Crash Rates by Age and Sex of Traveller

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by

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Abstract

Many studies of road safety concentrate on the numbers of crashes in the system as a measure of level of risk on the roads. This is often recognised as not being a true picture of risk, and most researchers note that a better measure of risk should account for the total "exposure" of the system, or segment of the system, to crashes. Often the size of the population group under consideration will be considered, but rarely will a true measure of exposure to risk, in terms of the usage of the road system by the population group, be used. This is often because of the difficulty in obtaining good measures of road user exposure. This paper provides an analysis of road user exposure and road crash rates in Melbourne, using crash data from VicRoads and exposure data from a survey of travel behaviour which provides detailed data about exposure levels by different demographic groups under different conditions. The paper examines the crash rates of drivers from different demographic groups (classified by age and sex) and shows that different perspectives on relative risk can be obtained, depending on the type of crash rate being examined and the measure of exposure being used.

Introduction

A major demographic change occurring in most western countries, including Australia, is the “greying” of the population. According to Australian Bureau of Statistics population estimates and projections, for example, the Victorian population is expected to grow from 3.60 million in 1971, to 4.77 million in 2001, to 5.46 million in 2021 and on to 5.87 million in 2051. Of even greater significance in this growth in population, however, is the growth rate in particular age groups. While the growth in the working age population (20 to 60 years old) is very similar to the growth in the total population (58% growth from 1971 to 2051, compared to 63% growth for the total population), the growth in the population over 60 years of age will be 300%. At the same time, the population under 20 years of age will fall by about 10%. In addition to the growth in the numbers of older people, this new generation of older people, especially women, will also be more likely to have driver’s licences than today’s older generation.

One of the consequences of increasing numbers of older people having driver’s licences and travelling greater distances as a car driver is that they will be more likely to be involved in traffic crashes of various severities. Many studies of road safety concentrate on the numbers of crashes in the system as a measure of level of risk on the roads. This is often recognised as not being a true picture of risk, and most researchers note that a better measure of risk should account for the total "exposure" of the system, or segment of the system, to crashes. Often the size of the population group under consideration will be considered, and sometimes the number of licenced drivers, but rarely will a true measure of exposure to risk, in terms of the usage of the road system by the population group, be used. This is often because of the difficulty in obtaining good measures of road user exposure. This paper provides an analysis of road user exposure and road crash rates in Melbourne, using crash data from VicRoads and exposure data from a survey of travel behaviour which provides detailed data about exposure levels by different demographic groups under different conditions. The paper examines the crash rates of drivers from different demographic groups (classified by age and sex) and shows that different perspectives on relative risk can be obtained, depending on the type of crash rate being examined and the measure of exposure being used.

Data Sources

The data to be used for this analysis comes from two sources. The crash involvement data was obtained from VicRoads in the form of a database entitled "CrashStats". This database contains Road Crash Statistics for the State of Victoria for the years 1991 through to 1999, for crashes where at least one person was injured. Police reports form the basic source of crash data. The data is converted from number of crashes (where there is one data record for each crash, perhaps involving several people) into number of crash involvements (where there is one data record for each of the people involved). The road user exposure data comes from the Victorian Activity and Travel Survey (VATS) conducted by the Transport Research Centre

(TRC). The survey records all travel by all modes by all people in the responding households in the survey sample. In addition, respondents were asked to provide a range of socio-demographic information. Each household was asked to provide their travel and activity data information for a specified travel day. The survey is continuous, covering all 365 days of the year, thereby enabling temporal variations in exposure patterns to be observed. The VATS survey began in December 1993 and has collected information from about 5000 responding households in each of the financial years from 1993-94 through 2000-01. The information being used in this analysis from both data sets is from the period January 1994 through December 1995.

In using these two data sources to calculate crash involvement rates, by dividing the number of fatalities or injuries by the exposure for a particular group, it is realised that the coverage of the two data sources is not identical. Specifically, CrashStats contains data on all crashes in Victoria, from which crashes in the Melbourne Statistical Division (MSD) were extracted. On the other hand, VATS contains all travel by residents of the MSD, from which travel in the MSD was extracted. To the extent to which there are crashes in the MSD by non-residents of the MSD, the data sources will be mis-matched. The extent of this mis-match, however, is considered to be relatively minor.

The main focus in this paper is directed towards the calculation of crash involvement rates for drivers in specific demographic groups. Specifically, the study considers age and gender variations in crash involvement rates for drivers of motor vehicles. The crashes for these groups are recorded by their level of severity (fatality, serious injury, minor injury and no injury) and transformed into crash involvement rates by the use of various measures of "exposure". The particular measures of exposure used in this paper are the population within a demographic group, the number of licence holders within the demographic group, and the total kilometres travelled by that demographic group as measured in the VATS survey. The idea is to see which demographic groups contribute disproportionately to motor vehicle crash involvement, and which have higher risk levels as measured by various measures of exposure.

The Effect of Different Measures of Exposure

To demonstrate the overall effects of using various measures on exposure in calculating crash involvement rates, the total number of drivers involved in all crashes (irrespective of injury severity) will be considered. The total number of crashes by age and sex of driver in Melbourne in 1994-95 is shown in Figure 1. The highest number of crashes is for males in the age group 20-24 years old. This does not, however, imply that these are the drivers who are most at risk. This result comes about partly by the way in which the age groups have been constructed. While most of the age groups are in 5-year intervals, the lowest group only contains drivers from two years of that interval (because of licence age restrictions), while the oldest group contains a wide range of ages above 75.

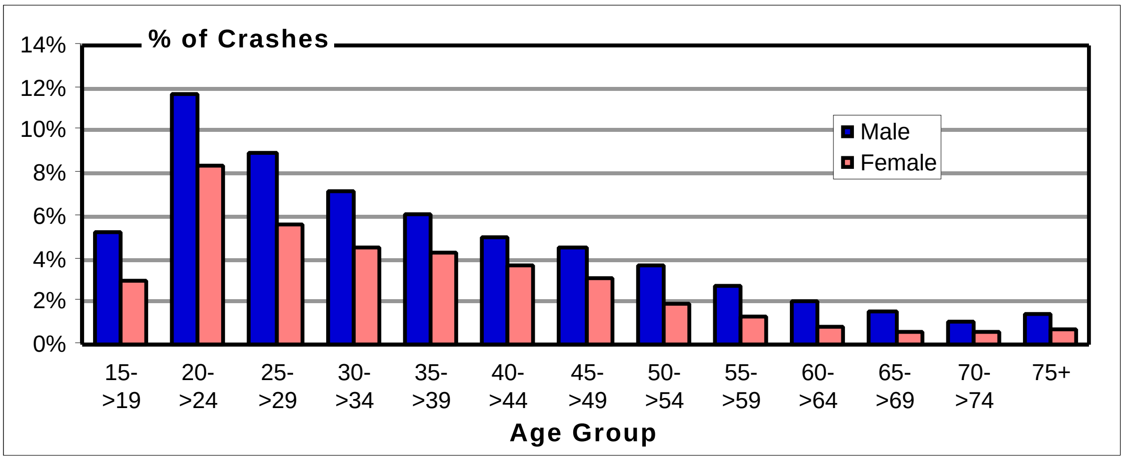

Figure 1 **Total Car Driver Crash Involvements by Age and Sex of Driver (94-95)**

In addition, there are more younger people involved in crashes in Melbourne partly because there are simply more younger people in Melbourne. Figure 2 shows the demographic structure of Melbourne in terms of age and sex. Clearly, there are more younger people than older people in Melbourne in 1994-95.

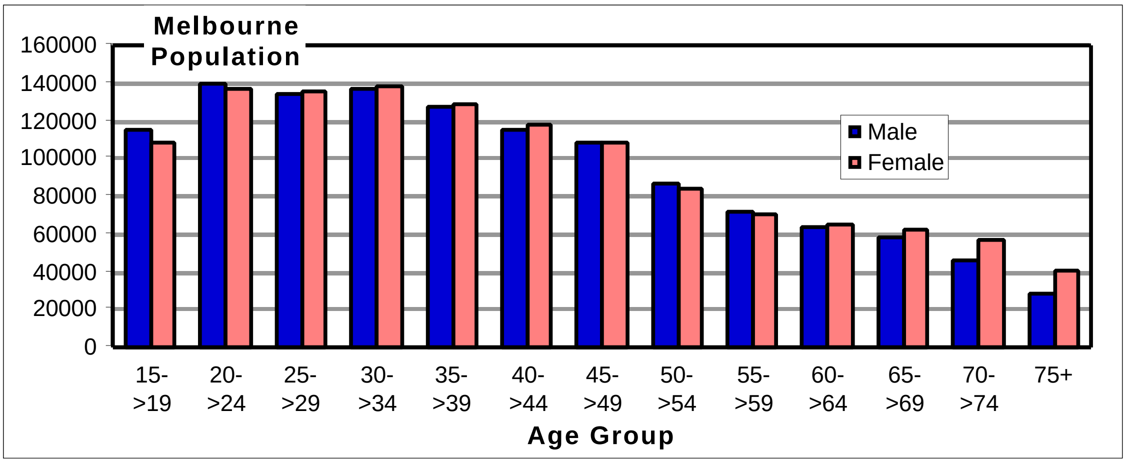

Figure 2 **Melbourne Population by Age and Sex (94-95)**

If one corrects for this difference in demographics, Figure 3 shows the number of crashes per thousand population in each age and sex group. This standardisation of the data shows three points. Firstly, young males, as expected, have the highest crash rates per head of population. Secondly, for both males and females, the number of crashes per year generally decreases with increasing age (although males over 75 show a reversal of this trend). Thirdly, females at each age have less crashes per head of population than males of the same age. This does not necessarily mean, however, that females are safer drivers. One of the differences between males and females is their probability of holding a driver’s licence, as shown in Figure 4. At all ages, but particularly for older groups, males are more likely to have a driver’s licence than females.

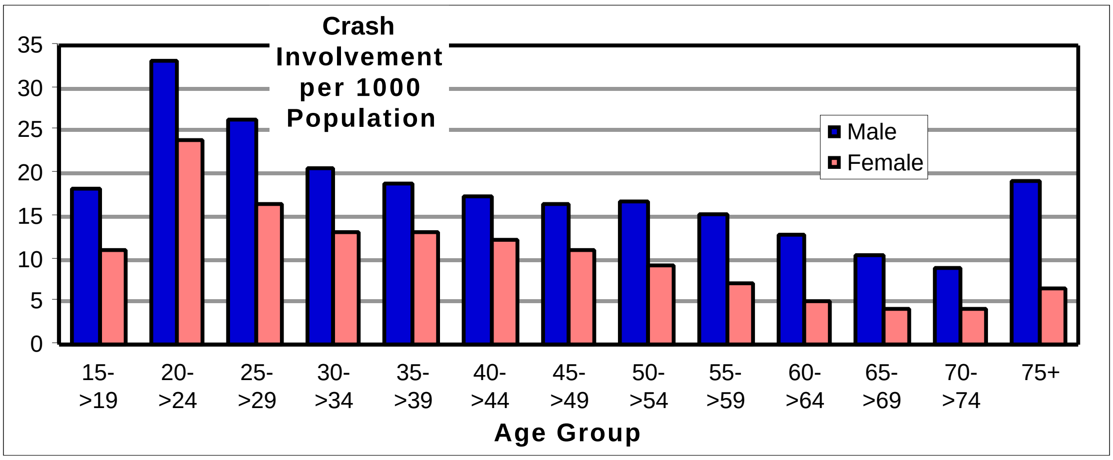

Figure 3 Crash Involvement per Capita by Age and Sex (94-95)

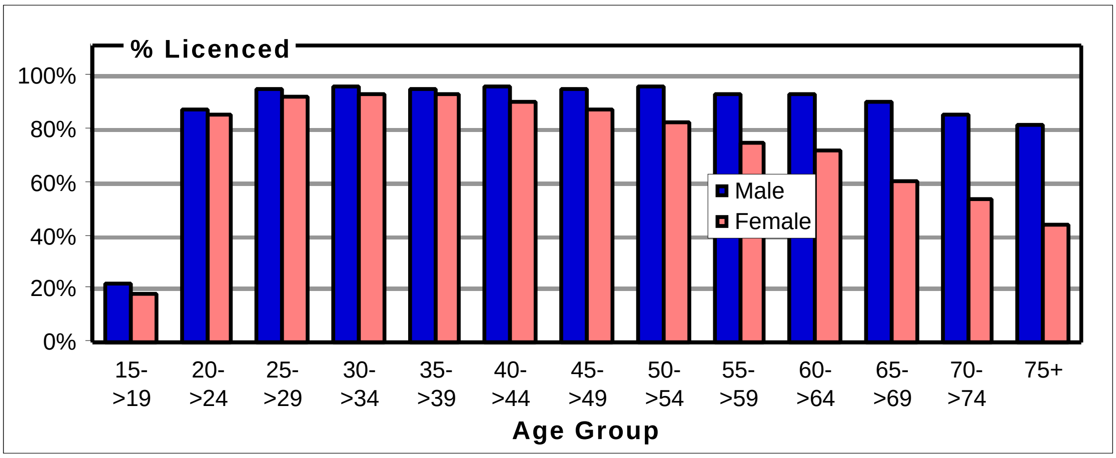

Figure 4 Licence-holding by Age and Sex (94-95)

If one accounts for this difference in licence-holding, and calculates the crash involvement per licenced driver by age and sex, a somewhat different picture emerges as shown in Figure 5. It is seen that the crash rate for female drivers rises relative to the male drivers, especially in the older age groups. However, females still have lower crash rates per licenced driver than males in all age groups. The very young driver (under 20) has the highest crash involvement per licenced driver.

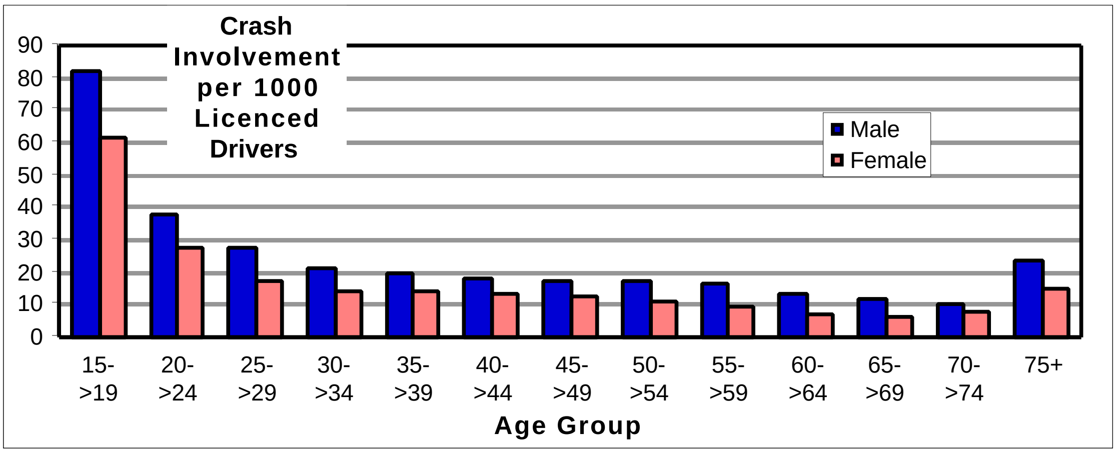

Figure 5 **Crash Involvement per Licenced Driver by Age and Sex (94-95)**

The number of licenced drivers in each age/sex group is only an approximate measure of the propensity to travel as a car driver. Another factor that relates more closely to the concept of exposure is the amount of driving done by each of the age and sex groups. It is known, for example, that as well as there being different licence holding rates by age and sex, the amount of driving by those licenced drivers also varies by age and sex, as shown from the VATS data in Figure 6. It can be seen that men drive more than women in all age groups. The annual kilometres driven by men peaks in the 40-44 age group, while the annual kilometres driven by women is relatively constant from 20 through 44.

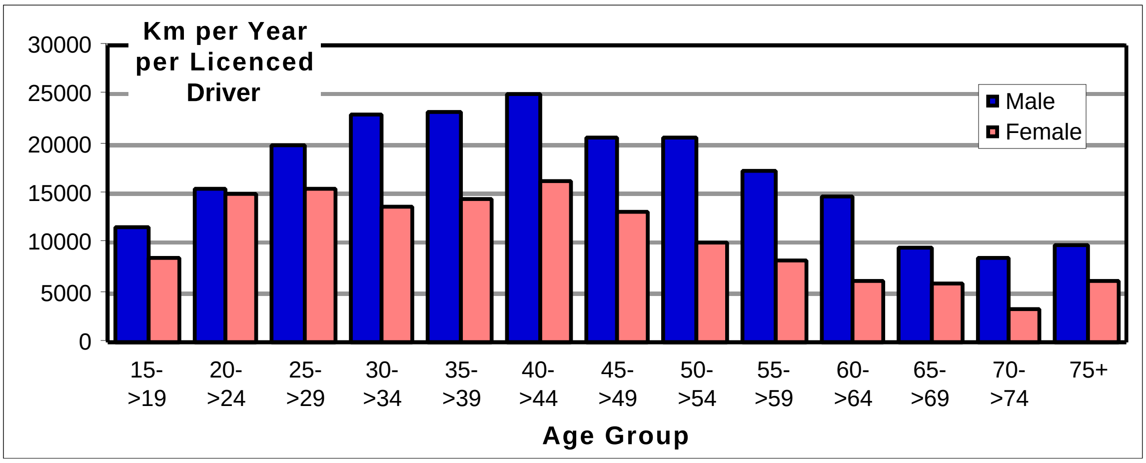

Figure 6 **Annual Kilometres Driven per Licenced Driver by Age and Sex (94-95)**

Combining the data in Figures 2, 4 and 6, one can estimate the total number of kilometres driven per year by each age/sex group, as shown in Figure 7. The crash involvement per kilometre of travel can then be calculated for each age/sex group as shown in Figure 8.

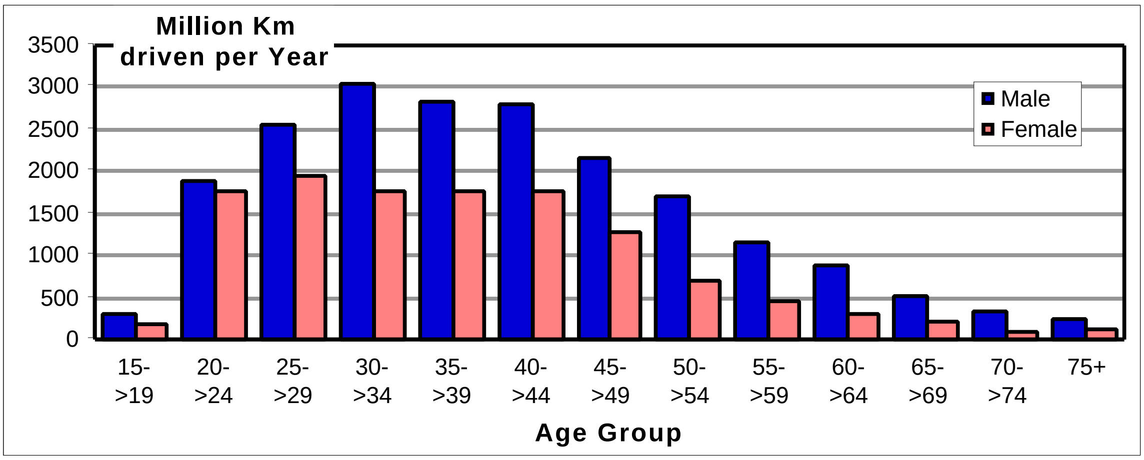

Figure 7 **Total Annual Kilometres Driven by Age and Sex (94-95)**

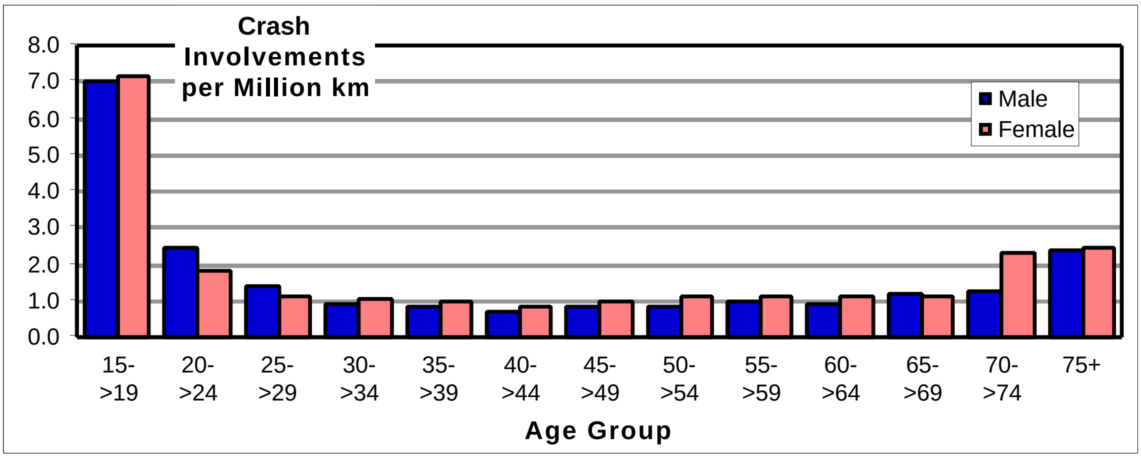

Figure 8 **Crash Involvement per Kilometre Driven by Age and Sex (94-95)**

It can be seen that the crash rate per kilometre driven is the highest for very young drivers (under 20). It then falls for both men and women as they approach their forties, and then increases thereafter, with quite substantial rises for drivers over 75. In addition, it can be seen that while male drivers of all ages have more crashes in total than females (Figure 1), and more crashes per head of population (Figure 3) and per licenced driver (Figure 5), the situation is quite different with respect to crashes per kilometre driven. In Figure 8, it can be seen that while male drivers below the age of 30 tend to have slightly more crashes per kilometre driven than their female contemporaries, the situation reverses for drivers over 30 where female drivers have more crashes per kilometre driven than their male contemporaries.

The importance of the differences between Figure 3, 5 and 8 should be re-emphasised. The use of readily available aggregate measures of exposure, such as population and licenced drivers, implies that males have higher crash rates than females and that these crash rates decrease with increasing age. However, the use of a more appropriate measure of exposure, total kilometres driven, shows that female drivers have higher crash rates than male drivers, while older drivers have crash rates which are second only to those of the youngest drivers.

Crash Severity by Demographic Group

The CrashStats database gives information not only on the total number of drivers involved in crashes but also on the level of injury sustained in those crashes. These injury levels are classified as Fatal, Serious Injury, Minor Injury and No Injury. The same type of analysis as described above has therefore been performed, to give crash involvement rates per kilometre driven by age and sex for each injury severity level.

The results for Fatal Car Driver crash involvements are shown in Figure 9. Very young males and females have high Fatality rates, those in their middle years have very low rates, while the Fatality rate begins to climb again as age passes 60, with drivers in their 70's having comparable Fatality rates as drivers below the age of 20. Males tend to have higher fatality rates than females in all age groups.

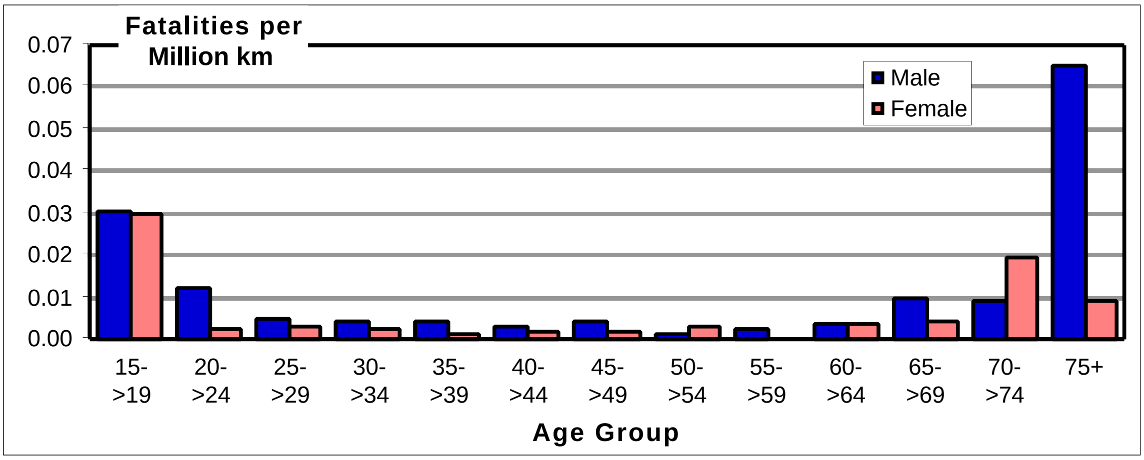

Figure 9 Fatalities per Million Km by Age and Sex of Driver (94-95)

The results for Serious Injury Car Driver crash involvements are shown in Figure 10. Overall, the results for Serious Injuries by age of driver are similar to those obtained for Fatalities. Very young drivers have high Serious Injury rates, those in their middle years have low rates, while the Serious Injury rate begins to climb again as age passes 60, with drivers in their 70's having similar Serious Injury rates as drivers below the age of 20. However, in contrast to fatal crash involvements, women tend to be more involved in Serious Injury crash involvements than men, in all age groups.

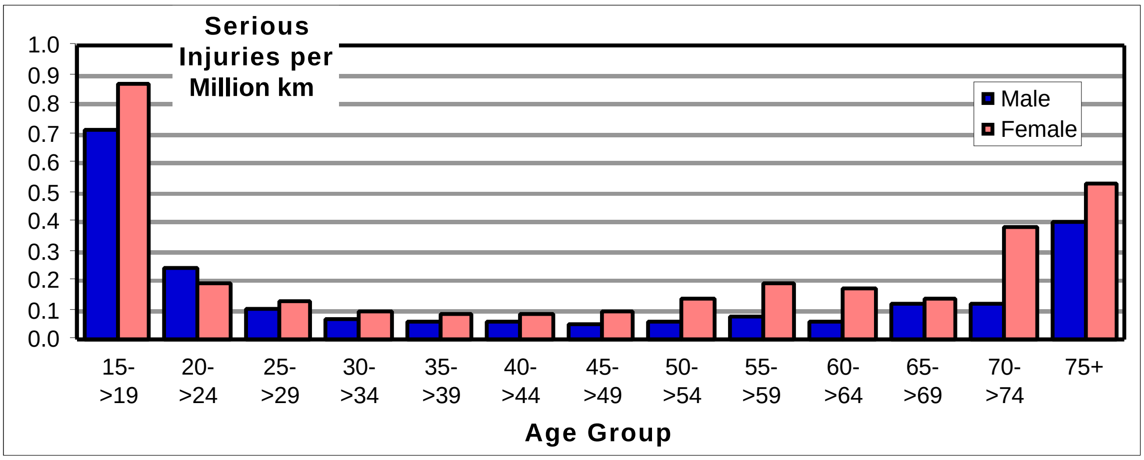

Figure 10 **Serious Injuries per Million Km by Age and Sex (94-95)**

The results for Minor Injury Car Driver crash involvements are shown in Figure 11. The results for Minor Injuries are similar to those obtained for Serious Injuries. Very young drivers have high Minor Injury rates, those in their middle years have low rates, while the Minor Injury rate begins to climb again as age passes 60, with drivers in their 70's having Minor Injury rates about half as much as drivers below the age of 20. As with Serious Injury crash involvements, women tend to be more involved in Minor Injury crash involvements than men, in all age groups.

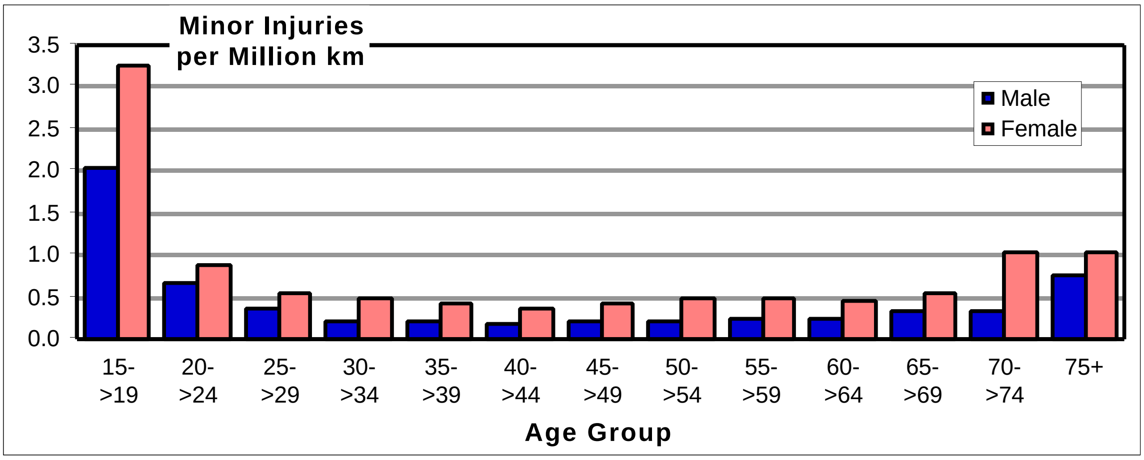

Figure 11 **Minor Injuries per Million Km by Age and Sex (94-95)**

Finally the results for No Injury Car Driver crash involvements are shown in Figure 12. The results for No Injury crash involvements are similar to those obtained for Minor Injuries, except that, compared to Minor Injury crash involvements, men tend to be more involved in No Injury crash involvements than women, in all age groups. Very young drivers have high No Injury rates, those in their middle years have low rates, while the No Injury rate begins to climb slowly as age passes 60, with drivers in their 70's having No Injury rates about the same as much as drivers in their mid-20s.

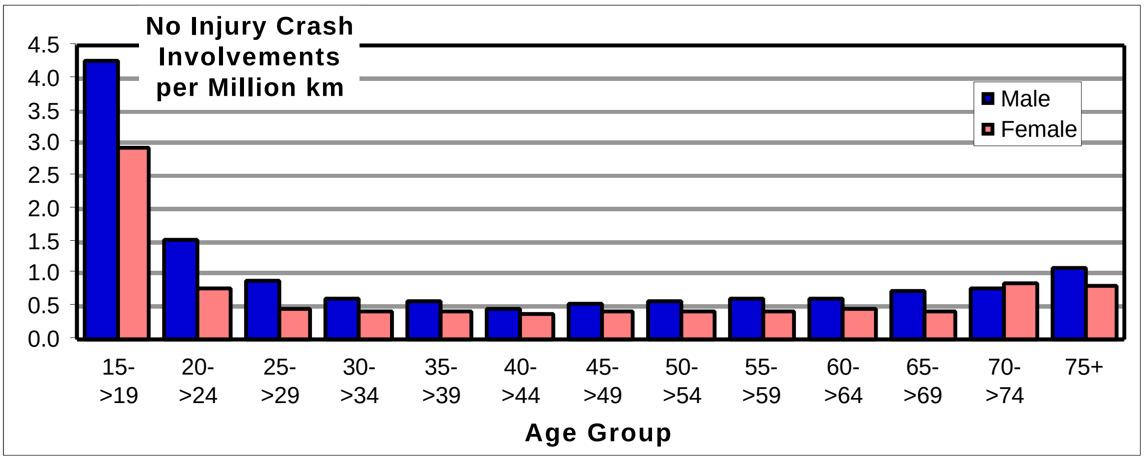

Figure 12 No Injury Crash Involvements per Million Km by Age and Sex (94-95)

In summary, males tend to be involved in crashes with severities at either end of the spectrum, i.e. they are either killed or they are not injured. On the other hand, females tend to suffer serious or minor injuries rather than being killed or not injured. The highest crash rates are experienced by the youngest drivers at all levels of severity. Older drivers have higher crash rates, relative to other ages, for the more serious crashes (fatalities and serious injuries) than they do for the less serious crashes.

Conclusions

Although the common perception is that male drivers, especially young male drivers, contribute to a large majority of crashes on our roads, and hence are most at risk, it was found from the combination of crash data with detailed exposure data that this was not necessarily the case. Males were involved in the most crashes, but for certain age categories and severities of injury, female drivers produced a higher crash rate per kilometre driven. Analysis of the total crashes for Melbourne in 1994-95 showed that there were significant variations between male and female drivers in terms of their involvement in crashes of different severity. Males were found to be more likely to be involved in fatal crashes and non-injury crashes, while females were more likely to be involved in crashes in which they suffered serious or minor injuries.

When comparing crash rates across age groups, the results are particularly alarming for the youngest age category (under 20) for both men and women. The rate is almost six times greater for this category than for the average driver. However, drivers aged 75 and above were also found to have a very high rate of involvement in all types of crash per kilometre driven, especially those crashes with more severe injuries to the driver.

These findings highlight the importance of using an appropriate measure of exposure when calculating crash rates. Groups, such as the elderly, who have a relatively limited amount of driving exposure may have very high crash rates without contributing significantly to the overall number of crashes. From an actuarial viewpoint, such groups may not be a problem. However, from a policy and counter-measure viewpoint, it is important to identify the high-risk groups, per unit of exposure, as well as the groups with a high number of crashes. This is especially the case where the size of these groups may well change significantly in the future. The implications of these findings for the vision of Zero Road Toll are explored in a companion paper at this conference (Richardson and Bell, 2001).

References

Richardson, A.J., and Bell, D.A. (2001). "A Simulation of Traffic Crashes into the 21st Century". Forum Papers, 24th Australasian Transport Research Forum, Hobart.