

# **SEX DIFFERENCES IN DRINK DRIVING**

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Sex Differences in Drink-Driving

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**Abstract**

BACs were obtained from drivers tested between 10pm and 3am in roadside surveys conducted in Adelaide between 1981 and 1987; drivers admitted to the Royal Adelaide Hospital between September 1985 & July 1987; and drivers killed on South Australian roads from 1981 to 1987 inclusive. The proportion of women in the night-time driving population increased significantly from 1981 to 1987, as did the proportion of women with BACs at or above 0.08. However, an examination of the BACs of fatally injured female drivers provided no evidence of increasing alcohol involvement over the same time period.

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## EXECUTIVE SUMMARY

This study describes the blood alcohol concentrations (BAC) of male and female drivers in three groups: the general population of night-time drivers, drivers admitted to hospital, and fatally injured drivers.

BACs were obtained from: drivers tested between 10 pm and 3 am in roadside surveys conducted in Adelaide between 1981 and 1987; drivers admitted to the Royal Adelaide Hospital between September 1985 and July 1987; and drivers killed on South Australian roads from 1981 to 1987 inclusive.

Late at night, about one fifth of female drivers and three tenths of male drivers had been drinking. For drivers of both sexes, the extent of alcohol involvement was greater among those involved in accidents and increased with the severity of injury.

The proportion of women in the night-time driving population increased significantly from 1981 to 1987, as did the proportion of women with BACs at or above 0.08. However, an examination of the BACs of fatally injured female drivers provided no evidence of increasing alcohol involvement over the same time period.

The study demonstrates the need to include women in campaigns aimed at reducing drink-driving and hence the deaths and injuries from alcohol-related crashes.

## **ACKNOWLEDGEMENTS**

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## INTRODUCTION

Not only do more men than women consume alcohol, they also drink more, in terms of both quantity and frequency (e.g. National Heart Foundation of Australia, 1983; Wilsnack, Wilsnack & Klassen, 1984-85). Although claims of increases in female drinking are made (e.g. Cisin, 1978), epidemiological evidence from the USA suggests constancy rather than change in women's drinking patterns over the past four decades, with a possible exception among young working women (Fillmore, 1984).

Changes in drinking practices in Australian society are not well documented. The National Heart Foundation (NHF) of Australia (1980, 1983) surveyed the drinking practices of adults aged between 25 and 64 years, who were resident in Australian State capital cities: 1980 estimates of the proportion of drinkers in the population were 91% and 81% for males and females respectively, and in 1983 these estimates were 88% and 75% respectively. However, the NHF itself advises great caution in drawing any conclusions from the differences between the survey estimates.

Historically, drink-driving and active involvement in alcohol-related crashes have been considered a male problem: statistics from roadside surveys of drink-driving, arrests for driving while intoxicated (DWI), and alcohol-related crash involvement all indicate a predominance of males. However, as noted recently by Popkin, Rudisill, Waller and Geissinger (1988), changes in women's roles and behaviours consequent upon their increased independence, labour force participation and income may lead to more drinking away from home and thus to more driving after drinking.

## **WOMEN AS DRIVERS AND DRINK-DRIVERS**

Very few published studies have examined women's involvement in drink-driving. However, recently this topic has attracted greater attention as evidenced by the conduct of a recent international workshop specifically on women, alcohol, drugs and traffic (Valverius, 1989).

### Licensure

The number of licensed drivers is increasing at a greater rate for females than for males, at least in the U.S.A. For example, between 1969 and 1983 in the state of North Carolina, the number of licensed drivers increased by 39% and 71% among men and women respectively, and in 1985, women comprised 49% of the total driving population (Popkin et al., 1988).

### Drink-driving arrests

It has been recognised for many years that women constitute only a small proportion of those arrested for DWI (e.g. Hyman, 1968). More recently, studies in the U.S.A. (Popkin et al., 1988), Finland (Pikkarainen & Penttila, 1989) and West Germany (e.g. Freudenstein, Schmidt & Bonte, 1989), among others, have shown that women represent increasing proportions of those arrested for DWI.

However, it should be noted that DWI figures may reflect biases in enforcement and legal procedures and, if so, not provide an accurate representation of the proportion of women who drink and drive. For instance, there is some evidence to suggest not only that police officers are more reluctant to arrest women for DWI even after detection (U.S. NHTSA, 1974), but that they also receive differential treatment in court (Popkin, Stewart & Lacey, 1983). Such bias in enforcement practices may be indicated by South Australian data, which showed that women accounted for a larger proportion of those drivers apprehended through random breath testing than of those detected by a police patrol for the same offence (exceeding the legal blood alcohol limit) (Bungey & Sutton, 1983).

### Involvement in alcohol-related crashes

There is no doubt that females represent a much smaller proportion of crash-involved drivers than do males. For example, women comprised 32% of drivers admitted to the major hospital in Adelaide (Holubowycz, 1988), 15% of drivers involved in single vehicle night-time crashes in Washtenaw County, Michigan (Carlson, 1972), approximately 20% of fatally injured drivers in the state of North Carolina (Popkin et al., 1988) and of all drivers involved in fatal crashes in the United States (Fell, 1987). This relative under-representation of female drivers is apparent in all types of crash even when crash rates per number of licensed drivers are examined (e.g. Popkin et al., 1988).

Among crash-involved drivers, the proportion of intoxicated males exceeds that of intoxicated females (e.g. Carlson, 1972; Fell, 1987; Popkin et al., 1988). However, Borkenstein and his colleagues (Borkenstein, Crowther, Shumate, Zeil & Zylman, 1964) were among the first to show that women who drank were at a greater risk of being involved in a crash than men, noting that at a blood alcohol concentration (BAC) of 0.08 g/100ml, the crash risk was greater for women than for men. A comparison of drivers tested in night-time roadside surveys with those involved in single vehicle crashes at night led to a similar conclusion by Carlson (1972): female high alcohol drivers were overinvolved in these crashes by a ratio of 6.1 to 1, whereas the overinvolvement ratio among male drivers was 2.8 to 1.

The recent publication by Popkin et al. (1988) has highlighted an increasing trend with respect to women's involvement in crashes, and particularly in those most likely to be alcohol-related: within the last decade in North Carolina crash rates of male drivers, calculated per 1000 licensed drivers, have decreased, whereas those of females have either increased or not changed. Furthermore, both Fell (1987) and Popkin and her colleagues have noted that the proportion of female drivers involved in crashes is increasing.



## METHOD

Current trends in driving and drink-driving of South Australian males and females are examined using five types of data, which are described below.

### Exposure data

The most direct measure of exposure to the risk of accident involvement is the distance driven. This provides only a crude indication, however, because many other factors influence the risk associated with any given journey. On a population basis, the extent and type of driving will be related to the number of licensed drivers, and their average annual distance driven. The latter measure will be influenced by the number who drive to work. Changes over time in these factors are likely to be related to changes in the size of the potential driving population and in the number in the labour force. South Australian data on these factors are likely to be related to changes in the size of the potential driving population and in the number in the labour force. South Australian data on these factors are available from the Australian Bureau of Statistics (1979, 1981, 1982, 1985, 1986).

### BACs of night-time drivers

The NHMRC Road Accident Research Unit conducted roadside BAC surveys of the night-time (i.e. 10pm to 3am) general driving population in metropolitan Adelaide in 1981, 1982, 1983 and 1987 (see e.g. McLean, Clark, Dorsch, Holubowycz & McCaul, 1984). BAC readings were obtained from 87.2%, 93.3%, 94.8% and 90.7% of the drivers surveyed in 1981 through 1987, respectively. A total of 10,583 male and 3,332 female drivers were tested.

### Alcohol usage of the general population of night-time drivers

A reply-paid mail questionnaire given to every driver approached during each of the surveys described above included a question on the frequency of alcohol consumption. Approximately 40% of the questionnaires were returned during each of the surveys.

### BAC's of injured crash-involved drivers

In South Australia, the law requires that a blood sample be taken for subsequent alcohol analysis from every person above the age of 14 years who presents at a hospital for treatment within eight hours of a road crash. Between September 1985 and July 1987 the author recorded the road user category of every individual admitted to the major trauma hospital in this state. During this period, 465 male and 218 female crash-involved drivers were admitted, and BACs were subsequently obtained for 91.4% of the males and 89.4% of the females.

### BACs of fatally injured drivers

BACs were obtained for 94.4% of the 551 male drivers and 96.1% of the 152 female drivers who died as a result of injuries sustained in a road crash in South Australia from 1981 to 1987 inclusive.

## RESULTS

### Exposure data

Tables 1 and 2 depict the magnitude and stability of several factors related to driving exposure in South Australia during the 1980s.

TABLE 1

### CHANGES IN EXPOSURE-RELATED INDICES BY SEX

SOUTH AUSTRALIA: 1981, 1986

Number of Persons	1981		1986		% Change	
	Males	Females	Males	Females	Males	Females
Over 15 years	467102	489157	502093	523919	+7.5	+7.1
In labour force	366375	227093	376741	252118	+2.8	+11.0
Drive to work	207710	86083	216135	111259	+4.1	+29.3

Note: Data are derived from the Australian Bureau of Statistics (1981, 1986)

No meaningful sex differences are evident in the changes from 1981 to 1986 in the number of individuals eligible on the basis of age to hold a driver's licence (an increase of 7.5% and 7.1% for males and females, respectively). However, the substantially greater increases among women, when compared with men, in labour force participation, driving to work, and licensure are consistent with the view that driving patterns are changing more rapidly for women than for men. On the other hand, there was relatively little difference in the percentage increases in reported annual distance driven from 1979 to 1985 for males and females; moreover, when annual distance driven was adjusted by the number of licence holders, very little change from 1979 to 1985 was evident for females whereas there was a small increase for males.

TABLE 2

## LICENSED DRIVERS BY SEX AND DISTANCE DRIVEN

SOUTH AUSTRALIA: 1979, 1982, AND 1985

	1979	1982	1985	% Change 1979-1985
<b>Number of car licence holders<sup>1</sup></b>				
Males	431,696	448,763	469,483	+ 8.8%
Females	291,061	319,994	351,359	+ 20.7%
<b>Annual kilometres driven (x10)<sup>2</sup></b>				
Males	5,563,812	6,013,087	6,376,391	+ 14.6%
Females	2,371,783	2,506,697	2,825,043	+ 19.1%
<b>Annual kilometres driven (x10) per 1000 licence holders</b>				
Males	12,888	13,398	13,581	+ 5.4%
Females	8,148	7,833	8,039	- 1.3%

<sup>1</sup> Motor Registration Division, South Australian Department of Transport.

<sup>2</sup> Australian Bureau of Statistics (1979, 1982, 1985).

**BACs of night-time drivers**

Table 3 depicts the BAC distributions of non-crash-involved male and female drivers breath tested between the hours of 10pm and 3am in Adelaide. It should be noted that the data have been weighted to allow for hourly sampling variation, and corrected for refusal bias.

TABLE 3

BLOOD ALCOHOL CONCENTRATION AND SEX OF NIGHT-TIME<sup>1</sup> DRIVERS

ADELAIDE: 1981-1983, 1987

BAC	1981		1982		1983		1987	
	Males	Females	Males	Females	Males	Females	Males	Females
Positive	30.4 <sup>2</sup>	17.7	28.1	19.1	28.7	19.5	28.9	17.9
≥0.08	5.0	1.0	3.9	1.8	5.5	3.3	5.8	2.4
≥0.15	0.5	-	0.5	-	1.2	0.6	1.6	0.5
No. tested	2219	603	2992	899	2762	811	2610	1019

<sup>1</sup> 10pm to 3am<sup>2</sup> Data weighted and corrected for refusal bias (% of total)

Maxwell's (1961) method of testing for trends in contingency tables was used to examine the changes over time in the proportions of drink-drivers, drivers at or exceeding the legal limit of 0.08 g/100ml, or drivers at or exceeding 0.15. Among both male and female drivers, there was no statistically significant trend over time in the proportion of drink-drivers ( $\chi^2$ , 1 df = 0.7,  $p > .30$ ; and 0.0,  $p > .90$ , respectively). A statistically significant increasing trend in the proportion of drivers with BACs at or exceeding 0.08 was evident among both males and females ( $\chi^2$ , 1 df = 5.0,  $p < .05$ ; and 4.6,  $p < .05$ , respectively). An increasing trend was also evident in the proportion of males with BACs at or above 0.15 ( $\chi^2$ , 1 df = 22.4,  $p < .001$ ); there were insufficient cases among females to confirm a similar trend.

The representation of women drivers in the night-time surveys has increased: in 1981, 21.8% of the drivers surveyed were female, whereas in 1987 this proportion had risen to 28.9%, representing almost a 33% increase.

Alcohol usage of the general population of night-time drivers

The frequency of alcohol consumption reported by night-time drivers is presented in Table 4. There was no statistically significant trend in the self-reported frequency of alcohol consumption between 1981 and 1987 for either male or female drivers (at least monthly:  $\chi^2$ , 1 df = 0.0 and 1.0, for males and females respectively; at least weekly:  $\chi^2$ , 1 df = 0.6 and 0.0, respectively; daily, or almost daily:  $\chi^2$ , 1 df = 0.2 and 1.3, respectively).

TABLE 4

SEX AND FREQUENCY OF ALCOHOL CONSUMPTION OF NIGHT-TIME<sup>1</sup> DRIVERS

ADELAIDE: 1981-1983, 1987

Drinking Frequency	1981		1982		1983		1987	
	Males	Females	Males	Females	Males	Females	Males	Females
At least monthly	85.5%	77.7	85.8	80.7	85.5	76.1	85.7	82.0
At least weekly	70.1	62.1	72.5	64.1	72.7	57.7	71.9	63.8
Daily, almost daily	15.2	8.2	16.4	10.8	17.6	11.3	15.8	11.2
Total no. respondents	894	269	1171	409	1099	364	1088	500

<sup>1</sup> 10 pm to 3 am

BACs of injured crash-involved drivers

Table 5 presents the BAC distribution by sex of crash-involved drivers admitted to the major trauma hospital in Adelaide.

TABLE 5  
 BLOOD ALCOHOL CONCENTRATION AND SEX OF DRIVER  
 ROYAL ADELAIDE HOSPITAL ADMISSIONS  
 SEPT. 1985 - JULY 1987

BAC	Males	Females
% positive	42.1	27.7
% $\geq 0.08$	33.9	22.1
% $\geq 0.15$	18.4	11.8
No. tested	425	195

A much larger proportion of male drivers than female drivers had positive BACs on admission to hospital ( $\chi^2 = 11.3$ , 1 df,  $p < .001$ ). However, it is important to note that among those individuals with positive BACs, almost equal proportions of both sexes had BACs in excess of the legal limit (80.4% of male drink-drivers, 79.6% of female drink-drivers).

As noted earlier, women constituted almost one-third (31.9%) of the total number of drivers admitted to hospital.

#### BACs of fatally injured drivers

From 1981 to 1987 inclusive, 703 drivers were killed on South Australian roads; over one-fifth (21.6%) were female. The BAC distribution, by year and sex, is shown in Table 6.

Prior alcohol consumption was evident in 53.8% of the males and 34.2% of the females; almost one-half of the males and one-quarter of the females exceeded the legal BAC limit. Among the fatally injured drinking drivers (i.e. those with a positive BAC), 91.4% of the males and 72.0% of the females recorded a BAC of at least 0.08.

For both males and females, the proportions with positive BACs, BACs of 0.08 or above, and BACs of 0.15 and above were analysed for trends over time, using Maxwell's (1961) method of testing for trends in contingency tables. The chi-square and probability values arising from these analyses are presented in Table 7.

TABLE 6

## BLOOD ALCOHOL CONCENTRATION AND SEX OF FATALLY INJURED DRIVERS

SOUTH AUSTRALIA: 1981 - 1987

BAC	1981	1982	1983	1984	1985	1986	1987	TOTAL
<b>Males</b>								
% positive <sup>1</sup>	58.3	60.0	47.1	62.3	48.7	60.7	42.7	53.8
% $\geq 0.08$	50.0	50.0	43.5	56.6	40.8	53.9	38.7	49.2
% $\geq 0.15$	34.7	40.0	38.8	45.3	30.3	40.4	33.3	37.3
No. tested	72	70	85	53	76	89	75	520
No. unknown (% of total) <sup>2</sup>	4 (5.3)	6 (7.9)	4 (4.5)	2 (2.3)	0 (-)	8 (8.2)	7 (8.5)	31 (5.6)
<b>Females:</b>								
% positive <sup>1</sup>	12.5	34.6	26.3	30.4	34.5	45.5	42.1	34.2
% $\geq 0.08$	-	30.8	21.1	17.4	20.7	31.8	36.8	24.7
% $\geq 0.15$	-	19.2	21.1	8.7	13.8	18.2	26.3	16.4
No. tested	8	26	19	23	29	22	19	146
No. unknown (% of total) <sup>2</sup>	1 (11.1)	0 (-)	0 (-)	2 (8.0)	0 (-)	1 (4.3)	2 (9.5)	6 (3.9)

<sup>1</sup> Percentage of those drivers for whom a BAC test was conducted.<sup>2</sup> Total = (no. tested + no. unknown) in the specified period.



TABLE 7.

## SIGNIFICANCE OF TRENDS OVER TIME IN BAC DISTRIBUTION

	$\chi^2$ (1 df)	p
<b>Males:</b>		
% positive BAC	1.7	> .10
% $\geq 0.08$ BAC	0.7	> .30
% $\geq 0.15$ BAC	0.1	> .70
<b>Females:</b>		
% positive BAC	2.4	> .10
% $\geq 0.08$ BAC	1.7	> .10
% $\geq 0.15$ BAC	0.8	> .30

These results indicate that among both male and female fatally injured drivers, there were no statistically significant trends over time in the proportions of drinking drivers, drivers with BACs at or above 0.08, or drivers with BACs at or above 0.15.

Table 8 presents driver fatality frequencies and fatality rates per 10,000 licensed drivers by sex for each year from 1981 to 1987. There was no statistically significant trend over time in the proportion of women among fatally injured drivers ( $\chi^2 = 1.0$ , 1 df,  $p > .30$ ).

TABLE 8.

FATALLY INJURED DRIVERS: FREQUENCY AND RATE<sup>1</sup> BY SEX

## SOUTH AUSTRALIA: 1981 - 1987

BAC	1981	1982	1983	1984	1985	1986	1987
Males	76 <sup>2</sup> (1.71) <sup>1</sup>	76(1.69)	89(1.96)	55(1.19)	76(1.62)	97(2.05)	82(1.72)
Females	9(0.12)	26(0.81)	19(0.58)	25(0.74)	29(0.83)	23(0.64)	21(0.57)
Females as % of total	10.6	25.5	17.6	31.3	27.6	19.2	20.4

<sup>1</sup> Rate: deaths per 10,000 licensed drivers.

<sup>2</sup> Number of fatally injured drivers.

## DISCUSSION

In South Australia, between 1981 and 1986 driving licensure, labour force participation, and driving to work all increased at a significantly greater rate among women than among men, suggesting that women's exposure to driving may be increasing relative to that of men. In contrast, however, the proportional increase in the total reported annual distance driven differed only marginally between the sexes; when adjustments for the numbers of licensed drivers were made, no evidence for an increase in women's exposure was forthcoming.

The degree of alcohol involvement was examined among night-time drivers not involved in crashes, drivers admitted to hospital, and fatally injured drivers. Within each type of sample, males exhibited a greater degree of alcohol involvement than did females and, among both males and females, the extent of alcohol involvement was greater among those involved in accidents and increased with the severity of injury.

There was an increase over time in the proportion of women in the night-time driving population. McLean et al (1984) have noted that, when there was a male and a female in the front seats of a car, the probability that the female was the driver was greater late at night than earlier in the evening following the introduction of media publicity relating to random breath testing. However, South Australian statistics did not indicate any statistically significant trend in the proportion of women among fatally injured drivers.

Although the proportion of drinking drivers among both male and female night-time drivers remained relatively constant in the roadside surveys conducted in 1981, 1982, 1983 and 1987, there was some evidence to suggest that, within each sex, the proportions with BACs at or above 0.08 and 0.15 increased over time. However, among fatally injured male and female drivers, there were no statistically significant trends over time in the proportions of drinking drivers, drivers with BACs at or above 0.08, or drivers with BACs at or above 0.15.

It should be noted that the results reported above were drawn from the entire samples of men and women without consideration of particular demographic characteristics such as age or marital status. Popkin (1989) recently concluded that of all age/sex groups, young women aged between 21 and 24 experienced the largest per cent increases from 1976 to 1985 in DWI arrests, and single vehicles night-time and alcohol-related crashes, with most of the change occurring from 1976 to 1980, rather than from 1980 to 1985. Several studies have also suggested that divorced and separated individuals are over-represented among those that drink and drive (eg Carlson, 1972; Argeriou & Paulino, 1976).

The analysis of a larger data base, derived for instance from the whole of Australia rather than just South Australia, would facilitate meaningful stratification by demographic characteristics and thereby the determination of drink-driving trends

within specific subgroups. The findings may have important implications for the nature of drink-driving campaigns which, to date, have tended to ignore female drivers.

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