

# Role of Health Sector in Road Traffic Injuries Prevention: A Public Health Approach

## Abstract

**Background:** Although the main burden of the Road Traffic Injuries (RTIs) is on the health sector, compared with other sectors, no clear definition is available about its role in the prevention of the RTIs. So this study has been performed to define the role of the health sector in the prevention of RTIs –before the incidence. **Methods:** In this qualitative study with a grounded theory approach, the possible roles of the health sector in the prevention of the RTIs were identified in three phases. At the first stage of the study, the roles of the health system in the prevention of the RTIs identified from the literature. In the next step, semi-structured interviews (ranged from 45 to 90 minutes) with 42 experts were done for identifying roles. Finally, Consensus attained on the identified roles by using the Delphi technique and with the participation of 30 experts. **Results:** Literature review and interviews resulted in 42 and 86 roles for the health sector in the prevention of the RTIs, respectively. After removing the duplicates and merging the similar, 46 roles were entered into Delphi. Five roles excluded in the Delphi leaving 41 roles in 7 dimensions of communications (6 roles), intra-sector cooperation (9 roles), inter-sector leadership (6 roles), evaluation (6 roles), research (5 roles), education (3 roles), and health-specific issues (6 roles). **Conclusions:** It seems that the health sector can help an impressing reduction of the RTIs by playing the roles identified in this study, which the most important of them is Communication/Informing role. So first the general public and then the health sector itself would benefit from it.

**Keywords:** Health sector, injuries, preventive medicine, public health, traffic accident

## Introduction

Road Traffic Injuries (RTIs) is one of the ignored social, economic, and health dilemmas<sup>[1,2]</sup> while it is the main cause of morbidity, and mortality worldwide.<sup>[3]</sup> It is estimated that 2 million people lose their lives due to RTIs worldwide every year and an additional 50 million people get injured.<sup>[4]</sup> Estimations also have shown that these numbers will grow 65% in the future 20 years.<sup>[5]</sup> Based on the results of the global burden of disease study in 2016, RTIs ranked 8<sup>th</sup> out of 20 fatal causes and alone accounted for about 2.46% of total deaths, worldwide.<sup>[6]</sup> Also according to monitoring reports of millennium development goals, RTIs accounted for 24% of deaths by accidents.<sup>[7]</sup> Furthermore, RTIs were the leading cause of mortality in the age group of 5–29 years worldwide.<sup>[8]</sup> It is estimated that for each RTIs-related death, 16 injuries lead to hospitalization, and 400 injuries lead to the use of outpatient services or transient activity

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restriction, which could impose a lot of cost on the health system.<sup>[9]</sup>

From a historical viewpoint, the RTIs are considered accidents that occur to others and are inevitable and non-preventable events. The word “accident” especially reminds the concept of being non-preventable, while results of research and high agreement between the experts show that the RTIs are preventable.<sup>[10-13]</sup>

Over the past century, there has been a perception that the transport sector is responsible for the prevention of RTIs. But the attitudes changed in the early 1960s and then the RTIs became not only a problem of the transport system but also one of the major public health issues.<sup>[14]</sup> The logic for this change is that the health sector can help the prevention of RTIs and thus reduce hospitalizations.<sup>[15]</sup> The public health approach to the RTIs prevention has a scientific base and benefits from the fields of medicine, biomechanics, epidemiology, social science, behavior

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sciences, criminology, education, economy, and engineering.<sup>[5]</sup>

RTIs pose a global threat to health and the development of societies. On the other hand, road accidents impose too much on the health system of different countries. Hence, the health sector should rethink its role and responsibilities and become a more active player and partner of other sectors involved, such as transport, finance, the judiciary and the environment.<sup>[16]</sup>

Considering the health-oriented approach in the prevention of the RTIs in recent years and the involvement of various organizations in this regard, there is a need to clearly define the tasks of health system in the prevention of the RTIs. Yet, the search showed that the literature lacks such a definition. So this study has been performed to identify the roles of the health sector in the prevention of the RTIs- in the pre-event phase.

## Methods

This was a qualitative study performed in 2018 in Iran with the grounded theory approach. The grounded theory is an inductive and exploratory research method that is a method for getting recognition about the issues in which no comprehensive research is available on them and our knowledge is limited.<sup>[17,18]</sup> This study consisted of three stages of literature review, semi-structured interviews, and Delphi technique as described below.

### Literature review

At the first stage of the study, the roles of the health system in the prevention of the RTIs identified from the literature. The keywords of injury, trauma, road traffic injury, road traffic accidents, road traffic crashes, motorcycle accident, motorcycle crash, motorcycle injury, motor vehicle injury, motor vehicle crash, motor vehicle accident, health system, health sector, public health, were used for searching the Cochrane, Embase, Scopus, PubMed, Google scholar, google search engine and the related websites up to the 31 December 2018. In this study any scientific document (paper, report, book, etc) in which the roles of the health system in road traffic accidents were mentioned were included. Documents referring to the role of the health system in other types of injuries (falls, burns, etc.) and non-road accidents (rail accidents, air and sea accidents) were excluded from the study. Titles of the retrieved articles screened and abstract and full text reviewed for eligibility. Studies that did not meet the inclusion criteria and had a weak relation with study purpose identified and excluded. Finally, 4 document included in analysis. The finalized table included authors, year, place, data collection method, and the roles of health system in RTIs. The content analysis method used to analyze the qualitative data extracted. The method is common for identifying, analyzing and reporting the themes that exist in the text.<sup>[19,20]</sup> The analysis performed in following steps: reviewing the data for several times,

gathering information to develop primary codes, searching the themes, developing the themes (creating a concept map), defining and naming the themes, summarizing and categorizing the themes, and finally rechecking the credibility of analysis by two researchers to arrive at an agreement.

The data obtained from this step were used to develop the next step interview questions.

### Interviews

This stage was performed with participants from various related organizations including the universities and research centers, Ministry of Roads and Urban Development, Ministry of Industry, Mine and Trade, Ministry of Health and Medical Education, Traffic Police, Ministry of Culture and Islamic Guidance, Ministry of Education, Legal (forensic) Medicine organization, insurance organizations, Ministry of Justice, Ministry of Interior, the Red Crescent organization, the EMS, Fire Department, Police, the Islamic Republic of Iran Broadcasting-IRIB, and the Judiciary Branch. The participants were either faculty members that had high knowledge and research on RTIs, chairmen of the research centers related to RTIs, chairmen, or high positions in the mentioned organizations that had direct responsibility about the RTIs, and some well-educated drivers. Inclusion criteria were publishing books and/or articles on RTIs (for faculty and research centers' member), having at least 2 years of direct working experience on RTIs, Iranian nationality, being fluent in Persian language, education of at least diploma, and having the ability and willingness to participate in the study.

The purposeful sampling method was applied in which those individuals who had the richest information and could it are selected.<sup>[21-23]</sup> Sampling continued until reaching the data saturation. The saturation has arrived after 42 interviews of which 5 were faculty members, 4 head of research centers, 20 high positions in related organizations, 10 province-level authorities, and 3 drivers. After starting the sampling and during the interviews the theoretical sampling method also was applied to identify those who can provide rich information. We also tried to make the study sample heterogeneous by selecting individuals with different ages, employment status, working history, education level, and job position.

To collect the data semi-structured face-to-face interviews conducted in the Persian language. A researcher-made semi-structured interview guide form in Persian language was used for conducting the interviews. This form was designed based on the literature review done in the first phase, and the opinions of the research team members. At the beginning of each interview, the interviewer explained the objectives of the study and then the results of the literature review were presented before the question was asked. The interviews held in places in which the

participants were comfortable. Ice breaks and researcher's introduction (personal information, goals, reasons for doing the research) done before the interviews start. An interview guide was used during the interviews to make sure that all aspects are discussed. After getting the consent of the participants, the interviews were recorded by a digital voice recorder. Besides the recordings, notes were taken during the interviews. The interviews were listened several times and transcribed soon after into MS Word software (version 2010).

To analyze the gathered data, the Conventional Content-Analysis method was applied which is a method for identifying, analyzing, and reporting the patterns within the text. The data analysis steps at this stage were similar to the literature review.

For rigor, transferability, and reliability of the data, we used a peer check, expert check, and the respondent validation. Respondent validation was performed immediately after each interview so that the participant provided a summary of the interview to confirm or revise what the researcher had understood from his/her sayings.

Regarding the ethics, the informed consent of all participants was obtained before the interviews. The study purposes were explained for the participants and they were told that they can leave the study at any stage they want. The study protocol was reviewed and approved by the institutional review board which is the Ethics Committee of the Iran University of Medical Sciences (Ethical code: IR.IUMS.REC 1394.9221557209).

### Delphi technique

The first round of the Delphi conducted with 20 experts. The questionnaire consisted of three parts: a short introduction about the aims and the necessity of the study, a guide on how to complete it, and the questions. The questionnaires were sent to the contributors by email and a reminder was sent in case no answer was received after two weeks. A Delphi forum that was previously used by the authors<sup>[24]</sup> was applied with minor changes (Additional file 1). In this form, the contributors scored each potential role of the health system in two dimensions of importance and feasibility. The answers to each question were: I disagree, I have no idea, and I agree. The contributors should select a score for their answers ranging from 1 to 9 to show the degree of agreement/disagreement. The answer "I disagree" had the scores of 1 to 4 in which score 1 represented most disagreement. The answer "I have no idea" had a score of 5 and the answer "I agree" had the scores of 6 to 9 in which score 9 represented the most agreement. The median scores were calculated for each item so that items with a median score of above 7 were accepted, below 4 were rejected, and between 4 and 7 went for the second round of the Delphi.

The median score of 11 items calculated between 4 and 7 and then they entered into the second round of the Delphi

with 10 experts. The second round conducted similar to the first round and all 11 items get a score of either below 4 or above 7. So the Delphi phase of the study finished.

### Results

This qualitative study aimed to define the possible role of the health sector in the prevention of RTIs through Literature review and semi-structured interviews with 42 experts and to attain consensus on the identified roles using the Delphi technique with the participation of 30 experts.

The study process and the results of each stage are shown in Figure 1.

The literature search resulted in four relevant resources of which 42 roles were extracted for the health system in the prevention of the RTIs. Characteristics of the resources and the number of roles extracted from each are presented in Table 1.

The guide was developed based on expert opinions. Each interview lasted for 45–90 minutes; except for one, which was 20 minutes due to the hectic schedule of the participant. The interviews resulted in 86 roles for the health system in the prevention of the RTIs. They were put together with the 42 roles identified from the literature review to make 128 roles. Then the duplicate roles were discarded and the similar roles were merged. Finally, 46 roles defined. These 46 roles were categorized into 7 categories by using the Content-Analysis method [Figure 2]. Since the Communication/Informing role was emphasized both in

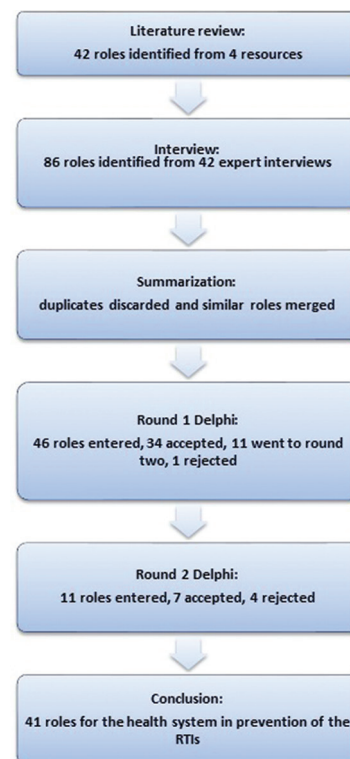
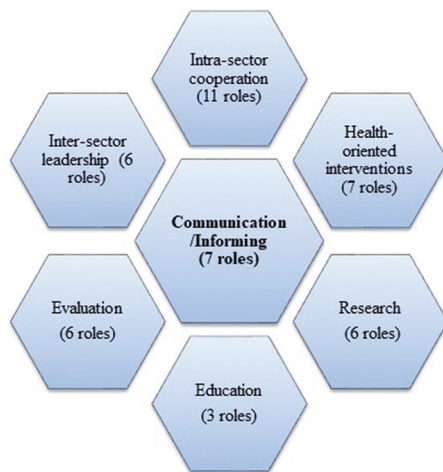


Figure 1: Process of the study in identifying the roles of the health system in the prevention of the RTIs



**Table 1: Characteristics of the reviewed resources on the role of the health system in prevention of the RTIs**

Row	Title	Type	Number of roles extracted
1	WHO. World report on road traffic injury prevention. Geneva: World Health Organization, 2004.	Report	8
2	Sleet DA, Dinh-Zarr TB, Dellinger AM. Traffic safety in the context of public health and medicine. Improving Traffic Safety Culture in the United States. 2007:41	Article	10
3	Racioppi F, Eriksson L, Tingvall C, Villaveces A. Preventing road traffic injury: a public health perspective for Europe. World Health Organization, Regional Office for Europe; 2004.	Report	6
4	Schopper D, Lormand J-D. Developing policies to prevent injuries and violence. World Health Organization. 2006	Article	18

**Figure 2: Roles of Health Sector in Road Traffic Injuries Prevention based on literature review and interviews (46 roles into 7 categories)**

literature and interviews, we put it in the center of the chart.

The 46 roles of the previous stage were entered into the Delphi phase. Round one of the Delphi ended with 34 roles approved and 11 roles went for a second round of the Delphi. Round two resulted in an additional seven accepted roles to make the overall 41 roles of the health system in the prevention of the RTIs. The five roles of the health system that were rejected in the Delphi phase are presented in (Additional file 2) and the 41 accepted roles are shown in Table 2.

## Discussion

Since the main burden of the RTIs is upon the health sector, this sector should play a more influencing role in the prevention of them. A review of the literature showed that the role of the health system is clear in event and post-event phases of the traffic accidents but its role in the pre-event phase is not well-defined. The possible roles of the health system in the prevention of the RTIs need to be clarified. This study had performed to identify such roles and resulted in 41 potential roles in 7 areas.

One main area in which the health system can act for prevention of the RTIs is communication on various aspects of the traffic accidents including frequency, causes, outcomes, and solutions. This area is highly repeated both

in literature and in interviews. Within this area, one main role of the health system is establishing a surveillance system for traffic injuries. There are some experiences available in this regard to be reviewed. The Road Traffic Injuries Surveillance System of India is an example. The system was developed in 2007 after many defects in data of the health system of India. Its main goal was to create a surveillance system in 25 large hospitals in India.<sup>[25]</sup> Under this injury surveillance system relevant information from a large number of participating organizations in a uniform way to understand injury profiles and characteristics were collected. Reliable and scientific information is one of the basic requisites to plan, implement, and evaluate road safety activities. Before conducting this system, information of RTI was collected by the Police department, and subsequently sufficient information is not available for the health sector and under-reporting is a serious problem undermining the public health burden and impact of RTIs. Based on the experiences and the lessons learnt, the program will be expanded to other parts of India. This surveillance system was merged with the Integrated Disease Surveillance Project- IDSP, which is a decentralized, state-based surveillance program in the country, intended to detect early warning signals of impending outbreaks, and initiate an effective response in a timely manner.<sup>[25,26]</sup> Another example is the case of Pakistan which launched the road traffic injuries surveillance system in 2006. The system aimed to estimate the burden of the RTIs, studying the hospitalized cases due to RTIs, and providing solutions for decreasing the RTIs. The system increased the attention to the RTIs and its outputs showed that the real number of deaths due to RTIs is higher than the statistics of the police.<sup>[27]</sup> Experiences of other countries also show that the health system can develop and implement RTIs surveillance systems successfully.<sup>[28-31]</sup> The point to consider is the cooperation of the health sector with other sectors in developing and launching such systems because the RTIs are multi-dimensional and several organizations are involved. So data from all involved organizations should be received and integrated.

Creating health campaigns on the prevention of the RTIs was another role for the health system. Experiences had shown that such campaigns can have a positive effect on the prevention of RTIs.<sup>[32]</sup> All people could attend these

**Table 2: Identified roles for the health system in the prevention of the RTIs (pre-incidence phase)**

Number	Category	Role	
1	Communication/ Informing	Developing a surveillance system for RTIs	
2		Increasing the knowledge of the authorities and policymakers	
3		Creating demand in people for a safe transport system	
4		Creating health campaigns on the prevention of the RTIs	
5		Developing evidence-based performance	
6		Cooperation with mass media in publishing the data and research	
7	Intra-sector cooperation	Playing a key role in the prioritization of the policies	
8		Consultation and contribution in designing and making a safe environment	
9		Consultation and contribution in the deployment of the interventions for the prevention of the RTIs	
10		Knowledge sharing (transferring the knowledge produced in the health sector to other sectors)	
11		Cooperation in political development (cooperation with others to make advocacy coalition)	
12		Making the capabilities of the health sector available for prevention of the RTIs	
13		Helping to the coordination of all involved organizations in the prevention of the RTIs	
14	Inter-sector leadership	Sharing the experiences, methods, and tools of the public health	
15		Contribution to put the RTIs prevention in health appendix of the plans of the organizations	
16		Stewardship and leadership of all health organizations in the prevention of the RTIs	
17		Helping to prevent the RTIs as the users of the transport system	
18		Developing the knowledge of management and policy-making towards the prevention of the RTIs	
19		Training the health service providers on prevention of the RTIs	
20		Merging the RTIs prevention into health promotion and disease prevention	
21		Attention to driving culture and safety culture in health education	
22		Evaluation	Using advanced and applied methods for evaluation of the interventions
23			Developing an observation and monitoring system for reducing the incidence and severity of the RTIs
24	Evaluation of the performance of other involved organizations		
25	Developing and measuring performance indicators for road transport safety		
26	Supervision and accreditation on vehicle safety		
27	Research	Using the evaluation and managerial methods	
28		Studying the epidemiology of the RTIs	
29		Identifying the causes of the RTIs and their share	
30		Studying the (economic, social, health, ...) burden of the RTIs	
31		Developing experimental/ laboratory research	
32	Education	Developing technical knowledge (biological research, psychological research, advanced safety equipment research, ...)	
33		Public education	
34		Academic and systemic education (developing specialized fields with the cooperation of other sectors)	
35	Health-oriented interventions	Holding specialized seminars and meetings	
36		Psychological issues (screening and treatment of attention deficit hyperactivity disorders, character types, ... in drivers)	
37		Assessment of physical disorders of the drivers (visual impairment, osteoporosis in elders, physical competence of the professional drivers, ...)	
38		Neuroscience studies (quality of sleep, recognition, and neurologic function, ...)	
39		Assessment of physical health of the professional drivers (bus drivers, public transport, and other professional drivers)	
40		Assessing the driving competence of specific population groups (elders, disabled, people with special diseases, ...)	
41		Screening and treatment of drivers for drug abuse, psychoactive substances, and alcohol	

campaigns, but these campaigns should target a specific group of society, such as people in the age group of 5-29 years, including students, drivers, and motorcyclists. Different contents such as traffic signs, road accident prevention, accident scene management, first aid for victims of road accidents, and psychological counseling to victims of road accidents, could be provided to participants

in these campaigns. It seems that this role is of special importance because it not only causes the increase of awareness and willingness of the people to prevent the RTIs but also can lead to increased sensitivity of the public and the authorities towards the RTIs. Such campaigns may also help put the issue on policy agenda in addition to creating demand in people for more safety of the transport

system. The important point about these campaigns is that although they can be helpful in the awareness and culture of the public, other steps are needed to be taken along with.<sup>[33,34]</sup> The growth of the communication tools in recent years has created a good opportunity for the success of the campaigns<sup>[35]</sup> and when developing campaigns for reducing the RTIs we should take into account the experiences of campaigns in other areas.<sup>[36]</sup> Finally considering the situation and the successful experiences of campaigns, it seems that the health sector can use this tool as an effective tool for the reduction of the RTIs.

Most identified roles were located in the category of “intra-sector cooperation” which shows the importance of cooperation in this field; it may be due to the multilateral nature of the RTIs. Several local, national, and international organizations are involved in the issue of RTIs in all countries around the world. But we should keep this fact in mind that the intra-sector cooperation comes true only with political commitment and support at the macro-level of the country.<sup>[37-39]</sup> Another issue is the need for a leading organization with clearly defined tasks and sufficient resources. Otherwise, the efforts and cooperation may face problems. Countries that had reduced the RTIs notably have such an organization that has the stewardship of decreasing the RTIs and other organizations have to interact with.<sup>[39-41]</sup> For instance, in Canada, the federal and provincial governments are in charge of road safety in their realm. The federal government has a commanding role in the transport system and develops and evaluates it by collecting data and doing research. The police have an executive role and participate in safety programs with the judiciary.<sup>[42]</sup>

Education was another important area for the health system to act in. It can be in the form of public education, academic and systemic education, and holding specialized seminars and meetings. Yet, some studies have shown that public education alone is not enough for reducing RTIs and mortalities.<sup>[43,44]</sup> They need to be along with proper regulations.<sup>[45]</sup> Education can be on driving rules, regulations, and the safety of the vehicles. It also can create a good atmosphere for safety and acceptance of the interventions. In Low- and Middle-Income Countries (LMICs) although some public education is in place usually there is no education available at an academic level for the students on the RTIs and safety. So it needs to be added to the curriculum of the academic fields. Moreover, these countries can establish specialized fields of study on RTIs prevention, just like some High-Income Countries (HICs).

Another category of roles of the health system was the “health-oriented interventions”. This category mainly treats with the competence of the drivers. An important issue in this regard is Attention Deficit Hyperactivity Disorder (ADHD) which several studies have proved

it as a risk factor for traffic accidents.<sup>[46-50]</sup> Another important issue is the assessment of the sleep disorders of the drivers which are among the main causes of the accidents.<sup>[51-53]</sup> The next issue is the screening and treatment of the drivers for drug abuse, psychoactive substances, and alcohol.<sup>[54-58]</sup> Considering the pivotal role of the drivers as in the occurrence of the traffic accidents the health system can play significant roles in this regard for the reduction of the RTIs. As the main trustee of providing psychology and neurology services in the country, the health system, in cooperation with the traffic police, can examine the applicants for driving licenses in terms of the existence of these disorders, as one of the prerequisites for driving license, and if these disorders exist, until solving problem and the health system approval, the issuance of certificates for these people be prevented, and also after the issuance of the certificate, they have been periodically examined, to renew driving license.

Based on our best knowledge this study was the first study to investigate and systematically review the role of the health system in the prevention of the RTIs. But there is an important limitation; we don't have access to experts in other countries. So the findings may not be fully applicable in other countries than Iran. We suggest similar research to include experts from various countries be conducted by international organizations on RTIs.

## Conclusions

The health system has the main burden of the RTIs and provides care for them. So it should play an active role in the prevention of them. This study identified 41 roles in 7 areas for the health system in the prevention of the RTIs. Communication/Informing was the most important role, which the health system must focus on it and try to make main policies and strategies to improve its performance in this area. It seems that the health system can help reduce the RTIs by playing the roles discussed in this paper which then the benefits go to firstly the public and then to the health system itself.

## Ethics approval

The study was approved by the Ethics Committees of the Institute of Iran University of Medical Sciences (Ethical code: IR.IUMS.REC 1394.9221557209). Written informed consent was obtained from all participants before the interview.

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## Conflicts of interest

There are no conflicts of interest.

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**Additional file 1: Delphi questionnaire/ form**

<b>Domain of role:</b>																							
<b>Title of role=</b>																							
<b>Brief description of role:</b>																							
<b>Your comments:</b>																							
Applicability								Importance															
agree				No-idea				Disagree				agree				No-idea				disagree			
<input type="checkbox"/>				<input type="checkbox"/>				<input type="checkbox"/>				<input type="checkbox"/>				<input type="checkbox"/>				<input type="checkbox"/>			
4	3	2	1	1	2	3	4	4	3	2	1	1	2	3	4								

**Additional file 2: The excluded roles in the Delphi phase**

Row	Category	Role
1	Communication/Informing	Developing an information system for traffic accidents by using the hospital data, health network, and research results
2	Intra-sector cooperation	Participation and consultation in developing and implementing new regulations and policies
3		Participation in fair distribution of the facilities and opportunities of RTIs prevention
4	Research	Identification and development of methods of prevention and reduction of the traffic accidents
5	Health-oriented interventions	Assessment of the role of the biology in occurrence of the traffic accidents