

## **The serious traffic crashes of young drivers and their previous traffic offence histories.**

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### **Abstract**

**Objectives** To explore the relationship between traffic offences, in particular drink driving and speeding, and subsequent involvement in traffic crashes.

**Method** The linked traffic offence and crash records of 73% of an original cohort of 61,000 high school students (Grade 10) recruited in 1988 and 1989 were studied to determine the prevalence of prior offences among 1063 drivers involved in a serious (fatal or hospitalisation) crash ("serious crash class") and 5543 drivers involved in a less serious crash ("minor crash class"), by year of first (index) crash. Offences were categorized as drink driving, speeding, dangerous driving and other. Cumulative mean number of offences per year for male cohort members without a recorded crash were also calculated; this was not done for females due to probable bias resulting from name change at marriage. Relative risks of a subsequent crash and differences in mean numbers of other offences were computed for serious versus minor crashes in both sexes and for serious and minor crashes versus no crashes in males, adjusting for year of index crash. An effort was made to account for possible over-statement of the size of the group with no recorded crashes ("null crash class").

**Results** Males: compared to drivers in the minor crash class, drivers in the serious crash class had a 42% greater prevalence of at least one drink driving offence and more other offences (both statistically significant), but only slightly and non-significantly more speeding offences. Compared to the null crash class, the minor crash class had no excess of drink driving offences, but on average more speeding and other offences, whereas the serious crash class had more offences on average in all three categories. Female drivers were only considered in the minor and serious crash classes; drivers in the latter had a two-fold increased prevalence of both prior drink driving and speeding offences, but no more other offences on average.

### **Introduction**

It seems to be generally assumed that drivers who have committed traffic offences indicative of risk taking, notably drink driving, dangerous driving or speeding, are destined to become involved sooner or later in serious or even fatal traffic crashes. However there appears to be a paucity of recent journal articles on the topic. A review of research before the mid 1980's (Elliott et al, 2001) revealed a consensus that previous traffic offences were better predictors of subsequent vehicle crashes than were previous crashes.

Fell (1992) compared the drink driving ("Under the Influence" or "While Intoxicated") convictions in the previous three years of all United States drivers involved in fatal crashes in 1990. Relative to the drivers with zero BACs, "intoxicated" drivers, those with illegal blood alcohol levels, were four times more likely to have had a drink driving conviction in the previous three years. Age of driver was not considered in this analysis. In New Zealand, Bailey (1992) examined the prior traffic and criminal records of drivers involved in fatal crashes in 1986. It was found that drivers judged to be at fault had on average almost twice as many prior convictions for a traffic offence than drivers not at fault, and that the former were more than twice as likely to have had a prior drink driving conviction than the latter. As a reference, the traffic histories of a random sample of 10,000 licensed drivers were examined. Compared to these controls, the drivers involved in a fatal crash who had illegal blood alcohol levels were about five times as likely to have had a prior drink driving conviction, but there was little difference between other crash-involved drivers and controls on this measure. All classes of drivers in the fatal crash group had appreciably more prior convictions for dangerous or careless driving, but not for speeding, than the control sample.

A meticulous study of Canadian drivers known to be licensed at the start and end of a four year period analysed a series of models to predict the likelihood of future crashes based on readily available items in drivers' traffic histories (Hauer et al 1991). The authors found that most traffic offences, even relatively minor ones, were predictive of crashes, with drink driving and related offences having the largest coefficient in the models. This finding gave support to the demerit point system in use also in Australia. Prior crashes were also predictive, but the distinction between "at fault" and "not at fault" incidents added little. This study failed to separate out crashes involving truck drivers, which the authors conclude was, in hindsight, an error. In the present study few crashes involved heavy vehicles.

Of most relevance to the present paper is a study of almost 14,000 young Michigan drivers who had participated in drug programs in high school, and were then followed up for up to nine years after licensing (Elliot et al, 2001). The main finding was a traffic offence in one year increased the risk of a road crash in the following year by 40%, with little additional increase if two or more offences had been incurred. A crash in one year led to only a 20% increase in risk, but a greater number of crashes in a year had the greatest predictive power. Here too the distinction between "at fault" and "not at fault" crashes, as both predictors or outcomes, was of no value. A paper presented at a conference in July 2002, with a somewhat different focus to ours, also deals with young drivers from the start of their driving experiences (Palamara et al, 2002). The authors did not distinguish between traffic offence types, but found that a history of prior traffic infringements or convictions is a strong predictor of subsequent crashes.

All these studies suffer from their inability to control satisfactorily for exposure, namely the time spent or distance traveled on the road. It is entirely plausible that persons who drive more will have both more offences and more crashes, although, because of the factor of experience and expertise, the relationships may not be straightforward. Surrogates for exposure, notably time since licensing, are often employed, but are in most instances not very adequate. The study to be described is not immune from this criticism.

The present study analyses offence and crash data from a cohort recruited in Grade 10 at Queensland State high schools in 1988 and 1989, which has been described previously (Siskind et al, 1998). It attempts to quantify the increase in risk of serious crash involvement as driver associated with prior traffic offences, including in particular drink driving and speeding. Dangerous driving, though of interest, proved too uncommon for useful examination. Here the term, driver, refers to a controller of a motor vehicle and includes motor-cyclists; by serious crashes is meant those that resulted in a fatality or a person being hospitalised.

## **Methods**

As described in papers presented to earlier conferences, just over 80% of members of the cohort were linked in early 1998 to traffic offence records held by Queensland Transport (QT), current to mid-March of that year (Siskind et al 1999). A separate linkage was performed in early 2001 to the Queensland Transport Crash Database (Siskind, 2001). A cross-matching then produced a file of 45,044 subjects, 73% of the original cohort, with both offence and crash data. It is on this file that the analysis is based.

For the purposes of this analysis, the index event is the chronologically first recorded crash. Since no offences after the first months of 1998 are available, index crashes later than 1998 are ignored. Three crash classes were created, a "serious crash" class, comprising drivers whose index crash was a serious one, a "minor crash" class comprising subjects who had had at least one crash as driver but had no recorded serious crash, and a "null" class of subjects with no recorded crash as driver. The serious crash class had initially two sub-classes, defined by the unit number, as recorded in the QT Crash Database, with those with unit numbers greater than 1 being regarded as less "at fault" than drivers with unit number equal to 1. Excluded were 32 subjects aged 17 years, and hence eligible for a driver's license, at the start of the year of their enrolment in the cohort, and 1781 cohort members who appear never to have driven on a Queensland road, despite their presence in the QT client database - they had no record of an application for a driver's or learner's license, or of any motor vehicle offence or crash. Subjects whose index crash was non-serious but had had a subsequent serious crash as driver are not members of any cohort and hence implicitly excluded,

as are persons whose index crash occurred in 1990, 1999, 2000 or 2001; there were 235 and 826 such individuals, respectively.

We consider four categories of traffic offence, namely three specific offences: drink driving, as defined in the record, speeding, here taken to mean driving at least 30 kph above the speed limit and, for completeness, dangerous driving, plus an "other" offence category. Only the first recorded specific offence is included in most analyses, but we also add up all drink driving and speeding offences prior to an index crash or, for drivers without an index crash, the end of each year. An effort was made in creating the "other offence" file to separate out the above-mentioned specific offences and choose only one offence on any one date; what appears in the file is an individual's total number of such offences reported in each of the years 1990 to 1997 (with the few offences in 1989 and 1998 added to the totals for 1990 and 1997 respectively). By contrast, the actual dates of drink driving, speeding and dangerous driving convictions are recorded. For the "other" category, yearly totals in all years prior to the index crash are summed in the serious and minor crash classes. To provide a more or less equivalent figure for the null class, cumulative weighted means to the end of each year from 1990 to 1997 are derived, with weights to be described. In the case of the specific single offences, the cumulative total prior to the index crash was computed for the two non-null crash classes; for the null crash class lacking a reference date, the yearly number of crashes was obtained and cumulative proportions computed as described below. As an additional measure, all drink driving and speeding offences prior to an index crash or overall, for the null crash class, were counted, and a value for total person years of exposure derived for each crash class

Certain methodological issues relating to sources of bias must first be addressed. Note firstly that all individuals having contact with QT in some capacity, for instance to obtain a learner's or driver's license or because of a traffic offence prior to licensing, are assigned a client number. This typically occurs in late teenage. Early adulthood is a time of considerable residential mobility, including interstate and international movement. It is probable that most young people who move will have acquired a driver's license and client number beforehand. It follows that membership in the sub-cohort linked to the QT client file does not guarantee continued residence in Queensland, and with it potential inclusion in the Crash Database, throughout the observation period. To some extent this has been addressed by excluding apparent never-drivers. It has not been possible to obtain a reliable estimate of appropriate attrition rates, so an arbitrary figure of 3% per year after 1991 was employed to reduce the membership of the null class in each subsequent year.

For females in particular there is an additional complication. If there were a subsequent name change after a client number had been assigned, due, say, to marriage, the original name would be retained on file. The traffic offences of most women in the cohort could thus be extracted from the client database, even those who did not retain their maiden names. However the police, and in consequence the Crash Database, only record names current at the time of a crash. There does in fact appear to be a deficit of crashes among women in the cohort after their early twenties (Siskind, 2001). While a comparison of crash-positive classes in females presumably remains valid, as there is no a priori reason to suppose that marital status would affect crash severity, no unbiased comparisons with a crash-free sample are possible.

Finally inability to control for exposure for those still in the cohort remains a problem for the comparisons with the null crash class, less so for the comparison between the serious and minor crash classes. For all the above reasons credible formal statistical analyses can only be carried out between the two non-null class. Cumulative estimates at the end of each year for the null crash class will be displayed graphically, and for males only. These estimates use the discounted denominators described above and are further adjusted to represent the distribution by year of the numbers of crashes in the combined non-null classes. The year by year distributions in the two crash-positive classes differ little in either sex, but all comparative analyses control for year of index crash: Mantel-Haenszel chi squares and relative risks for proportions of prior drink driving and speeding offences and analysis of variance for numbers of other offences; the latter were transformed by means of the inverse hyperbolic cosine applicable to negative binomial variates. However, despite the obvious limitations, a stratified Mantel-Haenszel relative risk with approximate standard error was also computed for each crash-positive classes against the null class on the assumption that the cumulative estimates of drink driving and speeding proportions in the latter were free of stochastic error.

## Results

There were 17,172 initial male members of the null crash class, 1984 of whom had had at least one drink driving offence, 3111 at least one speeding offence and 92 at least one conviction for dangerous driving; other traffic offences totaled 35,359. The minor crash class as defined had 3647 male and 1986 female members, while the serious crash class included 755 males and 308 females, 479 and 194 with "unit 1" crashes, respectively. There was little difference in either sex between the two subclasses in respect of the prior prevalence in any of the offence categories, and they will not be further distinguished.

Numbers of first specific offences and summed other offences (prior to an index crash if present, in total otherwise) in the various categories for all three crash classes, by sex, are given in Table 1, and the yearly means are compared graphically in Figures 1a, 1b and 1c for males. Among females, estimates for the null crash class are biased and hence not calculated, as explained earlier, while for the other two classes numbers of prior drink driving and speeding offences by year are too small for stability. Cumulative means of other offences are however presented in Figure 2. However, analyses stratified by year comparing prior offence histories in the minor and serious crash classes were performed for females as well as males, and the results are given in Table 2. Relative to the minor crash class, prior drink driving offences are estimated to be about 40% more prevalent in the serious crash class among males (relative risk (RR) = 1.42, 95% confidence interval (CI) 1.07 – 1.89), but over twice as prevalent among females (RR = 2.2, CI 1.03 – 4.7); there was no difference among males with respect to prior speeding (RR = 1.17, CI 0.94 – 1.47), but this was almost twice as prevalent among females in the serious class (RR = 1.85, CI 1.03 – 3.3). Relative to the null crash class, the crash risks associated with prior drink driving and speeding were estimated to be elevated by 31% (CI 5% - 64%) and 42% (CI 21% - 67%), respectively, in the serious crash class, while in the minor crash class, the risk associated with prior drink driving was not increased and that associated with prior speeding increased by only 25% (CI 15% - 35%).

On the other hand, no difference between the classes was found among females in respect of prior other offences, while among males the mean was significantly greater in the serious than in the minor crash class, the difference weighted by year of crash being 0.28 offences. Members of the serious and minor crash classes had on average 0.51 and 0.23 other offences, respectively, than members of the null class (Table 3).

Dangerous driving was uncommon and not obviously related to subsequent crashes of any severity.

Results in terms of total cumulative or prior offences per thousand person-years of observation (from the start of 1990 to March 1998) are given in Table 4. The relative values from this formulation are broadly consistent with the findings presented earlier.

In passing, little difference was observed between males in the two crash-positive classes in time from licensing, initial drink driving offence or speeding offence (for those who were licensed or incurred the offence) to index crash, all three intervals being two to three years on average. Similar results were observed in females, the one exception being time from initial drink driving offence to crash, which averaged just over one year among drivers involved in serious crashes, significantly shorter than among those with only minor crashes at over two years.

## Discussion

It appears from our data that prior offences do predict subsequent serious motor vehicle crashes, relative to both less serious crashes and no reported crashes. However the observed elevations in risk, which are similar to those reported elsewhere (Hauer 1991, Fell 1993, Elliott 2001), are modest at best and not immune from the effects of bias. While using a group of drivers with only minor crashes as one reference class will largely overcome the problem of on-road exposure, this category of severity is more subject to under-reporting than more serious crashes, possibly to a degree dependent on prior driving history. Thus a driver with a drink driving record may be less inclined to report a crash involving only property damage or minor injury than one with a clean drink driving record. Such a scenario would lead to a corresponding under-estimate of the mean number of prior drink driving offences in this group. Numbers in the null crash class have been adjusted to allow for 3% annual attrition; this procedure has little objective evidence to

support it. We plan to obtain better estimates, derived from census data, when they become available. Even then there would be no assurance that members of this class drove as much as the drivers who crashed.

Having regard to the above caveats, it is nonetheless of interest to note the larger relative risks of a serious crash (compared to a minor crash) for prior speeding or drink driving among females than among males. Offences prior to the index crash defined as “other”, however, were on average equally common among females in both crash classes. Numbers of prior specific offences among the female drivers in the serious crash group, in particular, are not large, leading to rather wide confidence limits for the relative risks. Thus caution is needed in interpretation. But one is tempted to say of female drivers, more so than of male drivers, that “when they are good, they are very very good, but when they are bad they are horrid”. Young female drivers demonstrate a far smaller tendency for aberrant traffic behaviour than do young male drivers, and in consequence have perhaps received less research attention than they deserve.

### Conclusion

It would appear that the utility of using traffic offences for policy interventions to prevent subsequent serious traffic crashes is questionable, and unlikely to lead to cost-effective intervention strategies. Underlying such approaches is the implicit classification of offenders as persistent risk-takers and, especially among young drivers whose risk-taking behaviour is being rapidly modified with maturity, this is a dubious assumption. Drink driving and speeding, even at the level considered here, are common among young drivers and apprehension is, from the driver’s standpoint, a fairly rare random event, whereas serious crashes are uncommon, although too frequent from a public health point of view. It may be that this is less so for young female offenders, but their involvement in crashes is far less than that of their male coevals. Unless one is able somehow to identify offenders likely to persist in driving behaviour which increases their crash risk, elaborate preventive measures are probably not justified. Further research should be directed to refining methods of detecting drivers at high risk of crash involvement other than only by the commission of traffic offences.

Table 1 Total numbers by sex of drink driving, speeding, dangerous driving and other offences in the null crash class, and prior to the index crash in the minor and serious crash classes.

Crash Class	N	Offences			
		Drink Driving	Speeding	Dangerous Driving	Other
<b>Males</b>					
Null	17,172	1,984	3,111	92	35,359
Minor	3,647	266	555	14	4,402
Serious	755	75	131	7	1,109
<b>Females</b>					
Minor	1,896	29	64	1	747
Serious	308	9	17	0	127

Table 2 Relative risks (RRs) of subsequent crashes for at least one prior drink driving or speeding offence with 95% confidence intervals (95%CI), stratified by year.

Crash Classes	Drink Driving		Speeding	
	RR	95% CI	RR	95% CI
<b>Males</b>				
Serious v Minor	1.42	1.07 – 1.89	1.17	0.94 – 1.47
Minor vs Null	0.95	0.84 – 1.07	1.25	1.15 – 1.35
Serious vs Null	1.31	1.05 – 1.64	1.42	1.21 – 1.67
<b>Females</b>				
Serious vs Minor	2.20	1.03 – 4.70	1.85	1.03 – 3.30

Table 3. Differences in mean number of (prior) other offences for serious, minor and null crash classes, adjusted for year, with significance levels calculated from analysis of variance of transformed variates.

Crash Classes	Mean difference	F	p value
<b>Males</b>			
Serious v Minor	0.28	12.3	<0.001
Minor vs Null	0.23		
Serious vs Null	0.51		
<b>Females</b>			
Serious vs Minor	0.04	0.91	0.35

Table 4 Person years of exposure and rates per thousand person years of all drink driving, speeding and other offences in the null crash class, and of all offences prior to the index crash in the minor and serious crash classes.

Crash Class	Person years x 10 <sup>3</sup>	Offence Rates/ 1000 person years			
		Drink Driving	Speeding	Dangerous Driving	Other
<b>Males</b>					
Null	123.8	19.8	30.9	0.8	272.2
Minor	16.5	19.5	41.4	0.8	267.3
Serious	3.4	27.4	51.3	2.1	326.8
<b>Females</b>					
Minor	8.1	3.6	9.2		92.5
Serious	1.4	7.1	12.7		89.8

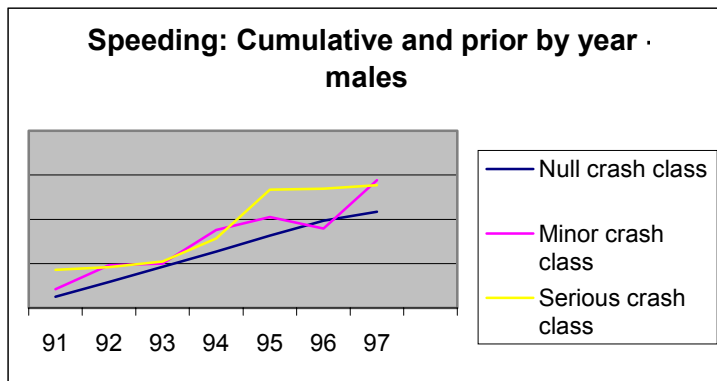
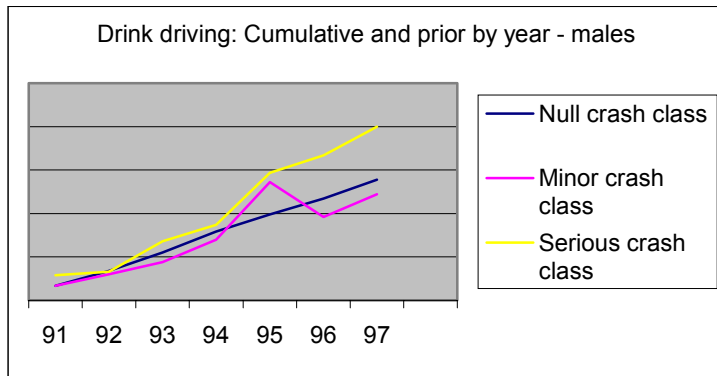
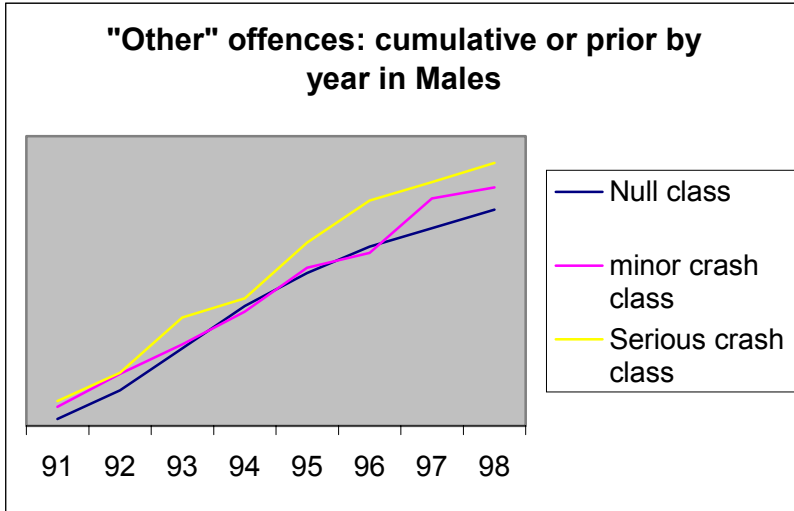


Figure 1a, b, c. Mean numbers of other offences and proportions of (at least one) drink driving or speeding offence cumulatively for the null crash class or prior to the index crash where present, by year.

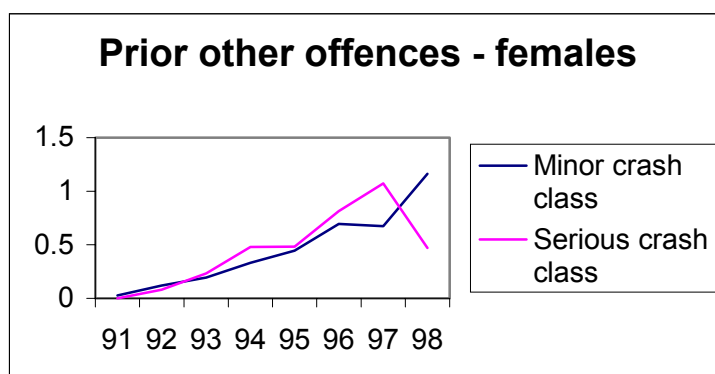


Figure 2. Mean numbers of prior “other” offences in two crash classes – females.

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