

Road User Interactions: Patterns of Road Use and Perceptions of Driving Risk

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Abstract

The goal of the Road User Interactions research programme is a better understanding of the human factors of our road transport system: road user demographics, risk perceptions of road users, and the driving attitudes of various road user groups. Our analysis of the 1989 and 1999 New Zealand Household Travel Surveys identified several fundamental road user differences and consistent demographic trends over the past 10 years. The driver characteristics of gender, age, and area of residence (urban, secondary urban, and rural) are the demographic factors which most clearly differentiate New Zealand road user groups. Analysis of the patterns of road use suggests that, although these road user groups do drive at distinctly different times, there are periods of conflict which are also associated with the greatest crash risk for these drivers. Our analysis of a sample of road user groups in Hamilton, Auckland, Gisborne, New Plymouth, and Palmerston North found significant differences in their perceptions of risk and driving behaviours. Rural drivers and women drivers rated a range of driving situations as having greater risk than did the other road user groups, and they rated the high risk scenarios as being much riskier. Men indicated the greatest willingness to accept the risk in driving situations and rated their own driving skill as higher. Older drivers also rated driving situations as having higher risk, and young drivers generally rated low risk situations much lower than other drivers. In the survey of driving behaviour, young men in our sample reported very high levels of violations and aggressive violations. The male drivers' rates of violations and aggressive violations were significantly higher than the women drivers' and the number of both decreased significantly with age. Finally, inspection of crash data show that young drivers' and older drivers' crashes have some characteristics in common; both groups have a disproportionate number of crossing, turning, and manoeuvring crashes at intersections in the mid-afternoon.

Introduction

Fundamental to reducing the negative impact of the New Zealand road transport on our society is the need to better understand the human factors of the system. Even basic facts such as who the road users are in terms of their demographics (age, gender, experience, etc.) and the nature of their use of the road system (when, where, and how long they drive) are presently unavailable to planners, government decision-makers, and the road transport industry. Road users' perceptions of risk, attitudes towards road transport and road safety, and the interactions between road user groups is also important information that at this stage is unknown. To help identify these fundamental data, the goals of this research were threefold: 1) provide detailed information on road user demographics and patterns of road use, 2) identify the perceptions of risk and attitudes of various road user groups, and 3) characterise road user interactions and conflicts through analysis of the behaviours and attitudes of road user groups.

Patterns of Road Use

Our examination of New Zealand driver demographics and patterns of road use was undertaken through analysis of the 1989 and 1999 New Zealand Household Travel Surveys (NZHTS). These surveys were undertaken by the Land Transport Division of the Ministry of Transport and subsequently by the Land Transport Safety Authority of New Zealand (MOT,

1992a; LTSA, 2001a). We chose to use these surveys as a starting point in order to provide information about who is on the road, when, and the purpose(s) of their travel. The NZHTSs sampled all of the major urban areas in New Zealand and collected information on road user characteristics such as age, sex, ethnicity, occupation, type of vehicle(s), type of licence, accident history, and number of kilometres driven. Respondents were also asked to complete travel diaries for all of their travel on two designated days. The 1989 NZHTS contained data from 3102 households and the 1999 NZHTS contained 5367 households. The data from these two surveys were made available to us by the Land Transport Safety Authority of New Zealand for use in the present research. For purposes of comparison, we have also (where appropriate) included data from the Great Britain National Travel Survey (DETR, 2001) and the National Personal Travel Survey from the United States (DOT, 1999). Similar to the NZHTS, these surveys were based on travel diaries from a representative sample of households.

Amount of Driving

New Zealanders increased their total amount of driving by car 35% in the 10 years since 1990 (to 273,200,000 km per year)¹. The total number of trips taken by drivers also increased 22% during that period, while the average distance per trip increased 10% (to 8.8 km per trip). These changes are similar to trends observed in Great Britain from the mid-1980s to 1999 where the distance travelled by car increased by 41%, the number of trips increased by 30%, and the average trip distance increased by 11% (DETR, 2001). While the reported annual average per driver in New Zealand rose between 1989 and 1999 (from 13,786 to 14,794 km), the amount of increase was not uniform across all segments of road users. In 1989 men reported driving an annual average of 17,746 kilometres, whereas women reported an average of 9,409 kilometres (a difference of 8,337 km). This difference was not as large in 1999; men reported driving 18,655 kilometres whereas women reported 10,967 kilometres (a difference of 7,598). Thus, women's driving showed the greater relative increase between 1989 and 1999 (16.5%), whereas men increased their driving by only 4.6%.

The amount of driving by young women (aged 15 to 19 years), in particular, substantially increased, from an annual total of 2.5 million kilometres in 1989 to 4.4 million kilometres in 1999; an increase of 76%. In comparison, young male drivers (15 to 19 years) increased their driving 19%, from an annual total of 4.8 million kilometres in 1989 to 5.7 million kilometres in 1999. The number of driver trips showed the same trend; a 75% increase for young women (39.4 million annual trips in 1989 and 68.7 million trips in 1999) and an increase of 7% for young men (70.5 million annual trips in 1989 and 75.6 million trips in 1999).

The relationship between age and amount of driving is illustrated in Figure 1; the amount driven increases sharply from the teens to early twenties (no doubt coinciding with the beginning of employment) and then levels off until late middle age where it decreases sharply (again, probably corresponding to the end of paid employment). It is noteworthy that men report driving a greater number of kilometres than women at all ages; however, they also show a steeper decline in kilometres at the older ages. These age differences are statistically reliable regardless of the survey year: 1989, $F(13, 5086) = 19.46$, $p < .0001$; 1999, $F(13, 9340) = 41.17$, $p < .0001$. In both 1989 and 1999, the effect of age on distance driven was greater for men than for women (i.e., statistical interactions between gender and age group: 1989, $F(13, 5086) = 2.79$, $p < .001$; and 1999, $F(13, 9340) = 4.17$, $p < .0001$). Men showed the greatest decrease in driving after 55-59 years of age in the 1989 study, and after 60-64 in the 1999 study. Women showed their greatest decrease occurring after 65-69 years of age in 1989 and, like men, after 60-64 in 1999.

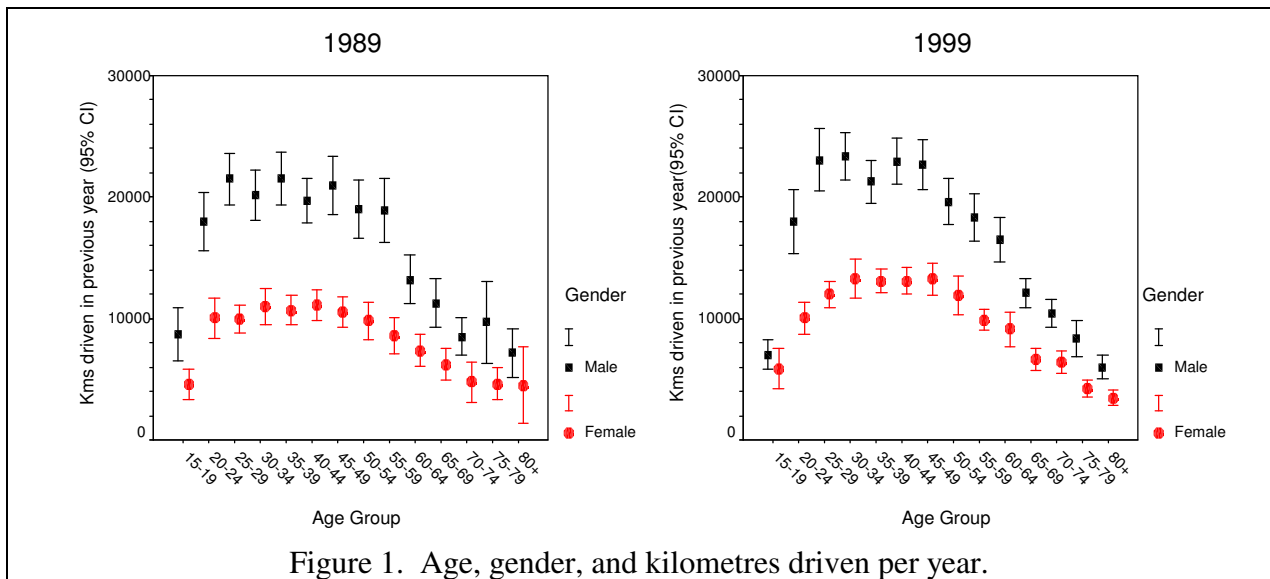


Figure 1. Age, gender, and kilometres driven per year.

The residential area or district also makes a significant difference in the number of kilometres driven. For example, comparison of the number of kilometres driven by area (main urban¹, secondary urban, and rural) in 1999 reveals that area has a significant effect on the number of kilometres driven ($F(2,9362) = 11.48, p < .0001$) such that those in rural areas drive more kilometres per year (an average of 16109 km) than those in main urban (14224 km) and secondary urban (13914 km) areas². Total kilometres driven by rural drivers were significantly greater than those of either main urban or secondary urban drivers. The total kilometres driven in main urban and secondary urban areas were not significantly different from one another. Interestingly, there are some geographical regions of the country where the amount of driving is significantly higher; the regions with the greatest number of kilometres per year were the Waikato, Auckland and Wellington regions (in that order). The regions in which individuals reported driving the fewest number of kilometres were the Gisborne, Nelson and Southland regions (again, in order). It is also interesting to note that women in the Waikato drove more than women in any other region, including Auckland and Wellington, and the difference between Otago women and men was much greater than for other regions.

Other demographic factors considered included the income, occupation, and ethnicity of drivers. While both women and men reported driving an increasing number of kilometres with higher income, men's driving increased at a greater rate with higher income (i.e., statistical interactions between gender and income: 1989, $F(9,4857) = 3.12, p < .001$; 1999, $F(10,8756) = 4.218, p < .0001$). Whereas men's distance travelled per year varied by occupation, women reported travelling the same distance, regardless of occupation (i.e., statistical interactions between gender and occupation: 1989, $F(6, 3303) = 3.197, p < .004$ and 1999, $F(8,5689) = 2.588, p < .008$). The occupations that reported driving the greatest amount were sales and administration/managerial. Importantly, men drive more than women even when they are in the same occupation or income level (i.e., controlling for income and occupation in an analysis of covariance: 1989, $F(1,3303) = 91.244, p < .0001$; 1999, $F(1,5699) = 88.012, p < .0001$). In other words, men drive more than women because they are men, not because of their occupation or income. Finally, our analyses showed no significant effect of ethnicity on kilometres or any significant interactions of ethnicity with gender, income, experience.

¹ Main urban areas include cities with over 60,000 residents (i.e., greater Auckland, Christchurch, Wellington, Hamilton, Dunedin, and New Plymouth), secondary urban areas included cities with a population of 10,000 or greater, with the remainder classified as rural (based on 1996 census data).

² This analysis was limited to the 1999 NZHTS as these data were not available in the 1989 data set.

Another perspective on the demographics of the New Zealand population is provided by looking at the number of daily trips made by car drivers. Here, the gender difference in drivers is not as profound, with female drivers making nearly as many trips per day as men. Young female drivers, however, take more trips per day than young male drivers, whereas the older male drivers take many more trips than their female counterparts. Drivers in rural areas make the fewest trips per day and drivers in the main urban areas making the greatest number of daily trips. Not surprisingly, male and female drivers living in rural areas drive much further than drivers in main urban and secondary urban areas. Male drivers' trips are longer than those of female drivers in all areas, with the exception of rural drivers where the trips taken by young female drivers are slightly longer on average than those of young males. Figure 2 shows rankings of some of the noteworthy road user groups according to their annual driving distances and their average number of daily trips.

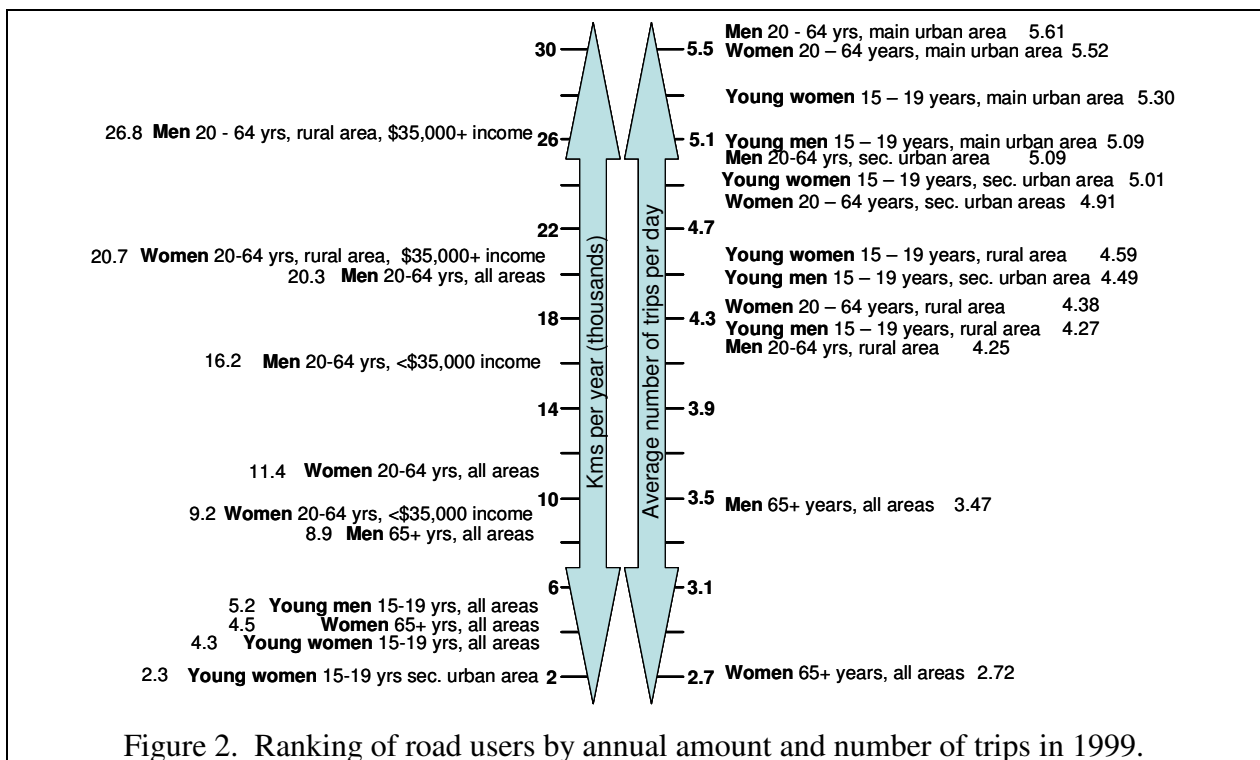


Figure 2. Ranking of road users by annual amount and number of trips in 1999.

Driving Times and Destinations.

Figure 3 shows the distribution of New Zealand drivers' trips by time of day and day of week. As can be seen in the figure, weekday trips (Monday through Friday) show some clearly differentiated peak travel times, particularly during the hours of 7.00 - 8.00, 15.00 - 18.00, and to a much lesser extent 10.00 - 12.00. In contrast, travel on weekend days show the peak travel time to be during the hours of 9.00 - 13.00. For purposes of comparison, the right panel of Figure 3 shows the distribution of trips by drivers in Great Britain in 1997/99 by time of day and day of week, a nearly identical distribution.

Comparing the timing of men's and women's trips throughout the day, men's weekday trips begin and peak earlier in the morning and later in the afternoon than women's trips. In contrast, women's peak travel times on week days are more clearly differentiated than men's trips, and occur later in the morning and earlier in the afternoon. Weekend trips for men and women drivers are essentially equivalent, with men reporting a higher proportion of early morning trips. Older drivers' trips are more concentrated, 84.5% of their trips occur between

the hours of 9.00 and 16.00, later and earlier than the peak times for other drivers. On the weekend, older drivers' trips begin earlier in the day than the general population, but otherwise conform to the pattern found on weekdays. In contrast, young drivers' trips are distributed throughout the day but tend to occur later in the day, particularly on weekends. The times at which there is the greatest overlap in road use by young, middle-aged, and older drivers are weekday afternoons between the hours of 14.00 and 16.00 and weekend mornings between 9.00 and 11.00.

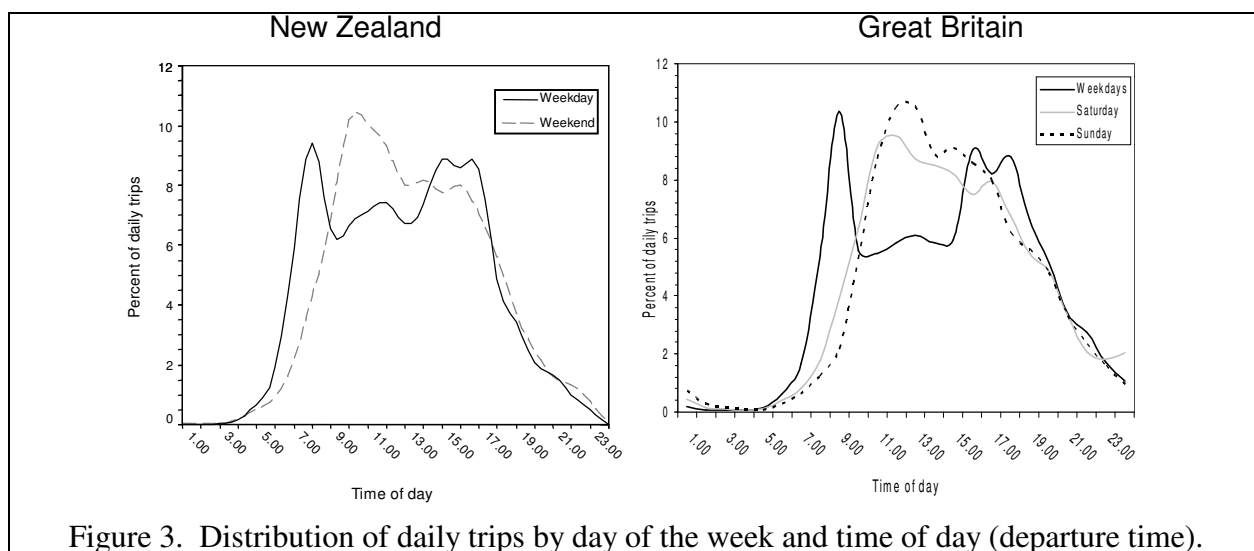


Figure 3. Distribution of daily trips by day of the week and time of day (departure time).

Another aspect of travel patterns across various road user groups can be explored by comparing the purpose of the daily trips. Although men and women drivers take approximately the same number of trips each day, the reasons for those trips are somewhat different. As can be seen in Figure 4, women drivers make a higher proportion of shopping trips and twice as many trips to transport passengers whereas a higher proportion of men's trips are related to their work. Men and women drivers have approximately the same proportion of social/recreational trips and trips returning to their homes. Interestingly, in terms of trip purpose, driver age has a greater effect than gender. Young drivers (15-19 years) and older drivers (65+) both take a much higher proportion of social/recreational trips, particularly during weekdays. Similarly, older drivers make a substantially higher percentage of shopping trips than any other drivers and the lowest proportion of work trips, with this difference again being most prominent on weekdays. Not surprisingly, young drivers show the highest proportion of education-related trips (on weekdays) and the fewest trips for shopping.

Summarising the above findings, gender has the greatest influence on amount of driving. Men report driving almost twice as far as women, although this gender difference is not as apparent when considering the number of daily trips. Young women drivers make many more trips than young male drivers (and even more trips than their parents in rural areas). Driver age was the second most important predictor of road use; individuals between 25 and 55 drove more than either young (15-19) or older (60 and above) individuals. Rural drivers drive further, presumably because they have more distance to cover, but drivers in urban areas drive more frequently. Finally, a higher income also makes it likely that one will drive more than someone who earns less.

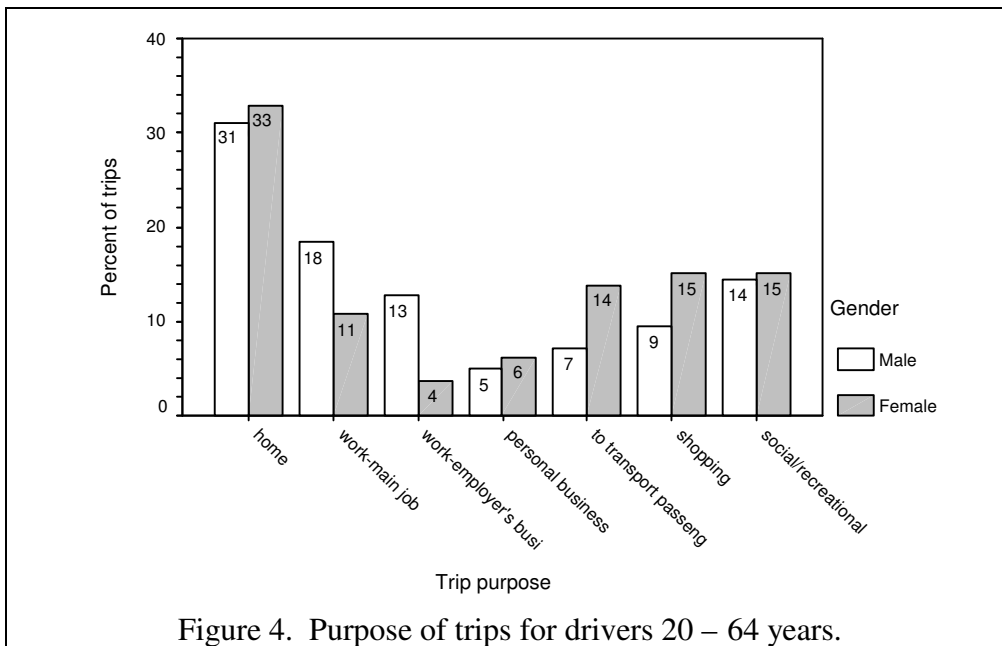


Figure 4. Purpose of trips for drivers 20 – 64 years.

These findings are similar to overseas patterns. Men in the United States and Great Britain drive cars approximately 40% further than women, but take the same number of daily trips (DETR, 2001; DOT, 1999). In the United States in 1969, women drove fewer than 50% as many miles as men, but by 1990 in the United States and New Zealand women drove 58% and 53% as far as men respectively. In 1995, women in the United States were driving 63% as far as men (17,700 km as compared to 28,200 km per year) and by 1998 women in New Zealand were driving 59% as far as men (11,000 annual km as compared to 18,700 km). Residents of rural areas of the Great Britain drive further than residents of urban areas, and Great Britain and United States households with high incomes report the highest use of cars. New Zealand drivers' trips are somewhat shorter than trips in the United States and Great Britain; the average distance per trip here is 8.8 km, as compared to 14.5 km in the United States and 13.7 km in Great Britain. Our number of trips, however, is nearly equivalent; New Zealand drivers made an average of 4.38 daily trips (4.63 trips per weekday, 3.76 per weekend day) in 1998, as compared to 4.30 trips per day by United States drivers in 1995.

Perceptions of Risk

Given that the driving population of New Zealand can be differentiated into groups on the basis of their gender, age and area of residence, it is reasonable to ask how these groups differ in terms of their perceptions, attitudes and driving behaviour. Overseas research (Trankle, Gelau, & Metker, 1990; Groeger & Chapman, 1996; Lerner & Rabinovich, 1997) has shown that young male drivers tend to underestimate the risk inherent in various driving situations and overestimate their own driving skill and degree of control, while older female drivers overestimate driving risk and underestimate their degree of control. Further, the risk acceptance of some road users (e.g., young males) appears to be significantly related to risk taking behaviours, such as speed choice, and thus to an increased probability of crash involvement (Matthews & Moran, 1986; Harré, Field, & Kirkwood, 1996; Horswill & McKenna, 1999).

The risk perceptions and attitudes of New Zealand road users were assessed by asking participants to rate the relative risk in a series of photographs of common driving situations, their willingness to accept that risk, their own driving skill, and the skill of the other drivers in the situation. Driving behaviours were assessed by the Manchester Driver Behaviour

Questionnaire (DBQ). The DBQ categorises driver behaviour in terms of errors, lapses, and violations and has been found to be a good predictor of crash involvement (Reason, et. al., 1990; Parker, Reason, Manstead & Stradling 1995; Stradling & Meadows, 2000). The DBQ was developed to explore the role of human error in causing crashes. Norman (1981), Rasmussen (1982), Reason (1990) and others have argued that human error is comprised of three distinct categories: lapses or slips (inadvertent or inappropriate occurrences of highly practiced behaviours), errors or mistakes (errors of omission or commission resulting from a lack of knowledge or information) and violations (intentional actions in violation of rules or established practice). The DBQ asks questions about a driver's propensity to commit lapses, errors, and violations. Comparison of drivers' DBQ answers to their crash histories has shown that the violations score on the DBQ, particularly items classified as aggressive violations, is a good predictor of accident involvement (Parker et al, 1995, Rothengatter, 1997).

Method

Three hundred twenty seven participants were recruited to participate in the experiment through schools, sports clubs, Senior Citizens Associations and church groups in Auckland, Hamilton, Tauranga, Gisborne, New Plymouth, and Palmerston North. The participants ranged in age from 15 to 78 (mean age 41.63, std. dev. of 15.35) and all possessed an unrestricted driver licence. The sample consisted of 158 men and 154 women (15 participants did not indicate their gender on the questionnaire). Thirty-five percent of the participants resided in a main urban area at the time of the survey, 41% resided in a secondary urban area, and 24% resided in a rural area³. The groups that organised sessions were given a donation in recognition for their participation.

The primary experimental materials consisted of photographs of driving situations adapted from driving situations described in the Ministry of Transport's Advanced Assessment and Training Manual (1992), Lerner and Rabinovich's (1996) training program for improving young drivers' risk perception, and the NRMA (1999) young driver education programme. The scenarios were comprised of 8 different urban, rural, and motorway driving situations and each driving situation photograph was digitally edited to contain one of several vehicle types (e.g., motorcycle, compact car (coupe), sedan, van or ute, or large rigid truck). The resulting set of 34 photographs were independently reviewed by two professional driving instructors and subsequently modified according to their comments.

The participants were surveyed in groups ranging from 5 to 15. The participants were asked to complete several demographic questions (e.g., age, gender, occupation, income, typical purposes and times of day of car trips) in a questionnaire booklet. Following completion of the demographic questions, the participants were shown an example driving scene and allowed to practice answering the four questions: 1) the degree of driving risk in the situation, 2) their willingness to accept the risk in that situation, 3) their degree of control over their own vehicle in that situation, and 4) the driving skills of the other driver(s) depicted in the situations. Each question was rated on a 100-point scale by the participants. The driving scenes were projected on a screen in front of the group of participants and were presented at a rate of approximately 30 sec per scene with 5 sec interval between scenes. The participants rated the driving scenes individually in their questionnaire booklets and if desired by the group, a short rest break was allowed at the half-way point. Following the rating of the driving scenes,

³ Main urban areas included cities with over 60,000 residents (i.e., Auckland, Hamilton, and New Plymouth), secondary urban areas included cities with a population of 10,000 or greater, (i.e., Tauranga, Gisborne, and Palmerston North), with participants living outside those cities identifying themselves as rural.

the participants were asked to complete the 28 DBQ items. Experimental sessions took between 45 min and 1 hr to complete.

Results

The demographic data collected from the sample was consistent with the data from the NZHTS; rural males aged 20-64 reported driving the most with young and older drivers in secondary urban areas driving the least. As with the NZHTS, there was a significant positive correlation between reported income and the amount of driving, with higher earners driving more; $r = .183, p < .01$. The distribution of driving throughout the day also matched the NZHTS, with clearly defined peaks between the hours of 6.00 to 10.00 and 14.00 to 18.00, young drivers reporting a greater proportion of their driving later in the day, and older drivers allocating their driving to off-peak hours (later in the morning and in the early evening).

Figure 5 shows the participants' ratings of driving risk for the 8 driving situations and 5 vehicle types. As can be seen, the participants regarded some of the situations as more hazardous than others. A repeated-measures analysis of variance indicated that the differences between scenario types were statistically reliable, $F(7, 318) = 71.18, p < .01$, and that the differences between vehicle types were statistically reliable, $F(4, 320) = 55.13, p < .01$. The *urban overtaking* situation, passing a row of parked cars (one of which had begun reversing), was rated as having the highest risk. The *rural pass* in which there was oncoming traffic with a potential passing manoeuvre involved was also rated as having a high degree of risk. In contrast, the risk ratings for the *urban turn* and *urban T* situations were significantly lower than other situations. Regardless of participant age, gender, or area of residence, driving situations containing trucks and motorcycles were viewed as riskier, and the drivers of those vehicles were seen as having the potential to cause a serious problem; $F(4, 320) = 7.456, p < .01$. Scenes with the two-door cars were rated as least likely to lead to a serious problem.

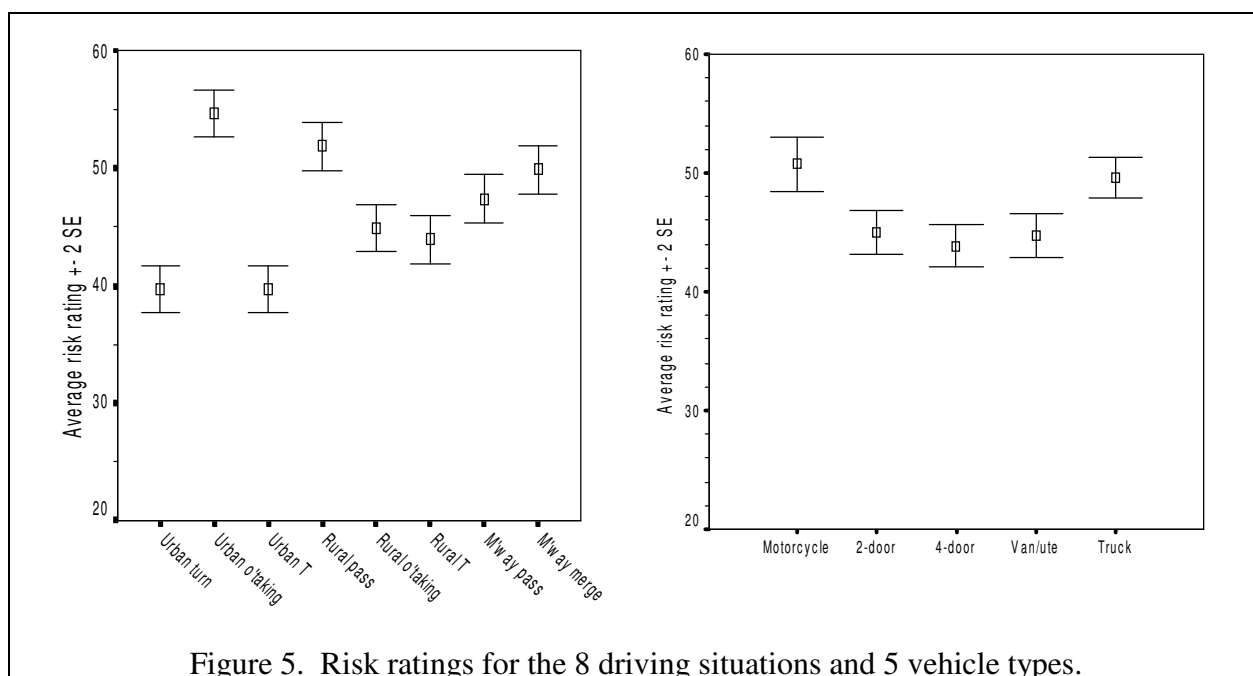


Figure 5. Risk ratings for the 8 driving situations and 5 vehicle types.

Overall, participants rated urban situations as least risky, followed by rural situations, with motorway situations receiving the highest risk ratings ($F(2, 646) = 26.24, p < .01$), but no differences between the ratings of participants from different residential areas. Women participants generally rated the situations riskier than men, but rated motorcycle scenes as much riskier (i.e., a significant interaction between gender and type of vehicle: $F(4,301) = 2.39, p <$

.05). Older drivers rated high risk scenes (e.g., *urban overtaking truck*) as having higher risk than did other drivers ($F(2, 304) = 105.11, p < .01$). Male participants were more willing to accept risk than women regardless of their age ($F(1, 304) = 4.72, p < .05$), and rated their skill as being better able to cope with the situation ($F(1, 302) = 7.52, p < .05$).

The violations and aggressive violations scores from the DBQ are shown in Figure 6. Young males were much more likely to violate traffic rules and display aggressive acts towards other drivers. There was a decrease in these scores with driver age, although young women did not display the high levels of violations reported by young men. Statistical analysis indicated significant age and gender differences for violations ($F(2, 304) = 17.11, p < .01$ and $F(1, 304) = 19.47, p < .01$, respectively), and aggressive violations ($F(2, 304) = 16.31, p < .01$ and $F(1, 304) = 10.18, p < .01$). There were also significant positive correlations between these scores and the amount of weekly driving reported; $r = .173$ and $r = .144, p < .01$ for violations and aggressive violations respectively. Rural residents also reported high rates of violations, although this difference was only marginally significant; $F(2, 321) = 2.62, p < .07$. Women reported more lapses, more frequently trying to start in the wrong gear, getting into the wrong lane approaching a roundabout, etc.; $F(1, 308) = 6.16, p < .01$. Finally, young drivers reported more errors than older drivers ($F(2, 322) = 2.59, p < .07$).

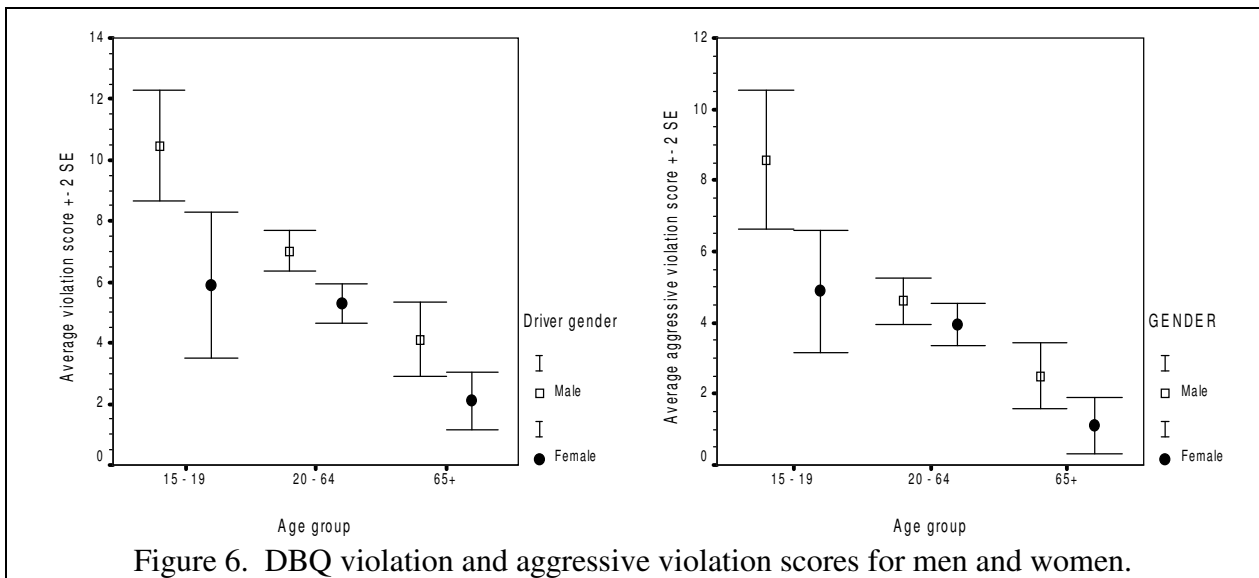


Figure 6. DBQ violation and aggressive violation scores for men and women.

This pattern of findings corresponds well to overseas results. As with our New Zealand sample, older drivers and women drivers in the United Kingdom and the United States rate dangerous driving situations as being higher in risk whereas young drivers and men drivers are more willing to accept the risk in these situations and rate their own driving abilities higher (Groeger & Chapman, 1996; Lerner & Rabinovich, 1997). Similarly, young drivers in the United Kingdom have higher rates of violations and aggressive violations as measured with the DBQ. New Zealand drivers, however, (particularly our young males) appear to have much greater propensity for some types of aggressive violations such as racing other drivers at stop lights. This finding is perhaps indicative of the high level of acceptance of speeding by New Zealand drivers'. In the Public Attitudes To Road Safety Survey 2000, 46% of male drivers and 34% of females said that they enjoyed driving fast on the open road (LTSA, 2001b). This attitude is strongest among our young male drivers; in the 2001 version of the Survey 65% of male drivers aged between 15 and 24 said they liked driving fast, including 22% who said they liked it 'very much' (LTSA, 2002). Young drivers were also the most likely to report having

received a speeding ticket from a speed camera in the preceding year; 26% as compared to 17% of all drivers).

Conflicts & crashes

Another analysis of interest is the potential for conflicts between road user groups resulting from their differing patterns of road use, attitudes, perceptions, and driving behaviours. Recalling the driving time data described earlier, the times at which there is the greatest overlap in road use by young, middle-aged, and older drivers are weekday afternoons between the hours of 14.00 and 16.00 and weekend mornings between 9.00 and 11.00. Figure 7 shows the distribution of multiple-vehicle injury crashes throughout the day for drivers of different ages groups⁴, and as can be seen, there are indeed elevated crash rates, particularly for older drivers, at those times. Interestingly, these crash peaks are offset from peak travel times in the direction predicted by the potential for conflicts between different road user groups (older drivers' crashes happen later than their peak travel time, and younger drivers' crashes occur earlier than their peak travel times). Analysis of the locations and vehicle movement codes for these crashes suggest that when conflicts exist, they are primarily between older drivers and young drivers. Older drivers had a disproportionately high number of crossing, turning, and manoeuvring crashes on 50 kph roads during these times of day; the young drivers had high rates of collisions with turning vehicles as well as crossing and manoeuvring crashes in 50 kph zones. In contrast, the crashes drivers between the ages of 20 and 64 at these times involved higher speed roads and were predominantly overtaking, head on, and rear end crashes.

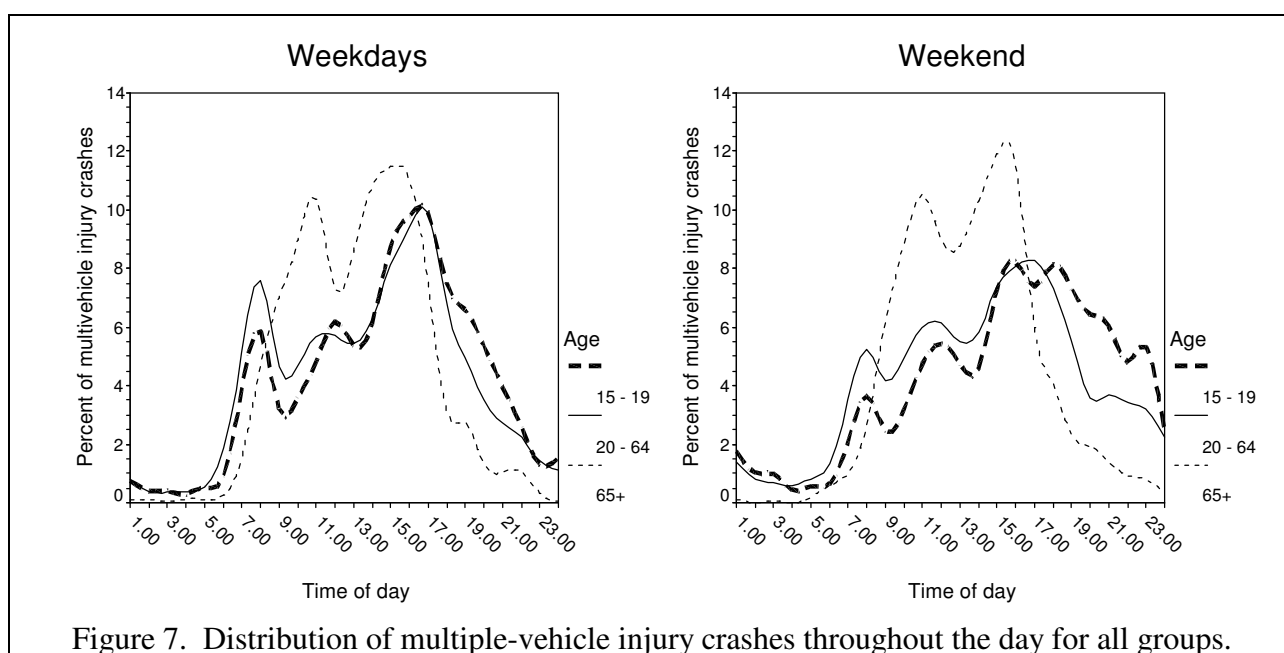


Figure 7. Distribution of multiple-vehicle injury crashes throughout the day for all groups.

What is it that these groups have in common, and what makes them different? On rural roads, elderly drivers display a very smooth and uniform driving style with fewer accelerations and braking actions than young and middle aged drivers (Schlag, 1993). When driving on inner city roads, however, the elderly are much more likely than other drivers to ignore red lights at controlled intersections (although less likely to drive through on amber lights), fail to follow give way rules at intersections, and failed to reduce speed at road-level railway crossings (Schlag, 1993). In contrast, young drivers in these situations display generally higher speeds, more overtaking manoeuvres, acceptance of smaller gaps between vehicles when turning at

⁴ The crash data are from the LTSA National Crash data base for the years 1992 to 1997.

intersections, and a more dynamic driving style (rapid acceleration and deceleration, sharp braking, etc.). Although older drivers bring a wealth of advantages to the driving task in terms of experience and knowledge, they generally have greater difficulty perceiving, interpreting, and judging the movements and intentions of other drivers (Schmidt, 1987). When the behaviour of those other drivers is prone to rapid changes and higher velocities, as it is with young drivers, conflicts and crashes are perhaps a predictable result.

Discussion

Based on our results, several clear generalisations can be made about New Zealand road users. First, there is a profound gender difference in the driving behaviour and perceptions of men and women drivers. Men drive more than women and they are on the road earlier in the morning and later at night. Men rate high-risk scenarios as being less risky, they show a greater willingness to accept the risk, and they rate their own driving skill higher. They have significantly higher violation and aggressive violation scores and a higher crash risk (injury and fatality) than women.

There are also differences in driver behaviour and perceptions of residents of rural and urban areas. Rural drivers drive further, but make fewer trips than residents of urban and secondary urban areas. Rural residents rate high and low risk situations as slightly more risky than urban and secondary urban drivers and interestingly, rural drivers report a higher number of violations. Statistically, rural roads are associated with a higher rate of injury crashes but a lower rate of fatality crashes.

There are significant differences in driver behaviour and perceptions due to age. Young and older drivers drive less than middle-aged drivers. Young drivers drive later in the day, while older drivers tend to avoid peak hours by driving in the middle of the day. Older drivers tend to rate driving situations as being riskier. Young drivers have much higher violation and aggressive violation scores and a higher rate of driving errors. There are, however, notable similarities between young and older drivers in terms of their crashes. Compared to middle aged drivers, older drivers have more crossing, turning, & manoeuvring crashes during the mid-afternoon hours. Young drivers also have high rates of crashes involving crossing and manoeuvring at these times of day, as well as the highest rates of loss of control and cornering crashes later in the day.

Given the differences in the perceptions and attitudes of young and older drivers, why do they share a propensity for mid-afternoon crashes at intersections? Perhaps by virtue of their greater experience on the road, older drivers have a heightened perception of risk as compared to young drivers. This is accompanied, however, by older drivers' greater difficulty perceiving, interpreting, and judging the movements and intentions of other drivers (in part due to some degradation in perceptual abilities with age). When driving on urban roads the elderly are much more likely than other drivers to ignore red lights at controlled intersections and often fail to follow give way rules at intersections. In contrast, young drivers perceive urban driving as less hazardous than older drivers and typically drive at higher speeds, make more overtaking manoeuvres, accept smaller gaps between vehicles when turning at intersections, and display a generally more dynamic driving style (rapid acceleration and deceleration, sharp braking, etc.). When these two different perceptual and behavioural styles share the same road (during the mid-afternoon), it is not at all surprising that older and young drivers have the majority of mid-afternoon crashes at intersections.

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