# Understanding parental beliefs relating to child restraint system (CRS) use and child vehicle occupant safety.

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## Key Findings

- Despite motor vehicle crashes being a leading cause of childhood death and serious injury in Australia, significant gaps remain in parents' knowledge regarding child restraint system (CRS) use and child occupant safety.
- More than half of the parents who completed an online survey (59%) reported that the minimum recommended height (145cm), for a child to most safely transition from a CRS to an adult seatbelt, would be reached by most children by the age of seven years.
- Parents tended to attribute the responsibility of child vehicle occupant safety to internal factors such as their own driving abilities and their own safety compliance, rather than external factors such as fate.
- Results suggest that there are still significant gaps in parents' understanding about CRS use and child occupant safety which is important for the development and success of future child occupant safety initiatives.

## Abstract

The aim of the current study was to understand Australian parents' beliefs relating to child restraint system (CRS) use and child vehicle occupant safety. Three hundred and eighty parents completed an online survey related to CRS knowledge and their beliefs about which factors (the influence of internal and external) influence child vehicle occupant safety. The online survey was active from June 2013 until November 2014. Results revealed a wide variation in parents' beliefs relating to CRS use and child vehicle occupant safety. The majority of parents responded correctly to CRS related questions, including: the appropriate CRS for child vehicle occupants aged between four and seven years (95%); and the need to adjust CRS harnesses for each trip for optimal safety (91%). However, half of the parents (50%) held the misconception that the after-market H-harness accessory, provided additional protection to their child/ren, regardless of the context of use and 41 percent of parents incorrectly believed that their child/ren would reach the recommended height (145cm) for a safe adult seatbelt fit by the age of seven years. Parents tended to attribute the responsibility of child/ren's vehicle occupant safety to internal factors such as their own driving abilities (64%) and their own safety compliance (64%), rather than external factors (e.g., fate [7%]). The results of the current study suggest that there are still significant gaps in Australian parents' understanding about CRS use and child occupant safety which is important for the development and success of future child occupant safety initiatives.

## Keywords

Child vehicle occupant safety, child restraint systems (CRS), CRS use, CRS misuse

## Introduction

Motor vehicle crashes remain a leading cause of childhood death and serious injury in Australia and in most OECD countries (Commonwealth of Australia, 2016; World Health Organization, 2008). Child Restraint Systems (CRS) are designed to provide specialised protection to child vehicle occupants in the event of a crash, with research demonstrating that CRS can effectively reduce the risk of child vehicle occupant death and injury by approximately 70 percent when compared to restraint by an adult seatbelt (Brown, McCaskill, Henderson, & Bilston, 2006; Durbin, Elliott, & Winston, 2003). The Australian government introduced new CRS legislation in 2009 mandating the use of an age-appropriate CRS until children reach the age of at least seven years (National Road Transport Commission, 2009). The updated legislation included the following Australian Road Rules (National Road Transport Commission, 2009):

- All children under the age of 6 months must be restrained in a rearward-facing approved CRS;
- All children aged between 6 months and 4 years must be restrained by a rearward-facing OR forward facing approved CRS, with the type of restraint dependent on the child's height and weight;

- All children aged between 4 and 7 years of age must be restrained in either a forward-facing approved CRS with an inbuilt harness, OR an approved belt-positioning booster seat, with the type of restraint dependent on the child's height and weight;
- A child aged 7 years to 16 years must travel in either an approved booster seat OR an adult seatbelt, with the type of restraint will depend on the child's size, and
- A person 16 years of age and over must travel in an adult seatbelt.

In addition, the legislation states that CRS transitions (from one type to the next) be guided by age, however transitions are also dependent on the child's size (National Road Transport Commission, 2009). Shoulder markings on CRS provide a visual guidance for transition based on size and are now included in the Safety Standards of all CRS (Standards Australia/Standards New Zealand, 2010). Use of a child safety harness with a belt positioning booster seat (BS), commonly referred to as the H-harness, 'is recommended only in situations where it is not possible to replace (the) lap-only seatbelt with a lap-sash seatbelt' (VicRoads, 2014, p. 1).

Previous research indicates high CRS use rates by Australian child vehicle occupants aged 0-12 years (Koppel et al., 2008; Koppel et al., 2013b), however the specialised protection provided by CRS relies on correct and appropriate CRS use. 'Incorrect CRS use' is defined as the use of a CRS system contrary to the manufacturer's instruction, and used in ways other than those intended and includes: installation errors, harnessing/belt errors, and child movement/posture away from the 'ideal' position within the CRS (Ivers et al., 2011). 'Inappropriate CRS use' is defined as the use of a CRS by a child that is not within the height or age range for which the system was designed and safety tested (Ivers et al., 2011). Australian research suggests that there are significant implications of CRS misuse for injury risk in the event of a motor vehicle crash, particularly to the head, spine and abdomen (Bilston et al., 2007; Brown et al., 2006).

## The role of parental knowledge and CRS use and child vehicle occupant safety

The relationship between parents' knowledge and CRS use and misuse was recently investigated following the introduction of Australia's CRS legislation changes in 2009 (Koppel, et al., 2013b). Koppel and colleagues surveyed 272 parents with children aged between three and ten years. Findings revealed that although most parents reportedly 'always' restrained their child/ren (99%), over half did not know the best time to graduate their children from a booster seat to an adult seatbelt (53%) or the age for which it is appropriate for their child to sit in the front passenger seat of the vehicle (20%). However, previous research has not explored how parental beliefs may influence their use of CRS.

## Parental beliefs

The Health Belief Model (HBM) offers a useful framework for understanding how parents' knowledge and beliefs might guide their expectations and influence their behaviour with respect to their children's transportation safety (Butler, 2001). The HBM has its foundations in Social Learning psychology and focuses on understanding beliefs to assist in the prediction of health behaviours (Bandura, 1971; Rosenstock, 1974). In the HBM, beliefs are explained in terms of perceptions of threat, perceived benefits and the perceived consequences (Nelson & Moffit, 1988). Perceptions are described as an individual's internal 'picture' or representation of the world (Reisberg, 2007). Existing belief systems, their subjective interpretation and reflection on past experiences assist the individual to evaluate and interpret a situation or event (Stutts et al., 2003). Importantly, the perception formed, may either reflect reality, or may not, that is, it may be a misconception (Weiten, 2005).

The HBM has been successfully applied to child injury research by Peterson and colleagues (Peterson, Farmer, & Kashani, 1990). Findings from this research show a significant positive association between HBM belief constructs of parents (knowledge, competence to teach, effort required and perceived benefits to safety) and reported teaching and environmental interventions to reduce child injury risk. In other research, the HBM has been used to explore parents' perceptions of risk for the purpose of guiding future interventions for improving CRS use (Chen, Yang, Peek-Asa, & Li, 2014; Will & Geller, 2004).

In the context of children's safety in motor vehicles, the HBM might predict that parents who are aware of their child/ren's susceptibility to injury (*threat*) in the event of a motor vehicle crash and aware of the improved safety (*benefits*) offered from appropriate and correct CRS use are more likely to engage in behaviours conducive to child occupant safety. Arguably, these combined beliefs might influence parents' engagement in precautionary behaviours and facilitate their acceptance of information about safe use of CRS such as routine checking of harnesses and correct decisions regarding CRS transitions. A recent qualitative study in China found that 'lack of awareness' was the most important factor explaining the low rate of CRS use (Chen et al., 2014). In contrast, a recent cluster randomised controlled trial of 830 families conducted by Hunter and colleagues (Hunter et al., 2015) in New South Wales, Australia, demonstrated that the delivery of information sessions to parents of children enrolled in preschools and day care centres significantly improved the use of age appropriate CRS. These findings suggest that there may be a benefit to be gained by providing appropriate knowledge to parents to guide beliefs on child vehicle occupant injury risk and skills on optimal use of CRS to improve the safety of children in motor vehicle travel in Australia.

The concept of Locus of control (LOC) offers another framework for understanding and categorising beliefs (Rotter, 1954). LOC focuses on the individual's belief systems about responsibility and accountability for their own behaviours and the perceived self-control over actual and possible events. Individuals with a high *internal* LOC view themselves as responsible for events and outcomes, conversely individuals with high *external* LOC consider

others or external factors predominantly responsible for events and outcomes. The LOC theory has been applied to help predict behaviour in areas such as automobile travel beliefs, business leadership, driving behaviour and health (Hoyt, 1973; McDonald, Spears, & Parker, 2004; Montag & Comrey, 1987; Wallston, Strudler Wallston, & DeVellis, 1978). The relationship between parents' beliefs about the influence of internal and external factors (e.g., LOC) on child vehicle safety has not yet been explored in Australia.

## Aims of the current study

The broad aim of the current study was to understand Australian parents' beliefs relating to child restraint system (CRS) use and child vehicle occupant safety. It is important to note that this research forms part of a larger Australian Research Council (ARC) Linkage Project – Child safety in cars: an international collaboration (see Figure 1).

The current study relates to Stage 1 and involves an online survey of Australian parents to explore: i) parents' beliefs regarding CRS use; ii) parents' beliefs relating to their susceptibility of being involved in a motor vehicle crash; iii) parents' attribution of responsibility for their children's transportation safety; iv) parents' perceptions about the influence of internal and external factors (e.g., vehicle factors, CRS factors, child factors, driver and driving factors) on child vehicle occupant safety, and; v) the relationship between parent and family characteristics and CRS-related knowledge.

The current study (Stage 1) will be complimented by a naturalistic driving study (NDS) to observe and quantify child vehicle occupant positions and/or behaviour during real-world, everyday driving trips within an instrumented study vehicle (Stage 2) and a sled testing program to investigate implications of child vehicle occupants' real-world, everyday positions and/or behaviour on injury risk in the event of a motor vehicle crash (Stage 3).

# Method

## Participants

Participants were defined as Australian parents with at least one child who usually travelled in a forward facing CRS (FFCRS) with an integral 3-point harness system or BS during their everyday driving trips. Data from the Australia's Mothers and Babies, 1995 and 2005 report (Australian Institute of Health and Welfare, 2005) and the Australian Bureau of Statistics (Commonwealth of Australia, 2013) assisted in the identification of an age-representative sample of Australian parents. These sources identified the average age of Australian first time mothers and fathers (30.7 years, 33.1 years, respectively). Based on these figures, adults aged 25 years and over, who were parents of any children in the study age range and from across all states of Australia were recruited.

Recruitment was multi-modal in an effort to recruit a representative sample from both metropolitan and rural areas in Australia (i.e., Victorian population characteristic of 74 percent metropolitan and 26 percent rural, Commonwealth of Australia, 2013). Recruitment included an invitation from various Australian Automobile Clubs with online survey links. The Royal Australian Automobile Club of Victoria (RACV) mailed 2,000 invitations to complete the online survey to members in the eligible age range (e.g., 25+ years) and stratified by metropolitan/rural residence. There was limited capacity to ensure a representative sample due to the survey being computer-based and in written English. To help address this a national television news broadcast, national newspaper media, posters at child care centres near Monash University and project partners (e.g., automobile clubs, RACV and General Motors Holden) were also active in sharing recruitment information to parents in Australia.

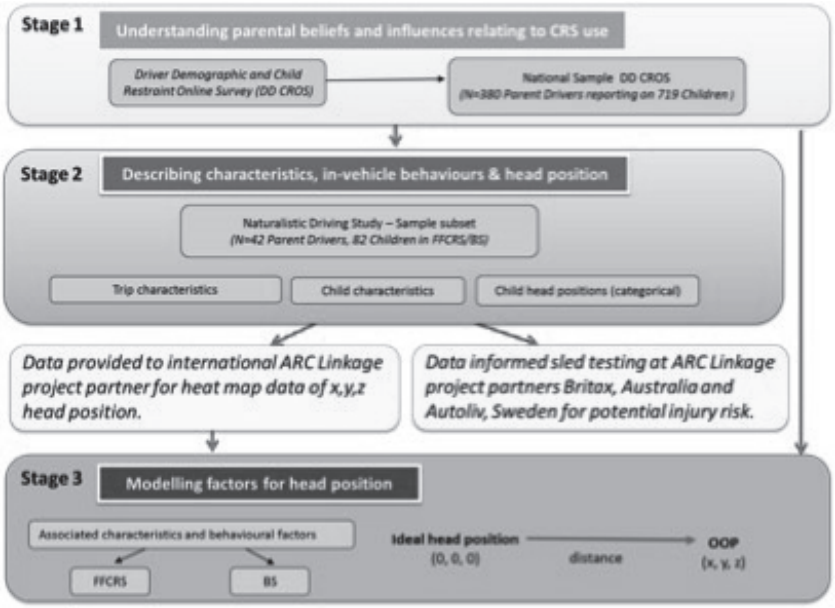


**Figure 1: Child safety in cars: an international collaboration**

## Materials

The Driver Demographic and Child Restraint Online Survey (DDCROS) was developed to investigate parental beliefs relating to CRS use and child vehicle occupant safety. The online survey comprised five discrete sections:

1. Participant demographics;
2. Driving history;
3. Restraint use and knowledge about CRS;
4. Travel safety beliefs, and
5. Child occupant safety LOC beliefs.

For the purpose of this study, beliefs relating to child occupant safety were investigated using 'true' or 'false' answers to questions on CRS related knowledge (Section C, see Table 4). Correct answers were operationalised as knowledge. Incorrect answers, or beliefs that differed from the factual evidence, were operationalised as misconceptions.

The susceptibility of threat construct of the HBM was applied to investigate parents' beliefs about their susceptibility of being involved in a motor vehicle crash. Parents were asked 'How concerned are you about the possibility of being in a car crash?' Responses were on a 4-point Likert scale; 'not at all', 'somewhat', 'quite' and 'extremely concerned'.

Parental perceptions relating to child occupant vehicle safety were also explored using a set of LOC questions which focussed on perceived responsibility and accountability for their own behaviours and control over actual and possible events (see Table 1). Factors were classified as either internal (e.g., their own driving abilities, their safety compliance, their choice of CRS) or external (e.g., other driver's behaviours, road maintenance, legislation, fate). For each safety factor, parents were asked to use a slider scale (lowest to highest: 0-100%) to indicate the strength to which they believed each factor was responsible for child occupant safety. Ratings over 80 percent (≥80%) were classified as a high attribution of responsibility. This measure identified whether parents' considered general travel safety to be the responsibility of self (internal) or others (external).

## Procedure

Ethical approval was granted by Monash University Human Research Ethics Committee (MUHREC). Participants were invited to complete the DDCROS. Participation was voluntary and without compensatory incentive and took approximately 25-35 minutes. The DDCROS also included an invitation to participate in an observational driving study that is part of a broader research program (Stage 2, see Charlton et al., 2013).

## Analysis

Completed DDCROS responses were uploaded to a secured Qualtrics online survey website and downloaded and imported into SPSS Statistics 20 for data analysis. Data was cleaned and transformed prior to analysis and cases were deleted when critical variables were missing. Descriptive analyses were used to describe sample characteristics and responses to relevant DDCROS items, and univariate analyses (e.g., chi squares) were used to explore the relationships between variables of interest.

# Results

## Participants

Responses to the DDCROS were collected from 569 Australian parents with at least one child aged between one and eight years who used a FFCRS or BS. A total of 189 incomplete surveys were removed from the analyses due to missing data (i.e., responses relating to CRS related knowledge). Responses from the remaining 380 completed surveys were analysed.

A summary of the parents' demographic characteristics is presented in Table 2. Most parents who completed the DDCROS were: female (80%), only spoke English (91%) and were married or in a defacto relationship (92%). Most parents who completed the DDCROS had completed a

**Table 1. Parental beliefs about responsibility for child occupant safety**

| Factors | High attribution of responsibility (≥80%) | Low attribution of responsibility ≤79% | Unanswered* |
|---|---|---|---|
| **Internal LOC (self-accountability)** | | | |
| Own driving abilities | 241 (64) | 104 (27) | 35 (9) |
| Safety compliance | 241 (64) | 104 (27) | 35 (9) |
| Choice of CRS | 232 (61) | 112 (30) | 36 (9) |
| Choice of vehicle | 144 (38) | 201 (53) | 35 (9) |
| **External LOC (accountability to others)** | | | |
| Other driver's behaviours | 190 (50) | 153 (40) | 37 (10) |
| Road maintenance | 89 (24) | 257 (67) | 34 (9) |
| Legislation/Policy Makers | 79 (21) | 267 (70) | 34 (9) |
| Fate | 25 (7) | 321 (84) | 34 (9) |

***n=380**

**Table 2. Participant demographics**

| Demographic variables | *n (%)* |
|---|---|
| **Gender** | |
| Males | 76 (20) |
| Females | 304(80) |
| **Area of Residence** | |
| Metropolitan | 261 (69) |
| Rural | 119 (31) |
| **Age group of parent (years)** | |
| 20-29 | 60 (16) |
| 30-39 | 197 (52) |
| 40-49 | 92 (24) |
| 50-59 | 9 (2) |
| 60+ | 3 (1) |
| Unspecified | 19 (5) |
| **Ethnicity** | |
| Born in Australia | 305 (80) |
| Born elsewhere | 75 (20) |
| **Language other than English** | |
| No | 346 (91) |
| Yes | 32 (8) |
| Unknown | 21 (1) |
| **Marital status** | |
| Married/Defacto | 348 (92) |
| Divorced/Separated | 12 (3) |
| Widowed | 1 (<1) |
| Never married | 15 (4) |
| Not specified | 3 (<1) |
| **Education level** | |
| TAFE, VCE/HSC or less | 127 (33) |
| University | 167 (44) |
| Higher Degree | 86 (23) |
| **Gross income bracket (000,AUD$)** | |
| <50 | 37 (10) |
| 50 - <110 | 163 (43) |
| 110 + | 176 (46) |
| Not Specified | 4 (1) |
| **Work status** | |
| Working/Studying full-time, self-employed | 146 (38) |
| Working/Studying part-time/casual, | |
| Volunteering, Carer (eg. children), | 133 (35) |
| unemployed, parental leave, pension | 101 (27) |
| **Number of children** | |
| 1 | 132 (35) |
| 2 | 176 (46) |
| 3 | 53 (14) |
| 4+ | 19 (5) |
| **Parents with at least one child in age group†** | |
| Child under 1 year | 60 (16) |
| Child 1 to under 4 years | 252 (66) |
| Child 4 to under 7 years | 172 (45) |
| Child 7 years plus | 104 (27) |
| **Years of parenting experience** | |
| 0-<4 years | 161 (42) |
| 4-<7 years | 116 (31) |
| 7 years+ | 103 (27) |

† Groups are not mutually exclusive and parents may be represented more than once.

minimum of a tertiary/university education (67%), and nearly half of the sample earned a combined household gross income of $110,000AUD (46%). Over one third of parents reported that they worked/studied full time (38%). Most parents reported having two children (46%) and having more than four years' parenting experience (58%).

## Driving history

Approximately three quarters of parents who completed the DDCROS had more than ten years driving experience on a full licence (76%, see Table 3). Most parents reported no history of property damage crashes (89%) and no crash history resulting in injury (97%). Amongst those parents who reported receiving a driving-related infringement in the previous two years (25%), the most common infringement types were speeding (83%) and failing to stop (9%).

**Table 3. Driving history**

| Driving history variables | *n (%)* |
|---|---|
| **Years driving experience on full licence** | |
| Less than 5 years | |
| 5-10 years | 23 (6) |
| 10-15 years | 62 (16) |
| 15-20 years | 85 (23) |
| 20+ | 107 (28) |
| Not specified | 95 (25) |
| | 8 (2) |
| **Crash history - property damage (last 2 years)** | |
| None | 340 (89) |
| 1 | 36 (9) |
| 2 | 3 (1) |
| 3 | 0 (0) |
| 4 | 0 (0) |
| 5+ | 1 (1) |
| **Crash History – Injury (last 2 years)** | |
| None | |
| 1 | 368 (97) |
| Unspecified | 5 (1) |
| | 7 (2) |
| **History of traffic infringement (last 2 years)** | |
| No | 287 (76) |
| Yes | 92 (24) |
| Unspecified | 1 (<1) |
| **Types of traffic infringements (n=95, 25%)** | |
| Speeding | |
| Failing to stop | 79 (83) |
| Distraction | 8 (9) |
| Failing to signal | 3 (3) |
| Didn't know | 3 (3) |
| | 2 (2) |

## CRS use

Parents were asked questions about all of their children who were aged under 16 years. This equated to 719 children (males = 365, females = 352, gender not specified = 2). Table 4 shows the types of CRS used for these 719 children. Most children usually travelled in a FFCRS (45%) or a BS (23%). The use of an aftermarket H-harness accessory was minimal (2% or less) with FFCRS, BS or unspecified restraint types.

## Parents' knowledge about CRS use

Parents' knowledge about CRS use was ascertained by their responses to ten true/false questions. Table 5 summarises the findings with the questions presented in descending order of percentage of correct responses.

The majority of parents responded correctly to the questions relating to: the safety benefits of children travelling in the rear versus front passenger seat (97%) (Q6); the appropriate CRS for children aged between four and seven years (95%) (Q4); and the need to adjust harnesses for each trip for optimal safety (91%) (Q10). Additionally, most parents correctly identified the purpose of seatbelt guides on BS (89%) (Q9) and the minimum recommended height for use of a seatbelt (85%) (Q5).

Up to three-quarters of parents (66-76%) were able to correctly identify important CRS transition recommendations (Q1-3). Approximately three quarters of parents (76%) were able to correctly identify that the transition from a RFCRS to a FFCRS may occur from six months of age, dependent on size (Q1) and that the transition from a FFCRS to a BS may occur from four years and is also dependent on size (Q2), with visual shoulder markers to guide this transition (75%), (Q3). Approximately two thirds (66%) of parents correctly indicated that CRS transition from a FFCRS into a BS should be guided by age as well as on children's individual height (Q2).

In contrast, forty-one percent of parents incorrectly responded that most children would reach the recommended height for transitioning into an adult seatbelt by seven years of age (Q8) and half of the parents (50%) incorrectly responded that the H-harness provides an added safety benefit for children in all situations (Q7).

Scores were summed to provide an overall score reflecting parents' general level of CRS-related knowledge (see Figure A1 in Appendix). All parents answered at least three questions correctly and 16 percent answered all ten questions correctly. For the purpose of further analyses, parents were divided into two groups based on an arbitrary cut-point: low CRS-related knowledge score group (7 correct responses or less) and high CRS-related knowledge score group (8 correct responses or more). Forty percent of parents were allocated to the low knowledge score group.

The relationship between parent characteristics, driving history and CRS-related knowledge scores (high CRS-related knowledge vs. low CRS-related knowledge) is presented in Table 6. There was a significant relationship between CRS-related knowledge scores and parental age, gender and age of child/ren in family (parental age: $\chi^2$ (2) = 15.330, $p < 0.001$; gender: $\chi^2$ (1) = 8.011, $p < 0.01$; at least one child aged under one year: $\chi^2$ (1) = 5.083, $p < 0.05$; and at least one child aged between one and four years: $\chi^2$ (1) = 6.102, $p < 0.05$, respectively). Male parents were more likely to be in the low CRS-related knowledge group (54%) than females (36%). Parents aged 40 years and older were more likely to be in the low CRS-related knowledge group (55%) compared to parents aged 20-29 years and 30-39 years (27%, 36%, respectively). Parents with at least one child aged under one year were significantly more likely to be in the high CRS-related knowledge group (73%) compared to the low CRS-related knowledge score group (27%). Similarly, parents with at least one child aged between one and four years were also significantly more likely to be in the high CRS-related knowledge group (65%) compared to low CRS-related knowledge group (35%). There were no other significant relationships between parent characteristics and CRS-related knowledge scores.

**Table 4. Restraint type used by children**

| Restraint type | *n (%)* |
|---|---|
| Rearward facing child restraint with integral 3-point harness (RFCRS) | 111 (15) |
| Forward facing child restraint with integral 3-point harness (FFCRS) | 326 (45) |
| Forward facing child restraint with integral 3-point harness with added H-harness accessory | 1 (<1) |
| Booster Seat using shoulder and lap seatbelt (BS) | 162 (23) |
| Booster Seat using shoulder and lap seatbelt with added H-harness accessory | 16 (2) |
| Backless booster cushion with shoulder and lap seatbelt | 10 (1) |
| Adult seatbelt – lap/sash | 79 (11) |
| Adult seatbelt – lap only | 4 (1) |
| H-harness accessory without specification of restraint type | 4 (1) |
| Unknown | 6 (1) |

## Beliefs relating to travel safety

Parents' beliefs relating to crash susceptibility were measured using their rating of concern for being involved in a motor vehicle crash. Most parents reported that they were 'not at all' or 'somewhat' concerned about involvement in a motor vehicle crash (6%, 53%, respectively), while 29 percent were 'quite' concerned and 12 percent were 'extremely concerned'. Almost two-thirds of parents reported a high attribution of responsibility for their children's occupant safety to internal factors such as their own driving ability (64%), safety compliance (64%), and choice of CRS (61%). Fifty percent of parents reported high attributions to other drivers' behaviours, while more modest levels of reporting were observed for other external factors including road maintenance (24%), legislation (21%) and fate (7%).

**Table 5. Summary of parents' responses to CRS knowledge questions**

| Question # | Survey question | *Correct n (%)* | *Incorrect n (%)* | *Unanswered n (%)* |
|---|---|---|---|---|
| **6** | Research shows that children under the age of 16 years are at 40% greater injury risk in front seat. | 367 (97) | 13 (3) | 0 (0) |
| **4** | Children 4-7 years to use FFCRS or BS. The type will depend on the child's size. | 361 (95) | 19 (5) | 0 (0) |
| **10** | Harnesses need to be adjusted for each trip for best protection against injury. | 346 (91) | 33 (9) | 1 (<1) |
| **9** | Main purpose of seatbelt guides on BS to encourage correct placement of sash seatbelt. | 339 (89) | 39 (10) | 2 (1) |
| **5** | An adult lap/sash seatbelt designed for people with a minimum height of 145cm. | 323 (85) | 52 (14) | 4 (1) |
| **1** | Children older than 6 months should only be moved from RFCRS to FFCRS when they have outgrown RFCRS. | 287 (76) | 92 (24) | 1 (<1) |
| **3** | FFCRS that comply with recent safety standards do not have a weight limit but instead use shoulder height markers to guide selection. | 284 (75) | 94 (25) | 1 (<1) |
| **2** | All children 4-7 years should move into booster | 252 (66) | 128 (34) | 0 (0) |
| **8** | Most children reach seatbelt height by 7 years | 222 (58) | 156 (41) | 2 (1) |
| **7** | An 'H-harness' add-on accessory does not provide additional protection to all booster seat use. | 187 (49) | 190 (50) | 3 (1) |

Parents were asked to rank the factors that may influence their choice of CRS, including the safety rating of the CRS, fines/legal deterrents, and community or family advice (where 1= highest ranked influence, 6 = lowest ranked influence. See Table A1 in Appendix). Most parents reported that the safety rating specified in the CRS Buyers Guide had the most influence over their choice of CRS (84%). Parents were also asked to rank six factors that influence child occupant safety, including type of vehicle, type/brand of CRS, restraint fitment in car, child/ren's rear seating location in car, child/ren's movement during motor vehicle travel and driving performance (where 1 = most influential, 6 = least influential. See Table A2 in Appendix). Parents ranked driving performance (35%) and the fitment of the CRS into the motor vehicle (30%) as the most influential factors for child occupant safety. In contrast, child/ren's movement during vehicle travel was ranked most influential by only three percent of parents.

## Discussion

This study has identified a number of interesting findings. The majority of parents were able to correctly answer questions related to the recommended transition from one restraint to the next based on age and visual marker guides. In contrast, most parents were not able to correctly identify the recommended height for transitioning their child into an adult seatbelt safely. Interestingly, parents with children under the age of four years were more likely to be in the high CRS related knowledge group. Females were more likely to be in the high CRS knowledge group, whereas males were more likely to be in the low CRS knowledge group.

The aims of the current study were to explore parents' beliefs regarding CRS use, travel safety and the factors that may influence child occupant safety. Results revealed a wide variation in parents' beliefs relating to CRS use and child vehicle occupant safety. When asked about their knowledge regarding CRS use, 97 percent of parents correctly reported that their children are safest when travelling in the rear of the vehicle. Most parents also correctly reported that the most appropriate type of CRS for children aged between four and seven years is a BS (95%). Most parents also reported the importance of correct CRS use for each individual trip by identifying the need to adjust harnesses for maximum safety (91%) and to use BS sash guides (89%).

Recommended CRS transition times from one CRS type to the next was less well known with three quarters (75%) of parents able to correctly identify transition recommendations from a FFCRS to a BS. Parents were required to have an understanding of transition times being dependent on age, size and be guided by the visual shoulder markers, as outlined in the recent safety standards. Using a different approach, an earlier study by Brown and colleagues (Brown, Fell, & Bilston, 2010) used mannequins for CRS inspections and found significantly fewer restraint errors in judging restraint appropriateness. This suggests some success in communicating CRS transition times to parents. Further initiatives may be warranted to reduce any remaining confusion and ambiguity between age and size that was found in this study.

Over 40 percent of parents incorrectly believed that most children would be at an appropriate height to be restrained effectively and safely by an adult seatbelt by the age of seven years. Previous research suggests that

**Table 6. Summary data for participant demographics by CRS-related knowledge groups**

| Participant demographics variables | Low score group (≤7/10) (*n*=151) *n* (%) | High score group (≥8/10) (*n*=229) *n* (%) | Total (*n*=380) *n* (%) | Chi-square |
|---|---|---|---|---|
| **Parental age (years)** | | | | |
| 20-29 | 16 (27) | 44 (73) | 60 (16) | |
| 30-39 | 78 (36) | 138 (64) | 216 (57) | $\chi^2(2)=15.3$, $p=0.000$* |
| 40 + | 57 (55) | 47 (45) | 104 (27) | |
| **Gender** | | | | |
| Female | 110 (36) | 194 (64) | 304 (80) | $\chi^2$ (1)=8.0, $p$=0.005* |
| Male | 41 (54) | 35 (46) | 76 (20) | |
| **Education** | | | | |
| HSC/VCE/TAFE | 41 (33) | 82 (67) | 123 (32) | |
| University degree | 73 (44) | 94 (56) | 167 (44) | $\chi^2$ (2)=3.3, $p$=0.194 |
| Higher degree | 37 (41) | 53 (59) | 90 (24) | |
| **Work status** | | | | |
| Full time: worker/student/self-employed | 65 (45) 50 (38) | 81 (55) 83 (62) | 146 (38) 133 (35) | $\chi^2$ (2)=2.4, $p$=0.308 |
| Part time: worker/student | 36 (35) | 65 (65) | 101 (27) | |
| Other: carer/pension/leave | | | | |
| **Income (AUD$)** | | | | |
| Low ≤49,999 | 13 (35) | 24 (65) | 37 (10) | |
| Middle 50,000-109,999 | 60 (37) | 103 (63) | 163 (43) | $\chi^2$ (2)=2.1, $p$ =0.352 |
| High ≥110,000 | 77 (44) | 99 (56) | 176 (46) | |
| Unspecified | 1 (25) | 3 (75) | 4 (1) | |
| **Number of children** | | | | |
| 1 | 56 (42) | 76 (58) | 132 (35) | |
| 2 | 70 (40) | 106 (60) | 176 (46) | $\chi^2$ (3)=3.2, $p$ =0.366 |
| 3 | 21 (40) | 32 (60) | 53 (14) | |
| 4+ | 4 (21) | 15 (79) | 19 (5) | |
| **Parents with at least one child in age group**† | | | | |
| Child < 1 year (*n*=60, 16%) | 16 (27) | 44 (73) | | $\chi^2$ (1)=5.1, $p$=0.024* |
| Child 1 - 4 years (*n*=252, 66%) | 89 (35) | 163 (65) | | $\chi^2$ (1)=6.1, $p$=0.014* |
| Child 4 - 7 years (*n*=172, 45% ) | 75 (44) | 97 (56) | | $\chi^2$ (1)=2.0, $p$=0.161 |
| Child > 7 years (*n*=104, 27%) | 43 (41) | 61 (59) | | $\chi^2$ (1)=0.2, $p$=0.694 |

*Statistically significant at $p<0.05$

† Analyses were not mutually exclusive and parents may be represented more than once.

most children do not reach this height until around the age of eleven years (Anderson, Hutchinson, & Edwards, 2007). Further opportunities exist to address the existing ambiguity amongst parents.by recommending height (145cm) for optimal protection from an adult seatbelt and communicating the approximate age range for reaching this height milestone (10-11 years).

Responses relating to the use of an H-harness aftermarket add-on accessory also indicated that there is some confusion regarding its use and safety benefits. Fifty percent of parents incorrectly responded that the H-harness improves safety in all circumstances including when a sash/lap belt is available. However, it should be noted that the H-harness is recommended for use when only a lap belt is available in the vehicle and only in combination with a BS and approved anti-submarining clip (National Road Transport Commission, 2009). Research by Koppel and colleagues (2013a) highlighted a high proportion of H-harnesses were being misused by Australian parents (84%). The relatively low use of H-harness amongst parents in this study (less than 4%) may explain the high level of misconception. Another plausible interpretation of the findings is that parents may be informed of the best practice and choose to not use the accessory and instead use the vehicle's lap/sash belt. Lap/sash belts are commonly available in Australian vehicles. These potential gaps in knowledge could be addressed by more effective communication about the contexts in which H-harness use is appropriate/effective.

The relationship between parent characteristics and CRS-related knowledge was also explored. Male participants were more likely to have lower CRS-related knowledge scores compared to female participants. Older participants (aged 40 years and older) were also more likely to have lower CRS-related knowledge scores compared to younger participants (aged between 22-39 years). Parents with children under four years of age were significantly more likely to have higher CRS-related knowledge than have lower CRS-related knowledge**.** Younger, female participants with children under four years of age may be more likely to have higher CRS-related knowledge scores because they may have had more recent exposure to maternal health care providers and other child-related health professionals. A plausible explanation for this would be recent communications with maternal health professionals. This finding supports recent research by Hunter and colleagues (2015) that revealed a relationship between exposure to information sessions regarding appropriate CRS use and actual appropriate CRS use. Other research has explored the challenges of promoting and achieving correct CRS use and acknowledged the importance of being able to deliver consistent CRS safety messages, as well as ensuring the delivering of tailored communications to minority groups (Brown et al., 2013; Weaver, Brixey, Williams, & Nansel, 2013). Knowing the target audience of those parents with lower CRS-related knowledge is a critical step to developing strategies that will encourage behaviour change.

Previous studies have identified a link between beliefs in terms of susceptibility to injury, LOC and behaviour (Bandura, 1971; Nelson & Moffit, 1988; Peterson, Farmer, & Kashani, 1990; Rosenstock, 1974). For example, individuals who understand motor vehicle injury risk and believe that they are accountable for safety have been shown to be more receptive to becoming engaged in seatbelt use (Hoyt, 1973). Despite the potential insights offered, no previous studies of LOC analysis of parents' child occupant safety were identified. Arguably, initiatives may be more successful in optimising child safety when travelling in motor vehicles if there is a greater understanding of parents' beliefs relating to crash injury risk, child occupant safety and the accountability for potential motor vehicle crash outcomes. When asked about whether they were concerned about being involved in a motor vehicle crash, parents reported being either 'quite' (29%) or 'extremely concerned' (12%) about being involved in a motor vehicle crash. This finding may mean that these parents will be more receptive to any CRS or child vehicle occupant safety initiatives.

Parents tended to attribute the responsibility of child vehicle occupant safety to internal factors such as their own driving abilities (64%), safety compliance (64%) and their choice of CRS (61%). Fewer attributed the responsibility to external factors such as other drivers (50%), road maintenance (24%) legislation (21%) and fate (7%). Early behavioural change research suggests that individuals who attribute the responsibility of the events/outcomes in their lives to internal factors are more receptive to adopting behaviour changes such as precautionary travel safety behaviours, when compared to the individuals that attribute responsibility of the events/outcomes in their lives on others, luck/chance or fate (Hoyt, 1973)**.** Encouragingly, few parents reported that they believed child vehicle occupant safety was luck or chance and therefore out of their control.

The findings of strong attribution of internal factors to child occupant safety indicates that parents may be receptive to future informative strategies to improve CRS knowledge. The strong influence of the CRS Buyers Guide on appropriate CRS use and the fitment of the CRS into the vehicle for optimal safety reported in this study is indicative of receptiveness to such current initiatives (Kidsafe Australia, 2014; RACV, 2014).

The study also explored parents' perceptions of the factors that contribute to the provision of optimal child occupant safety. CRS use is dependent on correct installation and use. CRS use does not equate to protection (Brown, McCaskill, Henderson, & Bilston, 2006). The movement of the child while travelling in a CRS was considered by parents as most influential to child occupant safety by three percent of parents. Given that correct use of a CRS includes the placement of a child's head within the protective zone of the CRS structure, with other placements potentially compromising safety delivered by the CRS, further exploration on movement is warranted.

Whether there is a relationship between CRS related knowledge and self-reported perceptions (such as safety consequences of child vehicle occupant movement) and child occupant travel behaviour, as suggested by the HBM (Bandura, 1971; Chen, et al., 2014; Rosenstock, 1974), will be further explored in a NDS. The injury consequences of child occupant movement and common OOP head placements will be explored in the next phase of this research through sled testing (see Stage 2, Figure 1). Future educational initiatives will be recommended from these findings.

Some limitations are noted. Despite attempts to recruit a representative sample, participants were predominantly female, had at least a university level of education and were in the two highest brackets for household combined gross income ($110,000 AUD or more). Therefore, the findings may not be representative of the general population. It should be noted that the study did successfully recruit 69% metropolitan participants and 31% rural participants which is consistent with recent Victorian data (Commonwealth of Australia, 2013). Another limitation to consider is the fact that the survey was only available in English language which may have biased the sample.

Also, findings reported in this study are based on responses to an online survey. While survey studies have provided valuable insights into child occupant safety, they have limitations in their capacity for accurate and unbiased reports regarding CRS use and misuse during real-world motor vehicle travel. For example, parents in the current study tended to attribute the responsibility of child occupant safety to internal factors such as their own driving performance. This may also be the result of social bias that has been evident in other research involving behaviours that may be

deemed socially unacceptable (Williams, 2003). Parents may have reported themselves as being responsible for child occupant safety as it is socially expected and 'the right thing to do' rather than an accurate representation of their beliefs. Finally, the parental knowledge was measured by true or false questions. Parents' CRS related knowledge should be explored further through the use of more qualitative and open ended interviewing techniques. To address the potential limitations associated with survey-based research on CRS use and misuse, a subset of participants from the current study (n = 42) were invited to participate in a NDS (Stage 2, Figure 1). NDS have been recently used to explore the nature and extent of CRS use and misuse (Andersson, Bohman, & Osvalder, 2010; Bohman et al., 2011; Charlton, Koppel, Kopinathan, & Taranto, 2010; Forman, Segui-Gomez, Ash, & Lopez-Valdes, 2011; Koppel, Charlton, Kopinathan, & Taranto, 2011). Importantly, NDS afford the possibility to examine the relative frequency and duration of occurrence of CRS misuse during everyday motor vehicle travel, providing better insight into the way in which child occupant safety may be compromised in the event of a motor vehicle crash. As part of Stage 2, participating families will be invited to drive an instrumented study vehicle (Charlton et al., 2013).

## Conclusion

All parents demonstrated some level of knowledge on correct and appropriate CRS use, however a number of misconceptions and gaps in CRS related knowledge remain. A key finding was that most parents attributed child occupant safety to internal factors, which suggests that parents may be receptive to injury risk reduction initiatives. The recruited sample is not representative of the Australian population and may provide an under-estimation of gaps in CRS related knowledge. Future initiatives need to be broad and multicultural to capture the needs of the general population. Future research will use video data of child occupant behaviour from a NDS from the larger study to compare these self-reported online survey findings with real-world child occupant travel.

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# Appendix

**Table A1. Factors influencing parents' choice of CRS**

| Factors influencing choice of CRS (n=341) | 1st ranked influence *n (%)* |
|---|---|
| Fines and legal deterrents | 12 (4) |
| What everyone else chooses | 6 (2) |
| Community/family advice | 14 (4) |
| The safety rating of CRS by Buyers Guide | 288 (84) |
| Other features not safety related (eg price, colour) | 17 (5) |
| Child/ren's choice/preference | 4 (1) |

**Table A2. Factors influencing child occupant safety**

| Factors influencing child occupant safety Total (*n*=346) | 1st ranked influence *n (%)* |
|---|---|
| Vehicle used | 42 (12) |
| Type/brand of restraint used | 44 (13) |
| Restraint fitment in motor vehicle | 104 (30) |
| Child/ren's rear seating location in car | 24 (7) |
| Child/ren's movement during travel | 11 (3) |
| Provision of best driving performance | 121 (35) |

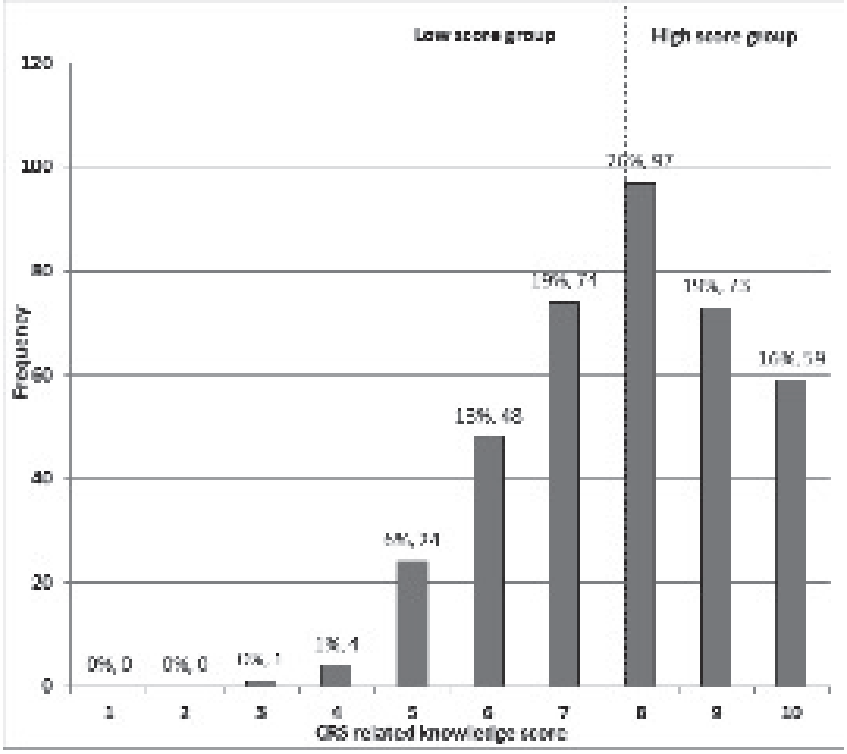


**Figure A1. CRS related knowledge total score**