Journal of Adolescent Health 59 (2016) S76–S87

ELSEVIER

JOURNAL OF ADOLESCENT HEALTH

www.jahonline.org

Review article

Interventions to Prevent Unintentional Injuries Among Adolescents: A Systematic Review and Meta-Analysis

Rehana A. Salam, M.Sc. [a], Ahmed Arshad, M.B.B.S. [a], Jai K. Das, M.D., M.B.A. [a], Marium Naveed Khan [a], Wajeeha Mahmood [b], Stephen B. Freedman, M.D.C.M., M.Sc. [c,d], and Zulfiqar A. Bhutta, Ph.D. [e,f,*]

[a] *Division of Women and Child Health, Aga Khan University, Karachi, Pakistan*
[b] *Ziauddin University, Karachi, Pakistan*
[c] *Section of Pediatric Emergency Medicine, Alberta Children's Hospital and Alberta Children's Hospital Research Institute, Cumming School of Medicine, University of Calgary, Calgary, Canada*
[d] *Section of Gastroenterology, Alberta Children's Hospital and Alberta Children's Hospital Research Institute, Cumming School of Medicine, University of Calgary, Calgary, Canada*
[e] *Centre for Global Child Heath, The Hospital for Sick Children, Toronto, Canada*
[f] *Center of Excellence in Women and Child Health, The Aga Khan University, Karachi, Pakistan*

Article history: Received January 25, 2016; Accepted August 1, 2016
Keywords: Accidents; Injuries; Adolescent health; Unintentional injuries; Road traffic accidents; Motor vehicle injuries

A B S T R A C T

Globally, every day, ~2,300 children and adolescents succumb to unintentional injuries sustained from motor vehicle collisions, drowning, poisoning, falls, burns, and violence. The rate of deaths due to motor vehicle injuries in adolescents is 10.2 per 100,000 adolescents. We systematically reviewed published evidence to identify interventions to prevent unintentional injuries among adolescents aged 11–19 years. We defined unintentional injuries as a subset of injuries for which there was no evidence of predetermined intent, and the definition included motor vehicle injuries, suffocation, drowning, poisoning, burns, falls, and sports and recreation. Thirty-five studies met study eligibility criteria. The included studies focused on interventions to prevent motor vehicle injuries and sports-related injuries. Results suggest that possession of a graduated driver license (GDL) significantly reduced road accidents by 19% (relative risk [RR]: .81; 95% confidence interval [CI]: .75–.88; n = 5). There was no impact of GDL programs on incidence of injuries (RR: .78; 95% CI: .57–1.06; n = 2), helmet use (RR: 1.0; 95% CI: .98–1.02; n = 3), and seat belt use (RR: .99; 95% CI: .97–1.0; n = 3). Sports-related injury prevention interventions led to reductions in the incidence of injuries (RR: .66; 95% CI: .53–.82; n = 15), incidence of injury per hour of exposure (RR: .63; 95% CI: .47–.86; n = 5), and injuries per number of exposures (RR: .79; 95% CI: .70–.88; n = 4). Subgroup analysis according to the type of interventions suggests that training ± education and the use of safety equipment had significant impacts on reducing the incidence of injuries. We did not find any study focusing on interventions to prevent suffocation, drowning, poisoning, burns, and falls in the adolescent age group. The existing evidence is mostly from high-income countries, limiting the generalizability of these findings for low- and middle-income countries. Studies evaluating these interventions need to be replicated in a low- and middle-income country–context to evaluate effectiveness with standardized outcome measures.

Conflicts of Interest: The authors do not have any financial or nonfinancial competing interests for this review.
Disclaimer: Publication of this article was supported by the Bill and Melinda Gates Foundation. The opinions or views expressed in this supplement are those of the authors and do not necessarily represent the official position of the funder.
* Address correspondence to: Zulfiqar A. Bhutta, Ph.D., Centre for Global Child Health, The Hospital for Sick Children, 686 Bay Street, Toronto, Ontario M6S 1S6, Canada.
E-mail address: zulfiqar.bhutta@sickkids.ca (Z.A. Bhutta).

http://dx.doi.org/10.1016/j.jadohealth.2016.07.024

Injuries are defined as damage to a person caused by an acute transfer of mechanical, thermal, electrical, chemical, or radiation energy or by the sudden absence of heat or oxygen [1]. Unintentional injuries consist of the subset of injuries for which there is no evidence of predetermined intent and include motor vehicle injuries, suffocation, drowning, poisoning, burns, falls, and sports and recreation [1]. Worldwide, unintentional injuries are the second leading cause of years lost because of disabilities for 10- to 24-year-olds accounting for 12% of the total years lost because of disabilities in this age group [2]. Every day nearly 2,300 children and adolescents die from injuries sustained from motor vehicle injuries, drowning, poisoning, falls, burns, and violence while motor vehicle injuries alone are responsible for 10.2 deaths per 100,000 adolescents [3]. Overall, more than 95% of all injury-related deaths occur in low- and middle-income countries (LMICs) in all age groups. In high-income countries (HICs), injuries account for more than 40% of all deaths among children and adolescents [3]. Many of those who do not die due to these injuries are at an increased risk of lifelong disabling health consequences [4,5]. Furthermore, the impact of these injuries is not limited to physical consequences but also encompasses psychosocial and financial consequences that extend beyond the injury victim [6].

With progress in preventing infectious diseases, there has been a shift in epidemiological patterns with injuries accounting for 9% of global mortality; injuries are a threat to health worldwide [7]. Data indicate an increase in the global burden of injuries with the clear potential to increase steadily if measures are not taken to prevent unintended injuries [7]. Unfortunately, awareness of the problem, the means to prevent it, and the political commitment to act remain unacceptably low [3]. The first global report that brought attention to the issue of child injury prevention was published in December 2008 by the World Health Organization (WHO) and the United Nations Children's Fund [8]. The evidence base for unintentional injury prevention is limited, especially in LMICs; however, some countries have implemented strategies in the form of legislation, product and environment modifications, safety devices, and education to prevent injuries [8]. These interventions target behavioral changes to prevent unintentional injuries (including increased use of safety equipment, seat belt use, helmet use etc.) along with consequent reduction in unintentional injuries. Existing systematic reviews on unintentional injury prevention involve parent injury prevention education and training programs [9], interventions to prevent sports-related injuries [10], home safety education, the provision of safety equipment for injury prevention [11], bicycle helmet legislation [12], and school-based driver education for the prevention of traffic crashes [13]. Existing reviews have either focused on the effectiveness of certain specific interventions or do not target the adolescent age group (11–19 years).

This article is part of a series of reviews conducted to evaluate the effectiveness of potential interventions for adolescent health and well-being. Detailed framework, methodology, and other potential interventions are discussed elsewhere [14–20]. Our conceptual framework depicts the individual and general risk factors through the life cycle perspective that can have implications at any stage of life [14]. We acknowledge that interventions directed toward parents also have an impact on preventing unintentional injuries among children and adolescents. However, the focus of our review is to evaluate potential interventions directly targeted toward adolescents only and its impact on quality of life. With this focus, we systematically reviewed the evidence regarding interventions to prevent unintentional injuries among adolescents.

Methods

We systematically reviewed published literature up to December 2014 to identify studies on interventions to prevent unintentional injuries among adolescents, defined as all individuals between the ages 11 and 19 years. We defined unintentional injuries as a subset of injuries for which there is no evidence of predetermined intent; these included motor vehicle injuries, suffocation, drowning, poisoning, burns, falls, and sports- and recreation-related injuries. Studies that did not specifically report outcomes for adolescents or had overlapping age groups were excluded. Eligible study designs included randomized controlled trials (RCTs), quasirandomized, and before/after studies, in which the intervention was directed toward the adolescent population. We did not restrict our search to publication dates or geographical settings. A separate search strategy was developed for each aspect using appropriate keywords, medical subject heading, and free text terms. Key search words included "adolescents, teenagers, youth, injury, accident, license, training, education, driving, burns, fall, drown* and suffocate/ion." The following principal sources of electronic reference libraries were searched to access the available data: the Cochrane Library, Medline, PubMed, Popline, LILACS, CINAHL, Embase, World Bank's JOLIS search engine, CAB Abstracts, British Library for Development Studies at IDS, the WHO regional databases, Google, and Google Scholar.

The titles and abstracts of all studies identified were screened independently by two reviewers for relevance and matched. Any disagreements on selection of studies between these two primary abstractors were resolved by the third reviewer. After retrieval of full texts of studies that met the inclusion/exclusion criteria, data from each study were abstracted independently and in duplicate into a standardized form. Quality assessment of the included RCTs was done according to the Cochrane risk of bias assessment tool [21].

A meta-analysis of individual studies was performed. The results of comparisons between the experimental and control groups are reported as relative risks (RRs) for categorical variables and standard mean differences for continuous variables. The analysis included all outcomes as reported by study authors of the eligible articles. The pooled statistics were reported using Mantel–Haenszel (M-H) pooled method or DerSimonian–Laird method where there was an unexplained heterogeneity. Heterogeneity was quantified by χ^2 and I^2; a low p value (less than .1) or a large chi-square statistic relative to its degree of freedom and I^2 values greater than 50% were taken as substantial and high heterogeneity. In situations of high heterogeneity, causes were explored by sensitivity analysis and random effect models were used. All analyses were conducted using Review Manager, version 5.3 (Cochrane Collaboration, London, United Kingdom), which is a freely downloadable software used for conducting meta-analysis and presenting results graphically [22]. For all outcomes, the analysis was conducted employing the intention-to-treat principal. Our primary comparison was to evaluate the effectiveness of any interventions to prevent unintentional injuries among adolescents compared to no intervention or standard care; however, where possible, we attempted to conduct subgroup analysis according to the type of interventions.