costs imposed on the elderly and children are not counted [45, 46]. In contrast, the WTP method is a simple, high-precision approach and understanding the results of this approach is easier for policymakers [39, 47, 48].

In the present study, using the WTP approach, the total cost of RTIs in Iran in 2013 was reported to be 6.64 percent of GDP. With this approach, the total cost of RTIs is \$ 39,048,341,074. Also, with the use of HC approach, the share of RTIs costs in the whole of Iran has been reported from GNP, respectively 1.4 and 2.1 percent, while according to the results of the calculations and research of the Islamic Consultative Assembly, the economic and social costs of the expenses incurred Driving accidents in the country are very high. So that, it is about 8.5% of the country's GDP [49]. The results of studies conducted in Iran indicate that the cost of RTIs in Iran is more comparable to other countries. Due to the possible reasons, we can mention the low safety of Iran's roads, which increase the severity of RTIs, low safety of vehicles, and they are expensive, more young people are injured and killed in road accidents, high administrative costs and Cost management, and the like. Hence, planning and paying more attention to preventing RTIs, and increasing the safety of roads and vehicles, are essential.

One part of the economic burden of RTIs, which is worthiest of attention, was more compared to other types of costs, and

the cost of vehicles. In this regard, the study by Ayati et al. (2008) showed that the cost of damage to vehicles in RTIs in Iran in 2004 is equal to six thousand billion Rials, which is more than 0.5% of the GDP, and more than the total budget for road construction and road construction, the same year [50]. However, human and therapeutic costs of RTIs in other areas are much higher [51-53]. One of the reasons for this can be low quality cars, on the roads of Iran, at the same time high prices. This raises the cost of damages to vehicles. Hence, considering the increased safety of vehicles, in order to reduce the economic burden of RTIs, is unavoidable.

One of the important limitations of this study is the lack of access to some existing reports and theses, despite the great effort. Another limitation of the present study is the high degree of heterogeneity in the reporting of the results of studies, which made the possibility of quantitative analysis (meta-analysis) impossible.

## Conclusion

According to the results of the studies, the economic burden of RTIs in Iran is high. Hence, planning and paying more attention to preventing RTIs, and increasing the safety of roads and vehicles, are essential. Due to the high costs of vehicles, in RTIs in Iran, the promotion of safety of vehicles must be planned by policymakers and officials. Considering that, other than HC, WTP approaches, other approaches have not been used. In calculating the costs of RTIs in Iran, estimating the cost of RTIs by other approaches is suggested.

## Conflict of interest

None.

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