

Road Traffic Injuries Among Iranian Children and Adolescents: An Epidemiological Review

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Abstract

Context: Road traffic injuries (RTIs) are the leading cause of death and globally kill 1.2 million people every year and leave 20 - 50 million people injured and disabled. In Iran, traffic related fatalities are the leading cause of death among all inadvertent fatal injuries imposed on children under five. Herein, authors review the epidemiological studies performed on vehicle accidents among Iranian children and adolescents to improve the knowledge about these preventable events.

Evidence Acquisition: International databases including PubMed, Google scholar, science direct Cochrane library, and national data bases such as scientific information database (SID) were searched for terms; children, motor vehicle accident, road traffic injuries, Iran 2000 - 2015. Publication in Persian or English language related to the subject including Iranian children and adolescent's age groups were included. Among the 312 articles, 11 (two abstracts and nine full texts) were selected. Nine full texts were reviewed.

Results: From 22865 victims, about 3578 children and adolescents under 19 years old were identified. Males were more affected than females. Pedestrian injury with 43.66% was the most common case of road traffic injuries. Head trauma was the most common cause of injuries reported by eight of the reviewed articles. Most of the accidents occurred between 1:00 - 6:00 PM. Most of RTIs occurred in summer. Care by emergency medical services (EMS) (29.14%) was reported by five out of the nine reviewed article.

Conclusions: Most of the road traffic injuries among Iranian children and adolescents are preventable using appropriate preventive strategies such as safety facilities, safe vehicles, and safe traffic behavior, and establishing comprehensive public education programs for older children and their parents.

Keywords: Pediatric, Traffic Accidents, Iran

1. Context

Road traffic injuries (RTIs) are major causes of death and disability in adolescents and young adults worldwide. Globally, RTIs kill 1.2 million people every year and lead to 20 - 50 million people injured and disabled. According to the report of united nations international children's emergency fund (UNICEF), road traffic injuries (RTIs) are the second leading cause of death for young people aged 5 - 25 years. Based on this report, among all unintentional fatal injuries imposed on Iranian children under five, RTI fatalities are the leading cause of death (1, 2). Causes of RTIs are multi factorial including people, vehicle and road environmental factors. According to the reports of some studies, human factors have the most important effect on RTIs. Other influencing factors include driver behavior, speed, and violation of traffic regulations, poor driving skills, decentralization, fatigue and physical disabilities (3, 4). RTIs also impact on the economy of the developing countries. The costs of RTIs, among all external causes of morbidity and mortality, represent one of the highest financial burdens to health care systems of the developing countries including Iran (2, 5). It is estimated that traffic fatalities impact on Iran's economy about six billion US dollars per annual (1). Deaths due to RTIs in children and adolescents are predictable and most of them can be prevented by preventive strategies such as use of safety equipment such as seat-belt and helmet (1, 2, 6). The current review was conducted due to limited data about epidemiology of RTIs among Iranian children and adolescents,

and to increase the knowledge about characteristics of these injuries for further appropriate intervention and to decrease the burden of such terrible events.

2. Evidence Acquisition

International databases including PubMed, Google scholar, science direct Cochrane library, and national data bases such as scientific information database (SID) were searched for terms: children, motor vehicle accident, road traffic injuries, Iran 2000 - 2015. Publication in the Persian or English languages related to the subject among Iranian children and adolescents were included. Article did not include the pediatric population or the studies not performed in Iran or in other languages, or abstracts. Among 312 articles, 11 (two abstracts and nine full texts) were related to road traffic accidents in Iran and in most of the reviewed articles; pediatric age groups were a part of the studied population. Of these, nine full texts were selected and only three of the nine were just related to children and adolescents age groups. The quantitative and qualitative data derived from the reviewed articles were discussed.

3. Results

Summary of data derived from the nine reviewed articles are shown in Table 1. From 22865 victims, about 3578 were children and adolescents under 19 years old and

Table 1. Summary of Data Derived From the Nine reviewed Articles About RTIs in Iranian Children and Adolescents

Author/Date	Study Design	No. of pts	Age (Range)	Gender	Road User Type	Types of Trauma	Day/Time of Accident	Season and Weather	Type of Transport	Cause and Location of Death	Mortality Rate
Karikhaneh et al., 2008 (7)	Secondary data analysis	440 (330 children and adolescents)	Median age: 14 y (75% ≤ 18 years)	M > F (general population including children and adolescents)	Bicyclists (100%)	Head trauma (25% general population including children and adolescents)	1:00 AM to 7:00 AM = 7 (1.6) 7:00 AM to 1:00 PM = 128 (29.4) 1:00 PM to 7:00 PM = 209 (48.0) 7:00 PM to 1:00 AM = 91 (20.9) Total = 435 (100.0) as a whole	As the weather got warm, the beginning of the spring to the mid-summer cycling injuries increased	EMS = 3 (25%) bystander = 9 (75%) people died at the scene of collision = 8 (40%) (general population including children and adolescents)	Head injuries (street or alley 7 (35%), highway 0, inter-city highway 5 (25%), inter-city express way 4 (20%), rural road 4 (20%), yard of house or school 0 (general population including children and adolescents)	20 (4.5%) (general population including children and adolescents)
Haghighparast-Bidgoli et al., 2013 (8)	Secondary data analysis	8,356 RTIs (~ 1304 children and adolescents)	0 - 14 (15.6%)	M > F	Pedestrian (0 - 4 years) = 178 (8%) -car occupant (5 - 14 years) = 1126 (52%) motorcyclist (15 - 18 years) = 865 (40%)	Head, spinal and lower extremity injuries			EMS ambulance = 1049 (12.7) Other ambulance = 972 (23.7) Other vehicles = 5272 (63.4) un-specified = 20 (0.24) as a whole	92 (6% patients) = not use a seat-belt in hospital 81 (3% patients) = not use a helmet in hospital, type and time of pre-hospital transportation (general population including children and adolescents)	12.4 general population including children and adolescents
Arhamidoulatabadi et al., 2013 (9)	Descriptive cross-sectional study	766	25 ± 12 y (2 - 73 y)	M > F	Motorcyclists crashes = 766 (100%)	Lower extremity injuries; knee injuries (60%) was the most type (General population including children and adolescents)	2 PM - 10 PM (70%)				

<p>Zargar et al., 2002 (10)</p>	<p>Descriptive and prospective study</p>	<p>7815 [901(40%)] (children and adolescents)</p>	<p><19y (most of car accident between 16-18y) (34.2%) mean age = 12 ± 5 y/o</p>	<p>M > F (3.5 time more than female)</p>	<p>Vehicle accident injuries [901(40%)]: pedestrian (5-9 y) = 47(5.2%) motorcycle accident (16-18y) = 229 (25.4%) bicyclists = 102 (11.3%) Car occupant = 89 (9.9%) others = 10 (1.1%)</p>	<p>head injury = 322 (79.8%) and Lower extremity injuries = 322 (35.7%)</p>	<p>12PM - 6:00PM</p>	<p>summer (30%)</p>	<p>31 (3.5%) cases of death: Pedestrian = 19 (61.2%), Car occupant = 4 (13%) Motorcyclists = 5 (16.1%) Bicyclists = 3 (9.7%)</p>
<p>Ghorbani et al. 2009 (11)</p>	<p>Secondary data analysis</p>	<p>316 (109 children)</p>	<p>Age range (1-79) Mean age (26,98 ± 14,79) (Age range in children = 1-18)</p>	<p>M > F as a whole</p>	<p>Motorcycle: 198(62.7%) pedestrian: 57(18%) car: 42(13.3%) bicycle: 14(4.4%) bus: 3(1%) others: 2(0.6) (general population including children and adolescents)</p>	<p>Lower extremity injuries: 167(52.9%) head and neck: 164(51.9%) upper extremity injuries: 8(25.6%) Others: 43(13.8%)</p>	<p>100- 6:00 PM (most of RTIs)</p>	<p>Summer</p>	<p>EMS ambulances (24%), private vehicles (most of the time)</p>
<p>Javid et al., 2006 (12)</p>	<p>Descriptive and prospective study</p>	<p>318</p>	<p><14y/0</p>	<p>M > F 3:1</p>	<p>Pedestrian (65.6%) included: motorcycle and pedestrian = 97 (33.7%) car and pedestrian = 92 (31.2%) motorcycle and car = 33 (11.5%) car occupant = 13.4% (75% on back seat) motorcycle occupant = 15.3% (75% in front of the vehicle) bicyclists = 3.7% (80% runner (including children and adolescents)</p>	<p>Head trauma = 182 (63.4%) chest trauma = 5 (1.7%) abdominal trauma = 14 (4.9%) musculoskeletal = 151 (52.6%) tibia Fx = 62 (45%)</p>	<p>At night = 65%</p>	<p>Summer and spring = 52.8% autumn = 21.7% winter = 25.5%</p>	<p>EMS ambulances = 24% Others transport</p>

<p>Entezami et al., 2015 (13)</p>	<p>Secondary data analysis</p>	<p>2463 (175)</p>	<p>0-15 y 0-4 y (the least)</p>	<p>M > F</p>	<p>(including children and adolescents and adult) Pedestrian: 746 (100%) Motorcyclist and bicyclists: 916 (100%) Car occupant: 1705 (100%) (general population including children and adolescents)</p>	<p>Head injury bleeding multiple trauma</p>	<p>Summer (the most) winter (the least)</p>	<p>Head injury/bleeding/multiple traumatic street (28.10%), inter-city express way (63.26%), rural road (8.44%)</p>
<p>Mahdian et al., 2015 (14)</p>	<p>Retrospective study</p>	<p>1723</p>	<p><15 ≥ 60</p>	<p>M > F M/F ratio = 51 < 15; M = 185 (41) F = 49 (11.6)</p>	<p>Pedestrian motorcycle: <15; male = 105 (23.3) and female = 21 (4.9) bicycle 45 (2.6%) truck 166 (9.6%) 1 (0.1%) (general population including children and adolescents)</p>	<p>Multiple trauma head injury: <5; Male (88%) and female (5.2%) spinal injury 53 (3.1) chest injury 20 (1.2) abdomen injury 7 (0.4) upper limb injury 47 (2.4.2) lower limb injury 572 (33.2) (general population including children and adolescents)</p>	<p>EMS (60%), private vehicles without receiving any specialized care</p>	<p>33 cases died due to urban traffic accidents, 12 people at the scene, 6 cases at emergency department and less than 24 h of hospitalization, while 15 cases deceased after 24 h of hospitalization</p>
<p>Yousefzadeh Chabok et al., 2012 (15)</p>	<p>Retrospective study</p>	<p>668 (441 were RTIS = 65%)</p>	<p><18 (mean = 10.4 ± 5.3) The most common age group = 14-18y</p>	<p>M > F = 41:487 boys and 181 girls</p>	<p>Agricultural machines and motorcycle? In <1 year: motorcycle accident (20%) In 2-5 y: pedestrian road traffic injuries (14.5%) and motorcycle accident (13%)</p>	<p>Head injury (100%)</p>	<p>Head injury (none of the motorcyclist or bicycle riders wore a helmet)</p>	

Abbreviations: RTIS, road traffic injuries; EMS, emergency medical services.

most of the children were under 14. Boys were affected more than girls, based on the three articles related to children age groups. The most common cause of RTIs was pedestrian injuries reported by seven of the nine reviewed articles. According to the data from three reviewed articles with pediatric age groups population, pedestrian injuries with 32.9% was the most common case of RTIs followed by motorcycle related injuries with 22.62%, car occupant with 16.5%, bicycle injuries with 10.66%, and 17.32% as others. Head trauma was the most common cause of injury reported by the eight reviewed articles followed by lower extremities injuries in seven of the articles. Most of the accidents occurred during 1:00 - 6:00 PM reported by four of the reviewed articles. Most of RTIs occurred in summer reported by five of the seventh reviewed articles. Based on five of the nine reviewed articles, 29.14% reported to receive care by emergency medical services (EMS), while transferring the victims to the hospital by private vehicles was reported by most of the reviewed articles. RTIs mortality rate was 4.64% according to five of the nine reviewed articles and 3.5% based on the report by one of the articles just related to children and adolescents.

4. Discussion

Road traffic injuries (RTIs) on Iran's roads lead to thousands of deaths and injuries every year, and it is estimated 20 times more than the global average (1). This review shows that most of the RTIs among Iranian children and adolescents are preventable using appropriate preventive strategies such as safety facilities, safe vehicles, and safe traffic behavior. It was found that factors such as age, gender, road safety, and type of trauma, time and place of RTIs, season, type of transport, and insurance status can influence the mortality rate among Iranian children and adolescents as RTIs victims (7-15). RTIs are also a leading cause of disability and death in children under five years old in Iran (1). In the current review, most of the children and adolescents were ≤ 14 years old (7, 8, 10, 12, 14). The 5 - 14 age group was also reported with the highest incidence rate of cycling injuries in Iran by Karkhaneh et al. (7, 16). They concluded that higher incidence of injuries in these age-groups may reflect a greater use of cycling vehicles. Lack of experience and greater risk taking behavior might be other factors that influence injury rates among this group. Soori et al. (17) revealed that traffic accidents were the main cause of death in children less than 14 years old in rural areas of Iran. In the study by Zargar et al. (10), most car accidents happened in the age group of 16 - 18, and children of 5 - 9 years age group mostly had the pedestrian related injuries. Similar to the others, the current review showed that boys were involved more than girls (7-15, 18). The reason that males were involved more than females in Iran, might be influenced socio-cultural aspects that discourage girls for some activities such as bicycling in public places; more risky behaviors, and spending more time out of home is

observed among boys. The current review found that pedestrians were the most road user type, similar to reports by the other studies (10, 12, 19). This finding might reflect the important role of parental supervision, and need for more educational programs to prevent RTIs in children (20, 21). Also, it can be due to the lack of pedestrian facilities in road designs and poor knowledge and practice of road safety measures in this age group. According to the reports by UNICEF about 25% of all road traffic fatalities in Iran are caused by motor cycles and two-thirds of the events occur because of not using helmet by the drivers that lead to head trauma. In the current review, motorcycle related accidents were the second most common cause of RTIs among the studied populations (8-12, 14). Zargar et al. concluded that immigration of people to the industrial cities increased the number of vehicle, especially motorcycle accidents in the city streets, allies and inter-city highways, and consequently a rapid increase in traffic accidents. Low price, doing risky behavior, paying less attention to traffic regulations and not using helmets are among other risk factors influencing the fatalities of motorcycle accidents (10, 11, 22-24). Similar to the others, the current review showed that head trauma was the most common RTIs among different road user types (7, 14, 25). In the study by Karkhaneh et al. (7), one-quarter of injured bicyclists involved severe head injuries. They reported that none of the injured bicyclists used bicycle helmet at the time of collision. The positive effect of using safety facilities including helmet and seatbelts is well identified (8, 26). Use of a helmet can be the most effective way to decrease head trauma caused by motorcycles and bicycle crashes (1). Use of child restraints can be highly effective to prevent fatalities among both infants and young children as car occupants. It is reported that, children restraint can reduce the rate of death due to car accident by 71% in infants and 54% in young children (1). It was reported that none of the patients who used safety helmet died in hospital compared to 3% of those who had not worn helmet or seat-belt. Higher hospital charges and longer length of hospitalization were reported due to not using safety facilities (27-30). Seatbelt legislation was passed in Iran in 2005 and Soori et al. (4), showed that mandatory seatbelt legislation reduced the number of RTIs in Iran. Use of seatbelts is reported to reduce mortality from RTIs by 25% - 67% (4, 31, 32). Yousefzadeh Chabok et al. (15) suggested more researches on environmental and cultural factors to identify determinants of head injury in children, particularly regarding traffic-related head injury. The role of day-time casualties is well known and there is sufficient data to support the role of time in RTIs and daytime is associated with high incidence of casualties (33). In the current review, four of the nine studies report day time and another one reported that night was the time of most casualties (7, 9-12). It can be concluded that by greater traffic volume during the day, results in greater risk of RTIs as people go to work and children go to school. RTIs during weekends were also reported by

previous studies, but no evidence was found in the current review (33). Warm weather begins from spring to mid-summer in most of the provinces in Iran, and most of RTIs in the current review occurred during these periods of year (7, 10-13). It can be explained that in Iran, children and adolescents spend more time out of home because of warm weather and have more leisure time due to summer vacation. Inadequate availability of EMS facilities can lead to the death of many RTIs victims before reaching the hospitals. In the current review, about one third of victims received care by EMS, while, the majority of them were transferred to the hospital by bystanders or other means of transportation (7, 8, 11-13). Similar to the other studies, the cause of death in the current review were multi factorial including severe head injuries, not use of safety facilities and inadequate EMS care services (34, 35). The current review had some limitations. Due to limited epidemiological studies performed on children and adolescents as the studied population, an accurate mortality rate and other influencing risk factors related to RTIs among this age group could not be found.

4.1. Conclusions

Iranian children and adolescents, particularly males are at higher risk of RTIs, and paying attention to safety facilities and the risk factors, establishing comprehensive public education programs for older children and their parents because of their important parental role to supervise and improve road designs and prevent inappropriate speed and design safer vehicles can lead to reducing RTIs among the population at risk.

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