
Injuries related to consumer products in Canada—a systematic literature review

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Abstract

Objectives: To conduct a systematic literature review of injury related to certain consumer products.

Methods: Forty-six empirical research reports along with 32 surveillance reports from the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) were examined to determine the approximate number of injuries associated with a given product per year and any trends in frequency. Percentages of injuries that: (1) resulted in hospitalization, (2) appeared to result from the product itself and (3) were associated with risky or inappropriate use and/or non-use of a helmet were also extracted from the reports.

Results: Outdoor play and sports equipment appear to be associated with the greatest numbers of injuries. A relatively high proportion of injuries appear to result from inappropriate or risky use of a product and/or inadequate safety precautions.

Conclusion: This review identified the following areas of concern regarding consumer products and injuries: lack of helmet use by people using in-line skates, sleds, snowboards, downhill skis and personal-powered watercraft; operation of all-terrain vehicles (ATVs) and snowmobiles by alcohol-impaired people; operation of snowmobiles at excessive speeds; poor design of playground equipment; and unsafe storage and use of matches.

Introduction

Consumer product safety has been identified as an injury prevention priority in Canada.¹ Data from the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP)^{2,*} indicate that almost half of injuries in children and youth (aged 19 years and less) are related to consumer products.³

At least four broad categories of factors influence injury associated with consumer products:

- (1) The quality of the product and its potential to cause injury by defects or characteristics such as sharp edges, faulty workmanship, poor assembly and product failure;
- (2) Factors related to how the product is used, for example, with too much force or speed, for an inappropriate purpose, or carelessly;
- (3) The element of chance whereby a sound product is used appropriately but an accident that possibly could not have been predicted or prevented occurs; and

- (4) Non-use of protective gear that could prevent or reduce the severity of injury in some instances.

This paper presents the results from a systematic review of the literature on the topic of injury related to consumer products in Canada. It examines, by product, what proportion of injuries may have resulted from a fault in the product itself or from inappropriate or risky use; what proportion of injured people were not using a helmet (where appropriate) when injured; the frequency and severity of injury by product; and any reported frequency trends.

Methods

Definitions of consumer product and injury

According to the *Canada Consumer Product Safety Act* (CCPSA), a consumer product is

“a product, including its components, parts or accessories, that may reasonably be expected to be obtained by an individual to be used for non-commercial purposes, including for domestic, recreational and sports purposes, and includes its packaging.”^{4, section 2}

Excluded from this definition are firearms, ammunition and explosives, cross-bows, food and drugs, pest control products, feeds, fertilizers, plants, seeds, controlled substances, aeronautical products, animals,

* CHIRPP is a computerized information system that collects and analyzes data on injuries to people seen at the emergency rooms of 10 pediatric and 4 general hospitals in Canada. More than 80% of the over 1.5 million records concern children and youth aged 19 years and younger.² CHIRPP data are hospital-based and therefore only contain information about injuries in those who presented to hospital.

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tobacco and tobacco products, boats and vehicles within the meaning of section 2 of the *Motor Vehicle Safety Act (MVSA)* (i.e. “any vehicle that is capable of being driven or drawn on roads by any means other than muscular power exclusively....”).^{5, section 2} However, even though they technically fall under the MVSA, off-road recreational powered vehicles, such as all-terrain vehicles (ATVs), snowmobiles and powered scooters, have been included in this review. Injuries in team sports that use equipment, such as soccer, hockey or baseball, were excluded from this review because they are fairly discrete categories that merit separate reviews, as were injuries resulting from poisonings. Finally, we did include playground equipment because, although not strictly domestic, Health Canada includes it among consumer products.⁶

The definition of injury was problematic in that the CCPSA does not define it. However, in the context of this review, injury implies *International Classification of Diseases, 10th Revision (ICD-10)*⁷ External Cause of Injury codes for unintentional injuries V01–X59, Y85–Y86, excluding motor vehicle traffic injuries occurring on a public highway or street where the injured person is an occupant, poisonings, complications of medical and surgical care, self-inflicted injuries and injuries due to assault, undetermined intent and legal intervention/war. It includes injuries to the head, neck, thorax, abdomen, lower back, lumbar spine, pelvis, shoulder and upper arm, elbow and forearm, wrist and hand, hip and thigh, knee and lower leg, ankle and foot (ICD-10 site codes S00–S99), and multiple body regions, unspecified parts of trunk, limb or body region, effects of foreign body entering through natural orifice, burns and corrosions (ICD-10 codes T00–T32). Because the majority of articles did not define injury, nor cite ICD codes, this systematic literature review relies on the definition of injury as described by the authors of the included material. All injuries were attended by a medical professional, most often in a hospital emergency department.

Systematic literature review search strategy

We searched seven databases covering: allied health, clinical medicine, nursing

and health policy (CINAHL Plus, EMBASE, MEDLINE); general science (Web of Science); public health (Global Health); social science (Social Policy & Practice), and applied life sciences (CAB Abstracts). The search took place in February 2011 and included literature published over the last 20 years.

The search terms were: Canad* + (injur* or accident*) + (consumer* or product*). As a convenient crosscheck for the thoroughness of this search, we examined the much larger number of results from an earlier search for a separate project on risk factors related to injury, conducted in July 2010. The risk factor search terms were Canad* + (injur* or accident*) + (risk factor or inciden* or caus* or hospital* or mortality or disabilit* or fall*). This larger search did not identify any additional research on consumer-product-related injury.

We also considered various additional sources including books, book chapters, electronic articles and reports. Three important sources published by the Public Health Agency of Canada (PHAC) were *Child and Youth Injury in Review, 2009 Edition – Spotlight on Consumer Product Safety*,³ *CHIRPP Injury Reports/Briefs/Data Samplers*,⁸ and *Inventory of Injury Data Sources and Surveillance Activities*.⁹ Reference lists were examined for pertinent articles missed by the search strategy. Articles were retrieved in both official languages.

Inclusion and exclusion criteria

We included reports of empirical research in Canada that examined injury associated with a consumer product and provided some numerical estimate of importance but excluded commentaries and editorials. Review articles were used as a source of additional references that may have been missed in the initial search, but were not included with the empirical material.

Indices for identifying risk management priorities

After examining all the research retrieved, we selected six indices to assist in identifying priorities for injury reduction. These

were (1) approximate annual number of injuries (estimated by dividing the number of injuries reported by the time period covered); (2) relative severity of the injury expressed in terms of percentage of injured people admitted to hospital; (3) reported trends; (4) proportion of injuries caused by the product itself (e.g. defects); (5) proportion of injuries caused by inappropriate or risky use (CHIRPP records circumstances surrounding the injury, e.g. excessive speed or jumping off the top bunk); and (6) the proportion of injured people who were not using a helmet at the time of the injury (where helmet use is considered appropriate, and where recorded). We highlighted for consideration as priorities those consumer products associated with about 500 or more injuries annually, 20% or more of injured people admitted to hospital, an increasing trend, 5% or more of injuries attributable to the product itself, 50% or more of injured people using the product inappropriately or recklessly, and 50% or more of injured people who were not using a helmet. Cut points on the indices were chosen arbitrarily to identify between five and ten consumer products each. Consumer products for which injuries were either the most numerous or more serious and which met at least one of the four remaining criteria were selected for consideration as priorities for risk management.

Results

The database search located 703 records after removal of duplicates. Of these, 46 reports met our inclusion criteria of original quantitative empirical research (Table 1). Within the resource and time constraints for this project, full articles were obtained for 37 of these. We used information in the abstract for the remaining nine reports. Abstract-only articles were retained in order to avoid any bias associated with using only references for which the whole article could be obtained and also to enable further attempts to locate the full article. In addition, 32 online reports from CHIRPP were retrieved from the Internet using the same search terms and augmented the data retrieved from the literature database search.

TABLE 1
Selected characteristics of injuries associated with consumer products

Product, years, age group studied and reference	Approximate number of injuries per year ^a , n	Percentage of injured people admitted to hospital, %	Age group most affected	Most common type/site of injury (percentage of all injuries from that product)	Trend
Stroller 1990–October 2002, ages 0–23 months ²⁷	140	4.1	0–5 mo	Head, face (78%)	
Infant swing 1990–September 1995, ages < 18 months ²⁸	9	6.0	3–5 mo	Head (87%)	
Car seat 1994–2000, ages < 12 months, Kingston ²⁹			3–5 mo	Head (40%)	
Baby walker 1990–early 2003, ages 5–14 months ^{3,30}	158	8.1	7–10 mo	Head, face (89%)	↓
1994–2000, ages < 12 months, Kingston ²⁹			6–8 mo	Head (50%)	
November 1990–January 1991, NB, PEI, NS ³¹			5–10 mo		
Bath seat 1990–2005, ages < 24 months ³	<1	50	6–9 mo		↑
Baby gate 1990–October 2002, ages 0–5 years ³²	75	3.6	9–11 mo	Head, face, neck (75%)	
Playpen 1990–October 2002, ages 0–5 years ³³	29	4.9	9–11 mo	Head, face, neck (45%)	
Gas fireplace 1990–2002, Toronto ³⁴		30.0	Median 14 mo	Hand(s) (92%)	
Bassinet, cradle crib 1990–January 1996, ages < 5 years ³⁵	155	5.4	< 2 y	Head, neck (66%)	
Magnet 1993–2007, ages 13 years and under ³	22	2.7	2–4 y	Ingestion (54.3%)	↑
1993–2003, ages ≤ 13 years ³⁶	16–17	3.9	0–4 y	Foreign body (82.8%)	↑
Television 1990–2007, ages 0–19 years ³	195	< 4.1	Median 2.8 y		
1990–2002, Halifax, children ³⁷			2–4 y	Head and neck (47%)	
Motorized ride-on toy 1990–2003, ages 1–9 years ³⁸	2–3	9.1	2–4 y	Head and face (45.4%)	
Blind or drapery cord 1990–2003 ³	1–2	52.9	3–5 y		
Bunk bed top bunk 2002–2006, all ages ³	187	10.8	3–5 y	Upper extremity (39%)	↓
1999–2001, all ages ³⁹	238	9.4	4–5 y		
Playground equipment 2000, ages 0–14 years ⁴⁰	4225	7.6	5–9 y	Fracture (43%)	
1995–2002, Toronto, fractures ⁴¹		29.0	5–9 y	Upper extremity (85% of fractures)	
Summers 1991 and 1995, Montreal ⁴²			5–9 y		
1995–1996, Toronto, severe injuries ⁴³		21.4	Mean 6.5 y	Fracture (47.6%) Upper extremity (47.6%)	
1995, ages 1–16, Kingston ⁴⁴			Mean 8.3 y	Extremities (55.6%) Fracture (35.6%)	
Wheeled shoes 2000–2006, all ages ⁴⁵	19	2.9	5–14 y	Upper extremity (61.8%)	↑
1990–2007, all ages ⁴⁶	12	2.9	Median 9.8 y		↑
June 2005–June 2007, Calgary children ⁴⁷		0.0	6–14 y	Upper extremity (76.7%)	
Trampoline 1999–2003, all ages ^{3,48,b}	541	12.4	5–14 y median 10.1 y	Lower (39.8) and upper (39.4) limb fracture	↑
January 1996–October 1997, Winnipeg, children, orthopedic injury ⁴⁹			2–15 y		
Unpowered scooter 1990–May 2001, all ages ⁵⁰	27	4.6	8–13 y	Upper extremity (33.9%)	
1990–2007, all ages ⁴⁶	236	7.3	Median 10.1 y		
1999–2003, ages ≥ 1 year ^{48,b}	273	6.2			

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TABLE 1 (continued)
Selected characteristics of injuries associated with consumer products

Product, years, age group studied and reference	Approximate number of injuries per year ^a , n	Percentage of injured people admitted to hospital, %	Age group most affected	Most common type/site of injury (percentage of all injuries from that product)	Trend
June 2005–June 2007, Calgary children ⁴⁷			6–9 y	Upper extremity (54.3%)	
Swimming pool (drowning or near drowning) 1990–2003, ages 0–14 years ⁵¹	46	57.1	< 4 y		
(entrapments) 1990–2003, all ages ⁵²	2–3	5.7	10–14 y	Foot (57%)	
Fireworks, fire crackers and sparklers June 1998–March 2004, all ages ⁵³	16–17	7.4	10–14 y	Upper extremities (46%)	
In-line skates 1998, all ages ⁵⁴	962	7.8	10–14 y	Fracture (47.6%)	
1999–2003, ages ≥ 1 year ^{48,b}	763	7.5			
1990–2007, all ages ⁴⁶	657	6.9	Median 11.9 y		
June 2005–June 2007, Calgary children ⁴⁷			10–14 y	Upper extremity (55.1%)	
Bicycle 2006, ages ≥ 1 year ⁵⁵	3993	11.0	11–15 y	Upper extremity (44.0%)	
1990–2007, all ages ⁴⁶	4726	10.7	Median 11.0 y		
1999–2003, ages ≥ 1 year ^{48,b}	3189	10.2			
1994, ages 0–19, Kingston and area ²⁵			5–14 y		
1994–1998, children ²⁶	2342				
1986–1991, Ontario fatalities ⁵⁶			15–44 y mean 26 y	Head (75%)	
June 2005–June 2009, Calgary children ⁴⁷		5.4	10–14 y	Upper extremity (49.1%)	
1993–2002, Halifax, children ≤ 15 years ⁵⁷		9.6	6–13 y	Shoulder/arm (48.2%)	
Go-cart 2000–2002, ages ≥ 5 years ⁵⁸	45	6.0	10–14 y	Head, face, neck (32.1%) Upper extremity (32.1%)	
1990–2007, all ages ⁵⁹	40	8.2	Median 11.9 y		
Powered scooter 1998–2005, ages ≥ 7 years ⁶⁰	5	15.0	10–19 y	Upper extremity (57.5%)	↑
1990–2007, all ages ⁵⁹	3–4	15.3	Median 12.3 y		
Sled 2000–2002, ages ≥ 5 years ⁶¹	855	9.2	5–14 y	Fracture (37.7%)	
Winter 2001–2002 ⁶²	1027	10.5	5–14 y	Upper (32.3%) and lower (28.0%) extremity and head, face, neck (29.8%)	
1999–2003 ages ≥ 1 year ^{48,b}	759	9.4			
April 1997–March 1999, Edmonton ⁶³		11.0	Median 12 y	Lower (32%) and upper (30%) extremity	
1 December, 1992–24 March, 1993, Sudbury ⁶⁴		7.0	Mean 16 y	Extremity (49%)	
Ice skates 2000–2002, ages ≥ 5 years ⁶¹	866	4.0	5–14 y	Fracture (32.4%)	
1999–2003 ages ≥ 1 year ^{48,b}	760	3.2			
Skateboard 1990–2007, all ages ⁴⁶	755	6.7	Median 13.5 y		
1999–2003 ages ≥ 1 year ^{48,b}	1001	7.3			
June 2005–June 2007, Calgary children ⁴⁷			10–14 y	Upper extremity (53.7%)	
Snowboard 2000–2002, ages ≥ 5 years ⁶¹	1471	11.3	10–14 y	Fracture (57.7%)	
April 2000–March 2001 ⁶⁵	1177	17.2		Upper limb fracture (51.3%)	↑
1999–2003 ages ≥ 1 year ^{48,b}	1262	12.0			
Snowshoes 2000–2002, ages ≥ 5 years ⁶¹	4	0.0	10–14 y	Fracture (38.5%)	
Snowblades 2000–2002, ages ≥ 5 years ⁶¹	35	10.6	10–14 y	Fracture (54.8%)	
Dirt bike 1993–2002, Halifax, children ≤ 15 years ⁵⁷	158	≈ 20.0	10–15 y	Shoulder/arm (50.6%)	
1990–2007, all ages ⁵⁹		25.7	Median 14.4 y		↑

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TABLE 1 (continued)
Selected characteristics of injuries associated with consumer products

Product, years, age group studied and reference	Approximate number of injuries per year ^a , n	Percentage of injured people admitted to hospital, %	Age group most affected	Most common type/site of injury (percentage of all injuries from that product)	Trend
Matches 1993–2003, ages ≤ 15 years ⁶⁶	3–4	25.6	13–15 y	Head, face and neck (39%)	
ATVs 1990–2007, all ages ⁵⁹	272	33.6	Median 15 y		↑
1999–2001, all ages ⁶⁷	298	38.4	20–29 y	Lower (30.4%) and upper (30.2%) extremity	
September 1 1998–August 31 2003, London, children ⁶⁸		19.5	8–17 y mean 13.7 y	Fracture (76%)	
1990–1997, Alberta, ages 0–17 ⁶⁹			Median 13 y	Head (44.7%)	
June 1990–December 2002, Halifax children < 16 years, hospital admissions ⁷⁰			13–15 y mean 12 y	Orthopedic (71.7%)	
2002, ages > 15 years, major trauma ⁷¹			16–34 y	Head injury (24%)	
2001–2004, Montreal pediatric hospital admissions ⁷²			3–17 y median 13 y	Brain injury (54%)	
1993–2002, Halifax, children ≤ 15 years ⁵⁷		30.8	14–15 y	Lower extremity (42.3%)	
Downhill/alpine skis 2000–2002, ages ≥ 5 years ⁶¹	899	12.6	10–14 y	Fracture (41.8%)	
October 1999–September 2000 ⁶⁵	865	16.0		Fracture (41.0%)	
1999–2003 ages ≥ 1 year ^{48,b}	699	12.9			
1991–1992 ski season, Blackcomb, BC ⁷³			7–17 y	Head or face (26.5% of males), knee (30% of females)	
Water tube 1990–2008, all ages ⁷⁴	18	8.7	15–19 y		↑
Water skis 1990–2008, all ages ⁷⁴	35	9.0	15+ y		
Lawnmower 1990–2006, all ages ⁷⁵	69	23.0	20+ y	Lacerations (32%)	
Jet ski/personal-powered watercraft 1990–1997, all ages ⁷⁶	11	28.4	20+ y	Head or neck (33.7%)	
1990–2007, all ages ⁵⁹	16	18.8	Median 20 y		
Cross-country skis 2000–2002, ages ≥ 5 years ⁶¹	34	12.8	20+ y	Fracture (34.3%)	
Annual average in the database as of December 2003 ⁶⁵	37	8.5		Fracture (27.1%)	
Snowmobile 1990–2007, all ages ⁵⁹	215	32.4	Median 22.6 y		
2000–2002, ages ≥ 5 years ⁶¹	223	39.0	20+ y	Fracture (39.3%)	
1985/86–1989/90, Ontario fatalities ²³			Mean 29.9 y		
January 1998–December 1997, Winnipeg, hospital admissions ⁷⁷			19–25 y mean 29.1 y	Musculoskeletal (57%)	
Wheelchair Nova Scotia, all ages ⁷⁸		1.8	21–40 y, mean 44.1 y	Head and neck (50%)	

Abbreviations: ATV, all-terrain vehicle; BC, British Columbia; CHIRRP, Canadian Hospitals Injury Reporting and Prevention Program; NB, New Brunswick; NS, Nova Scotia; PEI, Prince Edward Island.

Note: Highlighted items are associated with 500 or more injuries per year, have hospitalization rates of 20% or higher, and injuries are increasing.

^a Data from CHIRRP.

^b Article about trampolines includes comparison with other recreation-related equipment.

Table 1 summarizes the results of the systematic literature review by consumer product in terms of estimated annual numbers of injuries, percentage of injured admitted to hospital, most common type/site of injury and any reported trend. The results are ordered approximately by age

group most affected, from youngest to oldest.

From the literature reviewed, in which injuries to children and teenagers predominate, outdoor play and sports equipment appear to be associated with the

greatest numbers of injuries. Playground equipment (e.g. swings, monkey bars, slides, teeter-totters) and bicycles are related to more than 3000 injuries per year each. Downhill winter activities using sleds, snowboards and skis are the next most common at about 1000 injuries per

year each. Other consumer products that are involved with between 500 and 1000 injuries per year are skateboards, in-line skates, ice skates and trampolines.

Consumer products used around the home play a more important role in terms of injury severity than absolute numbers. Injury severity is defined here in terms of the proportion of the injured who are admitted to hospital. Although hospitalization rates can serve as a proxy for severity of injury across consumer products, the fact that CHIRPP data do not include information on people who died without being taken to hospital likely underestimates the severity of some types of consumer product-related injury. Over half of children injured by a blind or drapery cord or in a swimming pool are admitted to hospital, as are 25% to 30% of children burned by gas fireplaces or matches and over 20% of people injured by a lawnmower. Beyond the home, consumer products most likely to be related to serious injury are powered recreational equipment such as ATVs and snowmobiles (over 30% of injured admitted to hospital), personal-powered watercraft and dirt bikes (over 20% admitted to hospital).

Consumer products for which the numbers of injuries may be on the rise include

infant bath seats, trampolines, wheeled shoes, powered scooters, ATVs, dirt bikes, snowboards, water tubes and magnets.

Tables 2 through 4 show the circumstances related to the injury. Because most of the research describing injury circumstances is based on CHIRPP data, consumer products used by children and youth predominate. From the available data, it appears that injuries related to product characteristics are relatively rare (Table 2). Baby swings appear to be the product most often at fault with 12.0% of injuries attributable to the product itself, followed by wheeled shoes (7.6%), powered scooters (7.5%), playground equipment (6.6%), cribs, cradles or bassinets (5.7%), playpens (3.8%), baby gates (3.4%), motorized ride-on toys (3.0%), bunk beds (1.4%) and unpowered scooters (1.0%).

A relatively high proportion of injuries result from inappropriate or risky use of a product (Table 3). For magnets, almost all of the injuries (93.9%) appear to be the result of risky or inappropriate use (e.g. ingestion or insertion in the nose). About three-quarters of injuries from snowmobile accidents can be attributed to alcohol impairment or excessive speed. Alcohol impairment is implicated in just over half of ATV-related injuries. Over 70% of injuries from matches result from inap-

propriate use (e.g. playing with or ingestion). Leaving a child alone in a bath seat is likely the single most common reason for a related injury, accounting for 60.0% of injuries from bath seats. Other injury causes are leaving a baby gate open or not secured (43.4% of injuries), playing, jumping, standing or being pushed from a top bed bunk (40.5%), and lack of a barrier at the top of stairs when a baby is in a walker (24.7%).

The only type of protective gear for which data were available across some products was helmet use. Almost everyone (over 90%) injured while sledding, using wheeled shoes or a personal-powered watercraft were not wearing a helmet (Table 4). Approximately one-half to three-quarters of people injured while downhill skiing, snowboarding, or using an unpowered scooter or in-line skates were not using a helmet. A considerable proportion of those injured while using powered recreational equipment were also not wearing a helmet. For bicycles and ATVs, helmet non-use percentages were available by severity of injury. Almost everyone who was killed in a bicycle-related accident was not wearing a helmet, and for ATV-related injuries, non-use of a helmet occurred in a greater proportion of cases requiring hospital admission or where there was major trauma.

TABLE 2
Proportions of injuries caused by product characteristics

Product	Percentage of injuries caused by product failure, %	Percentage of injuries caused by body entrapment, %	Total percentage of injuries attributable to product characteristics, %
Baby swing	12.0 ²⁸		12.0
Wheeled shoes	7.6 ⁴⁵		7.6
Powered scooter	7.5 ⁶⁰		7.5
Playground equipment	2.2 ^{44,a}	4.4 ⁴⁴	6.6
Crib, cradle, bassinet	1.3 ^{35,b}	4.4 ³⁵	5.7
Playpen	2.2 ³³	1.6 ³³	3.8
Baby gate	1.2 ³²	2.2 ³²	3.4
Motorized ride-on toy	3.0 ³⁸		3.0
Bunk bed	1.2 ³⁹	0.2 ³	1.4
Unpowered scooter	1.0 ⁵⁰		1.0
In-line skates	0.5 ⁵⁴		0.5
Bicycle	0.3 ⁵⁵		0.3
Trampoline	0.1 ⁷⁹		0.1

^a Rough edge.

^b Includes 0.3% caused by child eating the wood or being injured by splinters.

TABLE 3
Proportions of injuries caused by inappropriate or risky use of a product

Product	Types of risky or inappropriate use	Percentage of injuries caused by risky or inappropriate use, %
Magnet	Ingestion, insertion in nose or ear	93.9 ³
Snowmobile	Impaired	69.0 ^{23,a} ; 70.0–88.0 ⁷⁷
	Excessive speed	82.0 ⁷⁷
Matches	Playing with or ingesting	71.8 ⁶⁶
Bath seat	Leaving child alone in seat	60.0 ³
All-terrain vehicle	Impaired	≤ 56.0 ^{71,b}
Baby gate	Left open or unsecured	43.4 ³²
Bunk bed (top bunk)	Playing, jumping and standing, being pushed	40.5 ³
Baby walker	Lack of a barrier at the top of stairs	24.7 ³⁰
Bicycle	Impaired or inappropriate use	1.8 ⁵⁵ ; 7.0 ⁵⁶

^a Deaths.

^b Major trauma.

None of the 41 products included in Table 1 was identified by all priority indices, but 26 products were identified by at least one (Table 5). Assuming that priorities are likely to focus on products where injuries are either the most common or the most serious, this table identifies 18 products that fall into one or the other category. The 9 products associated with the most injuries differ from the 9 that result in a higher proportion of hospital admissions. Further selection of products based on at least one other index reduces the prioritized products to 11, that is, 6 that result in a high

number of injuries and 5 that appear to result in more serious injuries requiring hospitalization.

Table 6 highlights consumer products and areas of concern. Of the 6 products associated with a high number of injuries, 4—in-line skates, sleds, snowboards and downhill skis—are associated with a relatively low proportion of helmet use.

Discussion

Systematic literature reviews are prone to both reporting bias (the tendency for

statistically significant results to be reported over results that show no association) and publication bias (the greater likelihood that reports showing statistical significance will be published). This review has attempted to deal with these sources of bias by including both published and unpublished information and articles for which only the abstract was located. A further source of bias can arise from the choice of search terms. Despite every attempt to make this review as comprehensive as possible within the resource constraints, we acknowledge that searching for each individual consumer product (sometimes with different names such as jet ski or personal-powered watercraft) would have been a more exhaustive approach than using the generic term “consumer product,” which some publications may not have used as a keyword.

“Grey literature” (i.e. literature not included in the databases searched) was partially addressed by including online publications (all of which used CHIRPP data); however, the fact that we did not search for government publications in each of the Canadian provinces means that we may have missed some relevant material.¹⁰⁻¹⁴ We assumed that the national reports using CHIRPP data would have included the data used in provincial reports.

The topic of injury associated with consumer products does not lend itself well to the classical systematic literature review for at least two reasons. First, epidemiological studies often take years to design, carry out, write up and publish in scientific journals; therefore, published epidemiological reports likely will not represent those products where incident reports result in early recalls. Second, a literature review that spans several years may not be relevant to today’s hazards, in that dangerous products may already have been recalled and are no longer available and new products and designs have appeared. For example, missing in the results of this search are potentially harmful effects of personal electronic devices. An example is hearing loss associated with MP3 players.¹⁵

TABLE 4
Non-use of helmets among injured people by product

Consumer product	% of injuries where a helmet was not used
Sled	99.0% ⁶⁴ ; 93% ⁶³
Wheeled shoes	95.4 ⁴⁷ ; 87.3 ⁴⁶
Jet ski/personal-powered watercraft	90.9 ⁵⁹
Skis and snowboard	79.1% ⁸⁰
Skateboard	73.7 ⁴⁷ ; 67.9 ⁴⁶
Unpowered scooter	72.4 ⁵⁰ ; 66.3 ⁴⁷ ; 57.6 ⁴⁶
In-line skates	56.8 ⁴⁷ ; 50.5 ⁵⁴ ; 49.6 ⁴⁶
Snowmobile	43.1 ⁵⁹
Go-cart	39.6 ⁵⁸ ; 17.8 ⁵⁹
Powered scooter	38.9 ⁵⁹
Bicycle	37.3 ⁵⁵ ; 29.8 ⁴⁶ ; 15.4 ⁴⁷ ; 96.0 ^{56,a}
All-terrain vehicle	29.0 ⁵⁹ ; 28.2 ⁶⁷ ; 35.0 ^{68,b} ; 84 ^{71,b} ; 84 ^{72,c} ; 31.7 ^{70,c}
Dirt bike	12.7 ⁵⁹

^a Fatalities.

^b Major trauma.

^c Pediatric hospital admissions.

TABLE 5
Combined priority indices from Tables 1 to 4

Consumer Product	> 500 injuries per year	≥ 20% of injured people hospitalized	Increasing trend	≥ 5% caused by product characteristics	≥ 50% caused by inappropriate or risky use	≥ 50% of injured not using a helmet ^a
Infant swing				✓		
Infant bath seat			✓		✓	
Gas fireplace		✓				
Crib, cradle, bassinet				✓		
Magnet			✓		✓	
Blind or drapery cord		✓				
Playground equipment	✓			✓		
Wheeled shoes			✓	✓		✓
Trampoline	✓		✓			
Unpowered scooter						✓
Swimming pool		✓				
In-line skates	✓					✓
Bicycle	✓					
Powered scooter			✓	✓		
Sled	✓					✓
Ice skates	✓					
Skateboard	✓					
Snowboard	✓		✓			✓
Dirt bike		✓	✓			
Matches		✓			✓	
All-terrain vehicle		✓	✓		✓	
Downhill skis	✓					✓
Water tube			✓			
Lawnmower		✓				
Personal-powered watercraft		✓				✓
Snowmobile		✓			✓	

Note: Highlighted products are those that are most numerous or serious and have values that exceed the cut-point on at least one other priority index.

^a Where helmet use is considered appropriate and where reported.

Since the bulk of CHIRPP data comes from hospitals in cities, and most are pediatric hospitals, injuries suffered by older teen-

agers and adults seen at general hospitals and by First Nations, Métis, Inuit and other people who live in rural and remote

areas are under-represented in the CHIRPP database. In addition, not all provinces and territories have hospitals participating in CHIRPP (e.g. Saskatchewan, New Brunswick, Prince Edward Island, Yukon, Northwest Territories, Nunavut). Fatal injuries are also under-represented because CHIRPP does not capture information about people who died before they could be taken to hospital.² Studies that have assessed the representativeness of CHIRPP data indicate other biases. Sensitivity ranged from 30% to 91% across some hospitals;¹⁶ injuries among older children were more likely to be missed in some hospitals^{17,18} but not others;¹⁶ and more serious injuries (e.g. those admitted to hospital) were less likely

TABLE 6
Consumer products and areas of concern

Issue	Consumer Product
Helmet non-use	In-line skates
	Sleds
	Snowboards
	Downhill skis
	Personal-powered watercraft
Use while impaired	All-terrain vehicles
	Snowmobiles
Excessive speed	Snowmobiles
Product design	Playground equipment (includes surface material)
Inappropriate storage and use	Matches

to be missed in some hospitals^{17,18} and more likely to be missed in others.¹⁶ However, the data collected have been found to be both reliable and valid.¹⁹

Future efforts to look at consumer products and injuries in Canada may wish to focus on the following:

Population attributable risk

One possible approach would involve using the approximate number of injuries per year along with the prevalence of modifiable risk factors (e.g. non-use of helmets) to estimate the population attributable risk reduction of specific interventions. Such an estimate of the potential public health benefit could be used as the basis for setting priorities. However, this approach would likely require a meta-analysis based on a subset of articles with data suitable for pooling and/or the use of raw data from the CHIRPP database.

Exposure-based risk estimates

Although this review identifies those types of products associated with the greatest numbers of injuries, the absolute number of injuries is a function of both the availability of a given product and the risk of injury related to the product. To illustrate, does the fact that there are three to four times as many injuries associated with bicycles as with in-line skates indicate that cycling is riskier, that there are more bicycles than in-line skates or that people spend more time cycling than using in-line skates? Likely, it is a combination of all three factors. With a few exceptions, the studies cited here have not provided estimates of risk of injury relative to exposure to a product, which is necessary to identify particularly hazardous products and their associated activities. The difficulty in providing comparative estimates of risk lies in finding suitable denominators. In the future, for at least some types of consumer products, calculations of injury rates in relation to exposure may be possible. Methods similar to those used by others²⁰⁻²³ could be used to relate CHIRPP data to survey data, such as the physical activity of youth and adults collected in the Canadian Health Measures Survey,²⁴ to estimate risk in relation to exposure. Another approach

would be to combine injury data with sales data to give an estimate of risk based on the availability of certain consumer products.

Population-based injury rates

The studies cited here involved different age groups, in different locations and over different time periods, making comparisons of injury rates across products difficult. The CHIRPP database permits the calculation of injury rates in relation to the total number of injuries in the database (overall or for a particular age stratum); however, these rates only approximate population rates, in that people in the CHIRPP database likely do not represent the entire population from which they are drawn. CHIRPP data could be related to Census data to estimate the validity of the former method for estimating population rates (crude and adjusted) and to allow comparisons across products and with other studies where population rates have been used.^{25,26}

Age-specific rates

Although this review was able to identify the age groups most affected by injury related to specific consumer products, it could not identify the products most likely to be associated with injury for specific age groups throughout the lifespan. The CHIRPP dataset could be used to provide this information, which would assist priority-setting and injury reduction strategies in relation to specific age groups.

Conclusions

Despite its acknowledged limitations, this systematic literature review has provided a broad look at the problem of injury related to specific consumer products in Canada in terms of injury frequency, severity, possible trends, and likely causes. The most numerous injuries appear to involve playground equipment and bicycles; the most serious injuries occur around the home or while using powered recreational equipment; injuries related to several consumer products may be increasing; and the most frequent causes of injury appear to be behavioural (i.e. inappropriate or risky use and insufficient safety precautions, such as helmet use), rather than the fault of the product

itself. The analysis presented here identified the following areas of concern regarding consumer products and injuries: (1) lack of helmet use by people using in-line skates, sleds, snowboards, downhill skis and personal-powered watercraft; (2) the operation of ATVs and snowmobiles by people who are impaired by alcohol; (3) the operation of snowmobiles at excessive speeds; (4) poor design of playground equipment; and (5) non-secure storage and use of matches.

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