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Demographic and socioeconomic factors influencing disparities in prevalence of alcohol-related injury among underserved trauma patients in a safety-net hospital

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ABSTRACT

Background: Alcohol-related trauma remains high among underserved patients despite ongoing preventive measures. Geographic variability in prevalence of alcohol-related injury has prompted reexamination of this burden across different regions. We sought to elucidate demographic and socioeconomic factors influencing the prevalence of alcohol-related trauma among underserved patients and determine alcohol effects on selected outcomes.

Methods: A retrospective analysis examined whether patients admitted to a suburban trauma center differed according to their blood alcohol concentration (BAC) on admission. Patients were stratified based on their BAC into four categories (undetectable BAC, BAC 1–99 mg/dL, BAC 100–199 mg/dL, and BAC ≥ 200 mg/dL). T-tests and X2 tests were used to detect differences between BAC categories in terms of patient demographics and clinical outcomes. Multivariate linear and logistic regressions were used to investigate the association between patient variables and selected outcomes while controlling for confounders.

Results: One third of 738 patients analyzed were BAC-positive, mean (SD) BAC was 211.4 (118.9) mg/dL, 80% of BAC-positive patients had levels ≥ 100 mg/dL. After risk adjustments, the following patient characteristics were predictive of having highly elevated BAC (≥ 200 mg/dL) upon admission to the Trauma Center; Hispanic patients (adjusted odds ratio (OR) = 1.91, 95% confidence interval (CI): 1.14–3.21), unemployment (OR = 1.74, 95% CI: 1.09–2.78), Medicaid beneficiaries (OR = 3.59, 95% CI: 1.96–6.59), and uninsured patients (OR = 2.86, 95% CI: 1.60–5.13). Patients with BAC of 100–199 mg/dL were likely to be more severely injured ($P = 0.016$) compared to undetectable-BAC patients. There was no association between being intoxicated, and being ICU–admitted or having differences in length of ICU or hospital stay.

Conclusion: Demographic and socioeconomic factors underlie disparities in the prevalence of alcohol-related trauma among underserved patients. These findings may guide targeted interventions toward specific populations to help reduce the burden of alcohol-related injury.

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Introduction

Alcohol consumption is well documented to be the most common contributory factor to injury occurrence [1–6]. The U.S. Alcohol Epidemiologic Data shows that 21% of all alcohol-related emergency room (ER) visits are trauma-related, and 17% of all

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alcohol-related hospitalisations have an injury-related diagnosis [7,8]. Studies have shown a high prevalence of alcohol-dependence diagnosis among patients treated at safety-net hospitals [9,10]. In fact, alcohol-related diagnoses ranks among the top 10 comorbidities identified in patients treated at safety-net hospitals, in contradistinction to patients treated at non-safety-net hospitals [9]. Safety-net hospitals are medical facilities which provide care to a disproportionately high number of disadvantaged patients, including the uninsured, low-income underinsured, Medicaid beneficiaries, and patients with special needs [11,12].

Previous research has provided evidence of differences in patterns of alcohol misuse across socioeconomic groups, and some authors have suggested the need for culturally adapted interventions among various sociocultural groups [13–17]. Hence, the continued high prevalence of alcohol misuse among disadvantaged populations, raise questions of effectiveness of current preventive strategies in reducing alcohol-related injuries in underserved regions [18].

The variability in prevalence of alcohol-related trauma across regions, which has been demonstrated by different studies, calls for continued small case-series investigations in a greater number of geographic areas [19,20]. Regional studies present unique advantages, some of which include; the potential to enhance treatment decisions for specific patient groups, the locally based knowledge serving as a means of estimating generalizability of larger population studies, and smaller studies being able to focus on single mechanisms or discrete patient populations [19]. The purpose of this study, thus, was to examine the sociodemographic characteristics associated with alcohol-related trauma among patients from an underserved multi-ethnic suburban environment, and determine the influence of alcohol on outcome in patients admitted to a safety-net hospital. The study was approved by "*the study hospital's*" Institutional Review Board Committee.

Methods

A retrospective cohort analysis was performed on patients admitted with traumatic injuries for the period of January 2013 through December 2013 to "*the study hospital*". The hospital is a 500 bed tertiary care Level I Trauma Center, and functions as the County's public safety-net hospital [21]. A great majority of patients treated at "*the study hospital*" are uninsured or low-income underinsured individuals, minorities, undocumented patients, and people with special health care needs [21].

Selection of study population and outcome measures

The study cohort consisted of patients aged 15–70 years, who were admitted within 6 h of injury. Diagnoses of traumatic injuries were defined by ICD-9-CM external injury codes E800-995, based on the final diagnoses at the time of discharge. As part of standard trauma evaluations, and according to the trauma center's institutional policy, all adult patients presenting to the ER with traumatic injuries requiring a trauma team activation have their blood drawn for blood alcohol concentration (BAC) measurement. Only patients who had blood drawn for BAC were included. Information abstracted included age, gender, ethnicity, employment status, insurance type, injury mechanism, and selected measures of severity, i.e., Glasgow Coma Score (GCS), and Injury Severity Score (ISS). Patient or family self-reporting was used to determine ethnicity (White, African-American/Black, Hispanic/Latino, Asian, Other), which was abstracted from admission forms. Insurance and employment status were selected as indicators of a patient's socioeconomic status (SES) [10]. Patients' GCS, which assess degree of neurologic impairment from brain injury, were stratified in the usual standard fashion into GCS of 13–15, 9–12, and 3–9 to represent mild, moderate, and severe traumatic brain injury respectively [22]. The ISS, which is a validated anatomical scoring system, that assigns an aggregate score of overall injury severity of a patient, was stratified as low severity = ISS 1–8, medium severity = ISS 9–14, and high severity = ISS 16–75, following accepted recommendations [23]. Intensive Care Unit admission (ICUADMIT), ICU length of stay (ICULOS) and hospital LOS (HLOS) in days, as well as ISS were selected as outcomes of interest.

A patient's BAC status, based on measurements in mg/dL, was first categorized as a binary variable into either having an undetectable BAC or having a BAC-positive status. Further categorization was based on levels into BAC < 1 mg/dL to represent undetectable BAC, and then as an ordinal scale of 100 mg/dL BAC intervals to better evaluate the dose response relationship between positive BAC and selected outcome parameters, consistent with other recent studies [24]. Thus, BAC $\geq$ 1 mg/dL to $<$100 mg/dL, BAC $\geq$ 100 mg/dL to $<$200 mg/dL, and BAC $\geq$ 200 mg/dL represented categories of being BAC-positive. Patient's with BAC $\geq$ 100 mg/dL were considered intoxicated based on BAC of 100 mg/dL being the level at which the Centers for Disease Control and Prevention (CDC) contends "clear deterioration of reaction time and control" [25].

Excluded from the study were patients admitted after more than 6 h following injury, patients who died, were discharged, or transferred out to another facility, within 24 h of admission, and patients who had prolonged HLOS > 40 days. This was done in order to ensure a more accurate BAC at time of injury, and to limit distortion of length of stay results [3]. Selection of a trim point of 40 days for LOS distribution was based on elimination of the top 1 percentile of the LOS distribution; which were the extreme outliers of the LOS data when a histogram and Q–Q plot were to examine the LOS distribution. Patients with factors known to confound GCS assessment, such as intoxication with other substances, pre-existing seizure disorders causing the traumatic event, pre-existing schizoaffective disorders mimicking altered mental status, and patients with moderate and severe TBI prior to index injury, were also excluded. Finally, patients with mechanisms not reflective of common injuries in our trauma registry, such as, drowning, burns, and electrocutions, which all together constituted $<$1% of injury mechanisms in the registry were excluded.

Statistical analysis

Descriptive statistics were calculated by BAC status (i.e., positive or undetectable). Pearson $\chi 2$ test for categorical variables, and T-test for continuous variables were used to evaluate statistical differences between both cohorts. A series of multivariate regression analyses were also estimated. First, a multivariate logistic regression analysis was estimated in order to isolate the influence of socioeconomic and demographic factors on the odds of patients having a positive BAC category upon admission, while holding the other factors constant. This allowed us to isolate each factor while controlling for the other factors. Second, multivariate linear regressions were estimated to investigate the relationship between patient outcomes (i.e., ISS, ICULOS, HLOS) and the different BAC categories at admission while controlling for confounding factors. Patients' ICULOS and HLOS were calculated in hours. BAC categories consisted of undetectable BAC, BAC 1–99 mg/dL, BAC 100–199 mg/dL, and finally BAC greater than or equal to 200 mg/dL. The final analysis consisted of a multivariate logistic regression analysis to examining the relationship between the different BAC categories and the odds of being admitted to the ICU (ICUADMIT) while controlling for confounding variables. Prior knowledge of well described modifiers of trauma outcomes determined covariates included in final models [26,27]. Race, employment status and insurance type were not included as