



## The Epidemiological Pattern of Childhood Injuries and Accidents among Iranian Children: A Systematic Review

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### Abstract

**Background:** Injuries caused by accidents are the primary causes of disability, permanent deformities, and death in children. This study aimed to determine the epidemiological pattern of childhood accidents and injuries and their related factors among Iranian children.

**Materials and Methods:** In this systematic review, a systemic search of online databases (Medline, EMBASE, Scopus, Web of Science, Cochrane Library, CIVILICA, SID, Magiran, and Google Scholar search engine) was conducted for related studies with no time limit up to June 2022, using the related Mesh keywords. Two reviewers evaluated the quality of eligible studies and carried out the selection procedure.

**Results:** Nine studies (from 2005 to June 2022) with an overall sample size of 20,591 were selected. Of the total accidents, 70% occurred at home. The highest incidence of accidents among children was between 16% and 40%, and the mean age of accident victims was  $2.5 \pm 1.5$  years, with the highest in boys (59.4%). The most frequent causes of accidents were traffic accidents (53.4%), followed by physical injury (50.7%), falling (44.3%), and swallowing (22%). Also, 93.3% of accidents occurred in urban areas. There was a significant relationship between gender, age, type of house, place of accident, parental higher education, season, and injury types ( $p < 0.05$ ).

**Conclusion:** The results showed that 70% of accidents for children happened at home. The most frequent accident was traffic accidents, followed by physical injury, falling, and swallowing. It appears that almost all home accidents can be prevented by education. Therefore, developing educational and preventive policies is essential to achieve better standards of road transportation and reduce home accidents and injuries in Iran.

**Key Words:** Accident, Children, Iran, Injury, Pattern.

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## 1- INTRODUCTION

Children under five do not understand the dangers around them and are more vulnerable. In the past, injuries were considered a result of an accident, and it was believed that luck and fortune played a significant role. Today, it is known that most injuries are preventable. An accident is an unplanned event that can cause damage and disrupt the progress or natural process of activity (work), and it happens due to unsafe actions, unsafe conditions (behavior-environment), or a combination of both. An incident has three characteristics: a) suddenness, b) unwantedness, and c) harmfulness (1, 2).

Throughout history, accidents and similar events have been among the primary threats to human health. With the introduction of industry and technology into human life, accidents have expanded, taken new forms, and caused various losses and damages (3, 4). Children and young people are the most vulnerable to accidents (5-7), and children under five are especially more vulnerable than adults due to the limitation of risk diagnosis (8, 9). According to the UNICEF report in 2018, accidents were the cause of 30% of deaths in the age group younger than 19 years (10). According to the CDC (2018–2019), unintentional childhood injury rates were the highest among male children and babies under one year and teenagers from 15 to 19 years (11).

In Iran, accidents are the third cause of death in all age groups (12). Among children, accidents are the primary causes of injury that threaten their health at any time. However, they are largely neglected due to reasons such as a lack of knowledge and the general perception that accidents are random and unpreventable (13, 14). The occurrence of injuries follows a certain pattern along the physical and cognitive development of children so that some injuries are more common in a particular age (13, 15). Reducing injuries

and accidents is an international health goal and requires a consensus from institutions, organizations, and different scientific disciplines. Almost all injuries, whether intentional or unintentional, can be prevented (16), and there are various ways to prevent accidents. The best preventative measure is to be informed about the causes of injuries and how to prevent them (17). Since accidents are one of the main causes of death in children under five (1, 9), the present study aimed to determine the epidemiological pattern of childhood accidents and injuries and their related factors among Iranian children.

## 2- MATERIALS AND METHODS

The Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA) checklist was used as the template for this review (18).

### 2-1. Eligibility criteria

The participants, interventions, comparators, and outcomes (PICO) was used to formulate the objective and inclusion criteria.

**2-1-1. Participants:** Iranian children ( $\leq 6$  years old).

**2-2-2. Interventions:** The included studies were non-interventional, so a comparison group did not exist.

**2-1-3. Comparison:** We did not have a comparison group and intervention.

The included studies were non-interventional. Therefore, a comparison group did not exist.

**2-1-4. Outcome:** Childhood injuries and accidents.

**2-2. Included studies:** Studies that met the following criteria were included in the review: studies that 1) contained any form of quantitative assessment, measurement, and evaluation of injuries and accidents in Iranian children; 2) were performed inside Iran, 3) included children under six, 4)

provided data on the frequency, rate, and cause of childhood injuries and accidents (e.g., poisoning, falling, traffic accidents, and drowning) in children younger than six, and 5) were published in either English or Persian languages up to July 2022.

**2-3. Exclusion criteria:** The exclusion criteria were abstracts without the full article, studies on other age groups, articles not written in English or Persian, review articles, meta-analyses, letters to the editor, editorials, short reports, case reports, theses, and briefs.

#### **2-4. Information sources**

A systemic search of electronic databases Medline, EMBASE, Scopus, Web of Science, Cochrane Library, CINAHL, CIVILICA, SID, Magiran, and Google Scholar search engine was conducted. The search was done independently and in duplication by two reviewers, and any disagreement between the reviews was resolved by the supervisor.

#### **2-5. Search**

Search words were a combination of (Children OR Infants OR Toddlers) AND (Injury OR Accident) AND (Prevalence OR Ratio OR Epidemiology OR Incidence).

#### **2-6. Study selection**

The database search was done for possible studies, abstracts were screened for eligible studies, full-text articles were obtained and assessed, and a final list of included studies was made. The references of the retrieved articles were reviewed for further relevant studies and contributed as a source of additional records. This process was done independently and in duplication by two reviewers, and any disagreement was resolved by the third reviewer. References were organized and managed using EndNote software (version X8).

#### **2-7. Data collection process**

All studies reporting children's injuries and accidents were gathered according to the inclusion and exclusion criteria. After the quality appraisal, data were extracted and analyzed. The data extraction form was designed and finalized based on sample studies retrieved by an initial search. Two independent inspectors gathered the information based on the following parameters: 1) Author names, publication year, and study site (location); 2) Sample size; 3) Age range, and 4) The rate of injuries and accidents (e.g., poisoning, falling, traffic accidents, and drowning). Two reviewers collected the data independently. The collected data were combined and compared for accuracy, and any discrepancies were solved by a third reviewer.

#### **2-8. Risk of bias in individual studies**

The risk of bias was assessed using the standard tool of STROBE (STrengthening the Reporting of Observational Studies in Epidemiology) positioning guidelines (19). STROBE is a valuable tool for evaluating the quality of observational studies. This checklist has 22 items, scored based on the importance of each item according to the present study. The final score of the checklist was 30, and the minimum score was 15.0. The assessment was done by two reviewers independently and in duplication, and any discrepancies were resolved by the third reviewer.

#### **2-9. Synthesis of results**

Due to the difference in the included studies, study designs, age groups in some studies, and sample size, a meta-analysis was not conducted.

### **3- RESULTS**

The systematic search identified nine studies containing epidemiological characteristics of childhood injuries and accidents in Iran, with a total population of

20,591. A flow diagram illustrating the literature search and study selection is shown in **Figure 1**. The studies included in

the systematic review are characterized in **Table 1** and the following:

**Table-1:** General characteristics of included studies (n=9).

Author, Reference	Year	Area	Study population	Sample size	Main findings
Dehghani et al., 2015-2016, (20)		Yazd province	Children aged under 5 years	2489	The most frequent accident was falling (29.9%), followed by burns (21.8%) and trauma (19.9%).
Mirahmadizadeh et al., 2016-2017, (21)		Fars province	Children under 6 years	6000	The most common causes of accidents were burns (16%), falls (14%), and accidents involving objects (10%).
Nouhjah et al., 2011, (22)		Ahvaz	Children aged under 5 years	400	Four common causes of injury were falls (30.1%), swallowing (22%), burns (16.8%) and poisoning (11.4%).
Khodayari Zarnaq et al., 2015, (23)		Tabriz	Children aged under 5 years	1376	Falling, with a frequency of 44.3%, was the most prevalent accident and the most frequent injuries were fractures (66.9%).
Khazaei et al., 2009-2015, (24)		Hamadan province	Children aged under 5 years	4523	The results showed that urban residents and boys had a higher number of injuries. Motor vehicle-related injuries were the most common type of injury.
Nekooee Moghadam et al., 2013, (25)		Kerman	Children aged under 5 years	1303	The main kinds of accidents were injury (39.67%), poisoning (20.56%), and falling (15.11%).
Khazaei et al., 2009-2016, (26)		Hamadan province	Children under one year	3200	In total, car accidents (53.4%), trauma (12.6%) and fall from altitude (8.8%) were the most frequently observed had the most frequency from all accidents.
Sasan et al., 2005, (27)		Mashhad	Children aged 6-24 months	1000	The most common causes of accidents were falls 13.4%, suffocation due to aspiration of solids (12.8%), cuts (11.9%), burns (10.9%), and poisoning (3.9%).
Vakili et al., 2011, (28)		Yazd	Children aged under 6 years	300	Physical injury (50.7%), burn (15.3%), fall (12%), poisoning (11%), traffic accident (10.3%) and drowning (0.7%) were the reasons for children's accidents.

**1.** A cross-sectional study aimed to determine the frequency of different accident types in children aged under five years living in Yazd province from 2015 to 2016. The results showed that the frequency of accidents was 1460 (58.7%) in boys and 1029 (41.3%) in girls. Accidents occurred most frequently in April-May (n: 245, 9.8%), and winter (n: 693, 27.8%). Also, 93.3% of accidents occurred in urban areas, 4.4% the rural areas, and 2.3% outside the city and the villages. The total number of accidents at

home was 1743 (70%), and in the alleys and streets was 495 (19%). The most frequent accident was falling (n: 743, 29.9%), followed by burns (n: 543, 21.8%), and trauma (n: 495, 19.9%). The difference in the accident type between different age groups was significant ( $p < 0.001$ ) (20).

**2.** A population-based cross-sectional study investigated the incidences of different causes of accidents in children under six in the Fars province, South Iran, in one year (2016-2017). The results

showed that the annual incidence rate of accidents was 16%, and the mean age of accident victims was  $2.5 \pm 1.5$  years. Of these, 17.3% and 14.8% were male and female, respectively, and 25% of the children suffered more than one accident. The most common causes of accidents were burns (16%), falls (14%), and those involving objects (10%). In the multivariate analysis, a higher number of male children in the family and a lower age increased the likelihood of accidents significantly ( $p < 0.05$ ) (21).

**3.** A cross-sectional pilot study aimed to assess the prevalence of non-fatal home injuries and their related factors among children attending health centers in Ahvaz in 2011. The results showed that the overall prevalence of injuries among children under five years was 40% ( $n=156$ ). The four common causes of injury were falls (30.1%), swallowing (22%), burns (16.8%), and poisoning (11.4%). The logistic regression test showed a significant association between injuries and type of house ( $OR=2.52$ ; 95% CI 1.34-4.76), and the age of children ( $OR=0.031$ ; 95% CI 0.01-0.81;  $p < 0.05$ ) (22).

**4.** A cross-sectional study aimed to investigate the epidemiology of injuries in children younger than five who were admitted to Tabriz Shohada Hospital in 2015. The results showed that the highest number of accidents happened to boys (59.4%), and children at age four (41.1%). The most common insurance was social security insurance (50.3%). Falling, with a frequency of 44.3%, was the most prevalent accident, and the most frequent injuries were fractures (66.9%). Anatomically, the forearm was the most injured body part (22.7%). There was a significant relationship between children's age and the season of the accidents and between children's gender and injury types ( $p < 0.05$ ) (23).

**5.** A cross-sectional study aimed to clarify the personal, space, and time pattern of injury among children aged one to five in the Hamadan Province from 2009 to 2015. The results showed that urban residents and boys had a higher number of injuries. Motor vehicle-related injuries were the most common injury type. A seasonality pattern was found, so most cases occurred in the summer months. The lowest and highest incidence rate ratios (IRRs) occurred in January 2011 (IRR = 0.61 with 95% confidence interval [CI]: 0.31, 1.18), and May 2014, and August 2013 (IRR = 6.78 with 95% CI: 4.38, 10.51), respectively. This study included 4523 injury cases (24).

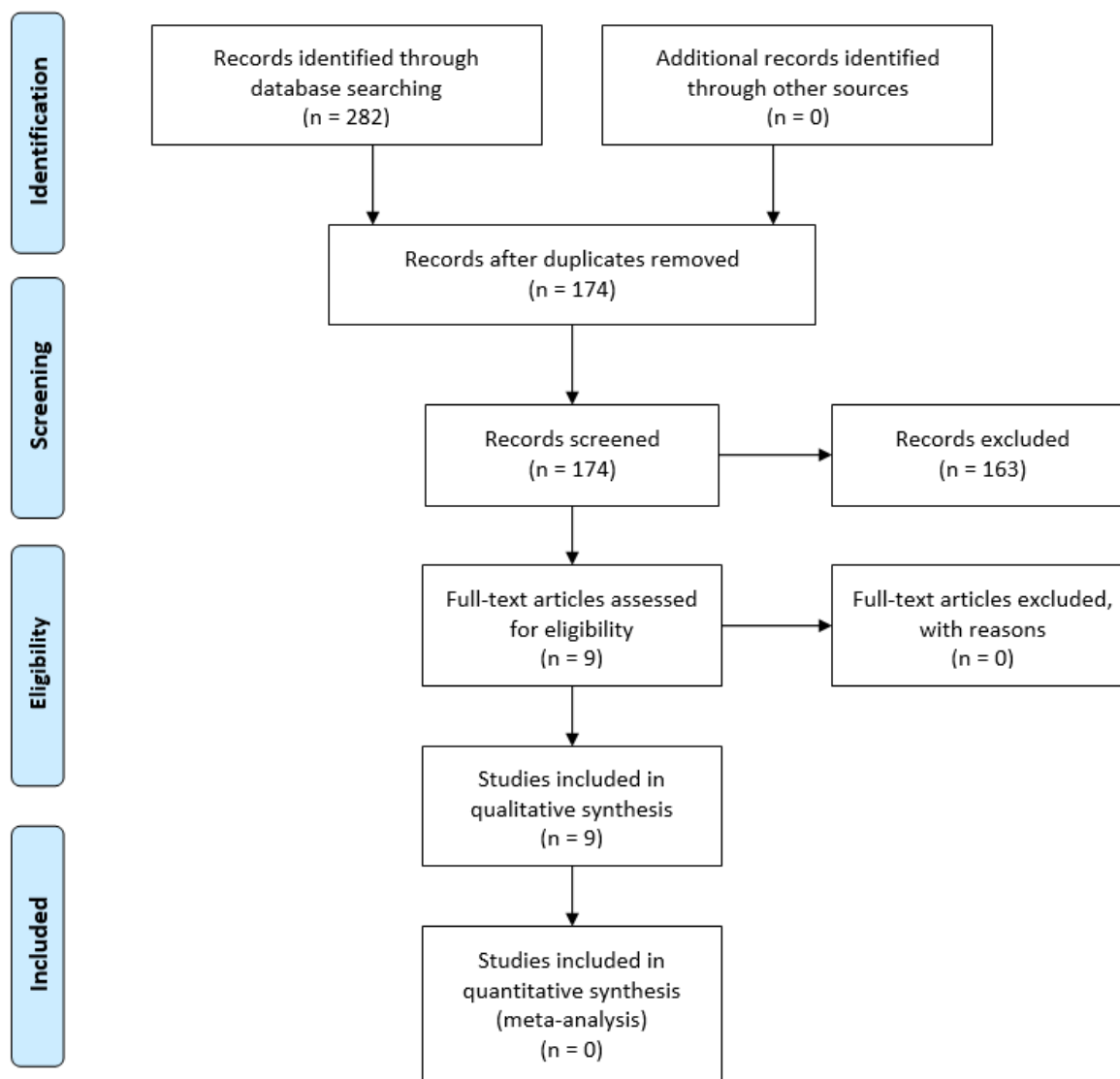
**6.** A descriptive-analytical prospective study investigated the causes of accidents and injuries among children younger than five in Kerman in 2013. The results showed that among those who died (159), 69% were girls. The most frequent accident was injury (39.67%), poisoning (20.56%), and falling (15.11%). Accidents were more frequent among girls and children aged three to four. Age, gender, and season of death had no correlation with the kind of accident. However, there was a significant correlation between accidents among children under five and the season of death (25).

**7.** A cross-sectional descriptive-analytic study aimed to investigate the extent and distribution of accidents among infants under one year in the Hamadan Province, Iran, from 2009 to 2016. The results showed that 3200 accidents were registered among children younger than one. The highest occurrence of accidents was 1029 in the spring (31.15% of cases). Also, 1890 (59.1%) of accidents occurred in urban areas, and only 429 (13.4%) were in rural areas. In total, car accidents (53.4%), trauma (12.6%), and fall from altitude (8.8%) were the most frequent accident. There was a significant correlation between gender and place of

accidents with accident type ( $p < 0.001$ ) (26).

**8.** A cross-sectional descriptive study investigated the rate and distribution of accidents in infants under one year in Mashhad in 2005. The average age of the study group was  $13.8 \pm 7.8$  months. During the study period, 55% of children experienced one type of injury. The incidents experienced in order of prevalence were falls 13.4%, suffocation due to aspiration of solids (12.8%), cuts (11.9%), burns (10.9%), poisoning (3.9%), traffic accidents (1.5%), drowning (0.7%), and electrocution (0.6%) (27)

**9.** A descriptive-analytical study aimed to investigate accidents in children under six years of age in Yazd, Iran, in 2011. The results showed that the mean age of the children was 5.30 years, and 78.4% had experienced an accident. Physical injury (50.7%), burn (15.3%), fall (12%), poisoning (11%), traffic accidents (10.3%), and drowning (0.7%) were the causes of children's accidents. The children of employed fathers and parents, who had higher education, had fewer accidents, and this difference was statistically significant ( $p < 0.001$ ) (28).



**Fig.1:** PRISMA flowchart.

#### 4- DISCUSSION

This systematic review aimed to determine the epidemiological pattern of childhood accidents and injuries and their related factors among Iranian children. It summarizes this epidemiological pattern reported by eleven studies from 2005 to July 2022. Results showed that 70% of accidents occurred at home. The highest incidence rate of accidents was between 16% and 40%, and the mean age of accident victims was  $2.5 \pm 1.5$  years, with the highest rate in boys (59.4%). Based on the results, traffic accidents (53.4%), physical injury (50.7%), falling (44.3%), and swallowing (22%) were the most frequent accidents in children younger than six. Also, 93.3% of accidents occurred in urban areas.

Accidents can be defined as unplanned occurrences or events. Accidents are important and common problems of health all over the world and one of the main causes of death in children under five years of age (1, 9). Injuries from accidents are the leading causes of disability, permanent deformities, and death in children. Every year, a large number of children experience accidents. A primary cause of accidents in children is their inability to understand the principles of safety and injury prevention. Some places in the home and outside are overlooked but potentially hazardous for the child (3, 5).

Children's injuries are preventable, but in most regions of the world, the general public, policy-makers, and healthcare service providers pay little attention to them (2, 11). Prevention is usually sought after an injury occurs, while injury and accident prevention should be integrated into life, especially for children, and parents and caregivers should follow its principles to prevent injury in children. The current decade has been named the decade of accident prevention (7). The most common home accidents occurred in the age group  $2.5 \pm 1.5$  years (41% at the

age of four). Various studies show that the most vulnerable age groups exposed to accidents are children and young people (1, 2, 5, 29, 30).

In the present study, 93.3% of accidents occurred in urban areas, and 70% of accidents happened at home. Home accidents are a major health problem due to their high frequency and result in death and disability. Several studies show that more than half of the accidents in children under five occur at home (31-33). Therefore, appropriate training for parents is of substantial importance in preventing accidents in children. In the current study, most accidents happened to male children (62%), which was consistent with the results of other studies in Iran (34-38) and similar studies in other countries (39-41). However, intentional and domestic injuries were significantly higher in girls ( $p < 0.05$ ). The reason why home accidents are more common in boys is that they are more active and more curious (42-44).

The results of the current study showed that most accidents (33.8%) occurred in winter, which is consistent with a study by Mobasheri et al. (35), but not with the findings of Dolatabadi et al. (45), and Asadi et al. (36). Equipping the playgrounds with safety equipment and improving the safety of public space help prevent child injuries. The adoption of safety rules in homes is highly effective. The current study showed that burns, traffic accidents, and falling were the most frequent accidents among children under six. One study reported falling as the most frequent accident (40.4%), followed by traffic accidents (35.1%) in another study from Iran (36).

However, in a study by Dolatabadi et al. (34), most of the accidents were traffic accidents (52.3%), followed by falls (41.5%). Stroke and falling were reported by Mobasheri et al. (35) as accidents with high frequency in children. Another study stated that falling and traffic accidents



were the most frequent accidents in children under six (46). In the study of Bayat et al., the most common causes of injury in children were falling from a height, poisoning, accidents, and burns (38). Mahfozi et al. ranked accidents as the most frequent accident in children, followed by burns (47).

It should be noted that the mean age of children in this study was  $2.5 \pm 1.5$  which is and relatively different from other studies (ranging from 1 to 6.5). The results of the current review showed that another important type of injury among young children is poisoning, and most poisonings (34%) occurred in summer. Several studies showed that the home environment and parenting characteristics are two important risk factors for poisoning in children (48).

Based on the results of the current study, the most frequent accident was burning (66.5%). The prevalence of burns in the study by Sasan et al. was 10.9% (27). Various studies show that up to 20% of burns caused by fire or hot liquids in children occur in the age group of less than one year (49-51). The present study showed that traffic accidents are the third most common cause of injuries in Iranian children. Road traffic crashes are predictable and can be prevented. Many countries have achieved sharp reductions in the number of crashes and the frequency and severity of traffic-related injuries by addressing key issues. Interventions that have been proven to be effective include those that deal with speeding, seat belt, child restraints, helmet, road design and infrastructure, and emergency services (52). In this study, it can be concluded that the children of employed fathers and parents, who had higher education, had fewer accidents, and this difference was statistically significant ( $p < 0.001$ ) (30).

It is certain that the more the awareness of families regarding ways to prevent accidents increases, the more careful they will be in taking care of their children.

Implementing educational programs at home, complying with traffic regulations, training through mass communication media such as television and radio, and strengthening monitoring systems on people's performance are necessary and effective in reducing social accidents.

#### **4-1. Study Limitations**

1. Due to the lack of sufficient information, this study did not provide a complete review of childhood injuries and accidents incidence;
2. Not all articles contained comprehensive and detailed data on all the reviewed elements.
3. There was considerable heterogeneity in the way studies reported their findings which limited some of the comparisons made in the present research.
4. The stated results are specific to Iranian society and children under six years of age and cannot be generalized to other age groups and societies.
5. Another weakness of this research was the lack of attention to child abuse, which is most likely a common but hidden cause of physical injuries in children under six.

#### **5- CONCLUSION**

Based on the results, 93.3% of accidents occurred in urban areas, and 70% happened at home. The highest rate of accidents among children younger than six ranged from 16% to 40%, and the mean age of accident victims was  $2.5 \pm 1.5$  years, with the highest in boys. The most common causes of accidents were traffic accidents (53.4%), followed by physical injury (50.7%), falling (44.3%), and swallowing (22%). There was a significant relationship between gender, children's age, and gender, type of house, place of accident, parental higher education, and season of the accidents with injury types. Increasing public awareness and education is necessary to decrease the incidence of



these potentially catastrophic injuries. Because childhood accidents, in addition to death, also result in a high rate of disability, and many children are forced to spend the rest of their lives with disabilities due to injuries from accidents.

**6- CONFLICT OF INTEREST:** None.

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