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The Young Driver Problem versus the Young Problem Driver - A Review and Crash Data Analysis

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Abstract

The concept of a young problem driver sub-group, that is, a sub-group who operate at a (substantially) higher than average crash risk and therefore contribute disproportionately to young driver crashes is often proposed. This report presents a literature review and mass crash data analyses and proposes a conceptual framework comprising crash risk, crash frequencies, crash countermeasures and countermeasure priorities to assist (policy) discussion of this issue. On the basis of information presented, it was concluded that action designed to focus specific attention on young problem drivers should be accorded low priority relative to the development and implementation of other young driver safety initiatives.

Keywords

young driver, problem driver, differential crash risk, risk taking, problem behaviour theory, statistical models

"THE YOUNG DRIVER *PROBLEM* VERSUS THE YOUNG *PROBLEM* DRIVER"

A REVIEW AND CRASH DATA ANALYSIS

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AUGUST 1994

EXECUTIVE SUMMARY

The concept of a young problem driver sub-group, that is, a sub-group of young drivers who operate at a (substantially) higher than average level of crash risk and therefore contribute disproportionately to young driver crashes is often proposed in the context of young driver crash countermeasure development. Historically, this has proven to be an attractive proposition and has attracted significant research effort, primarily in the investigation of demographic, lifestyle and motivational factors.

This report has presented both a literature review and selected mass crash data analyses and proposed a conceptual framework to assist the (policy) discussion process. This framework comprises crash risk, crash frequency, crash countermeasures and countermeasure priorities.

On the basis of the literature reviewed, it is difficult to determine whether the 'Young Driver Problem' or 'Young Problem Driver' syndrome is the more credible or accurate. Part of the problem is that some of the more promising theories and ideas within each of these syndromes do not consider aspects from the other. For example, Problem Behaviour Theory provides a good account of problem driving as an aspect of overall problem behaviour, but does not consider skill as an added contributor to problem driving. As long as theories remain 'self-contained' in this manner, they will always struggle to account for a majority of the variance in crash involvement.

While finding a particular problem group within the young driver population, as defined by biographical and personality characteristics, would be a convenient outcome for the purposes of directing road safety campaigns, it seems to be a somewhat unrealistic proposal. The focus of the 'problem driver' research has been to define a subgroup over represented in the crash statistics, who can be recognised by a certain collection of personal variables. The problem thus far is that *so many* different variables, in many different combinations, have been found to be related to crash involvement at some time. It seems just as likely that this outcome is a reflection of different types of individuals having a 'crash involved' period at some time in their lives.

On the basis of information presented, it was concluded:

- on first principles, a young problem driver sub-group (as defined above) does exist. The crash risk heterogeneity of the young driver population is acknowledged and the very concept of an average young driver crash risk means that a proportion of this population will operate at levels above the average (just as a proportion will operate at lower than average levels of crash risk). It is reasonable to suggest that membership of these groups is relatively consistent over time.

- the existence of such a sub-group does not, in itself, justify specific countermeasure development attention.

- if multiple crash involvement are considered to represent the majority of young problem drivers, crash data analyses indicate that this sub-group contributes a very small proportion of total young driver crash involvements. Further, there was no indication of proportional overinvolvement of selected variables in the (young) MCI group. The analysis approach, however, was not (and could not be) definitive.

- if it is assumed or contended that the young problem driver sub-group warrants specific attention due to their frequency of crashing, two further problems remain:

  - there is no agreed definition of a young problem driver and even very good, current identification procedures using crash, violation and demographic information are very inefficient. While managing to successfully identify some problem drivers, they only do so with a large false alarm rate (that is, substantial numbers of non-problem drivers are falsely included as problem drivers).

  - currently, there is very limited ability to actually treat identified "problem" drivers through driver improvement programs and the like which are designed to reduce their risk of crash involvement. Even if effective programs could be developed, they would be unlikely to be cost-beneficial due to a combination of small treatment effect sizes and the application of such programs to drivers who do not warrant inclusion in the treatment program (the "false alarm" drivers).

- on this basis, action designed to focus specific attention on young problem drivers should be accorded low priority relative to the development and implementation of other young driver safety initiatives.

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THE YOUNG DRIVER *PROBLEM* VERSUS THE YOUNG *PROBLEM* DRIVER

1.0 INTRODUCTION

The young driver population has received much attention in the road safety literature in the past three decades. This attention is not surprising as it has been well established that young drivers (typically defined as drivers under 25 years of age) are over-represented in road crashes and that this overinvolvement reflects a greater risk of crash involvement rather than a greater amount of driving (see Drummond and Yeo; 1992). A number of areas of research have attempted to explain the increased crash risk of young drivers, with a focus on poor skills, drug and alcohol use, and speeding (Peck; 1985). More recently, however, there has been a renewed interest in the investigation of personality or lifestyle characteristics of young drivers that may increase their chances of being involved in a crash.

Within this literature, there has been two areas of thought:

- all young drivers are "***problem***" drivers, in that their lack of driving experience predisposes them to greater crash involvement due to developmental or skill factors. These approaches conceptualise the overinvolvement of young drivers in crashes as a "**Young Driver *Problem***".

- there is a subgroup of drivers within the young driver population that are ***problem*** drivers due to certain defining personal characteristics. These theories support a "**Young *Problem* Driver**" notion.

There is little consensus regarding the superiority of either of the above positions. In this short review, studies pertaining to the two areas will be reviewed. Advantages and disadvantages of the number of methodologies employed in these studies will also be discussed, as these have a bearing on the conclusions that can be drawn from the results. Additionally, a number of crash data analysis will be presented which will attempt to place the "young problem driver" in an appropriate statistical and policy context.

2.0 OBJECTIVES OF THIS STUDY

The objectives of this study are to:

- provide an appropriate structure within which to discuss policy options on "the young driver problem or the young problem driver".

- extract general conclusions on the "state of the art" in this area via a literature review.

- undertake selected mass crash data analyses to enable assessments of priorities to be made.

3.0 A BRIEF HISTORY

3.1 Accident Proneness

The first attempts to link accidents with personal characteristics appeared in 1919 under the banner of 'Accident Proneness'. Accident proneness was initially used to examine the accident records of factory workers in order to identify the workers who were more prone to having accidents than what would be expected by chance (Porter; 1988). Accident proneness was believed to be a permanent and stable trait which was due to a single, identical characteristic in each person. Porter (1988) gives a description of the initial work by Greenwood and Woods (1919), which involved the identification of accident prone individuals by comparing population accident data with a series of theoretical accident involvement 'curves', or distributions:

- the *chance distribution* assumes the allocation of accidents is random across the population (similar to the Poisson distribution)

- the *biased distribution* assumes that after having had one accident, an individual becomes more or less likely to have another accident

- the *unequal liability distribution* assumes that a propensity towards accidents exists in some people and not others, thus the distribution is greatly skewed in the positive direction

The biased distribution was later thought by the experimenters to have little merit, whereas the chance and unequal liability distributions fitted the data well

The curve-fitting method has been criticised widely as it assumes, among other things, that the population is homogenous with respect to all variables leading to accidents such as age, poor health or lack of experience (Porter; 1988). A second means of analysing accident proneness was the correlation technique.

The correlation technique was also developed by Greenwood and Woods (1919). It assumed that if accident proneness was a stable trait, then a strong correlation should exist between accident rates of individuals over different time periods. However, this technique suffers from many of the problems inherent in the curve-fitting technique, including a lack of control over different levels of exposure to risky situations. Both high and low correlations between accident rates have been found, even within the same study (Holroyd; 1992).

The theory of accident proneness is now thought to be antiquated (Huguenin; 1988). Apart from its disputable validity, it is not clear what would be gained from proving its existence. Accident proneness seems to be a circular phenomenon - it is used to explain patterns of accident involvement and also as a causal explanation of the pattern of behaviour it has just been used to describe (Grey, Triggs and Haworth; 1989). With time, it seems more pertinent to try and uncover what characteristics actually are the cause of, or contribute to, crashes in certain individuals. Thus, accident proneness has been replaced by 'differential crash involvement' which aims to explain the differences between groups of individuals with varying rates of crash involvement.

3.2 Differential Crash Involvement

Differential crash involvement seeks to identify crash-involved individuals using psychological tests. However, the area is not restricted to psychological constructs only, as social, demographic and behavioural characteristics also are of interest. In most cases, a number of constructs from each of these different domains are investigated within the same study. For the purposes of this paper, these constructs will be grouped under the term 'personal' characteristics or variables.

This area of study assumes that individuals vary along a continuum regarding the factors that affect their crash risk (Elander, West and French; 1993) rather than the "all or nothing" approach of accident proneness. Further, as will be discussed later, the area has not only focussed on differential crash involvement, but also driving violations or convictions as a measure of driving style and performance.

A number of methodologies have been used to examine the relationship between crashes and/or violations and personal characteristics. These will be reviewed in the following section as they should be considered when evaluating these types of studies.

4.0 METHODOLOGICAL CONSIDERATIONS

Methodological issues can be broadly grouped under the headings 'data collection issues' and 'data analysis issues'.

4.1 Data Collection Issues

4.1.1 Type of data

4.1.1.1 Crashes

The primary choice in these studies has to be whether to use crashes or violations as the dependent variable. Initially, crashes were the popular choice as they were more severe, in terms of fatalities, injuries and social costs, and therefore warranted more attention. They were also believed to be most indicative of the outcome of poor driving. There are two ways of obtaining the crash history of individuals - self-reports and official records. Both methods have their own sources of bias, outlined well in a review by Elander et al (1993).

4.1.1.2 Self-reported crash involvement

The main bias associated with the self-report of crash involvement is that the reporting from the respondent could be, either intentionally or unintentionally, misleading. There is a chance crashes may not be reported, especially if they do not involve a fatality (Elander et al; 1993). There is also the possibility that crashes are simply forgotten. Further, unless the definition of a crash was made quite clear, for example in terms of injuries or cost of damage to the vehicle involved, there would be differing opinions on what makes a crash eligible for reporting.

However, related to this last point is that the self-reporting method, with clear instructions, does allow all types of crashes (obviously apart from driver fatalities) to be reported, including the "fender-benders" (McGuire; 1972) that may not make it onto the official records.

4.1.1.3 Official records

The major advantage of official records is that they are not prone to the human errors and biases associated with self-reporting (although, as demonstrated by Drummond & Vulcan (1989), a significant proportion of officially recorded

crashes are in fact self-reported). They also include crashes that the driver did not survive. The main disadvantage, as stated above, is that minor crashes may not be reported.

Further, certain groups of drivers may be over-represented in the records for reasons other than crash risk. For example, elderly drivers are more prone to injuries than younger drivers, and therefore may appear more often in the records for this reason even if their actual crash rate is no worse than younger drivers.

4.1.1.4 Crash heterogeneity

It is becoming increasingly common in this area to distinguish between the use of the terms 'accident' and 'crash', as the former is thought of more as a random, unpredictable event, whereas the latter has a greater connotation of human error (Elander et al; 1993). However, some studies still treat all crashes as being the same. That is, active crashes, where the driver can be held at least partially responsible, and passive crashes, where the driver is not liable at all, are grouped to create an individual's crash involvement.

Passive crashes are largely a function of exposure (Elander et al; 1993) and therefore may affect the relationship between variables of interest and crash involvement. A more reliable measure of crash risk could be to limit the definition of crashes to active crashes only.

It is clear, however, independent of fault, that crashes happen only very occasionally for most individuals, and the consistency of the number of crashes for individuals is low (Schuster and Guilford; 1964). Analysis of crash data is difficult if a great majority of the sample has never had an crash (for example Sobel and Underhill; 1974, 1976). Of those who did, many had had only one crash over a period of years, not allowing the investigation of a highly involved crash group, which may be a better representation of a true crash-involved group. There was a need for a more common indicator of 'poor' driving to allow the disaggregation of more disparate 'involved' and 'non-involved' groups. This indicator was the amount of traffic violations.

4.1.1.5 Traffic Violations

Levonian (1969) noted that crashes happen too infrequently to be of great use and therefore decided the solution was to use driving violations, which, in data taken from 1965, were four times as common as crashes. He justifies the use of violations as a valid replacement for crashes with the "modest positive correlation between numbers of accidents and violations which so frequently emerges" (p.10). Violations are also a useful independent variable as they are

easily available on official records, along with more detailed, and relevant, information such as the type of violation.

It is important to be able to distinguish the type of violation as different types of violations have been found to be more prevalent amongst certain groups of drivers (Harrington and McBride; 1970). For example, in a study of a sample of Californian drivers, the above authors found that males are more than seven times more likely to receive 'equipment' violations (eg faulty headlights) than females. Single people were more likely to receive violations than married people (although a lack of exposure data for married subjects means this result may partly be due to different exposure levels). Sign violations (eg. failing to stop at red lights) were most common amongst elderly subjects.

Another problem inherent in the use of violation data is that not all violations are enforced equally (Smiley, Hauer, Persaud, Clifford and Duncan; 1991). This may bias the data towards an over-representation of certain groups of drivers, such as the examples given above. Further, driver records only contain information on the number of times an individual is caught doing an illegal action, not the actual number of times an individual does an illegal action. In this sense, violation records are similar to crash records in that not all relevant incidents are recorded.

4.1.2 Length of time of crash/violation history

Some studies have been criticised for not collecting crash or violation data over a suitable length of time. Since crashes, and to a lesser extent violations, occur infrequently and somewhat randomly (Smiley et al; 1991), a substantial amount of time is required to get a representative account of a driver's true crash or violation potential. Most studies limit their data gathering period to between one and three years, which is thought to be insufficient. For studies of young drivers, of course, the study is limited by the amount of experience the sample has had, therefore long periods of data collection may simply not be possible.

4.1.3 Exposure

It is important that the amount of exposure a driver has is considered when calculating crash and violation involvement. If exposure is not controlled for, this may increase the error variance, reducing the relationship between crash or violation frequency and psychological variables (Elander et al; 1993). Controlling for the amount of exposure is achieved by obtaining an estimate of distance driven. Unfortunately, this can be a hazardous process in itself, and as yet there is no information on the reliability of subjective estimates of exposure (Holroyd; 1992).

Further, simple estimates of distance driven do not consider the different conditions under which the driving is done. For the most part, studies that take

exposure into consideration create a general crash or violation rate per unit distance - number per 10,000 kilometres driven, for example.

4.1.4 Types of 'psychological' tests administered

Apart from the use of self-report methods, as discussed above, there has also been a lack of objectivity in the measurement of driver characteristics (Grey et al; 1989). An example of this is the use of insufficiently standardised tests. For example, Lastovicka, Murray, Joachimsthaler, Bhalla and Scheurich (1987) used a questionnaire asking about drink driving beliefs and behaviours, lifestyle, media use and demographics, with questions developed from literature reviews, expert opinion and qualitative research. They used the results to segment the sample into four subgroups, despite having no data on the reliability or validity of the questionnaire.

The second main methodological area is the analysis of data and how it is interpreted. This is discussed in the next section.

4.2 Data analysis and interpretation issues

4.2.1 Correlational techniques

Correlational techniques have been used to establish crash risk, or crash involvement consistency, which represents how stable an individual's crash risk is over time. As already discussed, the correlational technique was devised in the early days of accident proneness. Generally, this technique has not provided reliable results.

Correlational techniques are also used to associate personal variables with crash and violation involvement. As in all areas of research, the major drawback of correlational analysis is that causality cannot be established. A correlation between a personal variable and driving behaviours may be due to:

- the variable directly affecting crash risk
- the variable affecting crash risk through another, more immediate variable
- the variable correlates with another factor that affects certain driving behaviours and plays no role itself
- crash risk may influence the variable (Elander et al; 1993)

Some studies which have large enough sample sizes also tend to report statistically significant correlations, which may in fact be very low. However, there are some authors (for example McGuire; 1972) who believe that a low statistically significant correlation, for instance 0.10, looks quite small, but may actually be significant in terms of the number of crashes or violations it represents. Further, criticising low correlations overlooks the fact that there are limits on the size of the correlation that can be obtained when dealing with rare events, especially crashes, that have a large random component (Lester; 1991).

Despite this, small correlations should be viewed with caution, and only support tentative conclusions. More sophisticated multivariate techniques have become more popular in this area, especially when combinations of traits or characteristics may be related to crash or violation involvement, and as a result of the shortcomings of correlational techniques.

4.2.2 State versus Trait characteristics

Compared to other dependent variables in road safety such as road design or physiological measures such as visual acuity, personality characteristics are much harder to measure (McGuire; 1976). It is difficult to separate the effects on crash or violation involvement of characteristics that may be permanent traits, and those that are transient state attributes.

This is especially important when you consider that there is a body of research demonstrating that many crashes can be attributed to current life events (Donovan, Marlatt and Salzberg; 1983) which may temporarily alter the 'personality' of the individual. The effects of characteristics under investigation should be interpreted with this distinction in mind.

4.2.3 Sample

The size of the sample, as in any area of research, is important. Small sample sizes severely restrict the scope of the conclusions that can be drawn from the results. Also, a matched control group for the crash or violation involved group is of use. The control group should be, and is usually, matched on broad demographic and personal characteristics. What is more difficult, and is therefore done less often, is the matching of the control group on exposure (both quantitative and qualitative) and risk of being caught violating traffic laws (Grey et al; 1989).

4.3 Summary of Methodological Considerations

Despite considerable progress having been made in the development of appropriate methodologies for the study of personal characteristics related to driving behaviour, many factors still need to be taken into account when designing or evaluating these studies:

- sources of bias in the gathering of both crash or violation data, and personal information, should be attended to
- both quality and quantity of exposure need to be controlled for
- type of crashes and violations used may create a bias in the sample demographics
- the longest possible time within which crashes or violations can occur should be considered
- standardised, reliable tests should be administered whenever possible
- appropriate statistical analyses should be employed, keeping in mind their respective deficiencies
- samples should be as large as possible with an adequate control group

The literature employing various combinations of the above 'conditions' has so far produced an array of findings and conclusions. The following section reviews a selection of these studies.

5.0 REVIEW OF THE RESEARCH LITERATURE

5.1 Young Driver Problem

Demographic studies have traditionally and consistently pointed to young drivers as a high risk population. What is it about young drivers that makes them such a high risk group? The main areas postulated are those of exposure, skill and motivation. The latter, as it relates to the willingness to take risks, can be framed as a component of a 'lifestyle' theory of young driver risk taking.

5.1.1 Exposure

It has been proposed that young drivers are over represented in the crash statistics due to the amount or type of exposure they have (Goldstein; 1972). Young drivers do not drive further than older drivers (Lewis; 1985) but may be exposed to the riskier types of driving such as night-time driving. Drummond and Yeo (1992) found an increased crash involvement for young drivers overall, and a further elevated risk at night-time, particularly for 19 year old drivers. It is not clear at this stage whether this increased crash risk at night is due to the impoverished visual conditions, or if it is a function of the qualitative aspects of driving undertaken by young drivers at these times or some combination of these two factors.

5.1.2 Skill vs Safety

It has been suggested that young people are taught how to drive, but not how to drive safely. While studies examining the skill or performance deficits of young drivers are difficult in the 'real world' (but are becoming more frequent with improving driving simulation technology) there have been a number of studies examining the different driving practices of younger and older drivers.

5.1.2.1 Driving Style

Evans and Wasielewski (1982, 1983) examined the headway distances of drivers in free flowing freeway traffic as a measure of willingness to take risks while driving. Risk was defined as short (less than one second) following headway. Photographs were taken and the characteristics of drivers who drove at a headway of less than, or equal to or greater than one second, were compared. They found that young drivers (those less than 21 years old) were more willing to take risks by driving with shorter headways (a correlation significant at 5%). This relationship with age was somewhat linear.

A similar methodology was employed by Wasielewski (1984) to examine speed as a measure or willingness to take risks. Young drivers were again found to accept higher risk in that they drove faster on average than older drivers (speed correlated 0.26 with age).

Macdonald (1992) provides a comprehensive review of the young driver performance literature and outlines other areas of the driving task in which young drivers may not be as proficient as their older counterparts. As these factors are not the main focus of this review, they shall be summarised as follows:

- Young drivers have less developed vehicle control skills, as evidenced by poorer acceleration, lateral control and less precise manoeuvring of the vehicle.

- Novice drivers also tend to concentrate more on conscious decision making and monitoring of their driving, and as a result have less attentional resources in reserve. This may result in a poor ability to cope with unexpected difficulties, or hazard perception in general.

- Attention switching may also be a problem for young drivers who are not experienced enough to switch attention between different driving tasks in order to maintain proper control over the vehicle.

The short discussion above suggests that some of the types of 'poor' driving exhibited by young drivers can be explained by lack of skills or experience (in these circumstances, risk taking behaviour may be considered as unintentional (Jonah, 1986)), while others are the results of a greater willingness to accept an element of risk. Acceptance of risk is the motivational component of exposure, which may also lead young drivers to take risks in the form of a greater amount of exposure, or driving under conditions which increase exposure to crashes such as night driving, or driving with many passengers.

5.1.3 Young Drivers and Risk

Risk-taking has been perceived as an explanation that may account for a large part of the over representation of young drivers in road crashes (Hodgdon, Bragg and Finn; 1981). Two studies have already been described that relate a higher level of risk taking to young drivers. In these studies, Evans and Wasielewski (1983) and Wasielewski (1984) assume that headway distance and speeding constitute a *willingness* to take risks. However, Macdonald (1992) warns that such objectively risky behaviours may come about partly due to lack of perception of the hazards of the behaviours.

Thus, the behaviour may not be wholly an indicator of deliberate risk taking, but also an indicator of lack of hazard perception and cognition. This suggests that the examination of young driver risk taking should be done in two parts - risk assessment (or perception) and risk taking.

5.1.3.1 Risk Assessment or Perception

Risk perception can be divided into the risk of a crash while driving in general, and the risk of a crash when driving in certain situation or ways (Jonah; 1986). Jonah and Dawson (1987), in a study of young drivers and risk, included several items in a questionnaire assessing the perceived risk of driving in general, and of specific driving situations. They found that drivers aged 16-20 perceived the greatest risk of injury crash involvement during the next three years. In an interesting contrast, drivers aged 16-24 rated themselves as less cautious than the older drivers, yet in an assortment of specific driving situations, consistently perceived less danger than did the older drivers.

It has been reported that the perception of risk is greatly influenced by young and/or inexperienced drivers' overestimation of their ability to cope with driving problems as they occur (Drummond; 1989). Jonah and Dawson's (1986) finding of young drivers perceiving less danger in all driving situations regardless of the dangerousness of the situations agrees with results of Finn and Bragg (1986) who found that young drivers ranked speeding lower in danger than older drivers.

Matthews and Moran (1986) reported that young drivers overestimated risk in medium risk situations, and underestimate risk in high risk situations. In any case, both of these studies reported that young drivers saw themselves as less likely to be in an crash than their peers. The discrepancies have been put down to differences in methodologies (Jonah and Dawson; 1987).

In a review of studies concerning risk perception, Jonah (1986) concludes that the weight of empirical evidence supports the view that young drivers take risks more often because they are less likely to recognise a risky situation as it arises. This is especially the case when the driving situation is specific, for example tailgating.

Apart from risk-taking resulting from the misperception of the hazards of driving, there is one other broad conceptual approach about why young drivers engage in risk-taking behaviour (Cvetkovich and Earle; 1988). That is, young driver risk taking is a form of default behaviour in that young drivers' decisions are formulated in terms of issues other than those of statistical risk.

5.1.3.2 Risk Taking

Cvetkovich and Earle (1988) defined risk in the following manner:

> "Risk is conceived of as an objective characteristic of the physical world which is reflected in frequency information collected over time concerning the high probability of injury, death or other large losses." (p9)

An important aspect of this definition is that information needs to be collected *over time*. Young drivers simply may not have had enough exposure to risky situations to have accurate judgments of their true objective risk. Alternatively, young drivers may be more willing to engage in risky behaviour as a result of additional utility or value that they assign to the dangerous behaviour (Hodgdon et al; 1981).

Lewis (1985) for example, suggests that some risk taking may come about as a means of improving self esteem. Risk taking may be undertaken to gain peer acceptance, to fulfil developmental needs relating to autonomy and adult decision making (Millstein and Irwin; 1987), or aggressive risk-taking may be an expression of chronic anger or resentment (Donovan et al; 1983). Or it simply may be that young drivers are more willing to accept certain risks to reach their destination faster.

Historically, investigations into young driver risk taking have presupposed that all young drivers have more risk-taking utilities than more experienced drivers that lead them to more dangerous driving practices (Hodgdon et al; 1981). In fact, some researchers hold the view that more deviant driving should be expected from young drivers simply because they are members of a 'deviant population' (Klein; 1972).

More recent and sophisticated theories, however, assert that young driver risk taking is one element of a set of problem behaviours related to a segment of the young population. An example of this, Problem Behaviour Theory, will be reviewed in Section 6.0. It is part of the growing amount of literature that does not assume the young driver population to be a homogenous group.

5.2 Young Problem Drivers

5.2.1 Introduction

The second area of thought in the young driver literature is that there is a subgroup of young drivers (usually males) that, due to some combination of personal characteristics, have a greater risk of being involved in a crash. It is thought that this subgroup is responsible for the over-representation of all young drivers in the crash statistics. Does such a subgroup exist? People have a seemingly natural tendency to want to label other people, or categorise them into groups. This is certainly the case with the stereotypical 'hoon' driver. The stereotypical young problem driver is often described as having all or at least some of the following characteristics: a high affinity with their own car, which is often modified (both mechanically and in appearance), they spend more time and money maintaining their car, drive at high speeds or perform risky manoeuvres, purchase vehicle accessories, play loud music, and do a large amount of driving, especially in conditions of increased risk such as night-time.

The scientific method has been employed to this area in an attempt to establish whether any subgroups really exist, or whether they are convenient labels to place on certain individuals for the purposes of our own information processing. The need to explore this theory of young driver crash involvement has been explained by Rolls and Ingham (1992):

> "The presentation of accident probability (whether controlled for exposure or not), or the presentation of average scores on particular measures, may provide a deceptive impression that *all* young drivers differ from other drivers in one sense or another. Not all drivers are unsafe drivers involved in traffic injury accidents, nor receive convictions for traffic offences. The need is to go beyond the traditional demographic or experience categories and explore variations *within* members of particular driving categories." (p.67-68)

The reader is reminded that the literature is not confined to personality variables alone. Demographic and social variables are still of parallel interest in many of the studies in this section. Further, while there is a literature concerning the relationship of traffic crashes and serious forms of crime [among these DSM-IIIR includes reckless driving and criminal behaviour as components of anti-social personality disorder (West, Elander and French; 1992) and; high risk drivers have been compared with suicide attempters (Rockett, Spirito, Fritz, Riggs and Bond; 1991)], this review will be restricted to personality characteristics within the 'normal' range.

It should also be noted that not all of the studies in this section relate to young drivers exclusively. However, it is felt that these studies still provide useful heuristic information to complement the studies focussing on young driver samples.

5.2.2 Results

Hemenway and Solnick (1993) set out to determine whether personality and demographic characteristics were related to driver behaviour, as well as to provide information on connections between road safety and other variables of interest such as those involving the car and its equipment.

They conducted a telephone interview of over 1800 Southern Californian residents of all ages. The young driver group was defined as drivers between 18 and 30 years of age. Drivers self-reported their crash and illegal behaviour involvement from the previous 12 months. The analysis explores the correlates of being involved in a crash and engaging in three illegal driving practices (drink driving, speeding and running red lights). Unfortunately, not many comparisons were made within the young age group, however the following findings were reported:

- Young drivers were particularly prone to speeding, running red lights and drink driving, and twice as likely to be involved in a crash as older respondents. This agrees with the traditional results of young driver studies. In fact, youth remained a risk factor for crashes even after controlling for the three illegal behaviours.

- High income and highly educated drivers tended to speed more, and the highly educated drivers reported more crashes per mile, a result that contradicts converse findings from previous research (for example Schulze; 1990, Smith and Kirkham; 1981).

- Respondents who were driving their "dream car" tended to engage in fewer risk behaviours and had fewer crashes. Drivers with "fuzzy dice" (or equivalents) hanging from the rear-view mirror, or bumper stickers on their cars were the same as other drivers.

- Overall, they found that drivers who customise their cars are not "menaces on the road" (p.168) however they do have a higher level of exposure and are more likely to drink and drive.

- The 4% of drivers with car phones engaged in the three illegal behaviours more but this can be explained by the fact that they drove 67% more miles than the other drivers.

- In terms of driver behaviour, indecent gestures, arguments with other drivers, and 'unusual activities' in the car (which were not defined!) were highly intercorrelated. These drivers tended to be risk prone. This finding lends support to the Problem Behaviour Theory, which will be discussed later in this section.

On a methodological note, regarding the use of a measure of exposure, Hemenway and Solnick (1993) believe that using crashes per mile as a measure of risk may exaggerate the apparent poor driving of low exposure drivers, as they do the majority of their driving on congested city streets, whereas the high exposure drivers tend to drive more on safer, limited access highways. With all other factors held constant, they found that mileage is not correlated with drink driving or running red lights, suggesting that certain types of drivers may engage in these behaviours, while others do not.

Hemenway and Solnick (1993) report the limitations of their study, including the use of self-reported data. On this point, they recognise that the data on illegal driving behaviours may have lacked precision - for example how much over the speed limit is speeding, and how much is too much to drink and so on.

As mentioned in the review of methodological issues already in this paper, some studies are criticised for using inadequately standardised tests, either relating to personality factors or driving related variables. Schuster and Guilford (1964) provided one of the earlier attempts to construct a survey

specifically for the predication of two types of problem drivers (characterised by either crashes or violations) from their assessed personality and biographical characteristics.

The groups of interest in this study were:

(i) **crash repeaters - drivers involved** in 3 or more crashes within the preceding 3 years, for two of which he/she was at least partly responsible, and;

(ii) negligent operators - cumulative, weighted points equalling four or more points in 12 months, 6 or more in 24 months, 8 or more in 36 months (points are given for violations and crashes).

The groups were compared with a randomly selected control group, matched on age and annual mileage, who had had no moving violations or crash involvement in the previous three years. The eventual survey, the "Driver Attitude Survey", consisted of 100 items and was able to classify problem drivers versus other drivers with an accuracy of approximately 70-75%.

The Schuster and Guilford questionnaire was later used by Kuzma, Dysinger, Strutz and Abbey (1973) to examine the crash rates of the general population against that of a non-drinking population - Seventh-day Adventists (SDAs) - and compare the psychological, biographical and religious factors of the two populations. This was an extension of an earlier study that examined the effect of alcohol consumption on crash rates, recognising that any difference in crash rates may not be the sole effect of alcohol consumption.

One hundred and two randomly selected Caucasian male SDAs, aged 19-65, were compared with a control neighbour on the basis of personal interview and psychological questionnaires. Respondents self-reported their crash and violation history, which was verified using official records. There was a 70% (of the sample) agreement between the two types of reporting for violations, and 83% for crashes. The amount of over- and under-reporting of violations or crashes was similar for both groups.

A comparison of non-adjusted crash rates demonstrated a 31% lower rate for SDAs than non SDAs. In terms of psychological variables, the two groups were quite similar, except that SDAs had lower mean scores for alcoholic tendency, masculinity and ambition, and higher mean scores for benevolence, friendliness and objectivity. SDAs did not differ from the control group for any of the factors (except alcoholic tendency) previously found to be related to violations or crashes in the Schuster-Guilford study.

For biographical variables, the groups, not surprisingly, differed on religious variables such as bible reading, as well as for military service and alcohol

consumption. For the combined groups, it was shown that military service, consumption of alcohol and not reading the bible were related to a higher number of crashes. The religious factor in the SDAs did not decrease the number of violations, however the control group had a non-fatal crash rate twice as large as the SDA group.

The authors conclude that it is difficult to distinguish between the long-term, deeper psychological characteristics that could be related to violations or crashes and the transient factors related to a specific crash. In this study it appeared that the two groups were similar in most of their 'deeper' characteristics, but differed on the military service, alcohol and bible reading variables that were related to crashes.

Rolls and Ingham (1992) conducted extensive interviews with 56 young male drivers, who, in a previous study, had been classified as either 'safe' or 'unsafe'. The previous study had found that a significant majority (35%) of young male drivers could be classified as 'unsafe'. The 1992 study set out to explore some of the more general lifestyle factors by giving these drivers the opportunity to provide their own accounts and explanations for their driving behaviour based on their own realities and experiences. A further methodological issue was to explore the efficacy of in-depth, qualitative interviews in this area of research.

The study reported a great number of observed differences between the two groups. Unfortunately, none of the differences were statistically tested, but were derived from differences in percentages of responses to certain questions or topics of the interview. Some of the differences were:

- more safe drivers had a regular girlfriend/partner; unsafe drivers spent more time with male friends as passengers;

- unsafe drivers were more influenced by the driving of their parents or peers, said that their driving was behaviour was affected by the actions of other drivers, and was more influenced by their mood;

- safe drivers rated themselves as more safe than skilled, whereas unsafe drivers rated the converse;

- more safe drivers had their own car, while more unsafe drivers had a company car or borrowed their parent's car;

- unsafe drivers were more enthusiastic about driving and cars (including maintenance);

- unsafe drivers were more likely to be a non-manual worker and to have stayed on at school past the age of 16.

The authors conclude that in-group differences among young male drivers do exist, and therefore it is wrong to stereotypically label all young male drivers as unsafe drivers. In terms of the methodology used, they felt that the interview technique helped move towards the understanding of the complex and detailed issues involved in this area of research, by allowing the collection of highly descriptive information from the target population.

One of the first to recognise the limitations of crash data in studies of this nature, as reported earlier, was Levonian (1969). He used violations as the independent variable for the purposes of correlating personality variables with driver behaviour. His sample comprised 1080 tenth grade driver education students, the majority of who were 15 years old. Subjects completed the personality inventories and self-reported their violation history. Groups were divided into none, one, two, and three or more violations.

The five personality variables tested were:

- Determination (oriented towards goal);
- Adaptiveness (oriented toward adjustment to situation);
- Expediency (oriented toward self-benefit at the expense of others);
- Defensiveness (oriented toward defence of ego) and;
- Ambivalence (oriented toward indecision in conflict situations).

Only expediency was clearly positively related to number of violations, even after having controlled for the four other variables, as well as sex, driving experience and social area. It should be noted, however, that a majority of the subjects would not have had any driving experience, as 15 year olds were not eligible to obtain a license.

Smith and Kirkham (1981) explored the relationship between extroversion (E), neuroticism (N) and type of crash. One hundred and thirteen male drivers, between 20 and 23 years of age, completed Eysenck's short form MPI and provided data on average kilometres per week, as well as crashes and violations over the previous three years. Analyses of the data included both self-report and officially recorded crashes and violations. Results included a significant positive correlation between E and total crashes (r=.184) especially non-intersection crashes (r=.187) as well as violations (r=.214). This was explained by the poor vigilance of high E score individuals. Subjects with both high N and E scores were more likely to have had two or more crashes than subjects with both low N and E scores. These results cannot be attributed to exposure,

although once controlled for the E and violation correlation was reduced slightly (r=.209).

A year later, Smith and Kirkham (1982) presented the results of a study examining the relationship between intelligence (as measure by group IQ test scores) and crashes and violations. Their sample comprised 113 male drivers aged 20-23 years who completed a written questionnaire with questions relating to education, occupation, kilometres driven in a typical week and any crashes or violations in the previous three years. The results showed an insignificant correlation between intelligence and total number of crashes (r=-.108). However, they did in fact show a significant negative correlation between intelligence and intersection crashes (r=-.174), and a contrasting positive correlation between non-intersection crashes and IQ (.067).

Further, low IQ subjects reported a disproportionate amount of speeding offences. The authors pointed out that the different direction of correlation of crashes and IQ is an interesting example of the heterogeneity of traffic crashes. They suggested that drivers low in intelligence would be over-represented in intersection crashes (a finding of the study) as this is where information processing demands are highest.

Another area of cognitive processing, information processing defect theory, was one of four theories of crash causation studied by Mayer and Treat (1977). This theory suggests that poor drivers lack efficient perceptual/motor speed and accuracy, making them susceptible to crashes. Their study involved 600 university students who were licensed drivers, aged 18-19. Those who had had 3 or more crashes (regardless of fault) in the previous three years were deemed to be the high risk group (n=30). They were randomly matched with a member of the no crash group on exposure, age and gender. In terms of information processing defect theory, the crash group performed worse on clerical tasks (finding words containing the letter 'a' and digit comparisons).

In a study deviating from the traditional focus on males in research in this area, Panek and Wagner (1986) compared the Hand Test variables to traffic moving violations in female drivers, and whether this relationship varies as a function of age. Moving violations included speeding, careless driving and disobeying traffic signs. One hundred and seventy-five female subjects grouped by age - young adult (mean age 31.81), old adult (mean age 59.9) - were administered the Hand test and a self-report driving questionnaire.

Typically, the young group had significantly more violations than the old group (an average total of 0.43 compared with 0.27 over 5 years). For the entire sample, there was a marginally significant correlation between moving violations and the variables of direction (a subset of aggressive-directive behaviour) and acting-out (both r=.14, p<.07). Moving violations were not significantly correlated with aggression. For the young group, no indicators of directive-aggressive behaviour were related to moving violations. For older drivers, there were significant correlations between moving violations and direction (r=.35) and acting-out (r=.36). Thus the conclusion of this study was

that certain personality traits are related to moving violations, and these vary as a function of age.

Hilakivi, Veilahti, Asplund, Sinivuo, Laitinen and Koskenvuo (1989) examined the predictive value of a properly standardised test, the Cattel 16-factor personality test, on the occurrence of crashes among a population of young adult males. The sample comprised 916 young (mean age 20 years) male military conscripts in Finland, whose previous training or occupations related to transportation. The Cattel inventory plus self-reported crash and violation history was taken at the beginning of their service. Two weeks before the end of the 11-month service, questionnaires concerning crashes and traffic fines and penalties received during the service period were completed.

Logistic regression model showed the following factors to be the most important predictors of driving crashes: Factor H - carefree, adventurous, impulsive, danger-ignoring; Factor L - easygoing, ready to take a chance; Factor Q3 - uncontrolled with little respect for social demands. It must be remembered, however, that these results should only be generalisable to individuals with a transportation background, as this was the basis on which the sample was chosen.

Mayer and Treat (1977) examined impulse non-control theory, and found too that their crash group tended to score higher on personality measures of impulsivity and belligerence

McGuire (1972) in a study of 2961 airmen aged 17-20 who had been licensed for 2 years, found that current smoking habits were significantly related to self-reported crash involvement (r=.12). A review of the literature current at the time led McGuire to conclude that smokers, apart from the possible effect of oxygen deficiency on performance, have personality traits conducive to crashes, including over dependency (the opposite of responsibility) which leads to a higher crash involvement. This is an alternative idea to the view that smoking is an indicator of the personality characteristic of willingness to take risks, which is related to a higher crash rate.

An individual's behaviour is known to be affected by his/her background (Lester; 1991). Sobel and Underhill (1974, 1976) postulated that most deviant behaviours in childhood and adolescence (not including biological or genetic defect) can be viewed as a result of inappropriate or faulty learning and socialisation within the family. Such deviant behaviours may include traffic crashes. They attempted to go beyond the behaviour and personality characteristics of the individual which are associated with a higher risk of crash, and locate the antecedent variables in the family that may show a relationship with crash involvement.

They conducted household interviews of 16-19 year olds who had applied for a drivers licence. Parents of the drivers were also interviewed. Official records were used for crash statistics, as well as self-reports. In this case, self-reported

data were felt to be more reliable as some crash were reported that were not on the official records. The Family Life Questionnaire was the instrument used. As three quarters of the sample had not had an crash, crash involvement was not adjusted for mileage. Instead, a dichotomised crash rate was used - none vs some. The results showed a similar crash involvement for males and females, but a different pattern of variables associated with them.

Only mileage was significantly related to crashes for females (32% of high mileage subjects had had an crash). Once mileage was taken into account, none of the other correlates add significantly to the variation in crashes. Among males, however, crashes were significantly correlated with family pathology (0.20), gross family disorganisation (0.16), annual life change units (0.20), measures of rebelliousness (0.17), sexual activity (0.20), alcohol abuse (0.21), smoking (0.20), and time spent working on cars (0.15). Driving violations (0.22) and a deviant driving scale (0.14) were significantly correlated, as was total lifetime mileage (0.26).

These results were thought to demonstrate that females do not seem to act out social or psychological problems in their driving, but their crash involvement is more related to exposure. For males, on the other hand, psychosocial variables, in combination with other variables, accounted for 10% of crash variance in a regression analysis, which is about as important as mileage and violation records.

Background variables were also investigated by Kraus, Steele, Ghent and Thompson (1970) who interviewed 205 drivers under 21 years of age, several weeks after they had been involved in a crash. Crashes must have involved fatalities, injuries, or damage exceeding $100. A control group was matched for age, sex, years of license and size of community or residence. Exposure was compared for the two groups and found to be highly comparable.

Results showed that significantly (at 0.05) more crash involved drivers failed one or more grades in or before year eight (30% vs 17%), became a regular smoker at or before age 16 (39% vs 27%), had first full-time employment at or before age 17 and before obtaining a driving license (13% vs 4%), and had been charged with a criminal offence not related to driving (14% vs 2%). Those who had been involved in a single vehicle crash showed even higher frequencies of these factors.

The Iowa State Farm Insurance Research Department (1988) researched what variables best distinguish youthful drivers with poor crash histories from those with good crash histories. Demographic, lifestyle, driving habits and crash history information was gathered from a random sample of drivers aged 16-24 who returned a mailout questionnaire. Validity of crash information was checked from official records and more than 90% of respondents reported as many crashes as appeared on the records. Crashes where the respondent was not at all at fault were excluded. Crash frequency was over a four year period, scaled by the number of months the individual had been licensed.

The following groups of drivers were found to have higher crash frequencies:

- males;
- single drivers;
- drivers who had been on probation or suspension at high school, or who had lower grade point averages;
- drivers who indicated they drank heavily (the lowest crash rate was amongst the 16-18 year old drivers who reported that they never drank);
- drivers who were regularly involved in parties and social activities;
- those who had driven in excess of 75 or 90 miles per hour and;
- those who infrequently or never wore a seatbelt.

Such an extensive list of factors means that many of these variables would be interrelated, especially the social and alcohol indices. Lastovicka et al (1987) explored the connection between social and drink-driving behaviours in order to identify different types of drinking drivers.

Lastovicka et al (1987) used psychometric measures and methodologies in order to define a target group for anti-drink driving campaigns. A telephone survey of 703 young males aged 18-24 was conducted. Respondents answered questions asking about drink driving beliefs and behaviours, lifestyle, media use and demographics. As previously mentioned in this paper, questions were developed from literature reviews, expert opinion and qualitative research.

The results of a cluster analysis included the segmentation of the sample into four groups. The means of the lifestyle factors within each of these groups were interpreted as follows:

- good timers - heavy partiers with a macho and sensation-seeking orientation
- well-adjusted - the 'happiest', little problem behaviour and average partying
- nerds - most dissatisfied with themselves, below average problem behaviour, partying, sensation seeking and macho orientation
- problem kids - above average problem behaviour and average on all other measures

Lastovicka et al (1987) concluded that this study demonstrates that lifestyle traits are related to drink-driving behaviours. They suggest that other studies may have failed to obtain a similar strong finding as they used "clinically based personality traits useful for studying abnormal behaviour when it may be the case that drink driving is a more common and normal behaviour than many care to believe." (p.262).

This study is one example of how the focus of crash involvement literature has recently turned towards the examination of a possible 'lifestyle' factor, involving many of the above personality variables, as well as driving behaviour itself as components.

The lifestyle, leisure style and traffic behaviour of 1024 18 to 24 year olds was studied by in Germany by Schulze (1990) who interviewed the persons involved in crashes that happened to, from, or on the way between discos. In three months, 216 crashes of this type were registered (crashes must have involved at least one injured person). Information was taken from police crash records. Only 8% of the responsible drivers were females, and 61% of the drivers had a BAC that was 'too high' (more than 30mg per 100ml). The significance of alcohol was higher in rural than urban areas.

Data was analysed using cluster analysis which led to seven groups. A goodness of classification showed that 85% of the subjects were classified correctly. A study of dangerous motives revealed that 30% of the sample could be regarded as a high risk group that was further broken down into three subgroups - the 'action', 'fan' and 'nonconforming' types. In comparing the three groups, however, no statistics or levels of significance were reported, thus it is unknown exactly how disparate the groups are on the lifestyle and leisure style factors.

Nonetheless, the 'action' group, which comprised 16% of the high-risk group, was characterised by a high amount of outdoor leisure activities, as well as frequenting pubs, bistros and discos. They favoured action films, and rejected sophisticated subjects (news, social films), like rock and punk music and had a high affinity with soccer. Passing time by driving their car was important to them.

The 'fan' type accounted for 9% of the high risk drivers and was the 'soccer and disco' fan cluster. Intellectual films were of no interest - action films were preferred. Time with their family was rejected outright, and the only leisure activity that gave them pleasure was driving around.

Thirdly, the 'nonconformist' group, 6% of the high risk drivers', rejected sports of any kind, as well as club memberships, family events and tended to favour driving around. They had the highest affinity with rock, punk and heavy metal music, but were more open to serious forms of music and film. They strongly disliked soccer and disco fans. This group had the highest annual amount of driving exposure.

In conclusion, Schulze is another to believe that global assessment of young drivers does not make sense, as this study demonstrated the existence of very different groups with their own behavioural codes.

The previous few studies reviewed list a number of variables all found to be related to driver behaviour. It seems apparent that many of these variables, especially the behavioural and attitudinal types, are interrelated. Thus there is a growing trend to study these variables as components of a behaviour system. A popular example of this is Problem Behaviour Theory which is discussed in the next section.

6.0 PROBLEM BEHAVIOUR THEORY

6.1 Introduction

Wilson and Jonah (1988) criticised road safety research for traditionally suffering from a lack of theory based explanations for driver behaviour. More recent work on the psychological understanding of driving behaviour, however, has relied on social psychological theory, in which risky driving is seen as one aspect of a larger circle of problem behaviours (Jessor, Donovan and Costa; 1989). Jessor and Jessor's (1977) Problem Behaviour Theory (PBT) has been viewed as a new step towards the understanding of differential crash involvement: Macdonald (1992) states that the development of Problem Behaviour Theory:

> "provides a conceptual basis for investigations of questions concerning the existence and practical significance of 'Young Problem Drivers'." (p.30)

Problem Behaviour Theory asserts that clusters of negative behaviours are interrelated and are reflective of a basic trait rather than isolated examples of negative behaviour (Swisher; 1988). Given this, risky driving would be an example of a component of an emerging negative lifestyle among certain groups of adolescents, and correlate highly with other 'deviant' behaviours.

The explanation of problem behaviour is provided by two systems in PBT - the personality system and the perceived environment system (Jessor et al; 1989). The personality system relate to socio-cognitive concepts such as values, beliefs, expectations and attitudes. The perceived environment system contains concepts such as approval of, controls against, and models for problem behaviour among friends. The factors within these two systems affect the frequency and type of problem behaviours (the behaviour system).

6.2 The Application of PBT to Driver Behaviour

Wilson and Jonah (1987) provide a detailed application of PBT to the understanding of risky driving. They had four objectives in mind:

(i) to provide support for the notion of a behaviour system that includes risky driving;

(ii) extend PBT to the prediction of risky driving in adults;

(iii) use PBT to predict the consequences of risky driving behaviour, and;

(iv) determine whether the applicability of PBT varies across age groups and types of drivers.

The sample was formed by three 'types' of drivers defined by their previous three year driving record:

1. drivers with one or more drink driving convictions (n=238)

2. drivers responsible for three or more reportable crashes (n=142), or drivers with nine or more demerit points - the criterion for an interview with the ministry (n=143). These group were initially separate crash and demerit groups but were found to be comparable enough to combine.

3. a sample of licensed drivers (n=412)

Data was collected from an interview questionnaire. A measure of exposure was taken, along with a variety of established behavioural, value and personality scales.

An initial analysis was to correlate the components of the three PBT systems and a risk index. The risk index was created by adding responsible crashes, traffic violation convictions and license suspensions within the previous three years. Risky driving was correlated moderately with the personality system (0.68), the behaviour system (0.51) and the perceived environment system (0.48).

A multiple regression analysis showed that the behaviour system variables accounted for 19% of the variance in driving risk, the personality system predicts 12% of the driving risk and the perceived environment system 9%. Of the personality system, thrill seeking appears to be a fundamental in the prediction of driver risk as well as problem behaviour in general. The overall model, where all systems were combined, was no better at predicting risk than was the behaviour system alone.

Within the three samples of drivers, the behaviour system had the highest correlation with the risk criterion across all groups, and was highest for the drink driving group. With respect to predicting driving risk across age groups (which were 16-24, 25-35 and 36 years and over) risk was much more predictable for the younger age groups. The overall model was only able to account for 7% of the variance relating to crash risk. The greater 'success' of the overall model for predicting risk in the younger age groups represented the explanation of 27% and 22% of the variance for the 16-24 and 25-35 year old groups respectively. The reduction in problem behaviour frequency probably accounts for the greater difficulty PBT has in predicting risk with age.

In conclusion, Wilson and Jonah agreed that risky driving is part of a problem behaviour syndrome and the components of PBT can account for considerable variance in risky driving (measured on the behavioural level). The limitation of this theory to only the younger age groups was established.

Beirness and Simpson (1988) examined how driving style may be linked to other more general lifestyle characteristics. They studied 1986 students aged between 12 and 19. 315 students reported that they had been involved in some type of motor vehicle crash in the previous 12 months, and 260 of these students were interviewed. Information on social, psychological and behavioural characteristics were derived from the Student Lifestyle Questionnaire. Four comparison groups were formed:

- DA: involved in a crash while driving a car;
- PA: involved in a crash while a passenger in a car driven by a young driver;
- OA: involved in a crash while a passenger in a car driven by an older driver, and;
- NA: no crash involvement

Results showed that smoking was twice as common for DA (31%) and PA (27%) than OA (15%) and NA (12%). DA scored higher on the Thrill and Adventure Seeking subscale of Zuckerman's (1979) Sensation Seeking Scale, whereas NA scored the lowest. The DA group was most tolerant and NA the least tolerant of deviance. DA drivers were less likely to wear a seatbelt as passengers (34%), with over 40% of every other group wearing seatbelts as passengers. 37% of DA and 41% of PA were more likely to use drugs other than alcohol (OA: 24%, NA; 14%), and displayed a more liberal attitude towards alcohol use. DA drivers were more likely to report that they felt run down or over-tired (81%, all other groups below 67%). Self confidence and peer influence did not differ between the groups.

Thus, young persons who had been involved in a crash as a driver or as a passenger while riding with a young driver exhibited a number of other high-risk or problem behaviours. Further, the similarity of the characteristics between driver and passenger crash groups suggests that general lifestyle factors may have a pervasive influence on an individual's behaviour and may not be necessarily restricted to the driving situation. The authors felt that the nature of the relationship between risk taking and risky driving, as predicted by PBT, was in this study "at best tenuous" (p.203).

Other studies have considered more specific risky behaviours and their relationship with PBT. An example of this is Jessor et al (1989) who researched whether driving under the influence of alcohol , as well as risky driving in general, are elements of a problem behaviour network. Data was all self-reported, and was derived from questionnaires that included well-established psychometric measures of the key variables in PBT. Their results showed that PBT, combining 15 measures of personality, the perceived environment and behaviour, accounted for 40% of the variance in drink driving for men, and for about 30% for the women.

Swisher (1988) presents an overview of the type and extent of adolescent drinking patterns and identified characteristics associated with risky driving and passenger practices. From the self-reported data of over 12,000 high school students, the results of a stepwise regression analysis showed that a range of negative behaviours were predictors of risky driving or the willingness to ride with a driver who had been drinking or taking drugs. Conversely, positive behaviours were indicative of a lower chance of being a passenger of an affected driver.

7.0 ANALYTICAL MODELS

One of the most comprehensive analytical studies in the prediction of crash involvement was carried out recently by Smiley et al (1991). Based on a representative subgroup from a sample of over 800,000 Ontario drivers, they used the amount of convictions and crashes on official records to predict which drivers are more likely to have a crash in the near future. This study differs from those reviewed above as it was not interested in social or personality characteristics, which are often difficult to measure accurately (McGuire; 1976), but a strict relationship between past and future crash involvement. It is a good illustration of the difficulty of predicting crash involvement despite rigorous methodological techniques. For this reason it warrants specific attention.

7.1 The Ontario Driver Records Study

As part of a preparatory analysis, the hundreds of offence types were grouped into a manageable number of categories by firstly grouping offences similar in nature, then consolidating those offences which were associated with a similar number of crashes.

In order to establish a relationship between information contained in a driver's record (gender, age, count of crashes, count of convictions) and his/her expected number of future crashes, information from the first 2 years of the record was used to estimate "regression weights" which best fitted the crash record in the second 2-year period. Various combinations of regression weights were put together to create 16 models of crash potential. Some models used age and gender information, and/or assigned different weights to each conviction category.

The "base" driver is a 17-20 year old male who is conviction and crash free in the first period, and is expected to have 0.176 crashes in the second period. From this number, regression weights are added or subtracted for the characteristics of the driver and his/her driving record eg. subtract .061 for being a female, add .027 for each speeding offence. The resultant number is the expected number of crashes in the second two-year period (the number is meant to be a long-term average, in that a result of .25 means 1 crash in the next 8 years)

The quality of the performance of the models was established by identifying "hits" - how many of the drivers estimated to have a high crash potential on the basis of their period-1 record were truly high crash potential drivers, and "false alarms" - the drivers selected out who actually had a true crash potential below the population average.

Smiley et al found that the models tended to be much better than the already established demerit points system in identifying crash involved drivers. However, the hit rate of the best model, one based on age, gender, convictions and crashes was only 3698 out of the worst 10000 drivers. This left, therefore, 67% of the worst drivers unaccounted for. Further, this model had a false alarm count of 674, meaning these drivers were incorrectly labelled as high crash potential drivers.

Among the conclusions drawn by the authors, was the fact that the models not utilising crash involvement performed worse than the models that did. Also, it made no difference to distinguish between at-fault and not at-fault crashes. Smiley et al recognise that the two year driving history utilised is insufficient to obtain an accurate estimate of future crash potential. Nevertheless, it can be seen that even with extensive analysis and the control of certain variables, it is extremely difficult to pick the drivers who will be involved in crashes with a high degree of accuracy.

8.0 LITERATURE REVIEW SUMMARY

One of the greatest difficulties in assessing the scope of work undertaken relating personal variables to crash involvement is dealing with the many methodologies involved. Added to this is the fact that many of the variables found to be related to crash involvement are interrelated with other variables found independently to also be related to crash involvement. Thus the true effect of a certain variable can often only be tentatively estimated.

On the basis of the literature reviewed, it is difficult to determine whether the 'Young Driver Problem' or 'Young Problem Driver' syndrome is the more credible or accurate. Part of the problem is that some of the more promising theories and ideas within each of these syndromes do not consider aspects from the other. For example, Problem Behaviour Theory provides a good account of problem driving as an aspect of overall problem behaviour, but does not consider skill as an added contributor to problem driving. As long as theories remain 'self-contained' in this manner, they will always struggle to account for a majority of the variance in crash involvement.

While finding a particular problem group within the young driver population, as defined by biographical and personality characteristics, would be a convenient outcome for the purposes of directing road safety campaigns, it seems to be a somewhat unrealistic proposal. The focus of the 'problem driver' research has been to define a subgroup over represented in the crash statistics, who can be recognised by a certain collection of personal variables. The problem thus far is that *so many* different variables, in many different combinations, have been found to be related to crash involvement at some time. It seems just as likely that this outcome is a reflection of different types of individuals having a 'crash involved' period at some time in their lives.

Given that many personal variables are difficult to measure to begin with, it may be more pertinent to develop better statistical models of crash or violation involvement over time periods, such as that of Smiley et al (1991). Such a focus would help determine whether it is even worthwhile trying to identify a 'problem driver' sub-group This is an important point to establish as it may be that the problem subgroup is such a small proportion of the population, that targetting and identification of the individuals involved would be costly and ineffective. Such studies would have to involve, where possible, a long period of data collection in order to gain a better indication of each driver's true crash or violation involvement. Demographic variables would certainly still be of great use in these types of studies. Moving the focus away from specific personal variables may help to remove the ease with which we can label certain drivers 'problem drivers' simply because they possess certain stereotyped characteristics, and thus blaming these few individuals for the over-representation of all young drivers in crashes.

9.0 CRASH RISK, CRASH FREQUENCY, CRASH COUNTERMEASURES AND COUNTERMEASURE PRIORITIES

The previous sections have provided an overview of literature concerned with the young problem driver issue, that is, the possible existence of a much higher than average crash risk young driver sub-group. This sub-group would also contribute highly disproportionately to the frequency of young driver crashes, making this young driver sub-group a high priority target for countermeasure development.

The following section presents selected mass crash data analyses which, although relatively straightforward, are designed to provide a (crash data) context for policy discussions on the young problem driver (which history has shown to be an inherently attractive issue).

This section straddles these two contributions (literature review and crash data analysis) and attempts to provide a simple conceptual framework comprising four factors, namely:

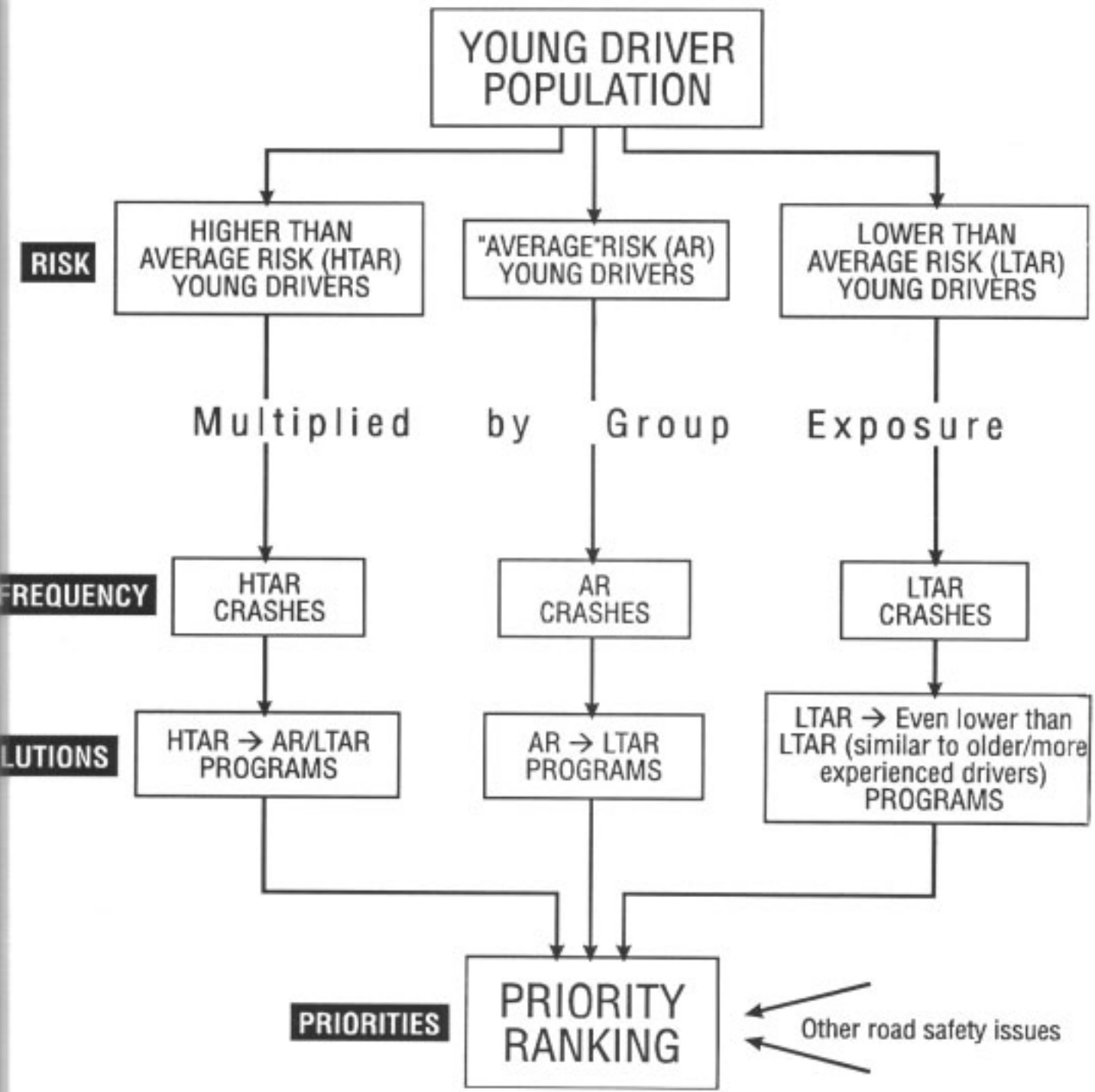
- crash risk
- crash frequency
- crash countermeasures
- countermeasure priorities.

The framework is set out overleaf.

As can be seen, action(s) in this area may be determined by either/both of the following considerations:

- the exposure (or size) of the various sub-groups, which translates into crash frequency as a function of the level of crash risk at which the sub-group operates.
- the potential ability of the road safety system to reduce the frequency of sub-group crashes, either by reducing their risk of crash involvement or by reducing their exposure to risk. Two issues should be kept in mind:
  - it is usually implicit in the countermeasure development process that a focus on higher risk groups or circumstances is more appropriate, more easily justified and generally more likely to be effective.
  - a valid (that is, both effective and efficient) identification procedure for sub-group membership is required.

These considerations will be addressed in the conclusions of this report.


YOUNG DRIVER POPULATION
RISK
HIGHER THAN AVERAGE RISK (HTAR) YOUNG DRIVERS
"AVERAGE"RISK (AR) YOUNG DRIVERS
LOWER THAN AVERAGE RISK (LTAR) YOUNG DRIVERS
Multiplied by Group Exposure
FREQUENCY
HTAR CRASHES
AR CRASHES
LTAR CRASHES
LUTIONS
HTAR → AR/LTAR PROGRAMS
AR → LTAR PROGRAMS
LTAR → Even lower than LTAR (similar to older/more experienced drivers) PROGRAMS
PRIORITIES
PRIORITY RANKING
Other road safety issues

10.0 CRASH DATA ANALYSIS

As noted above, this section deals with selected crash data analyses which attempt to place the young problem driver issue in an appropriate (to policy discussion) context. It should be remembered that it is not possible to directly relate the young problem driver issue to mass crash data and that, therefore, some assumptions are required in the structuring of the analysis. These assumptions are listed below.

10.1 Analysis Assumptions

In undertaking mass crash data analyses which may provide insight(s) into the young problem driver problem, the following analyses are predicated on the following assumptions:

- young problem drivers have a higher likelihood of being included in a mass crash database than other young drivers.
- from the above, young problem drivers are more likely to have multiple crash involvements (MCI) over time.
- the characteristics of MCI driver crashes, that is, young problem driver crashes, will reflect higher levels of risk or severity when compared to the characteristics of non-MCI young driver crashes.

10.2 The Data Set

The data set used for these analyses was prepared using information contained in both the Victorian Mass Crash Database and the Victorian Driver Licence Database.

Essentially, the file is a person-based file of 18-40 year old drivers involved in reported casualty crashes in Victoria during the period 1987-1993. In addition to a range of crash and driver variables (for example, time of day, number of occupants, driver age, driver sex etc.), the licence number was also extracted. The licence number was also used to obtain the date of issue of the (car) licence from licensing records.

The licence number match rate, by year of crash and age of driver, is set out overleaf for information.

TABLE 1

LICENCE NUMBER MATCH RATE BY AGE GROUP OF DRIVER AND YEAR OF CRASH

AGE GROUP	1987	1988	1989	1990	1991	1992	1993	TOTAL
18-25								
MATCHED	9546	10896	11363	9099	7202	7335	6908	62349
NOT MATCHED	23	103	56	20	19	2	10	233
% MATCHED	99.76	99.06	99.51	99.78	99.74	99.97	99.86	99.63
31-40								
MATCHED	5284	6193	6468	5308	4310	4357	4308	36228
NOT MATCHED	17	66	36	9	2	4	7	141
% MATCHED	99.68	98.95	99.45	99.83	99.95	99.91	99.84	99.61

10.3 Relative Size of the Multiple Crash Involvement Group

Two tables using 1991-1993 data are presented in this section which are designed to provide an indication of the relative size of the MCI group. It should be noted that no adjustments have been made for those drivers who were killed in the first crash.

Table 2 presents information on crash involvements for drivers who were licensed for the entire period (1991-1993) and cross-classified by their age at the beginning of the period.

TABLE 2

SINGLE (SCI) AND MULTIPLE (MCI) INVOLVEMENT DRIVERS (licensed prior to 1991) IN CASUALTY CRASHES BY AGE (at start of 1991), VICTORIA, 1991-1993

AGE	TOTAL DRIVERS	SCI DRIVERS	MCI DRIVERS	% MCI
18	2090	2027	63	3.01
19	2686	2613	73	2.72
20	2538	2482	56	2.21
21	2272	2207	65	2.86
18-21	**9586**	**9329**	**257**	**2.68**
22	2095	2047	48	2.29
23	1813	1772	41	2.26
24	1728	1685	43	2.49
25	1664	1631	33	1.98
22-25	**7300**	**7135**	**165**	**2.26**
31	1276	1245	31	2.43
32	1335	1309	26	1.95
33	1259	1239	20	1.59
34	1098	1080	18	1.64
35	1202	1180	22	1.83
36	1131	1116	15	1.33
37	1094	1075	19	1.74
31-37	**8395**	**8244**	**151**	**1.80**

The table shows that MCI drivers account for a small proportion of all drivers involved in crashes (generally less than 3%) and that there is an apparent tendency for this proportion to reduce as driver age increases.

The next table (Table 3) presents similar information but for a different group of drivers. In Table 3, drivers who were first licensed in 1991 and had crashes during the period 1991-1993 are analysed according to their SCI/MCI status and their age at the beginning of the period (thus, 17 year olds in the table would have turned 18 years of age during 1991 and been licensed in the same year). While cell sizes become small as driver age increases, there are very few MCI drivers in the older age groups.

TABLE 3

SINGLE (SCI) AND MULTIPLE (MCI) INVOLVEMENT DRIVERS (licensed during 1991) IN CASUALTY CRASHES BY AGE (at start of 1991), VICTORIA, 1991-1993

AGE	TOTAL DRIVERS	SCI DRIVERS	MCI DRIVERS	% MCI
17	1821	1767	54	2.97
18	649	624	25	3.85
19	214	207	7	3.27
20	115	114	1	0.87
21	77	76	1	1.30
17-21	**2876**	**2788**	**88**	**3.06**
22	57	55	2	3.51
23	51	50	1	1.96
24	41	40	1	2.44
25	43	42	1	2.33
22-25	**192**	**187**	**5**	**2.60**
31	38	38	0	0.00
32	29	29	0	0.00
33	22	21	1	4.55
34	22	21	1	4.55
35	23	23	0	0.00
36	17	17	0	0.00
37	9	9	0	0.00
31-37	**160**	**158**	**2**	**1.25**

Even if the MCI driver group contains only problem drivers, their contribution to the total number of drivers involved in casualty crashes is very modest. Given that the "problem" for a proportion of drivers in the MCI driver group could be higher than average exposure, and that this group would also contain non-culpable drivers, the size of a young problem driver group inferred from such analyses (and remembering the analysis assumptions) and therefore the

relevance of a young problem driver group to the countermeasure development process could be questioned.

10.4 Characteristics of SCI and MCI Driver Crashes

The final section looks at comparisons of crash characteristics by driver SCI/MCI status and age group in order to establish whether there are any substantial differences in the proportional representation of higher risk characteristics. The young driver group comprises drivers who received a driving licence in 1989 and presents crash frequencies for the period 1989-1993: thus, all drivers would have been "exposed" to the risk of a crash for a minimum of four years. The comparison group comprises drivers aged 31-40 years who were involved in one or more crashes in the period 1989-1993.

The sizes of the four groups are as follows:

	SCI	**MCI**	**TOTAL**
18-25	6101 (95.3%)	303 (4.7%)	6404
31-40	23296 (93.9%)	1513 (6.1%)	24809

Figure 1 presents the male/female proportions of SCI and MCI drivers for the two age groups.

It could be anticipated that there would be a proportionally greater male driver representation in the young MCI group. As Figure 1 shows, the male/female split is reasonably consistent across the four groups (although the young MCI group does have the highest male driver representation)

FIGURE 1

MALE/FEMALE PROPORTIONS IN YOUNG (18-25 YEARS) AND OLDER (31-40 YEARS) SCI AND MCI DRIVER GROUPS

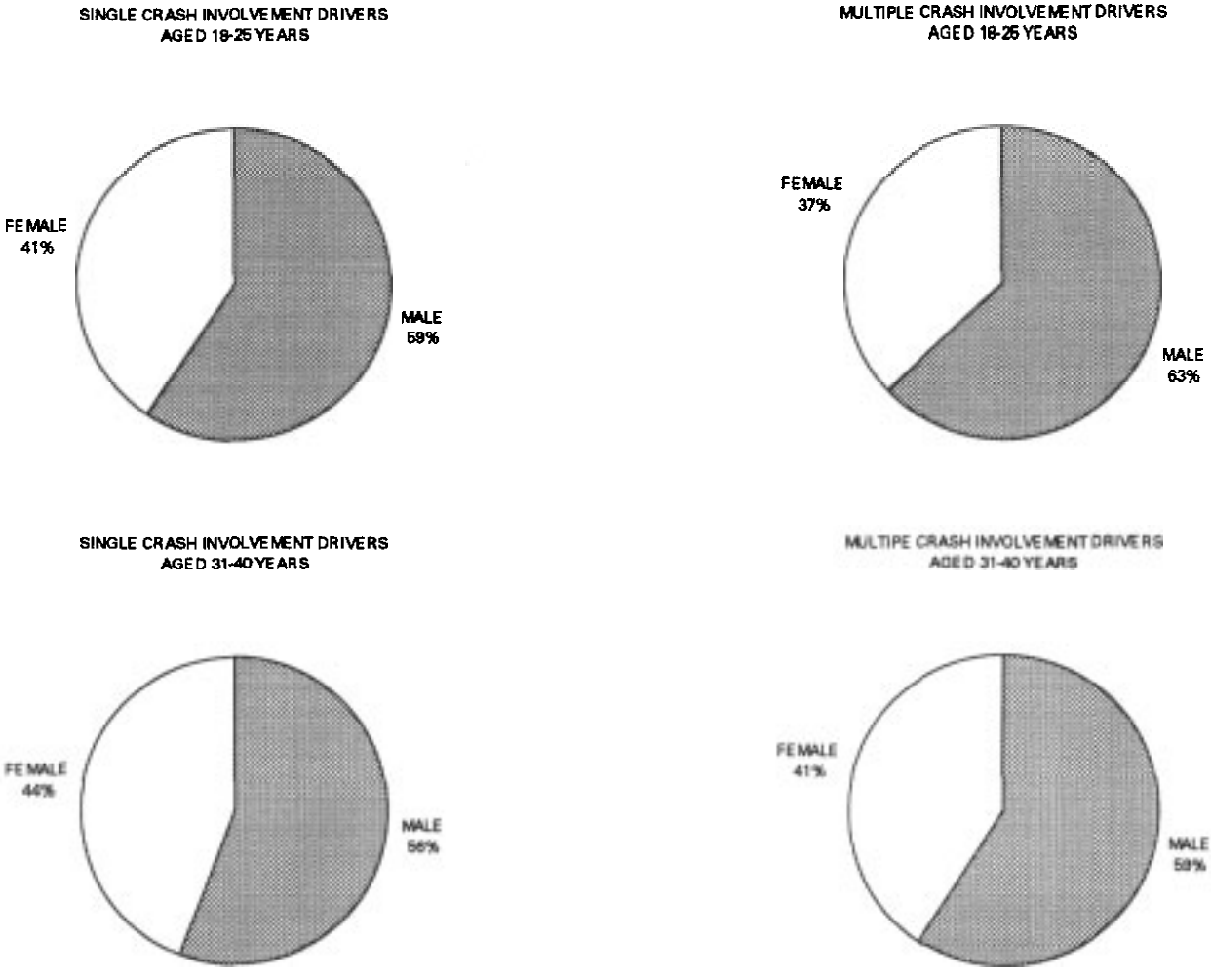


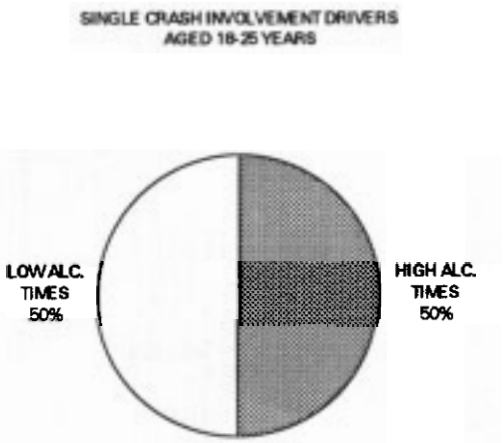
Figure 2 presents information on drivers involved in casualty by time of week. Time of week is presented as High Alcohol or Low Alcohol times of week. In high alcohol hours of the week, a driver admitted to hospital or killed as a result of a crash is 9.5 times more likely to have a Blood Alcohol Concentration (BAC) over 0.05g/100ml than a driver admitted to hospital or killed as a result of a crash in low alcohol hours (the complement of high alcohol hours).

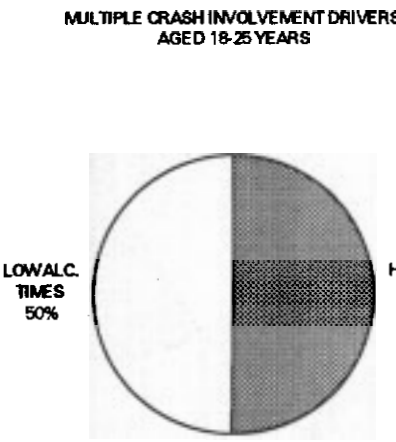
High alcohol hours of the week are defined as:

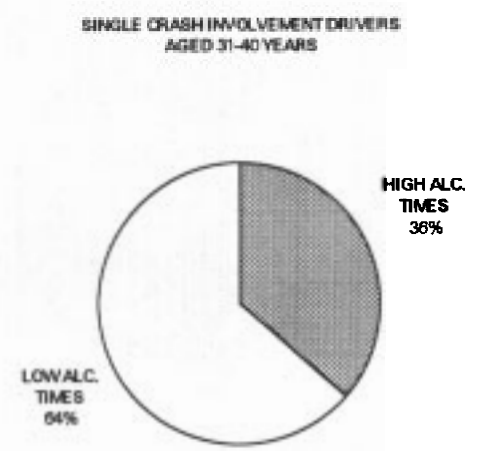
- Monday - Thursday 6pm to 6am
- Friday 4pm to Saturday 8am
- Saturday 2pm to Sunday 10am
- Sunday 4pm to Monday 6am

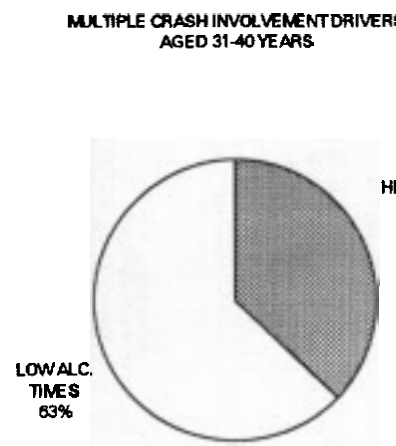
FIGURE 2

HIGH ALCOHOL/LOW ALCOHOL TIME PROPORTIONS IN YOUNG (18-25 YEARS) AND OLDER (31-40 YEARS) SCI AND MCI DRIVER GROUPS





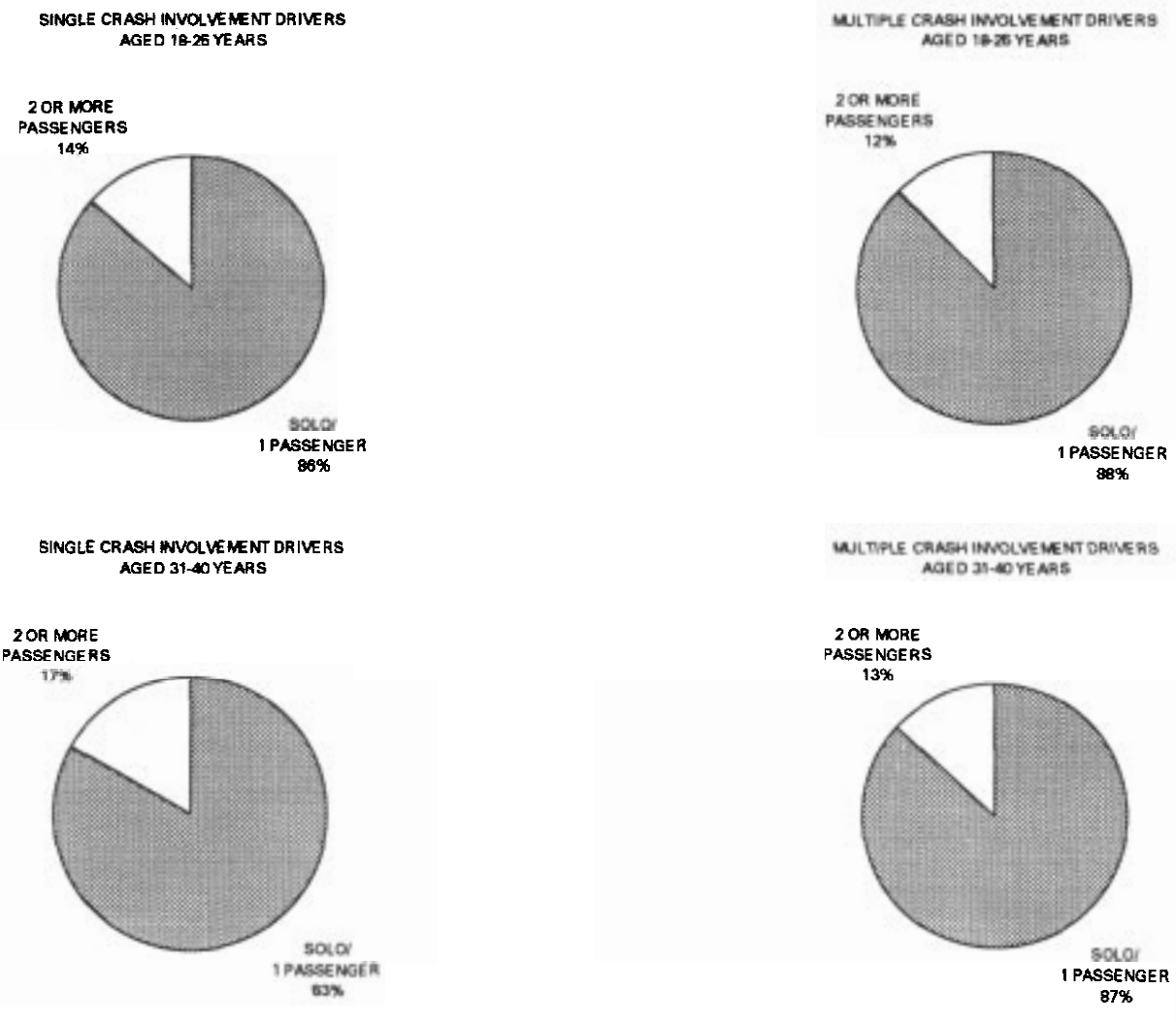




The graphs show that a substantially higher proportion of young driver involvements occur during high alcohol times of week when compared to older drivers (and therefore, perhaps, one indication of the young driver problem). However, there is no difference between the young SCI and MCI groups.

FIGURE 3

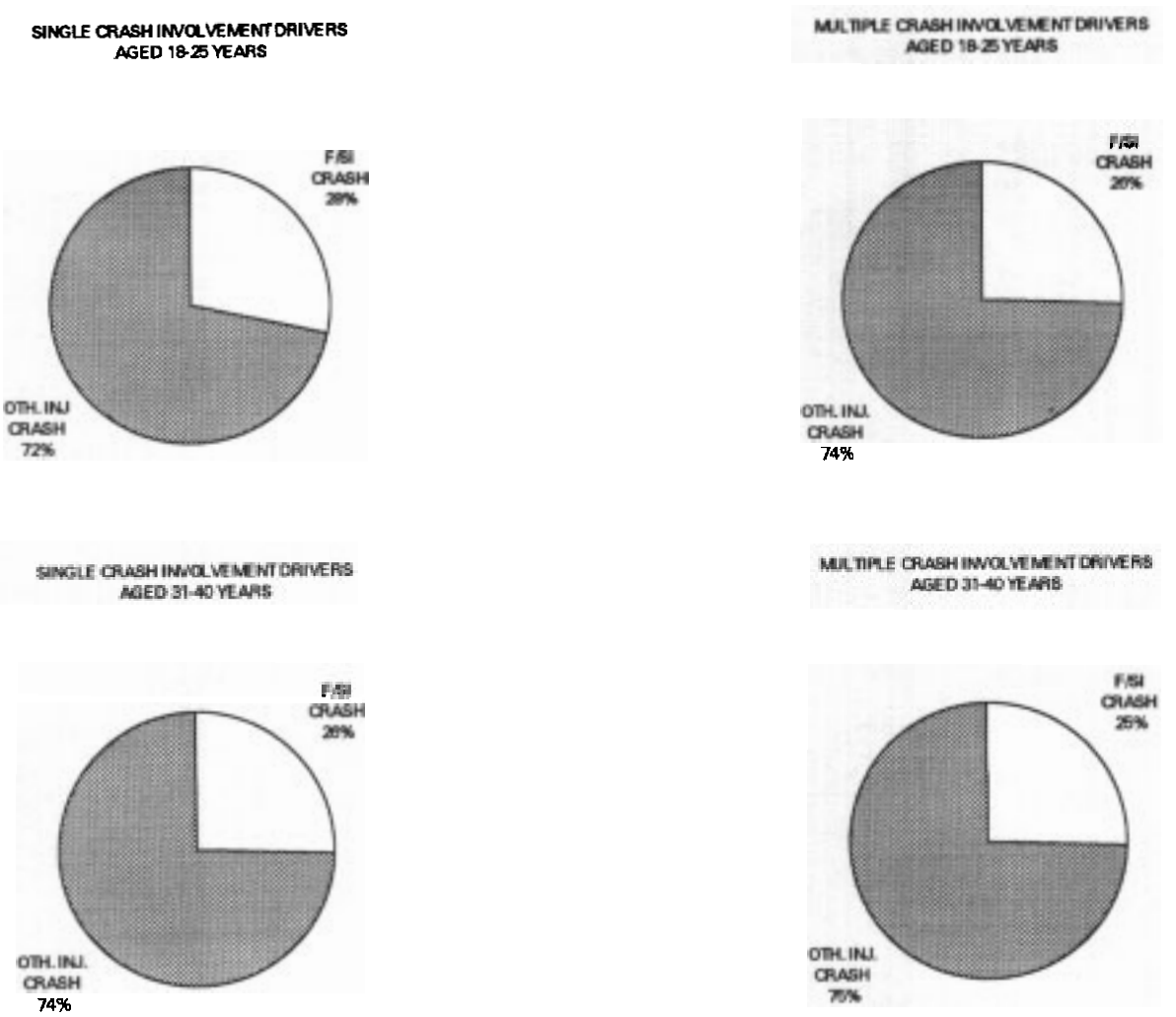
PASSENGER PROPORTIONS IN THE YOUNG (18-25 YEARS) AND OLDER (31-40 YEARS) SCI AND MCI DRIVER GROUPS



As it is known that young/inexperienced drivers carrying 2 or more passengers (at night) operate at elevated levels of crash risk, it could be expected that (young) MCI groups show a greater proportion of involvements while carrying multiple passengers. The above graphs, however, show very little difference across the four groups.

FIGURE 4

CRASH SEVERITY PROPORTIONS IN THE YOUNG (18-25 YEARS) AND OLDER (31-40 YEARS) SCI AND MCI DRIVER GROUPS

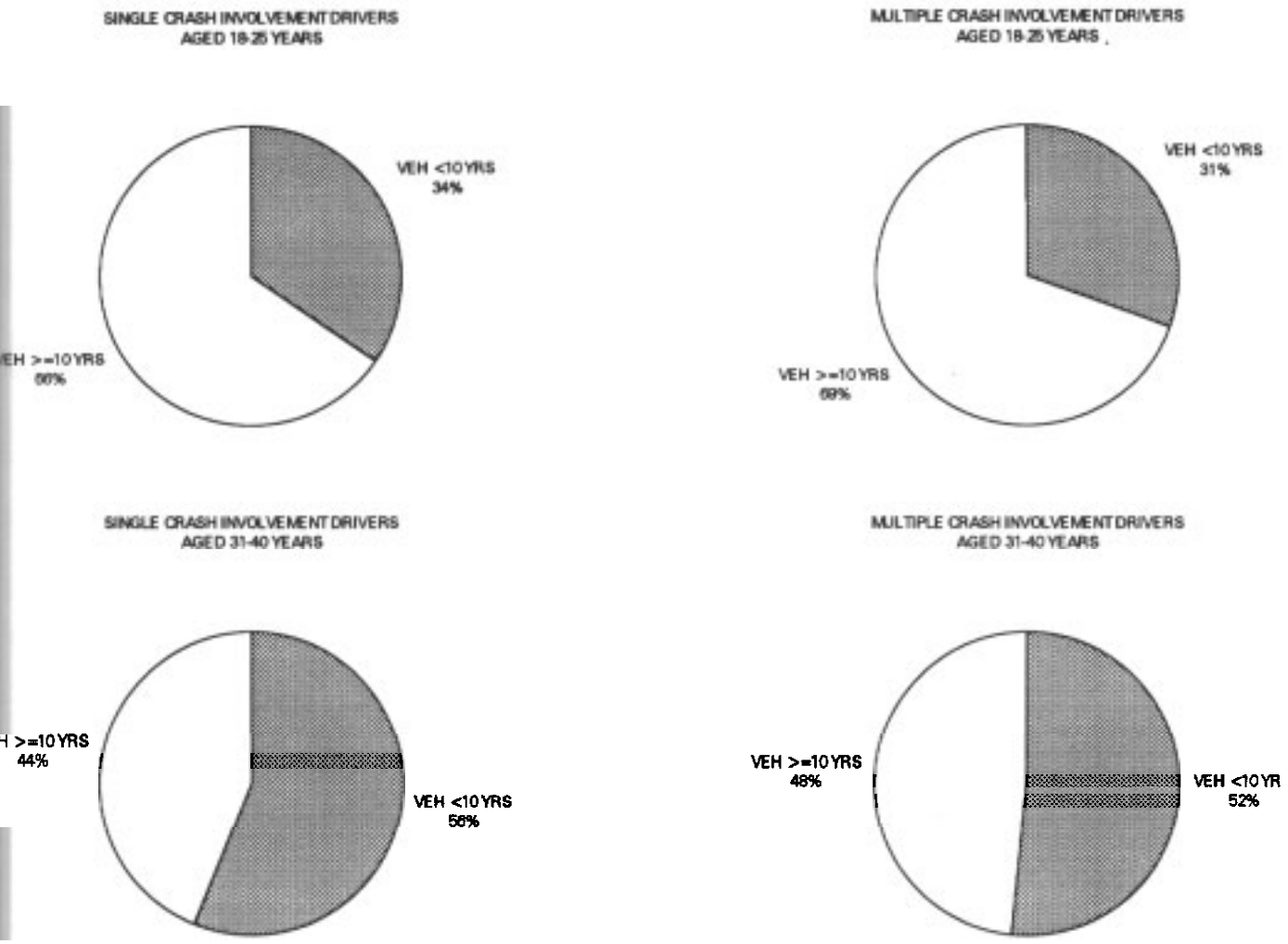


It could be suggested that MCI driver groups would be involved in more severe crashes. However, the above groups show a consistent 1 : 3 split.

The final set of graphs in this series presents vehicle age proportions.

FIGURE 5

VEHICLE AGE PROPORTIONS IN THE YOUNG (18-25 YEARS) AND OLDER (31-40 YEARS) SCI AND MCI DRIVER GROUPS



Similar to the High Alcohol/Low Alcohol split result, the above graphs indicate that young drivers are more likely to be involved in crashes while driving older cars but that there is no difference between the young SCI and MCI groups.

11.0 CONCLUSIONS

The concept of a young problem driver sub-group, that is, a sub-group of young drivers who operate at a (substantially) higher than average level of crash risk and therefore contribute disproportionately to young driver crashes is often proposed in the context of young driver crash countermeasure development. Historically, this has proven to be an attractive proposition and has attracted significant research effort, primarily in the investigation of demographic, lifestyle and motivational factors.

This report has presented both a literature review and selected mass crash data analyses and proposed a conceptual framework to assist the (policy) discussion process. This framework comprises crash risk, crash frequency, crash countermeasures and countermeasure priorities.

On the basis of information presented, it is concluded:

- on first principles, a young problem driver sub-group (as defined above) does exist. The crash risk heterogeneity of the young driver population is acknowledged and the very concept of an average young driver crash risk means that a proportion of this population will operate at levels above the average (just as a proportion will operate at lower than average levels of crash risk). It is reasonable to suggest that membership of these groups is relatively consistent over time.

- the existence of such a sub-group does not, in itself, justify specific countermeasure development attention.

- if multiple crash involvement are considered to represent the majority of young problem drivers, crash data analyses indicate that this sub-group contributes a very small proportion of total young driver crash involvements. Further, there was no indication of proportional overinvolvement of selected variables in the (young) MCI group. The analysis approach, however, was not (and could not be) definitive.

- if it is assumed or contended that the young problem driver sub-group warrants specific attention due to their frequency of crashing, two *further problems remain:*

    - there is no agreed definition of a young problem driver and even very good, current identification procedures using crash, violation and demographic information are very inefficient. While managing to successfully identify some problem drivers, they only do so with a large false alarm rate (that is, substantial numbers of non-problem drivers are falsely included as problem drivers).

- currently, there is very limited ability to actually treat identified "problem" drivers through driver improvement programs and the like which are designed to reduce their risk of crash involvement. Even if effective programs could be developed, they would be unlikely to be cost-beneficial due to a combination of small treatment effect sizes and the application of such programs to drivers who do not warrant inclusion in the treatment program (the "false alarm" drivers).

- on this basis, action designed to focus specific attention on young problem drivers should be accorded low priority relative to the development and implementation of other young driver safety initiatives.

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