# 6. Motor cyclists

- Fatality rates, per 100,000 males, for motor cyclists have fallen by an average of 2.0% each year between 1970 and 1990. However, the assumption of an average annual change does not provide an adequate fit to the data. **The fatality rate rose to a peak in 1976, then** declined and rose again to a smaller peak in 1982 before decreasing slowly for the rest of the period.

- Motor cycle ownership showed a similar irregular pattern from 1970 to 1990 as the population fatality rate. **This suggests that much of the variation in this fatality rate** is reflecting changes in the number of people riding motor cycles.

- Fatality rates per 10,000 motor cycles have fallen by an average of 4.2% each year between 1970 and 1990. **The assumption of a constant average annual change for this rate does** provide an adequate fit to the data. **In contrast to the population fatality rate, this** rate controls for variation in motor cycle ownership.

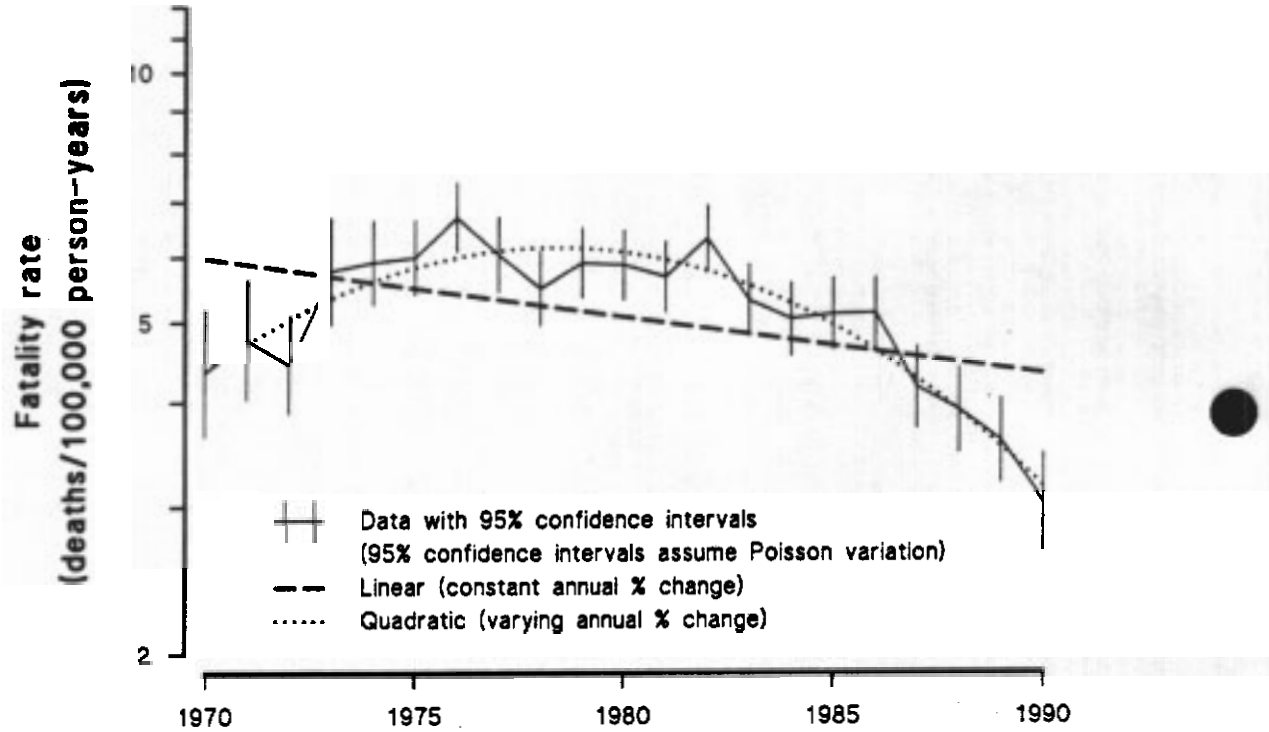
- However, it is not possible to compare this rate for males and females, age groups, times of the day or months because information on motor cycle ownership or use is not available for these groups.

- There is no statistically significant variation between States in the average annual % decrease in vehicle based fatality rates.

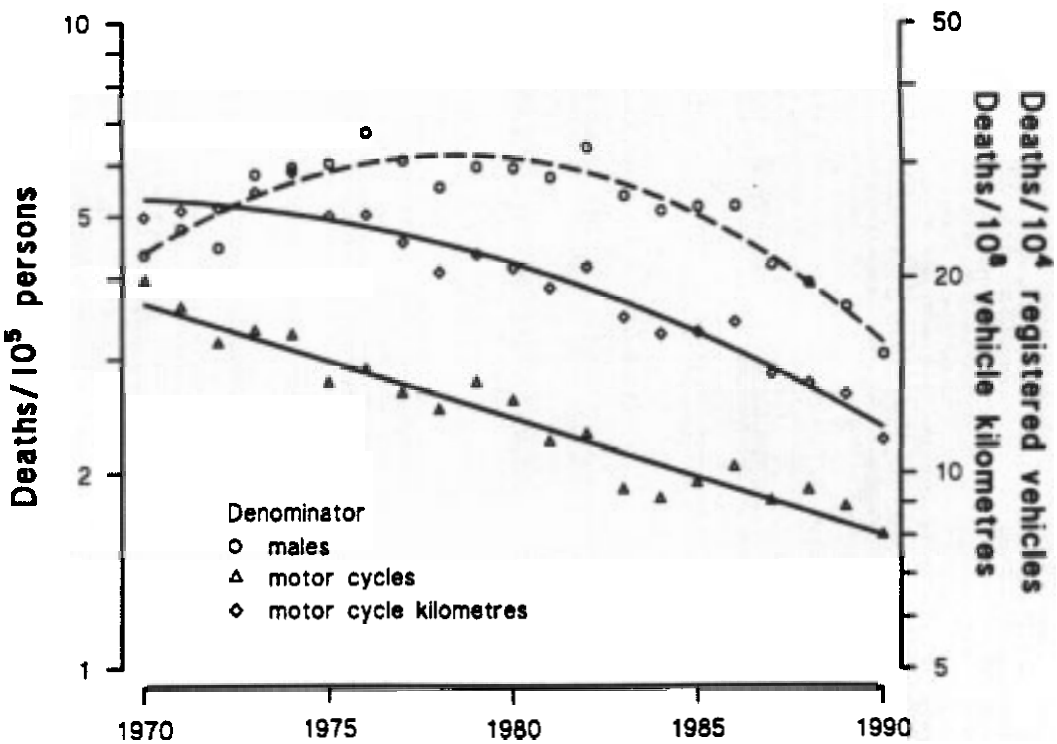
- The trends in fatality rates for different age groups provide evidence of a possible cohort effect. **A possible explanation is that the generation of males who were young adults in** the early 1970's had a high level of motor cycle use. As they have grown older, they have maintained a relatively high level of motor cycle use, whereas subsequent generations, even as young adults, have not ridden motor cycles as much.

**Figure 6.1.1 Fatality rates of male motor cyclists between 1970 and 1990**

**a. per $10^5$ persons with fitted linear and quadratic trends**




**b. per $10^5$ persons, per $10^4$ registered vehicles and per $10^8$ vehicle kilometres**



## 6.1 Fatality rates between 1970 and 1990

**Overall**

Male motor cyclist fatality rates (expressed as deaths/100,000 males) between 1970 and 1990 are shown in Table 6.1.1 and in Figure 6.1.1a. The annual percentage change has varied over this period. The peak fatality rate was 6.7 deaths/100,000 males in 1976, and there was a lesser peak in 1982. Modelling the annual percentage change as a smoothly varying curve gave a markedly better description of the data than assuming that it was constant (see the estimated quadratic and linear curves in Figure 6.1.1a).

The fatality rates in Figure 6.1.1a are deaths/100,000 person-years. Figure 6.1.1b shows this fatality rate, together with fatality rates expressed as deaths/10,000 registered motor cycles and deaths/100 million motor cycle kilometres of travel. The average annual % decrease was similar (4.0% and 4.2%, respectively) for these last two rates, and is greater than for the population based rate (average of 2.0%). In contrast to the population based rate the vehicle based rate is acceptably described as having a constant average annual decrease (Figure 6.1.1b).

Table 6.1.1 Male motor cycle fatality rates between 1970 and 1990, classified by type of rate (/$10^5$ males, /$10^4$ registered motor cycles and /$10^8$ motor cycle kilometres).

| | Fatality rate denominator | | | |
|---|---|---|---|---|
| Year | Persons | Vehicles | Kilometres | Deaths |
| 1970 | 4.3 | 19.7 | 24.9 | 123 |
| 1971 | 4.8 | 17.9 | 25.5 | 137 |
| 1972 | 4.5 | 15.8 | 25.7 | 203 |
| 1973 | 5.8 | 16.5 | 27.2 | 170 |
| 1974 | 5.9 | 16.3 | 29.2 | 277 |
| 1975 | 6.0 | 13.7 | 25.0 | 340 |
| 1976 | 6.7 | 14.4 | 25.0 | 413 |
| 1977 | 6.1 | 13.2 | 22.7 | 339 |
| 1978 | 5.5 | 12.4 | 20.4 | 354 |
| 1979 | 5.9 | 13.7 | 21.7 | 390 |
| 1980 | 5.9 | 12.8 | 20.6 | 393 |
| 1981 | 5.7 | 11.1 | 19.2 | 386 |
| 1982 | 6.4 | 11.4 | 20.7 | 438 |
| 1983 | 5.3 | 9.4 | 17.3 | 373 |
| 1984 | 5.1 | 9.1 | 16.3 | 358 |
| 1985 | 5.1 | 9.6 | 16.4 | 374 |
| 1986 | 5.2 | 10.2 | 17.0 | 381 |
| 1987 | 4.2 | 9.0 | 14.2 | 287 |
| 1988 | 3.9 | 9.4 | 13.7 | 274 |
| 1989 | 3.6 | 8.8 | 13.2 | 280 |
| 1990 | 3.0 | 8.0 | 11.2 | 216 |

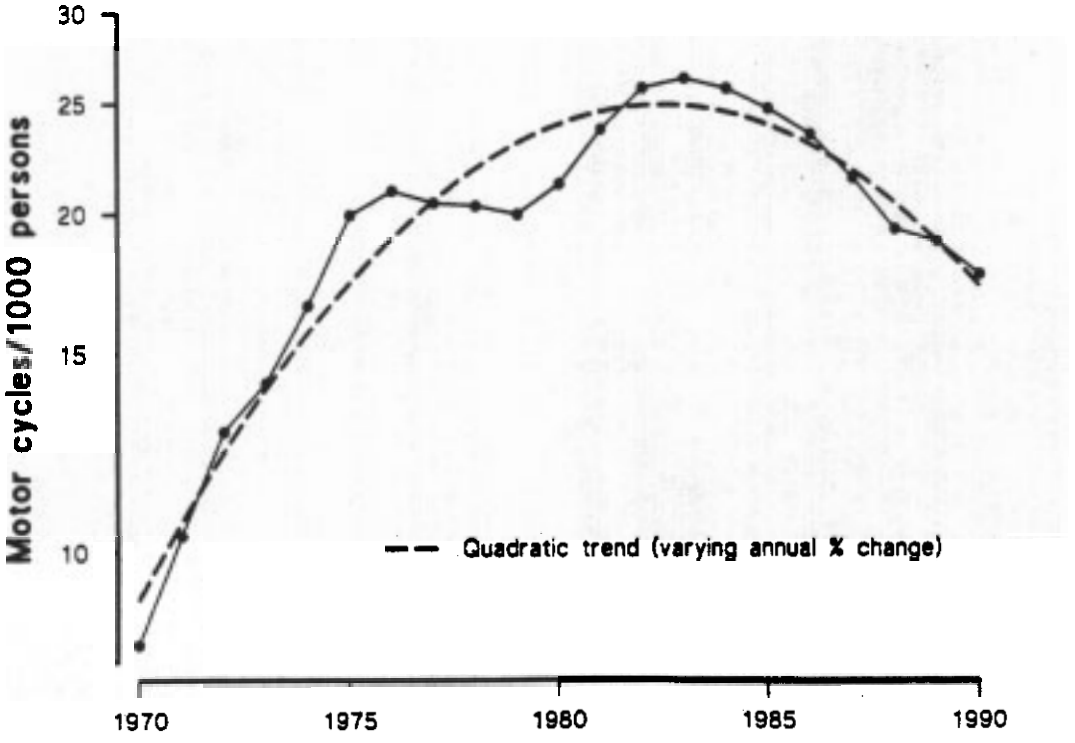
Years of data: Motor cyclist deaths in New South Wales (1970-90), Victoria (1972, 1974-1990), Queensland (1975-1990), South Australia (1970-1989 except 1977, 1987 and 1988), Western Australia (1976-1990), Tasmania (1970-1990), Northern Territory (1989-1990) and the Australian Capital Territory (1985-1989).
At-risk information is from sources described in Section 1.2.

Note: Only male motor cyclist fatalities are analysed in this chapter because the absolute number of female fatalities is too small (see Section 6.2). However the average annual % decrease is similar if females are included (4.2% and 4.4% for the vehicle-based and travel-based fatality rates, and 2.2% for the population-based rate).

This suggests that motor cycle ownership has not followed a regular trend. **Figure 6.1.2** confirms this. Motor cycle ownership rose sharply from 1970 to a first peak in 1976. Ownership then remained fairly steady for a few years before rising to a second higher peak in 1983. Since that year it has been steadily declining until 1990 which has a level of ownership similar to 1974. The two peak years of ownership are also the two peak years of the population fatality rate, and the two curves show the same pattern.

The fatality rate expressed per number of motorcycles has decreased steadily over time, but this did not occur for the population fatality rate because of the changing pattern of motor cycle ownership. This contrasts with the ownership of other vehicles which has grown steadily between 1970 and 1990. This means that for the other modes of road user, the population and vehicle-based fatality rates show similar trends.

**Figure 6.1.2 Motor cycle ownership between 1970 and 1990**



**States and Territories**

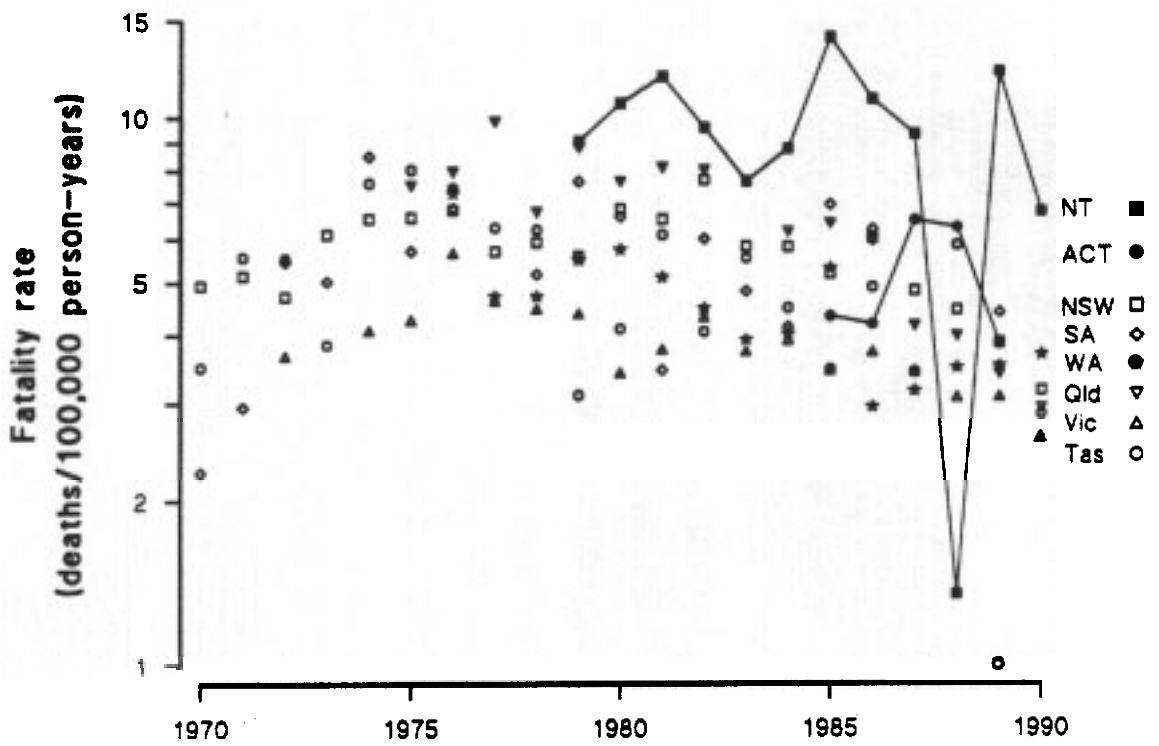
Most of the States had a similar trend in population fatality rates as that for the overall rate (Figures 6.1.3a and 6.1.3b).

Vehicle-based rates for motor cycle deaths are generally higher in the Northern Territory and the ACT than elsewhere (Figure 6.1.4a). Of the States (Figure 6.1.4b), New South Wales and Tasmania had high rates, while Queensland and Western Australia had low rates.

There was no statistically significant variation between States in the average annual % change in the vehicle fatality rate ($F_{5,1054} = 1.8$, $p > 0.05$). The largest estimated % decreases were for Victoria and Western Australia (5.3% and 4.9% respectively), and the least was South Australia (2.0%).

**Figure 6.1.3 Population fatality rates of motor cyclists between 1970 and 1990**

**a. for each State and Territory**




**b. for each State (with fitted trends)**

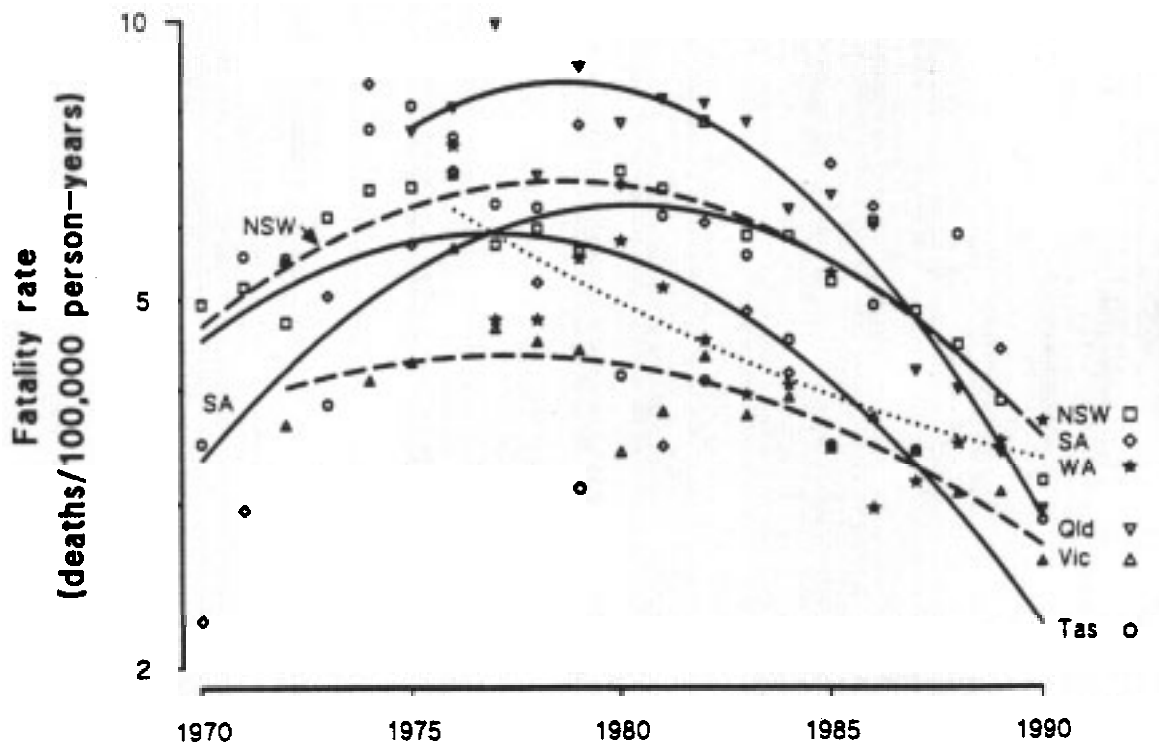
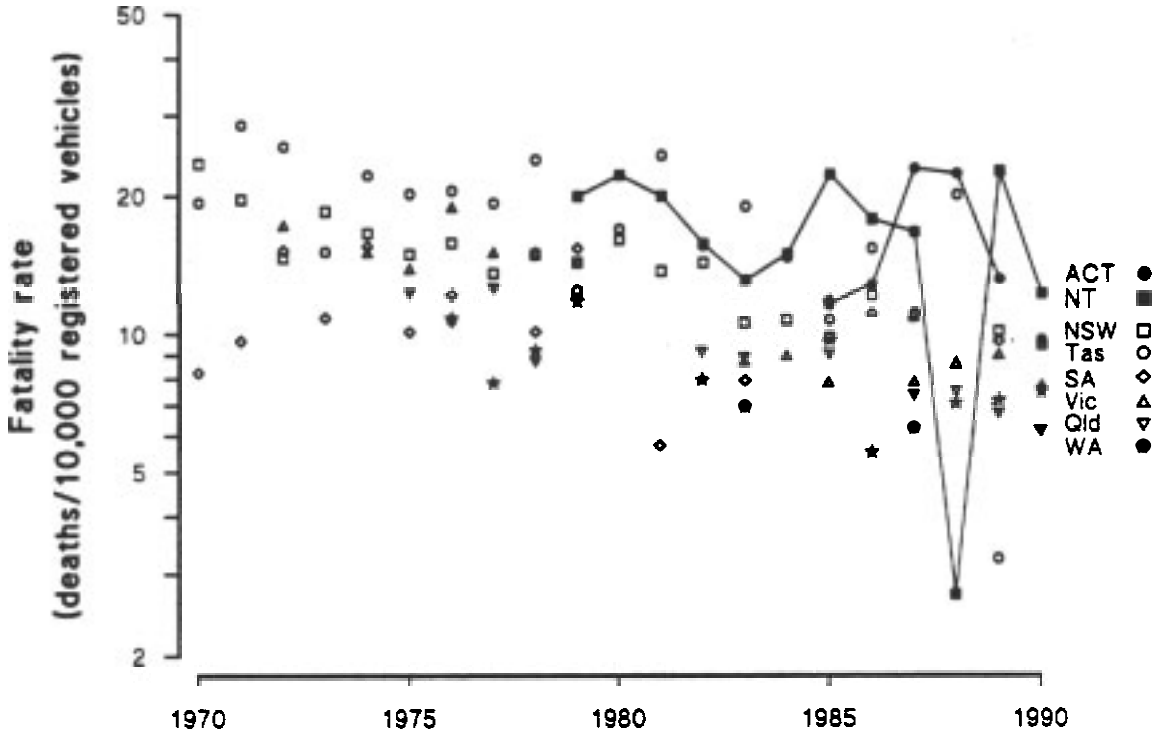
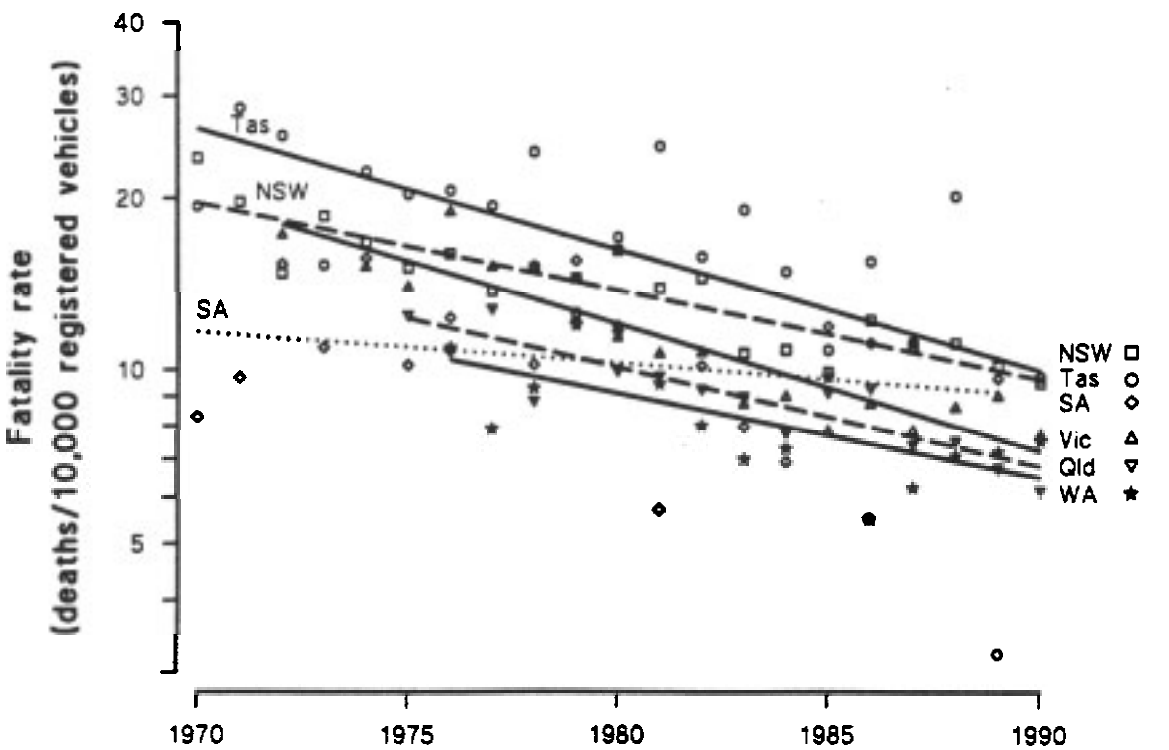


**Figure 6.1.4 Vehicle fatality rates of motor cyclists between 1970 and 1990**

**a. for each State and Territory**




**b. for each State (with fitted trends)**



## 6.2 Variation in fatality rates

**Gender**

Over 94% of motor cyclist fatalities were male. The absolute number of female deaths in the data set is too small (394) to obtain a reliable estimate of the difference between males and females in the annual trend.

**Age group**

Figure 6.2.1 shows the trends in motor cycle fatality rates for each age group for males. These are population rates as it is not possible to calculate vehicle based rates by age because ownership of vehicles by age is not known. Motor cyclist fatality rates were highest for 17 to 19 year olds and were successively lower for each older age group. Males aged over 40 years are combined into one group as they had very few fatalities.

For each age group, a quadratic curve was a better description of the data than a straight line, as was true for the overall population fatality rate. The maximum fatality rate occurred at a progressively later time for each older age group. From the fitted curves, for the 17 to 19 year olds it was around 1974, for the 20 to 24 year olds around 1980, the 25 to 29 year olds around 1983 and for the 30 to 39 year olds it was around 1990. This suggests that motor cycle use and thus the population fatality rate has been influenced by a cohort effect.

An explanation for this is that motor cycles were most popular in the early 1970's when ownership was growing at its fastest rate. The young group of people who first owned motor cycles at this time have continued to have high ownership. However, by the mid 1970's, ownership among potential new riders was decreasing. This is reflected in the decreasing fatality rate for the youngest age groups. Over time, the high ownership group gets older, and each younger age group is composed of newer riders only and has a lower ownership rate.

**Figure 6.2.1 Population fatality rates of motor cyclists between 1970 and 1990 for males aged 5 years and older (in 6 age groups)**

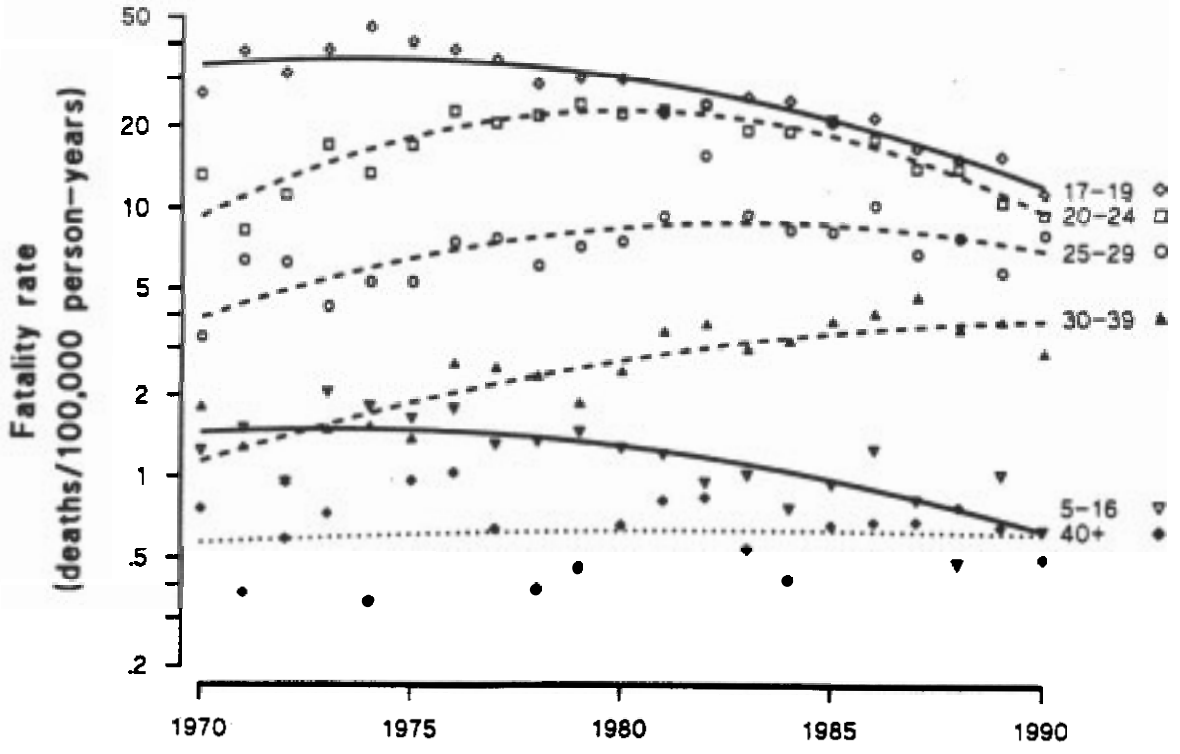
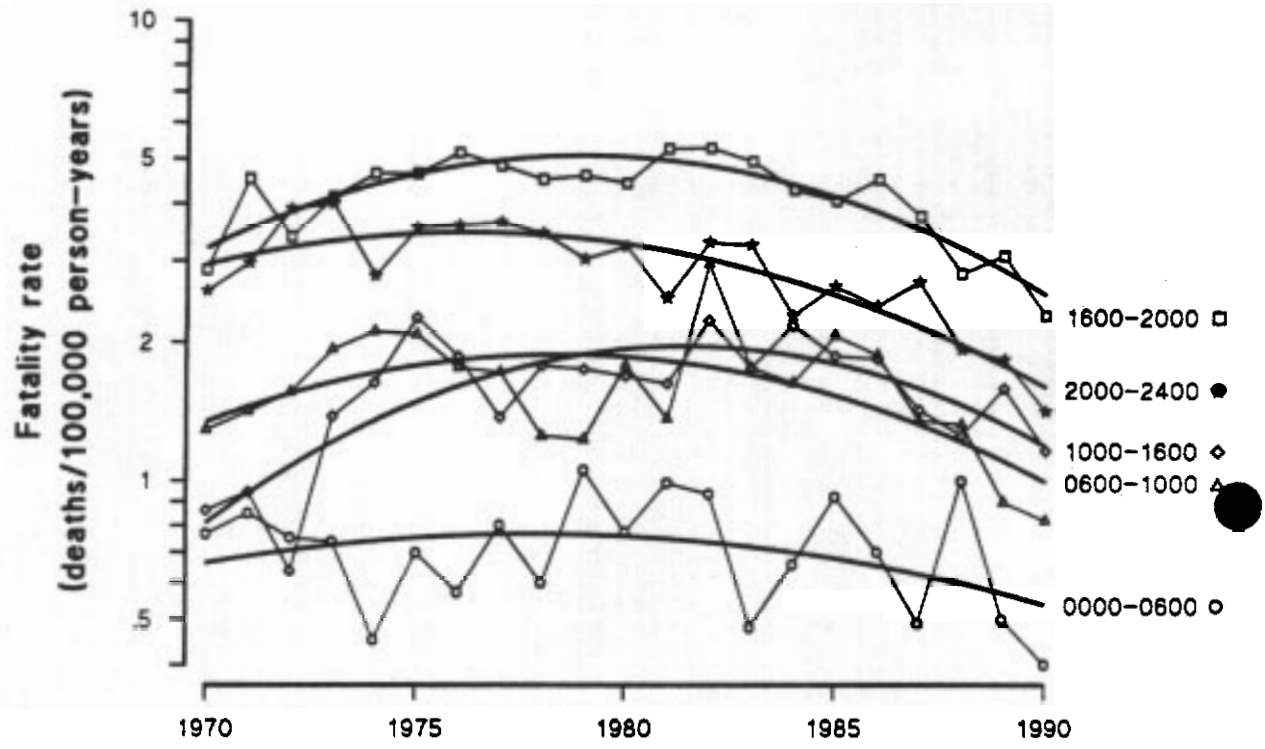
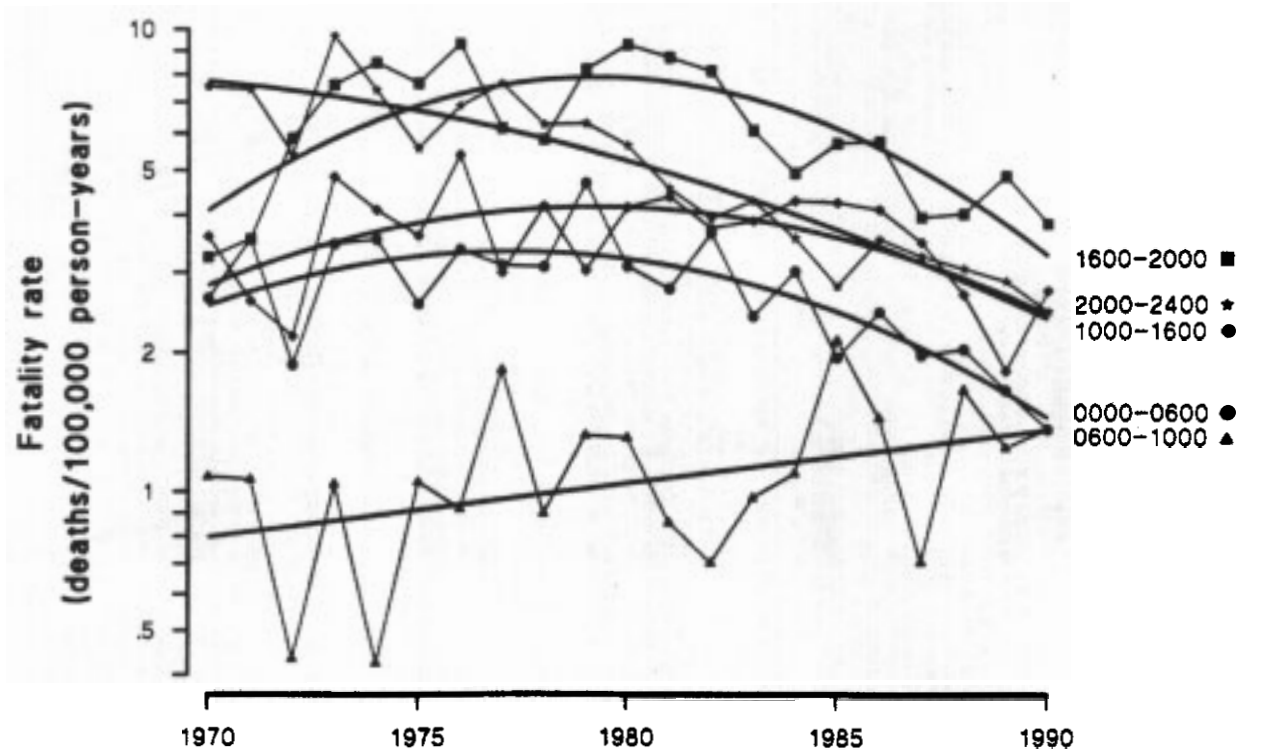


**Figure 6.2.2 Population fatality rates of motor cyclists between 1970 and 1990**

**a. during the week**




**b. during the weekend**



**Time of week**

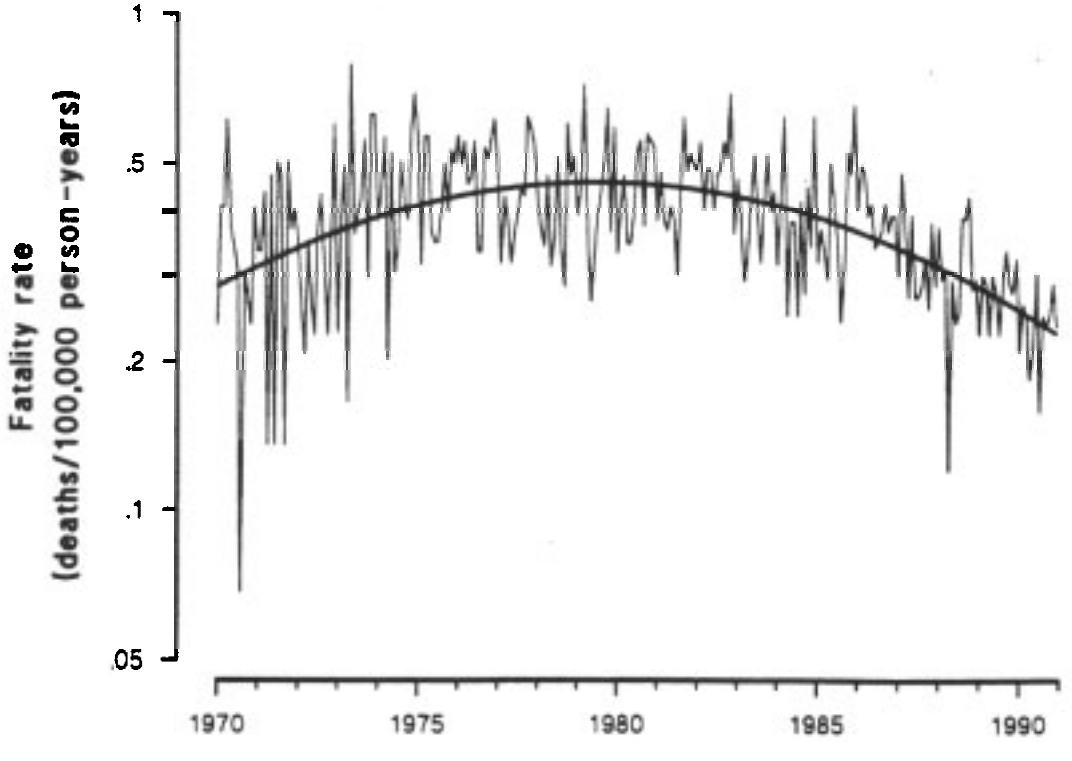
Both during the week and on the weekend, the highest male motor cyclist fatality rates were for the early evening (4pm to 8pm; Figures 6.2.3a and 6.2.3b), followed by day and late evening (10am to 4pm; 8pm to midnight), and night and morning (midnight to 10am).

The fatality rates for most periods mimic the overall trend, with a peak during the early 1980's followed by a slow decline. These rates are not adequately summarised by a single estimate of constant percentage change. This is especially true of the early evening (4pm to 8pm) which had the highest rates. The late evening (8pm to midnight) had the greatest decline between 1970 and 1990. In the early 1970's, the two evening periods had similar rates, but by 1990 the late evening period had lower rates. Overall, the variation in fatality rates between periods appears to have lessened.

**Month**

Monthly motor cyclist fatality rates show considerable variation about the long-term trend (Figure 6.2.3).

**Figure 6.2.3 Population fatality rates of male motor cyclists between 1970 and 1990 by month**



# 7. Bicyclists

- Fatality rates, per 100,000 persons, for bicyclists have fallen by an average of 1.0% each year between 1970 and 1990.

- This decrease is not statistically significantly different between the States.

- Males constitute 86% of bicycle fatalities. The average annual percentage decrease is not statistically significantly different between males and females.

- The average annual percentage decrease varied with age. Schoolchildren (5 to 16 years) had the greatest decrease (average of 2.2% each year). Young adults (17 to 29 years) had an average increase of 1.4% each year and older adults (30 years and older) had a very small decrease (average of 0.3% each year).

  - The variation between age groups may vary with the time of the week. In particular, 5 to 12 years olds had an average estimated increase of 3.4% each year for weekday mornings (6am to 10am).

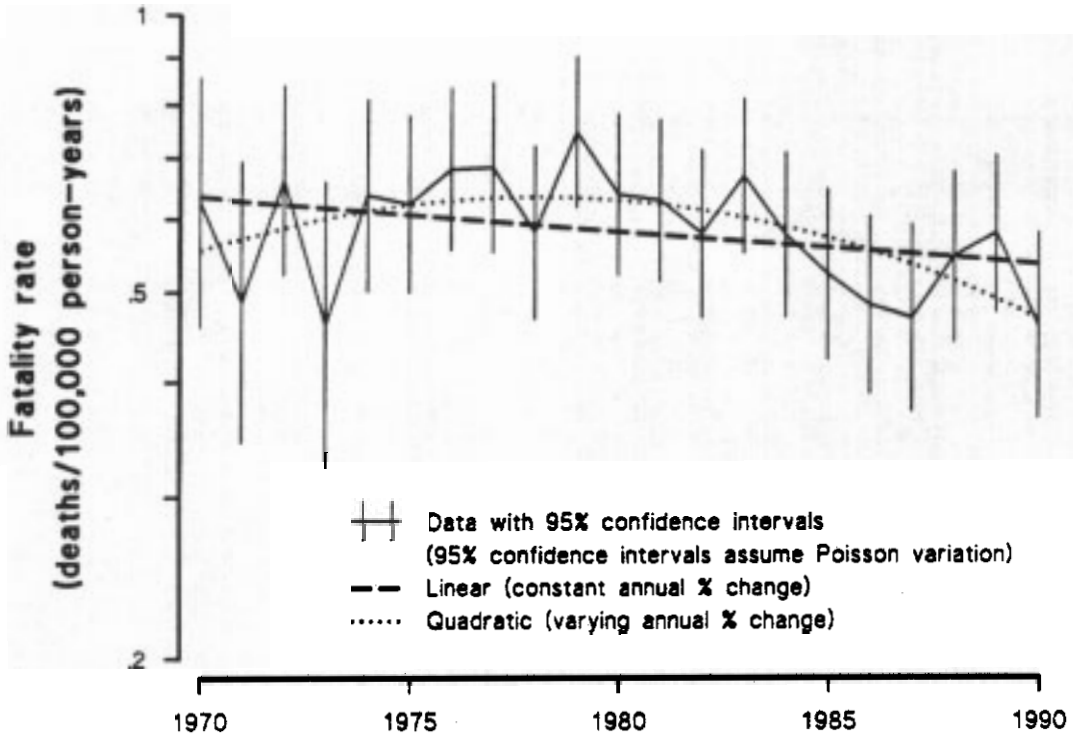
- During the week, the evening period (4pm to midnight) had an average decrease of 2.1% each year, while the daytime (6am to 4pm) had an average increase of 1.1% each year. Weekend late evening (8pm to midnight) had the greatest decrease (average of 9.1% each year), while the day and early evening had a lesser decrease (average of 1.6% each year). Other periods had too few fatalities for analysis.

- The average annual percentage decrease in fatality rates varied with month. April had the greatest decrease (average of 7.2% each year,) while January had an average increase of 2.7% each year.

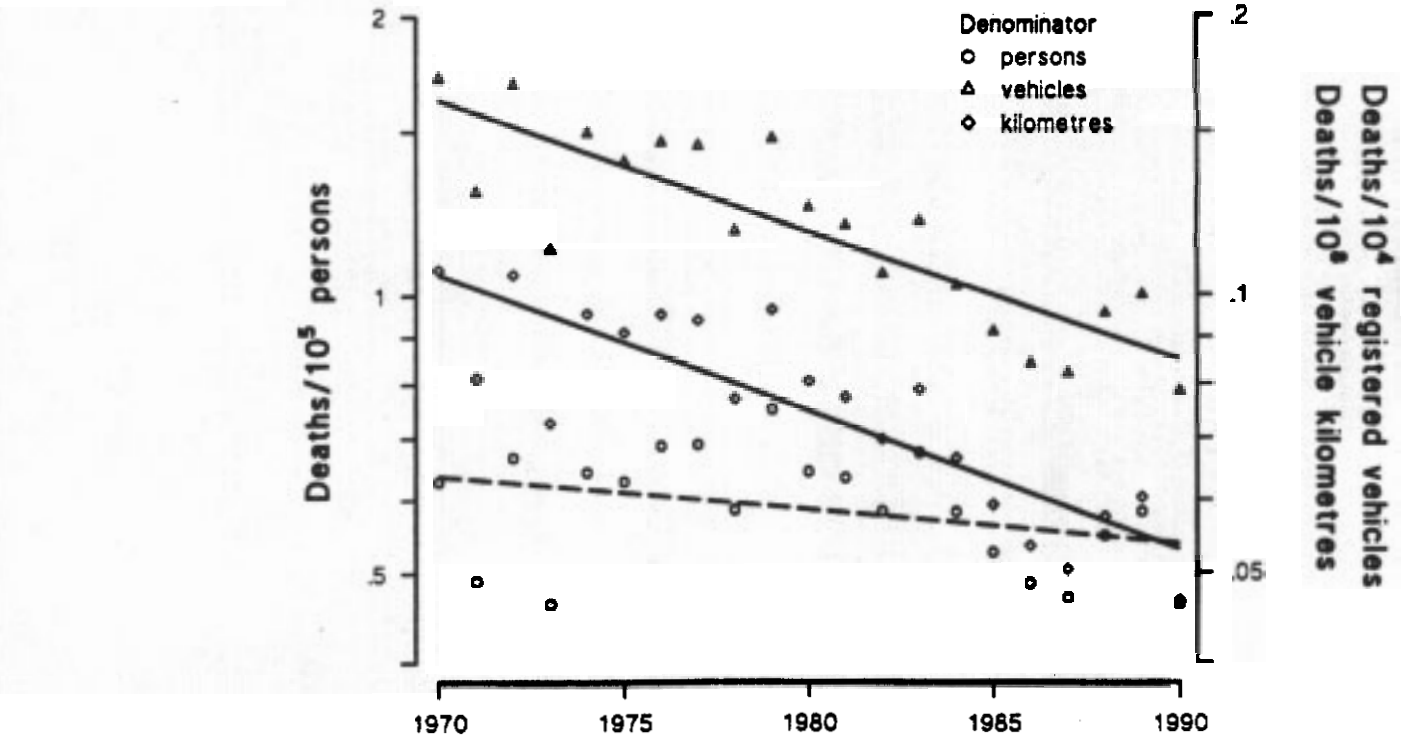
- Fatality rates, per 10,000 registered vehicles (not bicycles), fell by an average of 3.4% each year between 1970 and 1990.

**Figure 7.1.1 Fatality rates of bicyclists between 1970 and 1990**

**a. per $10^5$ persons with fitted linear and quadratic trends**




**b. per $10^5$ persons, per $10^4$ registered vehicles and per $10^8$ vehicle kilometres**



## 7.1 Fatality rates between 1970 and 1990

**Overall**

Bicyclist fatality rates have fallen from 0.63 deaths/100,000 persons in 1970 to 0.46 deaths/100,000 persons in 1990 (Figure 7.1.1a). The average % decrease in the rate was 1.0% each year, giving an estimated decrease over twenty years of 18%. A 95% confidence interval for the annual % decrease is 0.4% to 1.6%.

For 1970 to 1990 overall, the description of the bicyclist fatality rate as decreasing by an average of 1.0% annually is only approximate. Bicyclists comprise only 3% of all road fatalities, and there were usually fewer than 100 deaths per year. There were large fluctuations in the number of fatalities from year to year. In the late 1970's, the bicyclist fatality rate was mostly increasing and reached a peak in 1979 before again decreasing.

Modelling the annual percentage change as a smoothly varying curve did give a reasonable description of the data (see the estimated quadratic curve in Figure 7.1.1a). However, the assumption of a constant annual decrease does not appear to be misleading and further analysis has been performed using this summary measure.

The fatality rates in Figure 7.1.1a are deaths/100,000 person-years. Figure 7.1.1b shows this fatality rate, together with fatality rates expressed as deaths/10,000 registered motorised vehicles and deaths/100 million motorised vehicle kilometres of travel. The average annual % decrease is similar (3.4% and 3.7% respectively) for these last two rates, and is greater than for the population based rate (1.0%). That is, even though the number and use of motorised vehicles grew between 1970 and 1990, the bicyclist fatality rate decreased over this period.

Except for analyses by State, all later analyses are of the population based rate only. Unlike drivers, passengers and motor cyclists, the vehicle based rates do not take into account the amount of bicycle travel undertaken as vehicles are not defined to include bicycles. Instead, the risk of being hit by a vehicle on the road will be reflected to a degree by the number of vehicles and their total distance travelled.

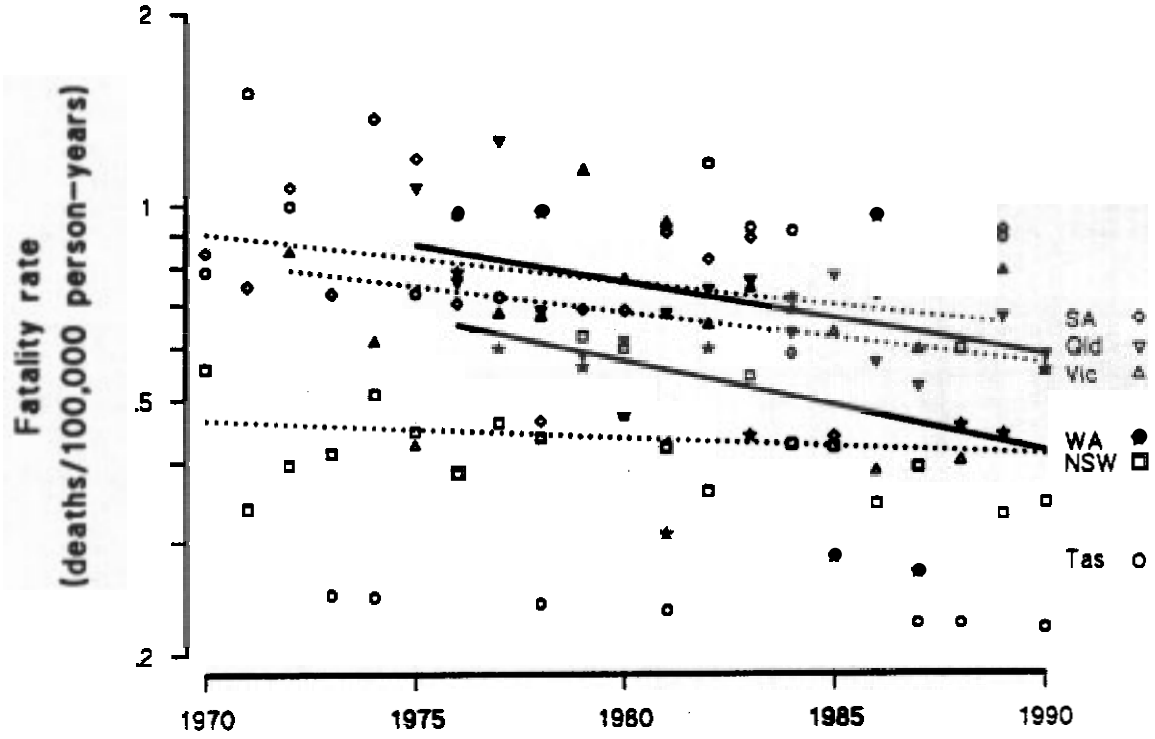
Table 7.1.1 Bicyclist fatality rates between 1970 and 1990, classified by type of rate (/$10^5$ persons, /$10^4$ registered vehicles and /$10^8$ vehicle kilometres).

| | Fatality rate denominator | | | |
|---|---|---|---|---|
| Year | Persons | Vehicles | Kilometres | Deaths |
| 1970 | .63 | .17 | .107 | 39 |
| 1971 | .49 | .13 | .081 | 31 |
| 1972 | .67 | .17 | .105 | 67 |
| 1973 | .46 | .11 | .072 | 30 |
| 1974 | .64 | .15 | .095 | 66 |
| 1975 | .63 | .14 | .091 | 78 |
| 1976 | .68 | .15 | .095 | 92 |
| 1977 | .69 | .15 | .094 | 84 |
| 1978 | .58 | .12 | .077 | 82 |
| 1979 | .75 | .15 | .096 | 106 |
| 1980 | .64 | .12 | .080 | 93 |
| 1981 | .63 | .12 | .077 | 93 |
| 1982 | .58 | .11 | .070 | 87 |
| 1983 | .67 | .12 | .079 | 102 |
| 1984 | .58 | .10 | .066 | 89 |
| 1985 | .53 | .09 | .059 | 83 |
| 1986 | .49 | .08 | .053 | 78 |
| 1987 | .47 | .08 | .050 | 70 |
| 1988 | .55 | .10 | .058 | 83 |
| 1989 | .58 | .10 | .060 | 98 |
| 1990 | .46 | .08 | .047 | 71 |

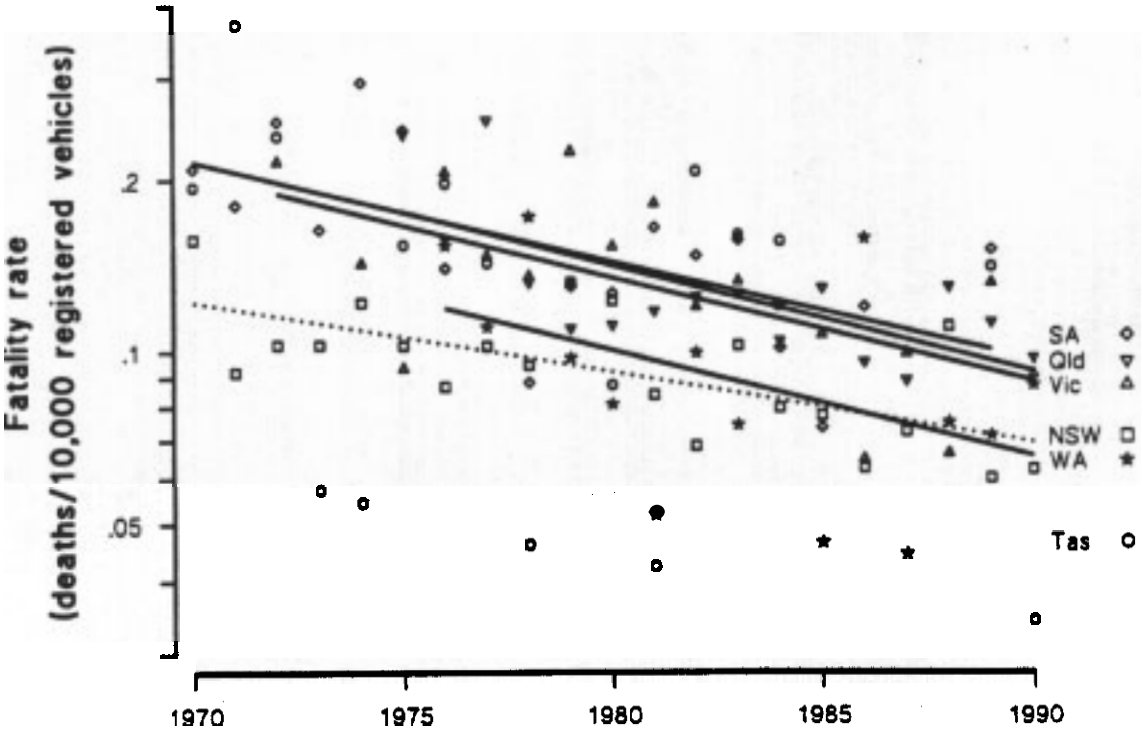
Years of data: Bicyclist deaths in New South Wales (1970-90), Victoria (1972, 1974-1990), Queensland (1975-1990), South Australia (1970-1989 except 1977, 1987 and 1988), Western Australia (1976-1990), Tasmania (1970-1990), Northern Territory (1989-1990) and the Australian Capital Territory (1985-1989).
At-risk information is from sources described in Section 1.2.

**Figure 7.1.2 Fatality rates of bicyclists between 1970 and 1990 for each State:**

**a. Population fatality rates**




**b. Vehicle fatality rate**




Note: Tasmania had no fatalities in 1979, 1985 and 1986 and the fitted lines are not plotted

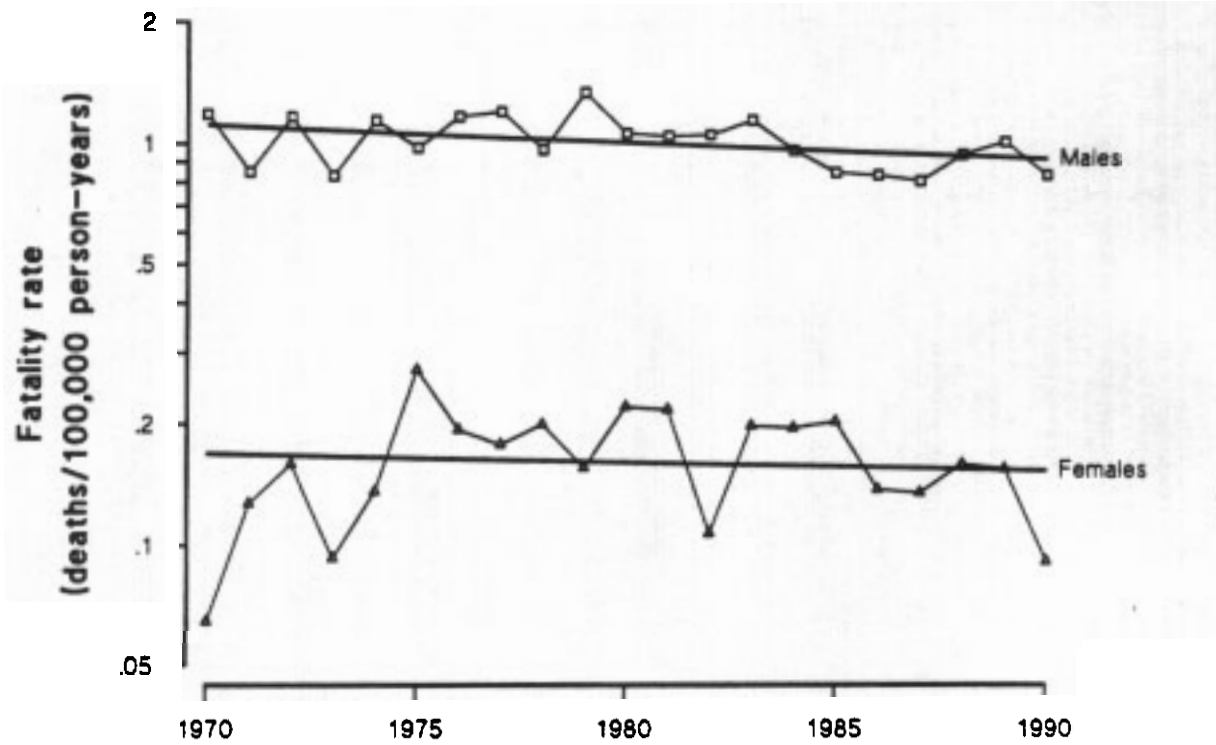
**States and Territories**

Population rates for bicyclist deaths fluctuated greatly for all States, particularly Western Australia and Tasmania which had few fatalities (Figure 7.1.2a). Of the larger States, New South Wales had the lowest rate most consistently (Figure 7.1.2b). It also had the lowest average annual % decrease. Although Western Australia and Tasmania were estimated to have had the highest average annual % decreases, these figures are not reliable due to the small number of fatalities for these States. The variation between States in the average annual % change was not statistically significant ($F_{5,504} = 1.4$, $p > 0.05$).

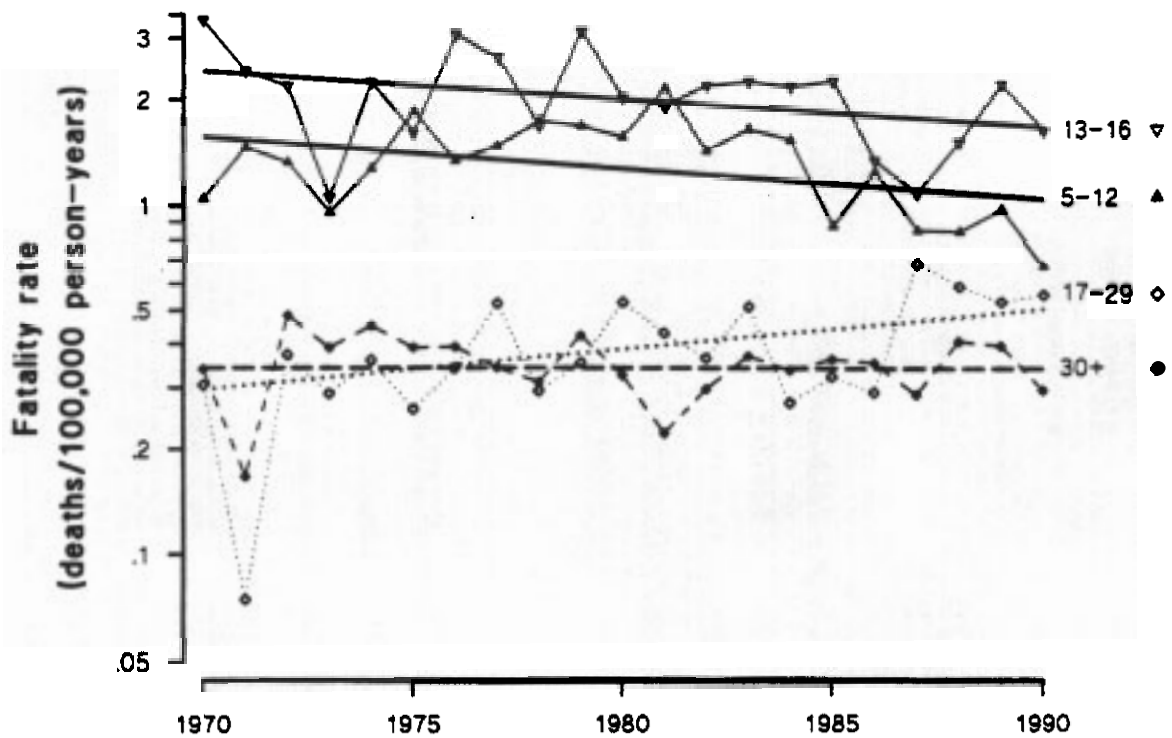
These patterns are broadly similar when the rates are expressed as deaths per 10,000 registered vehicles (Figure 7.1.2b).

**Figure 7.2.1 Population fatality rates of bicyclists between 1970 and 1990**

**a. for males and females**




**b. for persons aged 5 years and older (in 4 age groups)**



## 7.2 Variation in fatality rates

**Gender**

Males comprised 86% of bicycle fatalities. Male bicyclist fatality rates were about ten times higher than those for females. **However, the average annual decreases for males and females** were similar. The average annual % decrease was 1.1% for males and 0.8% for females and the difference was not statistically significant ($F_{1,508} = 0.1$, $p > 0.05$). The description of the change for males as an average constant % change between 1970 and 1990 gives an acceptable fit to the data **(Figure 7.2.1)**. The female fatality rate fluctuates greatly due to the low absolute number of fatalities, particularly in the early 1970's when the available data comprised fewer than 10 bicycle fatalities per year.

**Age group**

Bicyclists have been categorised into four age groups. **These** age groups were chosen to ensure sufficient fatalities in each age group for meaningful analysis.

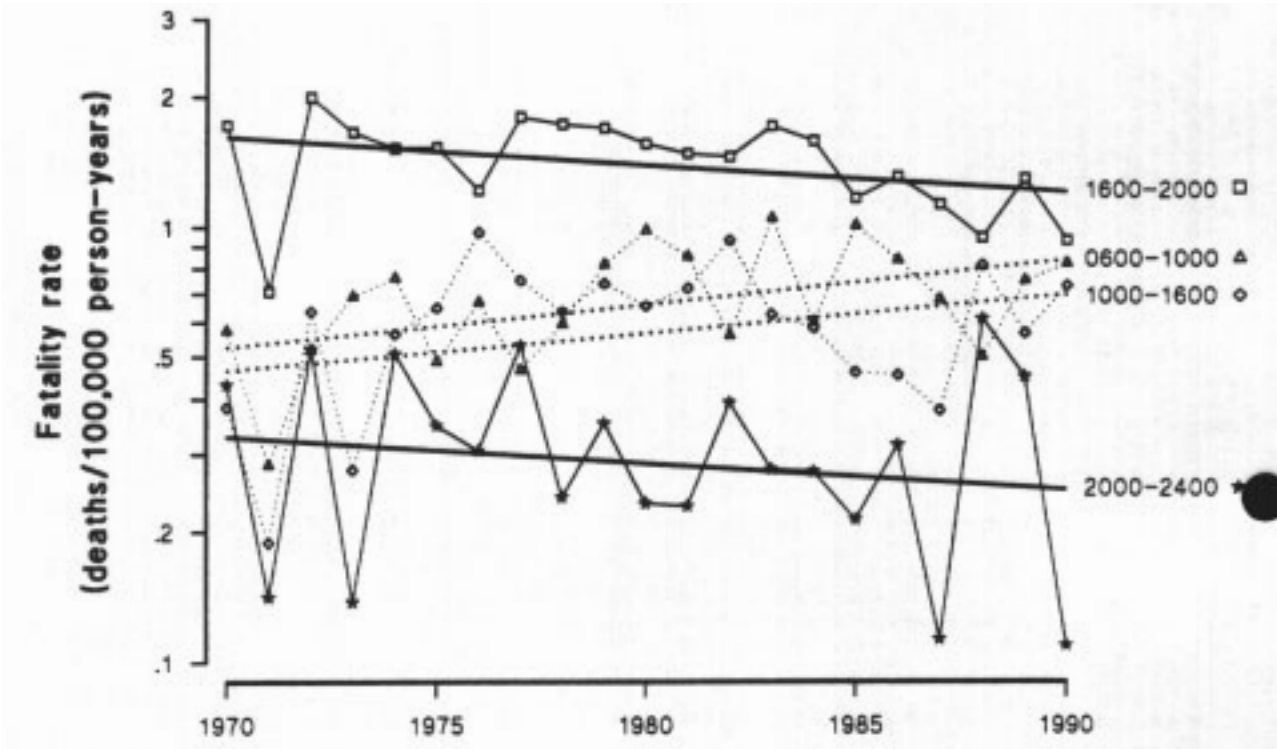
Bicyclist fatality rates were highest for 13 to 16 year olds, which were about one-and-a-half times those for 5 to 12 year olds. **For the two adult age groups, these rates were about one** quarter of those of the 5 to 12 year olds.

For each age group, there has been considerable fluctuation in fatality rates from year to year (Figure 7.2.2). The school age groups had similar average annual % decreases of 2.0% for 5 to 12 year olds and 2.4% for 13 to 16 year olds. The rate for persons aged 30 years and older remained almost constant with an average annual decrease of 0.3%, while that for 17 to 29 year olds had an average annual **increase** of 1.4%. **The rate for this group was less than** that for the oldest adults (30 years and older) during the 1970's, but was greater during most of the 1980's.

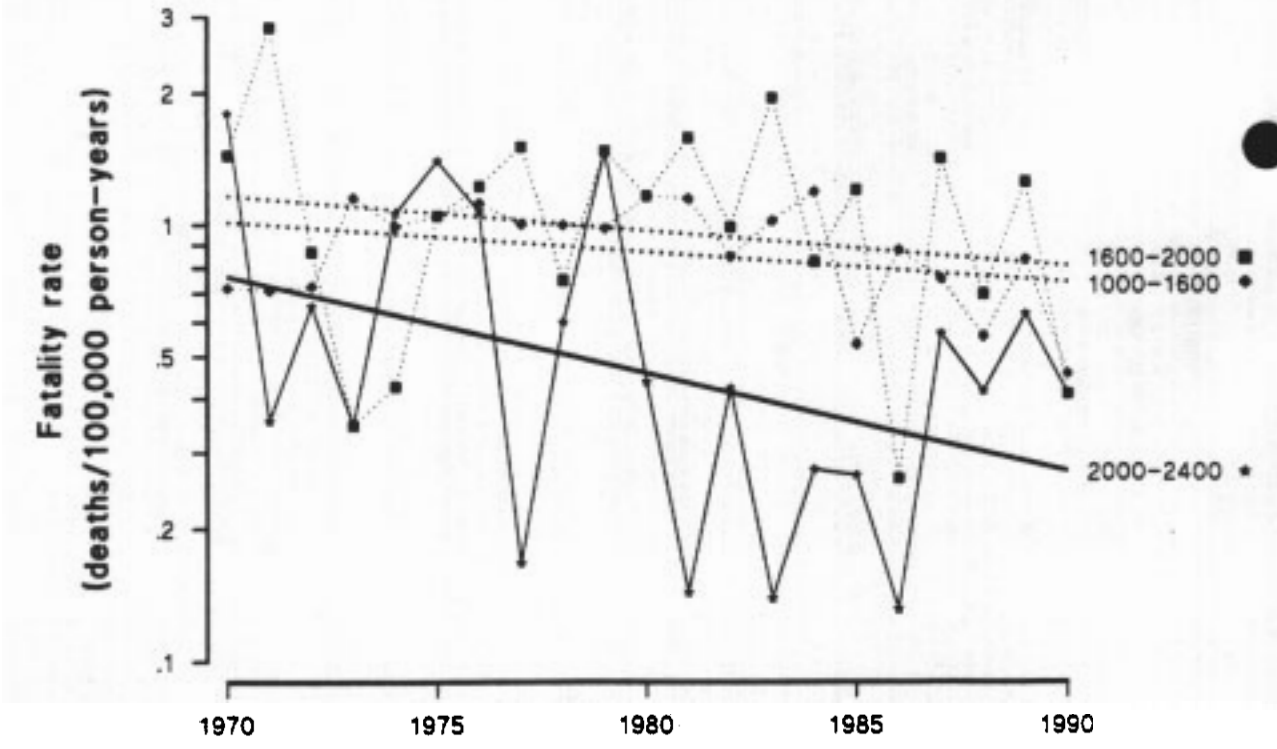
The variation in % changes between age groups was statistically significant ($F_{4,505} = 7.4$, $p < 0.001$).

**Figure 7.2.2 Population fatality rates of bicyclists between 1970 and 1990**

**a. during the week**




**b. during the weekend**




Note: One week day period and two weekend periods are omitted

**Time of week**

There were very few bicycle fatalities for some time periods. **Three** periods averaged fewer than two deaths annually. **Reliable estimates of the trends for these** three periods (midnight to 6am, weekday and weekend; 6am to 10am weekend) cannot be obtained.

Fatality rates fluctuated from year to year for the other time periods as well (Figures 7.2.3a and 7.2.3b). **Generally, the highest fatality rates were for the evening (4pm to 8pm) during** the week, followed by the same period during the weekend. **Of the remaining five periods, the** late evening (8pm to midnight) for both weekdays and weekend generally had the lowest rates and the other three periods were in between (10am to 4pm, weekday and weekend; 6am to 10am weekdays). Unlike other modes, there was little difference between weekday rates and weekend rates. An exception was the morning (6am to 10am), which had higher rates during the week.

The variation between times of the week in the average annual percentage decreases in the bicycle fatality rate was statistically significant ($F_{9,500} = 5.6$, $p < 0.001$). During the week, the evening periods had a decrease (4pm to midnight; 2.1%), whereas the daytime had an increase (6am to 4pm; +1.1%).

Day and evening (10am to 8pm) during the weekend had an average annual decrease of 1.6%. By far the largest decline was for the weekend late evening (8pm to midnight; average of 9.1%). However, this period also had very large yearly fluctuations.

**Month**

Monthly bicyclist fatality rates for males and for females show considerable variation about the long-term trend (Figure 7.2.4). **There is evidence that the fatality rate differed with** month (between months $F_{11,588} = 4.2$, $p < 0.001$; seasonal sinusoidal variation $F_{2,588} = 4.7$, $0.001 < p < 0.01$). January and April are the extreme months. January had an average annual % **increase** of 2.7%, while April had a large decrease of 7.2%. May, August and September also had above average decreases.

**Figure 7.2.3 Population fatality rates of bicyclists between 1970 and 1990 by month**

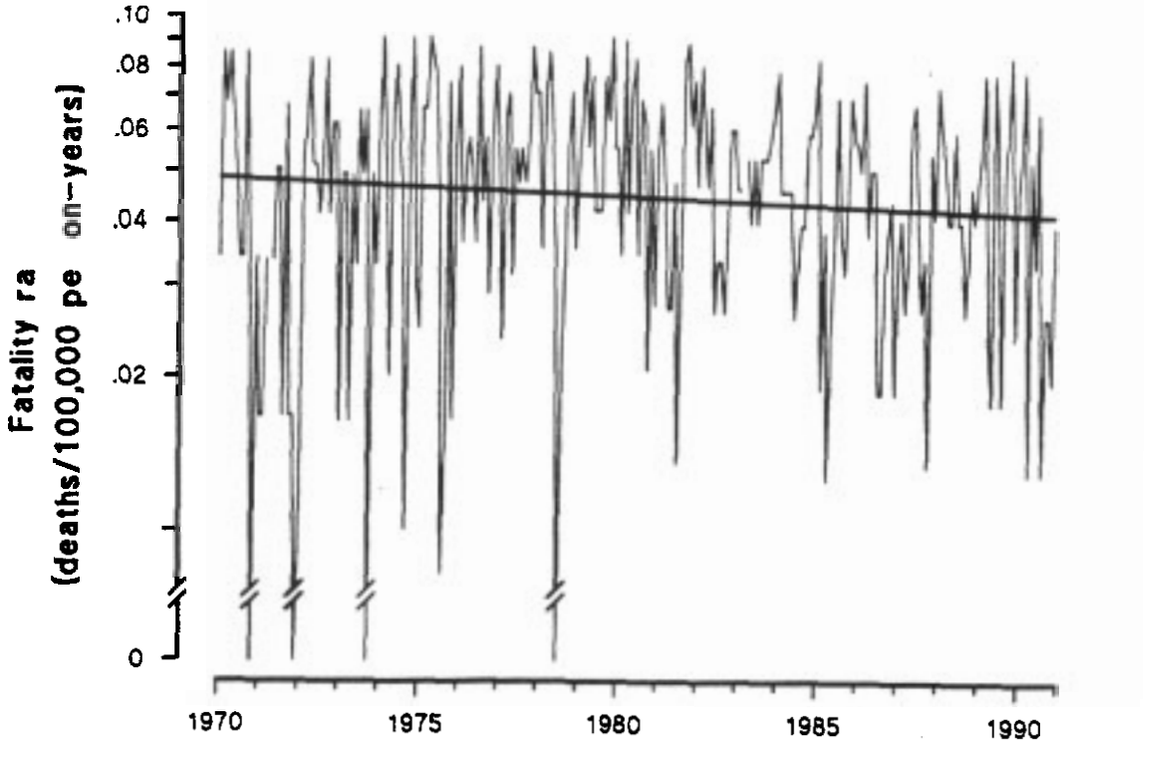
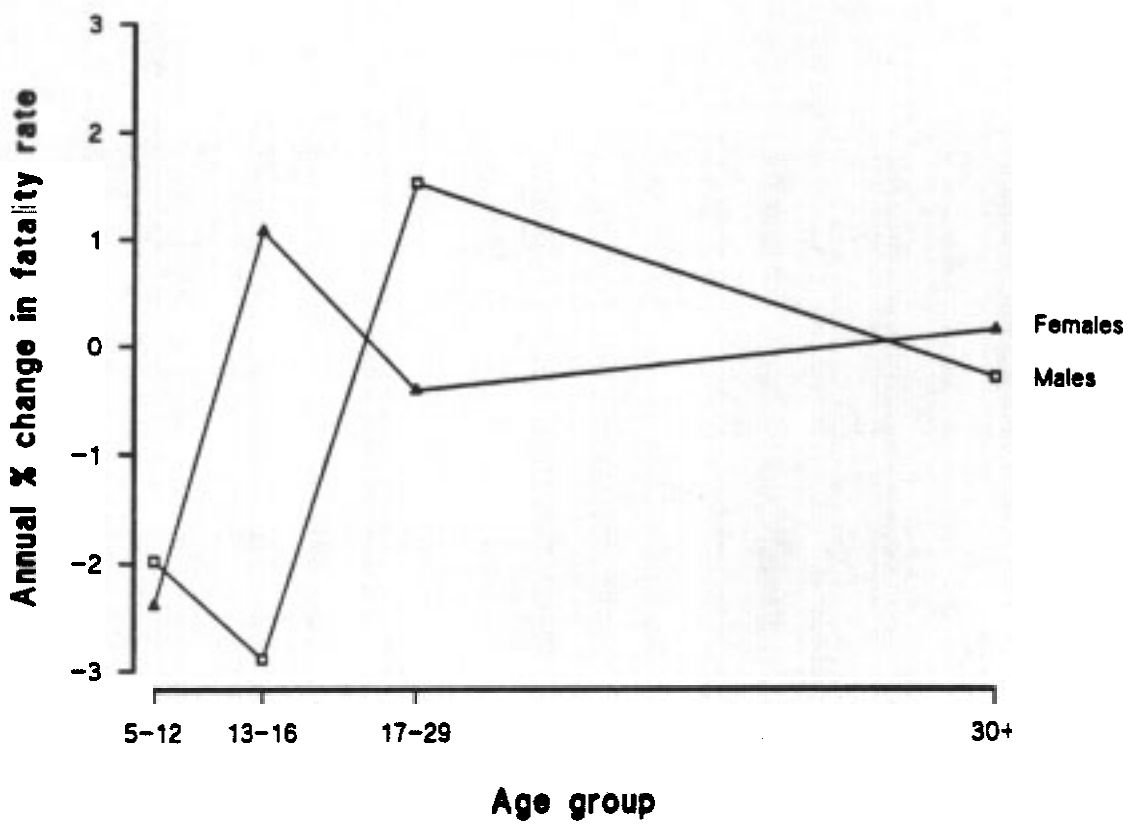
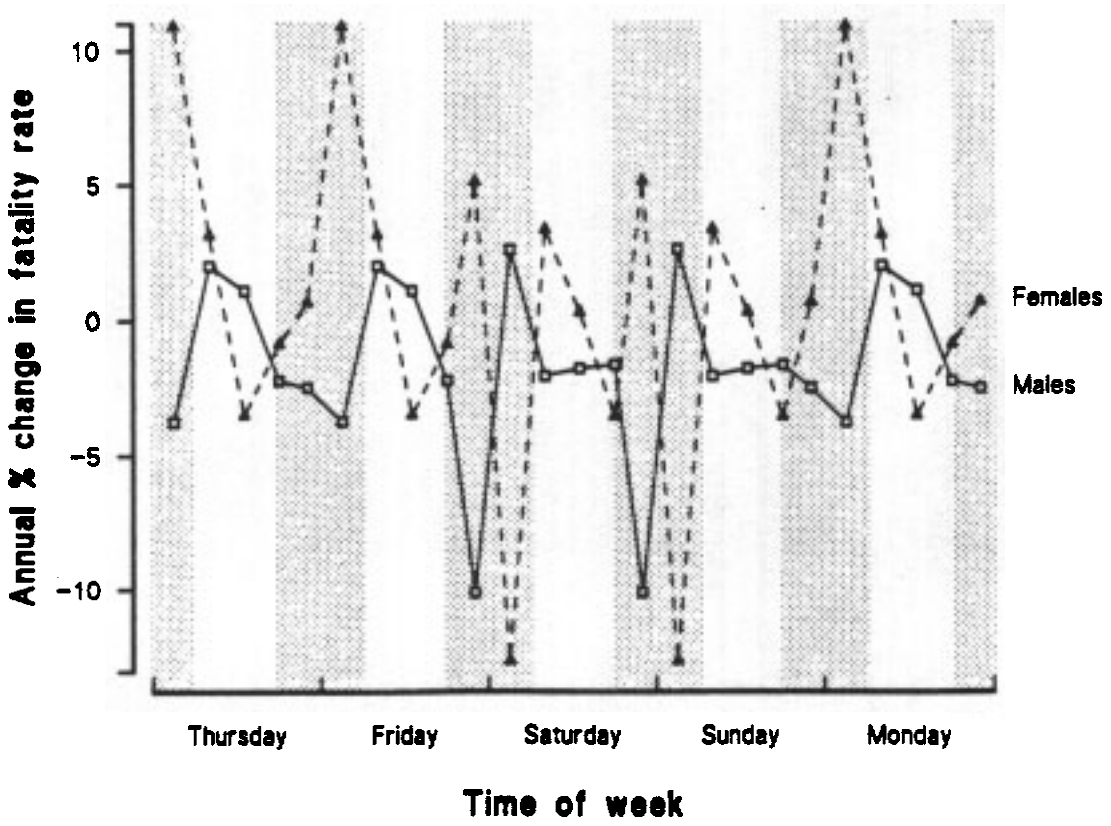


**Figure 7.3.1 Average annual % change in population fatality rate of bicyclists**

**a. for males and females by age group**




**b. for males and females by time of week**




Note: Shaded areas denote night (6pm to 6am)

## 7.3 Average annual % decrease in fatality rates

The small number of fatalities for bicyclists, especially compared with other modes, means that estimates of average annual % changes classified by two variables generally have high variances and may not be reliable.

The average annual % decrease in bicyclist fatality rates did not differ statistically significantly for males and females (Figure 7.2.1). **Male-female differences between the age groups were not statistically significant** ($F_{4,441} = 1.6$, $p > 0.05$; Figure 7.3.1a; Table 7.3.1).

Male-female differences in the pattern of average annual % decrease in bicyclist fatality rates with time of week were nominally statistically significant ($F_{9,450} = 2.8$, $0.001 < p < 0.01$; Figure 7.3.1b; Table 7.3.1).

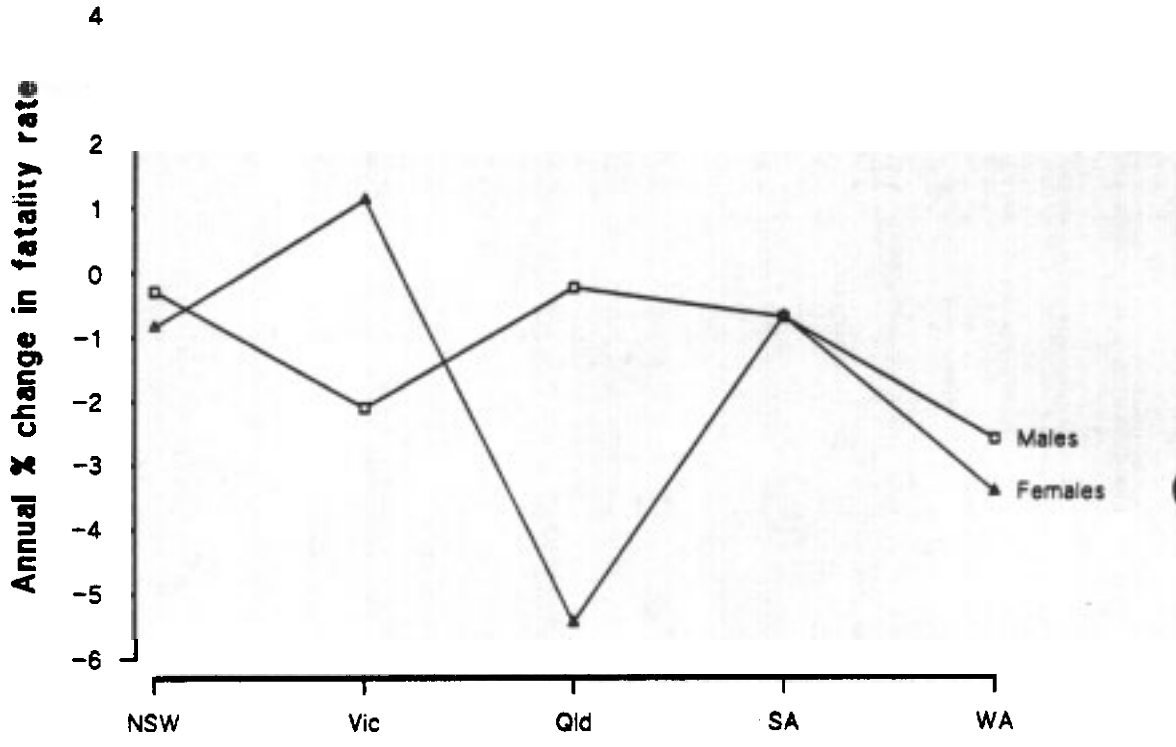
Table 7.3.1 Average annual % decrease in bicyclist fatality rates (deaths per person) between 1970 and 1990, classified by gender, by gender and age group, by gender and time of week, and by gender and State.

| | Gender | | |
|---|---|---|---|
| Group | Males | Females | Persons |
| **Total** | 1.1 | 0.8 | 1.0 |
| **Age group** | | | |
| 5-12 | 2.0 | 2.4 | 2.0 |
| 13-16 | 2.9 | +1.1 | 2.4 |
| 17-29 | +1.5 | 0.4 | +1.4 |
| 30+ | 0.3 | +0.2 | 0.3 |
| **Time of week** | | | |
| Weekday | | | |
| 0000-0600 | 3.8 | +10.9 | 3.5 |
| 0600-1000 | +2.0 | +3.1 | +2.1 |
| 1000-1600 | +1.1 | 3.5 | +0.3 |
| 1600-2000 | 2.2 | 0.9 | 2.1 |
| 2000-2400 | 2.5 | +0.7 | 2.4 |
| Weekend | | | |
| 0000-0600 | +2.6 | 12.6 | +1.2 |
| 0600-1000 | 2.0 | +3.3 | 1.8 |
| 1000-1600 | 1.8 | +0.3 | 1.5 |
| 1600-2000 | 1.6 | 3.6 | 1.8 |
| 2000-2400 | 10.1 | +5.1 | 9.1 |
| **State** | | | |
| Tasmania | 6.2 | +11.0 | 5.4 |
| Western Australia | 2.6 | 3.4 | 2.7 |
| Queensland | 2.1 | +1.1 | 1.7 |
| South Australia | 0.2 | 5.4 | 1.2 |
| New South Wales | 0.7 | 0.7 | 0.7 |
| Victoria | 0.3 | 0.8 | 0.3 |

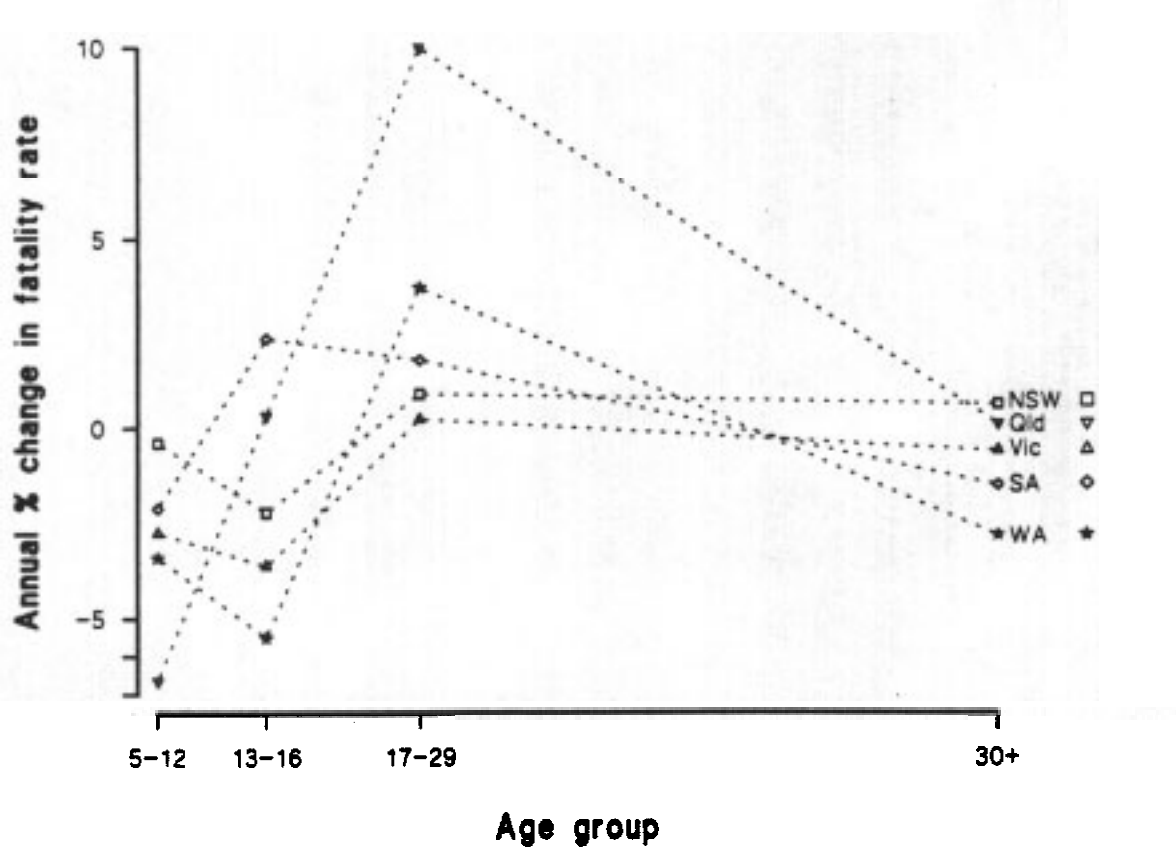
Notes: All changes are decreases, except those marked '+'
See Appendix 1 for data details

**Figure 7.3.2 Average annual % change in population fatality rate of bicyclists**

**a. for males and females by State**



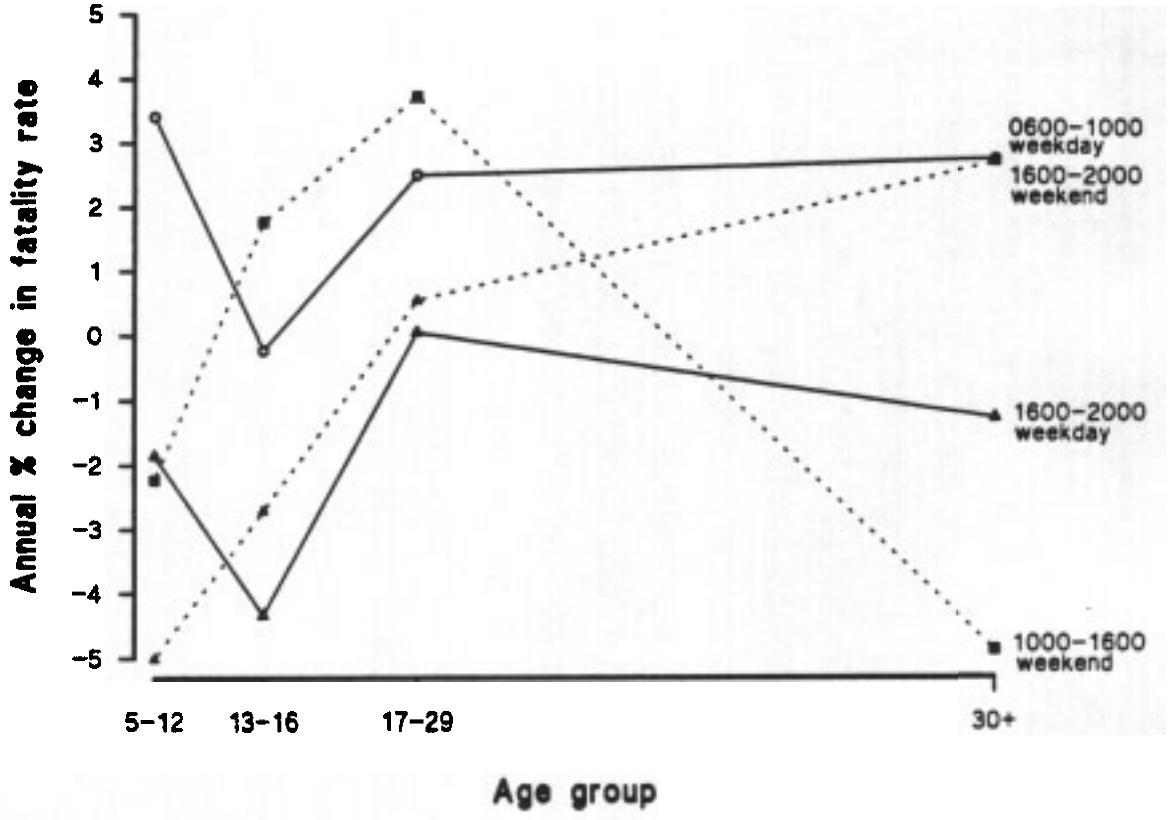

**b. for each State by age group**



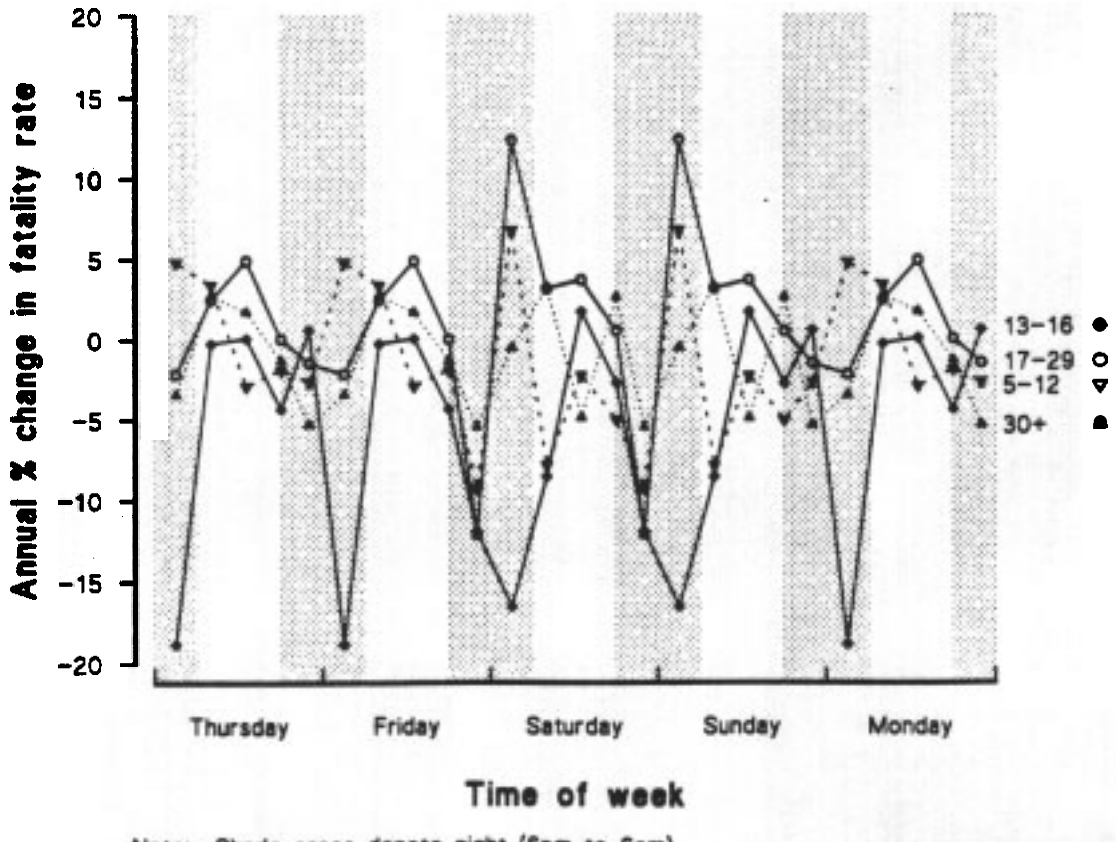
Male-female differences in the pattern of variation with State ($F_{5,436}$ = 2.5, 0.01 ≤ p < 0.05; Figure 7.3.2a; Table 7.3.1) and State differences in the age-related variation in the average annual % change in bicyclist fatality rates were both nominally statistically significant ($F_{20,421}$ = 2.3, 0.001 < p < 0.01; Figure 7.3.2b; Table 7.3.2).

**Figure 7.3.3 Average annual % change in population fatality rate of bicyclists**

**a. for selected times of the week by age group**




**b. for selected age groups by time of week**




Note: Shade areas denote night (6pm to 6am)

The age-related variation in the percentage change in bicycle fatality rates may differ according to the time of week, particularly for weekend periods, and this is nominally statistically significant ($F_{5,436} = 2.0$, $0.001 < p < 0.01$; Figures 7.3.3a and 7.3.3b; Table 7.3.2).

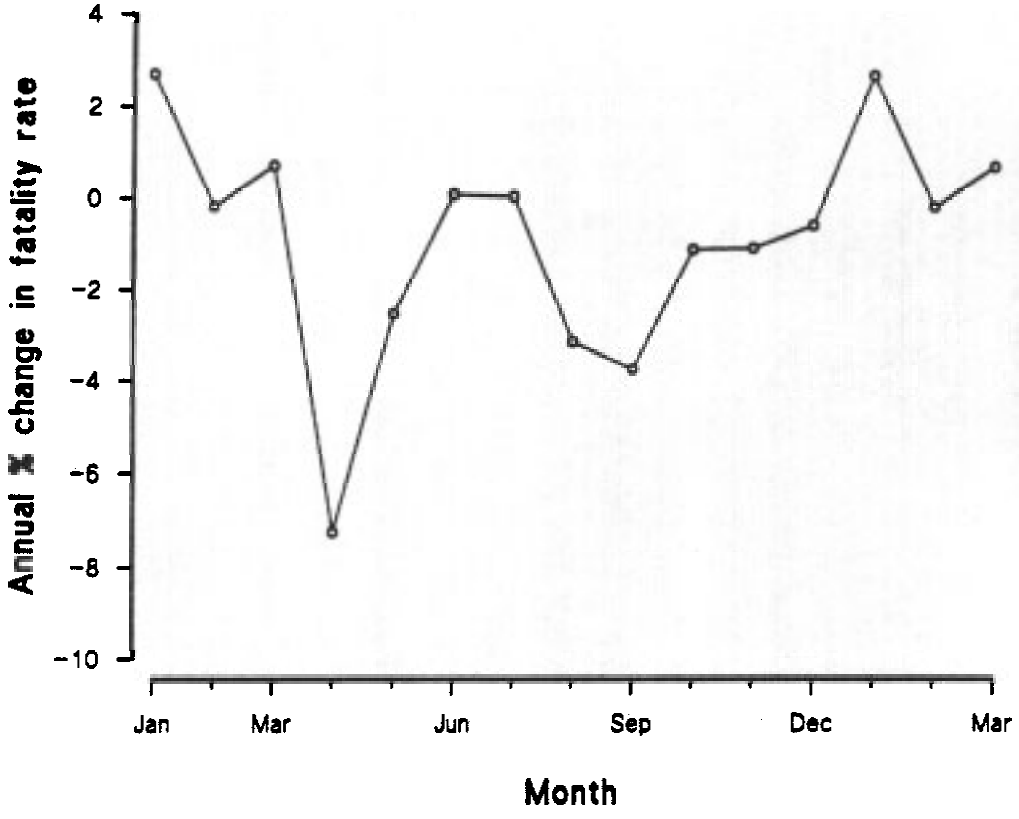
Table 7.3.2 Average annual % decrease in bicyclist fatality rates (deaths per person) between 1970 and 1990, classified by age group, by age group and State, and by age group and time of week.

| | Age group | | | | |
|---|---|---|---|---|---|
| Group | 5-12 | 13-16 | 17-29 | 30+ | All |
| **Total** | 2.0 | 2.4 | +1.4 | 0.3 | 1.0 |
| **State** | | | | | |
| Tasmania | 0.7 | 9.2 | 16.9 | 1.5 | 5.4 |
| Western Australia | 3.4 | 5.5 | +3.7 | 2.8 | 2.7 |
| Victoria | 2.8 | 3.6 | +0.2 | 0.6 | 1.7 |
| Queensland | 6.6 | +0.3 | +10.5 | +0.1 | 1.2 |
| South Australia | 2.1 | +2.4 | +1.8 | 1.5 | 0.7 |
| New South Wales | 0.4 | 2.2 | +0.9 | +0.6 | 0.3 |
| **Time of week** | | | | | |
| Weekday | | | | | |
| 0000-0600 | +4.8 | 18.8 | 2.1 | 3.4 | 3.5 |
| 0600-1000 | +3.4 | 0.2 | +2.5 | +2.8 | +2.1 |
| 1000-1600 | 2.9 | +0.1 | +4.9 | +1.8 | +0.3 |
| 1600-2000 | 1.9 | 4.3 | +0.1 | 1.3 | 2.1 |
| 2000-2400 | 2.6 | +0.6 | 1.5 | 5.3 | 2.4 |
| Week end | | | | | |
| 0000-0600 | +6.8 | 16.5 | +12.4 | 0.4 | +1.2 |
| 0600-1000 | 7.8 | 8.5 | +3.2 | +3.3 | 1.8 |
| 1000-1600 | 2.2 | +1.8 | +3.7 | 4.9 | 1.5 |
| 1600-2000 | 5.0 | 2.7 | +0.6 | +2.7 | 1.8 |
| 2000-2400 | 9.3 | 11.9 | 12.1 | 5.5 | 9.1 |

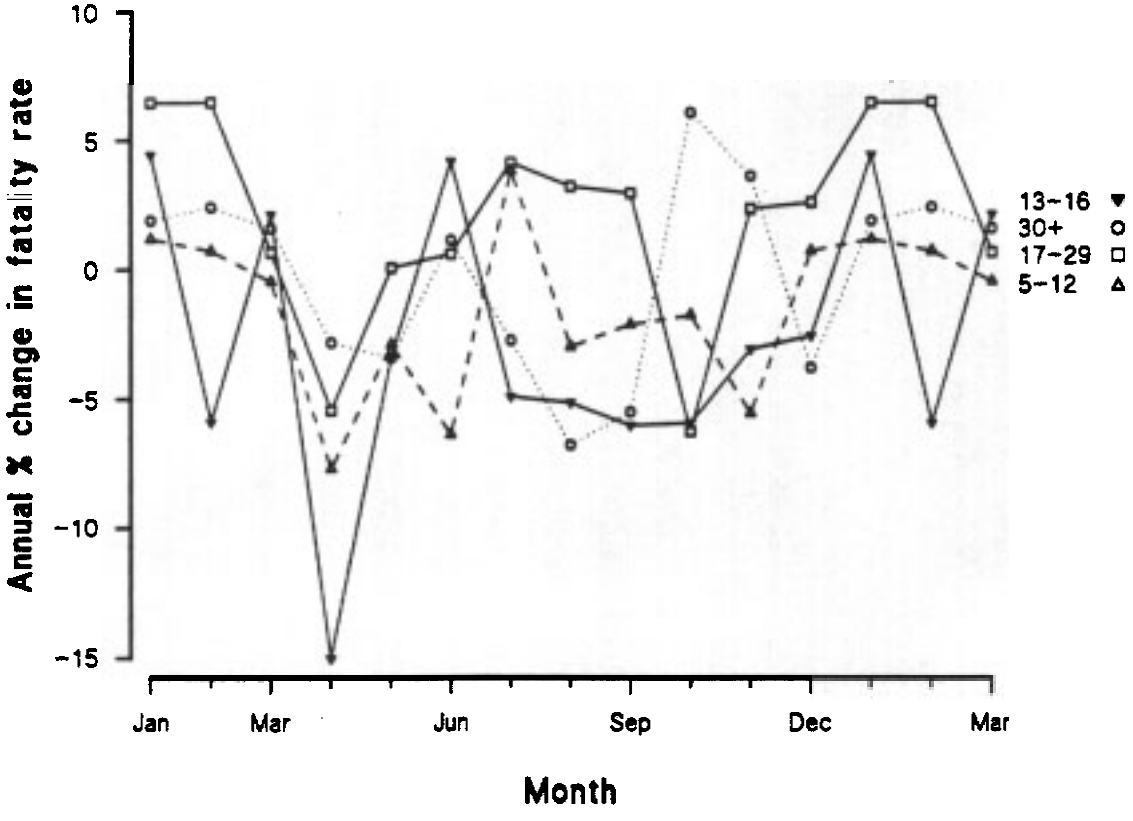
Notes: All changes are decreases, except those marked '+'
See Appendix 1 for data details

**Figure 7.3.4 Average annual % change in population fatality rate of bicylists**

**a. for all persons by month**




**b. for selected age groups by month**




Note: January to March are repeated

There are nominally statistically significant differences with month in the gender and age-related variation in the average annual % change in bicyclist fatality rates (gender x month interaction $F_{11,530} = 2.8$, $0.001 < p < 0.01$; age x month interaction $F_{44,563} = 2.2$, $0.001 < p < 0.05$; Figures 7.3.4a and 7.3.4b; Table 7.3.3). **Estimates in Table 7.3.3 may differ from** previous estimates as some data were omitted because of computational problems due to small numbers in some cells of the analysis. **Figure 7.3.4 shows the trend with month for all** persons because the estimates for females with month are unreliable and fluctuate wildly due to small absolute numbers.

Table 7.3.3 Average annual % decrease in bicyclist fatality rates (deaths per person) between 1970 and 1990, classified by month, by month and gender, and by month and age group.

| | Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Group | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | All |
| **Total** | +2.7 | 0.2 | +0.7 | 7.2 | 2.5 | +0.1 | +0.1 | 3.1 | 3.7 | 1.1 | 1.0 | 0.5 | 0.8 |
| **Gender** | | | | | | | | | | | | | |
| Males | +3.8 | 1.1 | +0.6 | 8.1 | 3.0 | +0.1 | +0.2 | 3.5 | 3.3 | 0.6 | 1.7 | 1.0 | 1.0 |
| Females | 2.1 | +9.6 | +2.0 | 0.5 | +3.2 | 0.2 | 1.1 | +10.3 | 6.7 | 4.7 | +3.1 | +5.0 | +0.7 |
| **Age group** | | | | | | | | | | | | | |
| 5-12 | +1.2 | +0.7 | 0.5 | 7.7 | 2.9 | 6.4 | +3.8 | 3.0 | 2.1 | 1.8 | 5.6 | +0.7 | 1.3 |
| 13-16 | +4.4 | 5.9 | +2.1 | 15.0 | 3.4 | +4.2 | 4.9 | 5.2 | 6.0 | 5.9 | 3.1 | 2.6 | 2.5 |
| 17-29 | +6.5 | +6.5 | +0.7 | 5.5 | +0.1 | +0.6 | +4.2 | +3.2 | +2.9 | 6.3 | +2.3 | +2.6 | +1.5 |
| 30+ | +1.9 | +2.4 | +1.6 | 2.8 | 3.4 | +1.1 | 2.7 | 6.8 | 5.5 | +6.1 | +3.6 | 3.8 | 0.3 |

Notes: All changes are decreases, except those marked '+'
See Appendix 1 for data details

# 8. Intermodal comparisons

- Fatality rates, per 100,000 persons, for all road users have fallen by an average of 3.3% each year between 1970 and 1990.

- Between 1970 and 1990, the greatest annual percentage decreases were for passenger and pedestrian fatality rates (each an average of 4.0%). **The driver fatality rates decreased** by an annual average of 3.0%, while, for bicyclists, the decrease was only 1.0% each year.

- For each mode, the average annual percentage decrease was greater for males than for females, although the difference was small for passengers, bicyclists and pedestrians. For driver fatality rates, males had an average annual percentage decrease of 3.8% while females had an **increase** of 0.5%.

- The decrease in the fatality rate for drivers between 1970 and 1990 was similar for all age groups.

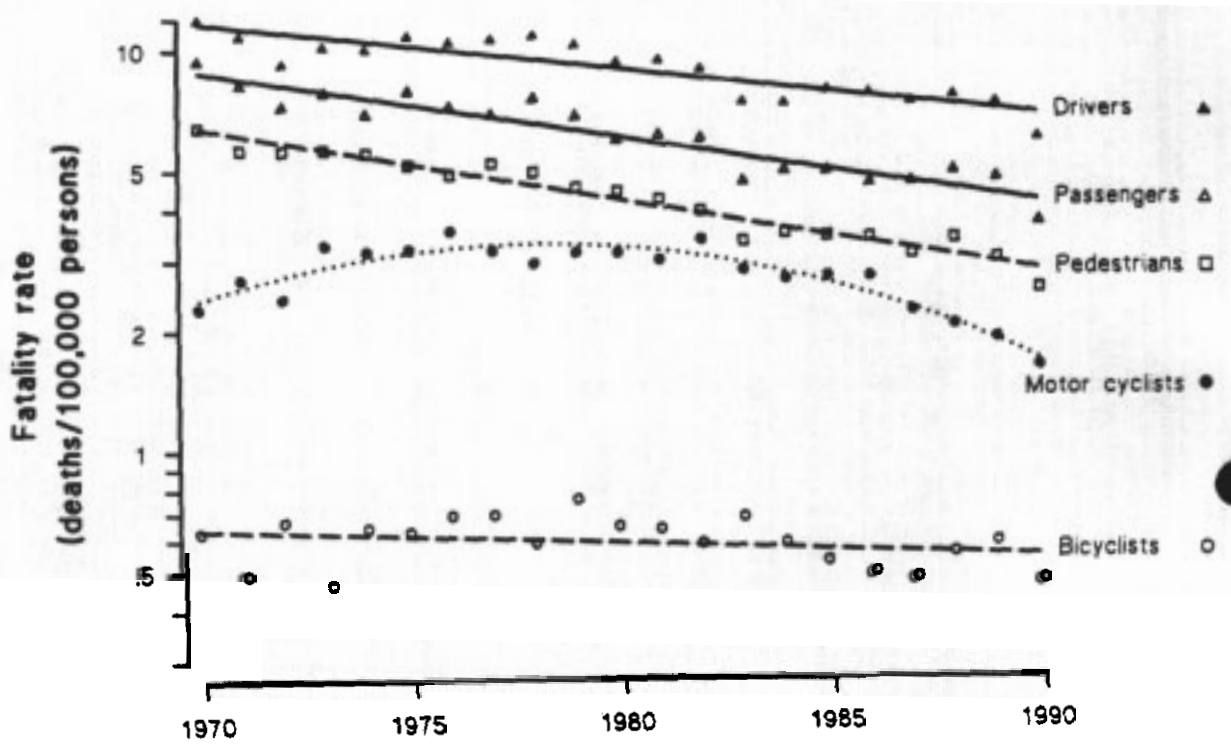
  Passenger and pedestrian fatality rates had similar average annual percentage decreases for children (aged up to 16 years) and for adults aged 30 or older. **For young adults, the** pedestrian rate changed little, or even increased, between 1970 and 1990, while the passenger rate showed a decrease over the same period.

- Young adult (aged 17 to 29) pedestrians and bicyclists had small increases in their fatality rates between 1970 and 1990.

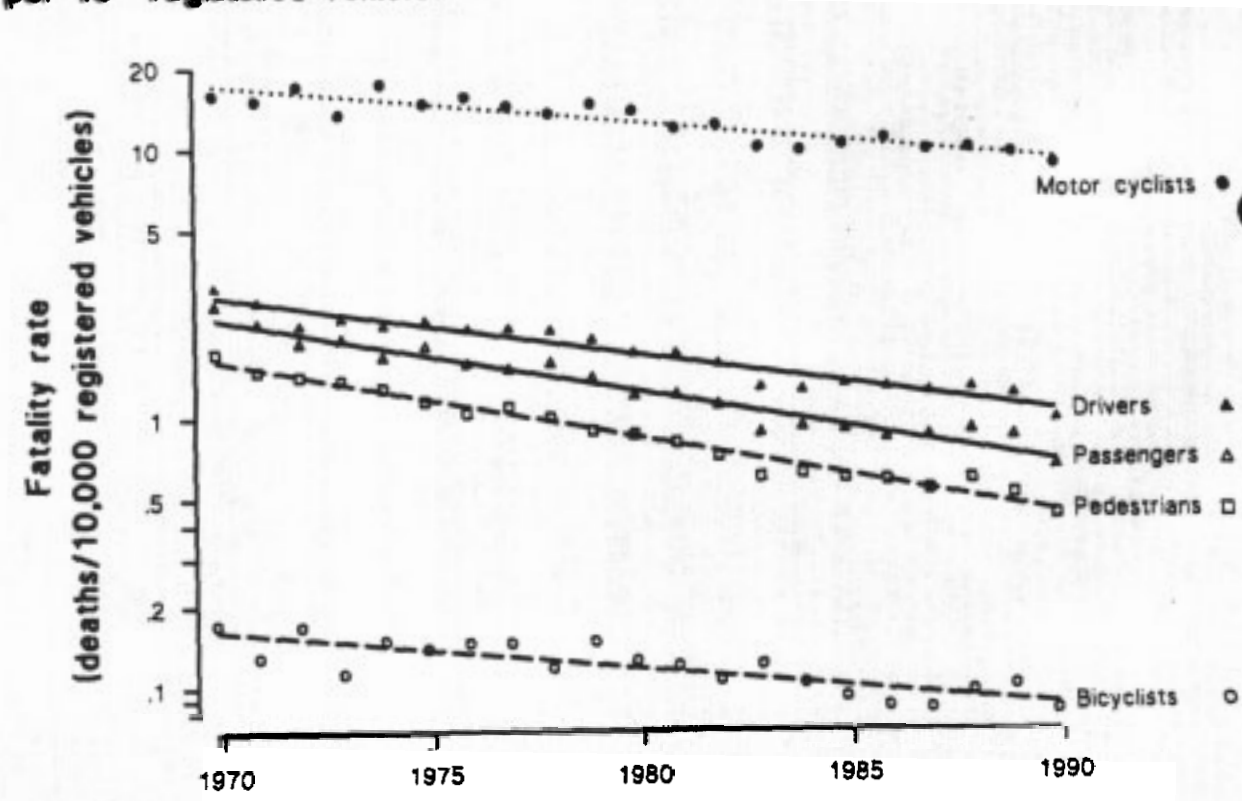
- For each time of week, changes over time for driver, passenger and pedestrian fatality rates were usually similar. Two exceptions were that pedestrian fatality rates showed a particularly large decrease between 1970 and 1990 for weekday evenings (8pm to midnight) and were almost unchanged between 1970 and 1990 for weekend nights (midnight to 6am).

**Figure 8.1 Fatality rates of all road users between 1970 and 1990 by road user mode**

**a. per $10^5$ persons**




**b. per $10^4$ registered vehicles**



Overall (Figure 8.1)

The average annual % decrease in fatality rate per 100,000 persons for all fatalities was 3.3% between 1970 and 1990.

Of the five road user categories (Figure 8.1a), passengers and pedestrians had the greatest average annual percentage decreases (3.9% and 4.0%, respectively). The average annual percentage decrease in the fatality rate for drivers was just below the average (3.0%), while that for bicyclists was much lower (1.0%).

Unlike the other four road user types, the trend in the population fatality rate for motor cyclists could not be adequately described by an average annual % decrease (Figure 8.1a). This was because there was an irregular pattern of motor cycle use between 1970 and 1990.

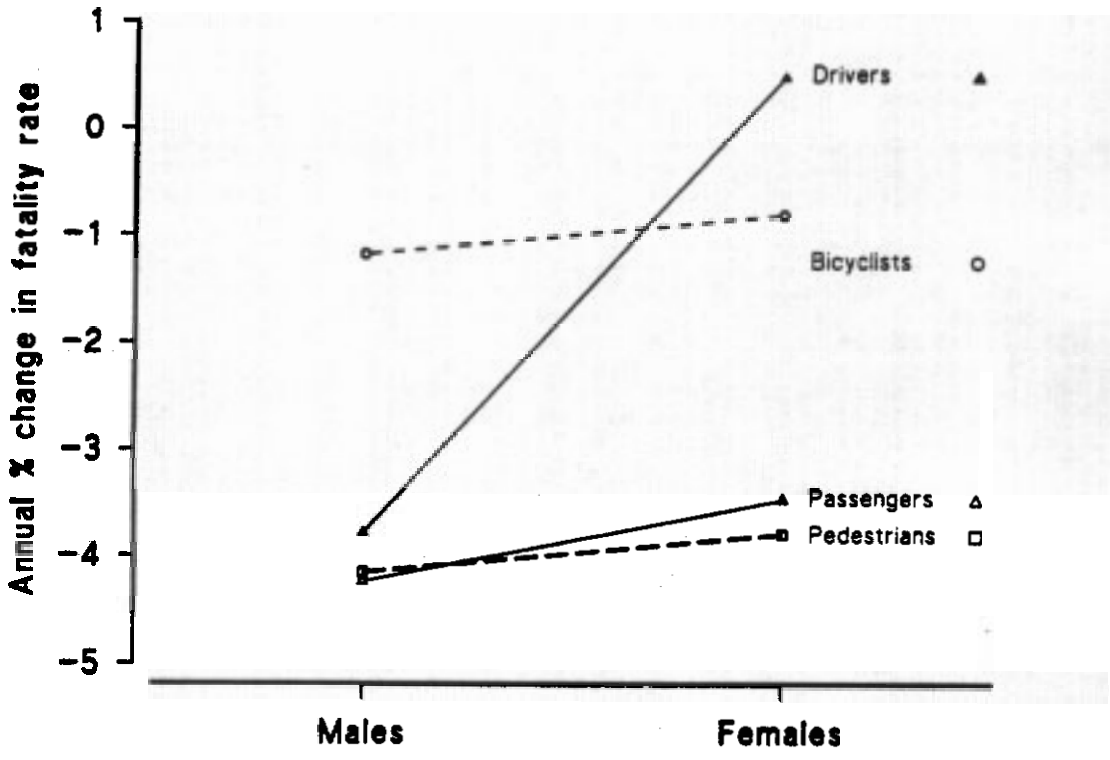
The highest fatality rates throughout the period were for drivers. These constituted about 40% of all road fatalities between 1970 and 1990. The proportion of fatalities decreased for both passengers and pedestrians because these two groups had the greatest decline in fatality rates. Passengers declined from 31% of fatalities in 1970 to 27% in 1990, while pedestrians declined from 22% to 19%.

In contrast, motor cyclists increased from 6% of fatalities in 1970 to 10% in 1990. The fatality rate for bicyclists has remained much lower than for the other modes, ranging from 2.2% of fatalities in 1970 to 3.5% in 1990.

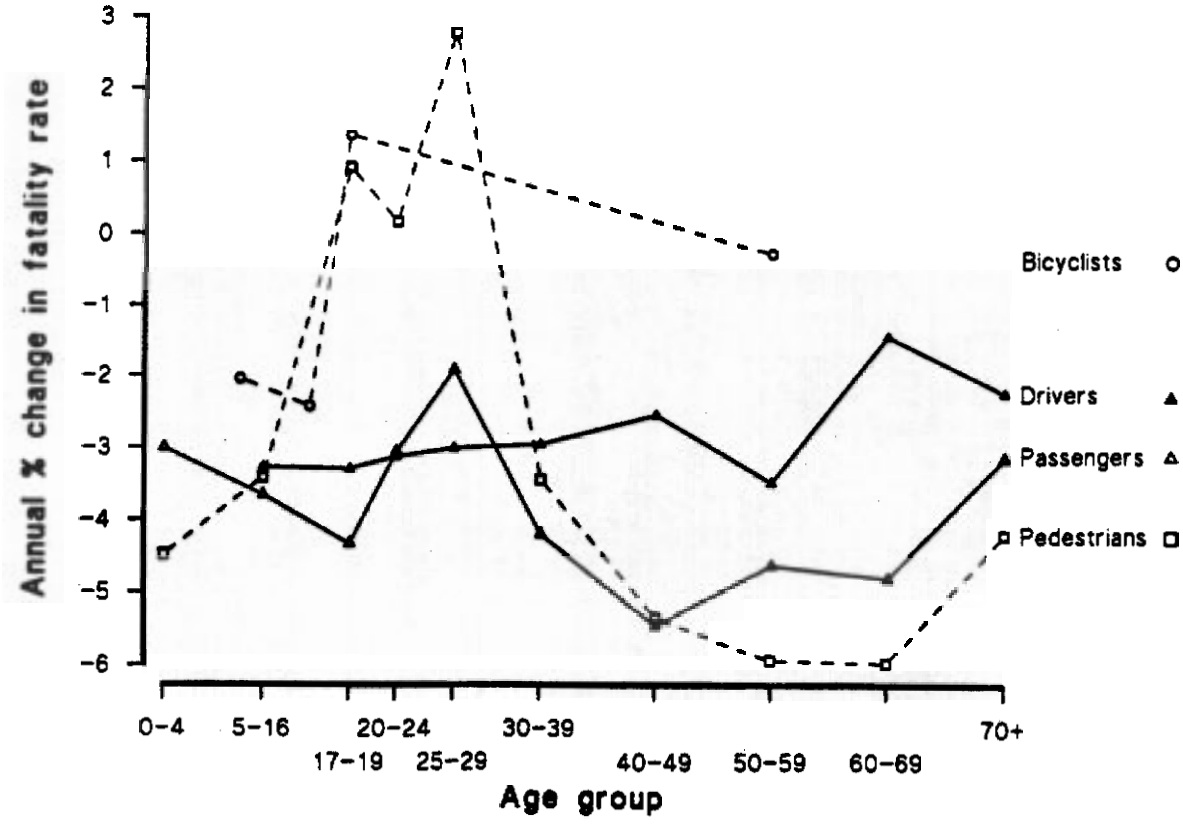
The fatality rate per 10,000 registered vehicles takes account of changes in vehicle ownership. This rate can be adequately described by an average annual % decrease for all modes (Figure 8.1b). The ordering of the modes is similar to that for the population fatality rate. The decrease for motor cyclists is greater than that for bicyclists, but less than that for drivers.

Figure 8.2 Average annual % change in population fatality rate of road users

a. for drivers, passengers, pedestrians and bicyclists by gender




b. for drivers, passengers, pedestrians and bicyclists by age group



(Figure 8.2a)

Overall, the average annual percentage decrease was greater for males than for females and this was true for each mode (Figure 8.2a).

The only large difference was for drivers. Male drivers had an average annual decrease of 3.8% in their fatality rate, while females an **increase** of 0.5%. Thus, male drivers had a decrease similar in magnitude to passengers and pedestrians.

The difference between males and females was much smaller for passengers, bicyclists and pedestrians. **It was statistically significant for only passengers.**

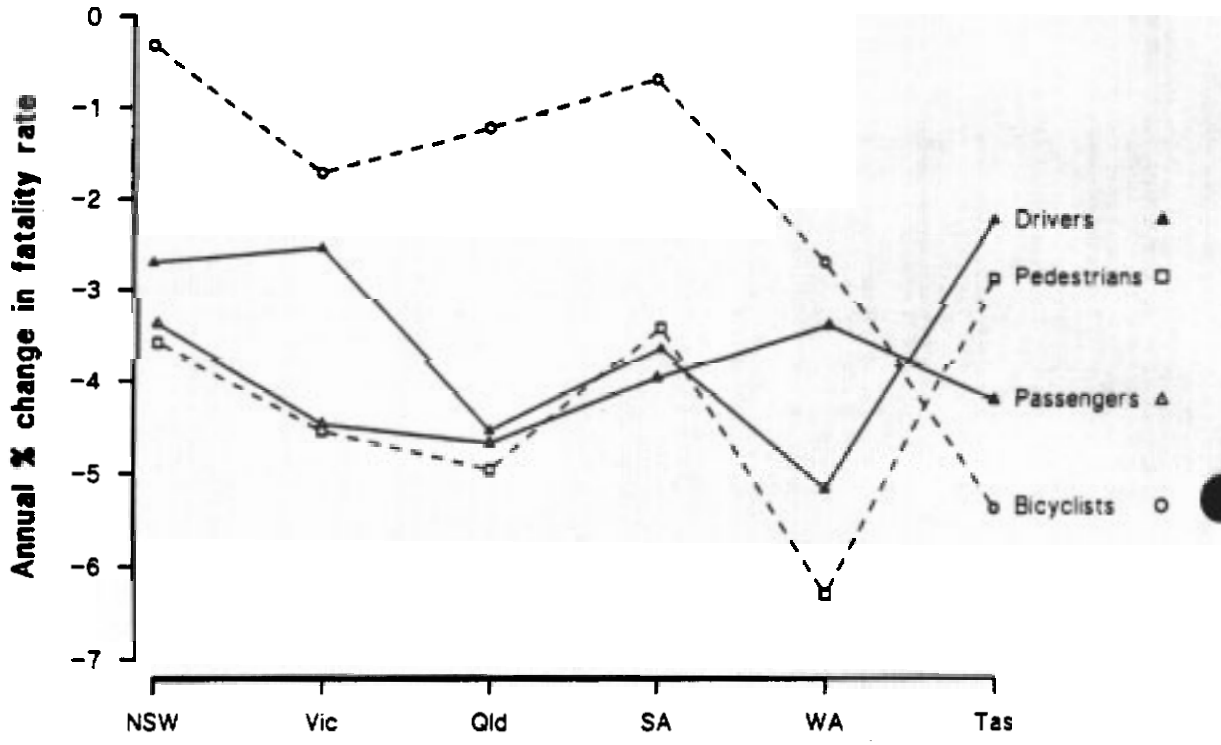
(Figure 8.2b)

The decrease in fatality rate for drivers between 1970 and 1990 was similar for all age groups (Figure 8.2b). Passengers had a comparatively greater decrease in the fatality rate than drivers for adults aged 30 years and older. Passengers and pedestrians had similar average annual percentage decreases in their fatality rates for children (16 years and younger) and for adults aged 30 or older. **For young adults, the pedestrian rate changed little or even** increased, while the passenger rate showed a decrease.

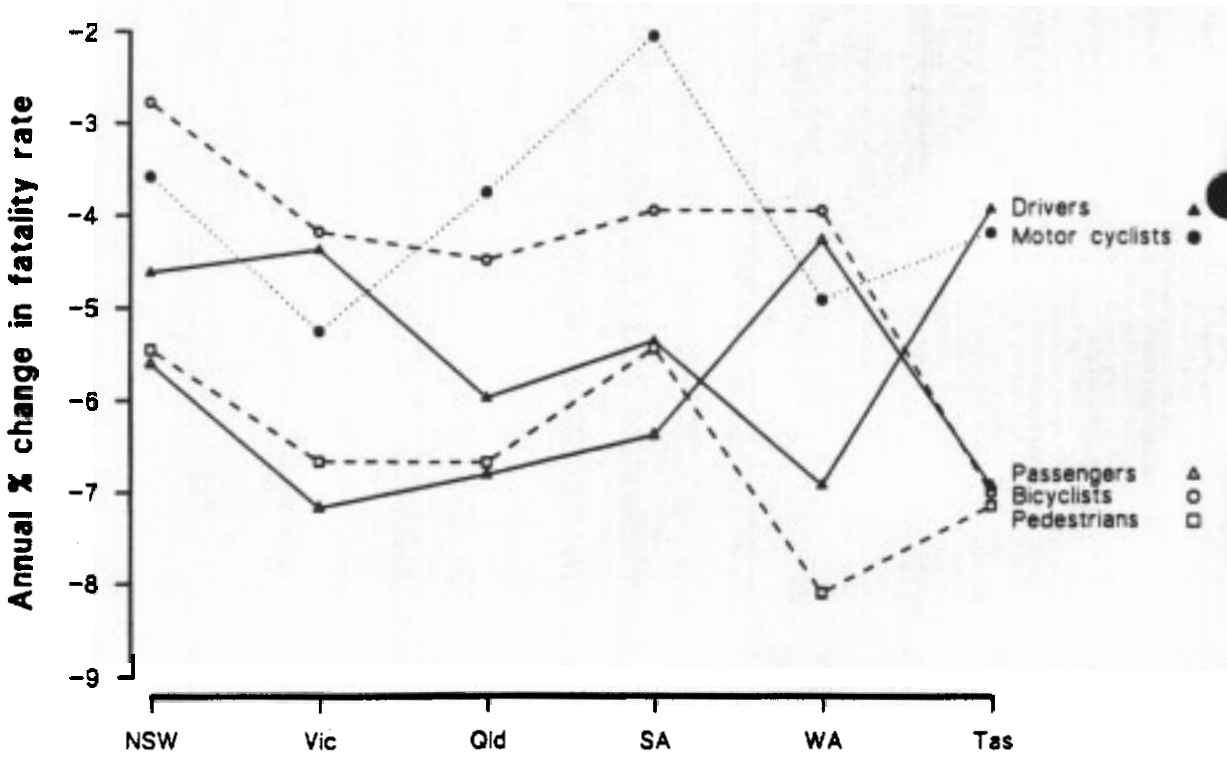
Pedestrians and bicyclists aged 17 to 29 years had small increases in their fatality rates between 1970 and 1990. Bicyclist fatality rates for school children (5 to 16 years) decreased about 2%.

**Figure 8.3 Average annual % change in fatality rate of road users by State**

**a. change in population fatality rate for drivers, passengers, pedestrians and bicyclists**




**b. change in vehicle fatality rate for each road user mode**

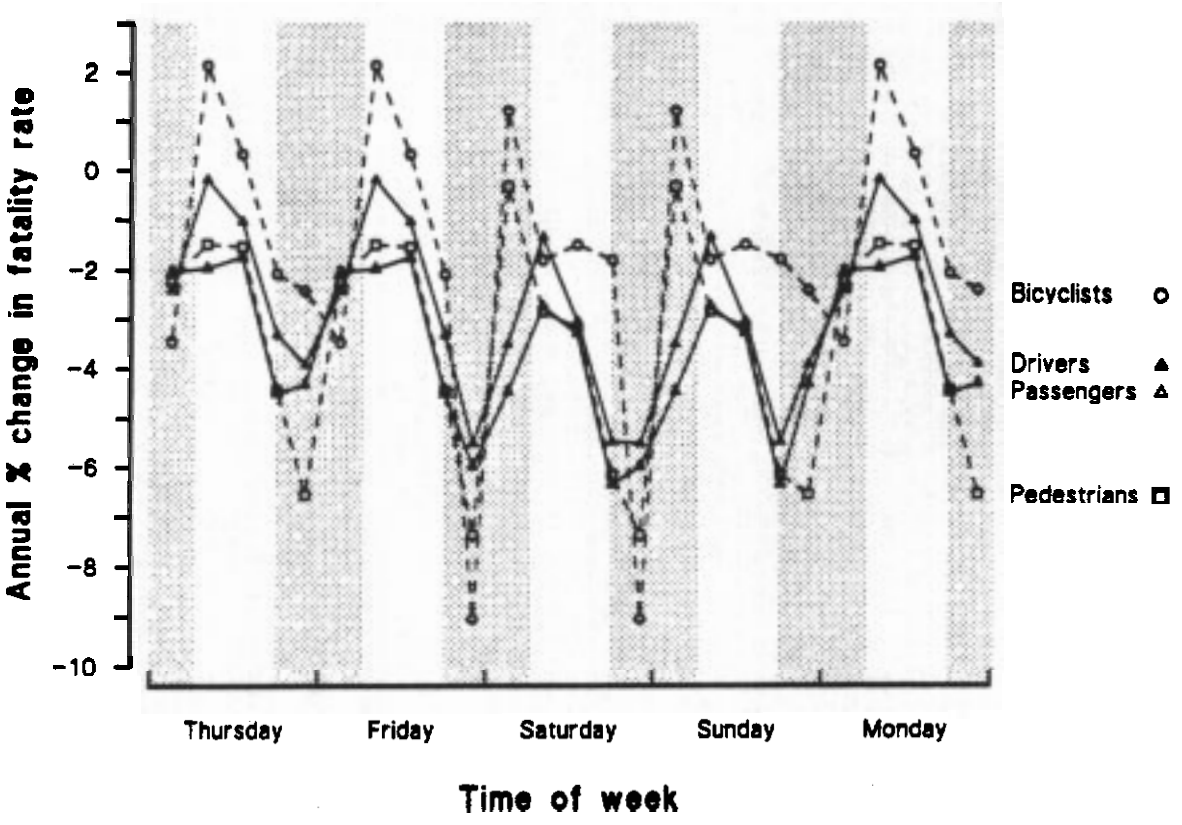


**State** (Figure 8.3)

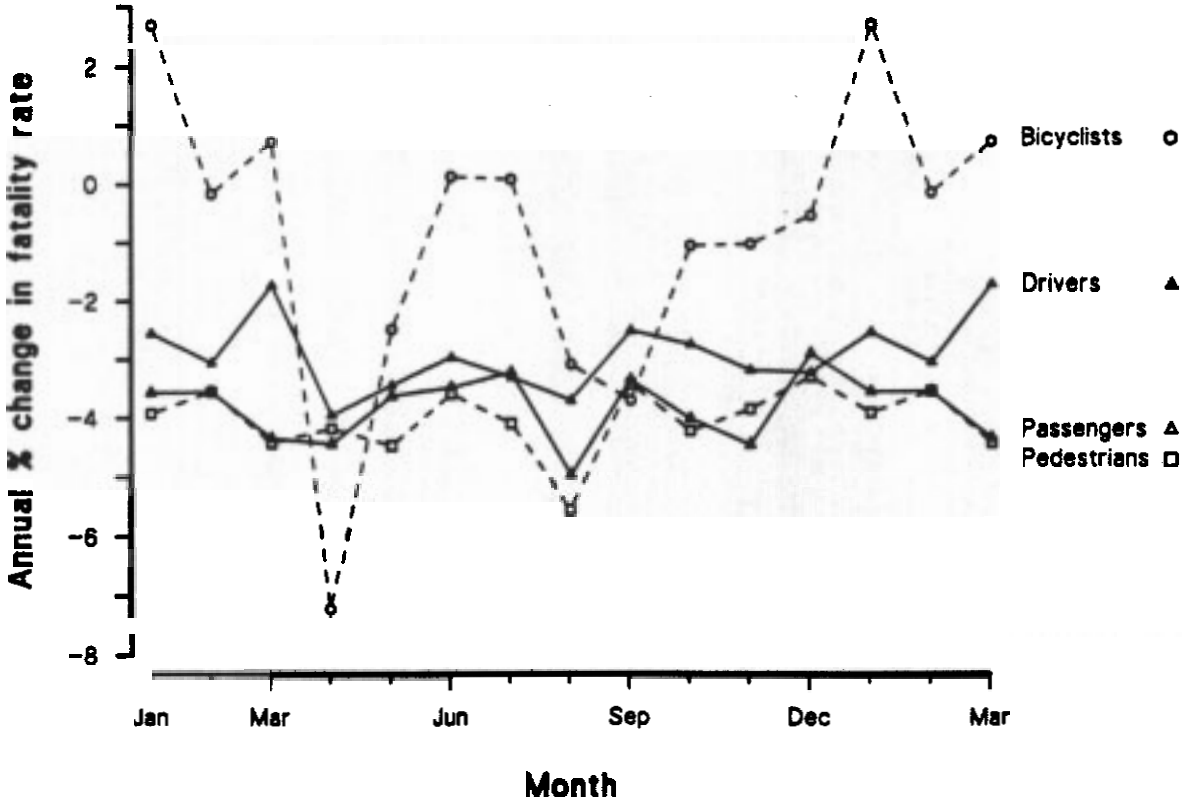
There were no statistically significant differences between States in the variation in the average annual % change in population fatality rate for the different modes of travel. Victoria appears to have a comparatively lesser decrease for drivers and Western Australia a comparatively lesser decrease for passengers (Figure 8.3a). South Australia and New South Wales generally have slightly lesser decreases for most modes. The pattern is similar for vehicle fatality rates (Figure 8.3b).

**Figure 8.4 Average annual % change in population fatality rate of road users**

**a. for drivers, passengers, pedestrians and bicyclists by time of week**




**b. for drivers, passengers, pedestrians and bicyclists by month**




Note: a. Shaded areas denote night (6am to 6pm) b. January to March are repeated

**Time of week** (Figure 8.4a)

The average annual % decrease in fatality rate varied statistically significantly with time of week for all modes. **The pattern with time of week was generally similar for drivers,** passengers, pedestrians and bicyclists (Figure 8.4a).

The largest average annual percentage decreases were mostly for evenings (4pm to midnight), particularly during the weekend. There were lesser decreases during the night (midnight tc 6am), and the least decreases during the day (6am to 4pm).

Pedestrian fatality rates showed a particularly large average annual percentage decrease for weekday late evenings (8pm to midnight). **In contrast to the average annual percentage** decreases for other times, the fatality rate was almost unchanged between 1970 and 1990 for drivers and passengers on weekend nights (midnight to 6am).

Bicyclists showed the largest fluctuation in average annual percentage change in fatality rate with time of week. **In particular, bicyclists had an increase in the fatality rate for the** weekday daytime period (6am to 4pm) and a particularly high decrease during the weekend late evening (8pm to midnight). However, for some time periods there were very small numbers of bicyclist fatalities so that the estimates of percentage change may not be reliable.

**Month** (Figure 8.4b)

Although the average annual percentage change in fatality rate varied statistically significantly with month for all fatalities, it did not do so for drivers, passengers and pedestrians separately. **There was no obvious seasonal pattern. August had a particularly** high average annual percentage decrease for drivers, passengers and pedestrians, and April had a particularly high decrease for bicyclists.

# Appendix 1. Data included in analyses

Not all States and Territories were able to provide complete data for fatalities between 1970 and 1990 classified to the level of detail requested (see Section 1.2). For some combinations of the classificatory variables (gender by age group by State/Territory by time of week or month), there were too few fatalities between 1970 and 1990 for the annual percentage change to be estimated, and this has lead to further loss of data for some analyses. The following table sets out the data available for analysis of trends in the fatality rate between 1970 and 1990:

| State | Years of data | Exclusions due to computational problems | |
|---|---|---|---|
| | | Times of the week | Months |
| **All fatalities** | | | |
| New South Wales | 1970-1990 | | |
| Victoria | 1970-1990 | | |
| Queensland | 1975-1990 | | |
| South Australia | 1970-1989 except 1977, 1987, 1988 | weekend 0000-1000 | |
| Western Australia | 1976-1990 | | |
| Tasmania | 1976-1990 for time of week<br>1970-1990 for month | weekday 0600-1000<br>weekend 0600-1000 | May, July, August |
| **Drivers** | | | |
| New South Wales | 1970-1990 | | |
| Victoria | 1972, 1974-1990 | weekend 0600-1000 | |
| Queensland | 1975-1990 | | |
| South Australia | 1970-1989 except 1977, 1987, 1988 | weekday 0600-1000<br>weekend 0600-1000 | March, June |
| Western Australia | 1976-1990 | weekday 1000-1600<br>weekend 1600-2000 | July |
| Tasmania | 1976-1990 | weekday 0000-6000<br>weekend 0600-1600<br>2000-2400 | Tasmania not included |
| **Passengers** | | | |
| New South Wales | 1970-1990 | | |
| Victoria | 1970-1990 | | |
| Queensland | 1975-1990 | | |
| South Australia | 1970-1989 except 1977, 1987, 1988 | weekend 0000-1000 | May, August |
| Western Australia | 1976-1990 | weekend 0600-1000 | October |

| State | Years of data | Exclusions due to computational problems | |
|---|---|---|---|
| | | Times of the week | Months |
| **Pedestrians** | | | |
| New South Wales | 1970-1990 | | |
| Victoria | 1970-1990 | | |
| Queensland | 1975-1990 | weekend 0600-1600 | September, November |
| South Australia | 1970-1989 except 1977, 1987, 1988 | weekday 0600-1000 | May, August |
| Western Australia | 1976-1990 | weekday 1600-1000<br>weekend 0600-1000 | January, April, June, July |
| Tasmania | 1976-1990 for time of week<br>1970-1990 for month | weekend 0600-1000 | March, April, October, December |
| **Bicyclists** | | | |
| New South Wales | 1970-1990 | | April |
| Victoria | 1972, 1974-1990 | | |
| Queensland | 1975-1990 | weekday 1600-2000<br>weekend 2000-2400 | March, April, October, December |
| South Australia | 1970-1989<br>except 1977, 1987, 1988 | weekend 1600-2400 | July, September |
| Western Australia | 1976-1990 | weekday 0600-1600<br>weekend 1600-2000 | May, July October December |
| Tasmania | 1976-1990 | weekday 0000-6000<br>weekend 0600-1600<br>2000-2400 | Tasmania not included |

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Numerical Algorithms Group (1987) GLIM 3.77 users manaul. NAG: Oxford.