

Effectiveness of Interventions in the Prevention of Home Injuries among Children Under 5 Years of Age: A Systematic Review

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Abstract

Background: Injuries caused by home injuries in children under 5 years of age is one of the main causes of death in this group and also constitutes a significant public health burden. This review aimed at summarizing the literature on the effectiveness of interventions to prevent home injuries in children under 5 years of age. **Methods:** Magiran, Iran Medex, and SID in Persian Scientific databases and BioMed Central, PubMed, ScienceDirect, Web of Science, and Scopus were systematically searched for articles published up to June 2016. Then, two researchers reviewed the papers independently and finally, 14 studies fulfilled the inclusion criteria. **Results:** The results showed the effectiveness of intervention measures including training sessions at home, home visit, group discussions, and interviews as the educational tools. The educational approach was used as the intervention in 11 studies; legislative/incentive approach and engineering/technology approaches had not been used in papers; and three studies had used the educational intervention and engineering/technological approaches. **Conclusions:** Most of the effective inventions included studies that used the combination of effective methods to reduce the risk of injuries. Since the accidents are preventable, the appropriate intervention strategies, especially active intervention or a combination of interventional measures are effective to reduce the risk of home accidents and injuries in children.

Keywords: Children, home accidents, injury, systematic review

INTRODUCTION

Injuries are one of the main reasons for hospitalization and death around the world in children and also loss of quality of life.^[1,2] The World Health Organization reports showed that 2000 infants died due to injury and 10,000 of children are exposed to some degrees of disability each year.^[3] The children under 5 years of age are most vulnerable to injury; so that, the road traffic injuries, drowning, burns, falls, poisoning, and suffocation cause the death and morbidity in these children.^[4]

For young children <6 years of age, more than half of the injuries resulting from accidents occur in the home.^[5,6] In general, children experience the first accidents at home,^[7]

so that, in many developing countries, the majority of injuries to children under 5 years of age occur in the home environment.^[8-10] Although many people consider the home as a safe place, therefore, the occurrence of home injuries and its consequences need to be analyzed.^[7] Home injuries are created for different reasons.^[11] The most important hazards that are effective to decrease the rate of home injuries

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are including the history of the previous injuries in young children,^[12,13] age,^[14] environmental factor or inappropriate home environment,^[15,16] poor socioeconomic status of the family, and parent's knowledge and attitude about home hazards^[17-19] and parents' supervision.^[20,21] Furthermore, children's dependency on parents and their vulnerability are led to increase the home injury in the children <5 years of age.^[22] Because children's health is an important issue for the future of society, the prevention of injuries caused by hazards in young children is essential.^[7]

According to the mentioned problems and the undesirable attitudes and perceptions about risk prevention in young children, the appropriate intervention programs should be designed and implemented.^[7] Hence, the interventions should be implemented to examine the factors for reducing the injuries caused by accidents and to assist the prevention of injury in children under 5 years of age.

To summarize the effects of interventions and to determine the most appropriate prevention of home injuries in children under 5 years of age, this paper presented the findings from an overview of reviews about the conducted interventions of children's injury prevention and a systematic review of the impact of interventions in the prevention of injuries caused by home accidents in children under 5 years of age. Given the different intervention approaches to promote the safety in the prevention of home injuries in children under 5 years of age in this fields, a systematic review is needed to identify and to describe the most current studies and to keep this information updated.

MATERIALS AND METHODS

Data sources

In this systematic review to identify the randomized trial interventions in order to prevent injuries caused by home hazards in children under 5 years of age, the systematic search was performed in English and Persian electronic databases, considering the articles published up to June 2016.

Referring to some of the published articles, the systematic review in Persian electronic databases was performed on Magiran, Iran Medex, SID with Persian keywords "child, children, under 5 years of age, injury, home injury, accident, intervention, and prevention." Furthermore, the systematic review in English electronic databases was performed on "BioMed Central, PubMed, ScienceDirect, Web of Science, and Scopus."

To search strategy, these following keywords were used:

Child*, "under 5-year-old," children, "5-year-old," "children under 5 years," "under 5 years of age," "under-five," "young children;" childhood, "home-related injuries," accident*, injury*, "child injury," unintentional, "home injuries," "injury prevention," "home-related injuries," "home injury," "unintentional home injuries;" prevent*, effect*, program*, "randomized controlled trial (RCT)," "cluster- RCT,"

"controlled clinical trial," "random allocation," "research design," "comparative study," "follow-up studies."

It should be noted that the databases investigation was performed by one person only. First, all articles were identified and entered in Endnote software. The titles of all retrieved articles were screened to exclude the nonpertinent papers and duplicates, then two researchers reviewed all papers independently, and the articles related to inclusion criteria were excluded. Abstracts of remaining papers were independently studied. Finally, the remaining full-text papers were studied and the articles, which were in accordance with the inclusion criteria, were identified. In the next step, the bibliographies of relevant articles, reference of remaining articles, and also the studies that cited these articles were reviewed to identify other potentially relevant articles and otherwise, they were not indexed or discoverable.

All the articles were again examined by two reviewers separately regarding the inclusion criteria; in case of the articles with the inconsistencies to the inclusion criteria, the papers were independently assessed by the third reviewer, and the settlement of these inconsistencies were performed by consensus.

Inclusion and exclusion criteria

Inclusion criteria included all RCTs that were conducted for mother, family, and parents of children and English and Persian-language to reduce and prevent home injuries in children under 5-year-old with no limitation on the year of publication.

Exclusion criteria included descriptive, quantitative, review, systematic review, meta-analysis, and quasi-experimental studies and before and after studies in the prevention of injuries caused by home hazards in children under 5 years. Studies for the prevention of unintentional injury among children with other interventions for health behaviors in this group, studies in elementary school, studies in ill and disabled children, studies on violence and child abuse, intervention studies about parent's psychological conditions in injury prevention, and studies of intentional injuries in children were excluded from the study.

Effect size

Data were analyzed using comprehensive meta-analysis software, then the effect size was calculated for studies for the prevention of home injuries among children under 5-year-old. Given the heterogeneity of the studies used, the random-effects model was used to combine the results and achieve the effect size. To interpret the results, Cohen's effect size table was used.^[23]

Quality assessment

Quality of the studies and risk of bias were assessed by two independent reviewers using the Cochrane Collaboration Risk of Bias Tool (CCRB). The CCRBT was designed to assess the risk of bias in RCTs.^[13] It evaluates six dissimilar domains: (1) sequence generation, (2) allocation concealment, (3) blinding, (4) incomplete data, (5) selective reporting, and (6)

other forms of bias. Final results of the quality assessment tools for studies lead to an overall methodological rating of strong, moderate, and weak. Two reviewers received a similar education, Cochrane Collaboration, and its guidelines.^[13]

Data extraction

After finalization of the remaining articles, the researchers extracted the data and extracted a summary characteristic of the studied articles and recorded in Table 1.

RESULTS

Initial searches identified 12,232 abstracts of papers. From which 11,798 were excluded because they did not fulfill the inclusion criteria. Then, 434 abstracts of papers were examined by two reviewers separately. In addition, 378 abstract were excluded because they did not fulfill inclusion criteria. Full texts of the remaining 56 papers were assessed by two reviewers separately, and 41 were excluded because they were not about the home injuries and in children under 5 years. Similarly, the quasi-experimental studies, as well as the studies for parents and health service providers, were excluded.

Furthermore, the results of Morrongiello *et al.*^[24] study have been reported in the paper Morrongiello *et al.*^[1] Therefore, Morrongiello *et al.*'s^[1] study was considered as the main study. The results of Gielen *et al.*^[25] study have been reported in the Gielen *et al.*^[26] and Gielen *et al.*^[26] was considered as the main

study. Thus, two articles came out. Finally, 14 randomized trial studies were identified in this study [Figure 1].

Features of place and time

Among the studies, two papers were published before 2000.^[27,28] During the next 10 years, seven studies were conducted between 2000 and 2010.^[25,29-34] Other studies were published during the past 6 years (since 2010).^[1,6,35,36] Four studies were conducted in the United States;^[25,30,35,36] one study in Pakistan,^[31] one in France,^[32] and one in the Netherlands,^[33] three studies in the United Kingdom,^[27,28,34] and two studies in Iran.^[37]

In two papers, the intervention groups were mothers,^[36,37] in five papers were the children's family^[25,27,30,32,34] and in seven papers were the parents.^[1,28,29,31,33,35] The follow-up period in four papers was 2 months or less,^[27,30,32,37] while this period was observed to be more than 3 months and even more than 2 years in other studies.

Features of the intervention strategies

Among all of the studies, the educational approach was used as the intervention in 11 studies;^[1,27,30-33,35-38] legislative/incentive approach, engineering/technology approaches had not been used in papers; and three studies had used the educational intervention and engineering/technological approaches.^[27,29,34] Most of the studies used the educational intervention approaches. The educational approach involved the individual- and group-based training sessions, home visits, questions and answers, group discussions and interviews, speeches, and video. Educational tools such as videos, booklets, and pamphlets were used. In other studies, in addition to educational intervention approach, the engineering/technology approach used involved the provision of safety equipment and the provision of financial facilities to provide the safety equipment.

Of 14 studies, 11 (78.6%) did not explicitly apply a behavioral theory. Health belief model,^[6] protection motivation theory (PMT),^[37] and the social-ecological model^[33] were theoretical frameworks employed. Furthermore, the three studies reported a significant change in results.^[6,33,37]

The effect of interventions

Of 11 studies, which were based on the educational approach, 8 reported a significant change in all outcomes, and two interventions were not provided with the significant changes. One study reported the significant changes in some outcomes, but other outcomes did not have significant changes. Of the three interventions, which had a combination of educational and engineering/technological approaches, the significant changes were reported in all outcomes. Similarly, the studies that utilized the behavior change models and theories were successful to achieve desired changes.

The amount of effect size obtained for the model of random effects was 0.446, which was significant at the level of 0.0001. This showed that interventions to the prevention of home injuries among children under 5-year-old were effective. The

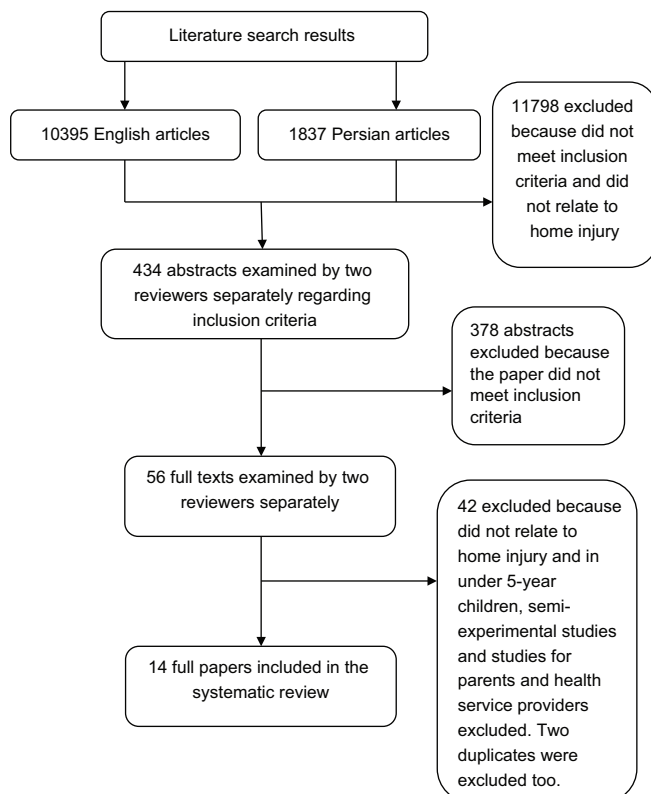


Figure 1: Flow diagram for the identification, screening, eligibility, and inclusion of studies

Table 1: Characteristics of primary studies included in systematic review

Author (year)	Study groups	Intervention (s)	Follow-up and models and intervention theories	Outcomes	Effect size	Study quality
Clamp and Kendrick (1998)	83 children in the intervention group 82 children in the control group	Intervention families received the general and specialized safety advice along with low-cost safety equipment. The control group received routine care. The average consultation time for safety advice was 20 min	6 weeks after intervention by telephone or sent by post to those families without a telephone Without theory or model	Increased the use of safety equipment and other safe practices in intervention group ($P<0.05$) No significant difference between the intervention and control groups ($P>0.05$)	0.231	High risk of bias
Kendrick (1999)	1124 children in the intervention group and 1028 children in the control group	A package of specific advice at routine child health surveillance, consultations, low-cost safety equipment, home safety checks, and first aid training	Follow-up at 6-9, 12-15, and 18-24 months Without theory or model	No significant decrease in injuries between the intervention and control groups ($P>0.05$)	0.145	High risk of bias
Gielen <i>et al.</i> (2001)	18 families in the intervention group 13 families in the control group	1-h seminar about injury prevention for the intervention and control group 5-h experiential instruction on injury prevention content and counseling skills for the intervention group	Followed up until the child reached the age between 12 and 18 months Without theory or model	No significant changes in knowledge, belief, and home safety behaviors ($P>0.05$)	0.322	High risk of bias
Sznajder <i>et al.</i> (2003)	100 families from four towns in two groups	Group 1 received the counseling and a kit including preventive devices and pamphlets about indoor injuries and ways to avoid them. The Group 2 received counseling but not the kit	The first visit was at home when their child reached 6-9 months and the second home visit was done 6-8 weeks later Without a theory or model	Number of safety improvements after the first home visit Between the first and the second visits, safety improvement was significantly higher in the group with the kit ($P<0.05$)	0.425	High risk of bias
Posner <i>et al.</i> (2004)	49 families in the intervention group 47 families in the control group	Home safety brochure, handout about the prevention of common household injuries to young children, providing the free home safety kit Control group received the handout with verbal counseling limited to prevention of the type of injury sustained by the child	Follow-up at 6-8 weeks after the intervention Without a theory or model	Significant higher average overall safety score in the intervention group ($P<0.05$) Significant improvements of injury in the intervention group ($P<0.05$) Significant improvements in safety devices in the intervention group ($P<0.05$)	0.397	High risk of bias
Watson <i>et al.</i> (2005)	1635 families in the intervention group 1642 families in the control group	Training for the intervention group and also a standardized safety consultation and provision of free and fitted stair gates, fireguards, smoke alarms, cupboard locks, and window locks	2 years' follow-up Without a theory or model	Intervention arm had a significantly higher attendance rate for injuries in primary care ($P=0.003$) Significant improvements in safety practices in the intervention group ($P<0.05$)	0.456	High risk of bias
Babul <i>et al.</i> (2007)	Home visit plus safety kit group, 173 parents Safety kit alone group, 164 parents Control group, 150 parents	Participants were randomly assigned to one of the three groups: 1. Home visit plus safety kit; 2. Safety kit alone	2 years' follow-up Without a theory or model	Significant increase in-home visit and the safety kit ($P<0.05$) Significant increase in the rate of injuries compared with the control group ($P<0.05$)	0.365	High risk of bias
Rehmani and LeBlanc (2010)	The interventions included: 170 families in the fall prevention 170 families in the ingestion prevention	Parents in Group 1 received falls safety and prevention counseling only Group 2 received ingestion safety and prevention counseling only	Follow-up in a 3-6 month period after the first home visit Without a theory or model	The percentage of safe houses in which families received counseling intervention was 13.5%, while it was 3.5% in the control group	0.512	Moderate risk of bias

Contd...

Table 1: Contd...

Author (year)	Study groups	Intervention (s)	Follow-up and models and intervention theories	Outcomes	Effect size	Study quality
Van Beelen <i>et al.</i> (2010)	420 parents in both the intervention and control groups	Participated parents were randomized into one of the two groups: 1 Internet-based, tailored safety information combined with personal counseling (intervention group), or 2 Personal counseling using the Safety Information Leaflets of the Consumer Safety Institute in the Netherlands for children aged 12-24 months (control group)	Follow-up in 6 months after the intervention Based on the social-ecological model	A difference of 8% between the percentages of unsafe families of the intervention group and the control group	0.475	Moderate risk of bias
Phelan <i>et al.</i> (2011)	181 parents in the intervention group 174 parents in the control group	Installation of multiple, passive measures (stair gates, window locks, smoke and carbon monoxide detectors) to reduce the injury hazards present in housing units	Follow-up in one and 2 years after the first home visit Without a theory or model	Significant reduction of injuries in the intervention group ($P<0.004$) There was no significant difference in the rate for all medically-attended injuries in the groups ($P=0.17$)	0.299	High risk of bias
Reich <i>et al.</i> (2011)	Three groups of women: an educational book group ($n=53$), a non-educational book group ($n=56$), or a no-book group ($n=58$)	Home visits and interviews measured the safety practices when women were in their third trimester of pregnancy (baseline) and when their child was 2, 4, 6, 9, 12, and 18 months of age	Follow-up in seven times for each mother over the period from pregnancy up to 18 months old Without a theory or model	Women in the educational book group had fewer risks in their homes and exercised more safety practices than the no-book group (20% risk reduction)	0.455	Moderate risk of bias
Morrongiello <i>et al.</i> (2013)	116 parents in the intervention group 112 parents in the control group	Providing a children's safety educational film to parents who care the child, conducting a structured discussion in a pilot environment, monitoring the performance of parents after a month from the home environment and examining the quality of their performance to overcome injury hazards to children	Follow-up immediately after, and 3 months later Without a theory or model	Significant increase in the level of supervision on the behavior of the children in the intervention group ($P<0.05$)	0.576	Moderate risk of bias
Ebadi Fardazar <i>et al.</i> (2016)	95 mothers in the case group 95 mothers in the control group	PMT-based intervention, Appropriate educational intervention designed and conducted only in the case group while there was no intervention in the control group	Follow-up of 2 months after the educational intervention PMT	A statistically significant difference between mean scores of all structures of PMT in groups after the intervention ($P<0.05$)	0.379	High risk of bias
Meymanat Abadi <i>et al.</i> (2016)	60 mothers in the intervention group 60 mothers in the control group	4 training sessions (55-65 min) with each mother Using the lecture method, ask and answer and use worksheets within 2 weeks for the intervention group	Follow-up after 2 months HBM	Significant differences in mean scores of all structures of HBM ($P<0.05$) after intervention between the groups	0.384	High risk of bias

PMT: Protection motivation theory, HBM: Health belief model

largest amount of effect was related to Morrongiello *et al.*^[1] study and the smallest amount of effect size related to the Kendrick study.^[28]

For quality assessment, there were no articles with low risk of bias, four articles had a moderate risk of bias,^[1,31,33,36] and ten articles had a high risk of bias^[6,25,27-30,32,34,35,37] [Table 1].

DISCUSSION

Home accidents occurred at home or surrounding environment and are led to the injury. On average, more than 50% of home injuries in children under 5 years of age are created by themselves.^[38] Studies showed that the greatest injury burden is related to children in the age range of 0–4 years.^[39,40] Accidents

are the leading cause of hospitalization in children,^[3] and regarding the high prevalence of home injuries in children and since these injuries are predictable and preventable,^[41,42] the appropriate information about the causes of injuries and intervention methods to prevent is important.

Injury prevention depends on behaviors and environmental factors, safety devices and tools, training of parents and families, and accepting the injury as a norm.^[43-45] The previous study also showed that a key injury prevention is the behaviors and efficacious interventions.^[43,45]

In general, the interventions for reducing accidents in children can be divided into two categories: active and passive strategies.^[46] When passive interventions are not appropriate, the active intervention is

utilized.^[45] Training methods are an active strategy. The training increases people's knowledge and skills and changes their attitude.^[46] Training is an important strategy to reduce the risk of home accidents among children.^[47] The most-reported intervention to reduce home injuries was education or training.

Parent safety behaviors may affect injury reduction.^[48,49] Posner *et al.* showed that safety training at home can lead to the improvement of people's safety score.^[30] Some other studies showed that there is no significant change in accident reduction. The study conducted by Dershewitz and Williamson showed that the educational program was effective in reducing home hazards.^[50] Gielen *et al.* also showed that the educational interventions did not significantly change the knowledge, belief, and home safety behaviors.^[25] Ebadi Fardazar *et al.* also showed that, after education, the mean scores of all structures of PMT in the intervention group were better than those in the control group and also there was a significant difference between the mean scores of all structures of PMT in the intervention group before and after the educational intervention.^[37]

Rehmani and Leblanc showed that safety advice is an effective method to improve the safety of the home.^[31] In some studies, the passive interventions such as safety kit, safety equipment, safe practices, and home safety checks were used.^[27,29,34] In general, home safety programs should focus on interventions that are more effective in changing parental behavior to reduce injuries and accidents. Several studies have shown that a home visit is one of the most effective interventions in changing behavior.

Babul *et al.* showed that the home visit, as a complementary method along with safety training, increases the use of safety devices by parents. He used a home safety kit containing nine items, instructional brochure, and a risk assessment checklist, but none of these interventions was related to the reduction of the injuries reported by parents.^[29] Kendrick stated that the home safety checks, safety equipment, and safety advice had no effect on the frequency of home accidents.^[28,34] Watson, despite finding the positive behavioral changes through the home visit, did not report the injury reduction.^[34] In a study conducted by Sznajder *et al.*, the safety behavior was significantly better in the parents who received the home visit, safety kit, and counseling.^[32] King *et al.* believe that the successfulness in-home visit program depends on the number of home visits and the child health issues that may affect the safety behaviors.^[48] It should be also mentioned that home visit for once is not adequate to increase the behavioral changes or to reduce the injuries and accidents.^[29] Furthermore, the detailed and extensive home visit and multiple home visits during pregnancy and after the child's birth are more effective to reduce home injuries.^[51]

Phelan *et al.* showed that the passive measures (stair gates, window locks, smoke, and carbon monoxide detectors) significantly reduce the risk of injury.^[35] Some studies believe that the causes of severe and fatal injuries should be

most emphasized and have a higher priority in preventing injuries.^[52] Thus, most of the home accidents occurred for children should be recorded, and further interventional measures and training for parents based on the risk factors should be implemented.^[53] On the other hand, several studies have shown the effectiveness levels of the conducted interventions on the risk of children's injuries. The results of the researches in the present study also revealed that the studies that had one interventional measure were more effective than other interventions to reduce the extent of the injuries.^[54-56] In addition, most of the accidents are not caused by a single factor, so it should be noted in the interventional measures.^[45] Active interventions should be utilized in this situation to reduce all injuries with different causes.^[45] Thus, it is expected that the studies with the combination of interventions be more effective to reduce the risk of home accidents and injuries.

We included multiple types of outcomes and study design which makes it impossible to perform a meta-analysis. In addition, to assess the higher quality evidence of the effectiveness of the intervention, we did not search the grey literature; therefore, a publication bias may exist in this.

CONCLUSION

Based on the available evidence, we observed the possibility of reducing or preventing the risk of home injuries in children, by taking into account the appropriate interventions. Obtained results in this study highlighted that the active interventions or combination of different interventions are most important and effective compared to the passive intervention; practitioners should develop the home accident and injury prevention strategies.

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Conflicts of interest

There are no conflicts of interest.

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