



MONASH University

Accident Research Centre

FACTORS THAT INFLUENCE CHILDREN'S BOOSTER SEAT USE

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Factors that Influence Children's Booster Seat Use

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Abstract:

The aim of this study was to gain a more detailed understanding of the restraint usage rates, 'appropriateness' of restraint use, and the factors that influence appropriate restraint use for children in the booster seat age group. Six hundred and ninety nine parents from the States of New South Wales and Victoria completed a questionnaire regarding restraint use by their children aged 4 to 11 years. The findings revealed that only 24 percent of children aged between 4 and 11 years old were travelling in a booster seat, while the remaining 76 percent were travelling in a seat belt. Children travelling in booster seats were significantly younger (5.8 years vs. 8.2 years), lighter in weight (21.9 kg vs. 30.3 kg) and shorter in height (115 cm vs. 131 cm) compared with children travelling in a seat belt. Children travelling in a booster seat were also significantly more likely to be sitting in the front passenger position (for all vehicle types) (38%) compared to children travelling in a seat belt (28%). Appropriateness of restraint use was computed using height criteria of 100-140 cm for booster seats and greater than 140 cm for seat belts. Based on the height measurements provided by parents, children travelling in booster seats were found to be significantly more likely to be appropriately restrained (93%) compared to children travelling in a seat belt (25%). The likelihood of being appropriately restrained in a booster seat was greater for female children compared with males and greater amongst those who had a sibling in a seat belt compared with those who did not. Appropriate booster use was also influenced by parents' knowledge about size thresholds for transition to seat belts and there was a greater likelihood of appropriate use of boosters with increasing age and weight of the child. Amongst those children using a seat belt, the mean age for their transition into a seat belt was 5.6 years. The most important reason cited by parents for moving a child into a seat belt was that the child was too big for their forward facing child restraint/booster seat (69%). Children who were appropriately restrained in a seat belt were more likely to be in a smaller vehicle than a larger vehicle and not have another sibling in a booster seat compared to those who did have a sibling in a booster seat. Additionally, the likelihood of appropriate seat belt use increased with greater weekly distance travelled and increased age and weight of the child. The findings highlighted the need to improve legislation on child restraint usage and to promote awareness amongst both parents and children of safety benefits associated with appropriate restraint use and seating position.

Key Words:

Child safety, Booster seats, Child Seats, Child Restraints, Safety, Countermeasure

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EXECUTIVE SUMMARY

Introduction

Motor vehicle crashes are one of the leading causes of child death and acquired disability. Australian legislation requires the use of a child restraint for infants up to one year old; however for older children the legislation is less definitive, stating that only an ‘appropriate’ restraint should be used. In the absence of more clear guidelines for child restraint system (CRS) use, the responsibility largely rests upon parents to determine what restraint is appropriate for their child. Previous research has shown that older children are commonly ‘graduated’ to seat belts too early. That is, children who grow out of a child restraint suitable for young children move directly into a seat belt, rather than moving into a booster seat. This premature graduation places children at a greatly increased risk of significant injuries in the event of a motor vehicle crash.

However, booster seat usage rates and the underlying explanations for inappropriate use of restraints (i.e., seat belts) are not well researched in Australia. While the call for better legislation and public awareness has gathered momentum internationally, Australia appears to be lagging behind Europe and the United States in terms of addressing the issue of appropriate restraint use for older children.

Survey of parents’ attitudes about child restraint use

The broad aim of this study was to gain a more detailed understanding of restraint usage rates, patterns of restraint usage and ‘appropriateness’ of restraint use by children in the ‘booster seat age’. Another aim of the study was to determine the factors that influence appropriate restraint use for children in the booster seat age group.

Six hundred and ninety nine parents (response rate = 17%) from the States of New South Wales and Victoria completed a questionnaire regarding restraint use by their children aged 4 to 11 years. The questionnaire asked parents about their restraint use, their children’s restraint use, their travel patterns, their motor vehicle crash history, as well as a range of demographic questions.

Results

Demographic and driving information for parents of booster seat aged children

Most participants who completed the questionnaire were female (88%), aged between 31 to 45 years (82%), married (78%), living in a metropolitan area (36%), living in NSW (70%), earning between \$41,000 and \$75,000 per year (33%) and had finished a degree or technical school/TAFE course (52%).

In terms of their driving information, most participants reported that they usually drive their children in a four door sedan (44%). Participants also reported that they typically drove less than 100 kilometres per week with their children (61%), that most of their trips were between five and ten kilometres (53%), that they drove their children daily or almost daily (81%) and that they were the person that drove their children the most (88%). Only a small proportion of participants reported that they had been in a motor vehicle crash in the last two years (5%).

Restraint usage rates, patterns of restraint usage and ‘appropriateness’ of restraint use

Almost all parents (99%) indicated they were ‘always’ restrained while travelling in their vehicle. Similarly, almost all parents indicated that their booster seat aged child/children was/were ‘always’ restrained (98%).

When asked to indicate the type of restraint that their children travelled in, only 24 percent of children aged between 4 to 11 years were travelling in a booster seat, while the remaining 76 percent were travelling in a seat belt. Not surprisingly, children travelling in booster seats were significantly younger, lighter (in terms of their weight) and shorter (in terms of their height) than children travelling in a seat belt. However what was surprising was that children travelling in a booster seat were significantly more likely to be sitting in the front passenger position (for all vehicle types) (38%) compared to children travelling in a seat belt (28%).

An important aim of this study was to determine if children aged between 4 and 11 years were appropriately restrained while travelling in their vehicle. While there is no current Australian legislation regarding the appropriateness of restraints for older children, there are some Australian-based guidelines and international recommendations and legislation indicating appropriateness of restraint use based on approximate age, weight and/or height measures. While there are some small variations in these guidelines, for the purpose of the current study, the criterion selected was a relatively conservative measure: Children were appropriately restrained in a booster seat if their height was more than 100 centimetres and less than or equal to 140 centimetres, while children travelling in a seat belt were appropriately restrained if their height was more than 140 centimetres (i.e., NHTSA, 2001). The children’s height, rather than their age or weight, was used to assess appropriateness because their height governs the positioning of the lap/shoulder seat belt across the child’s shoulder and hips. Based on the height measurements provided by parents, children travelling in a booster seat were significantly more likely to be appropriately restrained (93%) compared to children travelling in a seat belt (25%). That is, according to the current guidelines, 75 percent of children in the current sample are too short to be properly restrained by their seat belt.

When seating position (front vs. rear) was taken into account, the proportion of children travelling appropriately in a booster seat decreased from 93 percent to 51 percent. Similarly, the proportion of children travelling appropriately in a seat belt decreased from 25 percent to 15 percent. Rear seat occupancy is generally encouraged in Australia and there is a growing body of evidence supporting its safety benefit over front seat passenger occupancy.

Children’s use of booster seats

Booster seat use was examined using the responses from 243 parents with a child aged 4 to 11 years, who was currently restrained using a booster seat. When asked to indicate what factors were important in purchasing a booster seat, most parents stated that it was ensuring that the booster seat met with the Australian standards (94%) and that it was comfortable for their child (84%). Parents were also asked why they moved their child into a booster seat, and most parents indicated that the most important reason for moving their child into a booster seat was that their child was too big for a forward facing child restraint (72%). Furthermore, parents were asked to indicate how they would know when to move their child into a seat belt. Most parents indicated that they would move their child into a seat

belt when their child reached the upper end of the weight range recommended by the child seat manufacturer (75%).

Factors associated with the appropriate use of booster seats

Regression modelling was used to identify key factors associated with the appropriate booster seat use. There was an increased likelihood of children using booster seats appropriately with increasing age and weight of the child. Additionally, the likelihood of being appropriately restrained in a booster seat was greater for female children compared with males and greater amongst those who had a sibling in a seat belt compared with those who did not. Appropriate booster use was also influenced by parents' knowledge about size thresholds for transition to seat belts.

Children's use of seat belts

Children's use of seat belts was examined using the responses from 514 parents with a child aged 4 to 11 years, who were currently restrained in a seat belt. When asked to indicate what restraint their child had been in before moving into a seat belt, most parents indicated that their child had been restrained by a booster seat before moving into a seat belt (88%). The mean age for children moving into a seat belt was 5.6 years. Parents were asked to indicate the most important reason for moving their child into a seat belt, with the majority of parents indicating that they had moved their child because their child was too big for the forward facing child restraint/booster seat (69%).

Factors associated with the appropriate use of seat belts

A series of univariate analyses were conducted to determine the factors associated with appropriate use of seat belts. Children who were appropriately restrained in a seat belt were more likely to be in a smaller vehicle than a larger vehicle and not have another sibling in a booster seat compared to children who did have a sibling in a booster seat. Additionally, the likelihood of appropriate seat belt use increased with increased weekly distance travelled and increased age and weight of the child.

Conclusion and Recommendations

The results of this study showed that only 24 percent of children in the 'booster seat age group' (i.e. 4 to 11 years) were travelling in a booster seat. The findings from this study also showed that children travelling in a booster seat were significantly more likely to be appropriately restrained compared to children in a seat belt. Given the potential for either a volunteer or reporting bias, these results may even be an over-estimate of the appropriate usage of restraints.

Based on the findings of this study, it is recommended that educational and awareness materials and programs be developed for parents and children providing information on the safety benefits associated with CRS use; injury risk associated with premature graduation into seat belts; appropriate transition from forward facing child restraint to booster seats and booster seats to seat belts; safety benefits associated with rear seat positioning; and tips for parents to encourage their children to remain restrained in the appropriate restraint type.

This study has provided a rich source of information regarding restraint usage rates, patterns of restraint use, and 'appropriateness' of restraint use amongst children aged 4 to 11 years, as well as the factors that influence parents' decisions about their child's restraint

use. Future research should attempt to examine the influence of children's attitudes towards restraint use.

FACTORS THAT INFLUENCE CHILDREN'S BOOSTER SEAT USE

1 INTRODUCTION

Motor vehicle crashes are one of the leading causes of child death and acquired disability (NHTSA, 2002). Australian legislation specifies the use of a dedicated child restraint system (CRS) for infants up to one year old; however, for older children, the legislation is less definitive, stating only that an 'appropriate' restraint (dedicated child restraint or seat belt) should be used. Hence, the responsibility largely rests upon parents to determine what restraint is 'appropriate' for older children. The most difficult decisions are likely to be for the transitions from forward facing child restraints to booster seats and seat belts. The current study aimed to investigate restraint usage rates, patterns of restraint usage and 'appropriateness' of restraint use by children in the 'booster seat age group', as well as the attitudes of parents of children in the booster seat age group towards restraint wearing behaviour.

In order to investigate the 'appropriateness' of restraint use, as well as Australian parental attitudes and behaviours in relation to their child's restraint use, a self-administered questionnaire was sent to parents of booster seat aged children (i.e., 4-11 years) in New South Wales and Victoria. More specifically, the questionnaire asked parents to identify usage rates and patterns of restraint use by their children in the booster seat age group, as well as the factors that influenced their transition into a booster seat and/or into a seat belt.

This report briefly outlines the issues surrounding child occupant safety and particularly child restraint use for children in the booster seat age group. In this section of the report, the previous literature on child occupant crash rates is presented and a discussion of the factors that are likely to affect parental attitudes to child restraint use is provided. Section 2 describes the study method including the development of the questionnaire. In Sections 3 and 4, the results of the questionnaire are presented and discussed. Section 5 summarises the findings of the study and provides practical recommendations and areas for further research and development are considered.

1.1 CHILD INJURIES AND CRASH RISK

In Australia, for the 12 month period ending December 2005, 72 children aged 16 years and younger were killed as motor vehicle passengers (ATSB, 2006). On average, an additional 850 children are seriously injured annually on Australian roads (annual average for the four-year period 2000–2003; ATSB, 2004). In the State of New South Wales, approximately 10 children aged 10 years and younger are killed annually and 690 children are injured as car passengers (annual average for the six-year period 2000-2005; RTA, 2006). Figure 1 shows the number of child car occupant injuries and fatalities in NSW per 100,000 population by age groups. These data represent average annual figures for the six-year period from 2000 to 2005.

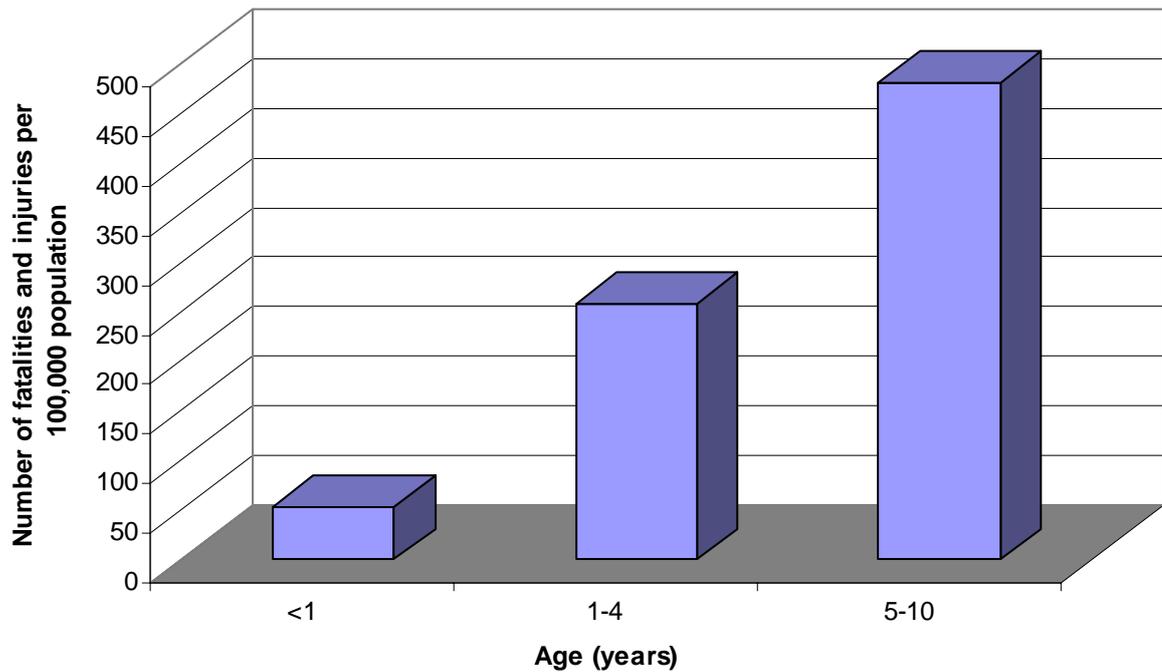


Figure 1 Number of fatalities and injuries adjusted per 100 000 population for children 10 years and younger by age group for the State of New South Wales in the six-year period from 2000 to 2005 (RTA, 2006; ABS, 2006).

When the data in Figure 1 is represented as percentages, it shows that 60.7 percent of all fatalities and injuries in children 10 years and younger during the period 2000 to 2005 occurred in children aged between 5 and 10 years, 32.5 percent occurred in 1-4 year olds and the remaining 6.8 percent were aged one year or younger. These data suggest that children aged 5 to 10 years or those in the ‘booster seat age group’ are over-represented in serious casualty and fatality motor vehicle crashes. While the data in Figure 1 has been adjusted per 100,000 population, it should be noted that data has not been corrected for travel exposure due to the fact that relevant child passenger data are not readily available.

Figure 2 shows the proportions of injuries and fatalities in children 10 years and younger by age group and restraint wearing status. For children aged less than 1 year who were killed or injured, just over 40 percent were restrained in a child restraint, around 16 percent were restrained by seat belts, around 10 percent were not belted and for approximately 30 percent of cases restraint type was unknown. A different pattern is evident for the 1-4 year age group: Around 40 percent in seat belts, 20 percent in child seats and for the remainder the restraint status was not known. For the 5-10 year olds, the same pattern is evident as the 1-4 year olds, but the effect is magnified: Around 84 percent of all injured children in this age group were restrained by seat belts and for the remainder of cases, restraint use was unknown.

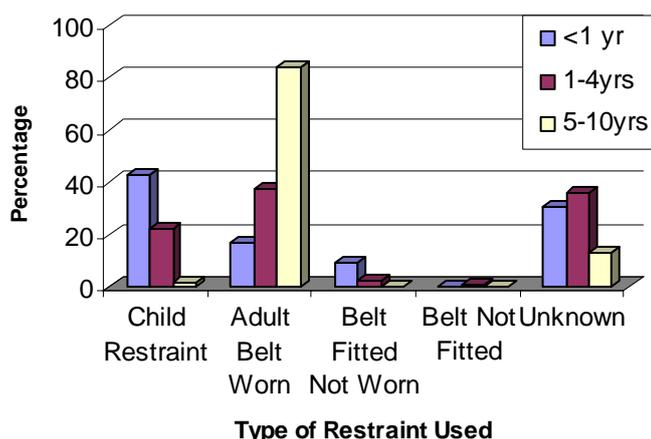


Figure 2 Percentages of child fatalities and injuries in children 10 years and younger by age group and restraint wearing status in 2005 for the State of New South Wales (RTA, 2006)

While these injury figures are of concern, it is important to consider them in the context of all crashes involving child occupants, including those in which no injuries were sustained. For example, previous research conducted in the mid-90s suggests that deaths and serious injuries represent a relatively small percentage of all restrained child occupants involved in crashes (approximately 12% of all cases sustained injuries greater than MAIS+2) (Henderson, 1994). These findings suggest that overall, Australian child restraint systems provide a good level of protection for young vehicle occupants.

1.1.1 Child Restraint Systems (CRSs)

There are four main types of CRSs, suitable for children of different sizes: infant capsules, convertible seats (converts from a rear-facing seat for infants to a forward-facing seat), dedicated forward facing child restraint and booster seats. Each of the CRS types are outlined briefly below.

- *Infant capsules* are designed for children from birth to approximately 6 months of age (or less than 9 kg and/or less than 70 cm). Infant capsules are typically one-piece, protective moulded shells. They are designed for rear-facing installation only. The capsule is designed so that in the event of a crash, impact forces will be evenly spread over the infant's back, with minimal jarring to the vulnerable head and neck area.
- *Convertible seats* incorporate features to allow use by infants as well as toddlers. In the rearward-facing position, the convertible seat is used from birth until approximately 6 months of age (or less than 9 kg and/or less than 70 cm). As with the infant capsule, the purpose of the harness system in the rearward-facing convertible seat is designed so that in the event of a crash, impact forces will be evenly spread over the infant's back, with minimal jarring to the vulnerable head and neck area. In the forward-facing position, the convertible seat carries the child from approximately 6 months to 4 years (or between 8 to 18 kg and/or 70 to 100 cm). This seating position is used when the child is able to sit and easily hold his or her head upright.

- *Forward-facing seats* are used to carry children from approximately 6 months to 4 years (or between 8 to 18 kg and/or 70 to 100 cm). Like the convertible CRS used in the forward-facing mode, dedicated forward-facing child seats should also be used only when the child is able to sit and easily hold his or her head upright. The restraint uses a five-point harness. For these seats, the height of the shoulder strap is usually above the child's shoulders to effectively limit head excursion and the height of the seat back should be above the child's ear in order to provide adequate head protection in the event of a crash.
- *Booster seats* are designed for children approximately aged between 4 and 10 years (or for children between the heights of 100 and 140 cm). Booster seats are used when the child has outgrown a forward-facing child seat but when they are still too small for a seat belt. The booster seat ensures that the lap/shoulder seat belt is positioned correctly across the child's shoulder and hips. It also raises the child so that they can see out of the window and so their knees bend comfortably. There are two types of booster seats: belt-positioning ('booster cushion') and high-back belt-positioning ('booster seat'). In assessing the range of children who would benefit from booster seats, height is a better indicator than age or weight because it governs the positioning of the lap/shoulder seat belt across the child's shoulder and hips (NHTSA, 2001).

Recent estimates of CRS effectiveness have suggested that overall, CRS may reduce injury by approximately 70 percent compared with unrestrained children (Mackay, 2001; Webber, 2000). For example, in an in-depth study of Australian fatal crashes involving child occupants, Henderson (1994) reported a 26 percent reduction in MAIS2+ injuries for those restrained in a CRS over a two- or three-point seat belt. In the US, Durbin (2001) found a 60 percent reduction in risk of injury overall for those restrained in a child seat over those in seat belts restraints, and a 70 percent reduction in risk of a head injury.

1.1.2 Legislation pertaining to CRS use

Australian legislation pertaining to CRS use requires that children less than one year must be restrained in an approved CRS that is properly fitted and adjusted. However, the law relating to use of child restraints by older children is less definitive and states that children over one year must be in either an appropriate child restraint or must use a suitable seat belt (National Transport Commission, 2000). In the absence of more clear guidelines for CRS use, the responsibility largely rests upon parents to determine what restraint is 'appropriate' for their child.

Internationally, there has been a great deal of emphasis on improving legislation relating to booster seat use and nationwide awareness campaigns have promoted the use of child restraints for older children (see National SafeKids Campaign, <http://www.safekids.org/>). For example, in the United States, legislation in California was changed in 2002 to specify that children must be secured in an appropriate child passenger restraint (safety seat or booster seat) until they are at least 6 years old or weigh at least 60 pounds (27 kg). The current legislation in Washington requires that children aged 4-6 years, or weighing 20-40 pounds (or 9.09-18.18 kg), must be in a booster seat. However, more comprehensive legislation is due to come into effect on June 1st 2007, which will require children up to the age of 8 years, or 4 foot 9 inches tall (145 cm) to be transported in a child restraint system (eg. a child car seat or booster seat). One shortfall of both the current and upcoming Washington legislation is that vehicles that are equipped with lap-only seat belts are exempt from the requirement to use a booster seat.

In Europe, a recent directive to take effect by 2006 has called for the use of boosters by children up to the age of 11 years and 153 cm tall. The UK legislation regarding child restraints will change in May 2006 in line with this directive, however it will only require that children aged 3 years or older and up to 135 cm (not 153 cm) in height will be required to wear an appropriate child restraint. It is interesting to note that there is some variability across the different countries in terms of the recommended height requirements for moving a child into a seat belt (between 135-153cm).

In 2004, Winston et al. (2004) demonstrated the dramatic effect of legislation on child restraint wearing rates in the United States. More specifically, the authors investigated restraint types used by US children under the age of 9 years between 1998 and 2002 following a series of outreach activities to promote restraint use for children over the age of four years. Between 1998 and 2002, the authors observed a 29 percent increase in CRS use for children under the age of 9 years with a concomitant 27 percent decrease in seat belt use. The authors concluded that the emphasis on appropriate child restraint use for older children had a significant impact on child passenger protection in the United States.

1.1.3 Educational resources available

Despite the lack of definitive Australian legislation regarding restraints for older children, there is a wide range of resources available for parents with recommendations on appropriate child restraints in Australia. In addition to the numerous school-based programs throughout Australia, there are a number of resources that are available on-line and as a brochure format from a variety of government, insurance, community and non-government organisations (see Table 1). The publications generally encourage rear seating of children under the age of 12 years. Booster seats are generally recommended for children up to 26 kg; however some publications do recommend the use of a booster seat up to 32 kg. One brochure, included in the Holden package, also provides a height recommendation, recommending booster seats for children greater than 100 cm, but does not provide an upper height recommendation. On the other hand, the ‘Choose Right Fit Right’ brochure on the MAA website recommends booster seats for children up to 145cm, but does not provide a lower height recommendation. Other recommendations in regards to height state that it is appropriate to move your child to a seat belt once their shoulders are above the top of the car seat back or head rest, or when their eyes are level with the top of the seat (ATSB, 2004b; Better Health Victorian Government, 2005). There are also ‘restraint fitting services’ available through a variety of organisations to assist parents in ensuring that their child restraint is appropriately fitted. In addition to these programs, there are hire schemes available for infant restraints that target new parents.

Internationally, there are a variety of innovative programs targeted at both parents and children. The Children’s Hospital of Philadelphia provides on-line videos for parents with information on when, why and how to use booster and car seats. It provides visual footage on the correct seat belt position for children in booster seats (www.chop.edu/carseat). The EUCHIRES campaign in ten European countries is targeted specifically at children. The campaign centres on the “Goochem” or “Armadillo” gadget, a toy, which makes wearing a seat belt more enjoyable for children (e.g. see www.gordan-online.de for information on the Euchires in Germany). The campaign was launched in the Netherlands, and now extends to Belgium, the Czech Republic, Finland, Germany, Poland, Portugal, Slovenia and Sweden. Evaluations on the change in behaviour will be undertaken in 2006 and 2007.

Table 1 Summary of Australian literature on child restraint recommendations

Organisation	State	Title	Format	Date	Target	Content	Contact
MAA	NSW	Choose Right Fit Right	Fact sheet, brochures, posters, video, shopping center displays	N/A	Parents/carers of children aged 2 to 6 years	Information to assist parents in choosing the most appropriate child restraint. This campaign includes as well as a fact sheet that targets parents/carers of children aged 2-6 years.	MAA:www.maa.nsw.gov.au/
RACV	VIC	Child Restraint Research – Implications for users	Brochure	July 2004	Parents	Provides findings of the latest research and considerations for parents when buying a booster.	Ph: 1800 134 126 or www.racv.com.au
Holden	National	A driving force in child safety	Package	2001	Parents	Outlines the different restraints and their features, includes pictures of correct and incorrect fitting procedures.	Ph: (03) 9647 1111 Fax: (03) 9647 1997
Kidsafe	National	SafeKIDSnow and the family car	Fact sheets	N/A	Parents	Provides information and tips on all aspects of car safety relating to children including car restraints.	Ph: (03) 9427 1008 or www.kidsafe.com.au
Australian Transport Safety Bureau	National	Road safety – it's not child's play	Brochure	N/A	Parents (of children under 5 years)	Provides information on child behaviour and protection strategies	Ph: 1800 621 372 Fax: (02) 6274 7922
Road and Traffic Authority; Federal Office of Road Safety	NSW	A simple guide to child restraints	Brochure	N/A	Parents	Information to assist parents in choosing the most appropriate child restraint	Ph: 1800 060 607
RACV; VicRoads	VIC	Restraint fitting stations – get it right	Brochure	2000	Parents	Installation guide for child restraints and list of fitting stations in Victoria	RACV: (03) 9790 2190 VicRoads: 1300 360 745
RTA; RACV; NRMA	Vic/NSW	Buyers guide to child restraints	Brochure	June 2000	Parents	Advice on rating systems and recommendations for purchasing	RTA: 1800 060 607 NRMA: (02) 9292 9636 RACV: (03) 9790 2190

NRMA	National	Child and infant restraints	Website	2004	Parents	Provides information on the correct child restraints to use and other information on child restraints	www.mynrma.com.au
The Bub Hub	National	Infant car seats and child restraints	Website	N/A	Parents	Provides product information, links to other organisations, and general information on car restraints and other areas of parenting	www.bubhub.com.au
Australian Transport Safety Bureau	National	A simple guide to child restraints	Online brochure	N/A	Parents	Information to assist parents in choosing the most appropriate child restraint	www.atsb.gov.au
Queensland Transport	QLD	Why are child restraints & seat belts important?	Online brochure	N/A	Parents	Information on choosing the right child restraint for the child and correct fitment	www.roadsafety.qld.gov.au
RACQ	QLD	Royal Automobile Club of Queensland	website	N/A	Parents	Links to a report 'child restraint advice and fitting service in Queensland' online shopping for car restraints and accessories, general information on car restraints	www.racq.com.au
Transport SA	SA	Seat belts and child restraint information	Online brochures	N/A	Parents	Provides six brochures on the different car restraints available for children all ages	www.transport.sa.gov.au
Office of Road Safety WA	WA	Restraint Facts	Website	April 2004	Parents	Provides statistics and facts on restraint use	www.officeofroadsafety.wa.gov.au
RACT	TAS	Child restraint guide	24-page guide	N/A	Parents	Provides comprehensive information on child restraints	www.ract.com.au
Australian Federal Police	ACT	Constable Kenny Koala	Interactive website and school visit	Ongoing	Pre-school and school aged children	General safety program which includes a road safety component and the message for children to 'buckle up' their seat belts.	www.afp.gov.au/afp/page/Kids/KennyKoala/Home.htm

1.1.4 CRS Use and Misuse

Notwithstanding the shortcomings in Australian legislation, usage rates of child restraints in Australia are relatively high. Both observational studies and parental reports of CRS use have found high levels of restraint use for very young children. For example, an observational study conducted in Australia in 1994 estimated that usage rates exceeded 95 percent (Henderson, Brown & Paine, 1994). However, the survey techniques used to obtain these estimates do not allow for accurate estimates of correct installation and appropriateness of restraint for the child (Paine & Vertsonis, 2001). Hence, while compliance estimates are high, these figures belie a number of errors in CRS use.

Indeed, studies show that inappropriate use and misuse of the fitment of CRS is widespread (Wren, Simpson, Chalmers, & Stephenson, 2001). Restraint inspection programs carried out in Australia reveal poor fitting rates and/or serious misuse of CRS. Common errors posing safety concerns include incorrect placement and loose adjustment of the seat belt and top tether strap (Paine, 1998; Glanvill, 2000; Paine & Vertsonis, 2001). Glanvill (2000) reported that 69 percent of the 4600 CRS checked during site inspections carried out by the Royal Automobile Club of Victoria (RACV) between 1996 and 1999 were faulty and a disturbing proportion of these (25%) were judged to be major faults. Paine and Vertsonis (2001) confirmed similar figures for serious, safety-related errors. They reported that approximately 20 percent of infant capsules and 19 percent of child seats had safety-related installation problems. A recent survey of parental attitudes and behaviours in relation to child restraints also revealed a number of gaps in knowledge about correct use of child restraints (Glanvill, 2000). For example, many participants did not understand the risks associated with incorrect installation, using old or damaged restraints or of children travelling in restraints that are inappropriate for their size.

It is important that as children grow, they use a restraint that is appropriate for their size (particularly, height and, to a lesser extent, weight) because incorrect and/or inappropriate fitment and use of restraints may reduce or nullify safety benefits (Boyle & Sharp, 1997; Henderson, 1994; Paine & Vertsonis, 2001; Winston, Durbin, Kallan & Moll, 2000). However studies have consistently shown that CRS use decreases with the increasing age of the child. For example, a recent observational study conducted for the National Highway Traffic Safety Administration (NHTSA) in four US States reported that CRS usage was 96 percent for infants; 89 percent for children aged between one and four years; and 81 percent for children aged between five and nine years (Decina & Knoebel, 1997).

In addition, a number of researchers have reported that a relatively high proportion of children 'graduate' to seat belts too early. That is, children who grow out of a CRS suitable for young children move directly into a seat belt rather than using a booster seat (Winston et al., 2000; Ramsey, Simpson & Rivara, 2000). For example, an observational study conducted in four states in the United States in 1995 showed that 21 percent of toddlers (20-40 lb or 9.09-18.18 kg) and 75 percent of preschoolers (40-60lb or 18.18-27.27 kg) were restrained by a seat belt only (Decina & Knoebel, 1997). In another study, 28 percent of four year olds, 36 percent of five year olds and 70 percent of six to eight year olds were restrained by a seat belt only (Ramsey et al., 2000). In addition, Ramsey et al. noted that more than 50 percent of parents owned the appropriate device but believed, incorrectly, that their children were large enough for a seat belt.

Although a seat belt provides better protection than no restraint at all (Winston, Chen, Elliot, Arbogast & Durbin, 2004), premature graduation of young children from CRS to seat belts puts them at greatly increased risks of significant injury in crashes (Winston et

al., 2000). When a child is prematurely graduated to a seat belt from a child restraint, the lap portion of the belt rides up over the abdomen and the shoulder portion crosses the neck or face. This places the child at risk for submarining or slipping out of the seat belt during a crash. In addition, rapid, jack knife bending about a poorly positioned seat belt increases the risk of intra-abdominal and spinal cord injuries, also known as seat belt syndrome and brain injury resulting from the impact of the head with the child's knee or the vehicle's interior (Gotschall, Better, Blaus, Eichelberger, Bents & Warner, 1998; Winston et al., 2000).

Recent studies have attempted to quantify the nature and risk of significant injury associated with premature graduation to seat belts in preschool aged children. Nance, Lutz, Arbogast, Cornejo, Kallan, Winston and Durbin (2004) investigated the relationship between abdominal injuries sustained and restraint appropriateness for children occupants aged 15 years or younger involved in a motor vehicle crash. Restraint use was categorised as appropriate/'optimal' or inappropriate/'sub-optimal' based on current American Academy of Pediatrics guidelines. Abdominal injury was defined as any reported injury to an intra-abdominal organ of AIS2+ severity. The authors noted that restraint use was optimal for 59 percent of child occupants (n = 120,473) and suboptimal for 41 percent of child occupants (n = 83,555). An associated abdominal organ injury was noted in 0.05 percent (n = 62) of the optimally restrained group and in 0.17 percent (n = 140) of the sub-optimally restrained group. After adjusting for age and seating position (front vs. rear), optimally restrained children were more than 3 times less likely than sub-optimally restrained children to sustain an abdominal injury (OR: 3.51 95% CI 1.87-6.60, P < 0.001). The authors reported a peak in abdominal injuries for children aged between 4 and 8 years that coincided with the age group that was least likely to be optimally restrained. In addition, the authors noted that there were no abdominal injuries reported among optimally restrained 4 to 8 year olds.

Winston et al. (2000) reported that once involved in a motor vehicle crash, children aged two to five years who were restrained in a seat belt were 3.5 times more likely to sustain a significant injury (RR: 3.5; 95% CI 2.4-5.2) and 4.2 times more likely to sustain a significant head injury (RR: 4.2; 95% CI 2.6-6.7) compared with children in child restraints. Similarly, Durbin et al. (2003) recently reported that booster seat restraints reduced the risk of head and brain injuries, all internal organ injuries, spinal cord injuries and extremity fractures by 59 percent when compared with seat belt restraint in four to seven year old children. In particular, the authors observed that booster seats virtually eliminated the 'seat belt syndrome' in these children; that is, injuries to the abdominal organs, lumbar spine and spinal cord. This analysis was conducted on a study sample that included all directions of impact, however 50 percent of the crashes were frontal crashes.

Similar findings have been reported in Australia. Brown, Bilston, McCaskill and Henderson (2005) recently investigated the injuries sustained by children aged 2 to 8 years following involvement in a motor vehicle crash. The authors reported that while most children within the sample used some form of restraint, the vast majority (over 80%) were using a sub-optimal form of restraint. In addition, the authors reported that the likelihood of a child being optimally restrained appeared to decrease after the age of 2 years. The authors noted that the most significant observation made from their study was that sub-optimal restraint was associated with more injury and, for those injured, more serious injury than those who were optimally restrained (p < 0.001).

More recently, Arbogast, Kallan and Durbin (2005) quantified that relative effectiveness of booster seats compared to seat belts in reducing the risk of injury among 4 to 8 year olds in side impact crashes. Using data from a large child specific crash surveillance system, the authors reported that children travelling in booster seats had a 58 percent lower risk of injury than those travelling in a seat belt in a side impact crash (OR: 0.42; 95% CI 0.21-0.83). In addition, the authors noted this finding varied by booster seat type: those in a high back booster seat were at a 70 percent reduction in injury risk (OR: 0.30; 95% CI 0.13-0.68), while those in backless boosters (or booster cushions) did not experience a statistically significant reduction in injury risk compared to those in seat belts (OR: 1.17; 95% CI 0.40-3.43). The authors suggested that this result may be due to geometric differences between the two types of booster seats: namely the presence of a specific belt path for the shoulder belt and the contoured back of the high back booster seat which may serve to better contain the occupant in these crashes, thus resulting in better protection.

The European Enhanced Vehicle-Safety Committee Working Group on Child Safety examined a series of European crash databases, including Child Restraint STandard (CREST – European collaborative research project), German In Depth Accident Study (GIDAS), GDV (German Insurance), International Road Traffic and Accident Database (IRTAD - German) and Laboratory of Accidentology and Biomechanics (LAB – France) to determine the most important body region in terms of frequency of severe injuries for children in the booster seat age group (Lesire, Guillemot & de Jager, 2005). The authors reported that, for booster seat aged children, the head and abdominal areas were the body regions that were the most frequent seriously injured in the event of a crash, and therefore should be given priority in terms of improved booster design to ensure good protection.

As outlined earlier, rear seating of children under the age of 12 years is generally encouraged in Australia. In 2005, Lennon conducted a study to estimate the proportion of Australian children who travel in the front seat of passenger vehicles. Lennon observed 1,295 passenger vehicles carrying child passengers in the State of Queensland and reported that approximately 60 percent of passenger vehicles carrying children had at least one child aged 12 years or younger travelling in the front seat. In addition, most children sitting in the front seat were observed to be restrained by a seat belt (95%). Lennon also reported that increasing age was associated with a greater likelihood of sitting in the front seat, with most children front seat passengers aged between 7 and 12 years.

Several studies have evaluated the relative safety benefits of seating position and CRS effectiveness. Braver, Whitfield and Ferguson (1998) estimated that rear seating reduced the risk of death by 36 percent for children involved in fatal crashes, regardless of whether the child was restrained. In addition, Berg, Cook, Corneli, Vernon & Dean (2000) demonstrated that children in the rear seats were 1.7 times less likely (95% CI 1.6-2.0) to suffer a fatal or severe injury than front seat child occupants. Both of these studies included children aged up to 12 or 14 respectively, so they encompass ages when child restraints and seat belts are recommended.

Durbin, Chen, Smith, Elliot & Winston (2005) investigated children under the age of 16 years who were involved in crashes of insured vehicles in 15 US States. Based on these crashes, Durbin et al. reported that inappropriately restrained children travelling in the front seat were at the highest risk of injury and appropriately restrained children travelling in the rear were at the lowest risk, for all age groups. Inappropriately restrained children were at nearly twice the risk of injury compared with appropriately restrained children (OR = 1.8, 95% CI 1.4-2.3). The authors noted that the effect of seating position was smaller

than the effect of restraint status; children in the front seat were at 40 percent greater risk of injury, compared with children in the rear seat (OR = 1.4 95% CI 1.2-1.7).

Previous research has also shown that there are different safety benefits associated with different restraint types and seating positions within the rear seat/row. For example, Arbogast, Durbin, Kallan and Winston (2004) have recently shown that belted children in the centre rear seating position of passenger vehicles equipped with a lap shoulder belt are 81 percent less likely to sustain serious injury than those belted in the centre rear equipped with a lap belt only (adjusted OR = 0.19 95% CI 0.04-0.92). In addition, Maltese, Chen and Arbogast (2005) reported that child occupants aged 4 to 15 years restrained in seat belts in the rear rows of passenger vehicles involved in side impacts were at an increased risk of injury if they were sitting alone on their row compared to sitting with other occupants. More specifically, center seated child occupants were 75 percent less likely to be injured if there was another occupant between them and the crash compared to if they were seated alone (OR: 0.25; 95% CI 0.07-0.93). In addition, child occupants seated in any other seat in the row occupied were at a 58 percent lower risk of injury compared to those that were seated alone (OR: 0.42; 95% CI 0.23-0.75). Most recently, Brown et al. (2005) have reported that children in the rear seat sustained significantly less severe injury than children in the front seat ($p < 0.05$).

1.1.5 Factors that influence booster seat use

It is likely that determinants of CRS wearing behaviour are multifactorial and complex.

In a comprehensive review of the underlying explanations for the inappropriate use of restraints, particularly by the “booster seat age group”, Eby and Kostyniuk (1999) identified several factors that have been found to be related to the frequency of CRS use:

- There is a positive relationship between driver seat belt use and CRS use (Decina & Knoebel, 1996).
- CRS use tends to be higher for children who travel frequently in the vehicle than for children who travel less than once per week with the driver (Margolis, Wagenaar & Molnar, 1992).
- When a parent or other family member is the vehicle driver, CRS use is higher than when the driver is a non-family member (Margolis et al., 1992; Decina & Knoebel, 1996).
- CRS use also tends to be higher in the second row of a vehicle than in either the front row or third row (in the case of minivans) of seats (Decina & Knoebel, 1996; Stoke, 1997).
- Race seems to influence use of CRSs, with Caucasian drivers showing higher use than African American drivers (e.g. Wagenaar, Molnar & Margolis, 1988; Margolis et al., 1992).
- A positive relationship has also been found with driver socioeconomic status (education and income) and frequency of CRS use (Wagenaar et al., 1988; Russell, Kresnow & Brackbill, 1994).

CRS use is also reported to be generally higher for younger children and for children from smaller families (Durbin Cornejo, Chen, Williams, & Wells, 2003).

In 2005, Eby, Bingham, Vivoda and Ragunathan conducted a state-wide survey of booster seat use by children aged 4 to 8 years in the State of Michigan. In their study, the authors reported that they observed 3,420 children while travelling in passenger vehicles, vans/minivans, sports-utility vehicles and pickup trucks. Overall, nine percent of the four to eight year old children were travelling in a booster seat, 49 percent were wearing a seat belt, five percent were travelling in a forward facing child restraint and 38 percent were travelling unrestrained. When examining the rates of restraint use by vehicle type, booster seat use was highest amongst children travelling in sports utility vehicles (14%) and lowest for those in pickups (2%). The authors were surprised to note that children travelling in passenger vehicles were more likely to be travelling unrestrained than those in any other type of vehicle. While the gender of the driver did not influence the restraint use of children, the driver's age did appear to have an effect. Booster seat use was very low for children travelling with a driver over the age of 60 years (1%) compared to those travelling with drivers aged 16-29 years (7%) and 30-59 years (9%). The restraint use of the driver also had a substantial influence on children's restraint use. Children travelling with restrained drivers were more likely to be travelling in a booster seat (10%) compared to children travelling with unrestrained drivers (1-2%).

In addition, several studies have identified a number of 'parental barriers' to using booster seats including: cost, the need to accommodate other children in the vehicle, the belief that seat belts provide adequate protection, a lack of knowledge about the importance of appropriate restraints, as well as a young child's desire to act grown up and not to have to sit in any type of restraint (Rivara, Bennett, Crispin Kruger, Ebel, & Sarewitz, 2001; Winston et al., 2004). Previous research has also indicated that parents appear to be confused about the appropriate age and weight thresholds for transition from a child restraint to a booster seat, as well as the transition from a booster seat to a seat belt (Rivara et al., 2001).

However, while the extent of the problem and the underlying explanations for the inappropriate use of restraints, particularly by the "booster seat age group" has received considerable attention internationally, this has not been well researched in Australia.

1.1.6 Summary and Aims of the Current Study

In sum, booster seat usage rates and the underlying explanations for inappropriate use of restraints (i.e., seat belts) is not well researched in Australia. While the call for better legislation and public awareness has gathered momentum internationally, Australia appears to be lagging behind Europe and the United States in addressing the issue of appropriate restraint use for older children.

The current study was designed to gather more knowledge about restraint usage rates, patterns of restraint usage and 'appropriateness' of restraint use by children in the 'booster seat age', as well as the attitudes of parents of children in the booster seat age group towards restraint wearing behaviour.

2 SURVEY OF THE FACTORS THAT INFLUENCE 'APPROPRIATE' RESTRAINT USE IN THE BOOSTER SEAT AGE GROUP

In order to investigate the 'appropriateness' of restraint use, as well as Australian parental attitudes and behaviours in relation to their children's restraint use, a self-administered questionnaire was sent to parents of booster seat aged children (i.e., 4-11 years) in the States of New South Wales and Victoria. More specifically, the questionnaire asked parents to identify usage rates and patterns of restraint use by children of booster seat age as well as the factors that influenced their transition into a booster seat and/or into a seat belt. A detailed description of the study's methodology, including a description of the recruitment phase, development of the questionnaire and procedure is outlined below.

2.1 METHOD

2.1.1 Participants and Recruitment

Participants in this study were defined as individuals with a child or children aged between 4 and 11 years *and* who had a valid driver's licence. Potential participants were recruited from the States of New South Wales and Victoria. The recruitment methods for participants from each State are outlined below. The procedure for New South Wales is outlined first, followed by the procedure for Victoria.

2.1.1.1 Recruitment in New South Wales

In order to recruit parents of 'booster seat aged' children in New South Wales, it was first necessary to seek approval from the New South Wales Department of Education and Training. Once approval was received from the Department, an email was sent to each New South Wales regional director inviting them and their schools to participate in the study. Figure 3 shows an outline of the school district regions in New South Wales.

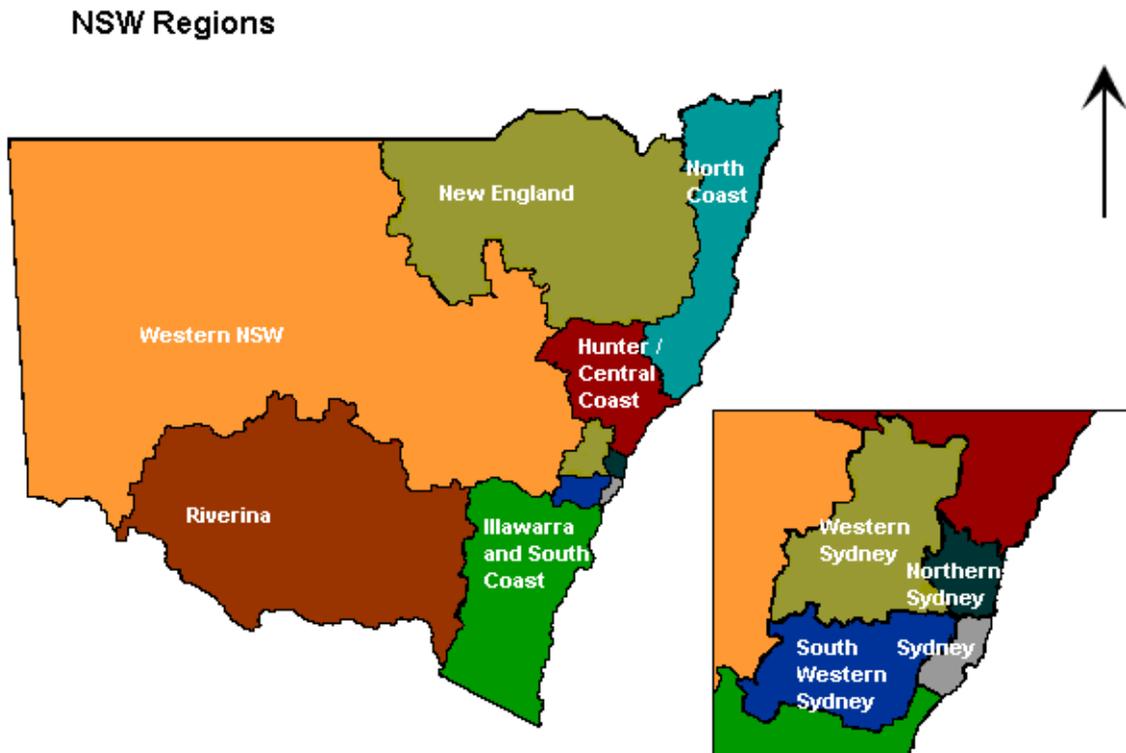


Figure 3 School regions in New South Wales

Interested New South Wales regional directors were then asked to email all public (primary) school principals in their region to invite them to participate in the study (see Appendix 1).

Following receipt of a letter of invitation, New South Wales primary school principals who agreed for their school to participate were asked to contact the research staff at the Monash University Accident Research Centre to discuss the study in greater detail and/or to organise for the questionnaires to be sent to their school for distribution.

Table 2 summarises the participating primary schools in each region and the number of questionnaires sent to each school for distribution.

Table 2 New South Wales public (primary) schools that agreed to participate

Name of School	School Region	Number of Surveys distributed
Niangala Primary School	New England and Central School Region	12
Nemingha Public School	New England and Central School Region	110
Ballimore Public School	Western Region	10
Orana Heights Public School	Western Region	250
Tullamore Central School	Western Region	36
Sofala Public School	Western Region	6
Breadalbane Public School	Illawarra/South Coast	10
Woonona Public School	Illawarra/South Coast	250
Coledale Public School	Illawarra/South Coast	62
Goulburn South Public School	Illawarra/South Coast	8
Dapto Public School	Illawarra/South Coast	250
Gwynneville Public School	Illawarra/South Coast	130
Dalgety Public School	Illawarra/South Coast	20
Vincentia Public School	Illawarra/South Coast	206
Port Kembla Public School	Illawarra/South Coast	150
Kangaroo Valley	Illawarra/South Coast	72
Wardell Public School	North Coast	42
Hastings Public School	North Coast	250
Mallaway Public School	North Coast	20
Jasper Road Public School	Western Sydney	100
Beaumont Hills Public School	Western Sydney	100
Thirlmere Public School	South Western Sydney	10
Ringrose Public School	South Western Sydney	100
Guildford West Public School	South Western Sydney	250
Camden South Public School	South Western Sydney	100
TOTAL		2554

Once the primary school principals received their ‘questionnaire packs’, they were asked to send a Letter of Invitation to parents (see Appendix 2), a Questionnaire (see Appendix 3) and an Expression of Interest for future research form (see Appendix 4) home to all the households of attending students.

2.1.1.2 Recruitment in Victoria

The recruitment procedure for Victorian parents of booster seat aged children was slightly different to that outlined above for New South Wales.

Initially, approval was sought from the Department of Education and Training Victoria to ‘conduct research in schools’. Once approval was received from the department, Victorian primary schools were randomly selected within each region and sent a letter of invitation to participate in the study (see Appendix 1). Figure 4 shows an outline of the school district regions in the State of Victoria.

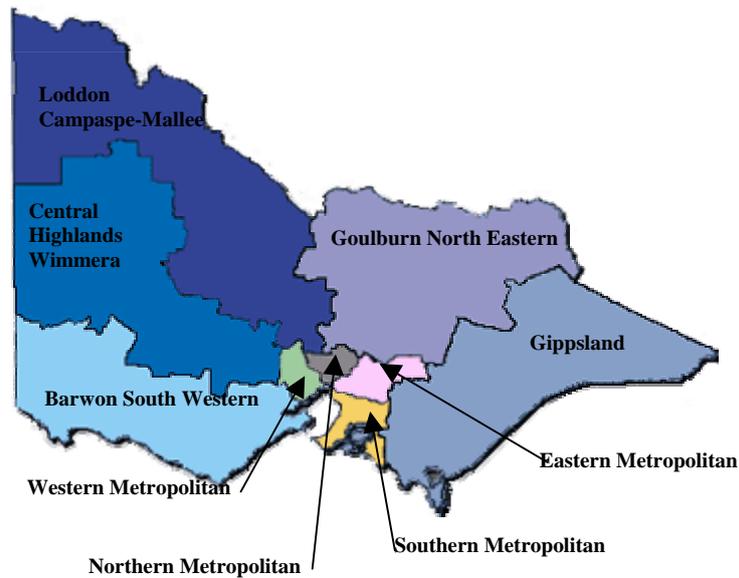


Figure 4 School regions in Victoria

Interested Victorian primary school principals were asked to contact the research staff at the Monash University Accident Research Centre, to discuss the study in greater detail and/or to organise for some questionnaires to be sent to the school for distribution.

A list of the Victorian primary schools that agreed to participate in the study, as well as the number of questionnaires sent to each school is shown below in Table 3.

Table 3 Victorian primary schools that agreed to participate

Name of School	School Region	Number of Surveys Distributed
Minyip Primary School	Central Highlands Wimmera	12
Newborough Primary School	Gippsland	200
Killara Primary School	Northern Metropolitan	250
Thomas Mitchell Primary School	Southern Metropolitan	100
Wangaratta West Primary School	Goulburn North Eastern	250
Toolangi Primary School	Eastern Metropolitan	15
Mont Albert Primary School	Eastern Metropolitan	578
TOTAL		1405

Consistent with the procedure outlined above for New South Wales, Victorian primary school principals were asked to send a Letter of Invitation to parents (see Appendix 2), a Questionnaire (see Appendix 3) and an Expression of Interest for future research form (see Appendix 4) home to all the households of attending students.

2.1.2 Questionnaire

A questionnaire was developed to gather information on restraint usage rates, patterns of use and ‘appropriateness’ of restraint use by children in the ‘booster seat age range’, as well as the attitudes of parents towards restraint wearing behaviour. The questionnaire was

designed to be self-administered (in approximate 20 minutes) by parents and was posted to researchers anonymously.

The questionnaire (see Appendix 3) comprised three sections:

- 1) Section A: All parents completed the first section. This section asked parents to answer questions on their restraint use, their children's restraint use, their travel patterns, their motor vehicle crash history as well as a range of demographic questions. These questions were included in the questionnaire because they may be a factor influencing children's restraint use.

Parents were then asked to complete Section B and/or Section C.

- 2) Section B: Parents completed the second section if they had a child aged 4 to 11 years who was currently travelling in a booster seat. Parents were asked to answer questions about how they had acquired the booster seat, if they obtained information about the booster seat, the factors that were important to them when choosing their booster seat and questions regarding their child's transition from a forward facing child restraint into a booster seat and their child's anticipated transition from a booster seat into a seat belt.
- 3) Section C: Parents completed the third section if they had a child aged 4 to 11 years who was currently travelling in a seat belt. In this section, parents were asked to answer questions about their child's transition from a child restraint or booster seat into a seat belt.

2.1.3 Procedure

In the Letter of Invitation sent home to the households of attending students (see Appendix 2), parents of a child or children aged 4 to 11 years were asked to complete the written, self-administered questionnaire. Parents were informed in the letter that they could complete the questionnaire at a time and place convenient for them and to return the completed questionnaire to the researchers at the Monash University Accident Research Centre using the reply-paid envelope provided in the 'questionnaire pack'.

In addition, parents were informed in the Letter of Invitation that researchers at the Monash University Accident Research Centre were planning to investigate other aspects of child restraint safety in the future and that if they would like to take part in other research projects being conducted by Monash University Accident Research Centre, they should complete the details in the Expression of Interest Form (see Appendix 4).

The procedure was the same for parents from both New South Wales and Victoria.

2.1.4 Analyses

Parents' responses to the questionnaire were summarised using descriptive statistics. These analyses included the frequency of 'appropriate child restraint use' as determined by criteria based on the current recommended guidelines. Relevant univariate analyses (e.g. t-tests and chi-squares) were conducted to compare appropriate child restraint use across variables of interest including place of residence (rural, urban; Victoria, New South Wales), age of child, education level and income of the parent, type of trip, duration of trip, etc. In addition, more sophisticated logistic regression modelling was conducted to ascertain the relative importance of these variables in predicting 'appropriate' restraint use.

3 RESULTS

The next section of the report describes the findings from the parents' responses to the questionnaire. The first section describes participants' responses to the demographic section of the questionnaire, including information regarding their driving habits and crash history. The second section describes the participants' responses regarding their children's use of booster seats and their child's transition from a child restraint to a booster seat. The third section describes the participants' responses regarding their children's use of adult seat belts, including their child's transition from a booster seat to a seat belt.

3.1 RECRUITMENT RATES

As outlined above in Table 1 and Table 2, questionnaire packs were sent out to 3,959 parents with a child or children aged between 4 and 11 years – 2,554 questionnaires were sent to parents in New South Wales (65%) and 1,405 questionnaires were sent to parents in Victoria (35%).

Of the 3,959 questionnaires sent out, 699 questionnaires were completed and returned to the researchers at Monash University Accident Research Centre (17%). Nineteen percent of parents in New South Wales and 15 percent of parents in Victoria completed and returned their questionnaire.

3.2 SECTION A: DEMOGRAPHIC AND DRIVING INFORMATION

The following analyses are based on Section A of the questionnaire. This section of the questionnaire was designed to elicit some demographic information about the parents who completed the questionnaire, as well as some information about their driving habits and crash and infringement history. All parents who participated in this study completed this section of the questionnaire. The analyses below are based on responses from 699 participants from both New South Wales and Victoria.

3.2.1 Demographic Information

First, participants were asked to indicate their age, gender and marital status. Most of the participants who completed the questionnaire were female (88%), were aged between 31 to 45 years (83%) (see Figure 5) and were married (78%) (see Figure 6).

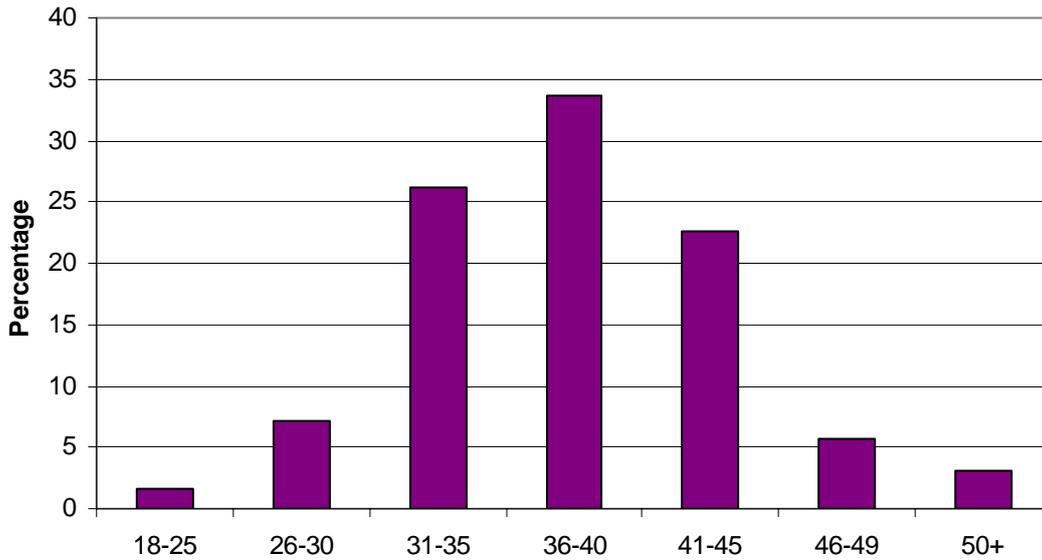


Figure 5 Age groups (years) of participants who completed the questionnaire

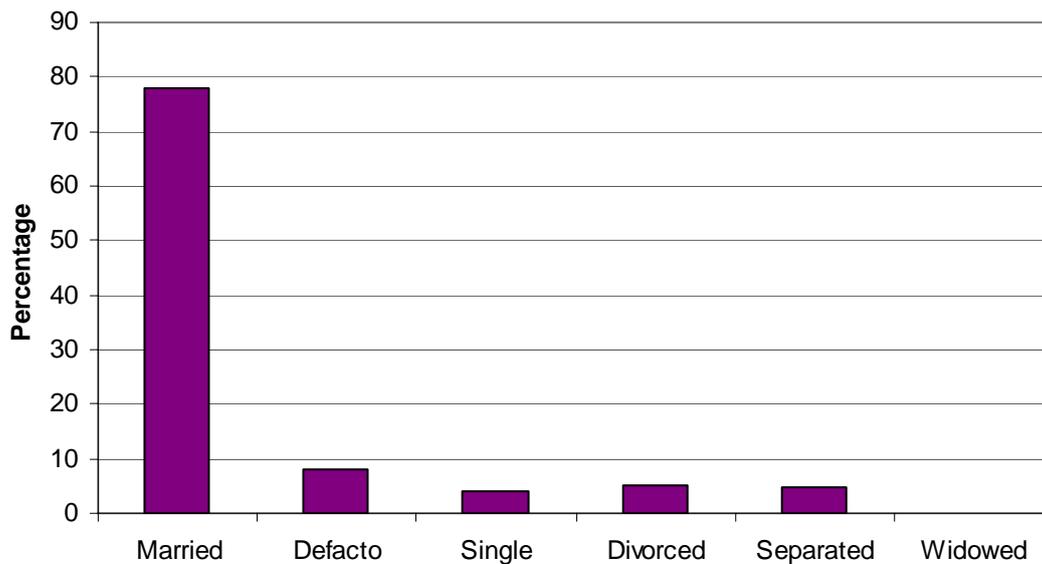


Figure 6 Marital status of participants who completed the questionnaire

Participants were also asked several questions about their place of residence. Most participants who completed the questionnaire lived in the State of New South Wales (70%), with the remaining participants living in the State of Victoria (30%). In addition, as shown in Figure 7, just over one third of participants reported that they lived in a metropolitan area (36%), just over one quarter of participants reported that they lived in a regional city, just over one quarter of participants reported that they lived in a country town and the remainder reported that they lived in a rural area.

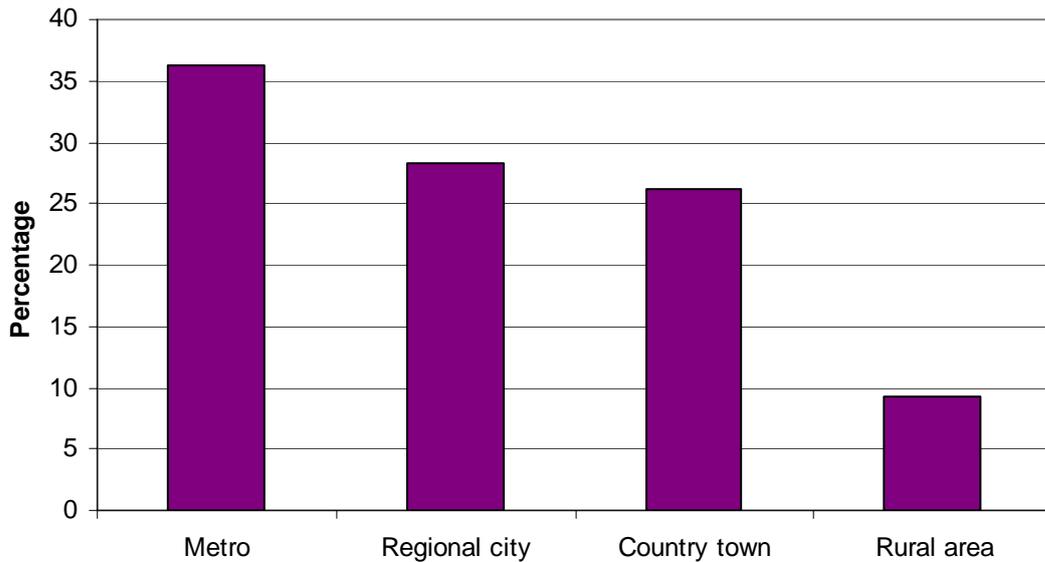


Figure 7 Place of residence for participants who completed the questionnaire

Participants were then asked about their annual household income (before tax). As shown in Figure 8, most participants indicated that their annual household income was between \$41,000 and \$75,000 per year.

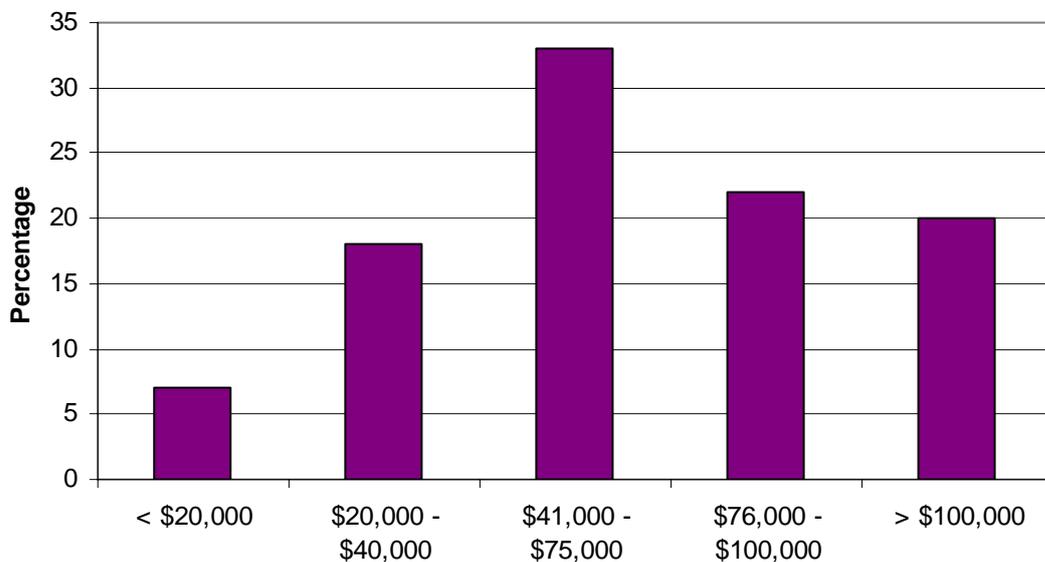


Figure 8 Annual household income for participants who completed the questionnaire

Participants were also asked about the highest level of education that they had reached. As shown in Figure 9, most participants indicated that they had finished technical school or a TAFE course (26%) or a higher degree (26%).

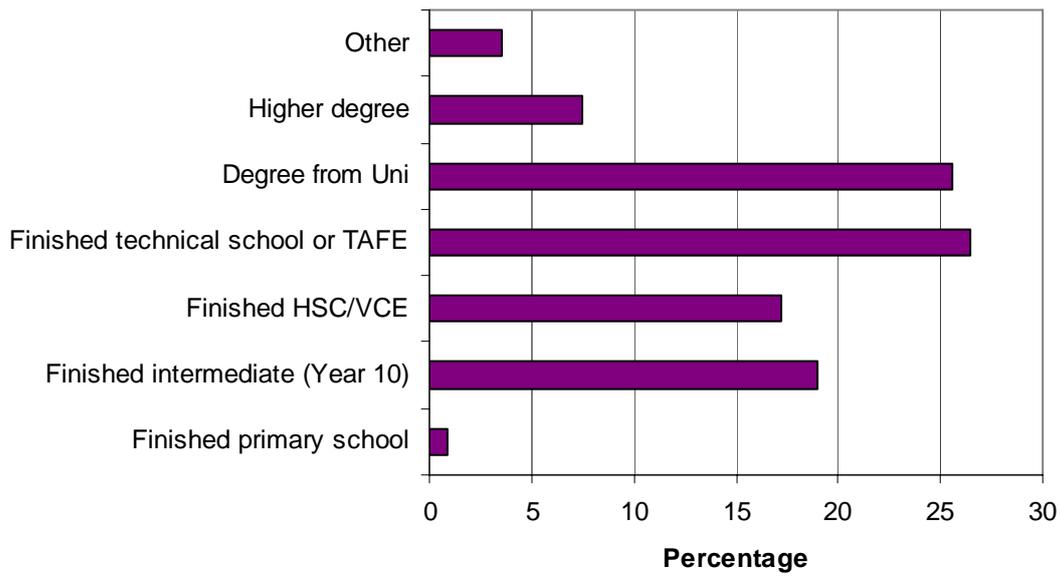


Figure 9 Highest level of education reached for participants who completed the questionnaire

The demographic characteristics of the participants were compared to the demographic characteristics of parents with at least one child under the age of 15 years reported in the 2001 Australian Bureau of Statistics Census data (2001) (see Table 4).

Table 4 Representativeness of the Demographic characteristics for participants

Demographic Characteristics		% of current sample	ABS Census data%*
<i>Gender</i>	Female	88	55 [#]
	Male	12	45 [#]
<i>Age Group</i>	18 - 30 years	9	11
	31 - 45 years	83	76
	46 + years	9	13
<i>Marital Status</i>	Married/Defacto	86	81
	Single	4	9
	Divorced	5	5
	Separated	5	4
	Widowed	0	1
<i>State of Residence</i>	NSW	70	58
	VIC	30	42
<i>Place of Residence</i>	Metropolitan	36	66
	Regional city	28	17
	Country town or Rural area	27	17
<i>Household Income</i>	< \$20,000	7	9
	\$20,000 - \$40,000	18	23
	\$41,000 - \$75,000	33	38
	\$76,000 - \$100,000	22	15
	> \$100,000	20	12
	Income not stated	0	2
<i>Highest Level of Education</i>	Finished intermediate education	20	40
	Finished secondary education	43	27
	Univ. degree or higher	33	18
	Other	4	15

*Source: Australian Bureau of Statistics (2001).

#NB: Gender data derived from ABS Cat 4102.0 Australian Social Trends Data Cube (based on 2003 data), additional information on the gender of same-sex couples and single parent families was derived from the Australian Yearbook 2005

As shown in Table 4, the comparison revealed that, compared to the information provided by parents in the 2001 Census, parents in the current sample were more likely to be: female; residing in metropolitan areas and in the State of NSW; and more likely to have completed secondary school or a university degree. However, it should be noted that the sample was relatively representative of the population on the remaining variables, including age, marital status and household income.

Participants were asked to indicate the type of vehicle typically driven while travelling with their children. As shown in Figure 10, most participants reported a four door sedan was the type of vehicle typically driven while travelling with their children (44%).

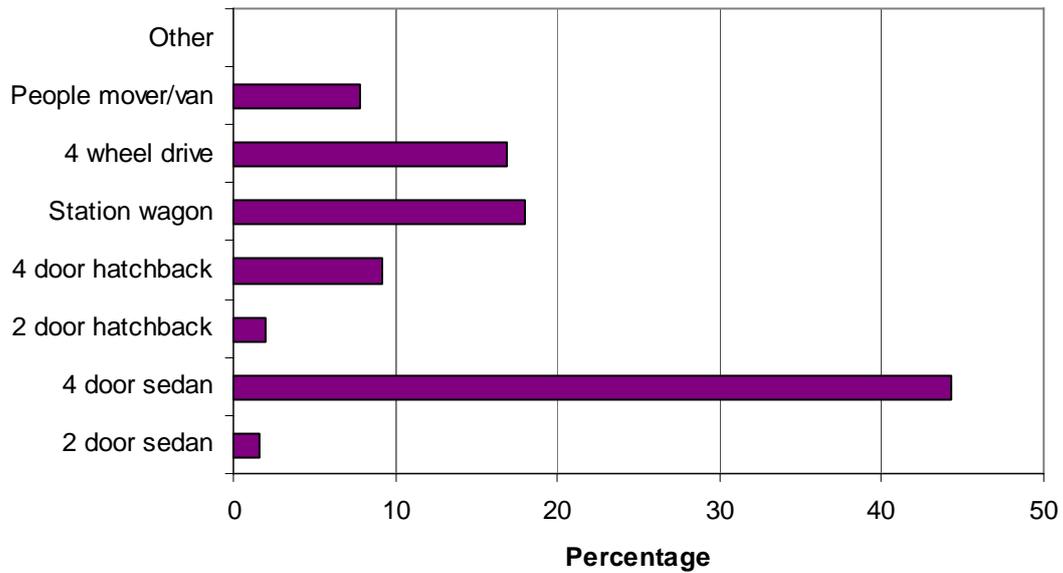


Figure 10 Type of vehicle typically driven by participants when travelling with their children

Participants also reported that they typically drove less than 100 kilometres per week with their children (see Figure 11), that most of their trips were between five and ten kilometres (see Figure 12), that they usually drove their children daily or almost daily (see Figure 13) and that they were the person who drove their children the most (see Figure 14).

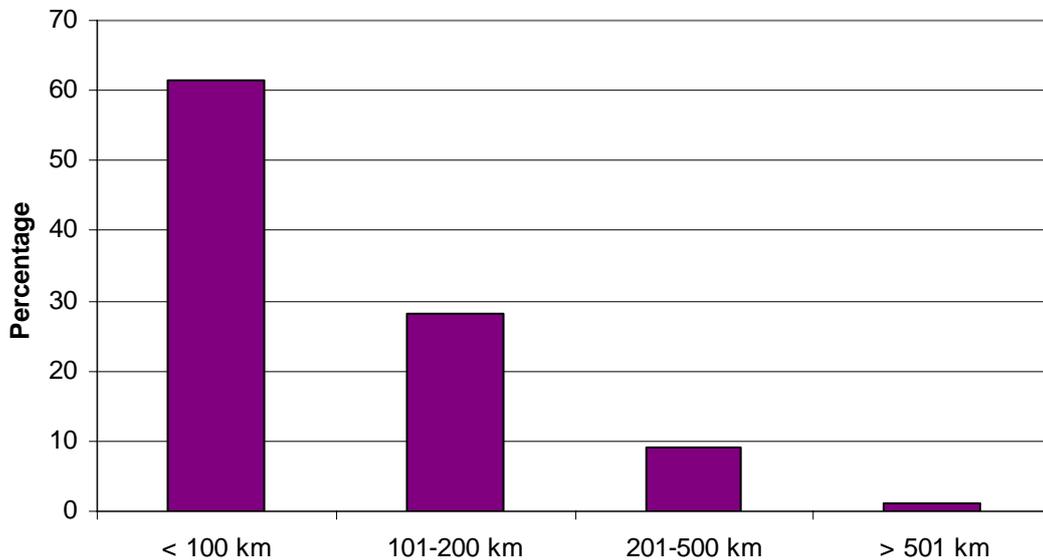


Figure 11 Kilometres driven with children per week for participants who completed the questionnaire

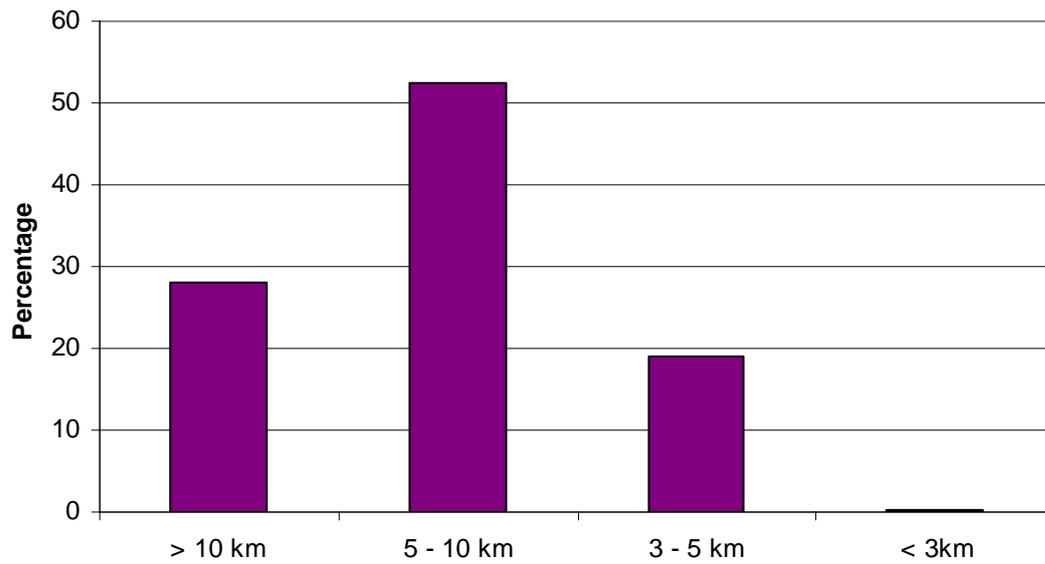


Figure 12 Average trip length driven with children for participants who completed the questionnaire

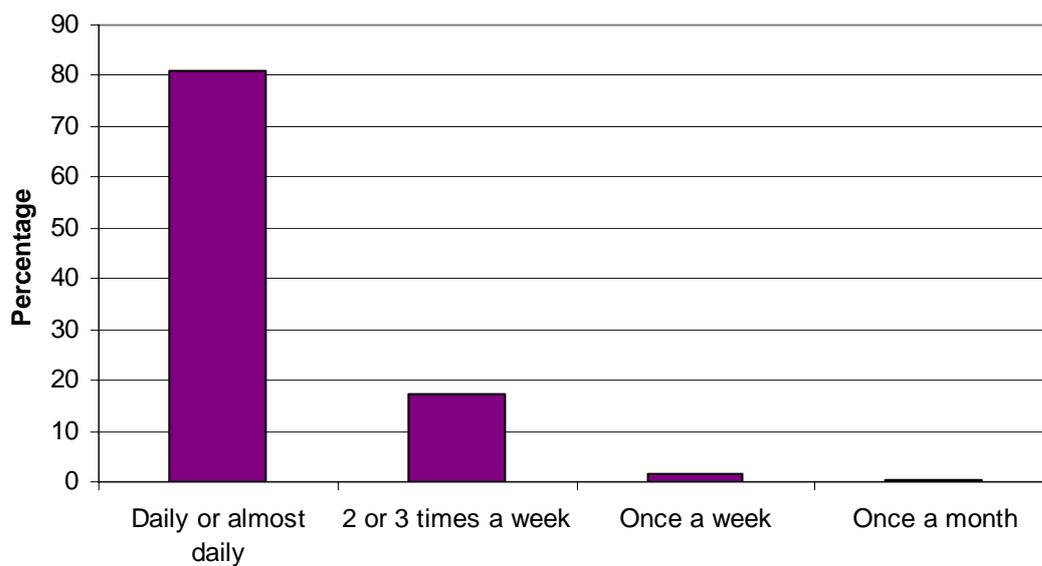


Figure 13 Frequency of driving with children for participants who completed the questionnaire

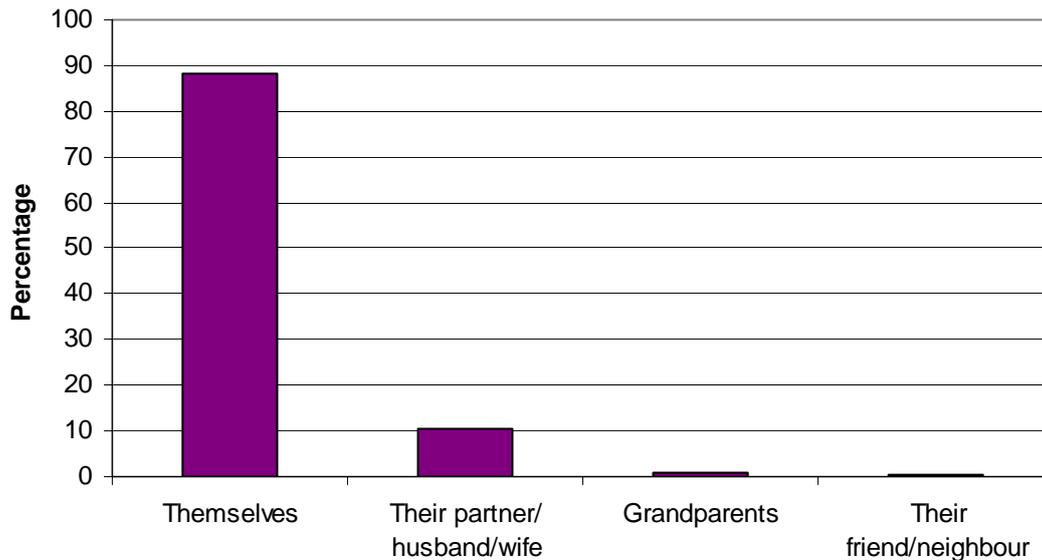


Figure 14 Person who does most of the driving with children for participants who completed the questionnaire

3.2.2 Restraint Use

The next section of the questionnaire was designed to investigate participants’ restraint use and their children’s restraint use while travelling in a vehicle.

Participants were asked how often they wear their seat belt while travelling in a vehicle (‘always/mostly/sometimes/never/not sure’). Almost all parents (99%) indicated that they ‘always’ wore their seat belt while travelling in a vehicle. Similarly, when participants were asked to indicate how often their children were restrained in their vehicle, 99 percent reported that their children were ‘always’ restrained.

Participants were then asked if there were any circumstances under which they would allow their child/children to travel while not restrained (either by a child restraint or a seat belt). Less than one percent of parents indicated that they would allow their child/children to travel unrestrained if: travelling at night, their child was asleep, or their child refused to use the restraint. Less than two percent of parents indicated that they would allow their child/children to travel unrestrained if: their child’s peers were travelling in the vehicle or their child was travelling in someone else’s vehicle. Just fewer than four percent of parents indicated that they would allow their child/children to travel unrestrained if there were not enough restraints for all passengers.

3.2.2.1 Child occupant information, including type of restraint use and seating position

Participants were asked to record their child’s/children’s age, weight, height, current restraint used and typical seating position. The following details are provided for all children aged between 4 and 11 years (see Table 5).

Table 5 Children's Age, Weight, Height and Seating position by Restraint Type

	Booster Seat	Seat Belt
Number	237 (24%)	751 (76%)
Age	Mean = 5.84 years (SD = 1.19) Range = 4 – 10 years	Mean = 8.18 years (SD = 1.84) Range = 4 – 11 years
Gender	Male = 52% Female = 48%	Male = 53% Female = 47%
Weight	Mean = 21.87 kg (SD = 8.62) Range = 13 – 35 kg	Mean = 30.35 kg (SD = 9.51) Range = 12 – 78 kg
Height	Mean = 115.15 cm (SD = 11.53) Range = 48 – 157 cm	Mean = 130.53 cm (SD = 15.63) Range = 45 – 200 cm
Restraint Type	Booster seat = 117 (49%) Booster cushion = 120 (51%)	Seat belt – sash/lap = 716 (95%) Seat belt – lap only = 35 (5%)
Seating position	Car front passenger = 24% Car rear left = 8% Car rear right = 3% Car rear centre = 26% Station wagon front passenger = 13% Station wagon middle left = 4% Station wagon middle centre = 11% Station wagon middle right = 2% Station wagon rear = 1% Van front passenger = 0% Van middle left = 3% Van middle centre = 3% Van middle right = 0% Van rear left = 3% Van rear centre = 0% Van rear right = 0%	Car front passenger = 21% Car rear left = 7% Car rear right = 8% Car rear centre = 24% Station wagon front passenger = 7% Station wagon middle left = 5% Station wagon middle centre = 7% Station wagon middle right = 3% Station wagon rear = 2% Van front passenger = 0% Van middle left = 4% Van middle centre = 5% Van middle right = 4% Van rear left = 5% Van rear centre = 0% Van rear right = 0%

The findings from the questionnaire revealed that children in the booster seat age range were more likely to be restrained by a seat belt (76%) compared to a booster seat (24%).

Children travelling in booster seats were significantly younger, lighter in weight and shorter in height than children traveling in a seat belt (Age: $t(617.75) = 22.964$, $p < 0.001$; Weight: $t(398.49) = 12.25$, $p < 0.001$; Height: $t(430.94) = 14.50$, $p < 0.001$). In addition, children travelling in a booster seat were significantly more likely to be sitting in the front passenger position (for all vehicle types) (38%) compared to children travelling in a seat belt (28%), $\chi^2(1) = 8.157$, $p < 0.01$.

An important aim of this study was to determine if children aged between 4 and 11 years of age were restrained appropriately. While there is no current Australian legislation regarding the appropriateness of restraints for older children, there are some Australian-based guidelines and international recommendations and legislation indicating appropriateness of restraint use based on approximate age, weight and/or height measures. While there are some small variations in these guidelines, for the purpose of the current study, the criterion selected was a relatively conservative measure: Children were appropriately restrained in a booster seat if their height was more than 100 centimetres and less than or equal to 140 centimetres, while children travelling in a seat belt were appropriately restrained if their height was more than 140 centimetres (i.e., NHTSA, 2001). The children's height, rather than their age or weight, was used to assess appropriateness because their height governs the positioning of the lap/shoulder seat belt across the child's shoulder and hips. Based on the height measurements provided by parents, children travelling in a booster seat were significantly more likely to be appropriately restrained (93%) compared to children travelling in a seat belt (25%), $\chi^2(1) = 266.940$, $p < 0.001$. That is, according to the current recommendations, 75 percent of children in the current study were too short to be 'appropriately' restrained by a seat belt. Figure 15 shows the proportion of booster seat aged children restrained 'appropriately' by age.

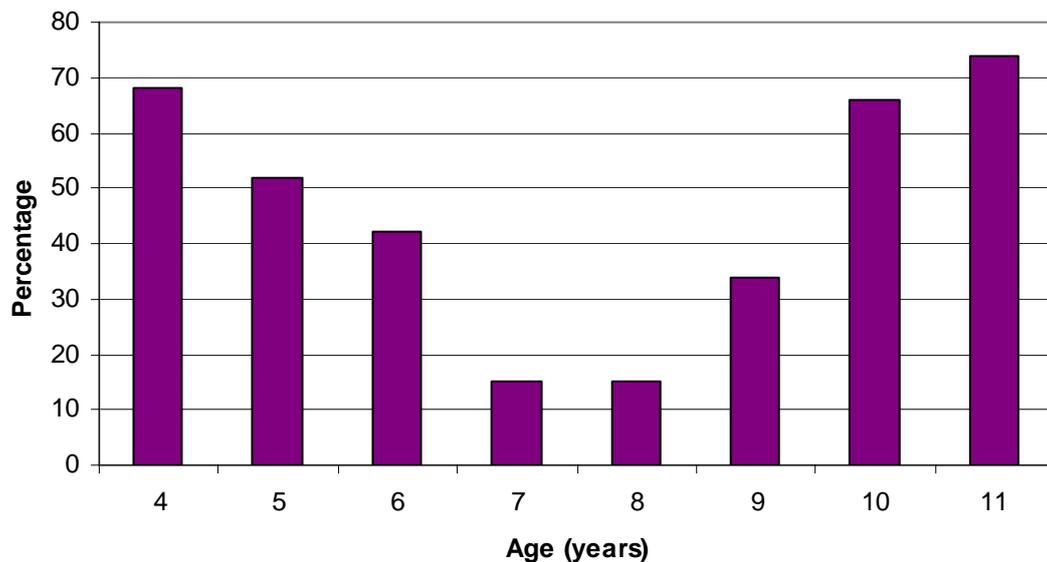


Figure 15 Proportion of booster seat aged children 'appropriately' restrained by age

As shown in Figure 15, the youngest children (4 years) and oldest children (10 and 11 years) were most likely to be restrained 'appropriately' (74%, 66%, 68%, respectively), whereas children aged 7 and 8 years were least likely to be appropriately restrained (15% for each age group).

As outlined earlier, children travelling in a booster seat were significantly more likely to be sitting in the front passenger position in their vehicle compared to children travelling in a seat belt. Previous research has reported that children travelling in the front seat are significantly more at risk of sustaining an injury in the front seat compared to if they were sitting in the rear seat. Consequently, a second measure of children's 'restraint appropriateness' was calculated, incorporating seating position. That is, children were only considered to be travelling appropriately if their height met the height criteria and they were not traveling in the front seat (for both booster seats and seat belts). Once seating

position was taken into account, the proportion of children travelling in a booster seat appropriately decreased from 93 percent to 51 percent. Similarly, the proportion of children travelling appropriately in a seat belt decreased from 25 percent to 15 percent, once seating position had been taken into account.

Nevertheless, children travelling in a booster seat were significantly more likely to be appropriately restrained and sitting in a middle or rear seat (51%) compared to children travelling in a seat belt (15%), $\chi^2(1) = 101.776, p < 0.001$.

Participants were asked to indicate if there were any circumstances when their children's seating positions changed from its typical position. Table 6 shows reasons why children's typical seating positions changed.

Table 6 Reasons that children's typical seating positions differed

Seating positions changes if:	Percentage
There is more than one adult travelling in the vehicle	29%
Travelling on long trips	19%
Travelling on short trips	20%
Other children are travelling in the vehicle	38%
Other reasons	16%

As shown in Table 6, participants indicated that their children's seating positions typically changed when other children were travelling in the vehicle (38%) or when an adult was travelling in the vehicle (29%). For both of these scenarios, parents indicated that the children who typically sat in the front seat generally moved to the back seat to sit with their peers or give the front seat to the adult.

Parents were presented with a series of statements to determine how much they understood about restraining their child while travelling in a vehicle. Most parents agreed with the following statements:

- Babies should travel in a specially fitted capsule (97%);
- Children under the age of 8 years should not sit in the front seat (78%);
- The main benefit of the booster is that the child can sit at a height so that the seat belt is positioned properly (85%);
- Some child restraints are safer than others (59%), and
- There are laws in my State against travelling with unrestrained passengers (97%).

3.2.3 Motor Vehicle Crashes

Participants were asked to indicate if they had been involved in a motor vehicle crash in the past two years, after which the vehicle had to be towed away. Only a small proportion of participants (5%) reported that they had been involved in a motor vehicle crash in the past two years. In addition, 54 percent of participants indicated that their children were passengers in the vehicle at the time of the crash. Finally, most participants indicated that there were 'no injuries' sustained in the crashes (65%), with some participants indicating that at least one passenger sustained minor or serious injuries (23%, 7%, respectively).

3.3 SECTION B: CHILDREN'S USE OF BOOSTER SEATS

The following analyses are based on Section B of the questionnaire. Parents completed this section of the questionnaire if they had a child aged 4 to 11 years currently restrained in their vehicle by a booster seat¹. The analyses below are based on responses from 243 parents from both New South Wales and Victoria.

Firstly, parents were asked to provide the age, gender, weight and height for the child who had most recently moved into a booster seat:

- The mean age for children travelling in a booster seat was 5.37 years (SD = 1.27 years), with children's ages ranging from 1.58 to 10.33 years.
- There were approximately equal proportions of male and female children (46%, 56%, respectively).
- The mean weight was 20.31 kilograms (SD = 4.05 kg), with the children's weights ranging from 12 to 35 kilograms.
- The mean height was 111.83 centimetres (SD = 12.90 cm), with the children's heights ranging from 48 to 156 cm.

A simple calculation was performed to determine if children were being appropriately restrained in their booster seats. Based on the height measurements provided by parents, 85 percent of children were being appropriately restrained in a booster seat according to the current restraint guidelines (i.e., their height was more than 100 centimetres and less than or equal to 140 centimetres).

Parents were asked to indicate how often their child was restrained while travelling in a vehicle (see Figure 16).

¹ Parents with more than one child aged 4 to 11 years were instructed to answer this section of the questionnaire with regard to the child who had most recently moved into a booster seat.

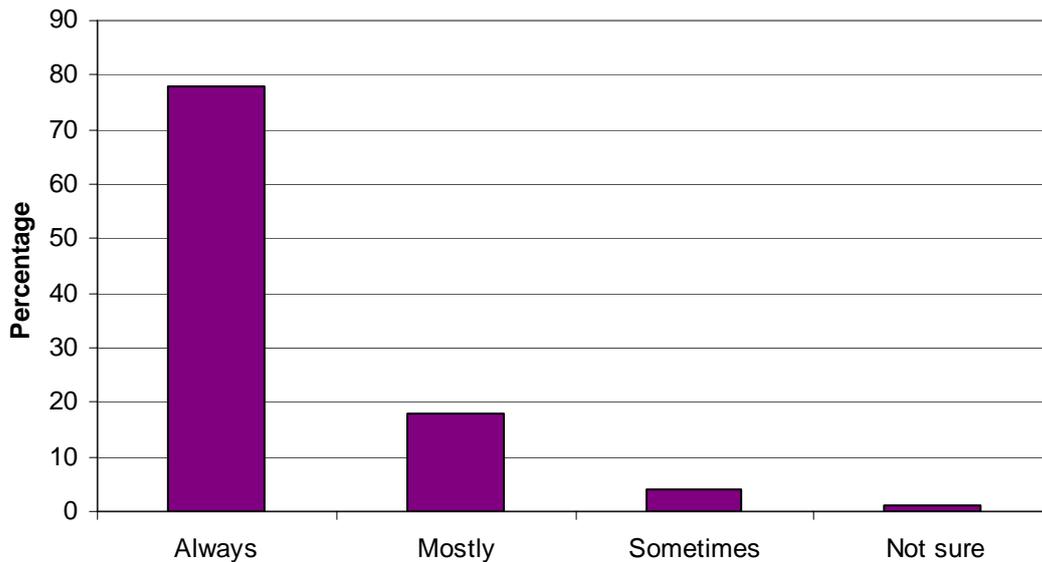


Figure 16 Frequency of booster seat use

As shown in Figure 16, the majority of parents reported that their child was ‘always’ restrained in a booster seat (78%).

Parents were then asked if there were any circumstances under which they would allow their child to travel in a vehicle without a booster seat (just in a seat belt) (see Figure 17). Parents were instructed to indicate as many circumstances as appropriate.

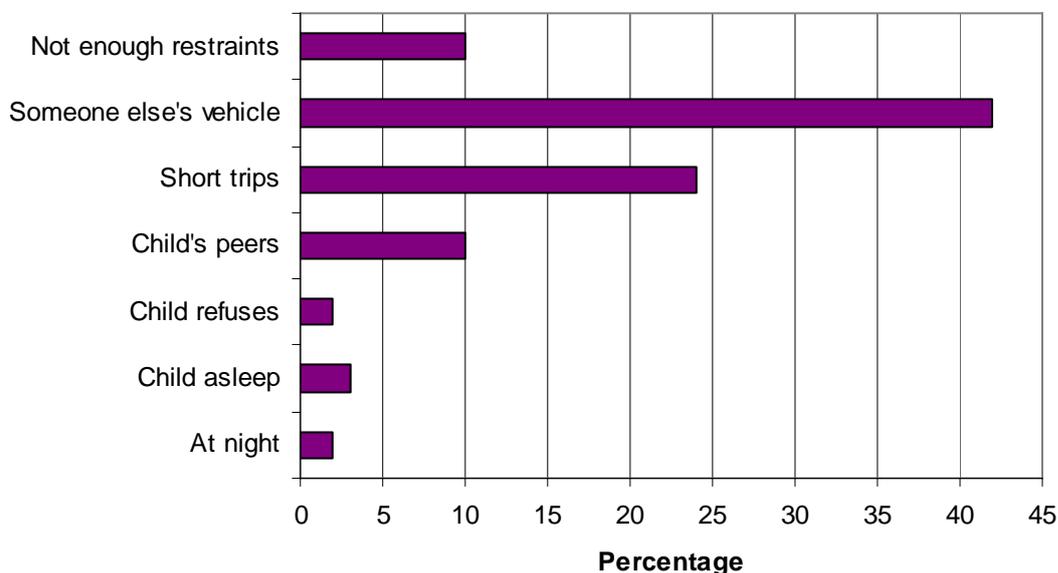


Figure 17 Circumstances under which children were allowed to travel in a vehicle without a booster seat

As shown in Figure 17, most parents indicated that their children were allowed to travel while not restrained in a booster seat when they were travelling in someone else’s vehicle (42%) or when they were travelling on short trips (24%).

Parents were asked to indicate what their child liked and disliked about travelling in their booster seat. The most popular reason provided by parents was that their child *liked* being elevated by the booster seat, and therefore had better visibility out of the window (71%). Other responses included that the children found the booster seat more comfortable/felt better restrained (12%) and that the children could rest their head on the booster seat wings when sleeping (7%).

On the other hand, the most popular reason provided by parents was that their child *disliked* the fact that they couldn't buckle/unbuckle themselves in their booster seat (33%). In addition, some children felt it was unfair that they had to travel in a booster seat when siblings or friends did not (22%), that they found the booster seat uncomfortable (22%) or that they were too big/mature/grown up to travel in a booster seat (20%).

Parents were asked to indicate how they acquired their booster seat. As shown in Figure 18, most parents purchased a new booster seat for their child (77%).

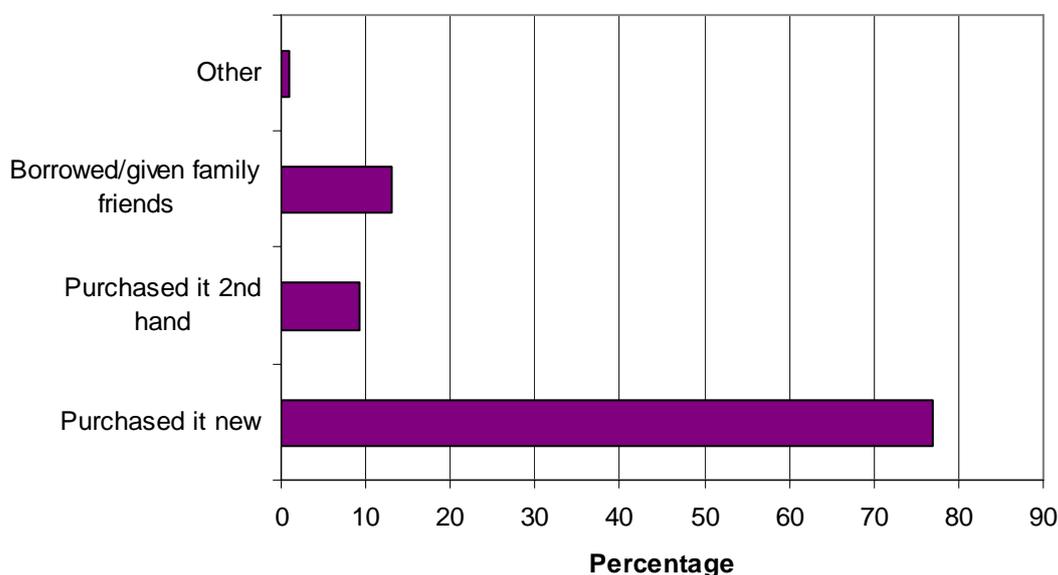


Figure 18 Parents' acquisition of a booster seat for their child

Parents who purchased their booster seat were then asked if they obtained any information about the booster seat before purchasing it. Fifty one percent of participants reported that they did obtain information about the booster seat before purchasing it. Parents who indicated that they had obtained information about the booster seat were then asked to indicate the sources of the information that they obtained (see Table 7).

Table 7 Information sources used when purchasing the booster seat

Information source	Percentage
Maternal and Child Health Centres	20%
Newspapers/Magazines/Brochure/Books	43%
School/Kinder/Playgroup	6%
Word of mouth (family, friend)	32%
RTA/RACV/NRMA Buyers guide	27%
VicRoads/RTA website/brochure	11%
Autoclub website/brochure	8%
Shop where you purchased the restraint	75%
Other (please specify)	1%

As shown in Table 7, most participants indicated that they obtained information about the booster seat from the shop where they purchased the booster seat (75%). Participants were then asked to indicate the most useful source of information that they obtained about the booster seat (see Table 8).

Table 8 Most useful information source used when purchasing the booster seat

Information source	Percentage
Maternal and Child Health Centres	8%
Newspapers/Magazines/Brochure/Books	18%
School/Kinder/Playgroup	3%
Word of mouth (family, friend)	15%
RTA/RACV/NRMA Buyers guide	13%
VicRoads/RTA website/brochure	6%
Autoclub website/brochure	1%
Shop where you purchased the restraint	28%
Other (please specify)	8%

As shown in Table 8, the most useful sources of information about booster seats were obtained by parents from the shop where they purchased the booster seat (28%), as well as information in newspapers/magazines/brochures/books (18%).

Parents who had purchased their booster seat, were then asked to indicate the factors that were priorities (e.g., high/medium/low) to them when choosing which booster seat to purchase. As shown in Figure 19, parents were most likely to report that purchasing a booster seat that met with Australian standards (94%) and that was comfortable for their child (84%) were the highest priorities in the purchase process. On the other hand, the lowest priorities for parents included the style/look/colour of the restraint, the weight of the restraint and the purchase price of the restraint.

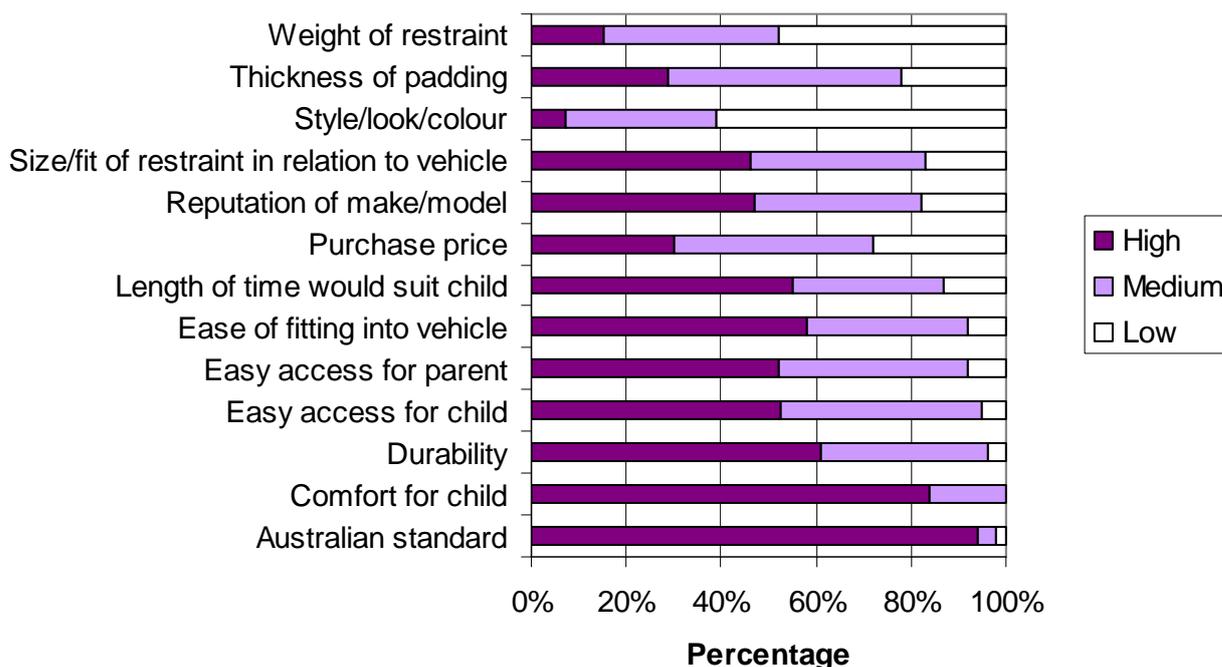


Figure 19 Factors that were priorities (high/medium/low) in the booster seat purchase process

In order to determine the most important factor in the booster seat purchasing process, participants were then asked to rank the factors they had rated as a high priority in order from highest (1) to lowest. Figure 20 shows the factors that were ranked by participants as the most important factor in the booster seat purchasing process.

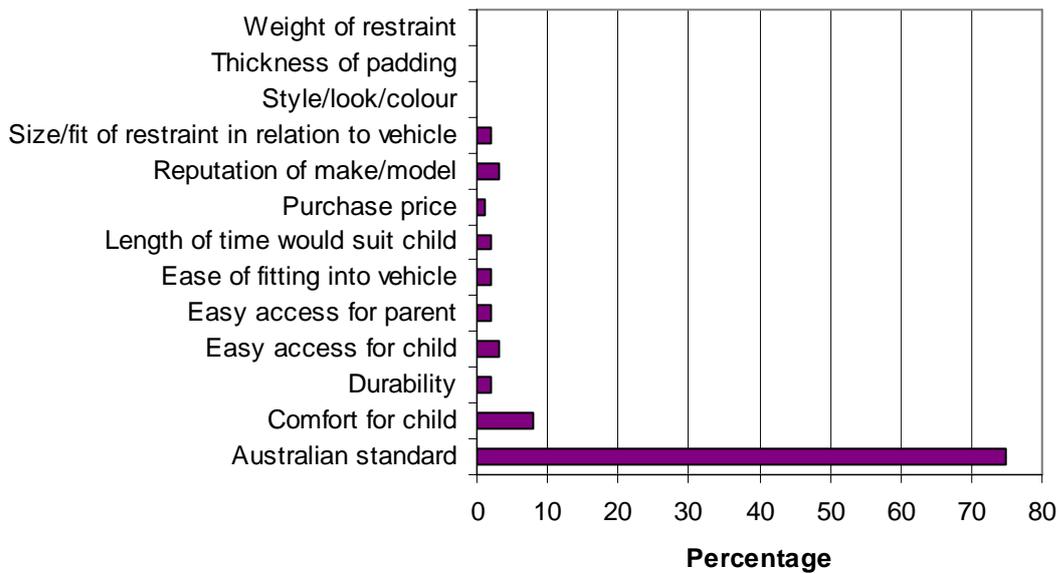


Figure 20 Factors ranked as the highest priority in the booster seat purchase process

As shown in Figure 20, most parents stated that ensuring that the booster seat met with Australian standards was the most important factor in choosing which booster seat to purchase.

In order to investigate the factors that had contributed to the decision making process about when to move their child from a forward facing child restraint to a booster seat, participants were asked to indicate the reasons why they had moved their child into a booster seat (see Table 9).

Table 9 Parents' reasons for moving their child into a booster seat

Reasons	Percentage
My child was too big for the forward facing child restraint	72%
My child disliked sitting in the forward facing child restraint	14%
I needed the forward facing child restraint for a younger child	23%
My child would be more comfortable in a booster seat compared to a forward facing child restraint	43%
My child reached upper end of the weight range recommended by the forward facing child restraint manufacturer	47%
My child would be safer in a booster seat compared to a seat belt	64%
My child thought they were too grown up to sit in a forward facing child restraint	14%
My child's shoulders were above the slots for the harness strap	55%
It would be easier to keep my child restrained in a booster seat compared to a seat belt	21%
A booster provides better visibility for my child compared to a seat belt	52%
My child had their 4 th birthday	7%
My child started kindergarten	5%
My child started primary school	4%

As shown in Table 9, most parents indicated that they had moved their child into a booster seat because their child was too big for the forward facing child restraint (72%) and because their child would be safer in a booster seat compared to a seat belt (64%). It was also interesting to note that factors relating to their child's size were also popular. For example, many parents indicated that they had moved their child because their shoulders were above the slots for the harness strap (55%) and because their child had reached upper end of the weight range recommended by the forward facing child restraint manufacturer (47%).

Parents were then asked to indicate the most important reasons for moving their child into a booster seat (see Table 10).

Table 10 Most important reason for moving their child into a booster seat

Reasons	Percentage
My child was too big for the forward facing child restraint	34%
My child disliked sitting in the forward facing child restraint	1%
I needed the forward facing child restraint for a younger child	6%
My child would be more comfortable in a booster seat compared to a forward facing child restraint	2%
My child reached upper end of the weight range recommended by the forward facing child restraint manufacturer	17%
My child would be safer in a booster seat compared to a seat belt	17%
My child thought they were too grown up to sit in a forward facing child restraint	1%
My child's shoulders were above the slots for the harness strap	19%
It would be easier to keep my child restrained in a booster seat compared to a seat belt	1%
A booster provides better visibility for my child compared to a seat belt	3%
My child had their 4 th birthday	1%
My child started kindergarten	0%
My child started primary school	0%

As shown in Table 10, most participants indicated that the most important reason for moving their child into a booster seat was because their child was too big for their forward facing child restraint (34%), their child's shoulders were above the slots for the harness strap (19%), their child had reached the upper end of the weight range recommended by the forward facing child restraint manufacturer (17%) and that their child would be safer in a booster seat compared to a seat belt (17%).

Participants were then asked about their child's transition from a booster seat to a seat belt. More specifically, participants were asked to anticipate how they would know when to move their child into a seat belt. Most participants indicated that they would move their child into a seat belt when their child reached the upper end of the weight range recommended by the child seat manufacturer (75%) or when their child's eyes were level with the top of the vehicle seat or headrest (47%). On the other hand, 'events' such as the start of kindergarten or primary school accounted for a relatively small proportion of the reasons for graduating their child to a seat belt. When asked to indicate the most important reason for moving their child into a seat belt, most parents stated that it would be when

their child reaches the upper end of the weight range recommended by the child seat manufacture (47%).

3.3.1 Factors associated with the Appropriate Use of Booster Seats

As outlined earlier, one of the main aims of this study was to determine the factors that influence appropriate restraint use in the booster seat age group. To determine the predictive relationship of the factors associated with appropriate use of a booster seat, a series of univariate logistic regression models were performed. Questionnaire factors with a statistical significance value of $p = 0.25$ were accepted, recognising that while a particular variable may not be highly predictive in the univariate sense, it may influence or moderate the effect of another variable. It should be noted that ‘annual household income’ appeared to influence the size of the other variables’ odds ratios within the model and therefore was retained in the model.

The final predictive multivariable model of the factors that influence the appropriate use of a booster seat involved the analysis of 154 participants (65% of the total sample, $n= 237$) and is comprised of the following factors, with relevant odds ratios presented in Table 11:

- Child’s age;
- Child’s gender;
- Child’s weight;
- Parent’s household income, defined as ‘less than \$40,000’, ‘\$41,000-\$75,000’, ‘more than \$75,000’;
- Average trip distance with children in the vehicle, defined as ‘less than 5km’, ‘more than 5 km less, than 10km’, ‘more than 10km’
- Knowledge about child restraints, - ‘I will know to move child from booster seat to a seat when my child’s eyes are level with the top of the seat or headrest’, defined as ‘true’, ‘false’, ‘don’t know’, and
- Parents with another child seated in a seat belt.

The multivariable logistic regression model was strongly predictive of the factors that influence the appropriate use of a booster seat, $\chi^2 (10) = 55.7$, $p \leq 0.001$, with the Hosmer-Lemeshow Goodness-of-fit suggesting good model fit, $p \geq 0.05$. The model was seen to correctly classify 90.91 percent of participants, with the ROC curve indicating ‘good’ discrimination (88%).

Table 11 Odds ratios (95th %CI) for key parameters associated with factors that influence the appropriate use of a booster seat

Predictor		Referent	OR	95 th %CI lower- upper	P
Child Age			2.4	1.24-4.69	.01
Child Weight			1.33	1.06-1.66	.01
Child Gender			3.44	1.07-11.05	.04
Parent's household income	\$41,000-\$75,000	< \$40,000'	4.15	0.74-23.2	.10
	\$75,000+	< \$40,000'	1.26	0.27-5.91	.77
Average Trip Length	> 5km, < 10km	> 10km	0.60	0.14-2.58	.40
	< 5km	> 10km	0.19	0.03-1.25	.08
Move my child into a seat belt when their eyes are level with top of seat or headrest	FALSE	TRUE	4.34	1.05-18.01	.04
	DON'T KNOW	TRUE	9.08	1.85-44.49	.01
With another child in seat belt	Parents with another child in a seat	Parents with only one child in sample	7.63	1.80-32.2	.006

Table 11 presents the odds ratios for key parameters associated the appropriate use of a booster seat. For ease of reading, each is discussed briefly in turn:

- Child age: Every 1 year increase in age was associated with a 2.4 higher likelihood of being seated appropriately in a booster, OR: 2.4, CI: 1.24-4.69, $p < 0.01$;
- Child weight: Every 1 unit increase in weight (kg) was associated with a 1.3 higher likelihood of being seated appropriately in a booster, OR: 1.33, CI: 1.06-1.66, $p < 0.05$;
- Child gender: Female children were 3.4 times more likely to be seated appropriately than male children, OR: 3.44, CI: 1.07-11.05, $p < 0.05$;
- Parent's household Income: Relative to those 'earning less than \$40,000', parents earning between \$41,000-75,000 were 4.15 times more likely to appropriately restrain their child in a booster seat, however this was not statistically significant OR: 4.15, CI: 0.74-23.2, $p = 0.1$. There was no significant difference in the proportion of appropriateness of booster seat use between those earning over \$75,000 and those 'earning less than \$40,000';

- Trip distance: Relative to participants whose average trip length with their children was ‘more than 10 km’, parents with an average trip length of ‘less than 5 km’ were approximately 80 percent less likely to appropriately seat their child in the booster, although this result was not statistically significant, OR: 0.19, CI: 0.03-1.25, $p = 0.08$;
- Knowledge regarding child restraint use - ‘I will know to move my child from booster seat to a seat when my child’s eyes are level with the top of the seat or headrest’: Relative to those parents who answered ‘true’, parents who answered ‘false’ to this question were 4.34 times more likely to use the booster appropriately, OR: 4.34, CI: 1.05-18.01, $p=0.04$. In addition, parents who answered ‘don’t know’ were 9 times more likely to use the booster appropriately than those answering ‘true’ to this statement, OR: 9.08, CI: 1.85-44.49, $p=0.006$, and
- Parents with another child in a seat belt: Relative to parents with only one child in the sample, parents with another child in a seat belt were 7.6 times more likely to use the booster seat appropriately, OR: 7.63, CI: 1.80-32.2, $p=0.006$.

The definition of ‘appropriate’ seating was derived from the child’s height (height was therefore not included in the model). This therefore does not account for appropriate seating in a booster in an inappropriate location in the vehicle, say the front seat. The confidence intervals on some of the parameters were large, however the overall model fits well, with the ROC curve indicating ‘good’ discrimination. Evidently, the high proportion of parents using the booster seats appropriately (83%, $n=155$) compared to the small number and proportion of parents using the booster seat inappropriately (16%, $n=31$) will ensure some of the CIs are large. These do not detract from their overall levels of statistical significance.

3.4 SECTION C: CHILDREN’S USE OF SEAT BELTS

The following analyses are based on Section C of the questionnaire. This section of the questionnaire was completed by parents with a child aged 4 to 11 years, currently restrained in their vehicle by a seat belt². The analyses below are based on the responses from 514 parents from both New South Wales and Victoria.

Firstly, parents were asked to provide the age, gender, weight and height for the child who had most recently moved into a seat belt:

- The mean age for children travelling in a seat belt was 7.8 years (SD = 1.8 years), with children’s ages ranging from 3.5 to 11.4 years.
- There were equal proportions of male and female children (50% for each group).
- The mean weight was 28.57 kilograms (SD = 8.04 kg), with the children’s weights ranging from 12 to 70 kilograms.

² Parents with more than one child aged 4 to 11 years were instructed to answer this section of the questionnaire with regard to the child who had most recently moved into a seat belt.

- The mean height was 127.94 centimetres (SD = 14.75 cm), with the children's heights ranging from 45 to 170 cm.

A simple calculation was performed to determine if children were being appropriately restrained in a seat belt. Based on the height measurements provided by parents, 83 percent of children were **not** being appropriately restrained according to the selected height criteria (i.e., they were not over 140cm).

Participants were asked to indicate the type of restraint that their child had used immediately before moving into a seat belt. Most parents indicated that their children were restrained by a booster seat before being moved into a seat belt (88%), with a small proportion indicating that their children had been moved from a forward facing child restraint straight into a seat belt (7%).

Parents were then asked to indicate the age at which their child was moved into a seat belt. The mean age for children moving into a seat belt was 5.6 years (SD = 1.29 years), with ages ranging from 3 to 9 years (see Figure 21 for the age distribution).

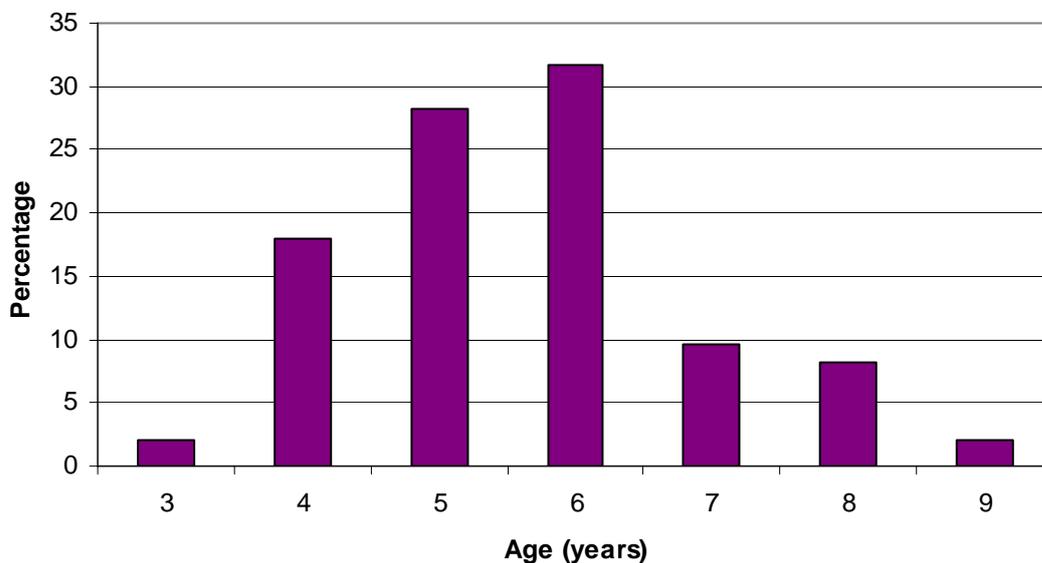


Figure 21 Age distribution for children moving into seat belts.

Parents were asked to list their reasons for moving their child from a forward facing child restraint/booster seat into a seat belt (see Table 12). Participants were instructed to indicate as many reasons as appropriate.

Table 12 Parents' reasons for moving their child into a seat belt

Reasons	Percentage
My child was too big for the forward facing child restraint /booster seat	69%
My child disliked sitting in a forward facing child restraint /booster seat	29%
I needed the forward facing child restraint /booster seat for a younger child	12%
My child would be more comfortable in a seat belt compared to a forward facing child restraint /booster seat	32%
My child reached upper end of the weight range recommended by the forward facing child restraint/booster seat manufacturer	35%
My child would be safer in a seat belt compared to a forward facing child restraint /booster seat	18%
My child thought that they were too grown up to sit in a forward facing child restraint/booster seat	27%
My child had their 4 th birthday	8%
My child started kindergarten	11%
My child started primary school	11%

Most parents indicated that they had moved their child into a seat belt because their child was too big for their forward facing child restraint/booster seat (69%).

Parents were then asked to indicate the most important reason for moving their child into a seat belt (see Table 13).

Table 13 The most important reason for moving their child into a seat belt

Most important reason	Percentage
My child was too big for the forward facing child restraint/booster seat	45%
My child disliked sitting in a forward facing child restraint/booster seat	5%
I needed the forward facing child restraint/booster seat for a younger child	5%
My child would be more comfortable in a seat belt compared to a forward facing child restraint /booster seat	9%
My child reached upper end of the weight range recommended by the forward facing child restraint /booster seat manufacturer	16%
My child would be safer in a seat belt compared to a forward facing child restraint/booster seat	9%
My child thought that they were too grown up to sit in a forward facing child restraint/booster seat	3%
My child had their 4 th birthday	0%
My child started kindergarten	0%
My child started primary school	1%
Other	7%

The most important reasons for moving their child into a seat belt was because their child was too big for their forward facing child restraint/booster seat (45%) and their child had reached the upper end of the weight range recommended by the forward facing child restraint/booster seat manufacturer (16%).

3.4.1 Factors associated with the Appropriate Use of Seat Belts

One of the main aims of this study was to determine the factors that influence appropriate restraint use in the booster seat age group. The proportion of children appropriately restrained in seatbelts was extremely low (25%), a finding that precluded multi-variable logistic regression. The data were analysed using contingency tables. The following factors were significantly associated with the appropriate use of seat belts:

- **Parents' Age:** As the age of the parent increased, the likelihood of restraining their child appropriately significantly increased (18-30 years = 3%; 31-40 years = 13%; 41-49 years = 27%; 50 + years = 36%, $\chi^2(3) = 17.03$, $p \leq 0.01$). However, this finding should be interpreted with caution since less than 5 percent of the participants were aged 50 years or older;

- **Vehicle Type:** Participants with smaller vehicles (i.e., 2 door vehicles) were significantly more likely to appropriately restrain their child (38%) compared to participants with a 4 door sedan (15%), $\chi^2(2) = 6.2, p < 0.05$;
- **Kilometres driven with children per week:** Participants who drove more kilometres per week with their children (more than 200 km) were significantly more likely to restrain their child appropriately (29%) compared to participants who drove fewer kilometres per week (less than 100 km) with their children (18%), $\chi^2(2) = 7.4, p < 0.05$;
- **Parents without a child in a booster seat:** Participants without another child travelling in a booster seat were significantly more likely to restrain their child appropriately (20%) compared to participants with a child travelling in a booster seat (8%), $\chi^2(1) = 7.33, p < 0.01$;
- **Child's Age:** Older children were significantly more likely to be restrained appropriately, in that there was a significant difference in the mean age of children restrained appropriately ($M = 10.16$ years, $SD = 0.96$ years) and inappropriately ($M = 7.44$ years, $SD = 1.12$ years), $t(388) = 14.15, p < 0.0001$. In addition, a univariate logistic regression model revealed that every 1 year increase in the child's age was associated with a 4.21 higher likelihood of being seated appropriately in a seat belt, OR: 4.21, CI: 3.03-5.84, $p < 0.0001$, and
- **Child's Weight:** Heavier children were significantly more likely to be restrained appropriately, in that there was a significant difference in the mean weight of children restrained appropriately ($M = 39.84$ kg, $SD = 8.35$ kg years) and inappropriately ($M = 26.38$ kg, $SD = 5.71$ kg), $t(380) = 15.93, p < 0.0001$. In addition, a univariate logistic regression model revealed that every 1 kilogram increase in the child's weight was associated with a 1.32 higher likelihood of being seated appropriately in a seat belt, OR: 1.32, CI: 1.24-1.41, $p < 0.0001$.

Three additional factors were identified as predictors of appropriate use of seatbelts, however the trends described below did not reach statistical significance:

- **State of Residence:** Victorian participants were more likely to restrain their child appropriately (23%) compared to participants from New South Wales (15%), $\chi^2(1) = 3.28, p = 0.07$;
- **Marital Status:** Divorced participants were more likely to restrain their child appropriately (29%) than married/defacto participants (17%) and single participants (0%), $\chi^2(2) = 5.6, p = 0.06$. It is important to note however that fewer than 10 percent of parents were either single or divorced; and
- **Average Trip Length:** Participants with higher average trip lengths (more than 10 km) were more likely to appropriately restrain their child (25%) compared to participants with shorter trip lengths (5-10 km = 17%; less than 5 km = 12%), $\chi^2(2) = 5.3, p = 0.07$.

4 SUMMARY AND DISCUSSION

The broad aim of this study was to gain a more detailed understanding of the restraint usage rates, patterns of restraint usage and ‘appropriateness’ of restraint use by children in the ‘booster seat age’. In addition, another aim of the study was to determine the factors that influence appropriate restraint use for children in the booster seat age group.

Six hundred and ninety nine parents from the States of New South Wales and Victoria completed a questionnaire regarding restraint use by their children aged 4 to 11 years. The questionnaire asked parents to answer questions about their restraint use, their children’s restraint use, their travel patterns, their motor vehicle crash history, as well as a range of demographic questions.

4.1 INFORMATION ABOUT PARENTS WHO COMPLETED THE QUESTIONNAIRE

All parents who participated in the study completed the first section of the questionnaire which asked them to answer a range of demographic, driving and crash history questions.

The key demographic characteristics of the parents who completed the questionnaire were as follows:

- female (88%);
- aged between 31 to 45 years (82%);
- married (78%);
- living in a metropolitan area (36%);
- living in the State of NSW (70%);
- earning between \$41,000 and \$75,000 per year (33%); and
- had finished a higher degree or technical school/TAFE course (52%).

When the demographic characteristics of the participants were compared to the demographic characteristics of parents with at least one child under the age of 15 years reported in the 2001 Australian Bureau of Statistics Census data (2001), the comparison revealed that parents in the current sample were more likely to be: female; residing in metropolitan areas and in the State of NSW; and more likely to have completed secondary school or a university degree.

In addition, analysis of the driving-related characteristics of the sample showed that parents:

- usually drove their children in a four door sedan (44%);
- typically drove less than 100 kilometres per week with their children (61%);
- typically travelled between five and ten kilometres on most trips with their children (53%);

- drove their children daily or almost daily (81%), and
- were the person that drove their children the most (88%).

When asked about their motor vehicle crash history in the past two years, only a small proportion of participants (5%) reported that they had been involved in a motor vehicle crash where the vehicle had to be towed away. Fifty four percent of the participants who were crash involved indicated that their children were passengers in the vehicle at the time of the crash. Finally, most participants indicated that there were ‘no injuries’ sustained in the crashes (65%), with some participants indicating that at least one passenger sustained minor or serious injuries (23%, 7%, respectively).

4.2 RESTRAINT USAGE RATES, PATTERNS OF RESTRAINT USAGE AND ‘APPROPRIATENESS’ OF RESTRAINT USE

In the questionnaire, parents were asked about their own and their children’s seating position and restraint use while travelling in a vehicle. Almost all parents (99%) indicated that they ‘always’ wore their seat belt while travelling in a vehicle. Similarly, when participants were asked to indicate how often their children are restrained in their vehicle, 99 percent reported that their children were ‘always’ restrained.

Participants were then asked if there were any circumstances under which they would allow their child/children to travel while not restrained (either by a booster seat or by a seat belt). Less than one percent of parents indicated that they would allow their child/children to travel unrestrained if: travelling at night, their child was asleep, or their child refused to use the restraint. Less than two percent of parents indicated that they would allow their child/children to travel unrestrained if: their child’s peers were travelling in the vehicle or their child was travelling in someone else’s vehicle. Just fewer than four percent of parents indicated that they would allow their child/children to travel unrestrained if there were not enough restraints for all passengers.

When asked to indicate the type of restraint that their children travelled in, only 24 percent of children aged between 4 to 11 year olds were travelling in a booster seat, while the remaining 76 percent were travelling in a seat belt. The large proportion of children aged 4 to 11 years travelling in a seat belt is consistent with the findings from several international observational studies that have reported high proportions of seat belt wearing rates (i.e., up to 75%) in the booster seat age group (Decina & Knoebel, 1997; Ramsey et al., 2000).

Not surprisingly, children travelling in booster seats were significantly younger, lighter (in terms of their weight) and shorter (in terms of their height) than children travelling in a seat belt. This is consistent with the findings reported by Durbin et al. (2003) who reported that child restraint use is generally higher for younger children. However what was surprising was that children travelling in a booster seat were significantly more likely to be sitting in the front passenger position (for all vehicle types) (38%) compared to children travelling in a seat belt (28%).

When asked whether there were circumstances under which their children’s seating positions changed from its typical position, most parents indicated children’s seating positions typically changed when other children were travelling in the vehicle (38%) or when another adult was travelling in the vehicle (29%). In both of these scenarios, parents

indicated that children who typically travelled in the front seat generally moved into the rear seat to sit with their peers or to give the front seat to the adult.

An important aim of this study was to determine if children aged between 4 and 11 years of age were being appropriately restrained while travelling in their vehicle. While there is no current Australian legislation regarding the appropriateness of restraints for older children, there are a number of Australian-based guidelines and international recommendations and legislation indicating appropriateness of restraint use based on approximate age, weight and/or height measures. While there is some small variation in these guidelines, for the purposes of this study, the criterion selected was a relatively conservative measure: Children were appropriately restrained in a booster seat if their height was more than 100 centimetres and less than or equal to 140 centimetres, while children travelling in a seat belt were appropriately restrained if their height was more than 140 centimetres (i.e., NHTSA, 2001). The children's height, rather than their age or weight, was used to assess appropriateness because their height governs the positioning of the lap/shoulder seat belt across the child's shoulders and hips. Based on the height measurements provided by parents, children travelling in a booster seat were significantly more likely to be appropriately restrained (93%) compared to children travelling in a seat belt (25%). That is, according to the current guidelines, 75 percent of children in the current sample are too short to be properly restrained by the seat belt.

When restraint appropriateness was investigated across the age range, children at the lower (4 year olds) and upper (i.e., 11 & 10 year olds) ends of the age group were most likely to be restrained appropriately, whereas children in the middle of the age range (i.e., 7 and 8 year olds) were least likely to be restrained appropriately, and are therefore at the greatest risk of injury if involved in a motor vehicle crash.

In addition as outlined earlier, children travelling in a booster seat were significantly more likely to be sitting in the front passenger position in their vehicle compared to children travelling in a seat belt. Previous research conducted by Braver et al. (1998), Berg et al. (2000) and Brown et al. (2005) has reported that children travelling in the front seat are significantly more likely to sustain an injury while sitting in the front seat compared to if they were travelling in a rear seat. Consequently, a second measure of children's 'restraint appropriateness' was calculated, incorporating seating position. That is, children were only considered to be travelling appropriately if their height met the current Australian restraint guidelines and they were not traveling in the front seat (for both booster seats and seat belts). Once seating position was taken into account, the proportion of children travelling appropriately in a booster seat decreased from 93 percent to 51 percent. Similarly, the proportion of children travelling appropriately in a seat belt decreased from 25 percent to 15 percent, once seating position had been taken into account.

These findings are consistent with a number of previous studies that have reported that a relatively high proportion of children are commonly 'graduated' to seat belts too early. That is, children who grow out of a CRS suitable for young children move directly into a seat belt rather than using a booster seat (Ramsey et al., 2000; Winston et al., 2000). One explanation for the premature graduation to seat belts could be that parents are confused about the appropriate thresholds for transition from a forward facing child restraint to a booster seat as well as the transition from a booster seat to a seat belt (Rivara et al., 2001). The underlying explanations for the inappropriate use of adult restraints, particularly by the "booster seat age group" is likely to be complex and is explored in more detail in the next section.

4.2.1 Children's Use of Booster Seats

Children's use of booster seats was examined using the responses from 243 parents with a child aged 4 to 11 years, currently restrained in their vehicle by a booster seat.

Firstly, parents were asked to provide the age, gender, weight and height for the child who had most recently moved into a booster seat:

- The mean age for children travelling in a booster seat was 5.37 years (SD = 1.27 years), with children's ages ranging from 1.58 to 10.33 years.
- There were approximately equal proportions of male and female children (46%, 56%, respectively).
- The mean weight was 20.31 kilograms (SD = 4.05kgs), with the children's weights ranging from 12 to 35 kilograms.
- The mean height was 111.83 centimetres (SD = 12.90cm), with the children's heights ranging from 48 to 156 cm.

Based on the height measurements provided by parents, 85 percent of children were appropriately restrained in a booster seat according to the current restraint guidelines (i.e., their height was more than 100 centimetres and less than or equal to 140 centimetres).

Parents were asked to indicate how often their child was restrained while travelling in a vehicle. The majority of parents reported that their child was 'always' restrained in their booster seat (78%). When asked if there were any circumstances under which they would allow their child to travel in a vehicle without a booster seat (i.e., in a seat belt), most parents indicated that it would be if their child was travelling in someone else's vehicle (42%) or when they were travelling on short trips (24%).

Parents were asked to indicate what their child liked and disliked about travelling in their booster seat. The most popular reason provided by parents was that their child *liked* being elevated by the booster seat, and therefore had better visibility out of the window (71%). Other responses included that the children found the booster seat more comfortable/felt better restrained (12%) and that the children could rest their head on the booster seat wings when sleeping (7%). Since these are factors that appeal to children, it is likely that they could be influential in promotion of booster seat use amongst children. On the other hand, the most popular reason provided by parents was that their child *disliked* the fact that they couldn't buckle/unbuckle themselves in their booster seat (33%). In addition, some children felt it was unfair that they had to travel in a booster seat when siblings or friends did not have to (22%), that they found the booster seat uncomfortable (22%) or that they were too big/mature/grown up to travel in a booster seat (20%). This finding is consistent with previous research conducted by Rivara et al. (2001) and Winston et al. (2004) which showed that one of the main barriers towards the use of booster seats was the "young child's desire to act grown up and not to have to sit in any type of restraint".

When asked about their child's booster seat, most participants indicated that they had purchased the booster seat new (77%). However, only 51 percent of parents appeared to regard the purchase of the booster seat as an important task that merited doing at least some homework. In addition, fairly 'low engagement' methods of obtaining information predominated, for example from the shop where they purchased the booster seat (75%).

When asked to indicate the factors that were important to them when choosing which booster seat to purchase, most participants reported that it was important to purchase a seat that met with Australian standards (94%) and that was comfortable (84%).

In order to investigate the factors that are involved in the decision making process about when to move their child from a forward facing child restraint to a booster seat, participants were asked to indicate the reasons why they had moved their child into a booster seat. Most parents indicated that they had moved their child into a booster seat because their child was too big for the forward facing child restraint (72%) and their child would be safer in a booster seat compared to a seat belt (64%). In addition, most participants indicated that the most important reason for moving their child into a booster seat was because their child was too big for their forward facing child restraint (34%).

Participants were then asked about their child's transition from a booster seat to a seat belt. More specifically, participants were asked to indicate how they would know when to move their child into a seat belt. Most participants indicated that they would move their child into a seat belt when their child reached the upper end of the weight range recommended by the child seat manufacturer (75%). Fewer parents of children currently using booster seats (47%) indicated that they would rely on height-based criteria (such as the position of child's eyes in relation to the top of the vehicle seat or headrest). This suggests that there needs to be a greater public awareness of the importance of height-based measures and goodness of fit of the seat belt to assist parents in knowing when their child should make the transition from boosters to seat belts.

4.2.1.1 Factors associated with the Appropriate Use of Booster Seats

One of the main aims of this study was to explore the factors that are associated the appropriate use of a booster seat. In order to investigate these factors, a multivariate logistic regression model was performed which revealed a number of key predictors of appropriate booster seat use. These are discussed below.

The first three key predictors related to the child. The child's age and weight were observed to be associated with being seated appropriately in a booster seat in the vehicle. This finding is not surprising given that 'appropriateness' of booster seat use was determined by using the child's height and that children typically grow taller as they get older. In addition, female children were more than three times more likely to be seated appropriately than male children. It is important to note that there was no significant difference in terms of height and weight for females and males. One explanation could be that female children may be more compliant in terms of being restrained in a booster seat, however this needs to be explored in future research.

The next three key predictors related to the parents. First, parents in the highest income bracket were more likely to seat their child appropriately than those in the lowest income bracket, although there was no difference for those in the middle-income bracket. This finding is consistent with previous research that showed a positive relationship between driver socioeconomic status (education and income) and frequency of CRS use (Wagenaar et al., 1988; Russell et al., 1994). Secondly, parents driving longer distances were more likely to seat their child appropriately than parents driving shorter distances. One possible explanation for this finding could be that parents who drive with their children more may be aware that they are increasing their children's driving exposure, and therefore crash risk, and therefore appropriate restraint may be more important to them. Thirdly, parents who answered 'false' to the statement "*I will know to move my child from a booster seat to a*

seat belt when my child's eyes are level with the top of the seat or headrest” were over four times more likely to use the booster appropriately, compared to parents who answered ‘true’. In addition, parents who answered ‘don’t know’ were nine times more likely to use the booster appropriately than those answering ‘true’. One explanation for this finding could be that the parents answering ‘false’ or ‘don’t know’ were following the booster seat manufacturer’s instructions for the upper limit of the booster seat manufacturer’s recommendations.

The final key predictor related to the restraint use of other children in the vehicle. Parents with another child in a seat belt were almost eight times more likely to be using a booster seat appropriately compared to parents without a child in a seat belt, a result that could be indicative of more experience in using booster seats for the older child.

4.2.2 Children’s Use of Seat Belts

Children’s use of seat belts was examined using the responses from 514 parents with a child aged 4 to 11 years, currently restrained in their vehicle by a seat belt.

Firstly, parents were asked to provide the age, gender, weight and height for the child who had most recently moved into a seat belt:

- The mean age for children travelling in a seat belt was 7.83 years (SD = 1.77 years), with children’s ages ranging from 3.5 to 11.42 years.
- There were equal proportions of male and female children (50% for each group).
- The mean weight was 28.57 kilograms (SD = 8.04 kg), with the children’s weights ranging from 12 to 70 kilograms.
- The mean height was 127.94 centimetres (SD = 14.75 cm), with the children’s heights ranging from 45 to 170 cm.

A simple calculation was performed to determine if children were being appropriately restrained in a seat belt. Based on the height measurements provided by parents, 83 percent of children were **not** being appropriately restrained according to the selected height criteria (i.e., they were not over 140cm).

When asked to indicate the type of restraint that their child had used immediately before moving into a seat belt, most parents indicated that their child had moved from a booster seat (88%), with a small proportion indicating that their child had been moved from a forward facing child restraint (7%). This finding indicates that the majority of parents are aware of the continued use of child restraint use beyond the toddler age group. However, the lack of definitive legislation regarding ‘appropriate’ restraints for older children appears to contribute to some level of confusion about when children should be moved into a seat belt. This may in turn contribute to the apparent widespread practice of premature graduation of children into seat belts, placing them at an unnecessarily higher risk of serious injury.

Parents were then asked to indicate the age at which their child was moved into a seat belt. The mean age for children moving into a seat belt was 5.62 years (SD = 1.29 years), with ages ranging from 3 to 9 years.

Parents were asked to list the reasons that they had moved their child from a forward facing child restraint/booster seat into a seat belt. Most parents indicated that they moved their child into a seat belt because their child was too big for their forward facing child restraint/booster seat (69%), their child was old enough not to slide out of the seat belt unaided (38%) or that their child would be more comfortable in a seat belt compared to a forward facing child restraint/booster seat (32%).

4.2.2.1 Factors associated with the appropriate use of seat belts

A number of factors were found to be associated with appropriate seat belt use. Consistent with the findings for appropriate booster seat use, the child's age and weight were observed to be positively associated with being appropriately restrained in a seat belt. Three other key predictors of appropriate seat belt use were related to the parents and their driving patterns. Firstly, parents with smaller vehicles (i.e., 2 door vehicles) were significantly more likely to appropriately restrain their child compared to participants driving a 4 door sedan. Secondly, consistent with the relationship observed between trip length and appropriateness of booster seat, parents driving more kilometers per week with their children in the vehicle were significantly more likely to restrain their child appropriately compared to participants driving fewer kilometers per week. As outlined earlier, one possible explanation for this finding could be that parents who drive with their children more may be aware that they are increasing their children's driving exposure, and therefore crash risk, and therefore appropriate restraint may be more important to them. Thirdly, as the age of the parent increased, the likelihood of restraining their child appropriately increased. Reasons for this finding are not clear, however, one possible explanation is that older parents may make more appropriate restraint choices because they have had more exposure to information about correct restraint use, possibly through experience with older children in their family. Finally, appropriate seat belt use was also found to be related to use of other booster seats in the vehicle. Parents without another child travelling in a booster seat in their vehicle were significantly more likely to restrain their child appropriately compared to participants with a child travelling in a booster seat. One explanation for this finding could be that parents with a younger child travelling in a booster seat in their vehicle may have had to move their older child prematurely into a seat belt to make room for the younger child.

4.3 LIMITATIONS

There are some limitations of this study that warrant some discussion. Firstly, the 'appropriateness' of restraint use was calculated using the height measurements provided by parents in the questionnaire. Although parents were encouraged to provide their child's current height measurement, it is not possible to determine if the provided measurements were current and/or accurate.

In addition, some children may have been moved into a seat belt because they exceeded the weight range recommended by the booster seat manufacturer (rather than their height), and therefore for the purpose of the current study would be deemed 'inappropriate'. However, given that it is the children's height, rather than their age or weight, that governs the positioning of the lap/shoulder seat belt across the child's torso and hips, height was chosen to calculate restraint appropriateness (NHTSA, 2001).

Although the current recruitment procedure endeavoured to ensure representativeness of participants on the basis of geographic location (i.e., recruited participants from both urban

and rural areas in both States), parents in the current sample were more likely to be residing in metropolitan areas and in the State of NSW, as well as being more likely to be female and to have completed secondary school or a university degree compared to the data provided by parents in the 2001 Australian Census. However, it should be noted that the sample was relatively representative of the population on the remaining variables, including age, marital status and household income. While the current sample of participants is perhaps less representative of the population, this limitation is an inherent problem of surveys of this kind.

The results demonstrated a high rate of parents who always wear a seatbelt (99%) and always restrain their children (99%). The vigilance of the participants in this survey is greater than that shown by crash data, where 10 percent of children who were injured or killed were not restrained and in 30 percent of cases, the victim's restraint status was unknown. This difference may be the result of a "volunteer bias," in that those individuals who agreed to participate in the study are systematically more vigilant about seatbelt and/or booster seat usage than non-participants. Alternatively, the difference could also be the result of a "reporting bias" Previous research involving self-reports of socially unacceptable behaviours, such as smoking, has shown that some participants tend to deny engaging in socially unacceptable behaviours in research settings (Suadicani, Hein & Gyntelberg, 1997). A similar effect may have occurred in these results; however, it is expected that the anonymity of surveys would have helped to control for it.

Notwithstanding these limitations, the study has provided some interesting and valuable information on which to base countermeasures and further research.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The results of this study revealed that only 24 percent of children in the 'booster seat age range' (i.e., 4 to 11 years) were travelling in a booster seat, with the remaining children travelling in a seat belt. The findings from this study also showed that children travelling in a booster seat were significantly more likely to be appropriately restrained (93%) compared to children travelling in a seat belt (25%).

One of the surprising findings from this study was that children travelling in a booster seat were significantly more likely to be sitting in the front passenger position in their vehicle compared to children travelling in a seat belt. Consequently, once seating position was taken into account, the proportion of children travelling appropriately decreased from 93 percent to 51 percent for booster seats and 25 percent to 15 percent for seat belts.

It was interesting to note that most parents of children currently restrained by a seat belt indicated that their children had moved into the seat belt from a booster seat (88%). This finding indicates that the majority of parents have good intentions regarding the appropriate restraint of their children. However, the lack of definitive legislation regarding 'appropriate' restraints for older children appears to be resulting in confusion about when children should be moved into a seat belt and therefore parents are prematurely graduating their children into seat belts and placing them at an unnecessarily higher risk of serious injury.

This study has provided a rich source of information regarding restraint usage rates, patterns of restraint usage and ‘appropriateness’ of restraint use by children in the ‘booster seat age’, as well as the attitudes of parents of children in the booster seat age group towards restraint wearing behaviour. Based on the findings of this study, a number of recommendations are made for strategies to enhance appropriate restraint use for the booster seat age group as well as future research.

5.1.1 Recommendations for promoting booster seat use

Based on the findings from this study, a key recommendation is the need for more definitive Australian legislation pertaining to child restraint use for older children. As outlined earlier, such legislation has the potential to have a dramatic positive effect on children’s restraint wearing rates (Winston et al., 2004), presumably because it reduces parents’ confusion about when to move their child from a forward facing child restraint into a booster seat and from a booster seat in to a seat belt.

In addition, guidelines provided by the child restraint manufacturers should include the upper end of the height range, rather than just the upper end of the weight range, since height, particularly seated height, plays a significant role in determining the correct alignment of the seat belt on the child’s pelvis and shoulder. This correct alignment is critical in reducing the potential for abdominal and neck injuries resulting from motor vehicle crashes.

Another strong recommendation emerging from this study is the need for development of improved educational and awareness materials and programs for both parents and children to enhance appropriate restraint use for the booster seat age group.

Such material should include the following information:

- The safety benefits associated with CRS use, particularly the benefits associated with booster seat use;
- Injury risks associated with the premature graduation into seat belts;
- Information regarding appropriate transition (especially highlighting the importance of using their children’s height as an indicator rather than their age or weight) from:
 - forward facing child restraints to a booster seats
 - booster seats to seat belts;
- Safety benefits associated with rear seat positioning; and,
- Tips for parents to encourage their child/children to remain restrained in the appropriate restraint type until they meet the height requirements for the next restraint type.

In addition, the distribution of this information is critical. The results of this study showed that parents primarily seek information at the point of purchase of restraint systems. However, little is known about the quality and nature of the information distributed at those sources. Clearly it will be important to explore how clear and effective safety messages can be distributed to both parents and children.

Current information on CRS available in Australia appears to be primarily directed towards parents. However, to maximise the effectiveness of this road safety message, it will be critical that children are also involved as active participants in road safety awareness campaigns. The EUCHIREES campaign, which has been adopted across a number of European countries, provides a useful model for a child-centred safety message on booster seat use.

5.1.2 Recommendations for further research

This study has provided detailed information regarding restraint usage rates, patterns of restraint usage and ‘appropriateness’ of restraint use, however there is still much to be learned about the factors that are associated with ‘appropriate’ restraint use by older children in the ‘booster seat age’ group. For example, while the current study has provided some information about the influence of parent’s demographic information, attitudes towards road safety and restraint wearing behaviour on their child’s restraint use, the study has not explored the influence of children’s attitudes towards restraint use. This may be important since children at this age are beginning to develop more mature decision making processes and forming their own set of attitudes and beliefs that could influence their restraint wearing behaviour. Such research may be able to identify potential barriers to restraint use in the booster seat age group, and therefore potential strategies to overcome inappropriate use.

6 REFERENCES

- Arbogast, K., Durbin, D., Kallan, M. & Winston, F. (2005). Evaluation of paediatric use of patterns and performance of lap shoulder belt systems in the centre rear. *Association for the Advancement of Automotive Medicine*, September 12-14, Boston.
- Arbogast, K., Kallan, M. & Durbin, D. (2005). Effectiveness of high back and backless belt-positioning booster seats in side impact crashes. *Association for the Advancement of Automotive Medicine*, September 12-14, Boston.
- Australian Bureau of Statistics (2001). Census of Population and Housing. Available at <http://www.abs.gov.au/websitedbs/d3310114.nsf/home/Previous%20Censuses:%20Census%20data>
- ABS. (2006). Population by Age and Sex, Australian States and Territories: Estimated Resident Population By Single Year Of Age, New South Wales. Cat. No.3201.0. Retrieved 28 June, 2006, from <http://www.abs.gov.au>
- Australian Transport Safety Bureau (2004a). Road Safety Statistics Report. Serious Injury Due to Road Crashes. <http://www.atsb.gov.au/publications/2004/rfa2004.aspx>
- Australian Transport Safety Bureau (2004b). A simple guide to Child Restraints. http://www.atsb.gov.au/pdfs/child_restraints.pdf.
- Better Health Victorian Government (2005). Child safety in the car. http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Child_safety_in_the_car?OpenDocument.
- Berg, M., Cook, L.J., Corneli, H., Vernon, D., Dean, J.M. (2000). Effect of Seating Position and Restraint Use on Injuries to Children in Motor Vehicle Crashes. *Pediatrics*, 105(4), 831-835.
- Braver, E., Whitfield, R. & Ferguson, S.A. (1998). Seating positions and children's risk of dying in motor vehicle crashes. *Injury Prevention*, 4, 181-187
- Brown, J., Bilston, L., McCaskill, M. & Henderson, M. (2005). Identification of Injury Mechanisms for Child Occupants aged 2-8 in Motor Vehicle Accidents. Report for the Motor Accidents Authority, NSW.
- Boyle, J. & Sharp, K. (1997). *1996 Motor Vehicle Occupant Safety Survey, Volume 5: Car Safety Seat Report (Survey Results DOT HS 808 634)*. Washington D.C.: National Highway Traffic Safety Administration.
- Decina, L.E. & Knoebel, K.Y. (1996). *Patterns of Misuse of Child Safety Seats (report no. DOT HS-808-440)*. Department of Transportation, Washington, DC.
- Decina, L.E. & Knoebel, K.Y. (1997). Child safety seat misuse in four states. *Accident Analysis and Prevention*, 29, 125-132.
- Durbin, D. (2001). Booster seat use and effectiveness in crashes. Booster Seats for Children. Closing the Gap Between Science and Public Policy. *Association for the Advancement of Automotive Medicine*, April 23-24, Washington DC.

- Durbin, D., Chen, I., Smith, R., Elliott, M.R. & Winston, F. (2005). Effects of Seating Position and Appropriate Restraint Use on the Risk of Injury to Children in Motor Vehicle Crashes. *Pediatrics*, 115(3): 305 - 309.
- Durbin, D.R., Cornejo, R.A., Chen, I, Williams, A. & Wells, J. (2003). Variation in child restraint transitions and consistency of restraint use. *47th Annual Proceedings of the Association for the Advancement of Automotive Medicine*, Sept 22-24, Lisbon.
- Eby, D.W., Bingham, C.R., Vivoda, J.M. & Ragunathan, T. (2005). Use of booster seats by Michigan children 4-8 years if age. *Accident Analysis and Prevention*, 37, 1153-1161.
- Eby, D. & Kostyniuk, L. (1998). Use and misuse of child restraint devices in Michigan. *Proceedings of the 16th International Technical Conference on the Enhanced Safety of Vehicles*, Windsor.
- Glanvill, L. (2000). *Child Restraint Issues in Victoria*. Report PP 00/01, Noble Park Victoria. Australia, Royal Automobile Club of Victoria.
- Gotschall, C.S., Better, S.I., Bulas, D., Eichelberger, M.R., Bents, F. & Warner, M. (1998). Injuries to children restrained in 2- and 3-point belts. *42nd Annual Proceedings, Association for the Advancement of Automotive Medicine*, 42, 29-44.
- Henderson, M. (1994). *Children in car crashes: An in-depth study of car crashes in which child occupants were injured*. Child Accident Prevention Foundation of Australia, New South Wales Division.
- Henderson, M., Brown, J., & Paine, M. (1994). Injuries to restrained children. *38th Annual Proceedings of the Association for the Advancement of Automotive Medicine*, September 21-23, Lyon, France.
- Howard, A.W. (2002). Automobile restraints for children: a review for clinicians. *Canadian Medical Association Journal*, 167(7), 769-773.
- Lennon, A. (2005). Where do children sit in Australian passenger vehicles? Results from an observational study. *Proceedings from the Australasian Road Safety Research Policing Education Conference*, November 14-16, Wellington New Zealand.
- Lesire, P., Guillemot, H. & de Jager, K. (2005). European Enhanced Vehicle Safety Committee Working Group 18: Child Safety Progress Report. Presented at the *Protection of Children in Cars*, December 1-2, Munich, Germany.
- Mackay, M. (2001). A global view of real world effectiveness of booster seats. *Booster Seats for Children. Closing the Gap Between Science and Public Policy. Association for the Advancement of Automotive Medicine*, April 23-24, Washington DC.
- Maltese, M., Chen, I. & Arbogast, K. (2005). Effect of increased rear row occupancy on injury to seat belt restrained children in side impact crashes. *Association for the Advancement of Automotive Medicine*, September 12-14, Boston.
- Margolis, L.H., Wagenaar, A.C. & Molnar, L.J. (1992). Use and misuse of automobile child restraint devices. *American Journal of Disabled Child*. 146, 361-366.

Nance, M., Lutz, N., Arbogast, K., Cornejo, R., Kallan, M., Winston, F., & Durbin, D. (2004). Optimal Restraint Reduces the Risk of Abdominal Injury in Children Involved in Motor Vehicle Crashes. *Annals of Surgery*, 239(1): 127-131.

National Highway Transportation Safety Authority, (2001). Booster seats. <http://www.nhtsa.gov/cars/rules/rulings/TREAD/MileStones/BoosterSeat.htm>

National Highway Transportation Safety Authority, (2001). Children's health topics: fact sheet. http://www.nhtsa.dot.gov/people/injury/ems/Child_Health/chmfacts.htm.

National SafeKids Campaign (2004). *Closing the Gaps Across the Map. A Progress Report on Safe Kids' Efforts to Improve Child Occupant Protection Laws*. February 2004. <http://www.safekids.org/>.

National Transport Commission. (2000). Australian Road Rules. http://210.50.193.45/links/aust_road.asp [last accessed 7/4/03].

Paine M, (1998). *Child Restraint Survey in New South Wales*. Research Report 98/3, Rosebury, New South Wales, Roads and Traffic Authority.

Paine, M. & Vertsonis, H. (2001). Surveys of child restraint use in New South Wales. Paper 214, *Proceedings of 17th International Technical Conference on the Enhanced Safety of Vehicles*, June 4-7, 2001.

Ramsey, A., Simpson, E. & Rivara, F.P. (2000). Booster seat use and reasons for non-use. *Pediatrics*, 106(2), 20-29.

Rivara, F.P., Bennett, E., Crispin B, Kruger, K., Ebel, B. & Sarewitz, A. (2001). Booster seats for child passengers: Lessons for increasing their use. *Injury Prevention*, 7(3), 210-13.

Roads and Traffic Authority (RTA) (2006). Personal communication, David Lewis, Strategic Projects, Road Safety Branch 22/3/2006.

Russell, J., Kresnow, M. & Brackbill, R. (1994). The effect of adult belt laws and other factors on restraint use for children under age 11. *Accident Analysis and Prevention*, 26, 287-295.

Suadecani, P., Hein, H.O. & Gyntelberg, F. (1997). Mortality and morbidity of potentially misclassified smokers. *International Journal of Epidemiology*, 2, 321-327.

Stoke, C.B. (1997). *Use of Child Safety Seats in Metropolitan Areas of Virginia During Summer 1996 (report no. VTRC 97-TAR8)*. Virginia Transportation Research Council, Charlottesville, VA.

Wagenaar, A.C., Molnar, L.J. & Margolis, L.H. (1988). Characteristics of child safety seat users. *Accident Analysis and Prevention*, 20, 311-322.

Webber, K. (2000). Crash protection for child passengers: A review of best practice. *UMTRI Research Review*, 31(3), 1-28.

Winston, F., Chen, I.G., Arbogast, K.B., Elliot, M.R. & Durbin, D. (2003). Shifts in child restraint use according to child weight in the United States from 1999-2002. *Annual Proceedings of the Association for the Advancement of Automotive Medicine*, 47, 313-328.

Winston, F., Durbin, D., Kallan, M., & Moll, E. (2000). The danger of premature graduation to seat belts for young children. *Pediatrics*, 105(6), 1179-1183.

Wren, J., Simpson, J., Chalmers, D., & Stephenson, S. (2001). "Obviously a man designed it". Barriers to using child car seats. *Presented at the Barriers Childhood Injury Prevention Symposium, Children and Young People: Their Environments Conference*, 28-30 June, Child Issues Centre, University of Otago.

7 APPENDICES

Appendix 1: Letter of Invitation to Principals



February 2005

Dear Principal,

The Monash University Accident Research Centre is carrying out a project for the Motor Accident Authority (MAA) to examine the attitudes of parents regarding the use of child seats by children of pre-school and primary school age. Child restraint systems for vehicles are designed to provide specialist protection for child occupants of vehicles in the event of a crash. Australian legislation specifies the use of a dedicated child restraint for infants up to one year old; however, for older children, the legislation is less definitive, stating only that an 'appropriate' restraint (dedicated child restraint or seat belt) should be used. Hence, the responsibility largely rests upon parents to determine what restraint is 'appropriate' for older children.

At the conclusion of this study, it is anticipated that we will have a better understanding of the underlying explanations why children are prematurely moved to adult restraints, and why some children continue to ride unrestrained.

A desired outcome of this study will be the provision of critical information for road safety authorities as well as the general community for raising parents' awareness of the safety benefits of: correct use of child restraints; child/child restraint compatibility; children being restrained at all times. Outcomes will be documented in a report for the funding body as well as a publication to be presented at a national or international road safety conference forum and a relevant scientific journal. The expected outcomes will potentially reduce the number and severity of injuries sustained by child passengers involved in crashes.

Who is conducting this research?

The Monash University Accident Research Centre (MUARC) is the largest multi-disciplinary research institute for accident and injury prevention research in Australia. The research at MUARC spans all forms of injury and injury prevention – road safety, occupational safety, sporting and recreational safety and domestic safety. The Centre has developed a strong national and international reputation for provision of high quality research and policy development that contribute to reducing the burden of injury. The research team consists of Dr Judith Charlton, Professor Brian Fildes and Dr Sjaanie Koppel who have extensive experience in research in road safety including a substantial research program on vehicle occupant protection including child passenger safety.

Who is being invited to participate in this research?

With the approval to approach schools of the department, we would like to extend an invitation to the parents/guardians of children attending your primary school to participate in this research. We are specifically recruiting individuals who:

- Have a valid driver's licence, and
- Have a child or children aged between 4 to 11 years of age.

What is involved?

If you agree to participate in this project, we will send you 'questionnaire packs' that we would ask you to send home to every student's household. This pack has been attached for your perusal. The 'questionnaire pack' includes:

- A letter of invitation;
- A questionnaire, and
- An expression of Interest form.

The letter of invitation outlines the general aims of the study and invites parents/guardians to participate in the study. The questionnaire includes questions regarding the use of dedicated child restraint systems; the factors influencing their choice of restraint type; their child's/children's seating position in their vehicle; their child's/children's height and weight; what their child/children like/dislike about their current restraint system; their general knowledge regarding child restraint systems, their prior involvement in motor vehicle crashes in the last two years and general injury outcomes resulting from these crashes and some general demographic questions (e.g., age, gender, number of kilometres driven per week).

The questionnaire will take approximately 25 to 30 minutes to complete. If the parents/guardians would like to participate in this project, we will ask them to complete the questionnaire and post it back to us using a reply-paid envelope that we will provide.

We are planning on investigating other aspects of child restraint safety in the future. If parents would like to take part in other research projects being conducted by MUARC, we will ask them to complete the details in the Expression of Interest form and return it to our research team using an additional reply-paid envelope. A member of our research team will contact the parent at a convenient time via telephone and provide them with more information about the future research projects. If parents fill out this form, they are not obligated to participate in future projects.

Confidentiality

The information we will collect is for research purposes only and will be treated in the strictest confidence. No identifying information will be reported or published. Only members directly involved in the research will have access to the data, which

will be stored securely for a minimum period of seven years in accordance with Monash University regulations.

Findings

It will not be possible to inform parents of the outcomes of the study on an individual basis. However, at the conclusion of the study, participants may obtain group findings from Monash University Accident Research Centre website. The findings will be made available to the sponsors of the project (MAA) in the form of a report and conference papers and journal articles may also arise from this research project.

Contacts

If you have any queries or would like to be informed of the findings of the study, please contact

Dr Judith Charlton at Monash University.
Tel: (03) 9905 1903
Fax: (03) 9905 4363
E-mail: Judith.Charlton@general.monash.edu.au
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Research Team Leaders

Dr Judith Charlton - Chief Investigator

Dr Sjaanie Koppel – Co-Investigator

Professor Brian Fildes- Co-Investigator

Should you have any complaint concerning the manner in which this research is conducted, please do not hesitate to contact The Standing Committee on Ethics in Research on Humans at the following address:

The Secretary

The Standing Committee on Ethics in Research on Humans

P.O. Box 3A, Monash University, Victoria 3800

Telephone: (03) 9905 2052 Fax: (03) 9905 1420

Child Passenger Safety: Children's use of seat belts and booster seats

Letter of Invitation/Explanatory Statement

June 2005

Dear Parent/Guardian,

Child restraint systems for vehicles are designed to provide specialist protection for child occupants of vehicles in the event of a crash. Australian legislation requires that for children older than one year, an 'appropriate' restraint (dedicated child restraint or seat belt) should be used. Hence, the responsibility largely rests upon parents to determine what restraint is 'appropriate' for older children.

The Monash University Accident Research Centre is carrying out a project for the Motor Accident Authority (MAA) to examine the attitudes of parents towards their children's restraint-wearing behaviour. In particular, the study aims to investigate the use of boosters and seat belts by children aged 4 to 11 years and how parents decide which restraints are appropriate for their child.

At the conclusion of this study, it is anticipated that we will have a better understanding of factors that influence parents' decision-making about whether/how their children are restrained when travelling as passengers in motor vehicles.

Who is invited to participate in this research?

With the approval of the Department of Education and Training, your primary school has been selected to participate in this research. We extend an invitation to parents/guardians who:

- Have a valid driver's licence,
- Have a child or children aged between 4 to 11 years of age.

What is involved?

If you agree to take part in the project, you will be asked to complete a questionnaire that is attached.

The questionnaire will ask questions about: whether your child/children use a dedicated Child Restraint System, the factors influencing the choice of restraint type; your child's/children's seating position in your vehicle; your child's/children's height and weight; what your child/children like/dislike about their current restraint system; your general knowledge regarding child restraint systems, your prior involvement in motor vehicle crashes in the last two years and general injury outcomes resulting from these crashes and some general questions about yourself (e.g., your age, gender, number of kilometres you drive per week).

The questionnaire will take approximately 25 to 30 minutes to complete. You do not have to answer any question or section of the questionnaire if you do not feel comfortable doing so. If you would like to participate in this research, please complete the questionnaire and post it back to us using the reply paid envelope provided.

We are planning on investigating other aspects of child restraint safety in the future. If you would like to take part in other research projects being conducted by MUARC, please complete the details in the *Expression of Interest form* and return it to our research team using the smaller reply paid envelope. A member of our research team will contact you at a convenient time via telephone and provide you with more information about the future research projects. If you fill out this form, you are not obligated to participate in future projects.

Confidentiality

The information we will collect is for research purposes only and will be treated in the strictest confidence. No identifying information will be reported or published. Only members directly involved in the research will have access to the data, which will be stored securely for a minimum period of seven years in accordance with Monash University regulations.

Findings

It will not be possible to inform you of the outcomes of the study on an individual basis. However, at the conclusion of the study, you may obtain group findings from Monash University Accident Research Centre website. The findings will be made available to the sponsors of the project (MAA) in the form of a report and conference papers and journal articles may also arise from this research project.

Contacts

If you have any queries or would like to be informed of the findings of the study, please contact Dr Judith Charlton at Monash University.

Tel: (03) 9905 1903

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Child Passenger Safety: Children's use of seat belts and booster seats

Please fill out this questionnaire if you have a child or children aged between 4 and 11 years of age.

Section A: Demographic Information

This section asks some questions about you and your driving habits. Please tick the box that best describes you.

A.1 What is your age? (Tick One)

- | | | |
|--------------------------------------------|----------------------------------------|----------------------------------------|
| <input type="checkbox"/> 18 - 25 years | <input type="checkbox"/> 26 - 30 years | <input type="checkbox"/> 31 - 35 years |
| <input type="checkbox"/> 36 - 40 years | <input type="checkbox"/> 41 - 45 years | <input type="checkbox"/> 46 - 49 years |
| <input type="checkbox"/> 50 years and over | | |

A.2 Are you: (Tick One)

- | | |
|--------------------------------|----------------------------------|
| <input type="checkbox"/> Male? | <input type="checkbox"/> Female? |
|--------------------------------|----------------------------------|

A.3 What is your place of residence? (Tick One)

- | | | |
|-------------------------------------------------------------------|----------------------------------------|---------------------------------------|
| <input type="checkbox"/> Metropolitan area | <input type="checkbox"/> Regional city | <input type="checkbox"/> Country town |
| <input type="checkbox"/> Rural area (i.e., not in a country town) | | |

A.4 What State of Australia do you live in? (Tick One)

- | | |
|------------------------------------------|-----------------------------------|
| <input type="checkbox"/> New South Wales | <input type="checkbox"/> Victoria |
|------------------------------------------|-----------------------------------|

A.5 What is your current marital status? (Tick One)

- | | | |
|-------------------------------------------------|------------------------------------|----------------------------------|
| <input type="checkbox"/> Single | <input type="checkbox"/> De facto | <input type="checkbox"/> Married |
| <input type="checkbox"/> Divorced | <input type="checkbox"/> Separated | <input type="checkbox"/> Widowed |
| <input type="checkbox"/> Other (please specify) | | |

A.6 Is English your first language? (Tick One)

- Yes No

A.7 What is your household income before tax? (Tick One)

- Less than \$20,000 \$20,000-\$40,000 \$41,000-\$75,000
 \$76,000-\$100,000 More than \$100,000

A.8 What is the highest level of education you have completed? (Tick One)

- Primary school
 Intermediate (Year 10)
 VCE/HSC
 Technical school or TAFE (including trade certificate/ apprenticeship)
 Degree from University, College of Advanced Education
 Higher Degree
 Other (please specify)
-

A.9 What type of car do you usually drive in with your children? (Tick One)

- 2 door sedan 4 door sedan 2 door hatchback
 4 door hatchback Station wagon 4WD
 People mover/Van Other (please specify)
-

A.10 What is the make and model of this vehicle?

Make _____ Model _____

A.11 How many kilometres do you drive with your children per week? (Tick One)

- Less than 100 km 101-200 km 201-500 km
 More than 501 km

A.12 Would you say that most of your trips are:

- | | |
|---------------------------------------------|---------------------------------------------|
| <input type="checkbox"/> More than 10 km | <input type="checkbox"/> Between 5 and 10km |
| <input type="checkbox"/> Between 3 and 5 km | <input type="checkbox"/> Less than 3 km |

A.13 How often do you drive with your children? (Tick One)

- | | |
|------------------------------------------------|----------------------------------------------------|
| <input type="checkbox"/> Daily or almost daily | <input type="checkbox"/> Two or three times a week |
| <input type="checkbox"/> Once a week | <input type="checkbox"/> Once a month or less |

A.14 Who drives your children most frequently? (Tick One)

- | | |
|-------------------------------------------------|----------------------------------------------------|
| <input type="checkbox"/> Yourself | <input type="checkbox"/> Your partner/husband/wife |
| <input type="checkbox"/> Grandparent | <input type="checkbox"/> Your friend/neighbour |
| <input type="checkbox"/> Other (please specify) | |
-

Restraint Use

This section asks some questions about how your family typically travels in your car – including any children younger and/or older than the 4 to 11 year age range of interest.

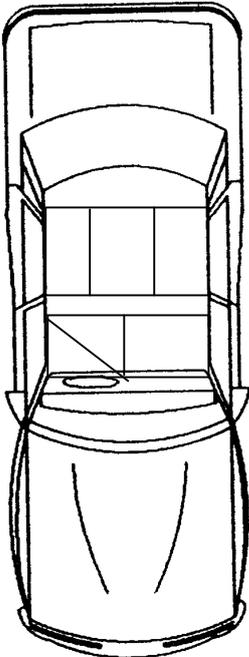
A.15 What type of restraints do your children currently use?

(Please state the age, gender, weight*, height* and type of restraint for each child in your household).

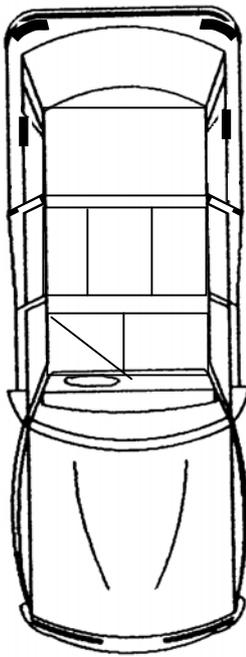
	Child 1		Child 2		Child 3		Child 4		Child 5		Child 6	
Age (years & months)												
Gender (male/female)	M	F										
Weight (kg) - Please weigh your child and record here												
Height (cm) - Please measure your child and record here												
Type of restraint:												
Infant capsule												
Convertible (Rear-facing for infant)												
Forward-facing child seat												
Booster seat (with high back)												
Booster cushion (without a back support)												
Seat belt - Lap/sash												
Seat belt - Lap only												

* It is important that the measures of your children's height and weight are current.

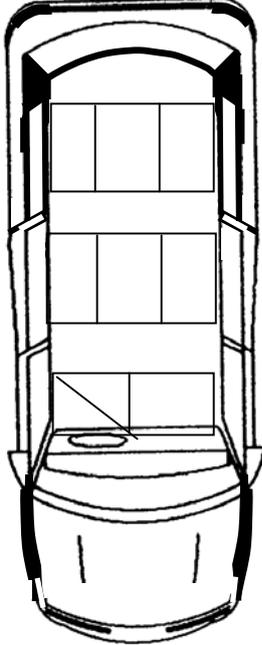
A.16 Please indicate on the diagram of the vehicle where your children typically sit when travelling in the vehicle *(For example if the child described as “Child 1” in the above Table typically sits in the left rear seat of your car, please write number 1 in the left rear box on the car. If “Child 4” sits in the third row of your station wagon, please write number 4 in the third row box on the station wagon. If you have a different type of vehicle see A.17).*



Car



Station Wagon



Van/People Mover

A.17 If the vehicles above do not reflect the seating pattern in your vehicle (i.e., if you typically drive a utility), please describe your children’s typical seating arrangements below.

**THE FOLLOWING QUESTIONS APPLY TO YOUR
CHILD/CHILDREN IN THE 4 TO 11 YEAR AGE RANGE
ONLY.**

A.18 Sometimes children’s seating positions may differ from their typical position. Please indicate which of the following reasons apply to your child/children (Tick as many as applicable).

Do the seating positions change:	No	If YES, please describe how and why the seating positions change.
When there is more than one adult travelling in the vehicle?		
When travelling on long trips?		
When travelling on short trips?		
When you have other people’s children travelling in your vehicle?		
Other (please specify):		

A.19 How often do you wear your seat belt while travelling in a vehicle?

- Always Mostly Sometimes Never Not sure

A.20 How often are your children restrained while travelling in a vehicle?

- Always Mostly Sometimes Never Not sure

A.21 Are there any circumstances under which you would allow your child/children to travel while not using either a seat belt or a child seat/booster? (Tick as many as applicable)

Reasons for non-restraint	Yes	No
While travelling at night		
If my child is asleep		
If my child refuses to use the restraint		
If my child's peers are travelling in the vehicle		
On short trips		
If my child is travelling in someone else's vehicle		
If there are not enough restraints for all passengers		
Other (please specify):		

Child Restraints - True or False

A.22 The following table contains a list of statements about child restraints. Please read each of the statements and indicate whether you think that they are true or false. If you are not sure, please tick the “don’t know” column*.

		True	False	Don't Know
1	Legally, children of any age can sit in the front seat of a car if they are wearing a seat belt			
2	Children under the age of 8 years should not sit in the front seat of a car			
3	Babies must travel in a specially fitted capsule			
4	If the car is in a major accident, the child restraint should be replaced and the old ones thrown away			
5	If the car is in a minor accident, the child restraint should be replaced and the old ones thrown away			
6	Children can sit in the back of a car with only a seat belt once their eyes are level with the head rest of the seat in front of them			
7	The correct time for a child to move from a child seat to a booster is when they are 4 years old			
8	If I am giving someone else's child a lift, their parents are responsible for restraining them in my car			
9	Crash tests show that some types and makes of child restraints are safer than others even if they meet the Australian Standard			
10	The main benefit of boosters is to lift children to a sitting height so that the seat belt is positioned properly			
11	There are laws in my State against travelling with unrestrained passengers			

Motor Vehicle Crashes

A.23 Thinking back over the last two years, have you been involved in a motor vehicle crash, in which any of the vehicles involved had to be towed away? (Tick One)

- Yes No

A.24 Were any of your children passengers in the car at the time of the motor vehicle crash?

- Yes No Not applicable

A.25 Did the crash result in: (Tick as many as applicable)

- No injuries to any occupants in your motor vehicle
 Minor injuries (i.e., not hospitalised) to you or someone else in the car
 Serious injuries (i.e., hospitalised) to you or someone else in the car
 Not applicable

Please complete Section B of this questionnaire if you have a child or children aged 4 to 11 years who travel in a booster seat.

AND/OR

Please complete Section C of this questionnaire if you have a child or children aged 4 to 11 years who travel in a seat belt.

Section B: Children's use of booster seats

Please fill out this section only if one or more of your children aged 4 to 11 years travels in a booster seat. If you have more than one child aged between 4 and 11 years in your household, please answer the following section with regard to the child who has most recently moved into a booster seat.

B.1 Please list the age, gender, weight and height for your child who has *most* recently moved into a booster seat.

Age: _____ years _____ months

Gender: Male Female

Weight: _____ kilograms

Height: _____ centimetres

B.2 How often is your child restrained in a booster seat while travelling in a vehicle?

Always Mostly Sometimes Never Not sure

B.3 Are there any circumstances under which you would allow your child to travel in a vehicle without a booster seat (just in a seat belt)? (Tick as many as applicable)

Reasons for not travelling in a booster seat	Yes	No
While travelling at night		
If my child is asleep		
If my child refuses to use the restraint		
If my child's peers are travelling in the vehicle		
On short trips		
If my child is travelling in someone else's vehicle		
If there are not enough restraints for all passengers		
Other (please specify):		

B.4 What does your child like about travelling in their booster seat?

B.5 What does your child dislike about travelling in their booster seat?

B.6 How did you acquire the booster seat?

- Purchased it new Purchased it second hand
- Borrowed/Given by friend/family Rented
- Other (please specify)

B.7 If you purchased the booster seat, did you obtain any information about the booster seat you selected before purchasing it? (Tick one)

Yes No Not applicable

B.8 If yes, – Please indicate where you obtained the information? (Tick as many as appropriate).

Information source	B.8 Tick where you obtained information	B.9 Tick the most useful (Tick one)
Maternal and Child Health Centres		
Newspapers/Magazines/Brochure/Books		
School/Kinder/Playgroup		
Word of mouth (family, friend)		
RTA/RACV/NRMA Buyers guide		
VicRoads/RTA website/brochure		
Autoclub website/brochure		
Shop where you purchased the restraint		
Other (please specify) -----		

B.9 What source in B.8 did you find *most* useful for making your decision? (Tick in column on right in table above).

B.10 Which of the following factors were important to you when choosing your child’s booster seat? (Low/Medium/High)

**For
Question
B.11**

	Low	Medium	High	Rank
Australian Standards approved				
Comfort for child				
Durability				
Ease of access for child				
Ease of access for parent/guardian				
Ease of fitting into vehicle				
Length of time that it would suit my child				
Purchase price				
Reputation of make/model of the restraint				
Size/fit of the restraint in relation to my vehicle				
Style/look/colour of the restraint				
Thickness of padding				
Weight of the restraint				

B.11 For those factors that you rated as “high” in B.10, please rank only these in order from highest (1) to lowest priority.

Use the right hand column of the table in B.10 (1 = highest priority)

B.12 How did you know when to move your child from a toddler child seat to a booster seat? (Tick as many as applicable).

Reasons	B.12 Tick which reason/s apply to you	B.13 Tick the most important reason (Tick one)
My child was too big for the toddler child seat		
My child disliked sitting in the toddler child seat		
I needed the toddler child seat for a younger child		
My child would be more comfortable in a booster seat compared to a seat belt		
My child reached upper end of the weight range recommended by the child seat manufacturer		
My child would be safer in a booster seat compared to a seat belt		
My child thought that they were too grown up to sit in a toddler child seat		
My child's shoulders were above the slots for the harness straps		
It would be easier to keep my child restrained in a booster seat compared to a seat belt		
A booster seat provides better visibility for my child compared to a seat belt		
My child had their 4 th birthday		
When my child started kindergarten		
When my child started primary school		
Other (please specify)		

B.13 Which was the one *most* important reason in B.12 for moving your child from a child restraint to a booster seat? (Tick in column on right in table above)

B.14 How will you know *when* to move your child from a booster seat to a seat belt? (Tick as many as applicable).

Reasons	B.14 Tick which reason/s apply to you	B.15 Tick the most important reason (Tick one)
When my child reaches the upper end of the weight range recommended by the child seat manufacturer		
When my child's eyes are level with the top of the vehicle seat or headrest		
When my child starts kindergarten		
When my child starts primary school		
Other (please specify)		

B.15 Which will be the one *most* important reason in B.14 for moving your child from a booster seat to a seat belt? (Tick in column on right in table above)

Thank you for your participation

Please return the completed Sections A, B and C (if applicable) to Monash University Accident Research Centre using the provided reply-paid envelope.

Section C: Children's use of seat belts

Please fill out this section only if one or more of your children aged 4 to 11 years is currently restrained by a seat **belt** while travelling in your vehicle. If you have more than one child aged between 4 and 11 years in your household, please answer the following section with regard to the child who has most recently moved into a seat belt.

C.1 Please list the age, weight and height for your child who has most recently moved into a seat belt.

Age: _____ years _____ months

Gender: Male Female

Weight: _____ kilograms

Height: _____ centimetres

C.2 What type of restraint did your child use immediately before moving into a seat belt?

Child seat Booster Seat Other (please specify)

C.3 How old was your child when he/she made the transition to a seat belt?

C.4 Please list the reasons why you moved your child into a seat belt? (Tick as many as applicable).

Reasons	C.4 Tick which reason/s apply to you	C.5 Tick the most important reason (Tick one)
My child was too big for the toddler child seat/booster seat		
My child disliked sitting in a toddler child seat/booster seat		
I needed the toddler child seat/booster seat for a younger child		
My child would be more comfortable in a seat belt compared to a toddler child seat/booster seat		
My child reached upper end of the weight range recommended by the toddler child seat/booster seat manufacturer		
My child would be safer in a seat belt compared to a toddler child seat/booster seat		
My child thought that they were too grown up to sit in a toddler child seat/booster seat		
My child had their 4 th birthday		
My child started kindergarten		
My child started primary school		
Other (please specify)		

C.5 Which was the one *most* important reason in C.4 for moving your child from a toddler child seat/booster seat to a seat belt? (Tick in column on right in table above)

Thank you for your participation

Please return the completed Sections A, C and B (if applicable) to Monash University Accident Research Centre using the provided reply-paid envelope.



Child Passenger Safety: Children's use of seat belts and booster seats

Expression of Interest for future research

- Yes, I would like the Monash University Accident Research Centre to contact me about participation in future research.

We are planning on investigating other aspects of child restraint safety in the future. If you would like to take part in other research projects being conducted by the Monash University Accident Research Centre, please complete the details below and post it back to Monash University with your completed questionnaire in the smaller reply paid envelope provided. A member of our research team will then contact you at the convenient time via telephone and provide you with more information about the research project. If you agree to be contacted, we would like to emphasise that you are not obligated to participate in any future research.

Name:

Contact phone number

The best time to call me on the above number is:am/pm

Thank you for your participation ☺