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ABSTRACT

This study investigated the frequency of child restraint choices in a sample consisting of 357 drivers in the Adelaide metropolitan area, who were transporting to school 586 children aged up to 10 years. The main survey result was that the rate of appropriate restraint was between 64% and 72% on such trips, (according to weight criteria in the Australian and New Zealand Standard on child restraints for motor vehicles). Only 1% are completely unrestrained. Most of those who were not restrained appropriately had prematurely progressed to an adult seatbelt.

Appropriate child restraint use is lowest for children in the age range 5 - <7. Inappropriate restraint choice is strongly related to the child's age, their seating location (children seated in the rear being more likely to be restrained appropriately), and possibly the child's entry into primary school.

Female drivers were more likely than male drivers to know what restraints were suitable for children in their carriage. However, it did not appear to be the case than good knowledge of child restraints is predictive of appropriate restraint use.

Barriers to booster seat use included the child's attitudes to using a booster seat. This effect may be lessened if the child's age were able to used to guide restraint selection, as peer cues (for child and parent) would be more consistent. Drivers almost never mentioned cost as a barrier to child restraint use. Encouraging parents to become better informed may also help, but recommendations should be reviewed. Further developemnt of the Australian and New Zealand Standard for child restraints may enable age to be used as a criterion, thus simplifying advice to parents.

KEYWORDS

Child restraint, Data collection

Summary

This study investigated the frequency of child restraint choices in a sample of 357 drivers in the Adelaide metropolitan area, who were transporting to school 586 children aged up to 10 years. The main survey result was that the rate of appropriate restraint use was between 64% and 72% on such trips, (according to weight criteria in the Australian and New Zealand Standard on child restraints for motor vehicles). Only 1% were completely unrestrained. Most of those who were not restrained appropriately had prematurely progressed to an adult seatbelt.

Appropriate child restraint use was lowest for children in the age range 5 - <7. Inappropriate restraint choice is strongly related to the child's age, their seating location (children seated in the rear being more likely to be restrained appropriately), and possibly the child's entry into primary school.

Female drivers were more likely than male drivers to know what restraints were suitable for children in their carriage. However, it did not appear to be the case than good knowledge of child restraints is predictive of appropriate restraint use.

Drivers told us that the child's safety was an important concern. But many believed that the child's safe travel could be achieved with the use of an adult seat belt. Drivers may not feel compelled to provide a forward facing child restraint or a booster seat for the children they are transporting, as state law does not mandate their use. Official guidelines are reasonably clear, but may be difficult to remember and confusing to implement: most drivers did not cite the guidelines when asked about appropriate transition between restraints.

Barriers to booster seat use included the child's attitudes to using a booster seat. Anecdotally, children are concerned that booster seats are for babies, and see the adult belt as more "grown up". This effect may be lessened if the child's age were able to used to guide restraint selection, as peer cues (for child and parent) would be more consistent. Drivers almost never mentioned cost as a barrier to child restraint use. Encouraging parents to become better informed may also help, but recommendations should be reviewed. Further development of the Australian and New Zealand Standard for child restraints may enable age to be used as the criteria for transition, thus simplifying advice to parents.

A preface on notation

The notation used in this report to specify children's ages was chosen to remove ambiguity: a statement such as "children aged 5 to 7" might be interpreted as a group of children who have had their fifth birthday but not their eighth, or as a group of children who have had their fifth birthday but not their seventh.

To remove such ambiguity, we have chosen to use the following notation convention: when an age range is meant to include children who have had their i^{th} birthday, but not their k^{th} birthday, then we have specified the age range as "i - < k".

Contents

1 Introduction

The frequency of child restraint use for young children travelling in motor vehicles in the Adelaide metropolitan area was surveyed. The knowledge, attitudes and perceptions regarding the use of child restraints of drivers transporting children were also explored. Thirty-one sites were randomly selected and attended by Centre for Automotive Safety Research (CASR) research officers during August 2004.

The investigation was commissioned by the then Department of Transport and Urban Planning (DTUP) (now Department for Transport, Energy and Infrastructure (DTEI), of the South Australian Government.

1.1 The current situation

In Australia, State and Federal laws govern child restraints and their use. Federal regulations require vehicles sold in Australia to provide anchorage points for the installation of child restraints. Furthermore, under the Trade Practices Act, child restraints sold in Australia must comply with the relevant Australian and New Zealand Standard. The use of child restraints is governed by the Road Traffic Regulations in each of the States and Territories of Australia. However, while the design and sale of child restraints is closely regulated, the Road Traffic Regulations are not specific about their use, with the exception that children under 1 year of age should be restrained in an "approved child restraint". An approved child restraint is typically described in the regulations as "a device that complies with the Australian Standard Specification for Child Restraints for Passenger Cars and Derivatives (AS 1754) and is clearly marked with the certification mark of the Standards Association of Australia" (Road Traffic, Miscellaneous; Regulations 1999 (SA) Reg 37; s1b). But, the regulation for children older than 12 months is ambiguous and it is generally accepted that the Road Traffic Regulations in South Australia legally permit the use of an adult belt for children older than 12 months of age.

The South Australian Department for Transport, Energy and Infrastructure (DTEI), non government bodies and manufacturers do provide parents with advice on choosing appropriate restraints and this advice is based on the relevant Australian Standard: AS 1754:2004 "Child restraint systems for use in motor vehicles". The standard defines specific restraint devices and the suitable weight ranges (and for some restraints, length) for each. The normal translation of the Standard into advice suitable for parents, takes the form of the weight range for each seat and then, often, a corresponding age range. These recommendations are summarised in Table 1.1 and photographs of typical restraints are shown in Figure 2.1. Advice often also mentions the size and/or age from which an adult seat belt may be used although this is not dealt with explicitly by the Standard.

The relationship between good restraint fit and the child's age is not straightforward because children grow at different rates, and the distribution of sizes of children at a given weight shows some variability. Because of this, it is normal practice to promote the selection of a restraint based primarily on the weight of a child.

In AS 1754, there are basically three graduated types of restraint device; the infant restraint, the forward facing child restraint and the booster seat (a child harness is a fourth), The weight of a child that can be accommodated by the forward facing child restraint overlaps with the weights accommodated by the infant restraint at the lower end of the range, and with a booster seat at the upper end of the range (see Table 1.1).

Table 1.1
Australian and New Zealand Standard child restraint specifications and ages often recommended for the restraint

Restraint type	AS/NZS 1754		Corresponding ages based on 50th percentile weights	Age group often associated with restraint
	Weight	Height		
Infant restraint	< 9 kg	< 70cm	Birth to 8 months (male), 10 months (female)	Birth - 6 months
Forward facing child seat or convertible	8-18 kg		6 m – 5 y (male), 8 m – 5 y (female)	6 m - < 5 y
Booster seat	14-26 kg		2.75 y – 8 y (male), 3 y – 8 y (female)	3 – < 6 / 8 years (age varies by source)
Harness (only with booster if <26kg)	14-32 kg (without booster)			

Note: The Department for Transport, Energy and Infrastructure supplements advice with the comment that booster seat use can cease at "about 6 years", but alternative advice (e.g. leading manufacturer) mentions booster seat use to 7 years. The Royal Automobile Association of South Australia does not make any age-based recommendations at all.

The regulations, design standards and advice given to parents may create some ambiguities for parents/care givers in the definition of "appropriate" child restraint. While the Australian and New Zealand Standard implies one definition (based on weight/length), regulations that permit adult seat belt use by children above 12 months of age imply another, while age ranges used to advise parents provide a third definition (although these are almost always provided as supplementary to weight specifications).

So a working definition of "appropriateness" might range from what is permissible under law, through to what is optimal based on the size of children.

1.2 Evidence supporting the benefits of using child restraints

The benefits of using child restraints for young children has been well documented in the research literature. For example, Winston, Durbin, Kallan and Moll (2000) analysed crash data from insurance companies and telephoned the drivers and parents of child occupants involved in the crash. Booster seat use for children aged between four and eight years was inadequate. Fewer than 1% of children greater than five years of age were using a booster seat. The authors concluded that young children were more likely to be injured if wearing an adult belt compared to a child restraint, with an elevated risk for head injury. Furthermore, abdominal injuries (albeit low in frequency) only occurred for children using adult seatbelts. In a later study, Durbin, Elliot and Winston (2003) showed that booster seats were effective in reducing injuries to children in the 4-7 age range. They demonstrated a reduction in abdominal injury and overall, the odds of being injured in a crash for children in a booster seat were estimated to be 56% lower than those restrained by an adult seatbelt alone. It was not clear from the study how injuries of different severity were affected.

Such data highlight the importance of using age-appropriate child restraints for children travelling in motor vehicles.

1.3 Evidence that child restraints are not used consistently

Generally, studies have found that a higher proportion of infants are restrained appropriately (in infant capsules) than are older children (in child safety seats or booster seats). As the child ages, compliance with the recommended progression of child safety restraints lessens (Smith and Drummond, 1988). A common finding is that booster seats are most frequently used by younger children (three years of age) than older children (four years and greater) who are still at the appropriate age to use booster seats (e.g., Apsler, Formica, Rosenthal

and Robinson, 2003; Winston et al., 2000). Reasons for the non-use of booster seats have been investigated, although barriers to use appear to be variable. For example, Ebel, Koepsell, Bennett, and Rivara (2003) found that driver perceptions that a child had outgrown a child restraint was the major barrier to child restraint use, whereas Apsler et al. (2003) reported that the cost of the restraint was a major barrier for low income families. The former study was an observational survey, while the latter included focus groups where barriers to booster seat use would have been probed and discussed in greater depth.

Previous observations of child restraint use in South Australia have revealed that a high proportion of children are inadequately restrained. The Royal Automobile Association of South Australia (RAA) conducted an observational study of child restraint use in the Adelaide metropolitan area (Simons and O'Dea 1995). At five shopping centres, vehicles arriving with a minimum of one child occupant judged to be under eight years of age were observed. Children between the age of six months and eight years were analysed as a whole, that is, no differentiation was made between age-appropriate use for safety seats and booster seats. Child safety seats were used by 43% of 580 children (aged six months to eight years), consistent with an earlier study (Simons, 1991). Only 15% of children were using a booster seat, a decline of 7% from the earlier study. In total, child restraints were used for 58% of the children aged six months to eight years, a decrease of 8% from the earlier study. Even though a restraint was available for nearly all children, 12% were unrestrained. From 1991 to 1995 there was a 12% increase of restraint use (79% use for all restraint types) for children aged six months to eight years, attributable to an increase in use of adult seatbelts. Simons and O'Dea (1995) noted that economic status appeared to be positively associated with seatbelt wearing rates and recommended that this association be further investigated.

A later investigation found that 59% of all interviewed drivers had correctly restrained children in either a seatbelt or an appropriate child restraint (Simons, 2000). Data was analysed from observations and interviews conducted with 115 drivers transporting children that were less than five years of age at pre-schools in the Adelaide metropolitan area. Of the 41% of drivers restraining children inadequately, the problems were described as minor in 14% of cases (e.g., seatbelt under arm or seatbelt loose), but serious in 27% (e.g., children completely unrestrained or sash behind their back). Drivers who adequately restrained the child they were transporting were able to correctly identify misuse of restraints in photographs. Simons (2000) argued that drivers had determined the risk of transporting their children unrestrained and that they justified their non-use of restraints (child or adult restraints) with statements alluding to the belief that short journeys in a vehicle did not require restraints. However, all of the drivers recognised that it was illegal to travel with a child unrestrained when a restraint was available.

Ramsey, Simpson and Rivara (2000) found that a common reason that parents did not use booster seats was because they believed that their child (in the three to eight years age range) was too big for them. Of those children in the booster seat age range, only 28% were using booster seats. Parents interviewed commonly believed that their child was not in need of a booster seat as the adult seatbelt provided adequate safety.

1.4 Overview of study

The present study attempted to estimate current child restraint use in the Adelaide metropolitan area, along with possible predictors of age-appropriate child restraint use.

The study had four objectives:

- Estimate the prevalence of child restraint use (focusing on booster seat use) in the Adelaide metropolitan area by examining trips to school.
- Identify variables that are predictive of age-appropriate restraint use.
- Estimate the degree of driver knowledge and beliefs about child restraint use.
- Identify variables that are predictive of knowledge and beliefs about restraint use

2 Method

2.1 Overview

The survey was designed to assess the frequency of child restraint use, with a focus on the use of booster seats. In short, children aged 0-10 were observed arriving by car at pre-schools and primary schools in the Adelaide metropolitan area. After they had been observed, the vehicle driver was asked a few questions about their knowledge and perceptions of child restraints.

2.2 Participants

Approval for this study was granted by the University of Adelaide's Human Research Ethics Committee, the Department of Education and Children's Services (DECS) and the Catholic Education Office. Thirty-one sites were randomly selected and attended by CASR research officers during August 2004. They were 16 pre-schools or child parent centres, and 15 junior primary or primary schools. CASR research officers approached 427 drivers of vehicles arriving at the designated sites, if they were transporting a child judged visually to be 10 years of age or less. In total, 357 interviews were conducted, a response rate of 84%. Among the 70 drivers refusing to participate, the most frequent reason given was that the driver was in a hurry to be elsewhere (59 drivers).

Corresponding to the 357 driver interviews, a total of 586 children in the desired age range (birth to 10 years) made up the sample. Observation of restraint use proved to be difficult when vehicles had tinted windows, were high and thus difficult to see into, and when children had removed their restraints ready to alight. In such instances, there was the need to rely on driver's report of restraint use. In some cases, self-report data were corroborated by observation. Considering the 586 children, restraint type and use were observed for 74%, were reported for 16%, and for the remaining 10%, restraint type was observed but use was reported (as the child had already removed it before the observer could see).

2.3 Sites

A sample of 16 pre-schools and 15 primary schools was randomly selected. An introductory letter was mailed to the selected schools/preschools, asking permission to conduct an overt observational study of the children arriving in vehicles at the sites together with a brief driver survey. This letter is reproduced at Appendix A. It explained the importance of keeping the purpose of the study confidential in order to permit a valid observation of actual child restraint use. A CASR research officer telephoned each site to confirm their participation and to obtain information on the following: scheduled closures, hours of operation, regular student arrival times, common entrance areas, number of children enrolled (< 11 years) and if any other pre-schools or schools adjoined the premises. One primary school refused consent, and a replacement school was randomly selected.

2.4 Survey schedule

The observations and interviews were undertaken on school days, over a four-week period during August 2004. Sites were randomly allocated to a date for data collection, with some exceptions to account for closure days and days when a higher-than-usual influx of arrivals was expected. Data were only collected during arrival times, not when children were being collected, to minimise any situation in which drivers could alter their behaviour as a consequence of being observed. Research officers attended primary schools from approximately 8:15 a.m. and pre-schools from 8:15 a.m. and 11:30 a.m. (to cover both sessions). Between two and four observers collected the data, depending on the number of children enrolled at the school. The survey was conducted openly, so as not to arouse any hostility or suspicion. Research officers wore CASR vests to show their affiliation. It was

assumed that overt data collection was adequate as those not using child restraints could not alter their behaviour prior to the observations.

2.5 Materials

A survey was designed to assess driver knowledge of child restraint use, reasons for the use or non-use of restraints and to collect demographic information. This is reproduced at Appendix B. It was essential to keep the survey short in order to increase driver participation: drivers were in transit and very likely would not have been prepared to participate in lengthy interviews. It was therefore designed to be conducted within 2-3 minutes, though this obviously depended on length of participants' responses. The survey consisted of four sections, as described below.

2.5.1 Knowledge of when to begin using child restraints

The first section of the survey assessed the driver's knowledge of when to begin using specific child restraints. It began, "To begin with I'm going to show you three photos and for each one I'd like you to tell me at what age, if any, you would first put your child into the pictured restraints?" The question was followed by the presentation, in a random order, of the three photographs shown in Figure 2.1. The photographs showed an infant capsule, a child safety seat and a booster cushion. (Presenting a booster cushion, i.e., without a high back, rather than a booster seat with a high back, was intended to avoid confusion with a child safety seat.) If the driver answered with an alternative to age, their response was recorded verbatim.

Figure 2.1
Photographs presented to participants: an infant capsule, child safety seat and a booster cushion

Following presentation of the photos, the driver was asked "At what age would you stop using a booster seat?". If the driver stated that they did not know what a booster seat was, the photo of the booster cushion was presented again for clarification.

2.5.2 Restraint use and child demographics

The second section of the survey required the interviewer to observe and record restraint selection for each child in the vehicle and any unoccupied child restraints. (The child had often alighted from the vehicle by this time, but the method of restraint was observed upon arrival.)

Questions were asked about the children being transported, to assess the suitability of the selected restraint. Drivers were asked to report the child's height, weight and age. Interviewers were equipped with tape measures and subsequently measured the child when drivers were unsure and permission was granted, provided the child had not already left (This was rarely done as many drivers provided an estimate of the child's height). Drivers were asked if the child was a member of their household and if they normally drove them to school to evaluate if any bias existed for restraining one's own child. Furthermore, drivers were asked the child's gender.

2.5.3 Driver beliefs for method of child transportation

The third section of the survey was designed to understand the driver's reasons for choosing the type of restraints they used whilst transporting children less than 11 years of age. There were two sets of questions and those asked were dependent upon the use or non-use of child restraints.

For drivers transporting a child seated in a child restraint, the interviewer asked the driver "What made you decide to use a <and named the restraint>?" The driver was then asked "Under what circumstances would you not use a child restraint for children whilst driving?", to determine if it was just a rare occasion of use or frequent, as well as to determine how much value they placed on the use of child restraints.

For those children not seated in a child restraint (that is, they were unrestrained or restrained with the adult seatbelt), the driver was asked "What made you decide not to use a child restraint?", to try and understand what attitudes created the belief that it was sufficient to use the adult seatbelt. The driver was then asked "Do you ever use child restraints when transporting children?", to determine the frequency of non-use of child restraints.

2.5.4 Driver demographics, knowledge of the law and vehicle details

The final section of the survey involved asking the driver questions regarding their knowledge of the law, their demographics and the year, make and model of their vehicle. The question about the law was asked to determine if knowledge about the law played any role in the use of child restraints: "As far as you're aware are there any current laws on restraining children in cars?" If they answered yes, they were asked to briefly describe their understanding of the law.

The survey closed by collecting demographic information about the driver. This information was collected last in case any driver found it invasive, and so that it did not influence driver responses to questions regarding attitudes and reasoning about the use or non-use of child restraints. The information obtained was age, gender, main language spoken at home, highest level of education completed, approximate annual household income and current employment status.

At completion of the driver interview, the participants were provided with a Kidsafe fact sheet on child restraint use, and with contact details for CASR, in case participants had further queries. The Kidsafe fact sheet (kindly provided by Kidsafe) gives recommendations for the age, weight and height requirements for child restraint use.

2.6 Procedure

Interviews were conducted on the footpaths and/or car parks associated with each site. A CASR vehicle (marked as such) was parked in close proximity to the site and research officers wore yellow vests and photo identification that identified them as CASR representatives. Researchers approached the driver of the first car (or similar vehicle) that stopped outside of the site with at least one child being transported who appeared to be less than 11 years of age. (Buses and taxis were excluded.) Following completion of that interview, the interviewer would approach the driver of the next vehicle that met the inclusion criteria.

The research officer noted the restraint use of the children and the seatbelt use of the driver as the vehicle approached. The research officer introduced herself or himself, and informed the driver that they were conducting a survey on travelling with children in cars. The research officer told the participant that the information they provided was confidential, that they were under no obligation to participate and that they could withdraw from the interview at any time. The driver was then asked for their consent to participate in the study. Drivers who escorted their child into the school or pre-school before answering questions were

interviewed upon return. In some cases, it was impossible to observe actual seatbelt use due to height of the vehicle or tinted windows, and restraint and seatbelt use were reported by the participants. Whether occupied or unoccupied, child restraints were directly observed in the vehicles. Drivers who declined participation were noted.

3 Characteristics of the sample

3.1 Driver demographic characteristics

A total of 357 drivers participated in the study (76% female, 24% male). Their ages ranged from 19 to 80 years (M = 38, SD = 9). Five hundred and eighty six child occupants in the relevant age range (0 - <11 years) were being transported by those drivers, with a mean age of 5.0 years (SD = 2.2 years; 52% male, 48% female). There were 72 vehicle occupants greater than 10 years of age (and thus outside of the relevant age range), and 38 unoccupied child restraints were observed.

Table 3.1 shows the distribution of age by gender of the driver. There were 35% of participants aged 25 to 34 years, and 46% aged 35 to 44 years. Three female drivers did not wish to report their age.

Table 3.1
Age distributions of female and male drivers

Age	Female (%)	Male (%)
	N = 268	N = 86
< 25	5	2
25 - 34	38	29
35 - 44	49	40
>= 45	9	29

A small proportion of participants (10%) stated that at home they spoke a non-English language or both English and non-English. (Two drivers stated that they did not wish to answer the question.)

Driver's level of education is reported in Table 3.2. The majority (61%) had completed secondary education, and 37% were undertaking or had completed tertiary education (university, TAFE or colleges). (Six participants were not willing to report their level of education.)

Table 3.2
Educational level distributions of female and male drivers

Educational level	Female (%)	Male (%)
	N = 266	N = 86
Primary school	2	4
Secondary school	62	59
Tertiary	37	38

Annual household income is reported in Table 3.3. (Data are missing for 17% of the drivers, as 6% were not willing to divulge their income and a further 11% stated that they were unsure.)

Table 3.3
Distribution of household income reported by interviewed drivers

Income (thousand dollars)	%
	N = 295
≤50	44
51-110	42
>110	13

Table 3.4 shows employment status by gender of the driver. Home duties was the most frequently reported status of employment, followed by full-time employment. (Two females were not willing to report their employment status and data were missing for another two females.)

Table 3.4
Distribution of employment status of female and male drivers

Employment status	Female (%)	Male (%)
	N = 267	N = 86
Full time	12	49
Self employed	2	5
Casual	9	2
Student	5	2
Home duties	33	5
Part time	23	7
Unemployed	11	9
Other[a]	6	21

[a] 'Other' includes: carer, pension and retired

Driver restraint use was extremely high, with 99% compliance (86% observed and 13% self-reported). Only 1% of drivers were observed not wearing a seatbelt. Restraint use was recorded for 299 drivers.

3.2 Region of surveys

The numbers of sites (randomly selected) and interviews conducted in each Department of Education and Children's Services (DECS) District are presented in Table 3.5.

Table 3.5
Percentage of interviews in each DECS district

District, and number of sites	Interviews (%)
N = 31	N = 357
Salisbury (2)	3
Kumangka Para (2)	5
North East (6)	18
East (4)	17
Inner South (3)	15
Wallara Outer South (3)	11
South West (5)	13
Metro West (6)	19

Only a small number of interviews were conducted in Salisbury and Kumangka Para. To facilitate statistical analysis, the districts were grouped by geography into north, east, south and west (Table 3.6).

Table 3.6
Combined districts to make geographic regions and percentage of surveys conducted in each region

Region	DECS districts combined to make regions	%
North	Salisbury, Kumangka Para, North East	26
East	East	17
South	Inner South, Wallara Outer South, South West	39
West	Metro West	19

3.3 Site, day and time of surveys

Sixty-four percent of surveys were conducted at primary schools, and 36% at preschools. For the primary schools, all of the surveys were conducted during morning arrival times, while at preschools they were conducted at the start of either of the two kindergarten sessions. Each site was randomly allocated to a day and time for data collection, subject to staff availability, site closures and number of students expected to be arriving on the given day. Table 3.7 shows the breakdown of surveys for each day of the school week.

Table 3.7
Percentage of surveys conducted by day of week and time of interview

Time	Monday	Tuesday	Wednesday	Thursday	Friday
Morning	10	17	24	21	7
Lunch	2	6	3	5	5
Total number	45	82	97	92	41

3.4 Vehicle type

Table 3.8 shows the range of vehicles driven by the participants. Van refers to a vehicle for more than six passengers, and utility to a vehicle for less than three occupants.

Table 3.8
Type of vehicle transporting the child

Vehicle type	%
3-door hatchback	1
4WD	12
Hatchback	11
Sedan	50
Station wagon	16
Utility	1
Van	9
Total	100 (n=320)

Note: 37 vehicle types were missing

4 Child restraint use

This section presents the main findings from the survey: the restraints used by children being transported by the survey respondents.

4.1 Child's age

Table 4.1 shows the percentages of children using each method of restraint, for each of 12 age groups. (In 74% of cases, restraint use or non-use was observed, and in 16% it was reported by the driver; in 10% of cases it was observed in some respect, such as presence of the restraint, and driver-reported in another respect, such as use on this occasion.)

Table 4.1 also shows with boxes the age brackets that approximately correspond to weight specifications in AS/NZS 1754:2004. These boxes are based the 50th percentile weights of children of particular ages, and whether or not that weight falls into the specification of the restraint type.

Table 4.1
Percentages within each age group using each method of restraint (N=586)

Age group	Infant capsule	Child seat	Booster seat	Adult belt	None	Count
0-<.5 years	82%	18%	0%	0%	0%	11
.5-<1 year	0%	100%	0%	0%	0%	13
1-<2 years	0%	84%	5%	11%	0%	19
2-<3 years	0%	68%	29%	3%	0%	38
3-<4 years	0%	38%	43%	17%	2%	42
4-<5 years	0%	9%	54%	35%	2%	162
5-<6 years	0%	2%	32%	65%	1%	91
6-<7 years	0%	2%	20%	75%	3%	64
7-<8 years	0%	0%	18%	82%	0%	56
8-<9 years	0%	0%	4%	91%	4%	45
9-<10 years	0%	0%	3%	97%	0%	31
10-<11 years	0%	0%	0%	100%	0%	14
Total %	2%	16%	29%	52%	2%	
Count	9	91	172	304	10	586

Five children were using a harness in conjunction with an adult seatbelt.

Boxes indicate age-approximate appropriate restraints based on 50th percentile weights for each age, and weights specified in AS/NZS 1754:2004.

For the purposes of this study, we considered that a restraint selection was appropriate, if the child's weight fell within the limits specified by AS 1754. The age of a child can be used a proxy for the child's weight, but only predictably across the study sample.

For each age group we would expect to see a distribution of weights. Therefore, the numbers falling within the boxes shown in Table 4.1 may or may not indicate the extent of appropriate restraint in each age group. Nevertheless, a cursory examination of Table 4.1 suggests that premature progression to restraints unsuited to the child's age is a characteristic of every age group, and is most prevalent amongst children of late pre-school age and early primary school age. Sizeable proportions of children in each age category above 2 years of age were wearing an adult seatbelt only. However, relatively few children in the sample were unrestrained (2% of the sample).

The criteria available to parents for selecting a restraint type for their children relate to the Australian and New Zealand Standard, AS/NZS 1754:2004. Some further fine tuning of the restraint selection process is sometimes made, with the seated height and the geometry of the adult belt in a particular vehicle determining the optimum time to move to an adult belt

and/or whether the use of a harness might be indicated. As we have mentioned, age is often offered as supplementary advice for restraint selection. Table 4.2 shows how such advice is typically rendered in South Australia. For example, the age criteria deem that a child from 0.5 to less-than 5 years of age may be appropriately restrained in a forward facing child seat. As we collected age information in our survey, we can report rates of restraint selection against the age criteria in Table 4.2. The result of such a comparison are shown in the first column of Table 4.4.

Table 4.2
Typical age recommendations for child restraints, South Australia

Age group	Infant capsule	Child seat	Booster seat	Adult belt
	< 6 m	6 m – 4 y	3 y – 6/7 y	> 6/7 y
0-<.5 years	*	-	-	-
.5-<1 year	-	*	-	-
1-<2 years	-	*	-	-
2-<3 years	-	*	-	-
3-<4 years	-	*	*	-
4-<5 years	-	*	*	-
5-<6 years	-	-	*	-
6-<7 years	-	-	*	*[1]
7-<8 years	-	-	*[1]	*
8-<9 years	-	-	-	*
9-<10 years	-	-	-	*
10-<11 years	-	-	-	*

Asterisks indicate recommended ages for each type of restraint

[1] The Department for Transport, Energy and Infrastructure indicates that booster seat use can cease at "about 6 years", but alternative advice (e.g. leading manufacturer) mentions booster seat use to 7 years.

We can also use the age of children to estimate weight-appropriate restraint use, by considering the weight distribution of children by age. By consulting human growth data, we calculated the relative proportions of children in each age category that satisfy the weight criteria in AS 1754. Consequently we are able to estimate the proportion of children at each age for who each type of restraint is suitable.

We consulted U.S. growth data from the Centers for Disease Control and Prevention (Kuczmarski et al., 2000). We assumed that these data were applicable to Australian children. Kuczmarski et al. (2000) tabulate growth data by age and sex, and the tabulated values for the mean and standard deviation for children's weight were pooled to provide mean and standard weight deviations for our age categories. Male and female data were also pooled. Then, for each age group, the expected proportion of each age category falling within the weight ranges specified by the Australian Standard was estimated by assuming a normal distribution of weights, and using standard Z-scores.

For example, an analysis of the Centers for Disease Control and Prevention (CDC) growth tables suggest that approximately 100% of all 2 - < 3 year old children's weights are greater than 8 kg and less than 18kg and thus, all 2 - < 3 year old children are suitable for restraint in a forward facing child seat. Thirty-four percent of children in the same age range weigh 14kg – 26 kg, and are therefore suitably restrained using a booster seat. Our analysis of the CDC growth tables in conjunction with AS/NZS 1754:2004 is shown in Table 4.3.

Table 4.3
Proportion of all children in the weight categories defined in AS/NZS 1754:2004, by age, based on CDC growth charts (Kuczmarski et al., 2000).

Age group	Birth – 9 kg (Infant capsule)	8 kg – 18 kg (Child seat)	14 kg – 26 kg (Booster seat)	>26 kg
0-<.5 years	n.a.[1]	n.a.[2]	0%	0%
.5-<1 year	44%	84%	0%	0%
1-<2 years	6%	99%	8%	0%
2-<3 years	0%	100%	34%	0%
3-<4 years	0%	88%	74%	0%
4-<5 years	0%	58%	90%	0%
5-<6 years	0%	29%	93%	3%
6-<7 years	0%	14%	85%	13%
7-<8 years	0%	6%	63%	37%
8-<9 years	0%	4%	38%	61%
9-<10 years	0%	3%	21%	78%
10-<11 years	0%	1%	12%	88%

[1] Tabulated CDC data are only available for birth weights and weights of children over 2 months. However, this proportion is greater than 94%

[2] Similarly, this proportion is less than 31%

Assuming that our sample of children is typical, and similar to the population used to create the CDC growth charts, we can estimate the rate of weight-inappropriate restraint use in each age group in the sample. Some assumption needs to be about the method of restraint selection for each individual child:

Optimistically, we can assume that, where the proportion of children using a particular restraint (Table 4.1) is less than the maximum proportion that we would expect (Table 4.3), that all children were in a correct restraint for their weight. For example, Table 4.3 shows that no more than 34% of 2 - < 3 year-old children are sufficiently heavy for a booster seat. Referring to Table 4.1, 29% of 2 - < 3 year-olds in our sample were restrained in a booster seat, which is less than the maximum, and therefore we can estimate optimistically that all of the 29% of the 2 - < 3 year-olds in booster seats were appropriately restrained for their weight. This method of estimating the rate of weight-appropriate restraint selection assumes that the children are distributed amongst the types of restraint according to the rank of the child's weight within the sample.

Alternatively, we can assume that children were "randomly allocated" their restraint, with no regard for their weight. For example, referring to Table 4.3, we estimate that, in our sample, only 88% of 3 - < 4 year-olds in child seats and only 74% in booster seats are within the correct weight range for their restraint. This gives a more pessimistic estimate of weight-appropriate restraint use.

Note that AS/NZS 1754:2004 does not specify a weight for the commencement of an adult belt. We have made the assumption that once a child exceeds 26 kg, a booster seat is unsuitable, and it is therefore preferable that they be restrained by an adult belt. This assumption strongly influences our results for children 5 years and older.

The results of our analysis along these lines, for rates of inappropriate restraint selection, are shown in Table 4.4.

Table 4.4
Estimated rates of weight-inappropriate restraint selection

Age group	Using age alone	Using age, and weight distributions at each age		Unrestrained
		optimistic	pessimistic	
0-<.5 years	18%	0%	17%	0%
.5-<1 year	0%	16%	16%	0%
1-<2 years	16%	16%	17%	0%
2-<3 years	32%	3%	22%	0%
3-<4 years	19%	17%	32%	2%
4-<5 years	37%	35%	44%	2%
5-<6 years	68%	62%	65%	1%
6-<7 years	5%	62%	68%	3%
7-<8 years	0%	46%	59%	0%
8-<9 years	9%	30%	38%	4%
9-<10 years	3%	19%	24%	0%
10-<11 years	0%	12%	12%	0%
Weighted mean	18%	28%	36%	1%

The rate of unrestrained child occupants was low – 1% (weighted mean). We have listed rates of unrestrained child occupants separately from the rates of inappropriate restraint in Table 4.4, as an unrestrained child is at significantly greater risk of injury in a crash than a restrained child, irrespective of a non-ideal restraint selection. Inappropriate restraint selection in this context of this survey is about choosing a less-than-ideal restraint for the child. Therefore, when interpreting Table 4.4, it should be borne in mind that even an inappropriate restraint, in this context, may provide some level of protection

A notable aspect of Table 4.4 is the fact that, at ages 6 and over, the numbers of children that are probably in the wrong restraint for their weight is not indicated by those in "age-inappropriate" restraints.

The 50th percentile weight for children on their 8th birthday is close to 26 kg. Figure 4.1 is a graphical representation of the data in Table 4.4, and also shows how the rate of inappropriate restraint selection, estimated by age, would look if we use the age of 8 years to indicate when a child can appropriately stop using a booster seat. The modified age criteria produce a better estimate of the proportion of restraint selections that were weight-inappropriate. However, the proportion is increasingly overestimated for children older than 6.

Note that this analysis does not suggest how age might be used to recommend a type of restraint for a particular child. The analysis only describes for our sample, the likely rates of weight-appropriate (or inappropriate) restraint selection, and how well the age of the child can be used to approximate this.

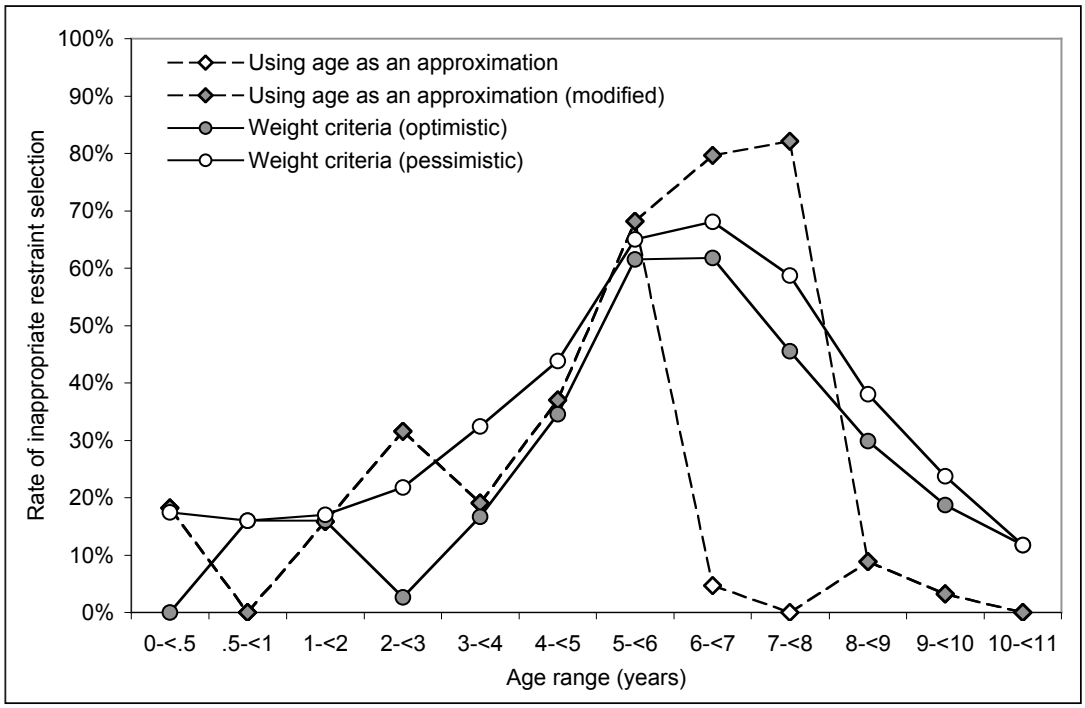

Figure 4.1
Rates of inappropriate restraint selection based on age criteria and an estimated rate based on weight criteria

4.2 Reported weight

Drivers were asked to report the child's weight and height. As we have already mentioned, these estimates were not reliable: many drivers were unsure and reported large measurements for small children and vice versa. Table 4.5 is analogous to Table 4.1, but refer to child's weight, instead of age. The unreliability of reported weight means that the interpretation of Table 4.5 is more uncertain than that of Table 4.1, but at least we can say that in general terms they confirm the previous finding that many children are in the wrong restraint for their weight.

Table 4.5
Percentage in each weight group using each method of restraint (N=417)

Kilograms	Infant Capsule	Child seat	Booster seat	Adult belt	None	Count
0-7	**67**	22	11	0	0	9
8	**0**	**100**	0	0	0	6
9-13	0	**69**	19	12	0	42
14-18	1	**22**	**50**	27	1	128
19-26	0	3	**38**	59	0	150
27+	0	1	9	**89**	1	82

Boldface indicates percentages of children in each weight category that were in the correct restraint for their weight

4.3 Restraint use by seating location

We observed the seating location of each child (or relied upon report of the parent when we could not see). Table 4.6 shows the seating location and restraint use for all children less than 11 years of age. The majority of the children were seated in the rear of the vehicle, and child restraints were not frequently used if the child was seated in the front of the vehicle.

Table 4.6
Cross-tabulation of seating location and method of restraint (N=586)

Seating Location	Infant seat	Child safety seat	Booster seat	Adult belt	None	Count
Front	0	1	3	22	1	154
Left Rear	1	7	11	13[a]	1	184
Centre Rear	1	4	2	7[b]	0	81
Right Rear	0	4	11	8	0	141
Third Row	0	0	2	2[c]	0	26

[a] One child was using a harness with the adult seatbelt.

[b] Three children were using a harness with the adult seatbelt.

[c] One child was using a harness with the adult seatbelt.

5 Drivers' knowledge of child restraints

Drivers were asked several questions to assess their knowledge of child restraints. Successive Sections below will report on knowledge of when to begin using an infant capsule, when to begin using a child safety seat, when to begin using a booster seat, when to cease use of a booster seat, and of the relevant law.

As we have already pointed out, information on the staged use of child restraints is somewhat ambiguous. We therefore have coded as correct, answers that are consistent with the Australian and New Zealand Standard 1754:1995 as well as age guidelines typically used in South Australia. It will be seen that most drivers' responses were made using aged-based criteria.

5.1 Driver's knowledge of when to begin using an infant capsule

Ninety eight percent of the 357 drivers interviewed correctly stated that they would use the pictured infant capsule from birth.

5.2 Driver's knowledge of when to begin using a child safety seat

The recommendations for commencing use of the child safety seat is when the child is 8 or 9 kg, greater than 700 mm in length, corresponding to an age of about 6 months.

Participant answers were categorised into four groups based upon the standard recommendations for commencing use and are presented in Table 5.1. Good knowledge was assessed if answers accorded with at least one the recommendations relating to weight, length and age. It can be seen that the majority (71%) of participants had incomplete or poor knowledge of when to begin using a child safety seat. Knowledge was assessed as incomplete if the driver knew the kind of factors that were important, such as weight and length, but did not know the recommended values for the commencement of child safety seat use. There were 84 participants who suggested criteria other than age for the appropriate time to begin child safety seat use. (Some of these participants also gave an age). Twenty-nine percent of participants believed that a child should use a child safety seat when the child is able to sit upright and support their head.

Table 5.1
Driver knowledge of when to begin child safety seat use

Driver knowledge	Count	%
Good knowledge		
6 months, 70 cm, or 8-9kgs	105	29.4
Poor knowledge		
Incomplete knowledge	20	5.6
< 6 months or weight and height less than recommendations	32	9.0
> 6 months or weight and height greater than recommendations	187	52.4
Don't Know/Never use	8	2.2
Incorrect or irrelevant comment	5	1.4
Total	357	100.0

There were 321 drivers who answered with a specific age to the question on when to begin child safety seat use. Figure 5.1 shows the distribution of responses. It can be seen that six months of age was the modal response.

It should be borne in mind that some interviewees were transporting older children and may have forgotten or had no prior experience of the transition from infant capsules to child seats.

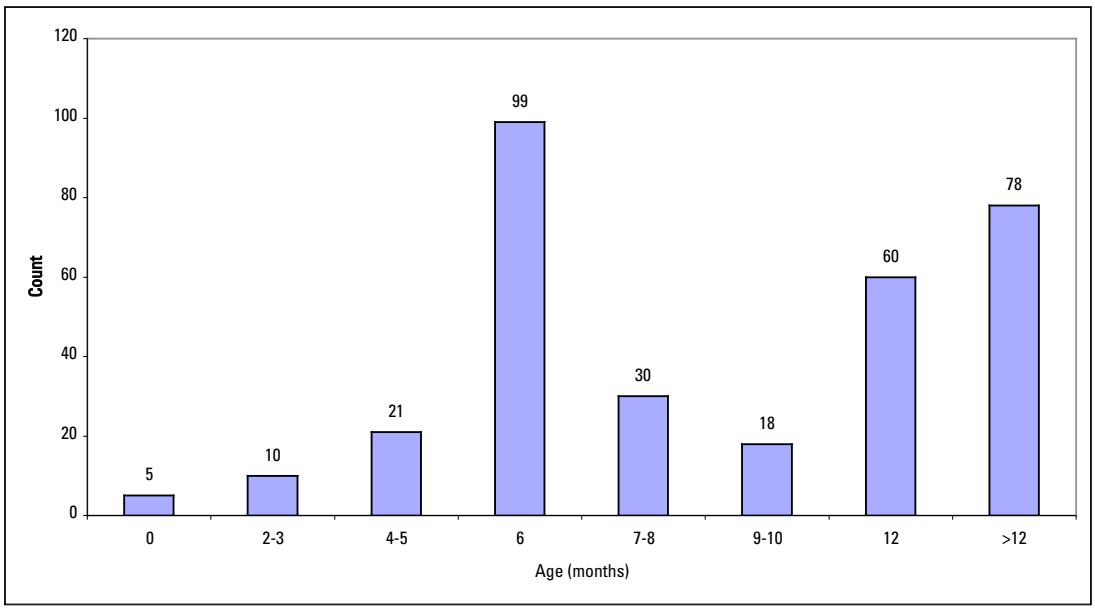

Figure 5.1
Distribution of age in months reported for beginning child safety seat use

5.3 Driver's knowledge of when to begin using a booster seat

A driver was assessed as having good knowledge of when to begin booster seat use if they responded with three, four or five years of age, or a weight between 14 and 18 kg. We allowed an age range of 3 to 5 because, in South Australia, DTEI suggests that child safety seats may be used to 4 years and that booster seats from 3-and-a-half years of age. This range seems reasonable given the analysis presented in Table 4.3: two-thirds of 2 year olds are too small for a booster seat and a similar proportion of 5 years old are too large, whereas a majority of 3 and four year olds are appropriately restrained with either device. Table 5.2 shows the frequencies of different answers. (A common response was that individuals would not use the booster cushion and would only use the booster seat with a back as they believed the booster cushion to be unsafe. Such answers were categorised according to information provided for when to begin booster use.)

Table 5.2
Driver knowledge of when to begin booster seat use

Driver knowledge	Count	%
Good knowledge		
3, 4 or 5 y, 14-18 kg	247	69.2
Poor knowledge		
< 3 y, weight less than recommendations	68	19.0
> 5 y, weight greater than recommendations	13	3.6
Never use/unsure/never seen	22	6.2
Incomplete knowledge	6	1.7
Incorrect/irrelevant comment	1	0.3
Total	357	100.0

Figure 5.2 shows the distribution of responses for the 307 participants who responded with an age to the question on commencing booster cushion use.

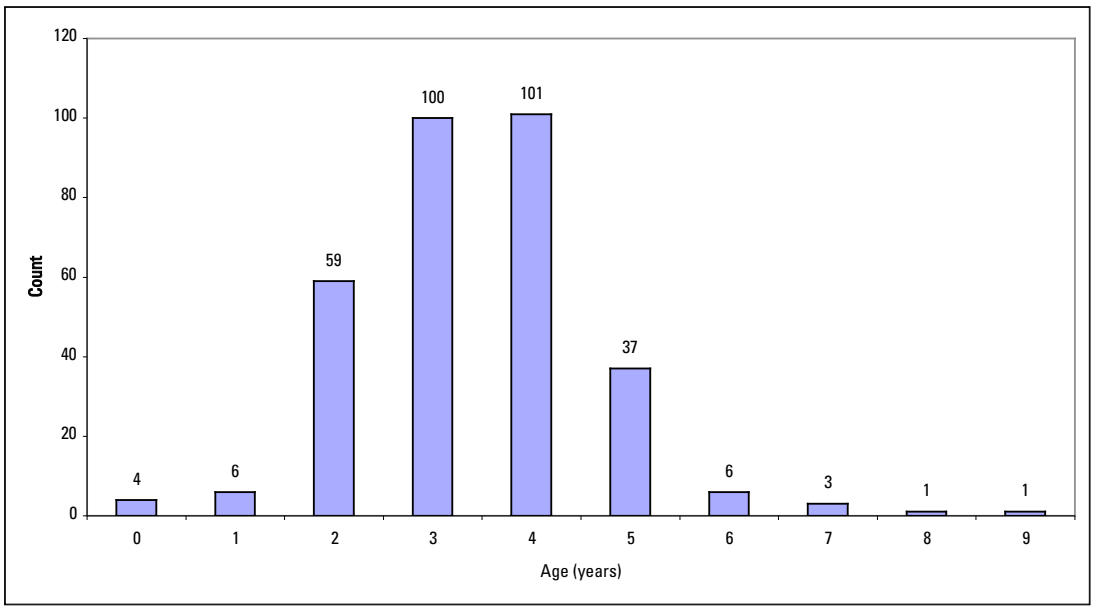

Figure 5.2
Distribution of age in years reported for beginning booster cushion use

Thirteen drivers who were transporting children in the three to eight year age range (appropriate age for booster seat use) stated that they would never use a booster seat: 11 of the children were using lap sash seatbelts (one with a pillow) and two children were not restrained.

5.4 Driver's knowledge of when to cease use of a booster seat

There were 344 participants who were asked when they would cease using a booster seat for a child. (Participants who stated that they did not know what a booster seat was were not asked this question.) Although 26 kg (the upper weight limit for a booster seat) corresponds to the 50th percentile weight of an eight year old, DTEI recommendations mention that an adult seat belt may be used from about 6 years of age. Therefore we considered respondents who answered with 6, 7 or 8 years were considered to have good knowledge.

A summary of responses is shown in Table 5.3. Only 33% of drivers had good knowledge of when to stop using a booster seat. Only seven respondents offered a weight criterion consistent with 26 kg (e.g. 27 kg , 25-30 kg). Only two responded with the correct weight.

Table 5.3
Driver knowledge of when to cease booster seat use

Driver knowledge	Count	%
Good knowledge		
6, 7 or 8 y, 26 kg	117	32.8
Poor knowledge		
< 7 y, weight less than recommendations	110	30.8
> 7 y, weight greater than recommendations	14	3.9
Never use/unsure	30	8.4
Incomplete knowledge	62	17.4
Incorrect/irrelevant comment	11	3.1
Did not know what a booster seat was	13	3.6
Total	357	100.0

Figure 5.3 shows the responses from 237 participants who nominated an age for appropriate cessation of booster seat use. One hundred and forty nine participants reported that they would stop using a booster seat for their child at 6, 7 or 8 years of age. The most common response was five years (school commencement age).

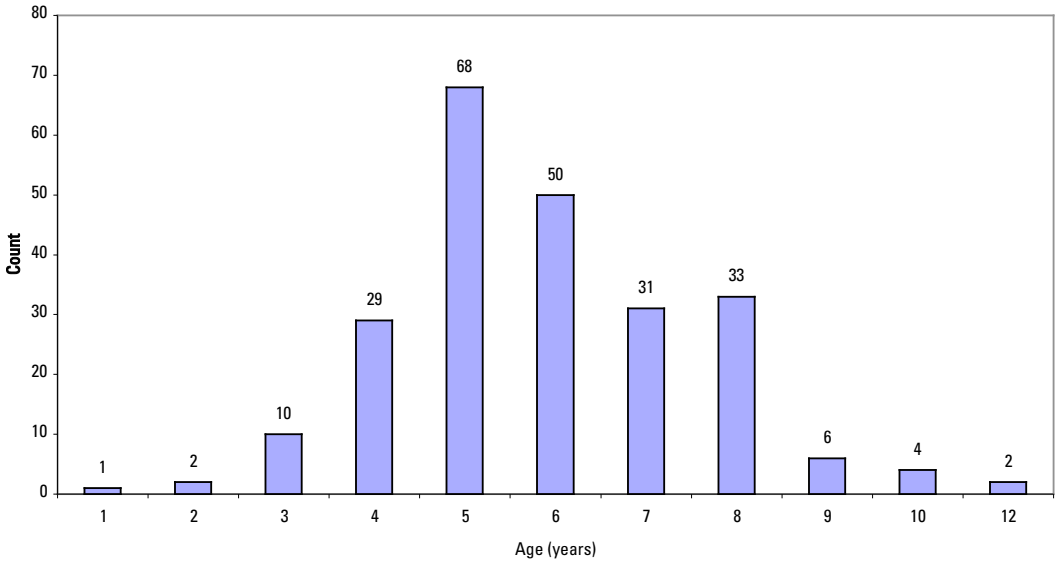

Figure 5.3
Distribution of age in years drivers stated they would cease booster seat use

5.5 Drivers' knowledge of the law

Participants were asked "As far as you're aware are there any current laws on restraining children in cars?" If they said yes, they were asked to describe the laws in an open-ended format. For ease of analysis, participant responses were coded as showing good knowledge if the law was specified correctly (whether partially or entirely), or otherwise as poor knowledge. The majority, 56%, had poor knowledge, 6% stating that no law existed to mandate the use of restraints while travelling with children in vehicles. While 44% had good knowledge of the law, only 3% were able to state all elements of it.

6 Predicting child restraint selection

Section 4 showed that the proportion of children appropriately restrained appeared to depend upon the age of the child. We now consider whether there are any other variables that are relevant, and perform a regression analysis, with the dependent variable being whether or not the child was appropriately restrained, and the independent variables being characteristics of the child, characteristics of the driver, and other variables. For this purpose, we have defined appropriate restraint by age alone, as better criteria, such as weight, were not accurately reported (as we have previously discussed).

The analyses in this section should be considered tentative. As several children were often being transported by a single driver, we have, for convenience, restricted this analysis to drivers who were transporting a single child. This overcomes numerical difficulties that would have been present if the entire dataset had been used. Furthermore, very few children being transported by this subset of drivers were less than 3 years of age. And as we have defined the use of an adult belt or booster as appropriate for children 6 years and older (because of the recommendations promoted in South Australia), few children in this older age range were categorised as being inappropriately restrained. Therefore, the regression analysis of appropriate restraint selection is further restricted to children 3 years and older, but younger than 6. There were 175 drivers transporting a single child, but these further restrictions limited the sample to 109 drivers, each transporting a single child 3 - < 6 years of age.

As the dependent variable is binary (appropriate versus inappropriate restraint choice), the variety of regression used is logistic regression. As is common with regression analysis, the exact results (the numerical sizes of the estimated effects, and level of statistical significance) depend upon conventions adopted, how variables were operationalised and which subsets of data were included.

Categories of the independent variables were grouped as shown in Table 6.1. They may be summarised in three groups:

> Driver variables: age, gender, restraint use, employment status, education, household income, main language spoken at home, knowledge of restraint use and knowledge of the law pertaining to transporting children in vehicles.
>
> Child variables: age, gender, seating location, member of driver's household and if the driver normally drives the child to school. (Weight and height were not among the variables included.)
>
> Other independent variables: time of day and day of week interview conducted, region of interview, type of site (preschool or junior/primary school) and vehicle type.

For the analyses, we based driver's knowledge of child restraint use on their responses to two questions: When is it appropriate to begin booster seat use? And, when is it appropriate to cease booster seat use? These questions were relevant to children in the regression sample.

Child restraint use, the dependent variable, had two categories, age-appropriate and age-inappropriate, that is, a child was coded as appropriately restrained if they were using one of the restraints recommended for their age group (according to Table 4.2).

Initially, appropriate restraint choice was regressed on all independent variables described above. As we are using a rather specific subset of cases, we judged that a parsimonious set of independent variables, able to account for the majority of the variance in appropriate restraint selection was preferable. Hence variables were eliminated gradually from the regression model if they showed poor statistical significance and a small effect size.

The strongest and most consistent (across different regressions) predictor of appropriate restraint choice was the child's age with the oldest children being far less likely to be appropriate restrained than the youngest. This finding was highly statistically significant, and the strength of the effect was consistent with the result shown in Table 4.1. This confirms what we have observed and described in Section 4. Additionally, front seat travel was also highly predictive of inappropriate restraint.

Certain other variables were not highly statistically significant; but their estimated effect size was large and therefore these variables may be worth investigating in more detail:

- In some analyses, children were much less likely to be using an appropriate restraint if the child was attending school, rather than pre-school. This effect remained, even if the child's age was used as a covariate in the model, suggesting that moving to an adult seatbelt may be a 'rite of passage' once the child begins school.
- In some analyses, the child was much less likely to be using an appropriate restraint if the driver was not a member of the child's household. However we should mention that this situation was rather rare, accounting for only 6% of the sample.

We might have expected other variables, such as driver's gender and driver's knowledge of child restraints, to be influential in our analyses, but they were not.

Table 6.1
Categories for independent variables entered into logistic regression analyses

Driver's age				
<25	25-34	35-44	≥ 45	
Driver's gender				
Female	Male			
Driver restrained				
Yes (observed)	Yes (Self-report)	No (observed)	Unknown	
Employment status				
Employed		Unemployed/Retired		
Education				
Primary/secondary	Tertiary			
Annual Household Income (k)				
≤50	51>110	>110		
Main language spoken at home				
English	Non-English language + English			
Child's age				
Years				
Child's gender				
Female	Male			
Child's seating location				
Front seat	Rear seat			
Child a member of driver's household				
Yes	No			
Driver normally drives child to school				
Yes	No			
Time of day interview conducted				
Morning	Lunch			
Day of week interview conducted				
Monday	Tuesday	Wednesday	Thursday	Friday
Region interview conducted in				
North	East	South	West	
Type of site				
Preschool	Primary School			
Vehicle type				
Sedan/station wagon	Hatchback	Utility	Van	4 WD
Knowledge of law related to transporting children in vehicles				
Good knowledge		Poor knowledge		
Knowledge of when to begin using child safety seat, booster seat and when to cease using booster seat (knowledge type dependent upon age of child transporting)				
Good knowledge (correct age, weight, height or comment)		Poor knowledge (incorrect age, weight, height or comment)		

7 Predicting knowledge of booster seat use

Logistic regression analyses were undertaken to determine whether driver's knowledge of age-appropriate children restraint use could be predicted. The same subset of drivers used in the previous regression analysis is used here as well, except we did not restrict the set based on the age of the child, giving a set of 175 drivers.

The two different aspects of knowledge in relation to booster seat use were treated separately: when to begin booster seat use, and when to cease booster seat use. We felt that knowledge of booster seat use was relevant to almost every child being transported in this subset of cases. The response to each question was analysed as a binary variable, good versus poor knowledge (see Section 5). The independent variables were those defined in Table 6.1.

Similarly to the regression model predicting child restraint use, we opted to focus on a parsimonious set of independent variables, and therefore variables were eliminated if they appeared to have no bearing on the predictive ability of the model.

- Concerning knowledge of when to begin booster seat use, driver's gender was consistently statistically significant in the variations of the regression model, with females being more likely than males to have good knowledge. In some regressions, not having tertiary level education was predictive of poor knowledge, but this was not consistently demonstrable in the presence of other demographic covariates.
- Concerning knowledge of when to cease booster seat use, results were not clear cut. In some regressions, speaking a non-English language at home was predictive of poor knowledge. In others, not having tertiary level education was predictive of poor knowledge, but rarely were these variables statistically significant ($p < 0.05$).

8 Drivers' attitudes towards use and non-use of child restraints

This Section describes and compares the attitudes of drivers using child restraints and drivers not using child restraints. We asked drivers to give reasons for their use or non-use of child restraints and asked them to describe circumstances in which they would not (or would) use a child restraint.

8.1 Attitudes of drivers using child restraints

8.1.1 Reasons for using child restraints

Participants who had a child in a child restraint were asked "What made you decide to use a <name restraint type>?". The responses, grouped into six categories, are shown in Table 8.1, classified according to the type of restraint being used. (Some drivers reported more than one reason.)

Table 8.1
Reasoning for using child restraints by restraint type

Reasoning	Infant Capsule/Rear Facing Convertible	Child Safety Seat/Forward Facing Convertible	Booster Seat	Harness
Safety/Seatbelt fits correctly	0	57	100	3
Child can see/Comfort	0	5	33	0
Law/Compulsory	3	6	15	
Did not know		1	2	
Convenience	5	26	27	1
Recommended by Authorities/Correct height/weight/age	1	12	38	1
Total	9	107	215	5

For the infant capsule and rear-facing convertible, drivers reported convenience as the most frequent reason for choice.

Reasons for use of child safety seats or forward-facing convertibles were most frequently safety-related, convenience being second.

Reasons for use of booster seats were most frequently safety-related. A recommendation by an authority, and so that the child could see, were also common reasons.

8.1.2 Beliefs about circumstances in which one would not use a child restraint

Drivers who had a child in a child restraint were asked "Under what circumstances would you not use a child restraint for children whilst driving?" Table 8.2 summarises responses. A large majority, 60%, reported that they always use child restraints, and 12% said that an emergency situation would be an extenuating circumstance where they would drive without child restraints. Two percent of drivers reported that they would not use a child restraint if the child refused to or if the child wanted to sit in the front seat.

Table 8.2
Summary of responses describing situations in which drivers would not use child restraints

Situations one would not use child restraint	Count	%
Emergency	24	12
Never	116	60
Limited restraints - Youngest child would use	3	2
Outgrown/old enough	9	5
On short trips	11	6
Taxi/bus/friends car/second car	19	10
To fit more children in the car	4	2
Child refuses, complains or wants to sit in front	4	2
Other[a]	3	1
Total	193	100

[a] Do not usually transport the child, do not use for eldest child as he gets ill in child restraint on long trips and do not use child restraint when breast feeding.

8.2 Attitudes of drivers not using child restraints

8.2.1 Reasons for not using child restraints

Participants who were not transporting children in a child restraint were asked "What made you decide not to use a child restraint?" The most common response was that the child was too old, too heavy, or too tall (see Table 8.3).

Table 8.3
Drivers' reasons for non-use of child restraints

Reason	Count	%
Too tall/heavy/old	122	46
Child refuses	39	15
Annoying to move, only have in one car	15	6
Can see out of window without it	5	2
Youngest child uses if limited available	5	2
Short trip/in a hurry	13	5
With many children, will not fit	6	2
Takes up too much room/car too small	8	3
Hassle	6	2
Just don't/don't think to/don't know	9	3
Not my child - parent's don't use	11	4
Not comfortable	8	3
Child mature enough to wear seat belt	5	2
Don't have one yet	3	1
Other	8	3
Total	263	100

8.2.2 Responses of drivers describing circumstances in which they would use a child restraint

The drivers that were not providing child restraints were then asked "Do you ever use child restraints when transporting children?" Of the 214 drivers asked this question, 75 drivers stated that at times they did use child restraints while the other 139 reported that they never did. See Table 8.4 for responses of the 75 occasional users of child restraints. The most frequent response given was "when travelling on long trips" (33%), and the next most frequent response was "when a younger or smaller child requires it" (25%).

Table 8.4
Drivers' beliefs about when they would use a child restraint

When to use a child restraint	Count	%
Long trips	25	33
Unless younger/smaller child requires	19	25
Usually/sometimes use	13	17
In bigger/other car	11	15
When room permits/if restraint is there	2	3
When child wants to use restraint	2	3
Other	3	4
Total	75	100

9 Discussion

The present study investigated the frequency of child restraint use in the Adelaide metropolitan area by observing usage during trips to school/preschool. The size of the sample was 586 children aged up to 10. Data were collected at 31 preschools and primary schools. Approximately 82% of all child occupants were appropriately restrained given supplementary age recommendations for child restraints published by DTEI, and only 1% (weighted) were completely unrestrained. However, we estimate that the true rate of appropriate restraint, based on the child's weight, is lower: between 64% and 72%.

In the 5 - <7 years age range, over 60% of children were not using a restraint appropriate for their weight, chiefly because they had progressed to an adult seatbelt too soon. This may increase the risk of being injured and the seriousness of the injury should their vehicle be involved in a crash (Winston et al., 2000).

To make these estimates, we relied on a technique that used the ages of the children and growth charts. This was because the weights of children were either not known to the driver, or unreliably reported.

9.1 Child restraint selection and knowledge

The use of forward-facing child seats is more common than the use of booster seats. Children will generally need to be moved to a forward-facing child seat before the age of 12 months, and therefore the continued use of the seat beyond 12 months is not surprising. It may also be that forward-facing child seats are regarded as both safe *and* practical when the child is younger, whereas, by school age, any perceived safety benefit may be outweighed by other factors that make parents perceive booster seats as impractical or unnecessary. These factors may include the attitude of the child, the small but added effort needed when using a booster seat, and the restraint use habits of the child's peers.

When asked about the criteria for progressing from restraint to restraint, the majority of participants responded with an age. These age responses were inconsistent, but the modal response for the transition from child seat to booster seat was in the correct range. The modal response for cessation of booster seat use was 5 years of age, which is lower than any recommendation promoted in South Australia and substantially underestimates the likely age at which a child will be too large for booster seat: about half of all children on their 8th birthday would still be suitably restrained by a booster seat.

Very few participants nominated the correct upper weight for booster seat use. Only two of 344 responses included the correct weight criterion: 26 kg. (A further five responses were within a couple of kilograms of the correct weight.)

Our regression analysis which aimed to identify predictors of correct child restraint selection was conducted on a subset of the sample. These were drivers of children in the age range 3 - <6. This subset is of children for whom the transition from forward facing child seat to booster seat is relevant. The most influential factor predicting correct restraint selection was the child's age: older children were less likely to be in an age-appropriate restraint (we had to use age alone to approximate weight-appropriate restraint for this exercise). Child's seating location within the vehicle was also predictive of restraint use in our regression analysis, children seated in the rear being more likely to be restrained appropriately. Nether knowledge of appropriate booster seat use, nor driver gender were predictive.

There was also some indication that attending school, rather than pre-school, was predictive of inappropriate restraint selection, beyond the effect of age. This may indicate that the use of the adult belt is linked to the transition from kindergarten to school.

Female drivers were more likely than males to respond correctly to question relating to the appropriate restraint of children (even though this was not apparent in actual use). One

might speculate that female parents/caregivers are more likely than males to select the method of restraints for their children, irrespective of whether or not they drive the child on any particular trip.

Due to limitations with the size of the sample used in the regression, and our reliance on age as an indicator of weight-appropriate restraint, we consider as tentative our findings on the predictors of appropriate restraint selection and knowledge.

9.2 Implications of the survey results

It is clear that drivers display, both in knowledge and actual use, a poor understanding of criteria for correct restraint selection. The most obvious response to this state of affairs is to suggest more education.

However, careful consideration should be given to the kind of education that is provided. Survey respondents had a high rate of personal seatbelt wearing compliance, and very few children were unrestrained, and so it is arguable that the high rate of mis-selection of restraint is not due to casual attitudes to restraint use in general.

The aim of public health messages on child restraints is to ensure that children are in the correct restraint for their weight. Current practice is to quote the Australian Standard 1754 verbatim. Where age is mentioned, it is almost always done so as a supplement, but rarely is it recommended that age be relied upon. Contrast this with the responses given in this survey: a majority of responses included reference to the child's age.

It is worth reflecting on the nature of the specifications of the Australian Standard. The standard is notable amongst similar standards globally in that there are considerable weight overlaps between types of restraint, and between the forward facing child seat and booster seat in particular. Earlier versions of the Australian Standard on child restraints included no overlapping weights. The mass ranges given were, at one stage, up to 9 kg for infants, 9 kg to 19 kg for larger children and 19 to 36 kg for the largest children (Molnar, 1976). Each of these weight ranges was adapted from the contemporaneous British Standard, and was designed to cater for children in a specific age range.

However, the relationship between age and weight is not straightforward, because of natural variation among children, and a better specification was sought. The solution was to lower the weight of the smallest child that could be accommodated by each successive restraint. The express purpose of this was to cater for the children whose weight was in the tail of the distribution, while still allowing recommendations to be provided on the basis of age (Henderson, personal communication, 2005).

In this light, the implications of the Standard for promotion might be rather different than it has turned out: the intent of the Standard might be seen as allowing all children to graduate to a restraint at a similar age, with the lower end of the weight range chosen to cater for the smallest children graduating to that restraint. A consequence of promoting restraint use on the basis of age, in conjunction with a coordinated design standard, should be that very few children at the low (or high) end of each weight range should be using any particular class of restraint. Inadvertently, and somewhat ironically, promoting the lower end of each weight range may encourage some parents to promote their children to successive restraint types at younger ages.

Indeed, the approach taken in the Standard might have been predicated on the basis that the restraints will be promoted on the basis of age alone, that the lower weight limit is not there for promotion or advertisement, but to cater for variations in children's sizes at each transition age. It is arguable that the promotion of the actual weight ranges defeats one of the important purposes of the Standard. However, the extent to which the Standard successfully achieves its purpose in this regard is debatable, and we are not aware of any published evaluation of this.

Nevertheless, if the aim was to design and promote restraints on the basis of weight, then there should have been no need for any weight overlaps in the Standard.

USING WEIGHT SPECIFICATIONS IN CHILD RESTRAINT PROMOTION

Current practice in child restraint promotion is to try and inculcate in parents the specifications laid out in AS 1754. There are certain advantages to this, and so one approach might be to step-up existing promotional efforts. The advantages of this approach, over promotion based on age, include:

- The advice being a straight rendering of AS 1754, with no obvious ambiguities
- Variation in child size by age becomes irrelevant

However, we would suggest that there are disadvantages too:

- The advice in probably not memorable. Very few of our respondents could cite the criteria
- Parents appear to not know the weight of their children
- Although it appears unambiguous, the advice might be confusing: where within the overlapping weight range should the transition to the next restraint be made?
- As we have discussed, it is probably inconsistent with, and defeats, one of the purposes of the Australian Standard
- Parents who do take careful note of the weight ranges may promote their children at the earliest possible weight, leading to progression at a younger age.

USING AGE SPECIFICATIONS IN CHILD RESTRAINT PROMOTION

Age was once used more prominently as criteria for restraint selection. However, expert practitioners who advise against promotion based on the child's age, often cite the high probability of selecting the wrong restraint should a recommendation be made on the basis of age, without referring to the child's physical size and development. However, in this survey, parents and carers who were driving children for whom child restraints are designed, could not recall the design criteria and mostly did not cite weight as a criterion for child restraint progression. The natural tendency was for parents to nominate an age. Many knew weight and/or height might be important, but the majority of these respondents did not know the relevant mass or length points.

Some advantages to age-based promotion might include:

- The criteria for restraint transition would be simple and easy to remember (e.g. 6 months, 4 years, 7 years)
- Fewer small children and fewer young children in booster seats.
- The child's peers would be more likely using same restraints, providing cues for both parents and children on correct restraint selection
- The possibility of pre-school and/or school-based promotion, with whole year levels making the transition together
- The ease with which it would be possible to specify and enforce any legislation/regulation in this area

There is a key disadvantage with age based promotion that does need to be addressed:

- Age based criteria are imperfect, and the resulting rate of incorrect selection of restraint type does need to be assessed.

However, one should consider the current high rate of inappropriate restraint selection when judging the relative merits of age-based promotion.

As it is, the transition between child seat and booster seat is handled reasonably well in the Australian and New Zealand Standard, with a large proportion of 3 and 4 year olds appropriately restrained with either device; it is likely that an age recommendation of child seat use to 4 years of age is satisfactory.

Irrespective of the kind of promotion that is used, there would be merit in removing inconsistencies within promotional messages, and between promotional efforts by different organisations. For example, supplementary age advice from the South Australian Government mentions that booster seat use is suitable until the child is greater than 26 kg, or about 6 years of age (Department of Transport and Urban Planning, 2000). However, as 26 kg is the 50th percentile weight of children on their 8th birthday, the advice might be altered for consistency. Child growth data is readily available, and should be used to provide consistent information where age criteria are promoted alongside weight.

One further point should be made about promotion. As we have already said, increasingly, promotional messages on restraints appear to be seen as consequential to the Standard, rather than a consideration in the setting of the Standard. This might be sensible enough given the requirements of the Standard are engineering ones, and manufacturers must ensure that their products can adequately protect children of the relevant sizes. But, an alternative view might be that, in the case of child restraints, correct selection and use relies heavily on the ability of parents to make the correct choice, and that should be pivotal in the setting of the Standard. Parents would clearly benefit from the simplest advice possible. If simple advice based on age were used, then the Standard could consequently be designed to ensure that the fewest possible children would be in the wrong restraint for their weight, when the restraint is selected based on age.

THE TRANSITION TO AN ADULT BELT

We have not addressed the transition from a booster to the adult belt comprehensively in this report, as it is beyond the scope of this survey. However, anecdotally, the transition between booster seat and adult seatbelt is problematic: children may be greater than 26 kg but remain difficult to restrain correctly with an adult belt, because the geometry of the belt is ill-suited to the child's stature. As a result, they may be more vulnerable to injury in a crash because the belt fitment is poor. While there are countermeasures available, such as harnesses, a relatively low uptake means that they are unlikely to address the problem across the population. Far more desirable would be a better transition between booster and adult seatbelt through better coordination between the Australian and New Zealand Standard and the Australian Design Rule on seatbelts, such that there is a more generous weight/stature overlap between the two restraints.

REGULATION

South Australian law appears to not mandate the use of child seats beyond 12 months of age, nor the use of booster seats. Once the child is greater than 12 months of age, the only legal minimum requirement for transporting them in a vehicle is to use an "appropriate restraint" or "suitable seatbelt" where one is available. This is widely interpreted as meaning an adult seatbelt for children above 12 months is sufficient to satisfy the regulation. Thus drivers may not feel compelled to provide appropriate seats for the children they are transporting.

As current regulation does not appear to encourage appropriate restraint use beyond 12 months, further developments in this area might be considered, in coordination with appropriate promotion, as a means of increasing the rate of appropriate restraint selection.

9.3 Limitations of this study

A limitation of this study lies in our use of concepts of appropriate restraint. While we have been able to estimate rates of weight-appropriate restraint in each age group, we cannot estimate weight-appropriate restraint for individual children in our sample, limiting our ability to determine the predictors of inappropriate restraint selection. The use of the actual weight or height of each child would have been most appropriate, but they were unreliably reported, and measurement was impracticable. It would have been better to find out sufficient information about each individual child (e.g., their weight, height, and perhaps other characteristics) to assess which restraint was the most appropriate. As it is, we do not really know how many children we have correctly categorised by the age-based rule, and how many incorrectly.

Our regression analyses were performed on a small subset of drivers and occupants. Alternative methods of coding the data may allow a fuller analysis of all occupants and drivers. As it is, our results are tentative, and a more comprehensive analysis in the future may be warranted.

The other point that should be mentioned is the obvious one that this survey was confined to journeys to school or pre-school. It is quite possible that for other journeys, age-appropriate restraint use would be different.

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Appendix A - Letter inviting schools to participate in the survey

Centre for Automotive Safety Research

THE UNIVERSITY OF ADELAIDE AUSTRALIA

PROFESSOR JACK McLEAN
DIRECTOR
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(Formerly the Road Accident Research Unit)
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THE UNIVERSITY OF ADELAIDE
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AUSTRALIA
TELEPHONE +61 8 8303 5997

<Date>

<Address>

Dear <representative>,

The Centre for Automotive Safety Research (CASR) at the University of Adelaide has been commissioned by the Department of Transport and Urban Planning to conduct a survey of knowledge of, attitudes to, and the prevalence of child restraint use while travelling in vehicles.

<Preschool/Primary school> has been randomly selected for inclusion in this research project. I ask your permission to allow CASR Research Officers to observe vehicles arriving at <Preschool/Primary school> with children up to nine years of age and to conduct a brief interview with the guardians and carers transporting the children. Research officers will only be present at your <Preschool/Primary school> for up to an hour on a single weekday morning during July or August 2004. This research project has been approved by the Department of Education and Children's Services and the University of Adelaide's Human Research Ethics Committee.

CASR research officers will wear traffic safety vests and carry photographic identification cards. Should, for whatever reason, you or your representative have any concern with the way in which this survey is being conducted we undertake to address that concern and/or cease the survey immediately.

All guardians and carers will be assured that their participation is voluntary, confidential and anonymous. The interview will last for no longer than two or three minutes. No conversation is necessary with the children as that part of the study is purely observational. After each interview the carer or guardian will be handed a Kidsafe fact sheet on child restraints.

Sally Edwards, (a CASR Research Officer) will contact you in the near future to answer any questions that you may have about this research project and hopefully to obtain your agreement for the survey to be conducted outside your <Preschool/Primary school>. At this time we would also like to confirm your hours of operation, regular arrival times, common entrance areas, and number of enrolled students.

It is important that the purpose of this study is kept confidential to minimise any effect that prior knowledge may have on participant behaviour.

The results obtained from the interviews and observations conducted at this random sample of primary schools and pre-schools will not be individually identifiable.

If you have any queries regarding the survey at this stage, please feel free to contact me at the Centre for Automotive Safety Research on 8303 5997. If you wish to discuss the

project with an independent person please contact the secretary of the Human Research Ethics Committee on 8303 6028.

I look forward to your participation in the Adelaide metropolitan pre-school and primary school child restraint project.

Sincerely,

PROFESSOR JACK McLEAN
DIRECTOR

Appendix B - Survey sheet

DRIVER INTERVIEW

INTERVIEWER: _____

DRIVER SEX Male Female **Total # Occupants** _____

DRIVER S/BELT Y N

(ONLY READ HIGHLIGHTED TEXT TO PARTICIPANTS)

Hello, I'm <name> from the Centre for Automotive Safety Research at the University of Adelaide. We're conducting a survey into transporting children in cars which takes about 2-3 minutes. You're under no obligation to take part and may withdraw at any time. The information you provide will be kept confidential and will not be released to anyone else. A report will be produced but you will not be identifiable in it.

Do you consent to answering some questions? YES / NO

NOTE THAT YOU MUST HAVE A "YES" RESPONSE PRIOR TO PROCEEDING

"NO" RESPONSE, THANK FOR THEIR TIME AND PROCEED TO NEXT PARTICIPANT.

To begin with I'm going to show you 3 photos and for each one I would like you to tell me at what age, if any, you would first put your child into the pictured restraints?

(NOTE: Randomise photo presentation. If alternatives to age are provided describe in other).

Photo Number _____

Never Birth _____ *Months old Years old* _____ *Other* _____

Photo Number _____

Never Birth _____ *Months old Years old* _____ *Other* _____

Photo Number _____

Never Birth _____ *Months old Years old* _____ *Other* _____

At what age would you stop using a booster seat? _____

Now I need to ask you a few questions relating to the child/ren you are transporting in your vehicle.

SEATING POSITION	**LF**		**LR**		**CR**		**RR**		**Other**	
	OB	SR	OB	SR	OB	SR	OB	SR	OB	SR
RESTRAINT USE										
CHILD RESTRAINT AVAILABLE										
Is the child a member of your household?										
Do you normally drive this child to school?										
What about other trips?										
AGE										
SEX										
APPROX HEIGHT										
APPROX WEIGHT										

SET 1 ***1) IF A CHILD RESTRAINT IS PRESENT ASK A-C***

A) What made you decide to use a <name restraint type>?

LF: Restraint:

LR: Restraint:

CR: Restraint

RR: Restraint

Other: Restraint

If they have 4-10yr olds ***but are NOT*** *seated in boosters (e.g., in another restraint) ASK:*

B) Do you ever use booster seats for your child/ren (reasons for y/n)?

YES

NO

C) Under what circumstances would you not use a child restraint for children whilst driving?
(How often?)

SET 2 ***2) IF A CHILD RESTRAINT . NOT PRESENT ASK D-E***

D) What made you decide NOT to use a child restraint?

E) Do you ever use child restraints when transporting children?
YES: Type, how often?

NO: Reason

Year of vehicle **Make/Model**
Vehicle Type

As far as you're aware are there any current laws on restraining children in cars (If yes describe)?
NO
YES

I now have a few questions about the people surveyed.
Please remember that all of the information is anonymous and confidential.
Could you please tell me your:

AGE yrs.

What is the main language spoken at your home?

The highest level of formal education you have completed?

Your approximate HOUSEHOLD income (annual)?

< $10,000	$60,001 - 70,000	$120,001 - 130,000
$10,001 - 20,000	$70,001 - 80,000	$130,001 - 140,000
$20,001 - 30,000	$80,001 - 90,000	$140,001 - 150,000
$30,001 - 40,000	$90,001 - 100,000	> $150,000
$40,001 - 50,000	$100,001 - 110,000	Don't know
$50,001 - 60,000	$110,001 - 120,000	

Your current employment status?

Full-time	Casual	Unemployed	Other
Part-time	Student	Retired	

THAT BRINGS US TO THE END OF THE SURVEY. THANK YOU VERY MUCH FOR YOUR TIME AND COMMENTS (GIVE BROCHURE) PLEASE TAKE A KIDSAFE FACT SHEET ON CHILD RESTRAINTS FOR YOUR REFERRAL AND OUR PHONE NUMBER IN CASE YOU WOULD LIKE TO CONTACT US IN THE FUTURE.

SURVEY #