



## Short Communication

## Prevention of unintentional childhood injury: A review of study designs in the published literature 2013–2016

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## ABSTRACT

The purpose of this review was to examine the range and quality of published injury prevention research, based on study design. Stratified random selection of journals (based on the average annual number of injury prevention publications) was conducted using a published inventory. Hand searches for empirical research articles on unintentional injury prevention in children and youth (0–19 years) over the four-year period 2013 to 2016, inclusive were conducted. Of the 380 studies identified, the majority were descriptive (133, 35%) or observational (163, 43%), with more than three quarters of the published studies using a “hypothesis-generating” study design. Only 12 (3%) studies were randomized controlled trials, and of the 44 experimental studies, 19 (43%) did not include a comparison group. Transportation injuries predominated, knowledge/attitude/behaviour outcomes were common, and the most common intervention approach was education. The majority of publications were from high-income countries.

This review of injury prevention research in children and youth showed that descriptive studies predominate in the published literature, and hypothesis-testing study designs are relatively infrequent. The findings suggest a need for the injury field to support and promote rigorous analytic study designs. In other words, to enhance and strengthen the evidence base for injury prevention policy and practice, injury prevention researchers should consider a greater focus on determination of cause and effect and evaluation of the effectiveness of interventions, particularly engineering and legislative interventions.

## 1. Introduction

Injury prevention research crosses a broad range of professions and disciplines including education, engineering, epidemiology, law, public health, policy, psychology, and geography, and articles on injury prevention are published in hundreds of different journals (Lawrence and Laflamme, 2008). Injury prevention research also has specific methodological challenges. For example, defining the numerator for an injury rate can be complicated, given the broad spectrum of injury (from poisoning to motor vehicle collisions) and the broad spectrum of injury severity (from minor injury to death). Defining the denominator for injury rates can also be challenging, for example, selecting the relevant “population at risk” and/or adjusting for “exposure” to injury risk. Other methodological issues include the challenge of interpreting the multi-causal nature of injuries, e.g., Haddon's host, agent, and environment model, and the issue of multiplicity, given that one person may sustain multiple injuries from a single event and, conversely, multiple individuals may be injured by a single event (Cummings et al., 1995; Roberts, 1995; Shrier et al., 2009). In this research context,

several authors have recommended that injury prevention research incorporate methodologically rigorous study designs to ensure high quality research (Cummings et al., 1995; MacKenzie, 2000). The rationale for rigorous design and high quality research is to increase the likelihood of research findings being used in injury prevention practice, policy, and programs.

To our knowledge, an empirical review of published injury prevention research by study design has not been done. Such a review - to determine the range and quality of injury prevention research, based on study design - would quantify the frequency of different types of study design used in injury research as well as potentially identify gaps in the injury prevention literature. The ultimate goal of such a review would be to encourage and promote high quality research in the field of injury prevention. Therefore, the primary objective of this review was to examine the range of research study designs in recently published articles on the prevention of unintentional injuries in children and youth. Secondary objectives were to examine the distribution of study designs by age group, injury type, prevention approach (education, engineering, and enforcement), primary outcome, journal impact factor,

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and country of origin.

## 2. Methods

### 2.1. Eligibility

In 2008, Lawrence and Laflamme created an inventory of injury prevention and safety promotion (IPSP) journals (Lawrence and Laflamme, 2008). The inventory was created using a structured process that included reviewing journal classification categories in two major periodical listings and hand searches to identify journals that published IPSP articles. Journals were included in the inventory if they were peer-reviewed and published original research that met the following criteria: (Center for Injury Prevention Policy and Practice):

- Research on intentional or unintentional injuries (defined as damage to the body resulting from acute exposure to thermal, mechanical, electrical, radiant or chemical energy or from the absence of essential energies such as heat or oxygen);
- Research on pre-event or event elements of the Haddon Matrix (host factors, vehicle factors, and physical and psychosocial environmental factors) (Haddon Jr, 1968)
- Safety promotion research
- Epidemiological research on injury or injury risk factors
- Research on the economic, personal, and societal costs and consequences of injury.

Of approximately 18,000 journals assessed, 597 journals met the threshold for inclusion in their inventory. For each journal in the inventory, they calculated the average number of IPSP articles published annually by the journal (Lawrence and Laflamme, 2008).

### 2.2. Sampling strategy

The sampling frame for this study was the Lawrence and Laflamme IPSP journal inventory. To ensure sampling of journals across a broad range of IPSP publication frequency, journals were arbitrarily stratified into three categories based on the average annual number of published IPSP articles: Stratum 1 ( $\geq 30$  articles per year); Stratum 2 (20–29 articles per year); and Stratum 3 ( $< 20$  articles per year).

articles per year); and Stratum 3 ( $< 20$  articles per year). Fig. 1 shows the sampling framework, process, and journals selected. As shown in Fig. 1, ten journals were randomly selected from each stratum, and hand searches of the selected journals over a four-year period (2013 to 2016, inclusive) were conducted. The four-year time period, 2013–2016 inclusive, was chosen to gather information across several years, and because 2016 was the most recent complete year of publication at the time of the review.

Published articles that contained empirical research on unintentional injuries in children and youth (0–19 years, or any sub-group within the age range) were included in the review. Articles were excluded if the language of publication was not English; or the topic was non-acute injuries (e.g. repetitive stress injuries), medical or surgical treatment for injuries, or complications of care. Random re-sampling of journals was done if no original research studies involving children and youth (0–19 years) were published in the initial journal selected over the four-year period of review. Last, hand searches of journals meeting the criteria for inclusion in the Lawrence and Laflamme inventory, but that began publishing after the original inventory was assembled in 2008 were also conducted.

### 2.3. Data collection

Two authors (LR, TC) independently reviewed all published articles and entered data into a standardized table. The authors then reviewed the results together and discrepancies were resolved through consensus; with involvement of a third author (CM) as required. Study designs were classified according to the flowchart in Fig. 2. Information was also collected on age group, injury type, prevention approach (education, engineering, enforcement), primary outcome, journal impact factor, and country of origin.

## 3. Results

Of the 597 journals in the inventory, 547 (92%) were English language. After stratifying by average annual IPSP publication frequency, strata 1, 2, and 3 contained 27, 38, and 482 journals, respectively. After random selection of journals from each stratum, 380 articles in 28 journals were examined, with 255 (67%) articles from stratum 1, 109

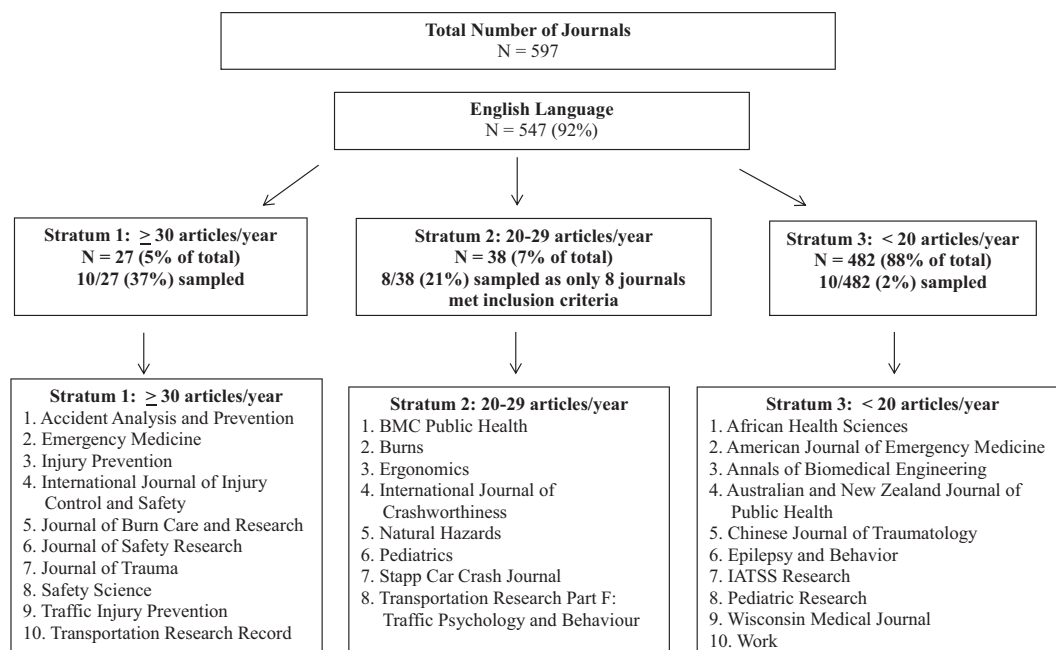


Fig. 1. Sampling framework, process, and journals selected.

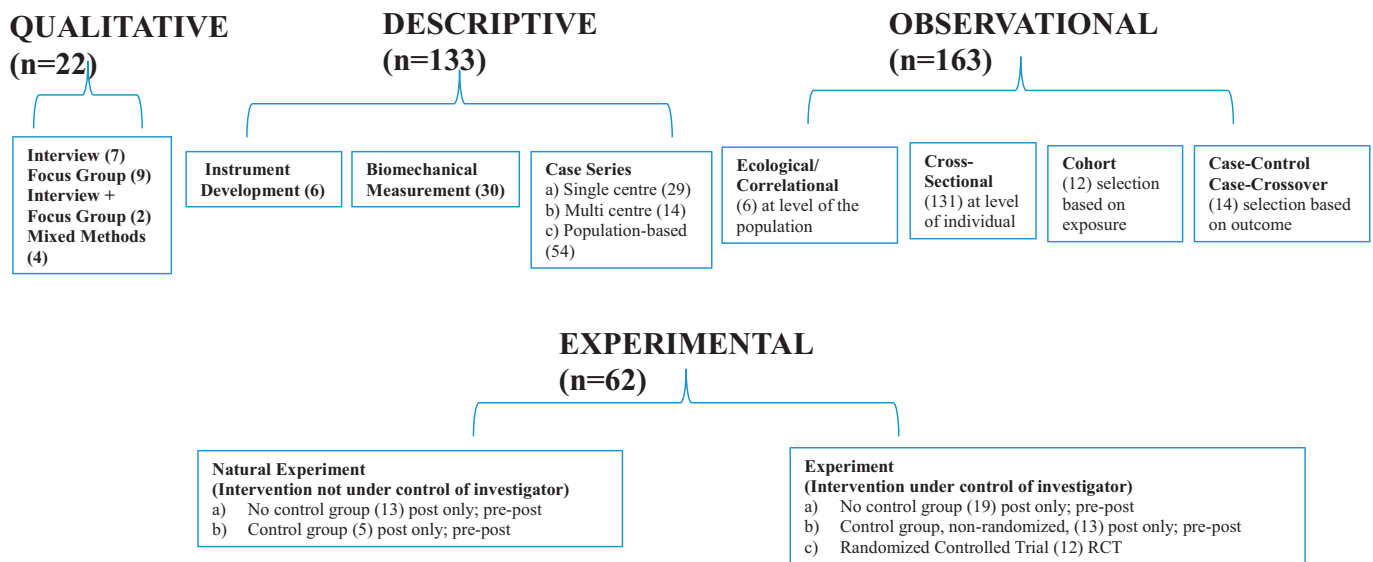


Fig. 2. Study design categories, total n = 380.

(29%) from stratum 2, and 16 (4%) from stratum 3. Random re-sampling to identify journals that met inclusion criteria was required 17 times in stratum 1 and 93 times in stratum 3. All 38 journals in stratum 2 had to be sampled to identify 8 journals that met inclusion criteria. Of note, of the 7 IPSP journals that began publishing after 2008, there were no articles that met inclusion criteria for this review.

Fig. 2 describes the study designs used in the 380 published articles. Overall, of the 380 published studies, 163 (43%) were observational with the majority being cross-sectional (131/163, 80%). One hundred and thirty three (35%) were descriptive, with the majority being case series (97/133, 73%). Of the 62 experimental studies, 18 (29%) were ‘natural experiments’ and 44 (71%) were experiments where the intervention was under the control of the investigator. Of these 44 experimental studies, 19 (43%) did not include a comparison group. In total, 12 of 380 studies (3%) were randomized controlled trials. Across all injury types, “hypothesis-generating” study designs (qualitative, mixed methods, descriptive, ecological/cross-sectional surveys) predominated. In total 292/380 (77%) published studies were “hypothesis-generating,” compared with 88/380 (23%) studies that could be described as “hypothesis-testing research” (cohort, case-control, case-crossover, and experimental).

The majority (221/380, 58%) of published studies focused on the prevention of transportation injuries; the most common topic was motor vehicle occupant safety (Table 1). Of the remaining studies, 51 (13%) focused on all injuries, 47 (12%) focused on burn injuries, and relatively few studies focused on drowning, falls, and poisonings. Across injury types, the percentage of experimental studies ranged from 0% to 22%, with the highest percentage noted for transportation

injuries.

Of the 62 experimental studies, 37 (60%) had education as the prevention approach, 13 (21%) focused on engineering interventions, 9 (15%) focused on enforcement/policy change, and 3 (5%) evaluated peer pressure on risk taking behaviour. Of the 12 randomized controlled trials, 9 (75%) had education as the primary intervention, while 3 (25%) trials evaluated the influence of peers on risk taking behaviour.

A variety of age groupings were used in the studies. As best as could be estimated, around 32% of studies focused on children 0–12 years, 23% on adolescents (13–19 years), and 42% on children and youth (0–19 years). Table 1 describes injury type by study design category across all 380 published articles.

Several studies listed more than one “primary” outcome in the published paper. Using all outcomes as the denominator, 47% of primary outcomes were injury burden (morbidity and mortality), while 44% of primary outcomes focused on knowledge/attitude/behaviour. The median journal impact factor across all articles was 1.84 (range 0.48–5.80). The frequency of specific study design categories did not vary significantly across the four years of review.

The majority of studies (309, 80%) were conducted in high-income countries, with the remainder from low- or medium-income countries (LMIC). Of the LMIC studies, the largest proportion was from the Western Pacific region (35%), followed by the Eastern Mediterranean (18%), and the African regions (15%). Of note, the child injury rate is highest in the African regions.

Table 1  
Injury type by study design.

	Observational	Descriptive	Experimental	Qualitative	Mixed methods	Total
All injury/multiple injury	31 (61%)	11 (22%)	2 (4%)	7 (14%)	0	51
Transportation	96 (43%)	68 (31%)	48 (22%)	6 (3%)	3 (1%)	221
Burns	16 (34%)	22 (47%)	7 (15%)	2 (4%)	0	47
Sports and recreation	3 (20%)	10 (67%)	2 (13%)	0	0	15
Drowning	5 (63%)	2 (25%)	1 (13%)	0	0	8
Falls	1 (13%)	6 (75%)	0	1 (13%)	0	8
Poisoning	3 (50%)	3 (50%)	0	0	0	6
Other <sup>a</sup>	8 (33%)	11 (46%)	2 (8%)	2 (8%)	1 (4%)	24
Total	163 (43%)	133 (35%)	62 (16%)	18 (5%)	4 (1%)	380

<sup>a</sup> Other includes firearms, home injuries, occupational, bites, head injury (≤ 5 studies in each category).

#### 4. Discussion

This review identified 380 empirical research articles on unintentional injury prevention in children and youth over the four-year period 2013 to 2016, inclusive. The majority of studies identified were descriptive or observational, with more than three quarters of the published studies using “hypothesis-generating” study designs. Only 12 (3%) studies were randomized controlled trials. Transportation injuries predominated, knowledge/attitude/behaviour primary outcomes were common, and the most common intervention approach was education. Last, despite a higher child injury rate in LMICs, the majority of studies were from high-income countries.

The global burden of injury has been well described (Kassebaum et al., 2017; World Health Organization, 2018). Given this knowledge, many authors have argued that the most pressing challenge for injury prevention is not to describe the injury burden, but rather to translate research findings into the development, implementation and evaluation of interventions to prevent childhood injury (Rivara and Wolf, 1989; Shakur et al., 2012). Less than one quarter of published studies in this review; however, used “hypothesis-testing” designs. In other words, there were relatively few analytic studies to determine ‘cause and effect’ related to putative risk factors or quantify the effectiveness of preventive interventions. Mixed methods studies to examine the barriers, facilitators, and contextual factors related to implementation of interventions were rare. The predominance of educational interventions amongst the experimental studies is also of note, given the evidence from previous systematic reviews that education alone is relatively ineffective in reducing the injury burden and that engineering and legislative interventions often hold greater promise (Aeron-Thomas and Hess, 2005; Bunn et al., 2003; Duperrex et al., 2002).

Limitations of this review include the use of an inventory of journals as the sampling frame, the restriction to English language publications, and the short time frame. Inference about the frequency of publications by injury type was difficult, given that the sampling process led to the identification of several specialty journals. As a result, transportation and burn injuries predominated. It is likely that a search based on injury terms and focused on individually published articles (rather than journals) would provide a different perspective. The four-year time frame of review also makes any inference about trends difficult.

To our knowledge, this is the first empirical review of the range and quality of published injury prevention research in children and youth based on study design. The review showed that descriptive studies

predominate in the published literature, and that hypothesis-testing study designs are relatively infrequent. The findings suggest a need for the injury field and research community to support and promote rigorous analytic study designs in injury prevention research. In other words, to enhance and strengthen the evidence base for injury prevention policy and practice, injury prevention researchers should consider a greater focus on determination of cause and effect and evaluation of the effectiveness of interventions, particularly engineering and legislative interventions. Last, there is also a need to support and promote injury prevention research in LMICs where the child and youth injury burden is highest.

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