

September 12, 2016

# Child Passenger Safety Primer



**Child Passenger Safety Symposium 2016**

**Truro, Nova Scotia**

**September 29, 2016**



Here for you with helpful information to keep your children safe every day and at every age.

# Child Passenger Safety Primer

## Introduction

Child passenger safety requires consistent use of correctly installed safety seats, booster seats, or seat belts that are appropriate for a child's size and age (1). Transport Canada (2) recommends the use of age appropriate child restraint systems. For all child safety seats (e.g. rear-facing, forward-facing, and boosters), Transport Canada recommends that children remain as long as possible in a seat that provides the greatest amount of protection, as long as the child fits within the recommended weight and height ranges (2).

The Canadian federal government sets standards for child safety seat use; however, it is up to the individual provinces and territories to implement and enforce child safety seat legislation (3).

### Purpose of the Primer

This primer is intended for those interested in child passenger safety (CPS), including governments, agencies who work with young families as well as Child Passenger Safety (CPS) technicians and instructors. The purpose of this primer is to:

- Provide an overview of data related to child passenger safety.
- Summarize some promising practices.
- Outline relevant recommendations from the literature.

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*Disclaimer: This is not a comprehensive review. It is a brief overview of the literature for discussion.*

## Overview of the Issue

As outlined in a recent Cochrane Review (4), most injuries sustained by vehicle occupants during a collision occur because the occupants of an impacted vehicle will keep moving even after the vehicle itself has come to a stop. During a head-on collision, unless suitably restrained, the occupants will generally either be ejected through the windshield or will collide with the dashboard, steering wheel or the seats in front of them, causing serious injury (4).

According to the Canadian Injury Prevention Resource (5), the incorrect and inappropriate use of child restraints continues to be a topic of concern. The Canadian National Survey on Child Restraint Use (6) indicated that while 95.8% of the child passengers were restrained, it was estimated that child safety seats were properly used only 64% of the time. This is a national observational survey that collected data from randomly selected intersections from across all provinces and territories (with the exception of Nunavut).

## Magnitude of the Problem

### Canada

- Motor vehicle crashes (MVCs) are the leading cause of death (7) and one of leading causes of hospitalization (8) for children under 14 years of age in Canada.
- MVCs are the primary cause of death and serious injury for Canadian children under the age of 9 years (9).
- In 2013 there were 70 MVC deaths and 430 serious injuries in the 0-14 age group in Canada. There were 8925 MVC injuries for this age group in total (10).
- According to the Canadian Injury Prevention Resource (5), road traffic crashes have substantially declined in Canada during the past three decades.

### Atlantic Canada (12, 13)

In Atlantic Canada over the 10 year period from 2004-2013 the rate of hospitalizations due to child – passenger injuries experienced a statistically significant average decrease of 6.3% annually. During this same time period the average number of hospitalizations was 24 admissions each year (240 injuries over 10 year period).

- The most common body part injured was the head with 30% (71 admissions) followed by torso with 17% (42 admissions), upper extremity injuries with 16% (38 admissions), and lower extremity injuries with 13% (32 admissions). Other injured regions accounted for 24% (57 admissions) which include injuries to the back, spinal cord, vertebral column, etc.
- 32% of those with head injuries were diagnosed with an internal brain injury, 24% had a concussion, 10% with a fractured skull or facial bone. Of the lower extremities, 75% were fractures.

### Child Passengers (Hospitalizations 2004-2013) (12)

Province	Age-stnd rate per 100,000 pop
NL	6
PEI	6.4
NS	6.6
NB	7.1
Atlantic	6.6
Canada	6

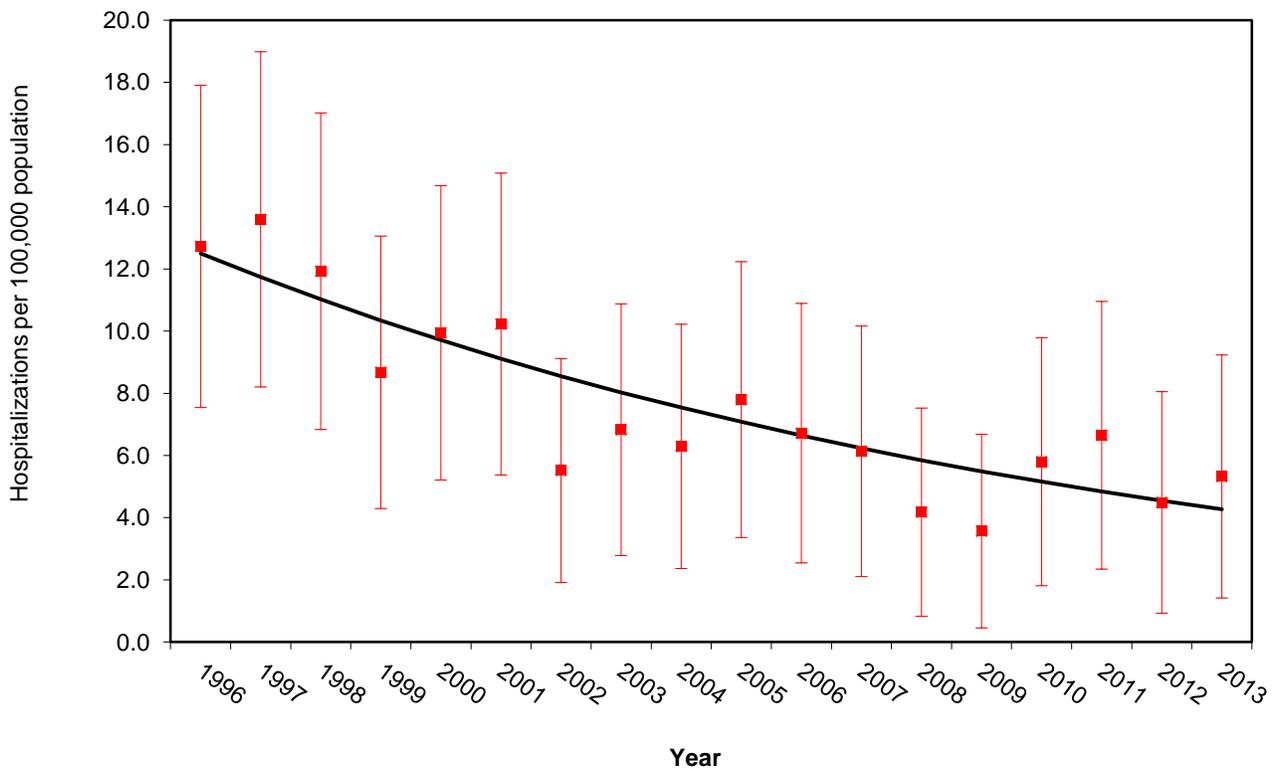
#### Nova Scotia

Between 2004 and 2013 the rate of child passenger-related injury hospitalizations for those aged 0-14 was 6.6 per 100,000 population. The national rate is 6.

### Nova Scotia (13)

- Over the 18-year period from 1996 to 2013 the hospitalization rate of infants less than 1 year of age varied (i.e. 12 of the 18 years there were zero hospitalizations).
- Children between 1 and 4 years of age experienced an average decrease in child-passenger related hospitalizations of 5.2% annually. There were 4 years in which there were zero hospitalizations.
- Children 5-9 years of age experienced a statistically significant 7.2% decrease.
- 10-14 years experienced a statistically significant 4.4% decrease.

Trends in child-passenger injury hospitalization rates among children who live in Nova Scotia, aged 0-14 years, 1996-2013, age standardized (13).



Nova Scotia: Over the 18 year period from 1996 to 2013 the hospitalization rates due to child-passenger injuries experienced a statistically significant decrease on average of 6.1% annually. In 1996 there were 23 hospitalizations and in 2013 there were 7 hospitalizations.



### Canada Road Safety Vision 2025

The Canadian Government's Road Safety Strategy 2025 vision is "Towards Zero: Having the safest roads in the world". The Road Safety Vision 2010 plan aimed to have a 95% rate of compliance in both seatbelt and proper child restraint usage (12) but Canadian and Nova Scotian statistics fall below this objective (14,15)).

**Nova Scotia Road Safety Strategy:** Nova Scotia will be releasing a Road Safety Strategy by the end of this year.

## Stages of Restraint Use - Issues and Concerns

Stages of restraint use are: rear-facing, forward-facing, booster seat, & seat belt.

### Rear-Facing/Forward-Facing Seats

In a local study (16), rates of installation and fit error were most prominent with forward-facing restraints. Some common errors for both rear-facing and forward-facing seats included: insecure fit of the seat to the vehicle and loose harness straps.

### Booster Seats/Seat belts

#### Booster Seats

The literature concerning the use of booster seats in cars is unanimous in its conclusion that they save the lives of children who are in serious motor vehicle crashes. Booster seats help position seat belts properly for children who have outgrown forward-facing child restraints with an internal harness but who are still too small for adult seat belts (17). In addition, children (ages 2-5) restrained in adult seat belts are 4.2 times more likely to have a clinically significant head injury such as concussion, skull fracture, or a more serious internal brain injury (18).

#### Seat belts

Seat belts are designed to prevent the occupant from being ejected from the vehicle and to extend the time that the decelerating force is applied to a person (19). Seat belts spread the area of impact to both a larger and less vulnerable part of the body. Abbas (20) reported that countries with high levels of seat belt usage have experienced marked reductions in traffic deaths.

According to Bruce et al (16), the most commonly seen errors of those observed (roadside observation) only wearing a seat belt were: the lap belt not sitting properly on the child's thighs and the shoulder belt not fitting properly across the chest. She concluded that these observations suggest that the child is too small to be using only a seat belt and would be safer in a crash if using the appropriate seat for their height and weight (16).

### Premature Transitioning to Seatbelt

According to best practice recommendations, almost 50% of children restrained in a seat belt would be more safely restrained in a booster seat (16). Often children who are inappropriately restrained in a booster seat had also transitioned too soon from a forward-facing seat (16). As noted in another study, Canadian school-aged children aged 4-8 years old have the lowest rates of correct safety seat use, with

reports of booster seat use ranging from 20-40% (6). These children were too small to be safely protected in a crash, according to Nova Scotia law and best practices. Children must be restrained in a booster seat until the age of 9 years or 145 cm (57 in.) tall under the Motor Vehicle Act. One study (21) showed that children properly restrained in child safety seats had half the injuries compared to children restrained in seat belts. Despite these findings, many children begin using the vehicle belt prematurely (22) which puts them at an increased risk for serious injuries in a crash (23, 24).

## Issues Regarding Booster Seat Compliance

### *Inadequate information*

Caregivers are often not adequately informed about the proper use of booster seats. Parents frequently do not have this information on hand or are using outdated information (7, 25).

### *Uninformed Professionals*

Doctors advise caregivers with regards to their child's health, and may provide them with incorrect information. Not only are parents often mistaken about the proper usage of booster seats, many are not aware of the benefits of child restraint devices in a serious collision (26). Often, even when parents are educated about how to properly use booster seats, their importance and their effectiveness in serious motor vehicle accidents is not made explicitly clear (25).

### *Socioeconomic factors*

Socioeconomic factors also play a role in the use of child restraint devices. Younger and less affluent parents are less likely to use child restraint devices than their older more affluent counterparts (25). There is also a positive correlation between parents who themselves correctly use their seat belts and those who use the child restraint devices correctly. A study in Michigan found that children travelling with unbelted drivers were using booster seats only 1-2% of the time (27).

### *Attitudes/Perception*

Many do not perceive that booster seats are necessary (26). The child's perception of the booster seat is also a factor in its use for older children. When older children are teased by their peers, parents are less likely to insist on booster seat usage (28). The compliance of the child also has an effect on the length of time parents choose to keep their children in booster seats (25).

## Installation and Use Challenges

Proper restraints for child and youth passengers in motor vehicles vary by height and weight in relation to stage of development. Both correct child vehicle restraints use and correct installation continue to be an issue.

### *Installation difficulties*

Instructions provided with the car/booster seat may be lengthy and unclear and vary depending on the amount of clothing the child is wearing (snowsuits). This may account for the high percentage of children who, though they are in a child safety seat, are not properly fastened, which can be as high as 70% in Canada (29, 3). This issue is further complicated by the fact that many car seats are made to be suitable for both rear and forward facing. Typically, people have more difficulty understanding the instructions for both rear-facing seats and forward-facing seats (30). This lack of understanding points to a need for either clearer instruction, child restraint devices that are more user-friendly or training for parents with young children (31).

### *Common Errors/Misuse*

A Nova Scotia-based researcher worked collaboratively with trained car seat specialists and police officers and conducted roadside checks to observe correct use of child restraints (25). They found that most children were in fact restrained (99.6%) by at least a seat belt, 91% were in the correct seat, and 48% of restraints were installed correctly. They also found that the seat/restraint type most used incorrectly were booster seats (31%) and seat belts (53%). The majority of incorrectly installed or fitted seats (55%) were forward facing.

The most common errors in installation and fit outlined in the literature include:

- The seat not being secured tightly enough to the vehicle (19,32),
- The harness is not snug, and /or the chest clip is in the wrong place (19, 32),
- Incorrect tether strap use (19, 32),
- The greatest proportion of incorrect seat use was among those children who transitioned to a seat belt too soon (19),
- Placing a rear-facing infant seat in front of an air bag (32),
- Wrong angle of infant seats (32),
- Not using a locking clip on the vehicle seat belt when necessary (32),
- Routing the seat belt through incorrect slots of the infant/child restraints (32),
- Using recalled or otherwise unsafe seats (32),
- Failing to restrain the child (32).

## Best Practice

In 2011, Safe Kids Canada produced the *Child Safety Good Practice Guide: Good investments in unintentional child injury prevention and safety promotion – Canadian Edition* (33). It outlines several good practices for child passenger safety by the E's of injury prevention: Education, Engineering, and Enforcement. Educational, enforcement-based, incentive-based, engineering-based or a combination thereof, are types of interventions (4). The E's in combination are considered more effective than one E only. Some practices are outlined below.

### **E: Engineering:** Effectiveness of Child Restraints

The use of safe restraints has substantially reduced MVC-related injury severity, mortality and costs to the health care system the last two decades, amongst all ages (34). The correct use of car seats and booster seats would reduce the risk of serious injury in a collision by 50-70% (14). Safe Kids Worldwide indicates that child safety seats and belts can reduce fatal MVC injury by up to 71% for infants and 54% for children ages 1-4 (35). Booster seat use reduces collision-related injury by 59%, and nearly eliminates the abdominal injuries seen in children using adult seat belts (31). Belt-positioning booster seats improve the fit of the lap and shoulder portions of adult seat belts and reduce injury risk among children four to seven years of age. As outlined in Canadian Injury Prevention resource (5), seat belts, when worn correctly, have been shown to reduce the chances of death in a collision by 47% and the chances of serious injury by 52%.

**E: Enforcement:** Enforcement strategies include the creation and enforcement of laws, regulations, and policies aimed at reducing injuries (5).

#### *CPS Legislation*

There is strong evidence that caregivers are more likely to secure young children in safety restraints if their use is mandated by law (17). When a new law is enacted regarding booster seat usage, parents increase their use of child restraint devices (3). Snowden, et al. (14) reported that in provinces with booster seat legislation, booster seats were more likely to be used and, when used, more likely to be used correctly. People who live in areas where no laws exist to regulate child restraint devices are less likely to voluntarily put their children in booster seats (28). Canadian parents reported that legislation is an important factor in their decision to use booster seats (34) and that most parents and caregivers believe that child safety seat laws represent “best proactive recommendations” (36).

#### *Enforcement*

Consistent enforcement is also a determinant of the use of booster seats, as is the amount of the fine levied on individuals who refuse to conform to the law (28). This may be related to the economic concerns which make certain parents less likely to buy booster seats if they are expensive. The

perception that one will have to pay a substantial fine because of consistent enforcement may change the financial incentive not to buy the booster seat. In addition to increasing booster seat usage, in areas where booster seat usage is mandatory by law, parents are also more likely to put their children into their booster seats correctly (29). Beth et al, 2015 recommended collaborating with police officers to review the most common errors and encourage observation at roadside checks and creating community awareness by way of roadside checks.

**E: Education:** The basic concept behind education is that the public, given information or skill training, will retain what has been taught and use it to reduce the risk of injury (5).

#### *Caregiver Education*

Education also contributed to the correct usage of child restraint devices. When parents understand the extent to which booster seats impact a child's chances of survival in a serious crash, they are more likely to use them. Having front line health professionals knowledgeable of proper child restraint practices may be a valuable resource for caregivers (26). In addition, having more precise instruction for child restraint devices could help parents who use car seats/booster seats be more confident that their child is strapped in correctly (14). Beth et al (16) recommended targeting caregivers with older children (ages 3 +) regarding transitioning too soon from forward-facing seats to booster seats and booster seats to seat belts and targeting caregivers with younger children regarding correct installation of rear-facing and forward-facing seats. Other researchers found that education and public awareness campaigns, especially when coupled with distribution of free child seats or other incentives, are effective in increasing child seat use (37).

Other Promising practices are outlined below in a chart printed with permission from Parachute 2015 (38).

Good Practice Recommendations: MVC-Related Fatalities (37)

Type of Recommendation	Evidence	Implementation
<b>Engineering</b>	<ul style="list-style-type: none"> <li>❖ Child passenger restraints result in decreases in death and injury <sup>35-38</sup></li> <li>❖ Rear seating position is the safest place for child passengers<sup>41, 48-50</sup></li> </ul>	<ul style="list-style-type: none"> <li>❖ Keeping a child in rear-facing restraints for longer has been shown to increase protection by 3 to 5 times<sup>39,40</sup></li> <li>❖ In children ages 4 to 7, booster seats can reduce the risk of experiencing a significant injury during a crash by 59%<sup>41-45</sup></li> <li>❖ Enhancing parental knowledge and restraint availability, accessibility, cost and ease of use impacts uptake<sup>46</sup></li> <li>❖ By placing children in the rear row(s) of the vehicle, their risk for injury decreases by one half to two thirds<sup>50</sup></li> <li>❖ Efforts to encourage rear-seating position should target parents' experiences of pressure to allow their children to sit in front seats and provide realistic risk perception and strategies that impact decision making<sup>51,52</sup></li> </ul>
<b>Enforcement</b>	<ul style="list-style-type: none"> <li>❖ Restraint and seatbelt legislation, alongside enforcement of child restraint legislation <sup>47, 53, 55</sup></li> </ul>	<ul style="list-style-type: none"> <li>❖ Level of enforcement will increase usage, thereby impacting effectiveness<sup>54</sup></li> <li>❖ Legislation is most effective when accompanied by educational efforts<sup>54</sup></li> </ul>
<b>Education</b>	<ul style="list-style-type: none"> <li>❖ Community-wide, multi-pronged intervention combining dissemination of child passenger restraint safety information with enforcement campaigns leads to increased use of restraints <sup>46, 47, 53</sup></li> <li>❖ Community-wide, multi-pronged intervention combining child passenger restraint distribution, loaner programs or incentives with educational programs leads to increased use<sup>46, 47,53</sup></li> </ul>	<ul style="list-style-type: none"> <li>❖ Successful intervention components include long-term strategy, focused leadership, multi-agency collaboration, and selecting appropriate targeting and timing techniques<sup>14</sup></li> <li>❖ Enforcement campaigns supported by school-based promotional tactics have demonstrated increases in seat belt use<sup>46</sup></li> <li>❖ Successful intervention components include long-term strategy, focused leadership, multi-agency collaboration, and selecting appropriate targeting and timing techniques<sup>14</sup></li> <li>❖ Selecting a reliable, well-established and well-informed organization is required to successfully run a loaner program<sup>46</sup></li> </ul>

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