Projecting the Future Burden of Older Road User Crashes in Queensland

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Abstract

The population of Queensland is growing rapidly, and ageing rapidly. As older road users (aged 60 or more) have a different pattern of crashes to other road users, it is expected that the nature of road crashes overall will change, along with the overall burden. This paper reports preliminary steps to project the future burden of older road user crashes in Queensland. Population projections show that the number of Queenslanders aged 60 and above will increase almost fivefold from 574,263 in 2001 to 2,743,304 in 2051. These increases will be greatest among people aged 80 or above. Projections of road crashes based on simple assumptions show that currently about 1 in 10 driver casualties and 1 in 5 driver fatalities are aged 60 or above, and these ratios are expected to double by 2051. Passengers show a similar pattern. At present, about 1 in 8 pedestrian casualties and 1 in 7 pedestrian fatalities is aged 60 or above, and by 2051 it is projected that 1 in 4 pedestrian casualties and 1 in 3 pedestrian fatalities will be aged 60 or more. There are limitations to these simple projections which imply that the raw crash figures are likely to be inflated. However, attempts to take historical trends into account indicate that a better understanding is needed of external influences on them. Other factors which may affect the projections include changes in travel patterns, levels of fragility and exposure patterns, which will be taken into account in future iterations. The implications are discussed.

Introduction

Population ageing is being experienced in Australia, as it is in most developed countries (ABS, 2006a). Elevated fertility rates in Australia between 1945 and the early 1960s, followed by subsequent declines, have led to a large cohort of individuals, commonly referred to as the “baby boom generation” (ABS, 2004; Harding, 2005; McDonald & Kippen, 1999). At the same time, life expectancy has increased dramatically (ABS, 2006b). In the 1950s and 1960s, life expectancy for males and females was 67 years and 72 years respectively; by 2003-2005 this had increased to 78.5 and 83.3 years respectively (ABS, 2006b). This means the Australian population will be characterised by a proportionally greater number of older people, who will live much longer than previously.

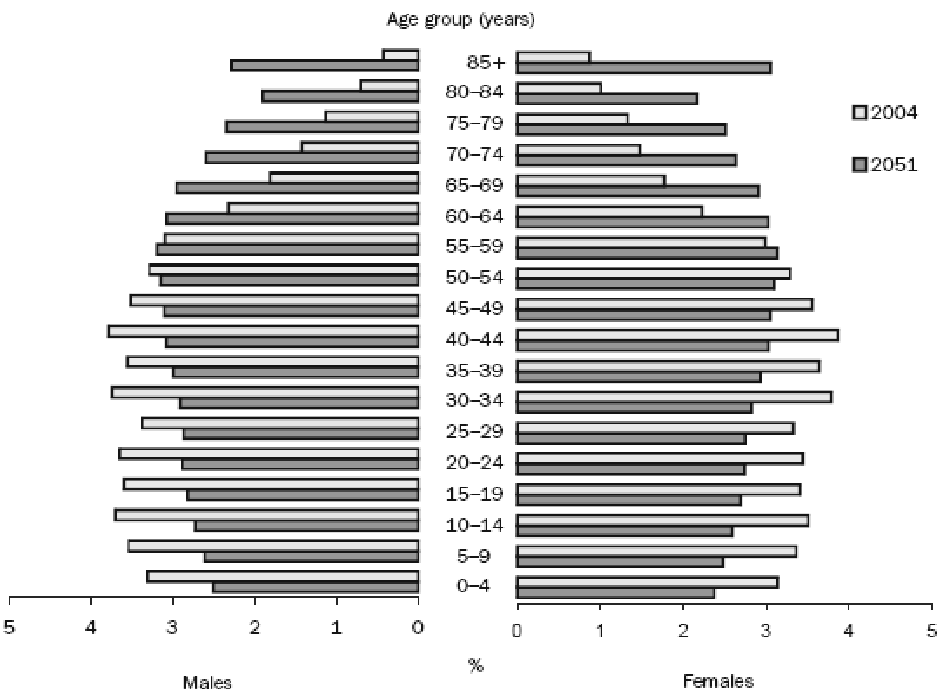
Older road users have different crash characteristics to younger road users, so this shift in the age profile of the population would be expected to lead to a change in the overall picture of road crashes and their related burden, with possible consequences for policy and program priorities (King, 2004). The nature of this change to the road crash profile is currently unclear. To develop a better understanding of its scale and implications, it is necessary to make projections of road crashes, taking into account the projected changes in population and other factors known to influence crash incidence and severity.

This paper outlines an initial attempt to model these changes in Queensland, and a discussion of the factors which would need to be taken into account for more sophisticated modelling. The implications of the simple projections for road safety policy and program priorities are discussed.

Background

The age profile of Queensland is expected to change significantly by the middle of this century. Figure 1 presents the age profile of Queensland for 2051 compared with 2004.

Figure 1: Age profile of the Queensland population (2004) and projected profile (2051), by gender (Source: ABS, 2006b)



It can be seen that the proportion of the population in every age group under 55 will decrease, while all those above will increase. Note in particular the proportion of females aged 85 and over, which in 2004 was the least numerous age category for females, but by 2051 will be the most numerous. It should also be emphasised that, along with this shift in age, Queensland's total population is expected to increase rapidly, from around 3 million at present to around 7 million in 2051.

Currently older road user crashes do not make up a significant proportion of the road toll. Queensland Transport defines "senior adult road users" as those aged 60 or above, while the Queensland licensing regulations impose additional requirements from age 75. Data obtained from Queensland Transport show that, in 2005, road users aged 60-74 made up 8.8% of people killed and 6.7% of people injured in Queensland, while road users aged 75 and over made up 7% of those killed and 2.8% of those injured. In contrast, young drivers (17-25 years old) made up 27.6% of road fatalities and 29.9% of injuries.

A comparison with young drivers is useful when considering older road users as a potentially high risk group, but does not take into account the changes that occur in crash patterns with maturity. As part of an exercise conducted for Queensland Transport, crash data for 2002 to 2006 were examined at different levels of crash severity, comparing crashes involving older drivers (aged 60 or above) with those involving "mature" drivers (aged 25-59), and comparing of crashes involving casualties in these age groups. The full findings are too detailed to report here, but some distinct patterns emerged. There were high numbers of multi-vehicle crashes involving older drivers and high rates of carrying passengers (multiple occupancy). There was a high proportion of angle crashes involving older drivers and older road user casualties, especially for more serious crashes at intersections. At-fault crashes increased with driver age, though there was a decrease in drink/drug driving. Older road user fatalities were more likely to be pedestrians.

Combined with demographic change, these differences in crash patterns have implications for the kinds of road safety problems which might become more prominent in the future. CARRS-Q is developing models to project older road user crashes in Queensland over the next few decades, with the aim of informing policy and program priorities. The Method and Results sections below outline the preliminary steps which have been taken and the findings which have emerged so far.

Method

The methodology involves multiple steps in an iterative process. The initial steps involve simple projections, followed by more detailed specification and modelling.

The first step was to project changes in the population exposed to risk, i.e. projections of population in the age groups of interest. Queensland population projections, prepared by the Office of Economic and Social Research (OESR) and based on ABS projections, are available until 2050 on the OESR website (OESR, 2006). For the purposes of this research, the OESR mid-range projections were used (there are also high-range and low-range projections). They were plotted over time separately for males and females.

The second step involved a simple projection of the number of crashes which could be expected in each age group by level of severity, based only on population changes. It was assumed that the injury rates per unit of population which currently apply will apply into the future. Separate projections were made for drivers, passengers and pedestrians.

The third step involved an exploration of other factors which are known to influence crash rates, focusing on the availability of the data, its reliability for projection purposes, and the impact of incorporating these factors into the projections.

Results

1. Changes in road user population by age group

Figures 2 and 3 give the population projections for males and females respectively. Figures 4 and 5 present the same data as proportions of the population. For both males and females (looking at Figures 2 and 3), the youngest age bands (17-20, 21-24 and 25-29) show the lowest level of increase, rising in 2051 to around double their representation in 2001. The most precipitate increases take place in the 80+ age bands. Overall there will be dramatic increases in numbers of older people (from 574,263 aged 60 or above in 2001 to 2,743,304 in 2051, almost a fivefold increase). Numbers of men aged 80 or above will increase from 37,403 in 2001 (with a sharp upturn from 2021) to 454,636 in 2051, a 12-fold increase. Women in the 80+ group are already more numerous (64,448 in 2001) and will increase to 527,739 in 2051 (with the same sharp upturn from 2021), an eightfold increase. The significance of this for the female 80+ category is that it will take them from being the least numerous group in 2001 to become the most numerous by 2051.

Figure 2: Projections of Queensland driving age population by age, males, 2001-2051

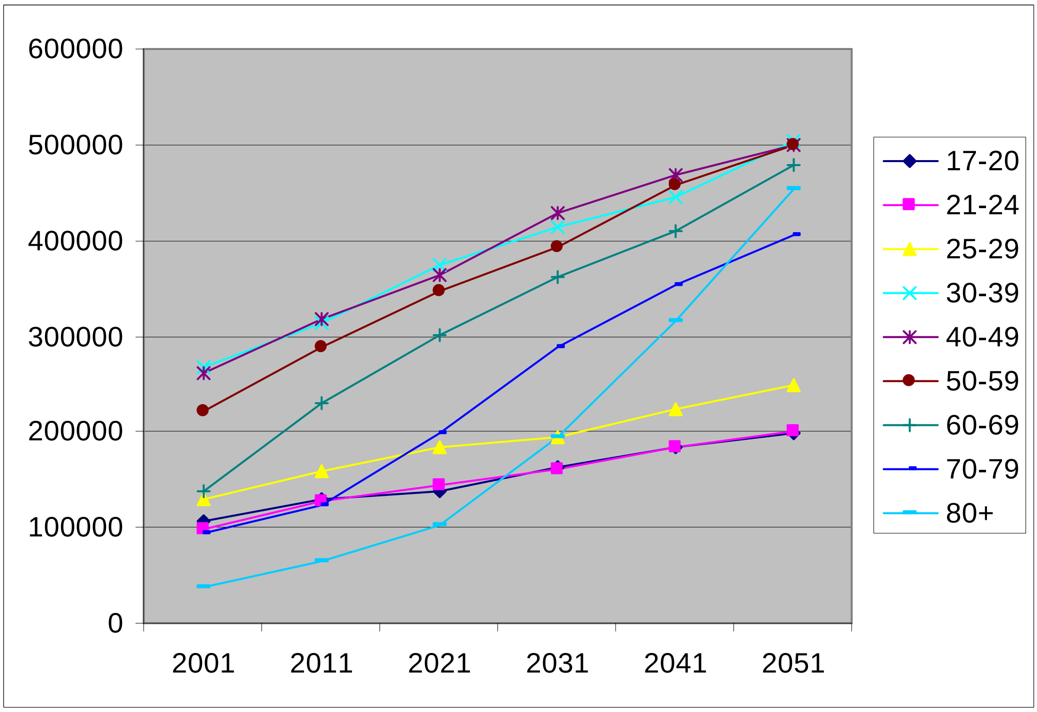
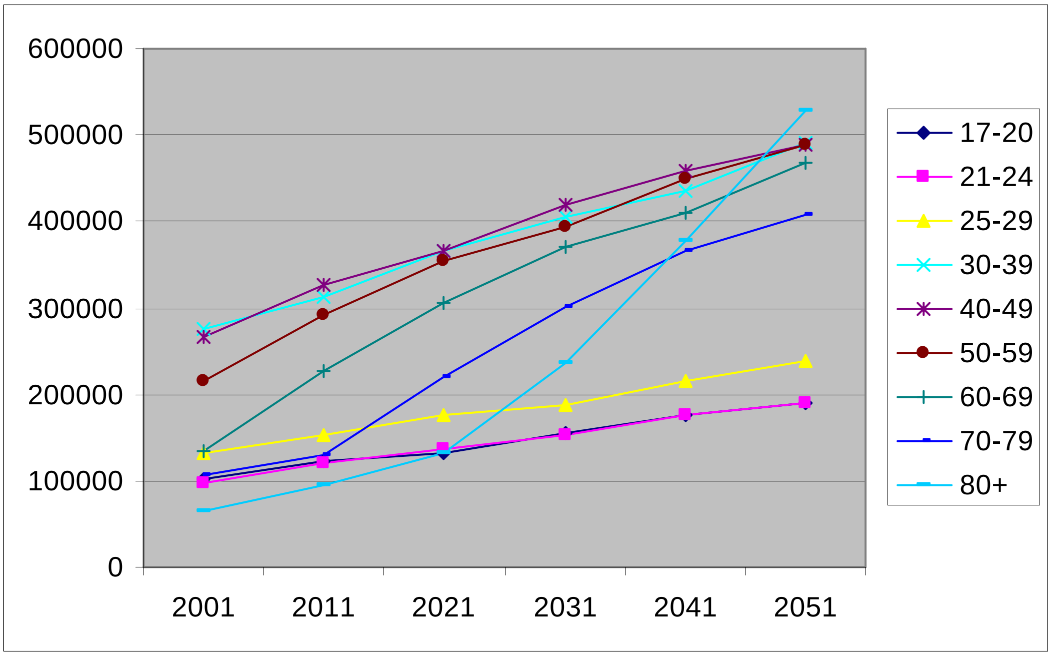


Figure 3: Projections of Queensland driving age population by age, females, 2001-2051



The 70-79 year old age band starts its sharper rise ten years earlier and increases roughly four-fold for both males and females. The remaining age bands (30-39, 40-49, 50-59 and 60-69) are marked by a convergence, such that their numbers are closer together by 2051 than they were in 2001, owing to more rapid increases in older age bands.

Figure 4: Projections of the proportional representation of Queensland driving age population by age, males, 2001-2051

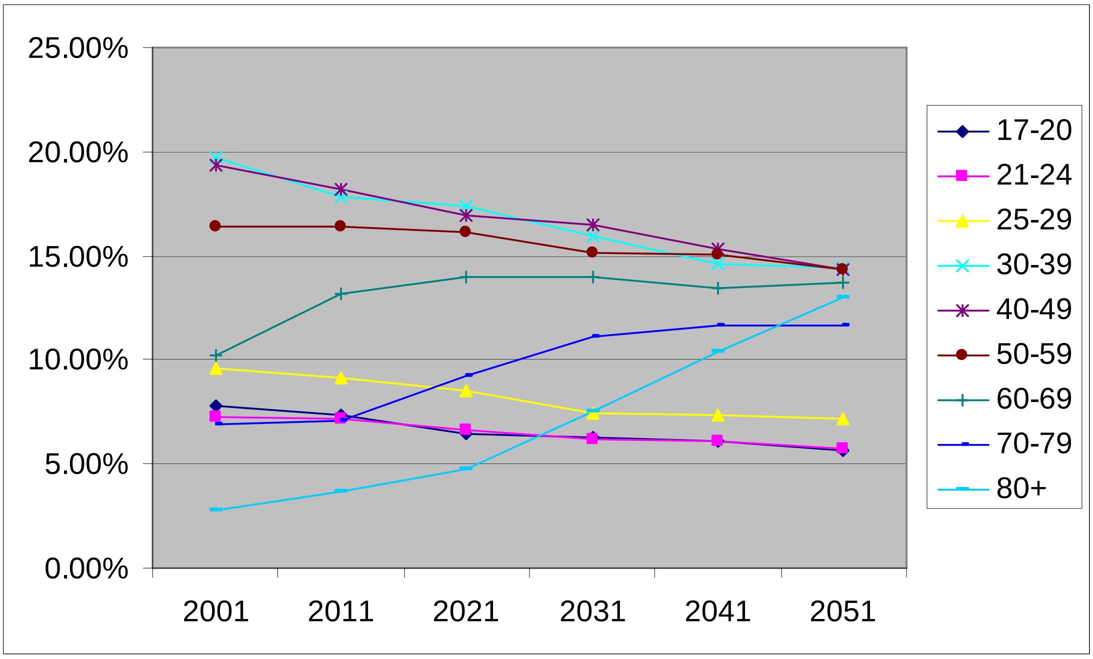
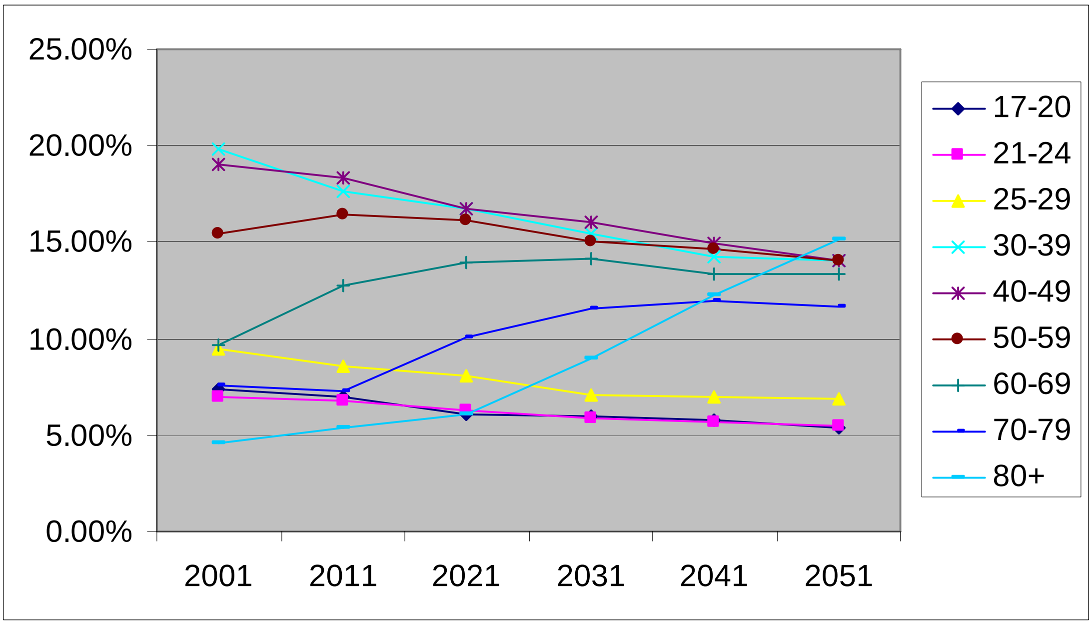


Figure 5: Projections of the proportional representation of Queensland driving age population by age, females, 2001-2051



Looking at the data re-expressed as proportions (Figures 4 and 5), among both males and females the proportion in all age bands up to age 49 declines from 2001, and for males this is also the case for the 50-59 year age band. For females the proportion in the 50-59 year band increases to 2011, then drops. The proportion in the 60-69 year band for both males and females increases then remains reasonably unchanged, a pattern followed by the 70-79 year band ten years later. The 80+ band, however, shows a large and sustained increase, from under 3 per cent of the male driving age population to around 13 per cent, and from under 5 per cent of the female driving age population to around 15 per cent.

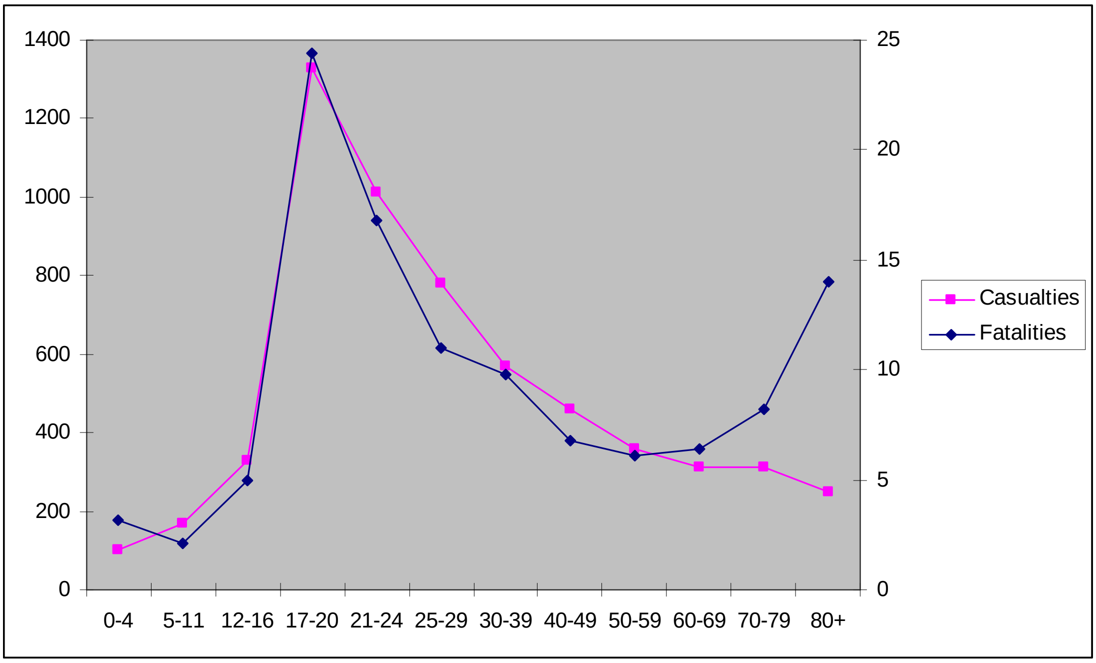
These changes in proportional representation have relevance in terms of the potential composition of the road user population. At present, about 15 per cent of driving age males and 14 per cent of driving age females are of "young driver" age (17-24 years old) while about 20 per cent of males and 22 per cent of females are older road users, of whom less than half of the males and just over half of the females are over 70. By 2051, about 11 per cent of driving age males and females will be of "young driver" age – a small drop – but a substantial 38 per cent of males and 40 per cent of females will be older road users, of whom around two-thirds will be over 70.

2. Crash projections based on population rates

This step was broken down into several smaller exercises. Prior to projecting crashes by age on the basis of population projections, the current relationship between crashes per unit of population and age was investigated. Rates of fatalities and total casualties per unit of population (in this case, per 100,000 population) for 2001 to 2005 were calculated. This is a common method of expressing risk in the public health context, as it represents the population risk of some event, i.e. the risk that is associated simply with being a member of a particular group in the population, without accounting for other kinds of exposure to the risk factors involved.

Crash data were drawn from Queensland Transport statistics, and population data from OESR. Figure 6 provides a comparison of the median casualty and fatality rates on separate axes to illustrate the differences. Crash rates peak for the 17-20 year age group, then there is a decline in population risk with age for all casualties, but an increase in population risk with age for fatalities from age 60-69. Although older road users are at a lower risk of being injured in a road crash as their age increases, they are increasingly likely to be killed as a result of the injuries they experience.

Figure 6: Median casualty and fatality rates per 10^5 population, Queensland 2001-2005 (casualty rate left axis, fatality rate right axis)



This greater severity with age can be expressed as the proportion of casualties which are fatal. From 12 years of age to 59 years of age, between 1.4% and 1.8% of casualties are fatal. This rises to 2.1% for 60-69 year olds, 2.6% for 70-79 year olds, and to 5.6% for people aged 80 and above. That is, given that a casualty crash occurs, most of the population have a chance of around 1 in 60 or 1 in 70 that they will die as a result, which rises to 1 in 50 for 60-69 year olds, 1 in 40 for 70-79 year olds, and about 1 in 18 for people aged 80 and above. This illustrates the fragility of older people.

The data on casualties per unit of population were used to project numbers of casualties by level of severity in Queensland by age group for each year up to 2051, for all road users, and separately for drivers, passengers and pedestrians. To present a simple picture, Figures 7 and 8 report only the comparison between 2006 and 2051 for fatalities (Figure 7) and all casualties (Figure 8) from age 17, with some age categories combined. The projections show a dramatic increase in the numbers of road crashes and fatalities among senior adults.

Figure 7: Number of fatalities, Queensland 2006 and 2051 (projected), by age group within road user type

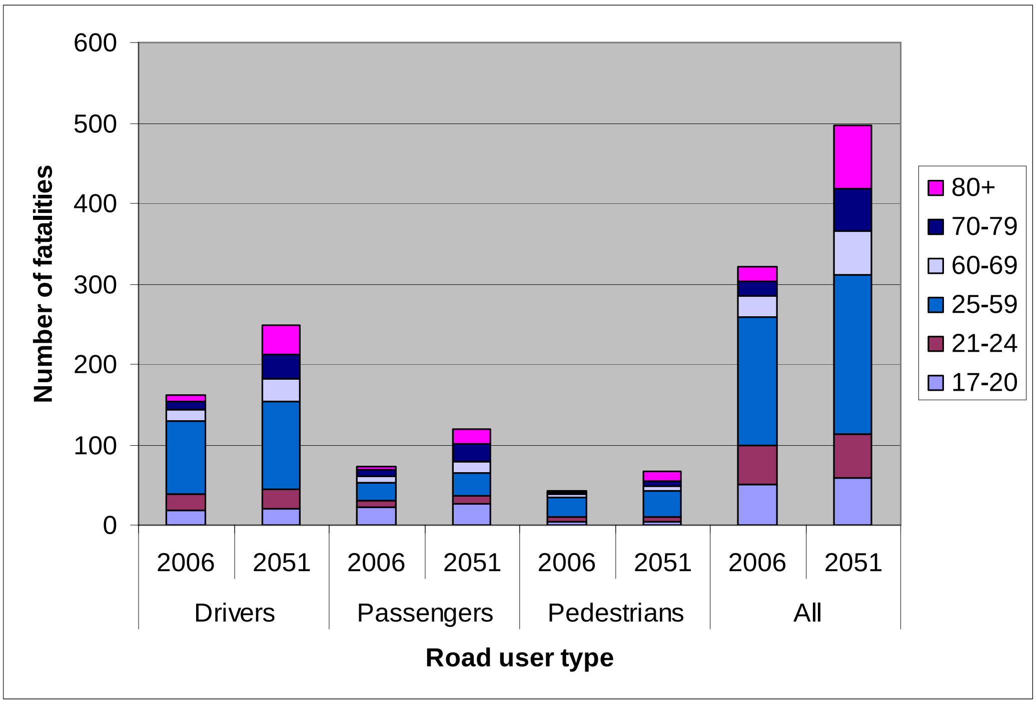
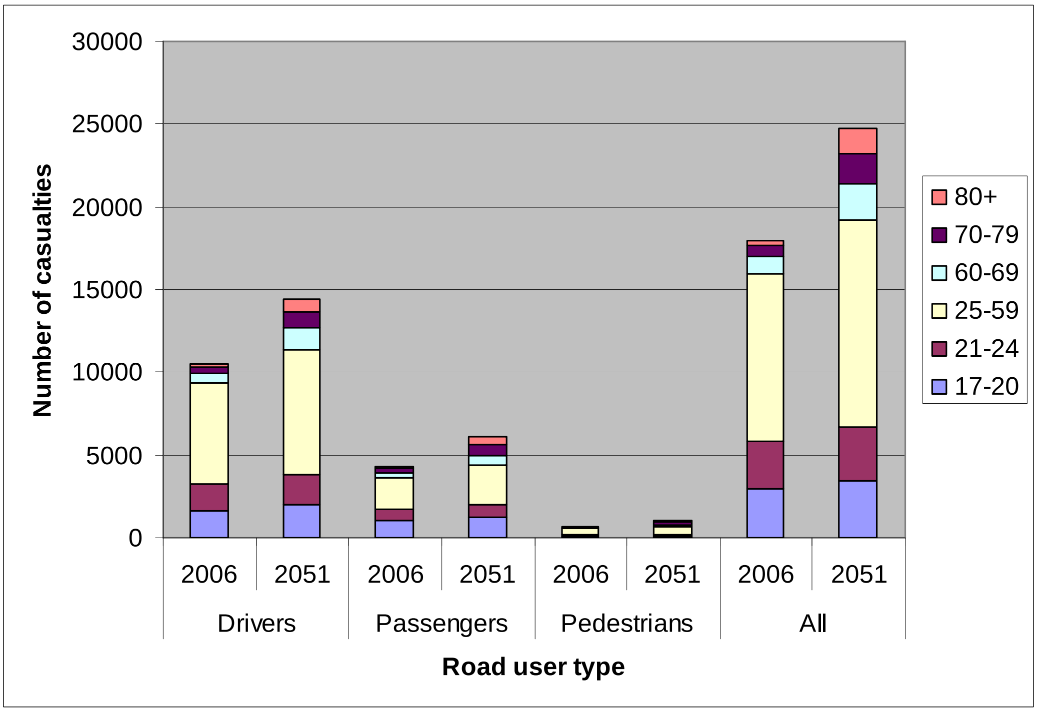


Figure 8: Number of casualties, Queensland 2006 and 2051 (projected), by age group within road user type



Between 2006 and 2051, the number of casualties among 60-69 year olds is expected to double, the number for 70-79 year olds will almost triple, and the number for 80+ year olds will almost quadruple, while casualties among 30-59 year olds will increase very little (by about a quarter). Currently about 1 in 10 driver casualties and 1 in 5 driver fatalities is a senior adult, and this is expected to double by 2051, such that 1 in 5 driver casualties and 2 in 5 driver fatalities will be senior adults. For driver fatalities, this will mean that senior adult drivers would account for twice as many driver fatalities as young drivers 17-24 year olds). Passengers show a similar pattern. The picture for pedestrians is more dramatic. At present, about 1 in 8 pedestrian casualties and 1 in 7 pedestrian fatalities is a senior adult, and this is expected to double by 2051, such that 1 in 4 pedestrian casualties and 1 in 3 pedestrian fatalities will be senior adults.

3. Elaboration of projection model

The population-based projections, while interesting, are very simplistic. The main assumption made is that the casualty rates per unit of population will remain the same, whereas the history of road safety in Australia has been marked by large declines. For example, the fatality rate per 100,000 population for Queensland was 32.2 in 1973 (Queensland Transport, 2005) and 8.31 in 2006 (Australian Transport Safety Bureau, 2006). A similar decline between 2006 and 2051 would lead to much smaller numbers of fatalities than were projected.

To examine how trends in casualty rates would affect the projections, ten years of fatality rate and hospitalisation rate data were used to generate regression models. These models were then used to modify the projections. The data are presented in Figures 9 and 10. These projections show divergent outcomes. Figure 9 shows a decline in numbers of fatalities aged 70-79, despite the large increase in their numbers. This is due to a decline in the fatality rate of 70-79 year olds in the previous decade, which is difficult to account for, as it does not occur in the age groups either side of it.

Figure 10 presents a picture for hospitalisations which is more consistent between the older age groups. In both figures, the increase in numbers is greatest for the 80+ age group, which is in accordance with their increased share of the population. However, there is an issue with the historical data at an aggregate level which will need to be followed up.

Figure 9: Projected number of fatalities, Queensland 2006-2051 (projected), based on historical trends in fatality rates per unit of population

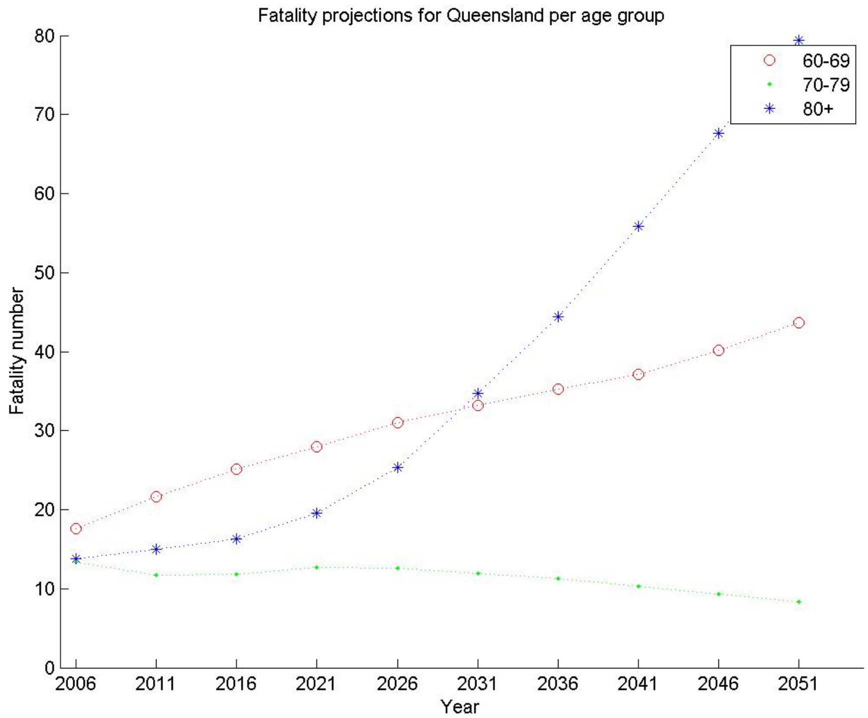
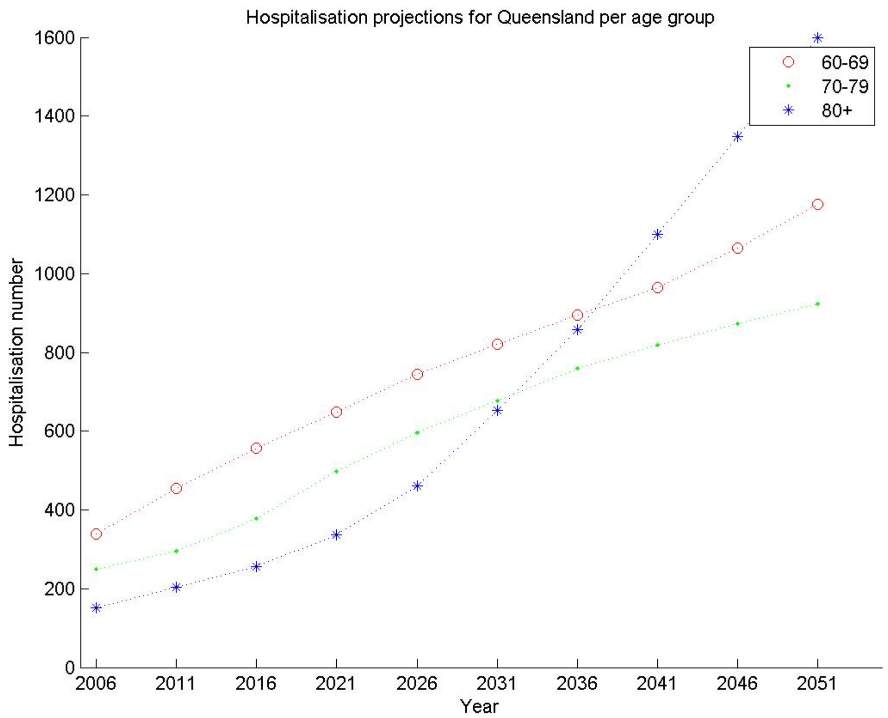


Figure 10: Projected number of hospitalisations, Queensland 2006-2051 (projected), based on historical trends in fatality rates per unit of population



In the past decade, the hospitalisation rate per unit of population has been rising in Queensland at the same time as the fatality rate has been falling. The reasons for this are not known with any certainty. Early this decade there was a change in Motor Accident Insurance Commission requirements, whereby a police report was needed before a compensation claim would be considered. This would be expected to lead to a stepwise increase in reported injury crashes, however a more gradual increase has been observed. There are suggestions that changes to hospital admission policies have taken place, but their nature, timing and impact have yet to be determined.

A second factor which was considered for inclusion in the models was a cohort effect (Stacey and Kendig, 1997), whereby successive age cohorts of drivers are more likely to be licensed. This would result in a shift between road user types (an increase in driver casualties and a decrease in passenger and pedestrian casualties). Data were examined from 1988 onwards, and evidence was found of a cohort effect, which appears to have worked its way through, such that over the period 2001-2005 there was no further change in the proportion of people licensed in particular age groups. This factor was therefore not taken into account.

A third factor relates to travel patterns. In the past, a relatively higher rate of crashes per kilometre travelled among older drivers was considered to reflect their greater risk as drivers, but in recent years it has been shown that this is largely an artefact of differences in crash rates per kilometre for short-distance travel patterns versus long-distance travel patterns, with older drivers being more highly represented among the former (Catchpole, 2006; Langford, Methorst and Hakamies-Blomqvist, 2006). However, it is possible that there are long term trends in travel patterns among older drivers, e.g. they may be travelling more distance now than a decade ago. Unfortunately, the only available time series data is the vehicle travel data collected by the Australian Bureau of Statistics (ABS) on an annual basis. Inquiries ascertained that obtaining ten years of this data would cost almost $40,000 because of the programming involved. As the data are collected by vehicle, with information on the drivers (including their ages) being secondary, there are issues of representativeness and accuracy. Advice was also received that the estimates in many of the tables of interest might have error bounds so large that ABS would not release them. At this stage it has been decided not to proceed with this factor.

Discussion

Population projections for Queensland show that the number of older people will increase dramatically. If simple assumptions are made about crash risk by age, the projections show large rises in numbers of older road users killed and injured. The patterns of older road user crashes (being associated with their greater fragility in a crash, their difficulties in dealing with complex situations such as intersections, and their high pedestrian activity) suggest that there will indeed be changes to overall crash patterns. These changes would be likely to influence policy and programs. For example, in-vehicle protection should assume a higher priority given the greater fragility of older people, and issues associated with pedestrian activity (such as crossing times and placement of facilities) should become more important. From a senior adult's perspective, the increasing risk of fatality is a more salient result than the decrease in risk of a casualty. From a policy and program perspective, reducing the *severity* of crashes which involve senior adults is therefore an important objective, even if the *number* of crashes prevented is modest.

Large changes in the composition of the road user population can be expected. At present, about 15 per cent of driving age males and 14 per cent of driving age females are of "young driver" age (17-24 years old) while about 20 per cent of males and 22 per cent of females are older road users, of whom less than half of the males and just over half of the females are over 70. By 2051, about 11 per cent of driving age males and females will be of "young driver" age – a small drop – but a substantial 38 per cent of males and 40 per cent of females will be older road users, of whom around two-thirds will be over 70. The relative changes in the proportions of young and older people of driving age means that, even if young road users remain at a greater risk of crashing, older road users are likely to be a more numerous road crash problem which will merit attention simply due to numbers.

The main weakness in these speculations is the assumption made that crash rates per unit of population will remain the same into the future, given that they have changed markedly in the past few decades. Unfortunately, the attempts to improve the models used for projection did not provide sounder projections. There have been changes in hospitalisation rates which are not yet accounted for, and kilometre-based exposure data by age is not readily available. Other factors with a potential influence have been identified and will be followed up as the research progresses. They include:

- Population proportions: older road user crashes are typically multi-vehicle, and the change in the proportion of older drivers on the road may affect both the risk and nature of the crashes;
- Sex ratio: the proportion of women who drive has increased, and crash rates may have changed differentially for men and women; given that there are more older women than older men, this will affect the projected crash patterns;.
- Complexity of exposure: with an increasing population, the average trip would be expected to involve interaction with greater numbers of vehicles, hence increased complexity; greater urbanisation may also entail the need to deal with more intersections;
- Time of day exposure: older people are less likely to drive at night or during peak hours, which would lead to an overall shift in traffic patterns;
- Severity index/fragility: older people are more fragile and so are more likely to be killed or severely injured in a crash, so that age-specific severity ratios need to be used; however, this assumes no change in fragility over time, which is questionable given the focus on osteoporosis and the use of hormone replacement therapy in recent years.

It is hoped that, as these and other potential influencing factors are worked through, a more reliable picture of future crash patterns in Queensland will emerge.

At this early stage the policy implications of the results remain unclear. There will be a greater increase in crashes involving older drivers than there will in crashes involving younger drivers, but there is no information in the projections which points to a need to apply stricter licence requirements for older drivers. What is known about crash patterns suggests that passive safety measures will become more important because they reduce the severity of crashes. While both older and young drivers have high levels of crashes in which they are considered to be at fault, younger driver fault is more likely to relate to acts of commission (e.g. drink driving and speeding), and older driver fault to errors in making decisions. This implies a shift in emphasis from deterring unsafe and illegal behaviour through enforcement, towards facilitating safer behaviour through measures such as assistive ITS and provision of a less complex and more forgiving road environment.

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