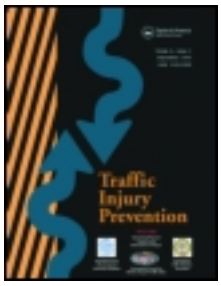


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# Proportion of Injured Drivers Presenting to a Tertiary Care Emergency Department Who Engage in Future Impaired Driving Activities

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# Proportion of Injured Drivers Presenting to a Tertiary Care Emergency Department Who Engage in Future Impaired Driving Activities

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***Objective:*** *We determined the rate of, and predictive factors for, subsequent impaired driving activity (IDA) by injured drivers treated in a Canadian tertiary care emergency department (ED) following a motor vehicle crash (MVC).*

***Methods:*** *We retrospectively identified all drivers injured in a MVC who presented to our tertiary care, urban ED (1999–2003) and had their blood alcohol content (BAC) measured. Injured drivers were categorized by BAC: group 1, BAC = 0; group 2, 0 < BAC ≤ 17.3 mM (80 mg/dL, legal limit); and group 3, BAC > 17.3 mM. IDA was defined as any of the following: a conviction for impaired driving; a 24-h or 90-day license suspension for impaired driving; involvement in alcohol-related MVC. Time to IDA following the index event between groups was compared with Kaplan-Meier survival analyses. Effects of covariates on time to IDA were analyzed using Cox proportional hazards models.*

***Results:*** *During the study period, 1489 injured drivers met study criteria: 1171 in group 1, 51 in group 2, and 267 in group 3. During an average follow-up of 52.4 months, 82 (30.7%) group 3 drivers engaged in subsequent IDA, compared with 80 (6.8%) group 1 drivers ($p < 0.0001$). Youth, male gender, history of previous IDA, and the number of previous IDA events were all associated with a significant increase in subsequent IDA. A history of IDA was the strongest predictor of future IDA in group 1 (440% increase risk) and in group 3 (80% increased risk). The magnitude of BAC elevation above the legal limit was not predictive of future IDA. Conclusions: A high portion of injured impaired drivers who present to hospital engage in repeat IDA following discharge. Besides impairment at time of hospital visit, the best predictor of future IDA is a history of IDA prior to the index event.*

**Keywords** Traffic crashes; Alcohol; Impaired driving

## *INTRODUCTION*

Motor vehicle crashes (MVCs) are the leading cause of death in Canadians between the ages of 10 and 29 and impaired driving is often implicated (Statistics Canada 2005). In 2005, an estimated 1100 persons died in alcohol-related crashes and alcohol was involved in 34.1 percent of all motor vehicle fatalities (Traffic Injury Research Foundation 2008). Canada lags far behind comparable democracies in reducing the number of alcohol-related traffic deaths even though many of these countries have far higher rates of per capita alcohol consumption. In 1997–1998 Canada had the highest rate of alcohol-impairment among fatally injured drivers of eight OECD countries (Gutoskie 2005). In order to address this problem, the Canadian "Strategy to Reduce Impaired Driving 2010" was launched in 2002 with the objective of achieving a 40 percent decrease in the percentage of road users fatally or seriously injured in crashes involving alcohol (Gutoskie 2005). However, according to a 2008 report by the Traffic Injury Research Foundation, there has not been significant progress towards achieving this goal (Traffic Injury Research Foundation 2008) and a 2004 review of worldwide trends in alcohol- and drug-impaired driving concluded that "... the recent upward trend in the alcohol-fatal crash problem [in Canada] suggests that progress witnessed in much of the 1990s has halted" (Sweedler et al. 2004, p. 177).

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The recidivism rate of high-risk drinking drivers is an important measure of the effectiveness of drunk driving prevention programs. Numerous recidivism studies have focused on convicted drunk driving offenders. (Nochajski and Stasiewicz 2006; Wells-Parker et al. 1995). However, it is equally important to know the recidivism rate of injured alcohol-impaired drivers because these drivers are also at high risk of recidivism and the interventions that are available for them are different from those available for convicted drunk drinking offenders. Injured alcohol-impaired drivers are rarely convicted of drinking and driving and therefore cannot be mandated to participate in rehabilitation programs (Goecke et al. 2007; Purssell et al. 2004). It would be logical to assume that being injured in a motor vehicle crash would deter an individual from subsequent drunk driving, but this does not appear to be the case. In New York State, 28.3 percent of injured alcohol-impaired drivers were convicted of another alcohol-related driving offense within 5 years (Lillis et al. 1995). Vingilis et al. (1996) interviewed injured drivers one year following discharge from a Toronto Trauma Center. Seven of the 15 interviewed drivers who had positive alcohol levels at the time of the index crash reported driving again while impaired. Impaired drivers admitted to U.S. trauma centers had subsequent impaired driving conviction rates ranging from 8.4 to 19.0 percent (Table I; Biffl et al. 2004; Cydulka et al. 1998; Schermer et al. 2006; Soderstrom et al. 1990; Sommers et al. 2006). This is comparable to the average 2-year recidivism rate of 19 percent that Wells Parker et al. (1995) reported for convicted impaired drivers and the average 11.5-year recidivism rate of 56 percent that Palmer (2007) reported for convicted impaired drivers.

These data suggest that injured impaired drivers are at high risk of engaging in drunk driving and being involved in car crashes following discharge from hospital, but more work is required. Most recidivism studies have used subsequent convictions for impaired driving as the main or only measure of subsequent impaired driving activity (IDA). This approach underestimates the true incidence of impaired driving because conviction rates are dependent on the amount of traffic law enforcement as well as the incidence of impaired driving. Estimates for the probability of being arrested when driving with an over-the-limit BAC range from 1 in 88 to 1 in 2000 (Borkenstein et al. 1975; Voas and Hause 1987; Zador et al. 2001). A primary goal of traffic injury prevention programs is to prevent injuries and deaths secondary to alcohol-related crashes. Therefore, it is important to include alcohol-involved crashes as one measure of the incidence of subsequent impaired driving activity. To our knowledge, no published studies have evaluated the incidence of subsequent alcohol-related crashes in injured alcohol-impaired drivers, although these drivers are at high risk for involvement in subsequent motor vehicle crashes. Australian investigators (Ferrante et al. 2001) linked records of drunk driving arrests to road crash records and found that drivers whose first drink driving arrest resulted from a road crash were three times more likely to experience a subsequent crash resulting in injury compared to those first arrested through routine detection. In the Toronto study (Vingilis et al. 1996) 15.8 percent of injured alcohol-impaired drivers reported being involved in another crash in the year following discharge.

The purpose of our study was to evaluate the rate of, and risk factors for, subsequent impaired driving in a cohort of injured drivers treated in a Canadian tertiary care emergence department (ED). Our intention was to derive current Canadian data that, to date, have been lacking and to add to the current literature by following a large cohort of injured drivers for an extended period of time using multiple objective indicators of impaired driving including administrative license sanctions and involvement in

**Table I** Studies of subsequent IDA in injured alcohol-impaired drivers

| Author, time period, jurisdiction | Patient group ($n$ = number of alcohol impaired drivers) | Outcome measure (source of outcome data) | Follow-up period | Rate of subsequent impaired driving activity |
|---|---|---|---|---|
| Lillis et al. (1995) Mid-1983–1986 Rochester, New York | Hospitalized patients ($n = 173$) | Alcohol related offenses (Department of Motor Vehicles Driver Abstracts | 5 years | 28.3% (49/173) |
| Biffl et al. (2004) January 1997–June 1998 Providence, Rhode Island | Admitted trauma center patients ($n = 113$) | DUI charges (court clerk records) | 14–32 months | 8.8% (10/113) |
| Cydulka et al. (1998) January 1993–April 1995 Cleveland, Ohio | Admitted trauma center patients ($n = 70$) | Alcohol-related citations (court clerk records) | 28 months or less | 10.0% (7/70) |
| Soderstrom et al. (1990) July 1985–June 1986 Baltimore, Maryland | Admitted trauma center patients ($n = 58$) | Convictions for alcohol-related offenses | 24–36 months | 19.0% (11/58) |
| Sommers et al. (2006) 12 months' recruitment Southwestern Ohio | Admitted trauma center patients ($n = 179$) | Citations for DUI | 1 year | 8.4% (15/179) |
| Schermer et al. (2006) August 2001–June 2004 Chapel Hill, North Carolina | Admitted trauma center patients ($n = 126$) | DUI arrest (state traffic safety data) | 3 years | 16.7% (21/126) |
| Vingilis et al. (1996) August 1986–August 1989 Toronto, Canada | Admitted trauma center patients ($n = 15$) | Self-reported impaired driving | 1 year | 46.7% (7/15) |
| Purssell (Current Study) Vancouver, Canada | Emergency department patients ($n = 267$) | License suspensions or convictions for impaired driving, alcohol involved crashes (police records) | 52 months | 30.7% (82/267) |

crashes where alcohol is considered a factor and evaluating multiple potential risk factors for this dangerous behavior.

## METHODS

This study was approved by the Institutional Research Ethics Board of the University of British Columbia.

### Identification of Drivers

We used hospital administrative and BC trauma registry data to retrospectively identify drivers injured in a MVC and treated in the ED of Vancouver General Hospital, an urban, tertiary care trauma referral center between January 1, 1999, and December 31, 2003 (64,000 visits annually). Patients were eligible for inclusion if they were injured in a MVC, had a blood alcohol concentration (BAC) measurement, could be linked to a valid BC driver's license, and were determined to be the driver. For patients captured in the BC trauma registry (1999–2003), driver status was determined from trauma registry data. For the remaining patients, driver status was determined from electronic trauma flags routinely entered by admission clerks for all injured ED patients. Patients were excluded if they could not be matched to a valid BC driver's license, if their driving record did not include record of a MVC corresponding to the hospital visit, if they were motorcyclists, or if they expired prior to discharge from hospital. For patients with multiple MVC-related visits, the first visit was used as the index visit for the study.

### Linkage with Driving Records

The Insurance Corporation of BC (ICBC) is the sole provider of basic automobile insurance in BC and maintains police traffic accident reports and driving records for every licensed driver in the province. Patients were linked to their driver's license and hence to their driving record using personal health numbers (PHN) and demographic information as described previously (Purssell et al. 2004). Cases without a corresponding police accident report (i.e., a MVC occurring within $\pm 2$ days of the hospital visit) were excluded. ICBC data were available between January 1, 1989, and December 31, 2005. We therefore had access to driving records for a minimum of 2 years following the index MVC.

### Manual Chart Review

Chart review was used to determine driver status of all patients flagged as driver status unknown. In additional, a random sample of non-trauma registry charts (5%) was reviewed to validate the accuracy of the trauma flags in our hospital database.

### Data Analysis

In Canada, it is an offense to drive with a BAC $>$ 17.3 mM (80 mg/dL). Therefore, drivers were stratified into three groups based on BAC: Group 1: BAC $= 0$, Group 2: $0 <$ BAC $\leq 17.3$ mM, Group 3: BAC $>$ 17.3 mM. Three outcome variables were studied: involvement in a subsequent IDA, time to subsequent IDA, and number of subsequent IDAs. Subjects were considered to have been involved in IDA if their driving record contained a Criminal Code conviction for impaired driving, a 24-h or 90-day license suspension for impaired driving, or involvement in an MVC where police cited alcohol as a factor. Kaplan-Meier survival analysis was used to compare outcomes between groups. Records of drivers with no recurrent IDA were censored at the time of last observation. Cox proportional hazards models were employed to analyze the effects of various covariates on the time to recidivism. The proportional hazards assumption was verified.

Fifteen variables were selected a priori and analyzed to determine their association with future IDA: BAC on ED arrival, Criminal Code Conviction (CCC) for impaired driving, 24-h license suspension, 90-day license suspension, alternate CCC or administrative sanction, age at time of index MVC, gender, causing injury to another person, number of other persons injured, hospital admission, length of hospital stay (admitted patients only), transfer from another facility, IDA preceding the index event, number of historical IDA incidents, and history of crashes not involving alcohol. Hazard ratios and $p$-values for each of the predictor variables were calculated individually and in combination using Cox regression on Group 1 (BAC $= 0$), Groups 2 and 3 combined (BAC $> 0$), and Group 3 (BAC $>$ legal limit).

## RESULTS

During the study period, there were 9075 ED visits by patients with injuries sustained in a MVC and 1489 injured drivers met all inclusion and exclusion criteria (Figures 1 and 2). Of these, 1278 (85.8%) were transported directly from the accident scene and 211 were transferred from another hospital; 696 (46.7%) were admitted to hospital and 793 were discharged from the ED. Of the 48 charts that underwent quality review, 4 had been flagged occupant unknown and could be reclassified as either driver or passenger after chart review. The electronic MVC flag and occupant status was correct in all remaining 44 charts. This corresponds to a 95 percent confidence interval (Mid P exact test) around the electronic flag error rate of 0–6.6 percent. We also reviewed all 235 charts flagged as occupant unknown (Figure 2).

Driver and crash characteristics, previous and subsequent driving records, and legal and administrative sanctions at the time of the index event are provided in Table II. In 84.7 percent of cases another person was injured or killed during the car crash. Only 18 (6.7%) Group 3 drivers were convicted of impaired driving and 19 (7.1%) were convicted of another criminal code offense. We had access to driving records for an average of 179 months preceding and 52 months following the index MVC. In Group 1, 13.0 percent had a history of IDA and 6.8 percent had subsequent IDA. In Group 3, 54.7 percent had a history of IDA and 30.7 percent had subsequent IDA.

Hazard ratios for potential risk factors are reported in Table III. We found that youth, male gender, history of IDA, and number of historical IDA events were independently associated with an increased likelihood of subsequent IDA. Drivers with a BAC above the legal limit during the index event were

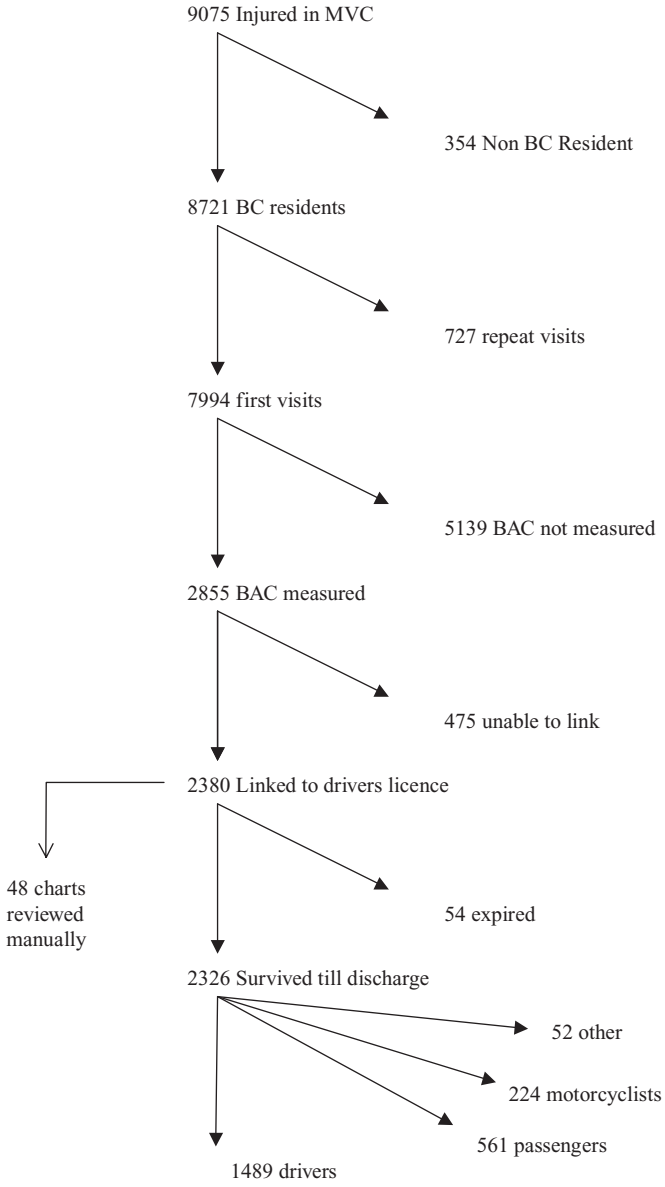


**Figure 1** Identification of drivers.

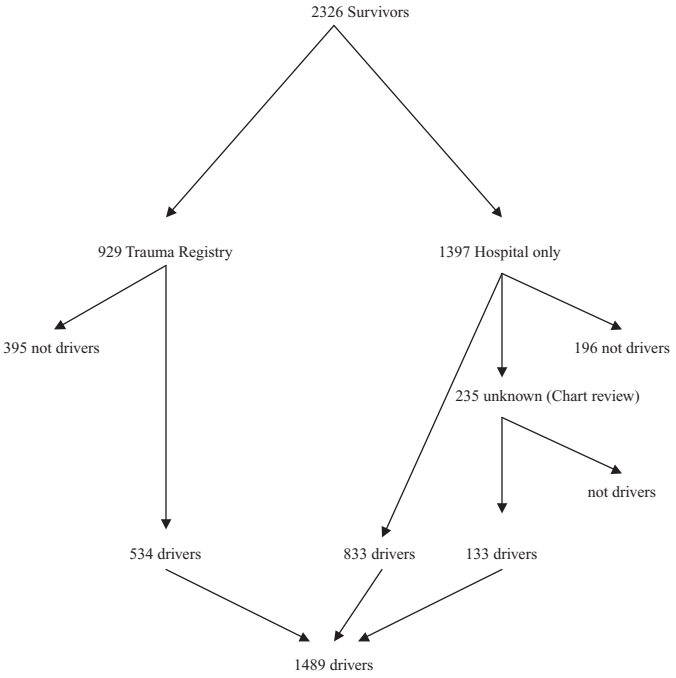


**Figure 2** Identification of drivers.

more likely to engage in subsequent IDA, had more IDAs, and had their first IDA after the index event sooner than other drivers. Kaplan-Meier curves for the three groups were significantly different ($p < 0.0001$; Figure 3). Survival analysis predicted that 50 percent of Group 3 drivers would engage in future IDA within 61 months (Figure 3). However, within Group 3, higher BAC was not associated with increased future IDA (Table III).

Drivers with a history of IDA prior to the index event had a significantly higher risk of subsequent IDA. Group 1 drivers with previous IDA were 5.2 times more likely to engage in subsequent IDA and Group 3 drivers with previous IDA were 1.8 times as likely to engage in subsequent IDA (Table III).

We examined the effect, in Group 3 drivers, of receiving a 24-h or 90-day license suspension or an impaired driving conviction and found no difference in the risk of future IDA associated with these sanctions. We also considered various markers of crash severity: whether another person was injured, the number of people injured, whether the patient was transferred from another facility for definitive care, whether the patient was admitted to hospital, and the duration of hospitalization. None of these factors were associated with significant change in the likelihood of subsequent IDA (Table III).

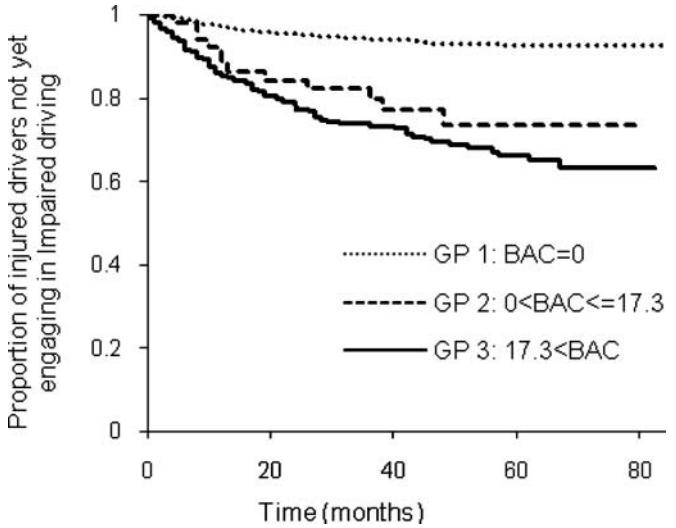


**Figure 3** KM curves: Survival curves for the three BAC groups were significantly different ($p < 0.0001$). When compared pair-wise, Group 2 ($0 < BAC < 17.3$) and Group 3 ($BAC > 17.3$) drivers were at increased risk of subsequent IDA events and had events sooner than Group 1 ($BAC = 0$) drivers. There was no significant difference in time to event between Group 2 and Group 3 drivers. It took 28 months for 25 percent of drivers in group 3 ($BAC > 17.3$) and 48 months for 25 percent of drivers in group 2 ($0 < BAC < 17.3$) to have a subsequent impaired driving event. The mean time to IDA event projected from the KM curves was 79.2 months for Group 1 drivers, 65.0 months for Group 2 drivers, and 61.0 months for Group 3 drivers.

**Table II** Driver characteristics

| | BAC = 0<br>$N = 1171$ | 0 < BAC < 17.3<br>$N = 51$ | BAC ≥ 17.3<br>$N = 267$ |
|---|---|---|---|
| Driver characteristics at time of index event | | | |
| Age | 39.3 | 33.7* | 31.5** |
| Gender (% male) | 66.6 | 80.4 | 80.5** |
| Another person injured in crash (%) | 998/1171 = 85.2 | 38/51 = 74.5 | 225/267 = 84.3 |
| Transferred from another institution (%) | 181/1171 = 15.5 | 10/51 = 19.6 | 20/267 = 7.5** |
| Admitted to hospital (%) | 542/1171 = 46.3 | 26/51 = 51.0 | 128/267 = 47.9 |
| Legal and administrative sanctions at time of index event. (Some drivers received more than one sanction) | | | |
| Impaired driving conviction | 4 (0.34%) | 0 | 18(6.7%)** |
| Other criminal code conviction | 11 (0.94%) | 2 (3.9%) | 19 (7.1%)** |
| 24-h suspension | 3 (0.26%) | 1 (2.0%) | 84 (31.5%)** |
| 90-day suspension | 3 (0.26%) | 0 | 36 (13.5%)** |
| Other traffic violation | 209 (17.8%) | 11(21.6%) | 44 (16.5%) |
| No sanction | 943 (80.5%) | 37 (72.5%) | 98 (36.7%)** |
| Previous driving record | | | |
| Months of driving records available prior to index event | 178.8 | 181.3 | 178.7 |
| Number subjects with record of previous IDA | 152 (13.0%) | 23 (45.1%)** | 146 (54.7%)** |
| Total number of previous IDA events (per subject with event) | 370 (2.4 per subject) | 61 (2.7 per subject) | 397 (2.7 per subject) |
| Number of subjects with previous CCC for DUI | 17 (1.5%) | 5 (9.8%)** | 16 (6.0%)** |
| Alcohol related crash | 35 (3.0%) | 4 (7.8%) | 32 (12.0%)** |
| Previous non-alcohol-related crash | 358 (30.6%) | 18 (35.3%) | 91 (34.1%) |
| Subsequent driving record | | | |
| Months of driving records available following index event | 52.5 | 50.0 | 52.6 |
| Number subjects with subsequent IDA | 80 (6.8%) | 12 (23.5%)** | 82 (30.7%)** |
| Number of subsequent IDA events (per subject with any event) | 130 (1.6) | 25 (2.1) | 181 (2.2) |
| Number of subjects with subsequent CCC for DUI | 2 (0.2%) | 1 (2.0%) | 6 (2.3%)** |
| Number of subsequent alcohol related crashes | 8 (0.7%) | 4 (7.8%)** | 17 (6.4%)** |
| Number of subsequent non-alcohol-related crashes | 124 (10.6%) | 6 (11.8%) | 31 (11.6%) |

*Note:* Other Criminal Code Convictions include Causing Death by Criminal Negligence, Causing Bodily Harm by Criminal Negligence, Punishment for Manslaughter, Dangerous Operation of Motor Vehicles, Vessels and Aircraft, Failure to Stop at Scene of Accident, and Operation of a Motor Vehicle While Disqualified.

*$p < 0.05$. **$p < 0.01$ in comparison with Gp1 drivers (BAC = 0). (Unpaired $t$-test for comparison of mean age. Fisher's exact test for comparison of proportions.)

**Table III** Hazard ratios* of potential risk factors for subsequent impaired driving (Cox regression)

| Potential risk factors | Group 1 (BAC = 0) | Groups 2 and 3 (BAC > 0) | Group 3 (BAC ≥ 17.3) |
|---|---|---|---|
| Sanctions for index event (DUI sanctions apply to Group 3 only) | | | |
| DUI conviction | | 0.879 (NS) | 0.834 (NS) |
| 24-h license suspension | | 1.170 (NS) | 1.127 (NS) |
| 90-day license suspension | | 1.044 (NS) | 0.990 (NS) |
| Either a DUI conviction or a 24-h or a 90-day license suspension | | 1.163 (NS) | 1.108 (NS) |
| Other Criminal Code Conviction or other traffic violation | 1.656 ($p = 0.044$) | 1.287 (NS) | 1.162 (NS) |
| Other factors associated with index event | | | |
| Increasing age | 0.954 ($p < 0.0001$) | 0.972 ($p = 0.0072$) | 0.976 ($p = 0.0308$) |
| Female gender | 0.186 ($p < 0.0001$) | 0.796 (NS) | 0.869 (NS) |
| BAC | NA | 1.005 (NS) | 1.001 (NS) |
| Causing injury to others | 1.191 (NS) | 1.356 (NS) | 1.418 (NS) |
| Number of persons injured | 1.061 (NS) | 1.167 ($p = 0.0215$) | 1.260 ($p = 0.0028$) |
| Transfer from another facility | 1.144 (NS) | 0.815 (NS) | 0.890 (NS) |
| Admission to hospital | 0.868 (NS) | 0.759 (NS) | 0.736 (NS) |
| Length of stay in hospital for admitted patients (days) | 0.987 (NS) | 0.970 ($p = 0.0433$) | 0.978 (NS) |
| Previous driving record | | | |
| History of IDA | 5.220 ($p < 0.0001$) | 1.846 ($p = 0.0044$) | 1.797 ($p = 0.0114$) |
| Number of previous IDA events | 1.237 ($p < 0.0001$) | 1.134 ($p = 0.0001$) | 1.129 ($p = 0.0006$) |
| History of being at fault during a non-alcohol-related crash | 1.312 (NS) | 1.400 (NS) | 1.490 (NS) |

*The hazard ratio is the relative risk of having the outcome for someone with the risk factor versus someone without. In the case of a score, the hazard ratio estimates the relative risk associated with a one-point increase in the score.

## *DISCUSSION*

We found a high incidence of subsequent IDA in injured alcohol-impaired drivers treated in an ED. During an average follow-up of 52 months following the index crash, 30.7 percent of the impaired drivers in our sample were involved in a subsequent IDA. Youth, male gender, history of IDA, number of previous IDA events, and BAC > 17.3 mM were all associated with a significant increase in subsequent IDA. Although injured drivers with BAC > 17.3 mM had an increased risk of recividism compared to drivers with BAC < 17.3 nM, this risk did not increase further at higher levels of BAC.

Our findings are consistent with previous research from other jurisdictions. An Australian study (Ferrante et al. 2001) found that youth and male sex are risk factors for IDA and that drivers who had been involved in an alcohol-related crash, and especially those involved at a younger age, were significantly more likely to drink, drive, and crash again and that the risk of doing so increased with each subsequent impaired driving charge. Other researchers have also found that a history of IDA is a strong predictor for future IDA. In Maryland, Rauch et al. (2002) found that drivers with no prior IDA had an annual rate of 3 alcohol-related offenses per 1000 drivers whereas drivers with one, two, and three or more prior alcohol-related events had respective annual rates of 28 (933% increase), 44 (1,467% increase), and 64 (2,133% increase) events per 1000 drivers. In New York State (Lillis et al. 1995), 46.2 percent of injured impaired drivers with an impaired driving conviction in the 2 years prior to a crash had at least one impaired driving conviction in the following 5 years compared to 24.5 percent of injured impaired drivers with no convictions in the previous 2 years. Many severe or fatal alcohol-related crashes are caused by previously apprehended alcohol-involved drivers (Simon 1992) and 34 percent of drivers responsible for fatal alcohol-related crashes in British Columbia have a prior impaired driving offense (Donelson et al. 1989).

Our finding that the magnitude of BAC elevation above the legal limit is not associated with an increased risk of recidivism is consistent with previous research. An Erie County, New York, study found no significant correlation between arrest BAC and measures of alcohol-related problems among convicted drunk drivers (Wieczorek et al. 1992), and a study conducted in California found only a small, nonlinear relationship between arrest BAC and recidivism (Marowitz and De Young 1996). This is important because some jurisdictions impose increased sanctions on impaired drivers with BAC > 32.4 mM (150 mg/dL) and organizations including the National Traffic Safety Board (NTSB 2000) and the Century Council (1997, 2003) have deemed that impaired drivers with a BAC > 32.4 mM (150 mg/dL) are "hard-core" or "high-risk" drinking drivers.

We did not find that administrative or legal sanctions reduced the rate of future IDA. Similarly, New York State researchers found that injured impaired drivers who were convicted of impaired driving were no less likely to have a subsequent conviction than those who were not convicted (Lillis et al. 1995). However, other researchers have found that sanctions are effective in preventing IDAs (Delaney et al. 2005; Kunitz et al. 2002; McKnight and Voas 1991; Voas and Tippets 1990; Wells-Parker et al. 1995). It is possible that the convicted impaired drivers in our study were at higher risk of subsequent IDA than those who were not convicted. It is also possible that our study did not have sufficient power to detect a detrimental effect of conviction because the conviction rate was so low. This low conviction rate is consistent with previous Canadian research (Goecke et al. 2007; Purssell et al. 2004).

In this study, we were not able to identify patients who received counseling or rehabilitation and therefore were unable to measure the effects of these interventions. However, alcohol screening and counseling programs were not readily available and therefore generally not applied to the population of patients that we studied. Wells-Parker et al. (1995) concluded that remediation programs result in an 8–9 percent reduction in recidivism and alcohol-related crashes. Gentilello et al. (1999) found that trauma center patients who received a brief alcohol intervention had a 47 percent reduction in injuries requiring either emergency department or trauma center admission and a 48 percent reduction in injures requiring hospital admission during a 3-year follow-up period. The American College of Surgeons, Committee on Trauma, in an attempt to reduce recidivism, has mandated alcohol screening and brief intervention programs for admitted patients in all level I and II Trauma Centers in the United States (American College of Surgeons 2006). Similar action has also been strongly recommended in Canada but has not been implemented widely nor appropriately funded (Trauma Association of Canada 2007).

## *LIMITATIONS*

This study has several limitations. First, alcohol levels were only measured for one third of MVCs. In our institution, alcohol concentrations are obtained in all moderately or severely injured drivers according to hospital protocol and our practice in this regard is similar to that of other Canadian tertiary care EDs. Therefore, drivers who did not have alcohol testing would likely have been less seriously injured than those who did and probably would not have been exhibiting signs of alcohol impairment. We do not have access to the driving records of drivers who were not tested for alcohol and therefore cannot compare their driving records with those of drivers who were tested. This may represent a source of selection bias. We suspect that the drivers who were not tested for ethanol would have a lower incidence of alcohol impairment and a lower incidence of subsequent IDAs compared to the drivers who were tested. However, we are convinced that our main conclusion that there is a high incidence of subsequent IDAs in injured alcohol-impaired drivers treated in an ED is valid and can be generalized to other ED settings. Second, our study design does not allow us to obtain information on other potential predictive factors for IDA such as distance driven per year, alcohol and drug use patterns, and risk-taking behavior. Such information is best captured prospectively with direct patient interviews. Third, we were only able to complete data linkage on patients who had a valid BC driver's license. Ross and Gonzales (1998) found that 66 percent of intoxicated

driving offenders report driving while their license is suspended. Our methods would capture drivers with a suspended license but not drivers who never had a license and it is possible that the rate of IDA is different in nonlicensed drivers. Fourth, subjects who left BC during the study period were lost to follow-up. Finally, we used the driving record to identify IDAs. This requires that the police detect and report an impaired driver and, as discussed earlier, almost certainly underestimates the true number of IDA events.

## *CONCLUSIONS*

During a follow-up period of 52 months, we found that 30.7 percent of injured impaired drivers subsequently engaged in impaired driving. Youth, male gender, history of IDA, the number of previous IDA events, and BAC $>$ 17.3 mM were all associated with a statistically significant increase in subsequent impaired driving. We believe that medical and legal interventions targeting these high-risk drivers are indicated to reduce their recidivism rates.

## *ACKNOWLEDGMENTS*

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