Preventive Care in Nursing and Midwifery Journal
2020; 10(3): 59-66

Injury Patterns and Severity of Motorcycle Crash Injuries Among Hospitalized Children and Adolescents in Darab, Iran in 2016: A cross-Sectional Study

Parisa Navabi[1], Rahim Tahmasebi[2], Maryam Ravanipour[3]

[1]MSc. Graduated of Nursing, Department of Nursing, School of Nursing and Midwifery, Bushehr university of Medical Sciences, Bushehr, Iran
[2]Ph.D. Professor in Biostatistics, Department of Biostatistics, School of Health and Nutrition, Bushehr University of Medical Sciences, Bushehr, Iran; And The Persian Gulf Tropical Medicine Research Center, The Persian Gulf Biomedical Sciences Research Institute, Bushehr university of Medical Sciences, Bushehr, Iran
[*3]Professor, Department of Nursing, School of Nursing and Midwifery; And The Persian Gulf Tropical Medicine Research Center, The Persian Gulf Biomedical Sciences Research Institute, Bushehr university of Medical Sciences, Bushehr, IR Iran

Corresponding Author Address: School of Nursing & Midwifery, Bushehr University of Medical Sciences, Rishehr Street, Bushehr, Iran. P.O.Box: 7518759577

Tel: 0098-7733450187

Email: ravanipour@gmail.com

Received: 20 Nov 2020 **Accepted**: 22 Feb 2021

Abstract

Background: Injuries caused by motorcycle crashes in children and adolescents are one of the main health problems that can cause serious injuries or even death in this population.

Objectives: This study aimed to determine the injury patterns and severity of motorcycle crash injuries among hospitalized children and adolescents in Darab, Iran.

Methods: This descriptive cross-sectional study was started on May 15, 2017 and continued for three months. All 212 children and adolescents, who had been injured in motorcycle crashes in 2016 and were referred to the emergency ward of the central hospital of Darab, were selected, and their medical records were reviewed. The data collection tools included a demographic information form, an injury-related questionnaire, and the Injury Severity Score (ISS). Data analysis was performed in SPSS v16, using descriptive statistics, Mann-Whitney test, and Chi-square test at a significance level of $\alpha \leq 0.05$.

***Results*:** The mean age of the injured children was 14.28±2.97 years. The head was the most commonly injured organ, while 130 (61.3%) cases had been injured in more than one organ. Most children had minor injuries with an ISS<9 (79%). The highest frequency of accidents was reported in the summer and spring. The majority of the injured motorcycle riders (n=191, 90%) had not used a helmet. Besides, the use of helmet was found to decrease with advancing age (P=0.017).

Conclusion: Although head injuries are more frequent than injuries to other parts of the body, and more than 90% of motorcyclists do not wear helmets, informing and educating children and families is very important in this area. It is recommended to implement strict traffic laws for motorcycling and highlight the necessity of wearing helmets by motorcycle riders. Moreover, families should be stricter about their children riding motorcycles, especially during school holidays (summer and spring).

Keywords: accidents, adolescent, child, injury severity score, motorcycle

Introduction

The traffic-related death rate is unacceptably high around the world, and road accidents are the eighth leading cause of mortality in all age groups. It is estimated that 1.35 million people die each year due to road traffic injuries [1]. These injuries are also a leading cause of death in children and young adults in the age range of 5-29 years [2]. Globally, about half of all road traffic deaths occur among vulnerable road users, including pedestrians, cyclists, and motorcyclists [1,3]. Due to the exposed design of motorcycles and their high speed, motorcyclists are much more likely to be injured in road accidents than other

road users [4]. Also, about a quarter of people killed by on-road or off-road accidents are motorcyclists [3].

Motorcycle crashes account for a very high percentage of all motor vehicle casualties in the United States [5]. The number of road deaths is increasing worldwide, and the rates are even higher in Iran. Motorcyclists are at the greatest risk of injury and death from road traffic accidents [6]. Based on a study conducted in Poorsina Hospital of Rasht, Iran on 8000 trauma cases in six academic centers over one year, the youths were injured mostly in motor accidents [7]. Moreover, in Chandigarh zone of North-West India, the epidemiology of road traffic accidents revealed that the most commonly affected age group was 16-18 years (35.3%). Also, injury to the head and neck region (81.4%) was responsible for the majority of deaths [8].

In a cross-sectional study on 28,356 motorcycle fatalities, registered in the Legal Medicine Organization of Iran between March 2011 and March 2017, among 31 provinces of Iran, Fars Province had the highest incidence of fatal motorcycle crashes (9.9%), and most of the motorcycle casualties were reported in the age group of 18-24 years (29.1%) [9]. Overall, population growth, increased use of vehicles, disregard for traffic laws, and inattention to safety issues related to vehicles and passengers have been among the major causes of children and adolescents' accidents over the past years [10] and have exposed adolescent cyclists and motorcyclists to severe road injuries. Therefore, it is necessary to focus on legal measures to protect these high-risk groups [11].

Considering the high number of traffic accidents at young age, analytical research is necessary to identify the causes of such accidents and to propose more effective approaches for providing health services and resource allocation. Accordingly, this issue must be considered as a priority of health and treatment services [12,13]. Moreover, determining the epidemiological patterns of motorcycle injuries is essential for a deeper understanding and better decision-making to reduce these injuries [9]. Therefore, the present study was conducted to determine the patterns and severity of motorcycle crash injuries among hospitalized children and adolescents in Darab, Iran, in 2016.

Methods

This descriptive cross-sectional study, which was conducted in the only central hospital of Darab in Fars Province, Iran, was started on May 15, 2017 and continued for three months. The inclusion criteria were as follows: [1] age range of 6-18 years; and [2] having a history of a motorcycle accident as a motorcyclist or a pillion passenger over the last year. For this purpose, all 212 individuals (i.e., motorcycle riders and pillion passengers), aged 6-18 years, who were injured in motorcycle accidents and were referred to the emergency department from March 20, 2016 to March 20, 2017, were selected, and their archived medical records were investigated.

The data were collected using a demographic form (e.g., age, gender, parents' occupation, and education), an injury-related information form (e.g., injured organs and time of accident), and the Injury Severity Score (ISS) for assessing the severity of the injury [14]. First, we obtained permission from the Ethics Committee and the Research Council to enter the data center. Next, in a phone call, the children's parents were told about the importance of participating in a telephone interview and answering the questions. They were then asked about their willingness to participate in the study and interview. The required data were confidentially and anonymously extracted from the existing records, and then, the children's parents were contacted via phone calls to confirm some information or acquire new information based on the form.

For classifying the severity of injuries, the Abbreviated Injury Score (AIS) was measured, which classifies injuries into five levels of severity (minor, moderate, serious, severe, and critical) [15]. The AIS, which was developed by the American Association for the Advancement of Automotive Medicine (AAAM) in 1971, is one of the first tools used for measuring the severity of traumas [16]. In this scale, the patient's body is divided into six significant regions (head and neck, face, thorax, abdomen, extremities, and exterior organs) and then evaluated. Each anatomical structure is scaled from zero (no injury) to five (mortal lesions), based on the injury severity (Score six is for fatal injuries.)

AIS is deemed as an appropriate tool for specifying the severity of damage to different body organs. However, it is not effective in

simply describing patients with multiple injuries [14,15]. In this regard, Baker et al. (1974) reported that numerous injuries would increase the mortality rate. They also showed that the sum of the highest AIS in different organs was correlated with mortality. Therefore, a new scale, called the ISS, was developed, which was calculated by summing the square of three highest AIS scores (in different body organs of the same patient) [14,16]. Since the AIS for each of the six body regions is between one (minor injury) and six (maximum injury, virtually unsurvivable) [16], the highest tolerance score is 25 for an individual with trauma in one organ. The AIS shows the correlation between the severity of injury and mortality and is considered a valid scoring system that can be widely used for children's trauma [14].

Generally, there are six stages of ISS: minor (1-8), moderate (9-15), serious (16-24), severe (25-49), critical (50-74), and maximum (75) [14]. In this regard, Brown et al. (2017) studied children under 16 years, who were referred to Pennsylvania hospital, based on the AIS and ISS, to predict mortality and define the optimal thresholds of severe injury in pediatric traumas. According to their results, AIS and ISS are widely consistent in trauma research and benchmarking, even in pediatric traumas, and are accurate indicators of trauma triage in children under 16 years [17]. Therefore, in this study, first, the severity of injury to each organ was calculated based on the AIS, and then, the square of the three most severe injuries was summed up; the final score was determined according to the ISS.

Data analysis was performed in SPSS version 22, and the significance level was considered to be $P \leq 0.05$. Descriptive indices (mean and standard deviation) were used to evaluate the demographic variables. Due to the non-normal distribution of age and length of hospital stay in male and female subjects, non-parametric Mann-Whitney and Chi-square tests were used, based on the results of Kolmogorov-Smirnov test to compare the age and length of hospital stay.

Results

The mean age of the injured subjects was 14.28±2.97 years (age range: 6-18 years). In all reported accidents, children and adolescents were students. Also, regarding the vehicle ownership, 160 (75.5%) participants owned the motorcycles. In terms of the parents' occupation, it was observed that 89 (43%) fathers were self-employed, and 197 (95%) mothers were housewives. Based on the results, 125 (59%) accidents occurred outside urban areas, while 87 accidents occurred in urban regions. Also, more than 90% of motorcycle riders had not used a helmet. Other demographic information of the participants is presented in Table 1.

Table 1: The demographic data of injured children (n=212) in traffic accidents

Characteristic Demographic Variable	Status		Number	Quantitative Percentage (%)
Birth Order	First Child		92	43.4
	Second Child Onward		120	56.6
History of Accident	No		180	84.9
	Yes		32	15.1
Age	Age Range	6-9	15	7.08
		10-13	61	28.77
		14-18	136	64.15
Sex	Male		199	93.9
	Female		13	6.1
The most common level of parental education (under diploma)	Father		176	83
	Mother		183	86.3
Place of accident	Rural		125	59
	Urban		87	41
Injured Organs	• Head(total)		169	79.72

	• Only upper Organ	2	0.94
	• Upper Organ& Other Injury	3	1.42
	• Only Lower Organ	6	2.83
	• Upper& Lower Organs	21	9.9
	• Lower Organ& Other Injury	6	2.83
	• Other organ	5	2.36
Time of Accident	Morning	29	13.7
	Afternoon	87	41
	Night	96	45.3
Traumas' Season	Spring	63	29.7
	Summer	89	42
	Autumn	40	18.9
	Winter	20	9.4

Regarding the anatomical injuries, 130 (61.3%) children were injured in more than only one organ. The children's injury severity based on the ISS is shown in Table 2. The most frequent injuries were minor (79%), whereas the least frequent injuries were severe and critical (0.5% per type). The boys within the age range of 16-18 years (41.5%) were the most injured group, followed by the age group of 14-15 years (22.5%). According to the results of Spearman's correlation test, the length of hospitalization increased with an increase in the age of injured children (Spearman's correlation coefficient=0.263; P<0.001). On the other hand, no significant difference was observed between the use of helmet and type of trauma (P=0.180), head injury (P=0.227), mother's occupation (P=0.421), mother's education (P=0.262), father's occupation (P=0.506), father's education (P=0.692), and vehicle ownership (P=0.225), based on the results of Chi-square test. There was also a relationship between age and helmet use; in other words, an increase in the former decreased the latter (P=0.017). The results related to the relationship of age and sex with the length of hospitalization are presented in Table 3.

Table 2: Classification of the severity of organ damage in children (n=212) injured in motor accidents

Injury severity based on ISS[a]	Number	Percentage (%)
Minor (1-8)	168	79
Moderate (9-15)	6	3
Serious (16-24)	36	17
Severe (25-49)	1	0.5
Critical (50-75)	1	0.5

[a]Injury Severity Score

Table 3: Comparison of age and length of hospital stay in boys and girls injured in motor accidents (n=212)

		Mean ±SD	IQR[a]	Median	P value[*]
Age	Boy	14.51±2.72	5	15	0.003
	Girl	10.85±4.39	8	9	
Hospitalization Period	Boy	2.54±1.62	1	2	0.617
	Girl	2.54±1.81	2	2	

[*]Mann-Whitney test
[a]Interquartile range

Discussion

The present study was conducted to determine the epidemiology of injuries in six- to 18-year-old children and adolescents, who were injured in motor accidents and were referred to the emergency department of Imam Hasan Mojtaba

Hospital in Darab, Iran in 2016. The results showed that 212 injured cases, aged 6-18 years, had been referred to the emergency ward of the hospital due to motorcycle crash injuries. Also, the number of injured boys in motor accidents was nearly 100%, and they were the most commonly injured group. This finding is consistent with another study conducted in Isfahan, Iran [18], as well as an epidemiological review on vehicle accidents in Iranian children and adolescents [19], probably because in Iran, motorcycle riding by women, especially in small cities and villages, is frowned upon.

Besides, the boys' greater freedom of action compared to girls in the society has increased the risk of trauma in boys. In a retrospective study of adolescents under the age of 18 years in India, male adolescents and children, between the age of 15 and 18 years, had a particularly high mortality rate in road accidents [20]. The injured girls were mostly pillion passengers and not motorcyclists. It should be noted that many families use motorcycles as a means of transportation for their family members. Also, the behavioral, physical, and psychological differences of men and women, as well as men's education and occupation (more difficult careers), can cause an increase in traumas among men. As mentioned before, in Iran, men are the main victims of motor accidents. However, even in countries where both sexes are free to use motorcycles, men still remain the main victims of motor-related injuries [11,20].

In the present study, most accidents occurred at night, in summer, and in spring, which might be due to the crowdedness of commuting routes, especially suburban roads, poor vision of drivers at night, popularity of motorcycles as the most accessible and attractive means of transportation during summer holidays, and also frequent holidays during spring and summer. In an epidemiological review of vehicle accidents among Iranian children, the highest number of accidents occurred between 1 pm and 6 pm, and most traffic injuries occurred during summer [19]. On the other hand, other studies have shown that the prevalence of accidents at night and in mid-afternoons was higher than other times of the day.

Moreover, a study on severely injured motorcyclists in the European Union (EU) (2016) revealed that the most frequent seasons of accidents were spring and summer [21]. Another study on road traffic injuries in a public hospital in Thika district, Kenya (2011), also revealed that severe injuries were associated with vulnerable road users, rainy weather, and nighttime crashes [22]. In line with the present study, some studies reported that most accidents occurred respectively in summer and spring. It seems that the cold weather of autumn and winter reduces the motorcycle traffic. In a survey of 641 traumatized children under 15 years in Poursina Hospital of Rasht, Iran, the most common episode of trauma was reported in summer, followed by spring [23].

In another study, 2300 children with trauma, aged 1-15 years, who were referred to Alzahra Hospital in Isfahan, Iran, were evaluated. They showed that the most common episode of traumatic occurrence was in summer and spring, which is consistent with the results of the present study [18]. In another study, the incidence of fractures in summer was 2.5 times higher than in winter, which is probably caused by longer days and the increased presence of children outside the house [24]. It is recommended that policymakers consider these findings to provide healthier recreational opportunities as the main purpose of their plans and interventions. Also, promoting the proper use of motorcycles through peer training groups, social networks, and media is recommended. If possible, stricter rules must be applied for motorcycle use, especially in spring and summer for children and the youth.

According to the current findings, after reviewing the accidents over one year, it was found that the most injured organs were the head and the spinal cord, and more than half of the victims were injured in more than one organ. In a study from Spain, head injuries were introduced as the main cause of injury in children [25]. In some other studies, the most traumatized anatomical areas were the neck [26] and the head [23]. It is recommended that interventions and educational programs for families and adolescents focus on the protection of the head and neck regions when riding a motorcycle and consider the vulnerability of these organs.

In the present study, there was no significant relationship between the use of helmets and type of trauma or head injury. However, there was a significant relationship between the use of helmets and age; in other words, with an increase in age, the use of helmets decreased. In addition,

the severity of injuries was higher in boys, aged 14-18 years, which was associated with the increased length of hospital stay. The limited use of helmets was also reported in another study conducted in Khorramabad, Iran, which showed that most casualties occurred in adolescents or young people who did not use a helmet [27]; this finding is in line with the results of the present study. In another study from the United States, social and developmental factors were associated with death from motor vehicle accidents in the adolescents (10-19 years) [28]. However, in a study on younger motorcyclists (≤40 years), those with helmets were less likely to be injured than those without helmets [29]; this difference can be either due to the age range of subjects under study or the incorrect use of helmets.

Based on the ISS scores, the most prevalent injuries were minor, while the least prevalent injuries were severe and critical. In a study based on the ISSs of motorcyclists under or above the age of 40 years, most injuries were mild (52%), followed by moderate (28%) and severe (20%) injuries [29]. Moreover, another study on road traffic injuries among children and adolescents in Singapore showed that most children had minor injuries with an ISS of <9 (95.9%) [11].

According to these findings, the occurrence of these injuries is multi-faceted and can involve families (e.g., driver training, preventing driving without a license, and reconsidering the situation when purchasing a motor vehicle for their adolescent children), the traffic police (e.g., controlling motorcyclists without a driver's license or a helmet), and road policymakers (e.g., preparation of proper places for riding bicycles instead of motorcycles). Also, training of safe motorcycle riding is recommended in media and even at schools. None of the participants in the present study had a driver's license, because they were all under the legal age (18 years old), and all of the accidents occurred in adolescents below this age.

A strength of this study was the collection of data from the only central hospital in the city. However, similar to any other research, this study also had some limitations, such as the past-oriented approach and the obligation to only use the information in the patients' medical files. In case of data deficiency, the researchers were required to contact the parents through phone calls for more complementary information. Besides, the impossibility of the accurate assessment of injured people, based on standard clinical criteria at the time of accident, caused some limitations in the accuracy and generalization of the results.

Conclusion

According to the present results, the most injured body part in motor accidents was the head, and more than half of the victims were injured in more than one organ in Darab, Iran. Most children had minor injuries based on the ISS. Age, sex, and length of hospital stay had significant relationships with the use of helmets.

It is suggested to design further prospective studies by considering the variables evaluated in this study, in addition to other influential factors, including the climatic condition, such as rainfalls and wet roads. Also, based on the present findings, it seems that the occurrence of these accidents is multifaceted, involving both families and policymakers; therefore, to prevent such accidents, the participation of all groups, including the families (e.g., driver training, preventing driving without a license, and reconsidering the situation when purchasing a motor vehicle for their adolescent children), the traffic police (e.g., checking motorcyclists without a driver's license or helmet and providing information leaflets about major potential hazards when issuing a motorcycle driver's license), and road policymakers (e.g., preparing proper places for riding motorcycles and improving the road safety), is needed. Finally, training for the proper methods of motorcycle riding is strongly suggested, even at schools and in media. Overall, effective measures cannot be taken without the assistance and cooperation of several executive sections. Moreover, increasing the educational efforts, along with monitoring adolescent driving in close cooperation with the Ministry of Education and the traffic police, can reduce the risk of accidents in adolescents and decrease the number of crashes and serious injuries.

Acknowledgments:

This study was supported by the Research Council of Bushehr University of Medical Sciences (grant No.: 1396.417) and the Research Ethics Committee (code: Ir.bpums.rec.1396.89).

We would like to thank the Research Deputy of Bushehr University of Medical Sciences for the valuable financial support, as well as the personnel and authorities of the emergency and surgery wards of Darab Imam Hasan Mojtaba Hospital, especially the personnel of the archives department. We also would like to thank the injured children and adolescents and their parents who provided the required complementary information without any expectations. We also extend our gratitude to Dr.Ali Foroutan (a general surgery specialist), Dr. Ali Ghaem-Maghami (an orthopedic specialist), and Dr. Mani Zare (an orthopedic specialist) for their valuable suggestions.

Conflict of interest

The authors declare no conflict of interest.

Funding:

This study was funded by the Vice-Chancellor for Research of Bushehr University of Medical Sciences.

References

1. World Health Organization (WHO). Global status report on road safety 2018: Summary. [Cited 2021 Feb 24];.Avaiable from:URL: https://apps.who.int/iris/bitstream/handle/10665/277370/WHO-NMH-NVI-18.20-eng.pdf

2 Road traffic injuries .[Cited 2021 Feb 24];. Avaiable from:URL:https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries

3 Araujo M, Illanes E, Chapman E, Rodrigues E. Effectiveness of interventions to prevent motorcycle injuries: systematic review of the literature. Int J Inj Contr Saf Promot. 2017; 24(3): 406-22.

4 .Australia I. Motorcycle safety. [Cited 2020 Aug 22];. Avaiable from:URL: http://cdn-nrspp.s3.amazonaws.com/wp-content/uploads/sites/4/2017/03/23093157/Motorcycle-Safety_20200430_1228_Awil.pdf

5. Cheng W, Gill GS, Sakrani T, Dasu M, Zhou J. Predicting motorcycle crash injury severity using weather data and alternative Bayesian multivariate crash frequency models. Accident Analysis & Prevention. 2017; 108: 172-80.

6. Bazargani HS, Vahidi RG, Abhari AA. Predictors of Survival in Motor Vehicle Accidents Among Motorcyclists, Bicyclists and Pedestrians. Trauma Mon. 2017; 22(2): e26019.

7. Yousef zade Chabok S, Safayi M, Hemati H, Mohammadi H, Shabani S. Epidemiology of head injury in patients who were reffered to Poorsina hospital. J Guilan Uni Med Sci. 2008; 16(64): 112-19. [In Persian].

8. Singh D, Singh SP, Kumaran M, Goel S. Epidemiology of road traffic accident deaths in children in Chandigarh zone of North West India. Egypt J Forensic Sci. 2016; 6(3): 255-60.

9. Barzegar A, Ghadipasha M, Forouzesh M, Valiyari S, Khademi A. Epidemiologic study of traffic crash mortality among motorcycle users in Iran (2011-2017). Chinese Journal of Traumatology. 2020.

10. Javid M, Shahcheraghi M, Lahiji A, et al. Road traffic injuries in children. Iran j Orthopaedic surgery. 2006; 4(3): 1-6. [In Persian]

11. Chong S-L, Tyebally A, Chew SY, et al. Road traffic injuries among children and adolescents in Singapore–Who is at greatest risk? Accid Anal Prev. 2017; 100: 59-64.

12. Saunders BE, Adams ZW. Epidemiology of traumatic experiences in childhood. Child Adolesc Psychiatr Clin N Am. 2014; 23(2): 167-84.

13. Soori H, Ainy E, Zayeri F, Mehmandar M. Comparison of road traffic death occurrence within urban and metropolitan roads focusing on environmental factors. Hakim Res J. 2013; 15(4): 339-45. [In Persian]

14. Flynn JM, Skaggs DL, Waters PM. Rockwood and Wilkins' Fractures in Children. 8th ed. Philadelphia: Lippincott Williams & Wilkins; 2014.

15. Moradi Lakeh M, Tehrani Banihashemi S, Varasteh Kia G, Roohipour M. Comparison of trauma scoring systems for prediction of patients' prognosis. Razi J Med Sci. 2002; 9(28): 129-37. [In Persian].

16. MacKenzie EJ, Shapiro S, Eastham JN. The Abbreviated Injury Scale and Injury Severity Score: levels of inter-and intrarater reliability. Med care. 1985; 23(6): 823-35.

17. Brown JB, Gestring ML, Leeper CM, et al. The value of the injury severity score in pediatric trauma: Time for a new definition of severe injury? J Trauma And Acute Care Surg. 2017; 82(6): 995-1001.

18. Memarzadeh M, Hoseinpour M, Sanjary N, Karimi Z. A study on trauma epidemiology in children referred to Isfahan Alzahra Hospital during 2004-7. FEYZ. 2011; 14(5): 488-93. [In Persian].
19. Behzadnia S, Shahmohammadi S. Road traffic injuries among Iranian children and adolescents: an epidemiological review. J Pediatr Rev. 2016; 4(1): 0-0. [In Persian].
20. Kumar S, Verma AK. Trends in trauma-related mortality among adolescents: A 6 year snapshot from a teaching hospital's post mortem data. J Clin Orthop Trauma. 2017; 8(2): S1-S5.
21. Aarts LT, Commandeur JJ, Welsh R, et al. Study on serious road traffic injuries in the EU. Luxembourg: Publications Office of the European Union; 2016.
22. Osoro ME, Ng Z, Oundo J, Omolo J, Luman E. Factors associated with severity of road traffic injuries, Thika, Kenya. Pan Afr Med J. 2011; 8: 20.
23. Asadi P, Asadi K, Rimaz S, Monsef-Kasmaie V, Zohrevandi B, Mohtasham-Amiri Z. Epidemiology of trauma in children admitted to Poursina teaching hospital. J Guilan Univ Med Sci. 2015; 23(92): 9-15. [In Persian].
24. Mathison DJ, Agrawal D. An update on the epidemiology of pediatric fractures. Pediatr emerg care. 2010; 26(8): 594-603.
25. Ferraz-Torres M, Belzunegui-Otano T , Martínez-García O, Iriarte-Cerdán L, Salgado-Reguero E. Epidemiological characteristics and overall burden of accidental injuries in navarra, spain: Epidemiology of injuries in children. J Trauma Nurs. 2016; 23(4): 231-6.
26. Tafida MA, Wagatsuma Y, Ma E, Mizutani T, Abe T. Descriptive epidemiology of traumatic spinal injury in Japan. J Orthop Sci. 2018; 23(2):273-76.
27. Torabi A, Tarrahi M J, Ali Mahmoudi G. Epidemiology of motorcycle accident in Khoramabad, Iran. Payesh. 2009; 8(3): 253-62. [In Persian].
28. Cunningham RM, Walton MA, Carter PM. The major causes of death in children and adolescents in the United States. N Engl J Med. 2018; 379(25): 2468-75.
29. Dischinger PC, Ryb GE, Ho SM, Braver ER, editors. Injury patterns and severity among hospitalized motorcyclists: a comparison of younger and older riders. Annu Proc Assoc Adv Automot Med. 2006; 50: 237- 49.