

The Relationship Between Alcohol-Related Medical Conditions and Road Crashes

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ABSTRACT

Many interventions have been implemented around the world in an attempt to deter drink drivers and prevent road crashes. However, these programs may not always target high risk offenders. If high risk drivers could be identified prior to receiving convictions for drink driving, or prior to being involved in a crash, they could then be targeted for a brief road safety intervention. For example, such an opportunity would occur when a road user was in hospital receiving treatment for an alcohol-related problem. The aim of this study was to measure the association between alcohol-related medical conditions and road crashes. This was achieved through a longitudinal analysis of the hospital records of people first admitted to hospital for an alcohol-related condition over the period 1980 to 1997 in Western Australia. During this period there were 41,537 people admitted to hospital at least once for an alcohol-related medical condition. About 11.7% of these people were also involved in a road crash requiring hospitalisation. However, only 23.6% were admitted to hospital for a road crash after being admitted for an alcohol-related medical condition. The remainder were either involved in a crash prior to being admitted to hospital for an alcohol condition, or were treated for an alcohol condition at the same time as being involved in a road crash. The implications of these findings for early drink driving intervention will be discussed.

INTRODUCTION

The problem of drink driving is well documented, as are the many programs to reduce its occurrence. For example, in Australia programs such as random breath testing and community-based education campaigns have been used as a means of deterring drink driving and thus preventing alcohol-related crashes. However, while these programs prove generally effective, they do not specifically target high risk offenders. In addition to these general measures, many states in Australia have designed rehabilitation courses for drivers who have repeat drink driving convictions. Courses aimed at drink driving rehabilitation are often

based on an assumption that a great proportion of repeat drink drivers also have an associated alcohol-related problem.

However, these interventions target drivers only after they have been apprehended for drink driving offences, or after they have been involved in a road crash. It may be more effective if potential drink drivers could be provided road safety intervention or education prior to receiving convictions for drink driving, or prior to being in a crash. An opportunity for preventative education might occur in the context of hospital patients receiving treatment for an alcohol-related condition. While not all alcohol patients may later become involved in a road crash that is associated with their condition, individual-based intervention in the hospital context may prevent some from later becoming involved in road crashes related to their alcohol consumption.

The aim of this study was to measure the association between alcohol-related medical conditions and road crashes through a longitudinal analysis of the hospital records of people first admitted to hospital for an alcohol-related condition over the period 1980 to 1997 in Western Australia.

METHOD

The Health Services Research Linked Database is maintained by the Health Department of Western Australia and the Department of Public Health at The University of Western Australia (Holman, Bass, Rouse & Hobbs, 1999). This database consists of individually linked hospital admission records, mental health records, cancer registrations and other health records for the whole of Western Australia since 1970.

All the hospital admission and death records for each patient admitted to hospital for an alcohol-related medical condition between 1980 and 1997 were extracted from this database. That is, if an individual was admitted at least once during this period for an alcohol-related condition, all other admissions (both alcohol-related and other) for that person were also extracted.

For this study, an "alcohol-related medical condition" was defined as a medical diagnosis that could only have resulted from excessive alcohol consumption. These diagnoses were defined as having an aetiological fraction of 1.0 (100% attribution) by English, Holman, Milne et al (1995) and were identified by the following ICD9 CM codes (ICD9 CM, 1986):

- 291 (alcohol psychosis)
- 303 (alcohol dependence)
- 305.0 (alcohol abuse)
- 357.5 (alcohol polyneuropathy)
- 425.5 (alcohol cardiomyopathy)
- 535.3 (alcoholic gastritis)
- 571.0 to 571.3 (alcoholic liver cirrhosis)
- 980.0 (ethanol toxicity)
- 980.1 (methanol toxicity)
- E860.0 to E860.2 (external cause of injury ethanol or methanol poisoning)
- E911 (external cause of injury alcohol aspiration)

Age, gender, area of residence, Aboriginality, and external cause of admission code were available for each hospital admission record for each person in the study.

Individuals were assumed to have been involved in a road crash in the period 1980 to 1997 if the following ICD9 CM external cause of injury codes were contained in any of their hospital admission records:

- E810.0 to E816.9
- E819.0 to E819.9
- E929.0

RESULTS

A more complete description of the results can be found in Cercarelli, Rosman, Kirov and Legge (1999).

Overview

There were 41,537 individuals admitted to hospital at least once for an alcohol-related medical condition between 1980 and 1997, involving a total of 330,585 admissions (307,476 distinct inpatient episodes). Among these admissions, 100,631 contained at least one diagnosis of an alcohol-related medical condition.

Of these 41,537 individuals admitted for at least one alcohol condition, 4,875 (11.7%) were involved in a road crash. Furthermore, of those who were involved in at least one road crash, 1,151 (23.6%) were admitted to hospital for an alcohol-related condition prior to being admitted as a result of a road crash. Of the remainder, 1,557 (31.9%) were diagnosed with an alcohol-related condition at the time of their road crash, and 2,167 (44.5%) were admitted for a crash before an alcohol condition was recognised.

Of those admitted to hospital for an alcohol-related medical condition, 9,281 died, and of these, 4,279 (46.1%) were admitted only once for an alcohol-related condition. There were 128 (1.4%) people who died as a result of a road crash; 103 of these were male, 42 were under the age of 25 years, and 39 were Aboriginal. In the following, these cases will be included with all admissions to hospital.

Table 1 shows that from 1980 to 1992, the number of admissions per year fluctuated between about 4,500 and 5,500, whereas there were 6,185 in 1993; 7,284 in 1994; 8,230 in 1995 and 8,047 in 1996. For 1997 the number fell to 5,348. The reason for this rise is unclear, but could be due to changes in hospital admission policies.

Table 1 Number of Alcohol-Related Inpatient Episodes for People Admitted to Hospital Each Year in Western Australia, 1980 to 1997

Year	n	%
1980	4,422	4.4
1981	4,550	4.5
1982	4,764	4.7
1983	5,578	5.5
1984	5,491	5.5
1985	5,416	5.4
1986	5,149	5.1
1987	4,732	4.7
1988	4,604	4.6
1989	5,266	5.2
1990	4,951	4.9
1991	5,187	5.2
1992	5,427	5.4
1993	6,185	6.1
1994	7,284	7.2
1995	8,230	8.2
1996	8,047	8.0
1997	5,348	5.3
Total	100,631	100.0

On average, each person had 7.4 inpatient episodes involving both alcohol-related and non-alcohol related hospitalisations between 1980 and 1997, and an average of 2.4 inpatient episodes involving an alcohol-related condition.

The majority of people had only one alcohol-related admission (62.8%). Around 26.1% of people experienced 2 to 4 inpatient episodes, and 7.4% experienced 5 to 9 episodes in hospital for an alcohol-related condition.

For those with between 2 to 4 episodes, the median time between admissions for an alcohol-related condition was 362 days (or about 12 months). For those with 5 to 9 admissions, the median time was 176 days (or about 6 months); 10 to 19 admissions, the median time was 106 days (or about 3 months); and for those with more than 20 alcohol-related admissions, the median time between admissions was 54 days (or about 2 months).

Road Crashes and Alcohol-Related Medical Conditions

The following relates to the 4,875 (11.7%) people in this study who were also admitted to hospital, at least once, as the result of a road crash. Of these, 1,151 (23.6%) had at least one alcohol-related admission prior to their first crash admission, 2,167 (44.5%) had a crash admission before their first alcohol admission, and 1,557 (31.9%) were diagnosed as having an alcohol-related condition while in hospital for injuries resulting from a crash. For those who had at least one road crash admission, the average number of crash admissions was 1.2. The majority of people were involved in only one crash (83.3%), however 15.7% were involved in between 2 and 4 crashes.

Around 80.7% of crash casualties were male, and 19.7% of the crash casualties were Aboriginal (3% of the Western Australian population is Aboriginal). About 64.9% were

residing in the Perth metropolitan area (72% of the population in Western Australia live in Perth), and 35.1% were living in rural and remote areas (28% of the population live in these areas).

Around 23.7% of crash casualties were motor vehicle drivers, 18.3% were pedestrians, 13.6% were motor vehicle passengers, 9.1% were motorcycle riders, and 26.4% of the crash casualties were unspecified road user type.

Predictors of Being Involved in a Road Crash

It is important to note that most people admitted to hospital for an alcohol-related condition were not admitted to hospital for a road crash at any time during the 18 year study period. For 1,151 (23.6%) of the 4,875 people who did have a crash admission, an admission for an alcohol-related medical condition preceded the admission for a crash. Among this group whose first alcohol admission preceded their crash admission, 311 were admitted as pedestrians, 102 as motorcycle riders, and 242 as drivers of motor vehicles. The remainder were admitted as passengers or unknown road user type.

In order to determine the factors associated with subsequent crash involvement, a Cox proportional hazard regression model was constructed using the time between the first alcohol-related admission and the first crash admission. Separate models were constructed for crashes involving drivers, riders and pedestrians. Factors included in the models were gender, age at first alcohol admission, Aboriginality, place of residence, and indicators of alcohol dependence and alcohol pathology. For the purpose of this analysis, alcohol pathology was defined to include alcohol polyneuropathy, alcohol cardiomyopathy, alcoholic gastritis, and alcoholic liver cirrhosis.

The Cox proportional hazard model assumes no particular distribution for the time between the alcohol-related medical condition and the crash. For each factor in the model, the relative risk was calculated by comparison to a baseline group. In this way, male patients were compared to female patients, young patients were compared to old patients, Aboriginal patients were compared to non-Aboriginal patients, and patients residing in rural and remote areas of Western Australia were compared to those from the metropolitan area of Perth. Indicators for a diagnosis of alcohol abuse, alcohol dependence or a condition resulting from altered pathology were included in the models.

Table 2 gives the results of the Cox proportional hazard models. The models were constructed using records of 39,580 patients for whom there was a subsequent crash admission or no crash admission among the series of hospital admission records in the study.

Results from these analyses indicate that male alcohol patients were significantly more likely than female patients to be involved in a road crash as a pedestrian or motorcycle rider, but not as a motor vehicle driver. For all road user groups, those admitted to hospital for an alcohol-related medical condition at a younger age were much more likely to later be involved in a road crash. For each additional year of age, the relative risk decreased by 1% (risk ratio=0.988) for pedestrians; 3% for drivers (risk ratio=0.967); to 8% for motorcycle riders (risk ratio=0.924). In addition, Aboriginal people were about five times (risk ratio=4.701) more likely to be involved in a pedestrian crash than non-Aboriginal people of similar age, gender, place of residence and alcohol status. Among the alcohol conditions, alcohol

dependence was the best predictor of pedestrian crashes for otherwise similar people. Whereas patients with a diagnosis of alcohol abuse, dependence or pathology had significantly increased risks of involvement in a motorcycle crash, the effect for motor vehicle drivers was not significant for any of these conditions.

Table 2 Factors Associated with the Time Between an Admission for an Alcohol-Related Medical Condition and an Admission for a Road Crash in Western Australia, 1980 to 1997

	coefficient	std error	p-value	risk ratio*
Any Crash (n=1,156)				
male	0.2411	0.0703	0.0006	1.273
age	-0.0310	0.0020	0.0001	0.969
Aboriginality	0.6417	0.0749	0.0001	1.900
rural	0.1092	0.0090	0.2298	
remote	0.1840	0.0779	0.0182	1.202
Alcohol abuse	0.0670	0.1011	0.5075	
Alcohol dependence	0.2478	0.1021	0.0152	1.281
Alcohol pathology	-0.2763	0.1239	0.0258	0.759
Motor Vehicle Driver (n=242)				
male	0.0336	0.1483	0.8204	
age	-0.0331	0.0042	0.0001	0.967
Aboriginality	-0.3126	0.2000	0.1181	
rural	0.1521	0.1925	0.4294	
remote	0.1177	0.1824	0.5188	
Alcohol abuse	0.3593	0.2240	0.1087	
Alcohol dependence	0.0712	0.2385	0.7654	
Alcohol pathology	-0.4030	0.3048	0.1861	
Motorcycle Rider (n=102)				
male	2.9389	0.7150	0.0001	18.895
age	-0.0791	0.0087	0.0001	0.924
Aboriginality	-1.3447	0.3894	0.0006	0.261
rural	-0.1316	0.3402	0.6989	
remote	0.6470	0.2447	0.0082	1.910
Alcohol abuse	1.0772	0.3668	0.0033	2.926
Alcohol dependence	0.8381	0.3971	0.0348	2.312
Alcohol pathology	0.9140	0.3732	0.0143	2.494
Pedestrian (n=311)				
male	0.3116	0.1381	0.0241	1.366
age	-0.0116	0.0037	0.0018	0.988
Aboriginality	1.5477	0.1370	0.0001	4.701
rural	-0.4126	0.1943	0.0337	0.662
remote	-0.3627	0.1513	0.0165	0.696
Alcohol abuse	-0.0858	0.2097	0.6825	
Alcohol dependence	0.4434	0.1999	0.0265	1.558
Alcohol pathology	-0.4124	0.2312	0.0756	

* only risk ratios significantly different from 1.0 are listed

DISCUSSION

The aim of this study was to measure the association between alcohol-related medical conditions and road crashes. A longitudinal analysis of the hospital records in the Health

Services Research Linked Database of people first admitted to hospital for an alcohol-related medical condition between 1980 and 1997 in Western Australia was conducted.

Information on all contacts with the hospital system in Western Australia for the 41,537 people in the study was available, however, the database does not provide the complete picture as hospital events prior to 1980 and after 1997 were not included.

The number of admissions per year fluctuated between about 4,500 and 5,500, with an increase between 1993 and 1996 to about 7,000 to 8,000 with a return to about 5,000 in 1997. The reason for this increase is unclear but may be due to changes in coding or in hospital admission policies. Those admitted to hospital for an alcohol-related condition had a mean of 7.4 admissions to hospital for all conditions, and 2.4 admissions for an alcohol-related condition. For those who had at least one road crash admission, the average number of crash admissions was 1.2.

Of those who also had a road crash admission (4,875, 11.7%), 23.6% had a crash admission after their first alcohol-related admission, and 44.5% had a crash admission before their first alcohol admission. There were 31.9% who were diagnosed as having an alcohol-related condition while in hospital for injuries resulting from a crash.

Over this time period, the majority of the 4,875 people were involved in only one crash. About 32.7% of those involved in a road crash were aged 17 to 24 years and 38.3% were aged 30 to 59 years. This group tended to be younger than those not involved in crashes.

The majority of people involved in a road crash resided in the metropolitan area, however, those living in the remote areas of Western Australia were over represented, as were Aboriginal people. While the majority of those who were admitted were motor vehicle drivers (23.7%), a large group were pedestrians (18.3%), and 9.1% were motorcyclists.

When examining factors associated with subsequent crash involvement, differences were found for drivers, motorcycle riders and pedestrians. For all road user groups, those admitted to hospital for an alcohol-related condition at a younger age were more likely to later be involved in a road crash. For each additional year of age, the relative risk decreased by 1% for pedestrians, 3% for drivers, and 8% for motorcycle riders. Aboriginal people were five times more likely to be involved in a pedestrian crash than non-Aboriginal people of the same gender, age and area of residence.

Over the 18 year period, 11.7% (about one in nine) of those admitted to hospital for an alcohol-related medical condition were also involved in a road crash. In comparison, about one in twenty seven people in Western Australia would have been admitted to hospital as a result of a road crash over the same length of time. (This was calculated using data for 1991 when there were 3,266 road crash hospital admissions for a population of about 1.6 million people in Western Australia). This suggests that those admitted to hospital for an alcohol-related condition were three times more likely to be involved in a road crash than the average Western Australian.

It appears from these findings that since only about one quarter of crash admissions were preceded by an alcohol-related admission, an intervention aimed at reducing crashes and applied to all alcohol-related admissions not associated with a crash would not be practical, as only about 2.5% (23.6% of 11.7%) of such admissions would potentially precede a crash.

Such an intervention might be made more specific by concentrating on males, those under 30 years of age, and Aboriginal people. An alternative approach would be to apply an alcohol-related intervention to all young males admitted for a crash. For almost half the crash cases, there was an alcohol-related admission at a later date. A cost effective intervention may be appropriate in these cases. Further research is required to explore the potential of these interventions.

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