USED CAR SAFETY RATINGS RESEARCH PROGRAM

ROAD SAFETY POLICY PAPER

THE ROAD SAFETY IMPLICATIONS OF YOUNG DRIVER VEHICLE CHOICE: POTENTIAL PATHS TO BETTER SAFETY OUTCOMES
The road safety implications of young driver vehicle choice: potential paths to better safety outcomes

Background
Ways to reduce young driver crashes and injuries are deservedly a focus of road safety efforts in many countries. Internationally, traffic injuries are the leading cause of death among young people, amounting to nearly 400,000 deaths annually, plus millions more injured and disabled (World Health Organisation, 2007). Per driver and per distance travelled, young drivers’ crash and injury rates are consistently higher than those of older drivers (Keall and Frith, 2003; OECD, 2006). In the State of Victoria, drivers aged 18 to 25 years constituted 28% of driver fatalities in 2002, despite representing only 14 % of licensed drivers (TAC, 2003). Such statistics motivate a number of policies aimed at young drivers, and more generally novice drivers who are generally young, to reduce their crash involvement rates. However, improving the safety of young drivers’ vehicles has so far received little attention in the literature. Vehicle safety can be defined as primary, indicating crash avoidance potential, or secondary, indicating safety performance once a crash has occurred. Secondary safety includes crashworthiness, which is the rate of driver fatal or serious injury given crash occurrence, and aggressivity, which is the rate of fatal or serious injury to the other driver in the case of two-vehicle crashes (Newstead et al, in press). In other words, crashworthiness measures the ability of the vehicle to protect its own occupants, and aggressivity measures the ability of the vehicle to confer less harm to other road users. The current paper examines the following topics:

- The characteristic patterns of young driver crashes.
- The vehicles typically driven by young drivers.
- The factors that lead to these vehicle choices.
- The ideal vehicle choices for young people to reduce road trauma.
- The appropriate audience for safety and information campaigns promoting safer vehicles for young drivers.
- Policy options for steering vehicle choices in a safer direction.

Crash types common among young drivers
Inexperience with the road environment and a propensity to take risks are two important reasons for high young driver crash rates (Williams, 2003). Inexperience affects their ability to perceive risk. For example, Underwood et al. (2002) studied visual scanning of novice drivers compared to experienced drivers and concluded that experienced drivers are more able to perceive important aspects of the traffic environment than young drivers. The consequences of inexperience lead to particular patterns of crash involvement, which are important to consider when vehicles are chosen for young people. In the case of the UK, research has identified four key young driver crash types (Clarke et al, 2006): (i) turning right either onto or off a more major road (an equivalent of a left turn...
in the US, Europe, etc), possibly due to a combination of such factors as speeding, slow perception of potential hazards, and assertion of right-of-way; (ii) crashing into the rear-end of another vehicle; (iii) negotiating curves, an important factor in single vehicle crashes; (iv) night-time crashes, particularly amongst young male drivers. They concluded that young driver crashes at night were not a consequence of lack of visibility but were related to excessive risks taken while night driving (ibid). Similar crash patterns were found amongst US novice drivers in Connecticut (Braitman et al, 2008). They found three common factors in these crashes: failing to detect another vehicle or traffic control, speeding, and losing control of the vehicle, particularly when the road was wet. Young driver crashes in Australia also have similar distinguishing characteristics. For young drivers compared to drivers aged 25 years or older, Whelan et al. (2009) found a higher prevalence of night crashes, single-vehicle crashes, rural area crashes, and crashes on wet roads. They also found that young drivers’ vehicles were consistently older than other drivers’ vehicles on average (ibid). There can also be particular young driver safety problems with given vehicle types. For example, young drivers have been shown to have elevated rollover risk when driving SUVs in Australian and New Zealand conditions, particularly in higher speed limit areas (Keall and Newstead, 2008; Keall and Newstead, 2009).

Despite the over-involvement of young drivers in crashes, there is evidence that most young drivers do not intentionally take unreasonable risks but genuinely want to drive safely (OECD, 2006). Fundamental to their high crash rates are lack of experience and poor self-assessment regarding risks taken, characteristics that take time to change (ibid). This highlights the importance of safe vehicle choices for young people.

Choice of vehicles

There have been various studies of factors leading to the choice of particular vehicles. Households’ socio-demographics have been found to be the most powerful determinant of types of vehicles owned by households, and secondarily the location of the house (Cao et al, 2006). Hellinga et al. (2007) studied parental decisions about vehicles driven by teenagers and parental knowledge of vehicle safety in the US. Generally the vehicle driven by a teenager was a second or third family vehicle that was nevertheless mainly driven by other family members. These vehicles tended to be older and were more likely to have poorer crashworthiness and fewer safety features (such as airbags and Electronic Stability Control (ESC)) than vehicles already owned. Nevertheless, they found that the parents had generally good knowledge about vehicle safety (ibid). As pointed out by Keall and Newstead (in press 2010), a major determinant of vehicle choice, particularly for driver groups with restricted incomes, such as young people, will be costs both related to vehicle purchase price and running costs. Lower priced vehicles tend to be older or smaller or both, resulting in poorer occupant protection performance (crashworthiness) compared to other vehicles in the fleet.

Other studies have focused on the vehicles actually being driven by young people. Watson and Newstead (2009) studied crashed vehicles from five Australian states as well as vehicles owned by RACV (Royal Automobile Club of Victoria) members who were enrolled in the emergency breakdown assistance scheme. They found that young people were generally driving older vehicles than drivers from older age groups. The vehicles driven by young people had generally poorer than average crashworthiness but better than average aggressivity (ibid). Even when compared to vehicles of a
similar age driven by other drivers, the vehicles driven by young drivers in Australia had poorer relative crashworthiness

Similar patterns in young driver vehicle size and crashworthiness have been found in NZ (Keall and Newstead, in press 2010) and the US (Cammisa et al, 1999; Ferguson, 2003). Also consistent with these findings, Williams et al. (2006) found that small cars were the most popular vehicles for teenagers in the US in their first year of driving, followed by SUVs, pickups (utility vehicles) or sports cars. They also found that after one year of licensure only 35% of teenagers were driving midsize or larger passenger cars and about one in three of their vehicles were more than ten years old.

There are other aspects of vehicle preference that have been investigated in the literature, including driver gender differences in the types of vehicles driven in Australasia. For example, SUVs have been shown to be much more commonly driven by males than females (Keall et al, 2006). For young drivers, small cars were the most common vehicle in the crash fleet for females, but large cars were most common for males (Watson and Newstead, 2009). There was less of a driver gender difference in vehicle choice for older age groups (ibid).

**Attitudes to safety of vehicles when purchasing**

Safety considerations in vehicle choice may be either explicit or incidental in the choice made. A study of safety considerations in vehicle choice in Sweden and Spain (Koppel et al, 2008) found that participants ranked safety-related factors (e.g., EuroNCAP) as more important in their new vehicle purchase decision than price, reliability etc., and considered safety features such as advanced braking systems and front passenger airbags of greater importance than route navigation systems, air conditioning etc.

Nevertheless, in the case of vehicles driven by young people, a US survey of parents and teenagers in 1999 found that safety was rarely cited as a reason for selecting vehicles (Cammisa et al, 1999). There is currently limited research on what drives parental decisions regarding appropriate vehicles for teenagers. Often the vehicle is an existing family vehicle handed down when a parent upgrades their vehicle or the vehicle is chosen for economic (cheap to purchase and run) and practical reasons (e.g., easy to manoeuvre) (ibid). Unfortunately, smaller and older vehicles increase the likelihood of teenager injury in a crash: smaller vehicles provide less crash protection on average, as do older vehicles through not having important safety features such as airbags (Cammisa et al, 1999). Crash risk can also be higher in older vehicles that lack crash avoidance technologies such as ESC or have inferior primary safety systems such as brakes and suspension. The tendency for young people to drive smaller, older, less crashworthy vehicles has also been noted in Australia and New Zealand (Whelan et al, 2009), and it is likely that there are similar motivating factors leading to these vehicle choices.

**Choice of vehicle to reduce young driver crashes and injury**

Overall, choices of vehicle that would reduce harm would be those that are less likely to support risky behaviour (such as high powered, high acceleration vehicles), those that are forgiving to errors in handling and those that provide good protection to the occupants when crash-involved but are less aggressive to other road users into which they impact (OECD, 2006).
As noted above, particular crash types that are common amongst young drivers include those where there is loss of control of the vehicle and others where vehicles are followed too closely or there are lapses in concentration. ESC has been shown to be highly effective in preventing crashes, particularly so for SUVs, which are inherently less stable vehicles than passenger cars due to a relatively high centre of gravity (Erke, 2008; Scully and Newstead, 2008). Seatbelt use is commonly low amongst young people (OECD, 2006), so technologies to increase seatbelt use may also have particular safety benefits in the cars driven by young people although effectiveness in Australasia may be less due to established high seatbelt wearing rates. Vehicle technologies to increase seatbelt use include reminder systems and types of interlock, which prevent or delay engine ignition or gear engagement or limit maximum speeds. Young driver collisions with the rear of other vehicles could be reduced by technologies such as adaptive cruise control, which actively applies light, imperceptible breaking to maintain a safe following distance, or forward collisions warning systems including those combined with autonomous braking. Another new technology that might offer benefits to young drivers is that of programmable ignition keys that limit vehicle performance. These can be given to young drivers to use when, for example, borrowing a high performance family vehicle.

These technologies and others that reduce the potential for risky driving may be effective in increasing safety for young drivers, although price is likely to be a barrier as older vehicles, typically favoured by young people, do not have such safety features. However, if these technologies are promoted in new vehicles, they will eventually become available to young drivers via second-hand vehicle sales. Only about 20% of young drivers’ vehicles are aged less than 6 years in Australia (Watson and Newstead, 2009), and an even smaller proportion in New Zealand (Keall and Newstead, in press 2010), so new technologies will take some time to filter through to the majority of young people’s vehicles.

As technologies that potentially impact on mobility might not be sought-after features by car buyers, Young et al. (2004) investigated the acceptability of various safety technologies to young Australian drivers. Overall, alcohol interlocks and seat belt reminder systems were found to be the most acceptable to young drivers.

Crashworthiness is provided by both effective vehicle construction and by safety devices that come into play once a collision occurs. Crumple zones absorb energy, effectively reducing the forces of the crash imposed on the occupants. Airbags have a similar function, but additionally prevent occupants from impacting interior structures of the vehicle during a collision. Injury from impacts from the side of the vehicle, where there is less room for protective features, can be reduced by side curtain airbags and improved frame construction. Differences in crashworthiness of vehicles is a potential mediating factor in some of the age differences found in crash rates as well as socio-economic differences, where higher socio-economic groups have lower crash rates (Hasselberg and Laflamme, 2003). Note that theoretically higher crash involvement rates can only be associated with crashworthiness if the crashworthiness of the vehicle affects the threshold where a crash might be reported (e.g., for a jurisdiction that records only injury crashes, a vehicle might provide sufficient protection to prevent a medically treated injury, whereas another vehicle does not).

**Rationale for analysis**

It is apparent from the above review of the literature about young driver crash patterns and their vehicle choices that appropriate vehicle choice has considerable potential to reduce crashes and
injuries without compromising mobility. There are some questions unanswered about who the target audience should be for guidance on appropriate vehicle choice. The objective of the analysis that follows is to supplement knowledge on whether vehicles crashed by teenage drivers are different according to whether they are owned by teenagers or owned by their parents (or other people in the 30-59 age group). Although the literature reviewed above defined “young” drivers variously as aged under 25 or aged under 20, or highlighted safety issues characteristic of novice drivers more generally, we will focus on the vehicles of teenage drivers as this group has the highest crash rate (Keall and Frith, 2003). The objective of the analysis is to inform approaches to improve the safety of young drivers’ vehicles and identify appropriate audiences for vehicle safety policy and promotion.

Data and Methods
Reported crash data involving an injury for one of the involved road users for the years 2004 to 2009 were provided by the New Zealand Ministry of Transport. Only records for drivers of light passenger vehicles (cars and vans) were analysed, consisting of 85,773 crashed driver/vehicle combinations. These data were then matched to the register of licensed vehicles by the vehicle registration plate number, which excluded 1,061 driver/vehicle combinations for whom there was no plate number recorded. Each of the six years of crash data was matched to a snapshot of registration data as at the beginning of the crash year, which was necessary as owner data, and occasionally plate numbers, can change for a given vehicle. The registration data provided some information on the owner of each vehicle, including the general geographic area, age and sex. When the vehicle was owned by a company or a collective, age and sex were not relevant or available. About 15% of the crashed vehicles able to be matched to registration data were either company vehicles or had missing data on age and sex of the owner. Geographic areas were coded according to levels of urbanisation to provide a measure of different types of exposure to risk.

Each make and model of crash-involved passenger vehicle was classified into one of 10 market groups for analysis, consisting of five passenger car classes, three classes of Sports Utility Vehicles (SUVs, more commonly known as 4-wheel drive vehicles in Australasia), and two classes of light commercial vehicles: Light (passenger car, hatch, sedan, coupe or convertible 3 or 4 cylinder engine, generally <1100kg); Small (passenger car, hatch, sedan, wagon, coupe or convertible 4 cylinder engine, generally 1100-1300kg tare mass); Medium (passenger car, hatch, sedan, wagon, coupe or convertible generally 4 cylinder engine, generally 1300-1550kg tare mass); Large (passenger car, hatch, sedan, wagon, coupe or convertible generally 6 or 8 cylinder engine, generally >1550kg tare mass); People Movers (seating capacity > 5 people); SUV Compact (<1700kg tare mass), SUV Medium (1700kg-2000kg tare mass) and SUV Large (>2000kg tare mass); Van; and Utility vehicles (known as pickup trucks in the US). Crashworthiness ratings for each vehicle, as described in Newstead et al (2009) were then matched to the crash fleet firstly by make, model and year of manufacture (30% of the fleet), then by market group and year of manufacture (43%), then – for vehicles not able to be decoded to a market group – just by year of manufacture (10%), with the remaining 17% of the fleet unable to be matched to registration data.
Results

The results section focuses on comparisons made on the crash fleets between vehicles driven by the same age group as the owner, and vehicles driven by different age groups. It is presumed that vehicles driven by teenagers but owned by someone in the 30-59-year-old age group will probably be a parental vehicle.

![Figure 1: Distribution by owner age group of vehicles crashed between 2004 and 2009 by teenage drivers](image)

Figure 1 shows who owns the vehicles driven by teenagers: they are mostly owned by 30-59-year-olds (the age group of most of their parents); only a small minority are owned by teenagers themselves (14%). In contrast, previous analysis has shown that for other age groups, the owner is highly likely to be in the same age group as the driver (Keall and Newstead, 2006). As explained above, “Company” indicates mainly vehicles owned by companies or groups, or occasionally by individuals with missing data on age and sex. There are small differences (not shown here) according to the sex of the driver: a larger proportion of female teenage drivers were driving parents’ cars (59%) compared to male teenage drivers (53%). 36% of teenage drivers in the crash data were female.

The remainder of the Results section compares vehicles crashed by teenagers according to whether the vehicle is owned by teenagers or someone in another age group, particularly the age group typical of parents of teenagers, 30-59.
Figure 2: Distribution by market groups of vehicles crashed between 2004 and 2009 by teenage drivers – those owned by teenagers (LHS) and owned by 30-59-year-olds (RHS)

Figure 2 shows the constitution of the fleet of vehicles crashed by teenage drivers separated into those owned by teenagers, on the left-hand side of the figure, and those owned by people in their parents’ age group, aged 30-59, on the right-hand side. This shows little difference between teenage-owned vehicles and parent-owned vehicles in the teenage driver crash fleet apart from a tendency for teenage vehicles to be slightly smaller.

Figure 3: Average age (years since manufacture) of vehicles crashed between 2004 and 2009 by age group of the driver and age group of the owner.

Figure 3 shows the average age of vehicles at the time of the crash according to the age group of the driver and the age group of the owner. This confirms that teenage drivers drive the oldest vehicles on average for each given owner group. Cars crashed by teens but owned by their parents’ age group (30-59) are on average almost two years younger than the teenager-owned and crashed vehicles. Male and female drivers were also examined separately by median ages of vehicles to see whether skewed distributions of vehicle ages could be affecting the means differentially for different driver or owner groups. All these analyses produced similar patterns to Figure 3.
Figure 4: Average crashworthiness of vehicles crashed between 2004 and 2009 by age group of the driver and age group of the owner.

Figure 4 shows the average crashworthiness of vehicles according to the age group of the driver and the age group of the owner. Reflecting the patterns shown in Figure 3 with respect to vehicle age, vehicles driven by teenage drivers have generally poor crashworthiness (note that crashworthiness measures the probability of fatal or serious injury for the driver when the vehicle is involved in a crash, so “poorer” crashworthiness equates to a higher value for this measure). The crashworthiness of teenage driven vehicles owned by their parents’ age group is notably superior to that of teenage-owned and driven vehicles. Although the parent-provided vehicles were generally more crashworthy than those owned by teenagers themselves, even the parent-provided vehicles had poorer crashworthiness than vehicles driven by drivers aged 20 plus.

Figure 5: Average crashworthiness of vehicles crashed between 2004 and 2009 by age group and sex of the driver and age group of the owner. Vehicles crashed by females on the LHS, by males on the RHS.

There are some important differences between male and female drivers, as shown in Figure 5. Female teenage drivers who drive parent-owned cars were in relatively crashworthy vehicles compared to the teenage-owned vehicles or 20-29-year-old-owned vehicles that other female teenage drivers had. For males, if anything their parents allow them to drive even less crashworthy vehicles than those owned by female teenagers. It can be speculated that parents are willing to lend their daughters superior, more crashworthy vehicles than they will lend their sons, perhaps reflecting the parents’ belief that daughters are less likely to damage the vehicle.
It should be noted that the analysis presented is based on data from New Zealand. It is possible that similar analysis on Australian data would yield different results. Unfortunately suitable Australian data were not available on which to replicate the analysis.

**Discussion**

The current literature on young driver crash patterns and vehicle choices show that the most appropriate safe vehicle choices for young drivers are not the vehicles actually being driven. Technology that would assist crash avoidance, such as ESC, assisted braking, etc., are not commonly available in the older vehicles typically driven by young people. Further, the high crash rate of young drivers means that cars that protect their occupants best in the event of a crash (highly crashworthy vehicles) would reduce injury. In fact, young drivers’ vehicles are on average the least crashworthy in the fleet. Attention must therefore be placed on vehicle purchasing patterns to specifically identify the reasons for poor vehicle selection from the point-of-view of safety.

The current paper has analysed linked crash and ownership data from New Zealand to examine the age profile and crashworthiness of young drivers’ vehicles according to who owns the vehicle (and who presumably has the most say in vehicle purchasing). This analysis has shown that in New Zealand only a small proportion of teenage drivers (less than 15%) are driving their own vehicle. Generally, there are strong similarities between the vehicles that parents own but allow their teenagers to drive, and those vehicles actually owned by teenagers: they tend to be smaller vehicles than average, older, and with poorer crashworthiness, confirming patterns found in previous Australasian research (Keall and Newstead, in press 2010; Watson and Newstead, 2009), as in other countries. It is obvious from the above analysis that parents are key people in making vehicle purchasing decisions regarding the cars teenagers drive.

It is a perverse outcome for safety that young drivers’ vehicles perform generally poorly in terms of occupant protection when this group has such high crash rates. For this group, who are likely to seek cheaper vehicles because of limited income and also to conform with vehicles driven by their peers, it is important that they and their parents are made aware of the range of available modestly priced vehicles that provide better occupant protection (Keall and Newstead, in press 2010). For these reasons Rivara and colleagues (1998) proposed that information about vehicle crashworthiness should be incorporated into education programmes to inform teenage drivers and their parents. When deciding (or assisting their teenager to decide) on an appropriate vehicle, it is important that parents consider safety alongside practical concerns such as cost and reliability (Hellinga et al, 2007).

*Improving Novice Driver Vehicle Selection – Policy Implications*

In light of the review of the literature on young drivers’ vehicles and their ownership, policy options for improving vehicle safety for young drivers could include:

- Improve the safety of vehicles entering the fleet, particularly with respect to safety requirements relevant to young drivers. This approach recognises that the new car of today is the second-hand car of future years, which will potentially be driven by young people whose families – or they themselves – cannot afford a new vehicle. A second aspect of this focus is to develop strategies to ensure that safer new vehicles pass through the fleet and into the hands of young drivers as quickly as possible.
Include vehicle restrictions for vehicles with noted high crash risk or poor crashworthiness for young drivers in graduated driver licensing schemes. Current restrictions focus largely on restricting vehicles based on power output and potential for rapid acceleration and high speeds. This approach is as yet unproven in terms of safety effects, although it has some face-validity as a very powerful vehicle can encourage and facilitate driving at unsafe speeds. Arguments against its effectiveness include that virtually any passenger vehicle can be driven at dangerous speeds, so the issue is primarily that of appropriate driver behaviour rather than vehicle capability. Evidence presented in this paper shows there are other vehicle types that present high crash risk or poor crashworthiness for young drivers. Of particular note are SUV vehicles that have high crash risk, and in particular high rollover risk, in the hands of young drivers as well as relatively poor crashworthiness for young drivers. Extending the basis of young driver vehicle restrictions to include other high risk vehicles may be warranted. Of course, regulating to prevent access to particular vehicles for particular driver groups might require a lot of administrative and policing effort that may not be justified by the safety benefits of this measure. Assessment needs to be made as to whether the same effort may be better spent in other ways.

Focus on educating parents. As implied by the above analysis, parents are the dominant owner group of the vehicles driven by teenagers. They are also likely to have an important advisory role in the vehicle purchases of the teens themselves. There needs to be a change in the safety culture of parents that recognises that their teenagers are at increased risk of crash and that the parents should be making safety the top priority in a car purchase for their children. They should also be encouraged to purchase newer, potentially more expensive cars with better vehicle safety features and crashworthiness to help protect their children. Purchase of proven aftermarket safety devices by parents for their children’s cars such as alcohol interlocks and intelligent speed limiting devices when they become readily available and easily installed should also be encouraged.

The role of insurance premiums in encouraging safer choices should be examined. Incentives such as insurance rebates should also be investigated as a means to motivate parents and young drivers themselves to purchase safer vehicles.

Ongoing research and particularly consumer research is required. A survey of teenage drivers was conducted in the US recently to study parental decisions about vehicles driven by teenagers and parental knowledge of vehicle safety (Hellinga et al, 2007). If parents in Australia and New Zealand are to be educated and informed, we need to know more about their attitudes to vehicle safety, the safety of their teenager and their willingness to spend money to increase safety. A similar study to the Hellinga study adapted to Australasian conditions would illuminate the attitudes of Australasian parents. It would also be useful to establish why teenagers select the current vehicles they favour and to illuminate reasons for the differences between vehicle preferences of male and female teenagers (who, on average, prefer large cars and small cars respectively). Ongoing research is required to understand changes in vehicle purchasing practices related to changing market forces and the role the vehicle manufacturers have in this process.
Improvements in the vehicle fleet are a long-term but important measure to reduce young driver crash and casualty rates. Such improvements increase safety while recognising that the crash rates of young drivers will always be elevated somewhat because of their lack of experience and as-yet undeveloped ability to evaluate risks and take safe options, which will always be characteristics of the young.

**References**


