Intoxicated Motor Vehicle Passengers

An Overlooked At-Risk Population

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Hypotheses: Intoxicated motor vehicle passengers are similar to intoxicated drivers in recurrent health care encounters and risk of death for 5 years after injury. Intoxicated passengers have a greater risk of death than population controls.

Design: Historical cohort study.

Setting: University-based level I trauma center.

Participants: Motor vehicle crash victims admitted to a level I trauma center in 1993.

Main Outcome Measures: Recurrent hospitalization, emergency department visits, survival analysis, and standardized mortality ratios for 5 years following injury.

Results: More than one quarter of intoxicated passengers and drivers had recurrent hospitalizations and emergency department visits. Intoxicated occupants were more likely to return to the hospital and the emergency department than nonintoxicated controls (odds ratios, 2.0 and 2.7, respectively). Intoxicated passengers were at increased risk of dying compared with nonintoxicated occupants ($P=.008$) and with the general population (standardized mortality ratio=5.8). Intoxicated occupants were more likely to die an alcohol-related death ($P<.001$).

Conclusions: Intoxicated passengers injured in a motor vehicle crash are similar to intoxicated drivers in recurrent hospitalizations and emergency department visits. Intoxicated passengers have an increased mortality rate in the 5 years following injury.

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Motor vehicle crashes (MVCs) are the leading cause of injury deaths, and it is estimated that 40 people are injured for every person killed. Alcohol is the leading risk factor for injury and has been implicated in nearly 50% of fatal MVCs. Alcohol use is more prevalent in fatal than in nonfatal injuries, and injury deaths occur with greater frequency among heavy drinkers. People with alcohol dependence are 3 to 5 times more likely than the general population to be killed in an MVC. Alcohol use disorders are the most common comorbid condition in trauma patients, affecting 25% to 40%.

Much attention has been paid to the drinking driver both as a public health risk and as a risk to self. Drivers previously arrested for driving under the influence of alcohol (DUI) are at a substantially increased risk of future death in an MVC. Intoxicated drivers are involved in more crashes, use more health care resources, and have an increased likelihood of death subsequent to an injury episode. Trauma patients in general suffer repeated injury, and are at increased risk for death compared with the general population.

Death due to injury occurs in a trimodal distribution: the first peak occurs at the time of injury; a second peak, within hours of injury; and a third peak, weeks after injury. Through the development of trauma systems, the magnitude of the second peak has been decreased through lowering the incidence of preventable deaths in the hours following injury. Trauma surgeons and intensivists have contributed to a decrease in the third peak through aggressive resuscitative and intensive care efforts to prevent the development of sepsis and multiple organ failure. The first and largest peak of deaths (those that occur immediately after injury) can only be decreased with prevention modalities.

The motor vehicle occupant dies in two thirds of fatal alcohol-related MVCs. Most literature on motor vehicle occupants addresses the risks incurred by the occupant either from riding with an intoxicated driver or from being in a crash involving an intoxicated driver. Except in the case of teenage drivers, in which the presence of passengers increases MVC risk, the passenger is generally viewed as an innocent bystander.
POPULATION, MATERIALS, AND METHODS

The study was performed after approval from the institutional human research review committee. The cohort was composed of New Mexico residents older than 16 years who were admitted after an MVC to the University of New Mexico Hospital (UNMH) Trauma Center in 1993 and discharged alive. Intoxicated MVC drivers and passengers admitted in 1993 were compared with nonintoxicated occupants for recurrent encounters with our health care system, and deaths occurring within 5 years subsequent to admission. Preliminary analysis of the 1993 data showed a trend in increased mortality of intoxicated MVC passengers vs controls. Since death is a relatively infrequent event in the age group, to determine if the trend was due to inadequate study power, patients admitted in 1994 were additionally evaluated for mortality events occurring 5 years subsequent to admission. Recidivism data analyses used the 1993 admissions; mortality data analyses used both 1993 and 1994 admissions.

DEFINITIONS

Intoxicated MVC occupants were defined as drivers and passengers with a blood alcohol concentration (BAC) of 80 mg/dL or greater—the legal limit for driving in New Mexico. Nonintoxicated occupants, who served as controls, were drivers and passengers with a BAC of 0 mg/dL on admission. Recurrent health care encounters were defined as inpatient admissions to UNMH for all nonlethal causes and emergency department (ED) visits for all causes except scheduled follow-up (eg, suture removal, wound check), for 5 years following admission for injury. A death was defined as alcohol-related if either the blood alcohol level at autopsy was positive or the autopsy report ascribed the cause of death to an alcohol-related condition, such as end-stage cirrhosis or upper gastrointestinal tract hemorrhage.

DATA SOURCES

The patient cohort was identified from the UNMH Trauma Registry and then matched to both hospital and Office of the Medical Investigator databases. Control data for standardized mortality ratios were obtained from the National Center for Health Statistics 1991 US decennial life tables for the state of New Mexico.

UNMH Trauma Registry

As the only American College of Surgeons–verified and state-designated level I trauma center in New Mexico, UNMH cares for more than 90% of significantly injured patients in the state. Demographic variables, injury description, and BAC of patients admitted to the trauma service are recorded in the registry. For the present investigation, data were compiled on all New Mexico residents 16 years and older who were admitted to UNMH after an MVC in 1993 and 1994. Information extracted from the registry included name, Social Security number, date of birth, whether the occupant was the driver or passenger, and measured BAC on admission.

It is our policy to obtain a BAC on all patients admitted to the trauma service. Patients with a measured BAC of at least 80 mg/dL and patients with a measured BAC of 0 mg/dL were included in the study. Patients without a measured BAC were excluded, as were patients with BACs measuring between 1 mg/dL and 79 mg/dL. Patients who died during the initial hospitalization were also excluded from the study.

The purpose of this study was to identify patients, in addition to intoxicated drivers, who may potentially benefit from alcohol intervention in the trauma setting in an attempt to deter further injury and recurrent use of health care resources. We have not found prior studies on intoxicated motor vehicle passengers that address the recurrent use of health care resources or death rates subsequent to an MVC. We conducted a historical cohort study with the following 3 hypotheses: intoxicated passengers are as likely as intoxicated drivers to die or have repeat encounters with our health care system subsequent to admission for injury; intoxicated drivers and passengers have more encounters with our health care system than nonintoxicated controls; and intoxicated drivers and passengers are at increased risk of dying in the 5 years after admission for injury.

RESULTS

Demographics for patients meeting entry criteria are presented in Table 1.

HOSPITAL READMISSION AND ED VISITS

Hospital readmission for intoxicated MVC occupants was compared with that of nonintoxicated occupants. Table 2 presents the ORs of occupants returning for repeat admission or ED visit. Intoxicated drivers and passengers were compared with each other and to their respective controls. In summary, intoxicated patients as a group were twice as likely to return as nonintoxicated controls; intoxicated drivers were no more likely than nonintoxicated drivers to return for hospital admissions but more likely to return for ED visits; and intoxicated passengers were more likely than nonintoxicated passengers to return for both categories of recurrent visit. Roughly 25% of intoxicated passengers and intoxicated drivers returned for both hospital readmission and ED visits.

Table 3 presents death data results. Using Fisher exact test to compare numbers of deaths, there was no difference between intoxicated and nonintoxicated groups. Age stratification was then performed (Table 3). The age stratified frequency table analysis for patients older than 30 years shows that intoxicated passengers had a 12.8% mortality, vs 5.5% among intoxicated drivers, and less than 2% in the nonintoxicated groups (overall P = .02). Post hoc analysis revealed that intoxicated passengers were more likely to die than either nonintoxicated drivers or passengers, but no more likely than intoxicated drivers.
Recurrent Health Care Encounter Data

Patients admitted in 1993 were evaluated for hospital readmission and ED visits for the 5 years following admission. There were 180 intoxicated and 197 nonintoxicated occupants. Patients meeting study criteria were linked to the hospital database that contains all UNMH inpatient admissions and ED visits. Data were matched by name, medical record number, birthdate, and Social Security number for 5 years following admission in 1993. Recorded data included date of and reason for hospital readmission or ED visit.

Office of the Medical Investigator Data

All reportable deaths in New Mexico are recorded by the Office of the Medical Investigator. Reportable deaths include, but are not limited to, any sudden or unexpected death, violent or suspicious deaths, deaths involving alcohol or substance abuse, and deaths not attended by a physician. Trauma patients admitted in 1993 and 1994 were linked to the Office of the Medical Investigator database by name, date of birth, and Social Security number for 5 years after admission for injury. Date of death, cause of death, and whether alcohol was present at the time of death were recorded. For the 2-year period of 1993 and 1994, there were 705 motor vehicle occupants who met study criteria, 338 of whom were intoxicated at the time of admission and 367 who were not.

Data Validity

The data include only recurrent encounters with our health care system and not with other facilities in the state or elsewhere. If the repeat ED visit or inpatient readmission was for serious injury, the likelihood that the patient received care at UNMH is greater than 90%. All death data are accurate if the patient died in the state of New Mexico. If a patient moved out of state after hospital discharge, data are not available.

STATISTICAL ANALYSIS

Admission demographics were compared with Fisher exact test for categorical variables and t test for continuous variables. The number of intoxicated drivers and passengers with recurrent hospital admissions and ED visits were compared with nonintoxicated occupants by Fisher exact test, and an odds ratio (OR) with a 95% confidence interval was calculated. Intoxicated drivers and passengers were also compared with each other. For the analysis, each patient was counted once despite multiple admissions for certain patients. The death analysis was divided into 2 components. First, internal comparisons between groups were performed, followed by external comparisons to population data. For internal comparisons, the number of deaths in each of the 4 groups, intoxicated drivers and passengers and nonintoxicated drivers and passengers, was compared using Fisher exact test. In addition, nonparametric age-adjusted survival analysis was performed using log-rank tests. A comparison between groups of deaths related to alcohol was also performed. The groups were then age stratified into 2 strata: older or younger than the median age of 30 years. External age-adjusted comparisons to population data were calculated using standardized mortality ratios by comparing observed deaths in each group with National Center for Health Statistics data for expected deaths in New Mexico. All analyses were done with SAS software, version 6.12 (SAS Institute Inc, Cary, NC). Data are presented as standardized mortality ratios, with a P value calculated from a continuity-corrected χ² statistic. A P value of .05 or less was considered statistically significant for all statistical tests performed.

Table 1. Recidivism and Mortality Demographics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Recidivism</th>
<th>P Value</th>
<th>Mortality</th>
<th>P Value</th>
</tr>
</thead>
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<tr>
<td>BAC ≥ 80 mg/dL</td>
<td>80</td>
<td>. .</td>
<td>338</td>
<td>. .</td>
</tr>
<tr>
<td>BAC = 0 mg/dL</td>
<td>47</td>
<td>. .</td>
<td>367</td>
<td>. .</td>
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<td>No. of patients</td>
<td>180</td>
<td>. .</td>
<td>234</td>
<td>. .</td>
</tr>
<tr>
<td>Mean BAC, mg/dL</td>
<td>223</td>
<td>. .</td>
<td>237</td>
<td>. .</td>
</tr>
<tr>
<td>No. (% of drivers)</td>
<td>118 (66)</td>
<td>131 (66)</td>
<td>232 (66)</td>
<td>243 (66)</td>
</tr>
<tr>
<td>Age, y</td>
<td>31</td>
<td>. .</td>
<td>31</td>
<td>. .</td>
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<tr>
<td>% Male</td>
<td>85</td>
<td>57</td>
<td>84</td>
<td>57</td>
</tr>
<tr>
<td>Injury Severity Score</td>
<td>13.7</td>
<td>13.0</td>
<td>13.8</td>
<td>12.2</td>
</tr>
</tbody>
</table>

*Data for recidivism correspond to the year 1993; data for mortality, the years 1993 through 1994. BAC indicates blood alcohol concentration; ellipses, not applicable.

The Fisher exact test revealed that autopsy confirmed alcohol-related deaths were far greater in the intoxicated group as a whole. Rate of death, evaluated by survival analysis, demonstrated that intoxicated passengers die more quickly than all other groups (P = .008, Figure).

Age-matched standardized mortality ratios were calculated by comparing the patient data set to all mortality data for New Mexico. Table 4 presents the standardized mortality ratios. In summary, intoxicated patients in general had a higher mortality than the population of New Mexico, but this was entirely due to the intoxicated passengers. Intoxicated drivers did not have an increased death rate over controls in the 5 years following injury, but intoxicated passengers had a 5.8-fold greater death rate than expected.

This study examined the natural history of intoxicated passengers admitted to UNMH after an MVC resulting in injury. Roughly one fourth of intoxicated MVC occu-
In addition, the group with a BAC of 0 mg/dL may not meet criteria for alcohol abuse or dependence. The use of a BAC of 0 mg/dL in this study may account for our inability to detect a difference in overall death rates between intoxicated and nonintoxicated groups in our internal comparisons and perhaps for the inability to detect a difference in hospital readmissions between intoxicated and nonintoxicated drivers.

The overall recidivism rate of 12% for the nonintoxicated group is similar to that previously reported for blunt trauma.13 We have no reason to suspect differential follow-up for serious injury or emergency visits, as we are both the primary indigent care and tertiary care facility in the state. As far as death data, we included only New Mexico residents in the study. There should be no reason that the nonintoxicated group would be more likely to move out of the state than the intoxicated group. Since both groups are young, there should be no difference in the deaths that would not be reported to the OMI in each group.

In addition, one could argue that intoxicated passengers are more likely to die in the years following hospital admission because intoxicated drivers have "learned the hard way." It is of interest that NIPs seemed to have a repeat ED encounter rate that was significantly greater than that of NID, IP, or ID. This may be due to factors that are not captured in the study. For example, NIPs may have a lower ability to detect a difference in alcohol abuse or dependence.

The patients in this study were identified through the MVC. No screening criteria other than admission BAC were used, these data likely underestimate the effect of harmful drinking done by intoxicated motor vehicle occupants. Other studies7 have shown that 46% of patients admitted with a BAC of 0 mg/dL meet criteria for alcohol abuse or dependence. The use of a BAC of 0 mg/dL in this study may account for our inability to detect a difference in overall death rates between intoxicated and nonintoxicated groups in our internal comparisons and perhaps for the inability to detect a difference in hospital readmissions between intoxicated and nonintoxicated drivers.

A decrease in harmful alcohol consumption should have a positive effect on alcohol-related motor vehicle trauma and injury prevention strategies in general. Randomized trials performed in various medical settings have demonstrated that alcohol consumption decreases after a brief motivational interview.22-24 Recently, Gentilello et al25 have shown that both alcohol consumption and injury recidivism are reduced after a brief intervention in an inpatient trauma population. Similarly, Monti et al26 have demonstrated lower rates of DUI and other alcohol-related problems following brief intervention in an ED setting. Our data indicate that intoxicated passengers may behave and take risks similarly to intoxicated drivers and may be candidates for similar types of interventions.

The patients in this study were identified through an adverse consequence of alcohol use—the MVC. No diagnosis of alcohol abuse or dependence was obtained. In addition, the group with a BAC of 0 mg/dL may not represent the general non-problem drinker. Since no screening criteria other than admission BAC were used, these data likely underestimate the effect of harmful drinking done by intoxicated motor vehicle occupants. Other studies7 have shown that 46% of patients admitted with a BAC of 0 mg/dL meet criteria for alcohol abuse or dependence. The use of a BAC of 0 mg/dL in this study may account for our inability to detect a difference in overall death rates between intoxicated and nonintoxicated groups in our internal comparisons and perhaps for the inability to detect a difference in hospital readmissions between intoxicated and nonintoxicated drivers.

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from their mistakes” or because they have been arrested for DU1. However, injury episodes have not been proven to have a clear teaching effect on the intoxicated driver if no intervention occurs.25

Drinking is associated with risk-taking behaviors,22 and trauma often occurs early in the course of harmful drinking.26 Our data indicate that intoxicated passengers may take more risks than others, including intoxicated drivers. Intervention after an injury episode may serve to decrease both further injury episodes and deter progression to more severe alcohol problems. The National Institute on Alcohol Abuse and Alcoholism27 recognizes a “need-treatment gap” for patients with alcohol use disorders. Capturing the appropriate patients at highest risk for recurrent harmful drinking, hospitalization, and death may help decrease the morbidity and mortality from alcohol use along with decreasing the burden to society. Holdner and Blose28 have shown that treating patients with alcohol use disorders results in decreased health care costs. Intervention for alcohol problems also seems to function as a secondary prevention of injury.25

To perform appropriate secondary prevention of injury, we need to accurately identify who will benefit from intervention during their first hospitalization for injury. Intoxicated passengers and drivers have equivalent recidivism rates that far exceed those of nonintoxicated controls. Although in this study, mortality rates of intoxicated drivers did not exceed those of the control group, intoxicated drivers have otherwise been shown to have an increased mortality.10,11 Rather than the tri-modal distribution of death due to injury, there seems to be a fourth peak of delayed death due to ongoing alcohol use disorders, as demonstrated by the intoxicated passengers in this study. We have identified a group of drinkers, intoxicated passengers, at particularly high risk for adverse consequences of alcohol use who would potentially benefit from appropriate screening and treatment.

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References


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