v. 3, n. 8, 2023

International Journal of Human Sciences Research

EDUCATIONAL INTERVENTIONS FOR REDUCING TRAFFIC ACCIDENTS UNDERTAKEN IN THE SCHOOL ENVIRONMENT: SYSTEMATIC REVIEW

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Abstract: **Objective**: To identify, in scientific production, interventions or educational practices carried out to reduce traffic accidents involving children undertaken in the school environment, which can support the construction or replication of intervention models in promoting children's health. **Methodology**: A systematic review was recorded on the prospero platform, using databases and virtual libraries accessed via CAFe/CAPES in the following databases: Web of Sciences, Scopus, Eric, SciELO, Cinahl, Lilacs and Pubmed. As for gray literature, we used Google Scholar and Open Grey. The search was carried out on May 4, 2022. Results: The final sample consisted of 24 articles, with evidence used in the prevention of traffic accidents in motor vehicles, cyclists, pedestrians, and accident prevention in general using various methodologies of teaching as intervention/educational practices in schools. **Conclusion**: Educational practices must be included as early as possible in school curricula. The combination of using teaching methods stood out in improving learning outcomes as well as learning skills and safe behavior in traffic.
Keywords: Child. Traffic-accidents. Education in health.

INTRODUCTION

Currently, Traffic Accidents (TA) account for 1.35 million deaths among people aged 5 to 29 years (W.H.O., 2018). In 2020, these numbers continue to increase, making it the main cause of death and causing millions of sequels and injuries, including children and young people (WHO, 2021).

According to the Ministry of Health, a traffic accident is an unintentional and preventable event that causes physical and emotional injuries. Therefore, it must be considered a health problem that may or may not be fatal, predictable and preventable (BRAZIL, 2005, p. 8).

In August 2020, the United Nations (UN) General Assembly, through resolution 74/299, designated the period 2021-2030 as the Decade of Action for Road Safety with the objective of reducing deaths and injuries in traffic by 50% by the end of 2020. year 2030 worldwide (WHO, 2021).

Due to this problem, it is estimated that by 2030 these accidents could cause around 13 million deaths and 500 million injuries (WHO, 2021) and traffic safety in low- and middle-class countries involving children remains a major concern (ITF, 2020) if no measures are adopted, these deaths must increase, which indicates the need for measures to prevent this health problem.

The peculiarities of this growth and development process place children in a vulnerable condition, in view of their dependence on their parents, family members, society and public authorities. Therefore, it is necessary to draw attention to the importance of making vehicle drivers aware of the effects that behavior in traffic and adult driving can have on their children (CASAROLLI et al., 2014).

For the development process to occur in a healthy way, it requires prevention and child protection measures through actions and health education, related to road safety (WHO, 2021) carried out in the different places where children most frequent, whether they are the home, school, entertainment venues, basic health units constantly.

Faced with the current scenario, I face the following question: What are the interventions and/or educational practices carried out in schools to prevent traffic accidents involving children found in the literature?

OBJECTIVE

Identify, in scientific production, interventions or educational practices

carried out to reduce traffic accidents involving children undertaken in the school environment, which can support the construction or replication of intervention models in promoting children's health.

METHODOLOGY

This is a systematic review, a method that combines searching, evaluating and synthesizing evidence of a specific identified theme (ROEVER, 2017). To start a systematic review, it is essential to understand three stages: planning, execution and reporting (DE LUCA CANTO et al., 2020).

The planning carried out is the most important phase of the process, which defines the team, the choice of topic, search for previous systematic reviews of the chosen topic, elaboration of the research question and grouping of the protocol information (DE LUCA CANTO et al. al., 2020).

In the execution phase, a search began in the databases on the desired topic, with the choice of using the Reference Manager (GR), in this study using Rayyan and Endnote, which are computer programs that help in selecting, organizing and remove duplicate folders.

Subsequently, the selection of studies began (phase 1) by reading abstracts and titles and classifying them as included or excluded, according to criteria established in the protocol, and then the full texts included were read (phase 2) (DONATO; DONATO, 2019).

Finally, the last step is the report of the research that must be started only after the execution stage. At this time, the authors read the titles and abstracts (Phase 1) and the complete articles (Phase 2) and formulate arguments for use in the article discussion (MEDINA; PAILAQUILÉN, 2010).

RESEARCH QUESTION

Regarding the elaboration of the research question and search strategy. This study adapted the criteria of the acronym PECO, which was used to formulate the question focused on in this study: P – population (Children - between 0 and 12 years old), E – exposure (interventions and/or educational practices), C – comparison (it was not comparison used in this study) O – outcomes (traffic accidents).

PROTOCOL FOR RESEARCH AND REGISTRATION

Initially, a search was carried out in Pubmed to survey a systematic review on the proposed topic, as well as in the PROSPERO platform (International prospective register of systematic reviews). No results were found, so the protocol was registered.

Before starting the searches, the strategy was registered, that is, a systematic review protocol (GALVÃO; SAWADA; TREVIZAN, 2004), was carried out in detail and judiciously on the prospero platform with registration number: 298524.

SEARCH STRATEGY

This way, this study retrieved articles with children aged up to 12 years in a school environment, through educational practices, seeking what interventions were carried out to reduce traffic accidents and thus identify whether the intervention brought benefits or not in behavior. and knowledge of children. The investigated hypothesis was: Participating in educational interventions improves participants' knowledge and behavior in relation to TA involving children.

The search for primary studies was carried out on May 4, 2022, using the following databases: Web of Sciences, Scopus, Eric, SciELO, Cinahl, Open Grey, Lilacs and Pubmed, Google Scholar. The structured search strategies presented in Table 1 were followed.

PUBMED **#1: "child" [MeSH] OR "child" OR "kid" OR "infant"** **#2:"Accident Prevention/education" [Mesh] OR "Accident Prevention/education" OR "Accident Prevention" OR "Health Education" [MeSH] OR "Health Education" OR "Health promotion/education" [MeSH] OR "Health promotion/education" OR "Health promotion/methods"[MeSH]) OR "Health promotion/ methods" OR "Health promotion"** **#3: "Accidents, traffic" [MeSH] OR "Accidents, traffic" OR "Traffic accident" OR "Traffic accidents" OR "Collisions" OR "Traffic collisions" OR "Traffic crashes" OR "Bicycling" [MeSH] OR "Bicycling" OR "Pedestrians" [MeSH] OR "Pedestrians" OR "Pedestrian**
OTHER BASES **#1: child OR kid OR infant** **#2: "Accident Prevention/education" OR "Accident Prevention" OR "Health Education" OR "Health promotion/education" OR "Health promotion/ methods" OR "Health promotion"** **#3: "Accidents, traffic" OR "Traffic accident" OR "Traffic accidents" OR Collisions OR "Traffic collisions" OR "Traffic crashes" OR Bicycling OR Pedestrians OR Pedestrian**
SIMPLE BASES **(Child) OR ("Accident Prevention") OR ("Traffic accident")**

Table 1- Search strategies and databases. Paraná, 2022

Source: Made by the authors of the study, 2022.

ELIGIBILITIES CRITERIA

The following were considered as inclusion criteria in the review: studies that developed interventions and/or educational activities carried out in schools with the aim of preventing traffic accidents involving children up to 12 years of age, studies whose educational practice was carried out by a educator/teacher or in the school environment; interventions that were carried out with parents, teachers, employees or other participants, provided that the objective of the strategy was to prevent accidents involving children and not just to prevent accidents in general, case-control studies, randomized controlled trials, randomized, non-randomized clinical trials; randomized experimental and controlled studies before and after, which carried out educational activities at school with the aim of preventing traffic accidents involving children.

Exclusion criteria were studies in which only the abstract or part of the work was available in event annals; studies whose target population was adults, aged over 12 years, abstract format, systematic reviews, literature reviews, editorials, letters or personal opinions, books and book chapters, studies not available in full, guidelines, protocol, commentary and even educational practices that have not been carried out by teachers/educators or in the school environment.

RESULTS

Initially, the search consisted of a sample of 3142 studies, according to the criteria presented above, the first step occurred with the identification of duplicate articles and they were removed using the Rayyan and EndNote manager. In this step, 408 studies were removed automatically and 182 manually, leaving a total of 2552 studies. In the second moment, the studies were selected through reading and analysis of the titles and abstracts, in the third moment, the studies were excluded because they did not meet the inclusion criteria even in the first reading of the article.

A total of 38 articles were retrieved in full, after reading the titles and abstracts. Articles in phase 2 were excluded from a total of 16 studies after complete reading, the final sample consisted of 24 articles, with 22 studies through the databases and 2 articles included through the references of the included studies, totaling 24 studies. Disagreements were resolved by consensus and if disagreement persisted, the opinion of a third evaluator was considered.

Of the twenty-four studies analyzed, regarding the nationality of the primary studies, fourteen were developed in the United States of America, two in Australia, one in Scotland-United Kingdom, one in England-United Kingdom, one in Canada, Holland,

Brazil, Cambodia -Asia, Iran and Belgium totaling 24 studies published in English. Regarding the year of publication, one survey was dated 1991, one in 1994, one in 2000, one in 2001, one in 2002, one in 2003, three in 2004, one in 2007, one in 2008, one in 2009, two in 2010, two in 2011, one in 2014, one in 2015, two in 2016, two in 2017, one in 2018 and one in 2019.

Regarding the type of intervention, seven studies report practices aimed at pedestrians, accident prevention in general was reported in eight studies, while those aimed at cyclists were the focus of six of the results and three studies addressed the prevention of traffic accidents in motor vehicles and/or use of protective equipment inside these vehicles.

As for the methodology used in educational practices, the articles with interventions carried out through virtual reality were three studies, one intervention used as part of the activity a mobile vehicle that can be used in several schools in the same municipality serving a large population at low cost. Educational intervention and delivery of PPE a total of 3 studies. Only one study worked with intervention through a magic box with 10 cards on traffic prevention in general and only five studies used teaching methods in a real street.

A total of nine articles discussed the use of traditional teaching didactics in conjunction with simulation activities, practices or in the environment in which the child was already used to, only one study evaluated the intervention in a traditional didactic session compared to virtual reality through video games. Still three studies highlight the delivery of PPE to participants as part of the activities carried out to change behavior.

A total of fourteen studies applied both practical and theoretical activities for a time ranging from 3 to 50 minutes and only one study had a long duration, using 70 minutes for its practice.

Regarding the success of the interventions, six of them did not obtain significantly positive results, two of which were developed for traffic prevention in general, one for pedestrians and three for cyclists. The methodologies used by these articles were: 3 studies were randomized case control, two randomized controls and one case control, the interventions applied vary in theoretical activity, street crossing practice, simulation, instruction for the use of helmets in cyclists and virtual reality.

Interventions successfully applied, used the most varied teaching methodologies, namely: traditional activity, virtual environment, simulations, games, challenges, real traffic simulation, use of software, poster competition, questionnaires, videos, picnics, use of television and theaters.

A significant number of studies, seven described interventions in a short period and still showed positive results in all, even using shorter periods of teaching, obtained improved knowledge regarding traffic safety, regarding the number of days used for activities, ranged from 2 to 21 days of learning.

A significant number of seven studies used interventions over a long period, and five of these studies showed positive results, the periods varied between one month, two months, five months, six months and 12 months.

Regarding the ages of the children, the interventions with children were carried out in different age groups up to 12 years old, from the analyzed studies the smallest age group was three years old, the others up to 12 years old, only two studies do not report specific age ranges, these were with children attending preschool to fifth grade. Regarding gender, only one study evaluated traffic safety with exclusively male children, the others applied it to both sexes.

DISCUSSION

Dealing with the phenomenon of violence, such as traffic accidents, is complex, specifically when the focus is on protecting children, since, considering that such events affect the health-disease process, it is necessary to consider the complexity of the context in which the event takes place before seek strategies that can culminate in the reduction of this problem.

In this sense, this review identified interventions for coping with traffic accidents that were used in different realities, as long as the activities were developed in schools or by teachers, such educational interventions can contribute to generating evidence for TA prevention practices involving children.

Educational interventions aimed at pedestrian safety on the streets in a real environment are the most successful programs, as they promote safer pedestrian behavior and improve knowledge regarding pedestrian safety, as observed in the study (ZARE et al., 2018). These findings are important because pedestrian injuries are the main causes of death in children between 5 and 9 years old (ROMERO; REZENDE; MARTINS, 2016).

Combining multiple modalities and reinforcing pedestrian safety guidelines needs to be considered when planning a school behavior intervention project. These combinations have shown promise as effective strategies to prevent TA for pedestrians (HOTZ et al., 2009; SCHWEBEL; MCCLURE; SEVERSON, 2014; ARBOGAST et al., 2014; SCHWEBEL; SHEN; MCCLURE, 2016; SCHWEBEL et al., 2016).

One study worked with short-term interventions with children between 4 and 5 years old, each intervention with 1 hour of training, even though it was short-term, the children achieved changes in their knowledge about traffic safety. Providing early education for preschoolers, and reinforcing these early safety lessons, is critical to keeping students walking safely and thus shaping their attitudes on the road (ALBERT; DOGIN, 2010; BOVIS; HARDEN; HOTZ, 2016).

In a study carried out to evaluate the knowledge of students from two elementary schools using a program (BikeSmart) identified the effectiveness in improving knowledge about bicycle safety in the participants. This used videos, animations, computational still images and real behavior of helmet fitting and still images to train children from kindergarten to third grade in key skills (rules for the road, use and fit of helmet and other safety equipment). necessary protection to use the bicycle) (MCLAUGHLIN; GLANG, 2010). Such results illustrate that the combination of teaching methods probably brings better results in the teaching and learning process, as well as in the acquisition of skills and safe behavior in traffic.

Activities that addressed bicycle safety in schools showed improvements in relation to other safety curricula, specifically those that implemented active practices in school curricula, while health education activities and those carried out by the media emerged with short-term results when it comes to decrease in bicycle accidents (MCLAUGHLIN; GLANG, 2010; JI; YE; LU; LI; YANG, 2017).

Traffic and its context is an important determinant of health, indicating that internationally there are inequalities in accident rates according to socioeconomic level and social inequality (BARRETO, 2017).

Converging with this observation, the results of a program of educational interventions combined with the distribution of free helmets to encourage or increase the use of helmets among cyclists resulted in adherence to the use of equipment that prevents many injuries. However, when making a comparison between poor and non-poor areas, it was identified that, when owning a helmet, the use rates do not show

a difference between those who live in poor and non-poor areas, or who have undergone educational intervention or not (KENDRICK; ROYAL, 2004).

Besides as observed in the study, in the intervention schools observed helmet use by students increased from an average of 0.46% pre-intervention to an average of 87.9% post-intervention. There was a reduction in the average number of accidents in cyclists of 23.8% compared to average numbers of accidents with previous years before the implementation of the educational program (EDERER et al., 2016; NAGEL et al., 2003).

It is noteworthy that the results of studies that carried out interventions in low, medium and high-income countries can be influenced by their cultural, economic and environmental specificities, making it difficult to associate results only in educational actions in each context.

Active teaching methods are effective and can improve memory, attention and the ability to analyze different situations (GURECKIS; MARKANT, 2012). The use of active methodologies and innovative teaching approaches bring significant results in the prevention of accidents, evidenced in the reduction of TA injuries in children (ARBOGAST et al., 2014; TREVINO SILLER et al., 2017; BACHMAN et al., 2015, ZARE et al., 2017; al., 2018).

Educational practices with parental participation can improve children's knowledge of road safety (HUNTER et al., 2015; WAKSMAN; PIRITO, 2005). However, these practices still appear in a very incipient number in schools, a privileged environment to develop educational strategies, not only in the activity, but in the entire teaching-learning process.

The studies evidenced here affirm that the use of seat belts increased from 32% to 68% in the intervention group, after the intervention, attitudes changed significantly, parents also reported a change in attitude regarding the position of the seats for children, in relation to interventions, even though they are simple and low-cost using school devices/media, they demonstrate that both changes in behavior and knowledge can be achievable (AITKEN et al., 2007; WILL; DUNAWAY, 2017).

These educational interventions/practices showed significant effects in reducing road traffic injuries or fatalities when combined with multiple approaches, which seem to be the most effective in significantly reducing road traffic deaths and injuries over time.

One of the negative points found in the results was the time that the children participated in the activities. Studies that carried out interventions lasting less than 30 minutes indicated the short period intended for the prevention of TA as a weakness (ZEEDYK et al., 2001).

However, the association of several learning modalities used in the strategy and the reinforcement during the following years seem to compensate for the short time used in each practice (HOTZ et al., 2009). Three studies used a program (WalkSafe) with videos, creativity, interventions of 1.5 hours as well as 2.5 hours, 5 days or 3 days, educational practices were significant in relation to knowledge in preschool children (BOVIS; HARDEN; HOTZ, 2016; HOTZ et al., 2004; HOTZ et al., 2009).

The educational curriculum can be one of the alternatives, if not the most effective, but one that encompasses a significant number of participants to address prevention issues, more specifically, it has shown that children aged from three to five years learn about traffic safety while pedestrians and manage to maintain this knowledge (BOVIS; HARDEN; HOTZ, 2016; HOTZ et al., 2004).

Traffic education and traffic safety must be implemented in schools from the early

grades in a lucid way, seeking to develop attitudes, values and acquire skills (PINTO; COSTA, 2022). The findings of these studies recommend that educational practices for TA prevention must be inserted as early as possible in school curricula, preferably that they are present even before elementary school and that reinforcement on the subject be maintained during elementary and high school (BOVIS; HARDEN; HOTZ, 2016; ZEEDYK et al., 2001; LURIA; SMITH; CHAPMAN, 2000; OXLEY et al., 2008).

However, it is necessary to consider the results of studies that indicate that it is not significant to teach younger children about safe behavior in traffic, with the same intensity as other children (LIVINGSTON et al., 2011). Thus, alternatives need to be implemented according to the child's age, including repetitions and expanding with the involvement of parents and guardians, which also suggests that more research is carried out to determine how each child in their age group must be taught to guarantee the effectiveness of educational activities.

Children's behavior when they were alone in traffic proved to be safer than children accompanied by parents or another adult (LIVINGSTON et al., 2011; BOVIS; HARDEN; HOTZ, 2016). In this sense, children need reinforcement of learning as they age, in accordance with cognitive maturity and also articulated with other elements that can make them more protected and secure.

In India, a study sought to analyze the frequency of serious non-fatal injuries in children aged 7 to 9 years over a period of three years and found that the incidence of non-fatal injuries was higher in boys (22 %) than in girls (15 %)., with traffic accidents being the second leading cause of injuries in this population, the results indicated that being male, having poor health and having a caregiver with low education were associated with an increased risk of non-fatal injuries (KATAOKA; GRIFFIN; DURHAN, 2015). These data illustrate the need for continuity in addressing the issue in schools and the importance of carrying out practices articulated with other sectors to intermediate actions to reduce accidents in childhood.

In Brazil, in São Luís do Maranhão, a study sought to evaluate the transportation of children in cars and the use of child restraint devices, among children aged 0 to 10 years and with 200 drivers (GARCÊS; COIMBRA; SILVA, 2016). In this study, it was observed that children were improperly transported inside cars, either due to improper use or lack of a car seat. Thus, a proposal for reversing these findings is to carry out educational practices so that children know and recommend to their parents and/or caregivers the need for the correct use of child transport and thus prevent injuries or death in the event of collisions.

The child's living spaces are essentially the school and home, so, in addition to the school, it is important to encourage parents, family and caregivers about their role in relation to safe behavior in traffic.

FINAL CONSIDERATIONS

This study is relevant for synthesizing the knowledge produced and published about educational interventions undertaken in the school environment involving children. From this, it will be possible to provide researchers, managers, educators, health and traffic professionals with scientific evidence for decision-making when implementing an intervention.

Educational practices for TA prevention must be included as early as possible in school curricula, that is, children aged three and over can take part in educational activities with successful learning and improvement in skills and safe behavior.

The combination of using teaching

methods stood out in improving learning outcomes as well as learning skills and safe behavior in traffic. While pedestrian injuries are the main causes of death in children between 5 and 9 years of age, interventions in a real environment, such as programs aimed at pedestrians, showed the best findings.

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