Blood Alcohol Tests, Prevalence of Involvement, and Outcomes Following Brain Injury

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Abstract: We collected data on all residents of San Diego County, California who were hospitalized for or died from a brain injury in 1981. The objectives were to assess the frequency of blood alcohol concentration (BAC) testing and the associations of BAC prevalence with the external cause of the brain injury and case outcome. We found that high BAC levels were most frequent among brain-injured subjects between the ages of 25 and 44 and among those subjects involved in motor vehicle crashes and assaults. Contrary to expectations, injury severity and hospital mortality were inversely related to BAC level, controlling for other predictors. We believe that these inverse associations might be due to differential rates of BAC testing by severity. Among brain-injured survivors with more severe injuries, however, we found that BAC level was positively associated with the prevalence of physician-diagnosed neurological impairment at discharge and with the length of hospitalization. (*Am J Public Health* 1989; 79:294–299.)

Introduction

The scientific literature on alcohol and motor vehicle crashes points to high risk of crash involvement when alcohol is consumed.[1] However, less information is available on many questions about alcohol use and injuries. For example, which subgroups of injured motorists are blood-alcohol-tested and, by extension, are the published findings representative of all those injured?

A related question is the relation of alcohol to the occurrence of some types of nonmotor-vehicle-related injuries. Although the association between blood alcohol concentration (BAC) and risk of injury is well established for motor vehicle crashes,[1] general aviation crashes, drownings, snowmobile crashes, and violence,[2–4] there are less well established linkages between alcohol and injuries from falls and from injuries at work or during some recreational activities.

A third question involves the role of alcohol in the outcome of injury. Animal studies[5–15] have demonstrated a variety of physiological effects of alcohol (ethanol) on injuries. In humans, however, the findings are equivocal. Some reports[16,17] suggest that intoxicated persons are somehow protected from serious injury; other studies suggest that intoxication leads to more severe injuries.[18–20] An important public health aspect of these findings is whether the physician's ability to establish accurate diagnoses for persons with neurological injuries[21–25] is compromised by the presence of alcohol.

This report describes BAC testing among a cohort of San Diego County, California residents who were brain-injured in 1981 and examines the rate of BAC testing, the proportion of positive BAC test results, the relation of BAC level to brain injuries from various external causes, and the relation between BAC level and injury outcome.

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Methods

Members of the cohort were residents of San Diego County, California who were hospitalized (or died) in 1981 due to brain injury. Specific details of the study design, study region, case ascertainment, and methodology are reported in detail elsewhere,[26–28] and certain relevant points are summarized here.

For purposes of this study, brain injury is physical damage to, or functional impairment of, the cranial contents from acute mechanical energy exchange exclusive of birth trauma. Information was ascertained on persons with autopsy evidence of brain injury who died at the injury scene or were dead on arrival at an emergency room and on persons admitted to a hospital with physician-diagnosed brain injury.

Brain-injury cases were identified from emergency room and inpatient hospital records of acute care general hospitals in the county; all coroners' records in San Diego County and the adjoining counties of Imperial, Orange, and Riverside; all death certificates (regardless of cause or place of death) for residents of San Diego County; a survey of all nursing homes and extended care facilities in San Diego County; and reviews of the nine major hospitals in the three counties bordering San Diego County. Autopsy and coroners' records were obtained for all relevant fatalities.

For people surviving until hospital admission, the Glasgow Coma Scale (GCS) was used to assess the level of brain-injury severity.[29] This scale was used consistently in all San Diego County emergency rooms during 1981. For a few patients, a verbal response was not recorded (e.g., because of intubation), and it was assumed to be unimpaired if eye and motor response were unimpaired. For a very small number (less than 1 per cent) of severely injured patients for whom the GCS was not assessable, the medical chart was examined thoroughly and all relevant clinical information was used to judge brain-injury severity. The GCS used for these analyses was measured upon arrival at the emergency room.

Patients admitted with a GCS of 8 or lower were defined as *severe* cases; those with a GCS of 9 or greater were defined as *moderate* if they had a hospital stay of at least 48 hours and either a GCS below 13, an abnormal computerized axial tomography (CAT) scan, or brain surgery. All other cases were termed *mild*. These categories and criteria are consistent with those suggested by Jennett and Teasdale[29] and Levin, *et al.*[30]

Overall injury severity was defined using the 1980 revision of the Abbreviated Injury Scale (AIS) which assigns a severity level from 1 to 6 to each injury.[31] The Injury Severity Score (ISS) assigns an overall measure of injury severity based on AIS scores.[32,33] Injuries are assigned to six body regions (face, head and neck, chest, abdomen, extremities, and general), and the ISS is calculated as the sum of the squares of the highest AIS values for three separate regions. A patient's ISS is a good measure of the risk of death from injuries, and this predictive power is improved by age-adjustment.[32,33]

Rates of neurological limitations were derived for all moderately or severely brain-injured persons admitted to a hospital. These rates were adjusted for age, gender, and injury severity at the time of emergency room treatment. Neurological limitations included only physician-diagnosed deficits or limitations at the time of hospital discharge.

Persons under the age of 15 have been excluded from the analysis because they were not generally tested for blood alcohol by either hospitals or coroners in 1981.

Blood alcohol samples were generally obtained while the person was in the emergency room, and results were abstracted from the hospital record or the coroner's report and were not based on police reports. Most hospitals and coroners used a gas chromatographic method to determine blood alcohol concentration.

The effects of BAC and other factors on injury severity and hospital mortality were estimated and tested with multiple logistic regression.[34]

Results

Of the 3,358 new cases of brain injury identified, 709 were under the age of 15 and excluded from the analyses.

BAC Testing

Forty-four per cent of 2,649 brain-injured persons age 15 and older were BAC tested. The overall BAC testing rate was higher for males (49 per cent) than for females (30 per cent) and varied by age. BAC testing was lowest in young adults (32 per cent) and those over age 64 (36 per cent), and it was highest for those aged 40–49 and 60–64 (52 per cent and 55 per cent, respectively).

Those dead on arrival (DOA) at the hospital had a BAC testing rate of 99 per cent, and those dead at the scene (DAS) of injury and taken directly to the county morgue had a BAC testing rate of 93 per cent. Persons admitted to a hospital with severe, moderate, or mild injuries had BAC testing rates of 61, 54, or 30 per cent, respectively.

BAC testing rates also varied by external cause of the injury (Figure 1). Persons with brain injuries from firearms had a BAC testing rate of 87 per cent, compared with 47 per cent from motor-vehicle crashes, 43 per cent from assault, 33 per cent from falls, and 22 per cent for all other external causes combined. Since the comparison of these BAC testing rates may be confounded by age, gender, and severity of brain injury, the external cause-specific rates were adjusted (by the direct method) for these factors. As shown in Figure 1, the differences in BAC testing rates among injury types (defined by external cause) were reduced substantially after adjustment, especially for firearm injuries.

BAC testing rates were highest for brain-injured pedestrians and lowest for bicyclists struck by a motor vehicle (Table 1). BAC testing rates were higher for drivers than for passengers, and the rates increased with severity of brain injury for all road-user categories. These BAC testing rates did not change appreciably when adjusted for age and gender.

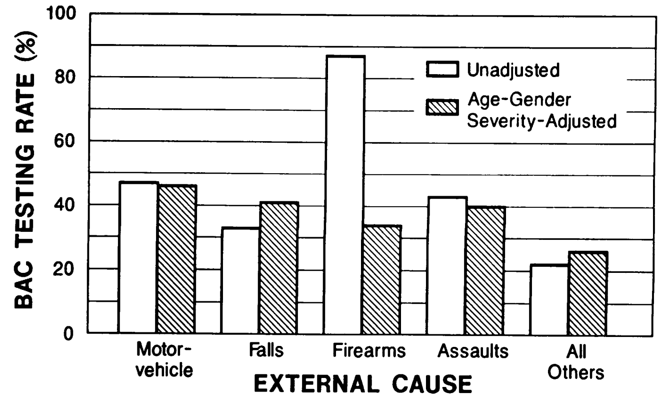

FIGURE 1—The per cent of brain-injured persons tested for BAC, by external cause of the injury: A comparison of results unadjusted and adjusted for age, gender, and injury severity

Proportion with Positive BAC

Of the 1,155 BAC-tested cases, 493 (43 per cent) had a negative result, 98 (8.5 per cent) had a BAC of 1 to 99 mg% (.22–21.70 mmol/L), 257 (22 percent) had a BAC of 100–199 mg% (21.71–43.20 mmol/L), and 307 (27 per cent) had a BAC of 200 mg% (43.42 mmol/L) or higher. Driving with BAC of 100 mg% (21.71 mmol/L) or higher is either an offense per se or presumptive evidence of driving under the influence (DUI). Driving with lower BACs can also result in DUI charges in most states. Generally, the proportion of those tested who had positive tests decreased beginning at about age 45 (Table 2). One-third of those aged 25–64 who tested BAC positive had a blood-alcohol level of 200 mg% (43.42 mmol/L) or higher.

Higher proportions of mildly brain-injured persons who were tested had positive BAC tests, compared with those with moderate or severe brain injuries or those who were DOA at the emergency room or taken directly to the coroner's office (Table 3).

The proportions with a positive blood-alcohol result varied by external cause of the injury. Two-thirds of those tested who were brain-injured from motor vehicle-related causes had a positive BAC; lower prevalences were observed for assaults (60 per cent), falls (44 per cent), firearms (35 per cent), and all other causes (42 per cent). These differences may be confounded by severity of injury and age (Tables 1 and 2); hence, the overall proportion with a positive BAC and the proportions at each BAC level were adjusted for these

TABLE 1—Per Cent of Brain-Injured Subjects Who Were Tested for Blood Alcohol Concentration (BAC), by Injury Severity and Road-User Category, San Diego County, California, 1981

	Injury Severity			
Road-User Category	Mild	Moderate/ Severe	DOA*	Total
Occupant	33	63	99	46
Driver	36	68	100	50
Passenger	29	56	96	39
Motorcyclist	34	66	100	49
Pedestrian	32	55	97	53
Bicyclist	20	29	100	29
Total	33	62	99	47

*Dead on arrival at the hospital.

TABLE 2—Per Cent of Tested Subjects with a Positive BAC and the Per Cent at Each BAC Level, by Age, San Diego County, California, 1981

	Blood Alcohol Concentration in mg% (mmol/L)			
Age (No. Tested)	1–99 (.2171–21.70)	100–199 (21.71–43.20)	200+ (43.21+)	Positive BAC* (≥1 mg% [.2171])
15–24 years (485)	11	26	22	58
25–44 (417)	8	26	33	67
45–64 (157)	8	12	34	54
65+ (96)	3	9	10	23
Total (1155)	9	22	27	58

*May not equal the sum of the other three columns because of rounding error.

factors. The unadjusted results did not differ much from the adjusted results for persons injured in motor vehicle crashes or falls (Figure 2) but did differ from the adjusted estimates for persons injured from firearms or assaults. Among tested subjects with a positive BAC, those injured by firearms tended to have a lower BAC level and those injured by falls had a higher BAC level than did other injured subjects.

Results of BAC testing by road-user category among motor vehicle-related brain injuries are given in Figure 3. The proportion with a positive BAC is between 60 and 70 per cent for all road-user categories, and the proportions are five to nine times higher for persons with BAC levels of 100 mg% (21.71 mmol/L) or higher than for those with BAC levels less than 100 mg% (21.71 mmol/L).

BAC results for brain-injured victims of motor vehicle crashes are given in Table 4 by injury severity and road-user category. Fifty-nine per cent of these tested subjects had BAC levels greater than or equal to 100 mg% (21.71 mmol/L), and this proportion was higher for drivers of cars, vans, or light trucks than for brain-injured passengers in these vehicles or for motorcyclists, pedestrians, and bicyclists. In each road-user category, the proportion having a high BAC level (≥100 mg% [21.71 mmol/L]) was greater for those with mild brain injuries than for those having more severe injuries.

Work-Related Brain Injuries

One hundred fourteen of the 2,649 members of the eligible cohort sustained a brain injury while engaged in work-related activities. Of the 21 subjects who were BAC-tested, 17 had a negative result, but all four subjects with a positive result had a BAC level of 100 mg% (21.71 mmol/L) or higher.

TABLE 3—Per Cent of Tested Subjects with a Positive BAC and the Per Cent at Each Level, by Injury Severity, San Diego County, California, 1981

	Blood Alcohol Concentration in mg% (mmol/L)			
Severity of Brain Injury	1–99 (.2171–21.70)	100–199 (21.71–43.20)	200+ (43.21+)	Positive BAC (≥1 mg% [.2171])
Mild	7	27	37	71
Moderate or Severe	8	18	21	48
DOA/DAS*	11	19	19	49
Total	9	22	27	58

*DOA = Dead on arrival at hospital; DAS = Dead at the scene of the injury.

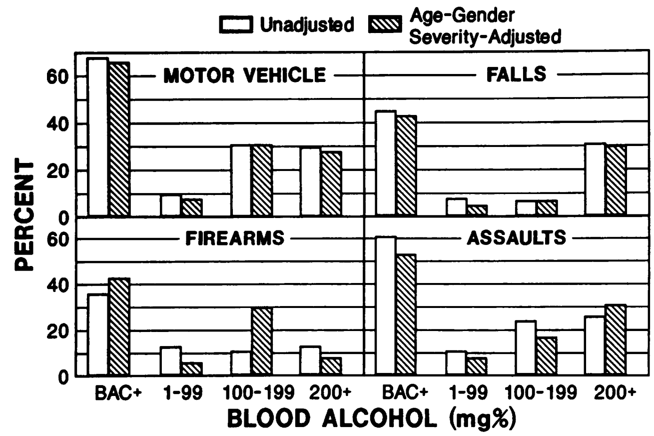

FIGURE 2—The per cent of brain-injured subjects with a positive BAC and the per cent of each BAC level, by external cause of the injury: A comparison of results unadjusted and adjusted for age, gender, and injury severity

BAC Testing and Possible Selection Bias

The effects of five factors on brain-injury severity (moderate or severe versus mild) are presented in Table 5. Results of multiple logistic regression show that the probability of sustaining a moderate or severe injury is positively associated with firearm injuries and age and inversely related to blood-alcohol level. This latter finding is consistent with the results of the crude (unadjusted) analyses shown in Tables 3 and 4. Although this inverse association with BAC level is in the direction opposite to that which one might expect, this finding may have resulted from differential rates of BAC testing by injury severity. It is conceivable, for example, that persons having a mild brain injury might not be tested for blood alcohol unless there was obvious intoxication while most persons with more severe injuries get routinely tested, regardless of actual BAC level. This explanation of selection bias is consistent with our data, which showed that while only 30 per cent of mild brain-injured persons were tested, 70 per cent of these persons had a positive BAC; yet, of the 74 per cent of moderate or severe injuries that were tested, only 45 per cent of these had a positive BAC. Thus, the apparent protective effect of alcohol seen in Table 5 (risk odds ratio of 0.6) could be the result of differential testing rates by severity.

The potential impact of differential BAC testing by severity is illustrated by the hypothetical data in Table 6. As shown in the upper panel, we have assumed that while there is no association between actual BAC level and BAC testing among all persons with moderate and severe injuries in the total source population (OR = 1.00), there is a positive association among persons with mild injuries (OR = 4.51). Using only the data for BAC-tested persons, as shown in the lower-left panel, we find that a positive BAC appears to protect against a more severe injury (OR = 0.35), which is the crude result actually obtained in this study. Using the hypothetical data for all persons in the source population, however, we see in the lower-right panel that there is no association between BAC level and injury severity (OR = 1.00). Thus, the inverse association observed in this study can be explained by selection bias caused by differential rates of BAC testing. Although the illustration in Table 6 is based on certain hypothetical data, we believe the underlying assumptions about BAC testing are quite plausible.

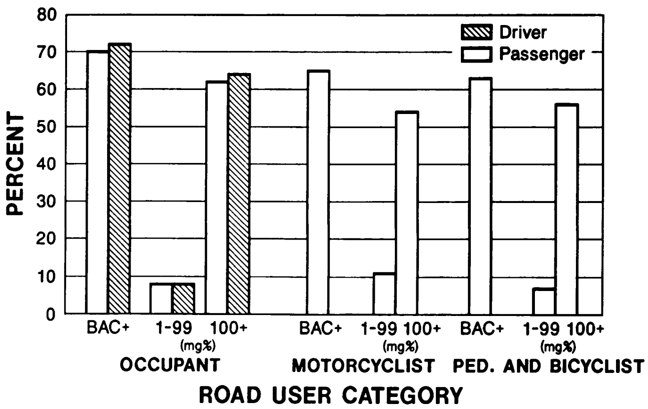

FIGURE 3—The per cent of motor vehicle-related brain-injured subjects with a positive BAC and the per cent at each BAC level, by road-user category and driver/passenger status

Effects on Hospital Mortality

Of the 1,155 persons who were tested for BAC level, 807 were admitted to a hospital alive because of their injuries and 86 died while hospitalized, an overall case-fatality rate of 11 per cent. The estimated effects of four factors on hospital mortality, based on multiple logistic regression, are given in Table 7. While the effects of injury severity and age are positive, as expected, the apparent protective effect of a higher BAC level on case fatality is similar to its effect on injury severity (Table 5). Thus, as with the previous finding, the observed effect of BAC level on case fatality might have been biased by differential rates of BAC testing (Table 6).

In Table 8, the adjusted BAC effect on hospital mortality is compared for various restrictions of the study population according to injury severity. Note that the apparent effect

TABLE 4—Per Cent of Tested Subjects with a Positive BAC and the Per Cent of Tested Subjects with a High BAC Level (≥100 mg% or 21.71+ mmol/L) among Brain-Injured Victims of Motor Vehicle Crashes, by Injury Severity and Road-User Category, San Diego County, California, 1981

Road-User Category	Severity of Brain Injury: Mild	Moderate/Severe	DOA[a]	Total
Motor Vehicle Occupants[b]				
Positive BAC	80	60	59	70
≥100 mg%	73	51	48	62
Drivers[b]				
Positive BAC	82	60	63	72
≥100 mg%	76	52	52	64
Passengers[b]				
Positive BAC	74	60	48	65
≥100 mg%	66	50	33[e]	55
Motorcyclists[c]				
Positive BAC	72	52	74	65
≥100 mg%	63	43	58	54
Pedestrians and Bicyclists[d]				
Positive BAC	82	29[e]	59	68
≥100 mg%	74	29[e]	47	53
All Road Users				
Positive BAC	78	54	62	67
≥100 mg%	71	46	50	59

[a]Includes those dead on arrival at the hospital or taken directly to morgue.
[b]Includes passenger cars, vans, pickup trucks.
[c]Includes three passengers.
[d]Includes only those involved in a motor-vehicle collision.
[e]Based on fewer than 10 BAC-positive cases.

TABLE 5—Estimated Adjusted Effects of Five Factors on Injury Severity (Moderate/Severe vs Mild): Results of Multiple Logistic Regression (n = 1155)

Factor	Risk Odds Ratio (ROR)	95% CI (ROR)
Age	1.54*	(1.21, 1.96)
BAC Level (mg%)	0.60**	(0.53, 0.68)
Cause of Injury		
Firearms	9.92	(3.69, 26.7)
Falls	0.67	(0.54, 0.83)
Assaults	0.44	(0.36, 0.55)
Other***	1.00	

*Corresponds to an age difference of 25 years.
**Corresponds to a BAC level difference of 100 mg%.
***The reference category of which 78% are motor vehicle injuries.

(ROR <1) decreases (i.e., ROR becomes closer to one) as the logistic regression analysis is restricted to more severe injuries. This finding is also consistent with our previous interpretation of possible selection bias due to differential rates of BAC testing since most severe injuries are routinely tested.

Other Outcomes

Physician-diagnosed neurological impairments were recorded for all brain-injured patients admitted to a hospital with moderate or severe injuries *and* discharged alive from an acute care hospital. Rates of neurological limitations were higher among those patients with positive BAC levels (46 per cent) than for patients with negative BAC levels (32 per cent). The difference in rates was 14 per cent (95% CI = 2, 26). As shown in Figure 4, however, the elevated risk of neurological impairment (adjusted for age, gender, and severity) seems to be restricted to persons with a BAC level of 100 mg% (21.71 mmol/L) or greater.

TABLE 6—Hypothetical Illustration of Selection Bias Due to Differential BAC Testing in Estimating the Effect of BAC Level on Injury Severity

A. BAC Testing

Actual BAC Level	Moderate/Severe Injury: BAC Test	No Test	Total	Mild Injury: BAC Test	No Test	Total
Positive	275	95*	370*	384	444*	828*
Negative	332	115*	447*	161	840*	1001*
Total	607	210	817	545	1284	1829
OR = 1.00				OR = 4.51		

B. Brain Injury Severity

BAC Level	Observed among Tested Subjects: Moderate/Severe	Mild	Total	Hypothetical Data in Total Source Population (Tested and Untested): Moderate/Severe	Mild	Total
Positive	275	384	659	370	828	1198
Negative	332	161	493	447	1001	1448
Total	607	545	1152	817	1829	2646
OR = 0.35 (95% CI = 0.27, 0.44)				OR = 1.00		

*These numbers are hypothetical but consistent with the assumptions about BAC testing that are stated in the text.

TABLE 7—Estimated Adjusted Effects of Five Predictors on Hospital Mortality among Hospitalized Patients: Results of Multiple Logistic Regression (n = 808)

Predictor	Risk Odds Ratio (ROR)	95% CI (ROR)
Age	2.90*	(1.70, 4.93)
Sex (Male/Female)	1.25	(0.85, 1.83)
BAC Level (mg%)	0.67**	(0.49, 0.92)
Injury Severity		
Severe	28.72	(10.4, 79.1)
Moderate	4.26	(1.46, 12.4)
Mild***	1.00	

*Corresponds to an age difference of 25 years.
**Corresponds to a BAC level difference of 100 mg%.
***The reference category.

Length of hospital stay did not differ by BAC level on admission. A similar result was found when persons who died in the hospital were excluded from the analysis. Yet length of stay was positively associated with BAC level among patients with severe injuries. Almost 80 per cent of those with a positive BAC test were hospitalized two weeks or longer, compared to 62 per cent of those with no blood alcohol on hospital admission. There was little association between length of stay and BAC level among patients with mild or moderate brain injuries.

Although the effect of BAC level on length of stay was observed for patients with severe brain injuries (i.e., GCS <8), it is still possible that this effect might have been confounded by amount or type of brain damage. Nevertheless, we found no evidence for such residual confounding in our data since the mean Injury Severity Score (ISS) in patients with severe injuries was similar for patients with positive and negative BAC levels.

Discussion

Findings from this study show that over one-half of all brain-injured persons who are seen in a hospital emergency room are BAC-tested; but until BAC testing for all hospital-treated injured persons is instituted, unbiased estimates of actual BAC frequency and its effects among brain-injured persons will not be possible.

We found that the rate of blood alcohol testing among brain-injured persons in San Diego County is related to type and severity of the injury. Thus, the inverse association observed between BAC level and injury outcome (severity and mortality) is very likely biased due to differential rates of BAC testing, especially among persons with less severe injuries (Table 6). Indeed, the adjusted estimate of the BAC effect on hospital mortality is reduced appreciably when the analysis is restricted to severe injuries only (Table 8).

TABLE 8—Comparison of Adjusted BAC Effect on Hospital Mortality by Restriction of the Study Population According to Injury Severity: Results of Three Multiple Logistic Regressions*

Severity Levels	No. Subjects	No. Deaths	Risk Odds Ratio (ROR)**	95% CI (ROR)
Mild, Moderate and Severe	808	88	0.67	0.49, 0.92
Moderate and Severe	263	87	0.80	0.61, 1.05
Severe Only	141	80	0.82	0.62, 1.09

*Each BAC effect estimate is adjusted for age, sex, and severity level (where needed).
**Corresponds to a BAC level difference of 100 mg%.

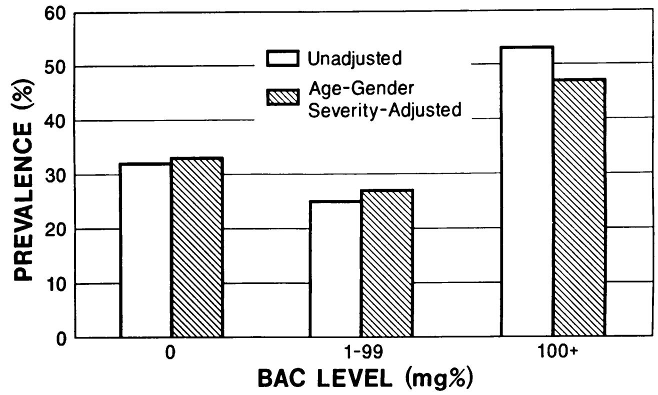

FIGURE 4—The prevalence (%) of physician-diagnosed neurological impairment at hospital discharge among moderately and severely brain-injured patients discharged alive from an acute care hospital, by BAC level: A comparison of results unadjusted and adjusted for age, gender, and injury severity

The ability of clinicians to diagnose and assess the nature and severity of brain injuries[35] influences treatment, particularly in persons with specific types of lesions.[16,23] Information on blood alcohol concentration is an important medical management tool and should be available on all persons seen for brain injuries in hospital emergency rooms.

There are at least two reasons why routine BAC testing of hospital emergency room patients who have been injured has not been more widely practiced:

- The principal function of emergency room activity is to determine whether the patient should be admitted to the hospital or discharged. If BAC testing is essential to the physician's decision on disposition of the patient, blood specimens are taken. Even if the patient shows signs of alcohol use (e.g., breath odor) the BAC test often may not be requested if it would not materially assist in determining disposition.
- Requesting a BAC test in the emergency room may have legal implications. That is, some physicians might not request a BAC test if the result, once recorded in the medical record, could lead to a legal problem for the patient. Because the prevailing practice in most emergency rooms of Level I or Level II trauma centers is to order a computerized tomography scan for any patient with altered consciousness, the value of a blood alcohol test is diminished. If there is altered consciousness and no overt evidence of alcohol use, however, a blood test may be requested to rule out alcohol in the diagnosis.

What remains for future research is to study the advantages and disadvantages of knowing blood alcohol level among possible brain-injured patients in the emergency room. Because blood samples are taken from patients with serious brain injuries who arrive at an emergency room for treatment of injuries, BAC testing could easily become routine even when there has been a substantial delay between injury and initiation of treatment. An alternative approach might be a quick, inexpensive, and noninvasive breath test to differentiate alcohol from ketones, as in diabetic ketosis.

The most perplexing finding from this study relates to outcomes from brain injury with and without alcohol involvement. Despite the animal evidence from observational and controlled laboratory studies,[5-15] the evidence that alcohol affects injury outcome is not conclusive. Ward and colleagues[16] reported that in a large series of patients having many different types of injuries, mortality was lower in patients who had been drinking than in those who had not been drinking. Huth *et al*,[17] found that hospital course and late outcomes were unaffected by the patient's blood alcohol level. Luna and associates[18] found that although injury severity in critically head-injured motorcyclists was not related to alcohol intoxication, mortality was twice as high in intoxicated patients as in nonintoxicated patients. The investigators suggested that severe brain injury and acute ethanol intoxication acted in a synergistic manner to prevent the patient's homeostatic injury response. Results from these studies may also have been biased due to differential rates of BAC testing, as in this investigation.

Although injury severity and case fatality were inversely related to BAC level, the rate of neurological limitations among moderately or severely brain-injured survivors was positively related to BAC level. In addition, for those with severe brain injuries, controlling for age and total body injury severity, brain-injured subjects with positive blood-alcohol concentration had a longer duration of hospital stay. Since BAC testing rates were highest in the most seriously injured group, these observed effects are less likely to have resulted from selection bias. On the other hand, a physician's knowledge of alcohol use (or blood alcohol) at the time of injury might conceivably influence reporting of neurological limitations, which might be related to chronic alcohol use. But this alternative explanation is not very likely among younger patients with brain injuries.

It was not possible with the information available to identify chronic alcoholics from occasional drinkers among the brain-injured cohort. Hervé, *et al*,[20] reported recently on injury mortality and blood alcohol levels in France. Their data seem to suggest that chronic alcoholics had a higher mortality rate than did non-alcoholics, occasional drinkers, or non-drinkers, controlling for age and overall injury severity level. The possible interaction of long-term, heavy alcohol use and the acute intoxication at the time of an injury has not yet been investigated.

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