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Comparative Study of Stewardship of Road Traffic Injuries Prevention with a Focus on the Role of Health System; Three Pioneer Countries and Three Similar to Iran

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ABSTRACT

Objective: To compare the stewardship of road traffic accidents (RTIs) prevention in three pioneer countries and three similar ones to Iran.

Methods: In this descriptive comparative study, the United States of America, Sweden, and Brazil as the pioneer countries in RTIs prevention were compared to the India, Pakistan, and Turkey as the countries socioeconomically similar to Iran. Embase, PubMed, Scopus, IranDoc, IranMedex, SID, and MagIran were searched. Also a hand search conducted on websites and search engines using related keywords.

Results: In the pioneer countries in RTIs prevention there was a delegation to a particular organization. In the other three countries a part of the Ministry of Transportation had the overall responsibility of RTIs. In Iran there was uncertainty in the stewardship of RTIs prevention. There was little evidence on the role and activities of health systems in RTIs prevention.

Conclusion: It seems necessary to define a lead agency organization on RTIs prevention in Iran with sufficient authority and resources. This study also recommends conducting reliable studies to investigate the possible roles that the health system of a country can assume regarding the RTIs prevention.

Keywords: Road traffic accident; Road traffic injury; Traffic-collision injuries; Policy; Stewardship; Decision making.

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Introduction

Today one of the major causes of mortality and morbidity around the world, especially in Low and Middle Income Countries (LMICs), is the Road Traffic Injuries (RTIs) [1, 2]. Moreover, the RTIs make huge and catastrophic direct and indirect costs to the individuals and the governments [3]. It is estimated that the global RTIs is about \$ 518,000 billion each year, of which \$65,000 billion is a share of LMICs [4, 5]. It is estimated that 1.2 million people die and 50 million people get injured in the traffic accidents annually [6]. It is estimated that this numbers will increase in the future 20 years by 65% [4]. The estimates shows that for every death due to the RTIs, 16 people get hospitalized and 400 people need outpatient hospital services or experience transient activity limit [7] so that the majority of hospital emergency department visitors are victims of the RTIs [3]. The mortality and morbidity due to the RTIs are a public health problem in LMICs [8]. In addition, attempts to prevention of RTIs in the LMICs has been hampered by restrictions such as lack of adequate knowledge and lack of reliable statistics RTIs [9].

The high income countries (HIC) have developed some regulations to decrease the RTIs including: speed limit, compulsory use of helmet and seat belt, alcohol ban, and safer design of the vehicles [10, 11]. For the prevention of the RTIs we need a comprehensive integration of the interventions [12-14]. Most countries that have achieved considerable success in reducing the RTIs, benefit from a strong controlling institute/organization that has sufficient authority to plan the actions and then the other involved organizations cooperate with it [15, 16]. Also, given the many interventions in the area of RTIs conducted, but still puts a lot of economic burden and mortality on the countries [17]. About the burden of RTIs on the health systems, the health systems have an active role in policy making and prevention of the RTIs around the world [18]. Also, the World Health Organization (WHO) illustrate which RTIs is a major public health and developing crisis [4, 19]. Considering the clear role of the health system in post-crash (after accidents), the role of health system in prevention or pre-crash (before the accident) is not clear. Also health system research

in this field mostly focused on clinical subject such as harm reduction [20]. Thus it is necessary to investigate the role of the health system in prevention of RTIs. This study conducted with the aim of comparing and description the lead agencies that are responsible for the RTIs prevention with a focus on the role of health system (all actors inside the governmental section that are engagement in health service provision) in three pioneer countries and three similar ones to Iran.

Materials and Methods

Search Strategy

The needed document for this descriptive comparative study gathered from the databases of EMBASE, PubMed, Scopus, IranDoc, IranMedex, MagIran, and SID and the websites of the World Health Organization (WHO), the United Nations (UN), the World Bank, Ministries of Roads and Transportation (or the corresponding Ministries in the studied countries), Traffic Police, Legal/Forensic Medicine, Ministry of Health, and the search engines of Yahoo and Google. Some of the relevant journals were searched manually. Reference lists of the selected articles also were checked. Finally, we also searched the gray literature and did expert contact. In order to check the grey literature, the European Association for Grey Literature Exploitation (EAGLE) and the Healthcare Management Information Consortium (HMIC), ProQuest and IranDoc databases were searched. The literature search was done up to September 31 August 2018 (Table 1).

Eligibility Criteria

Eligibility criteria for inclusion of documents were documents on the RTIs area (not airway, railroad or other transport form), documents that discusses about stewardship in RTIs area, documents that publish in selected counties and documents published in Persian and English language. Among 2917 retrieved documents in databases and other resources, 1116 documents were excluded due to the duplicated between deferent sources. In reviewing the titles and abstracts, 1721 documents were removed. In review of the full text 50 documents were excluded, and finally 30 documents were included (Figure 1).

Table 1. Complete search strategy for PubMed databases

Set	Strategy	Results
#1	(((((((((road[Title]) OR traffic[Title]) OR injury[Title]) OR accident[Title]) OR crash[Title]) OR collision[Title]) OR Motor Vehicles[Title]) OR motorcycle[Title]) OR pedestrians[Title]) OR car[Title]) OR automobile[Title])	79379
#2	(((((((((lead agencies[Title/Abstract]) OR management[Title/Abstract]) OR policy making[Title/Abstract]) OR decision making[Title/Abstract]) OR legislation[Title/Abstract]) OR stewardship[Title/Abstract]) OR leadership[Title/Abstract]) OR governance) OR responsibility) OR authority	538052
#3	(((((United States of America[Affiliation]) OR Sweden[Affiliation]) OR Brazil[Affiliation]) OR Turkey[Affiliation]) OR India[Affiliation]) OR Pakistan[Affiliation]) OR Iran[Affiliation]	534195
#4	#1 AND #2 AND #3	516 ^a

^a Filters activated: Full text, Publication date from 2000/01/01 to 2018/08/31, Humans, English

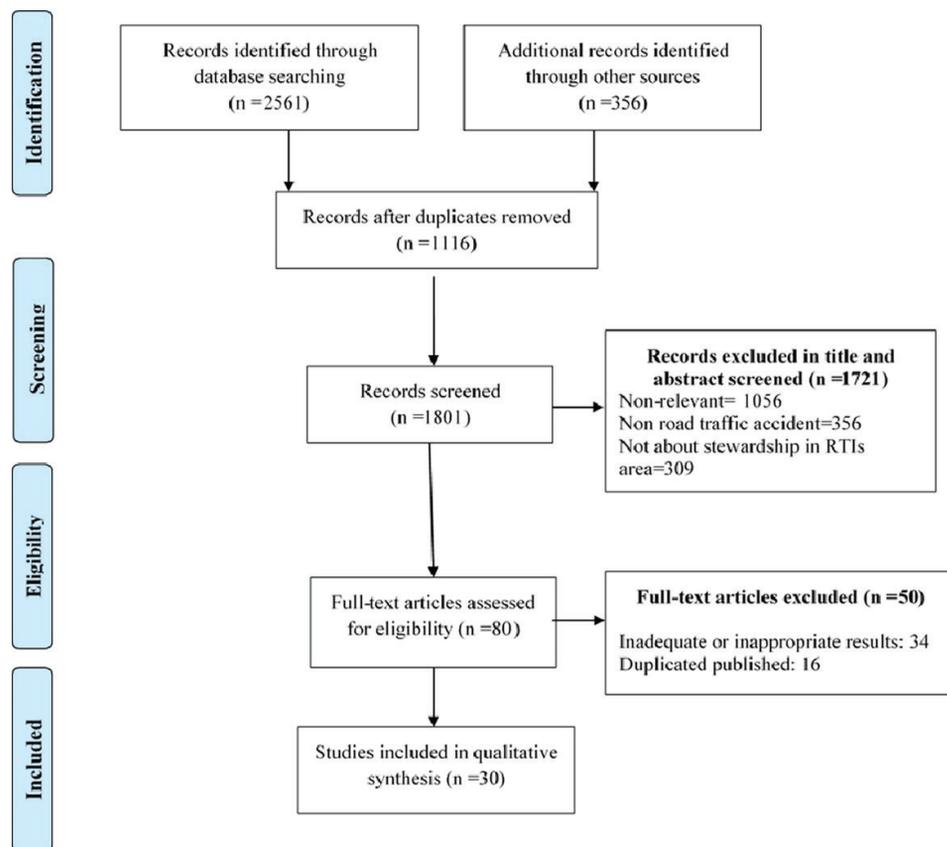


Fig. 1. Flow diagram of the search and inclusion process.

Countries Selection

All available articles and reports on the RTIs policy making in the USA, Sweden, Brazil (as the pioneer countries in RTIs prevention), and Turkey, India, Pakistan (as the countries similar to Iran), and the Iran were reviewed. The reason for selection of pioneer countries was their successful experiences in reducing the RTIs and for the other three countries was their similarity to Iran in social, economic and the RTIs situation. The WHO report 2015 on the burden of RTIs was used as the basis for selection of countries. The other criterion for selection was the availability of data in English language. So, countries such as Germany, Italy and some other European countries that the evidence about their RTIs prevention was not mainly in English were not selected. The three countries were selected among 56 countries. The countries similar to Iran were selected by the availability of evidence in English language and the similarities in cultural, social, economic, population, number of vehicles (India was an exception in number of vehicles), and traffic policies and regulations situation. The three countries were selected out of 21 countries.

Data Extraction and Data Analysis

The study tool was a comparative form that included the country name and information of transportation, the policy making institute(s), executive bodies, evaluating institute(s), the role of health system in

RTIs prevention, and examples of policies related to the health system. The text data were analyzed manually in an interpretive manner and by using the Descriptive Content-Analysis method. The Content-Analysis was applied which is a common method for identifying and reporting the patterns within the texts [21-24].

Results

The information of the three pioneer countries in RTIs prevention, three socio-economically similar to Iran, and the Iran about the RTIs prevention policy making and the role of health system in that are presented in Table 2.

Iran

The general responsibility of transportation in Iran is on the Ministry of Roads and Urban Development. The Ministry was set up in May 2011 by merging the two former Ministry of Roads and Transportation and the Ministry of Housing and Urban Development. The Ministry has 6 deputies: Planning and economy of transportation, urban development and architecture, Housing and construction, rural roads, Management and resources development, and the budget, legal, and parliament affairs [25]. Several organizations are involved in road transportation in Iran. One most important of them is the Road Maintenance and Transportation Organization which is part of

Table 2. Comparative information of the policy making of RTIs prevention and the role of health system in the studies countries

Country	Website of the organization mainly in charge of transportation	Policy making institute(s)	Executive institute(s)	Evaluating institute(s)	Role of health system in RTIs prevention	Examples of policies related to health system
Iran	http://www.mrud.ir/	<ul style="list-style-type: none"> - Ministry of Roads & Urban Development - Road Maintenance & Transportation Organization - Road Safety Commission 	<ul style="list-style-type: none"> - Ministry of Roads & Urban Development - Road Maintenance & Transportation Organization 	<ul style="list-style-type: none"> - Ministry of Roads & Urban Development - Road Maintenance & Transportation Organization - Road Safety Commission 	<ul style="list-style-type: none"> - Data collection 	-
USA	www.transportation.gov http://www.nhtsa.gov/	<ul style="list-style-type: none"> - Department of Transportation - National Highway Traffic Safety Administration 	<ul style="list-style-type: none"> - National Highway Traffic Safety Administration 	<ul style="list-style-type: none"> - Department of Transportation - National Highway Traffic Safety Administration 	<ul style="list-style-type: none"> - Consulting on behavior change interventions - Interventions for culture improvement 	<ul style="list-style-type: none"> - Healthy People and Objectives for the Nation - Healthy People 2010
Sweden	http://www.vv.se/language/index.htm	<ul style="list-style-type: none"> - Swedish National Road Administration 	<ul style="list-style-type: none"> - Swedish National Road Administration 	<ul style="list-style-type: none"> - Swedish National Road Administration 	<ul style="list-style-type: none"> - Sweden's "Vision Zero" 	<ul style="list-style-type: none"> - Healthy People and Objectives for the Nation - Healthy People 2010
India	http://morth.nic.in/#	<ul style="list-style-type: none"> - Ministry of Road Transport and Highways 	<ul style="list-style-type: none"> - Ministry of Road Transport and Highways 	<ul style="list-style-type: none"> - Ministry of Road Transport and Highways 	<ul style="list-style-type: none"> - Improving the data collection system - Involvement in policy development - Cooperation in policy implementation and evaluation 	<ul style="list-style-type: none"> - Road Traffic Injury Surveillance Project
Pakistan	http://www.communication.gov.pk/	<ul style="list-style-type: none"> - Ministry of Communications 	<ul style="list-style-type: none"> - Ministry of Communications 	<ul style="list-style-type: none"> - Ministry of Communications 	<ul style="list-style-type: none"> - Data collection and presentation 	<ul style="list-style-type: none"> - Road traffic injury surveillance system
Turkey	http://www.udhb.gov.tr/	<ul style="list-style-type: none"> - Ministry of Transport, Maritime Affairs and Communications 	<ul style="list-style-type: none"> - General Directorate of Highways 	<ul style="list-style-type: none"> - Ministry of Transport, Maritime Affairs and Communications - General Directorate of Highways 	<ul style="list-style-type: none"> - Data collection and presentation 	<ul style="list-style-type: none"> - Road traffic injury surveillance system
Brazil	http://www.transportes.gov.br/ http://www.dnit.gov.br/	<ul style="list-style-type: none"> - Ministry of Transport 	<ul style="list-style-type: none"> - National Department of Land Transport 	<ul style="list-style-type: none"> - Ministry of Transport - National Department of Land Transport 	<ul style="list-style-type: none"> - Data collection and presentation - Involvement in RTIs prevention programs - Consultation to the Ministry of Transport 	<ul style="list-style-type: none"> - Road Traffic Injury Project

the Ministry of Roads and Urban Development. The Organization has four deputies including: Road maintenance, Transportation, Planning, and the Management and resources development. The organization has six main duties which are listed here according to their order:

- Road maintenance: making the roads better and safer
- Road transportation: preparing the regulations on national and international transportation, building, operating, developing and maintaining the public terminals of passenger and cargo, licensing and supervising the passenger and cargo companies.
- Improvement of safety of and management of the traffic in the roads: defining the standards of vehicle, preparing the regulations of safety, analyzing the road crashes and deaths, planning and implementing safe roads plans.
- Development of international transportation: road transportation and building the border terminals
- Intelligent transportation systems: planning, designing, monitoring and utilizing the online surveillance and data collection systems.
- Traffic management and accidents communication: communicating and informing the people to choose the path [26].

The Cabinet of Ministers in 2003 approved the constitution of the Road Safety Commission with the aim of improving the safety level of the transportation and reducing the RTIs [27]. Reviewing the duties of the Commission we noticed a considerable overlap in the duties of the Road Maintenance and Transportation Organization. Also there is an overlap between these two bodies and the Traffic Police in terms of duties. through Administrative High Council ratification number 1901/74022 dated 2003/6/13 all duties, workforce, equipment's, obligations and credits of maintenance deputy of " Road and Transport Ministry " was transferred to state terminals and transport organization and the aforesaid deputy was omitted and according to the mentioned ratification paragraph (5), duties and directing affairs of " State Transport High Council Secretariat " was separated from organization and transferred to " Road and Transport Ministry " and the name of the organization changed to " Road Maintenance and Transport Organization ". Road Maintenance and Transport Organization as a custodian of maintaining, improving and securing the country's roads has a special impact on national development and increasing the country's economic productivity. Some of the tasks of the Road Maintenance and Transport Organization are: Set policies, road maintenance planning and policies and establishing national coordination for their implementation, preparation and delivery of technical and administrative instructions for maintenance of roads, technical buildings and related buildings to road, to construct and Interest to develop and maintain the buildings and facilities

needed for optimal use of the road and providing convenient road services.

The health system in Iran had no significant activity on reducing the RTIs in recent years. Its main role is after the accidents happen and is limited to the pre-hospital and hospital emergency services. Recently the Disaster and Emergency Medical Management Center has been set up in the Ministry of Health and Medical Education and all the provinces. These centers were still not seriously involved in the prevention of traffic accidents due to their newness and lack of sufficient authority and resources. Maybe the only activity that the health system is involved in regarding the RTIs is the collecting data on the injuries and deaths due to RTIs. Yet, this activity is not performed perfectly and in a systematic manner.

The USA

In the USA, the general policies of transportation (railways, airways, sailing, and roads) are developed by the Department of Transportation. And the National Highway Traffic Safety Administration works particularly on the roads. The Administration is part of the Department of Transportation and is established in 1970. Its mission is to reduce the deaths, injuries and the costs of traffic accidents. The Administration plays its role by developing the safety standards of the vehicles, developing the regulations, providing financial and consultation help for local governments, and conducting research on road safety [28].

Although some administrations of the Department of Transportation- such as Roads and Bridges, Public Transit, National Highway Traffic Safety Administration (NHTSA)- are involved in road transportation, but the main executive responsibility in safety and reducing the RTIs is upon the National Highway Traffic Safety Administration. In the field of control and assessment of prevention and road safety activities, both the Department of Transportation and the National Highway Traffic Safety Administration work by their own regulations and processes [29, 30]. Although the role of health system in the USA in RTIs prevention is not clearly defined, but we can count the following roles for it according to the reports and articles [31]:

- Consultation: such as consultations on Pasteurization of the milk, water Chlorination, avoiding high-fat and salty foods, regular exercising and so on.
- Behavior interventions: such as improving the lifestyle and behavior changes on quitting the smoke, cardiovascular diseases prevention, cancer prevention and so on.
- Culture interventions: such as education through the media about the seatbelt and the obvious examples of the role in RTIs prevention are the "Healthy people, Objectives for nation" and "Healthy people 2010" which are developed by the Department of Health and Human Services (Table 3) [32, 33].

Table 3. The objectives of the US “Healthy people 2010” that are related to RTIs

Number of objective	Title of objective	Base situation	Desired situation
15-15	Deaths from motor vehicle crashes	15.6 deaths per 100,000 people	9.2 deaths per 100,000 people
15-16	Pedestrian deaths on public roads	1.9 deaths per 100,000 people	1 death per 100,000 people
15-17	Nonfatal motor vehicle crash-related injuries on public roads	1181 injuries per 100,000 people	933 injuries per 100,000 people
15-18	Nonfatal pedestrian injuries on public roads	26 injuries per 100,000 people	19 injuries per 100,000 people
15-19	Safety belt use	69% of total population	92% of total population
15-20	Child restraint use	92% of children ≤4 years old	100% of children ≤4 years old
15-21	Motorcycle helmet use	67% of motorcyclists	79% of motorcyclists

Sweden

In the late 1960s the Swedish Road Safety Office (SRSO) was set up with the aim of assuring the safety of the roads. Although the SRSO had not sufficient power and resources for reducing the burden of RTIs, but the country had experienced a decreasing trend of RTIs mortality during 1970s to 1980s. In 1993 the SRSO merged with a larger and more powerful organization named the Swedish National Roads Administration. Then the administration became responsible for the overall policy making, implementing, monitoring and surveillance of the plans, safety of the roads, maintenance of the roads, and all works on road transportation on behalf of the Ministry of Transportation and Communication [28].

The Swedish National Roads Administration includes the Chairman, 7 local offices, 2 support and development centers (society and traffic, information and management), 2 collaborate organizations (agency for traffic crashes record, agency for driving license test), 4 commercial units (traffic operation, consultation services, construction and maintenance services, education and development services) [34].

The most famous policy in Sweden for reduction of the RTIs that is related to the health system is the “Vision Zero”. This policy was passed by the Parliament in 1997 with the aim of creating a road traffic system without any fatalities and serious crashes [35, 36]. The public health introduced as the basic introduction of the policy. The fundamental principle of the Vision was that “Life and health can never be exchanged for other benefits within the society”. The principle changed the conventional method of assuming monetary value for health and life of the people and then the cost-benefit analysis were done for decisions about investments on road infrastructures [37]. The results of implementing the Vision Zero were impressive. So that despite the increased traffic, the mortality caused by the traffic crashes dropped from 541 in 1997 to 314 deaths in 2011 [25, 38].

India

The responsibility of developing the regulations and laws in India is with the Road Transportation and Highways Unit. Road transportation is of high importance in India because 60% of the

cargo and 90% of the passengers are transported through the roads [39]. In the year 1999 the Ministry of Land Transportation divided to two units of sea transportation and roads and highway transportation. Then the situation became prepared to have a separate Ministry of Roads and Highway Transportation in the year 2000. The two Ministries of “Ministry of Shipping” and “Ministry of Road Transport and Highways” merged again to make the Ministry of Ministry of Shipping, Government. The roads and highway transportation now is one of the two main deputies of the Ministry [40]. The Deputy of Roads and Highway Transportation is running by a common secretary who is chosen by the Minister. It has a financial manager and also an operations manager to maintain and repair the roads. There is also a consultant for researches, data gathering and analysis [41]. The Deputy of Roads and Highway Transportation has 14 local administrations in various parts of the country [42].

Like many other sectors in India, in the road transportation sector the health system has an active and constructive role of which are providing pre-hospital, hospital and rehabilitation care, contribution in data collection, participation in policy development, cooperation in prevention programs, and having consultation role [43]. A good example of the role of health system of India in prevention of traffic accidents is the Road Traffic Injury Surveillance Project. The project was implemented by the Medical Research Council, World Health Organization, and the Indian Ministry of Health and Welfare in 2007 after the many defects in the data system of the health sector. The main objective of the project was to establish the care system in 25 large hospitals of the India which achieved great successes [44]. Then it merged with the Integrated Disease Surveillance Project [45].

Pakistan

The responsibility of policy making and management of road transportation in Pakistan is with the Ministry of Communications. It is one of the oldest Ministries of the Pakistan established in 1947 and includes 4 main subset organizations: The National Highway Organizations which constructs, repairs and maintains the roads and highways; The

National Highways and Motorway Police which develops, implements, and observes the roads transportation regulations; The National Transport Research Centre which performs the research and development and provides the information for decision making and cost-effectiveness of the programs and policies; The Construction Machinery Training Institute which established in 1986 with the cooperation of Japan and achieved successes in research and building the transportation machines. Despite some other countries like India, there is not much evidence on the role of the health system in prevention of traffic accidents. It seems that activities of the health system on RTIs are mainly limited to care of the RTIs' injuries. In the year 2006 the health system of Pakistan designed and implemented the road traffic injury surveillance with the aim of estimating the burden of the traffic injuries, studying the hospitalized traffic injuries, and providing solutions for reduction of the traffic injuries. As a result of implementing this system, attention to the RTIs grew. The outputs of the system showed that the mortality and morbidity of the RTIs are higher than the statistics that the police had [46].

Turkey

The Ministry of Transport, Maritime and Communication had the responsibility of road transportation in Turkey. The Ministry is one of the oldest Ministries of its kind which established in 1939 and has had many changes since then. It has the responsibility of airway, sea, railway, and roads transportations. In the field of road transportations, the priorities are improving the roads infrastructure, developing the highways and freeways, assuring roads safety, and research and development of the road transportation. The road transportation unit of the Ministry established in 1950 and has 18 units around the country now [47]. Consequently, to the excessive changes in the health system of Turkey in recent years that improved the health status of the country, the health system became involved in many activities to identify and remove the risk factors of traffic injuries which have led to considerable reduction on RTIs [48]. So that according to the WHO (2015), the mortality due to RTIs has been declined from 7 to 5 deaths per every 100,000 populations between 2007 and 2013 [49]. Yet, we could not find any evidence that show the activities of the health system in this regard.

Brazil

The Ministry of Transport has the overall responsibility of transportation in Brazil. It is established in 1992 and is the main body for regulation and supervision in transportation. The road transportation unit within the Ministry specifically performs the tasks related to roads which mainly are executive and to some extent observatory. The Ministry of Health has a significant role about

the RTIs of which are gathering and reporting data to the Ministry of Transport, involvement in some projects of the Ministry of Transport, and providing consultations. Two major activities of the Ministry of Health of Brazil are presented here as examples [37]:

Documenting the Road Traffic Injuries

Injuries -mainly by violence and RTIs- are the second most common causes of death in Brazil after the cardiovascular diseases. A study based on death registry system of the Ministry of Health for the period of 1991 to 2001 showed that the number of deaths due to RTIs has grown considerably between 1991 and 1997. So that it had reached its peak in 1997 by 35756 deaths. Reporting this data to the Ministry of Transport resulted in passing new law that moved the responsibility of the traffic management to the local authorities and also proposed heavier punishments for the offending drivers.

Defining the Priorities

The Brazilian Policy for Reduction of Morbidity and Mortality by Accidents and Violence passed in 2001. Although the statistics showed that the mortality by suicide was more prevalent than the RTIs, the Ministry of Health decided to take later as its priority. Some indicators are compared between the studied countries according to the WHO report 2015 (Table 4). As it can be seen in Table 4, in the difference of country reported deaths and WHO estimation is big for Iran and the similar countries- except for Turkey. The share of RTIs' cost on GDP in Iran is much higher than the pioneer countries. It is also higher than Pakistan. All studied countries have separate national budget for prevention of RTIs, except for Pakistan. But in Iran there is no separate budget for this purpose and the involved organizations use part of their budget in this regard. All countries, except Pakistan, had national strategy for reducing RTIs. The attracting point about the planned annual rate of reduction was that the plans in the pioneer countries were long term but in Iran it was annual plan. The frontal impact standards, electronic stability control, and the pedestrian protection standards were not applied in Iran, India and Pakistan. But they were in practice in the pioneer countries and Turkey. Like the pioneer countries, Iran has an emergency room injury surveillance system. The speed limit law, drinking and driving law, helmet law, seat belt law, and mobile phone law were in practice in all studied countries. These laws in Iran were as highly effective as the pioneer countries, while they were less effective in the countries similar to Iran. The child restraint law was in practice only in pioneer countries and Turkey.

Discussion

Findings of the study showed that there is an uncertainty about the stewardship of RTIs'

Table 4. Comparison of Iran with the selected countries (pioneers and similar) according to the WHO report 2015

Country Indicator	Iran	Pioneer countries			Countries similar to Iran		
		USA	Sweden	Brazil	Turkey	India	Pakistan
Number of deaths due to traffic accidents (country reported)	17994	32719	260	42291	3685	137572	7636
Number of deaths due to traffic accidents (WHO estimation)	24896	34064	272	46935	6687	207551	25781
Difference of country reported death and WHO estimation (%)	6902 ((38.3)	1345 (4.1)	12 (4.6)	4644 (9.8)	2 (-)	69979 (50.8)	18145 (23.7)
Death per 100,000 population	32.1	10.6	2.8	13.4	8.9	16.8	14.2
Total number of registered vehicles (car, motorcycle, bike, ...)	26886457	265043362	5755952	81600720	17939447	159490578	9080437
Share of traffic accidents' cost of GDP	6	1.9	Under %1	1.2	-	3	-
Financing through separate national budget	NO	YES	YES	YES	YES	YES	NO
National strategy for traffic accidents	YES	YES	YES	YES	YES	YES	NO
Planned annual rate of reduction of traffic accident deaths	10%	1.05 people per 100 million travel miles	50% from (2007-2020)	Reduce the death rate from %18 to %11 2004-2014	50% from (2012-2020)	-	-
Applying frontal impact standards	NO	YES	YES	YES	YES	NO	NO
Applying electronic stability control	NO	YES	YES	NO	YES	NO	NO
Applying pedestrian protection standards	NO	NO	YES	NO	YES	NO	NO
Emergency room injury surveillance system	YES	YES	YES	YES	YES	NO	NO
Speed limit law and its effectiveness score (0 least effective - 10 most effective)	YES-7-	YES- -	YES- 6	YES- 7	YES- 4	YES- 3	YES- 4
Drinking and driving law and its effectiveness score (0 least effective - 10 most effective)	YES- 8	YES- -	YES- 8	YES- 8	YES- 3	YES- 4	YES- 3
Helmet law and its effectiveness score (0 least effective - 10 most effective)	YES- 5	YES- -	YES- 8	YES- 6	YES- 3	YES- 4	YES- 2
Seat belt law and its effectiveness score (0 least effective - 10 most effective)	YES- 7	YES- -	YES- 8	YES- 7	YES- 2	YES- 4	YES- 3
Child restraint law and its effectiveness score (0 least effective - 10 most effective)	NO	YES- -	YES- 7	YES- 6	YES- 3	NO	NO
Mobile phone law and its effectiveness score (0 least effective - 10 most effective)	YES	YES	YES	YES	YES	YES	YES

prevention in Iran. In the pioneer countries there was a delegation to a particular organization, while in the other three countries a part of the Ministry of Transportation had the overall responsibility of RTIs. The results show that there is little evidence on the role and activities of the health systems in prevention of RTIs.

Various organizations with overlapping tasks are

involved in RTIs prevention in Iran of which are the 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, The Legal Medicine Organization (forensic medicine), The Central Insurance Organization, Ministry of Justice, Ministry of

Interior, Police, The Broadcasting Organization, and the Judicial Branch [50]. Each of these organizations has its own tasks and responsibilities but none of them has the sufficient authority and resources for integrated management of RTIs. Unlike this, in the countries which are successful in reducing the RTIs there is a particular organization that has the stewardship of the RTIs' prevention and the other involved organizations have to cooperate with it [15, 16]. For example, in Canada the federal and provincial governments are responsible for road safety in their territory. The federal government has the commanding role and also gathers data and performs research to develop and evaluate the system. The police have executive role and develops the safety programs by the Judiciary [3]. In Iran, the study of Soori *et al.* proposed the Traffic Police or the President as the steward of the RTIs prevention. Although the Traffic Police have had significant role in management of RTIs and had impressive achievements in this regard, it does not have the sufficient authority and resources to be the steward. So it seems that, like many successful countries, a joint commission of stakeholder organizations with the chairmanship of the President and the clearly defined responsibilities and tasks could be better.

According to the findings of the study, a kind of delegation to a particular organization exists in the pioneer countries. It seems that delegation to a single organization might cause that organization to investigate the RTIs in a more specialized manner. Yet, the political support and the cooperation of other involved organizations must be assured. In case of developing countries that creating a separate organization for RTIs is hard or impossible, the alternative solution might be enforcing the road transportation unit of the Ministry. This enforcement can be as increasing the budget, increasing the authority, and providing political support. Finally, according to the experience of many countries, involvement and role playing of the government in control and prevention of RTIs seems inevitable [4, 6].

Results of the study showed that there is little evidence on the role and activities of the health systems in prevention of RTIs. Regarding the fact that the health system has to cure the people injured in RTIs, this sector should play a more active role in prevention of these accidents. Review of the literature showed that the role of the health system during and after the accident is well known but its role before the occurrence of the accident is neglected [44, 45, 51, 52]. One of the main roles that the health system had in most of the investigated countries is developing and implementing the care system. There are several experiences in health sector on developing the injury surveillance system of RTIs. An example of this task is the Road Traffic Injury Surveillance Project in India [44]. Another example is the RTIs surveillance in Pakistan which increased the focus on the RTIs

[46]. Experiences of the other countries also show that the health system can play an effective role in designing and implementing RTIs surveillance [47, 53-55]. A key point to consider is the cooperation of health system and the other involved sectors and organizations in design and implementation of such system. For, the RTIs had multilateral nature and need intra-sector efforts and integrated data.

Among the other roles that the health system has in the reviewed countries, is contribution and consultation with other stakeholders in developing the programs and policies of prevention of the RTIs. In any country, various organizations are involved in local, national, and international levels in the RTIs. But it should be kept in mind that the inter-sector collaboration would not be attained unless with political support and commitment of the macro-level policy makers of the country [56]. Another point to consider is the existence of a leading organization with defined tasks and sufficient resources; otherwise the inter-sector collaborations would face problems. Given the experiences of the reviewed countries and the structures of Iran, it is not suggested that the health system of the country play the leading role in the RTIs.

Findings of the study showed that the costs of the road traffic injuries (RTIs) in Iran are relatively high, compared to the pioneer countries and even to countries similar to Iran. The high economic and social costs of the RTIs are fundamental issues that challenge the policy makers of the countries [57, 58]. The economic costs of the RTIs include all costs made by the RTIs and the costs made due to the RTIs [59]. It is estimated that the global costs of the RTIs is 518 billion USD of which 65 billion USD belong to the low-and-middle income countries (LMICs). It is also estimated that the costs of the RTIs in low, middle, and high income countries equal to 1, 1.5, and 2 percent of the gross domestic product (GDP) of the country [4, 60]. The cost of the RTIs in Iran was comprehensively assessed for the first time in the year 2001 to be 6170.7 billion Rials [61]. The study of Ainy *et al.*, by using the willingness to pay (WTP) method, estimated that the costs of the RTIs in Iran equal to 6.46% of the country's GDP [62]. Yet, according to the research center of the Parliament (the Majlis), the economic and social costs of the RTIs in the country is as high as 8.5% of the GDP [63]. Anyway, results of the studies conducted in Iran show that the costs of the RTIs in Iran are high compared to other similar countries. Some possible reasons for this might be the lower safety of the roads in Iran which results in increased severity of the crashes, lower safety of the vehicles and their high price, younger age of the injured and dead victims, and the higher administrative costs in Iran. Thus it seems necessary to prevent the RTIs and to improve the safety of the roads and vehicles.

A limitation of this study was the access to the needed data because the required data were either

managerial data or policy documents that were mainly in local languages. Thus we could not access and use those data.

In conclusion, results of the study suggest the existence of a particular organization as the steward of the RTIs prevention which should have sufficient

authority and resources. In addition, more studies are recommended on the potential roles of the health systems in prevention of the RTIs.

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