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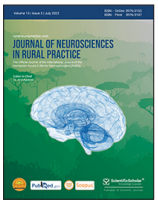

Original Article

Traumatic brain injury in college students and the influence of alcohol consumption: A retrospective review from a rural state

Sonia Chandi[1], Patricia Dekeseredy[2], Nicholas J. Brandmeir[2], Wei Fang[3], Cara L. Sedney[1]

[1]School of Medicine, West Virginia University, [2]Department of Neurosurgery, West Virginia University, [3]West Virginia Clinical and Translational Science Institute, West Virginia University, Morgantown, West Virginia, United States.

ABSTRACT

Objectives: There is a strong association between alcohol consumption and traumatic brain injury (TBI). Students are known to consume alcohol at a high rate. Despite the connection between alcohol and TBI, this is one of few studies to examine the connection between students, alcohol, and TBI. The objective of this study was to explore the relationship between students, alcohol, and TBI.

Materials and Methods: A retrospective chart review utilizing the institutional trauma data back was performed for patients 18–26 years of age, admitted to the emergency department with a diagnosis of a TBI and positive blood alcohol. Patient diagnosis, injury mechanism, alcohol level on admission, urine drug screen, mortality, injury severity score, and discharge disposition were recorded. The data were analyzed using Wilcoxon rank-sum tests and Chi-square tests to identify differences between students and non-student groups.

Results: Six hundred and thirty-six charts were reviewed for patients aged 18–26 with a positive blood alcohol level and TBI. The sample included 186 students, 209 non-students, and 241 uncertain of status. The student group had significantly higher levels of alcohol than the non-student group ($P < 0.0001$). $P < 0.0001$ showed that overall alcohol levels for males are significantly higher than levels of alcohol for females in the student group.

Conclusion: Alcohol consumption contributes to significant injuries such as TBI in college students. Male students had a higher prevalence of TBI, and higher alcohol levels than female students. These results can be used to inform and better target harm reduction and alcohol awareness programs.

Keywords: Brain injury, Alcohol, Trauma, Prevention

INTRODUCTION

Traumatic brain injury (TBI) is a form of acquired brain injury resulting from an external mechanical force that causes an alteration in brain function. A TBI is not a single pathophysiological phenomenon; instead, it is a chronic progression of a disease resulting in structural and functional damage initiated by an initial injury event.[1] Symptoms of a TBI can vary depending on the extent of the trauma and the resulting injury to the brain and can be permanent and debilitating. Even a mild TBI can have lasting cognitive, emotional, and functional impairment.[1] TBI severity ranges from mild to moderate to severe. The Glasgow Coma Scale (GCS) can be used to classify clinical severity, with approximately 75–90% of all TBIs classified as mild TBIs.[1] There is a peak in frequency of mild TBI seen in young adults during the 2nd and 3rd decade of life, around the time that young adults are of college-age.[2]

A modifiable risk factor associated with TBI in young adults is alcohol consumption. Studies from Norway and Spain have shown that alcohol consumption was involved in 24–51% of all TBIs.[3] Students are known to consume alcohol at higher rates when compared to non-college students of a similar age. Approximately 500,000 college students experience unintentional injuries under the influence of alcohol each year, and an estimated 1800 college students die each year from unintentional alcohol-related injuries.[4] Despite the connection between alcohol and TBI, few studies examine the association between students consuming alcohol and TBI.

TBI is a leading cause of death and long-term disability in young adults, representing a significant socioeconomic and health-care burden.[5] In 2010, TBI in hospital costs totaled $21.4 billion in the United States.[6] The impact of a TBI can be costly for patients, their families, and the community. Financially, the cost of treatment for individuals suffering TBI varies according to the severity of illness, with per-patient costs ranging from $2,130 to $401,808.[6] In a recent systematic review of international studies of TBI, van Dijck

***Corresponding author:** Cara L. Sedney, Department of Neurosurgery, West Virginia University, Morgantown, West Virginia, United States. csedney@hsc.wvu.edu

Received: 06 December 2022 **Accepted:** 24 February 2023 **EPub Ahead of Print:** 16 March 2023 **Published:** 03 May 2023 **DOI:** 10.25259/JNRP_64_2022

et al. reported median in-hospital costs per patient were $55,267.[6] The purpose of this study is to understand better the prevalence and circumstances surrounding TBI and associated alcohol use in the college student population.

MATERIALS AND METHODS

Data collection

This project was approved by the university's institutional review board. A search was conducted through the institutional trauma databank for all patients aged 18–26 years of age, admitted to the emergency department with a diagnosis of a TBI and positive blood alcohol level based on ICD 9 and 10 codes from 2010 to 2018. Patient diagnosis, injury mechanism, alcohol level on admission, urine drug screen, mortality, injury severity score (ISS), and discharge disposition were recorded. A retrospective review of the 636 records identified was conducted to determine if patients were students at the time of injury. Examples of student status included university email addresses or student status in history or discharge notes. Non-students included having an occupation or not documented in the electronic medical record, such as military or unemployed. Patients categorized as uncertain had no documentation of student status or employment.

Data analysis

Of the 636 charts reviewed, 186 patients were identified as students, 209 were non-students, and 241 were uncertain and could not be categorized as students or non-students. The group of patients that could not accurately be placed in the student or non-student group was excluded from data analysis. As it was of interest to identify differences between students and non-student groups, Wilcoxon rank-sum test was conducted for continuous variables, as it was not assumed that (1) homogeneity of variance and (2) normal distribution in the data, and Chi-squared test was conducted for categorical variables. All statistical analyses were performed using R 4.2.2 (R Core Team, Vienna Austria).

RESULTS

Of the 636 charts reviewed for patients aged 18–26 admitted with a positive blood alcohol level and TBI, there were 186 students, 209 non-students, and 241 uncertain. This distribution is illustrated in [Figure 1]. The majority of both the student and non-student population was male. The student group was 80% male and 20% female, and the non-student group was 74% male and 26% female [Table 1]. A Chi-squared test was conducted. *P*-value 0.195 showed that the distributions of males and females were not statistically significantly different between the student and non-student groups. A two-sample test for equality of proportions was conducted and the 95% confidence interval (CI) for the difference in the proportions was (−15.57%, 3.700%).

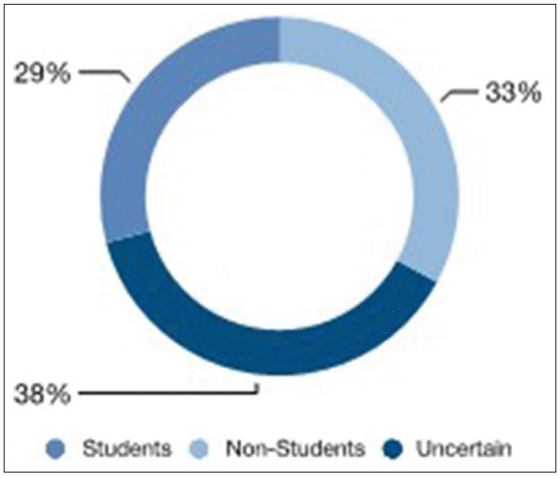

Figure 1: Study population distribution.

Age and alcohol levels

Overall, the age range for the study was 18–26 years old. The student population had a significantly greater percentage of patients under 21 than the non-student population (42% vs. 14%, $P < 0.0001$, 95% CI for the difference in the proportions: [18.54%, 36.63%]). A Wilcoxon rank-sum test was conducted and showed that, regardless of the student status groups, the group of young adults with a concussion under the age of 21 did not have significantly higher alcohol levels than the group over the age of 21 ($P = 0.2254$, 95% CI for the difference in location (−9.00, 37.00).

Drug and alcohol levels

A Wilcoxon rank-sum test was conducted and demonstrated that the non-student group had significantly lower levels of alcohol than the student group ($P < 0.0001$, 95% CI for the difference in location [−86.00, −48.00]) [Table 2]. The upper limit of the range for alcohol levels was less in non-students than students. Non-students had a higher percentage of patients (42% vs. 35%) with other drugs present on urine drug screen. A Chi-squared test determined that this distribution was not significantly different ($P = 0.1450$).

Injury severity

The 25th percentile, median, and 75th percentile injury severity score (ISS) were 5, 5.5, 10, and 5, 9, 17, for students and non-students, respectively. A Wilcoxon rank-sum test was conducted and demonstrated that there was significant difference in the distribution of ISS scores between the student and non-student groups ($P = 0.0006$, 95% CI for the difference in location (0.0001, 3.000). In terms of concussion

Table 1: Demographics and GCS range*.

	Sex		Age		Age Under 21	GCS* Range	
	Male	Female	Range	Mean	Percentage	Range	Mean
Students (*n*=186)	149	37	18–26	20.97	42	3–15	13.54
Non-Students (*n*=209)	112	39	18–26	22.75	14	3–15	12.30

n=395. *Glasgow coma scale

Table 2: Descriptives for alcohol level and injury severity score.

	Range		Mean		
	Students*	Non-Students+	Students*	Non-Students+	*P*-value
Alcohol Level in mg/dL	10–452	10–415	222.258	159.268	<0.0001
Injury Severity Scale	1–38	1–48	8.806	11.689	0.9997

*Students *n*=186. +Non-students *n*=209

severity based on the GCS, the 25th percentile, median, and 75th percentile GCS were 14, 15, 15, and 14, 15, 15, for students and non-students, respectively. A Wilcoxon rank-sum test was conducted and demonstrated that there was no significant difference in the distribution of GCS between the student and non-student groups (P = 0.271, 95% CI for the difference in location (−0.0001, 0.0001).

DISCUSSION

This study presents a novel analysis of the relationship between TBI, college students, and alcohol consumption. The significantly higher alcohol levels observed in college students with TBI compared to non-student young adults with TBI is consistent with the existing culture of college alcohol consumption.[4,7] A recent study exploring the relationship between alcohol and several risk factors in college-aged students found a significant relationship between hazardous drinking and formal concussion diagnosis.[8] Furthermore, Shore and Janssen found a dose-dependent relationship between concussion incidence and a multiple risk behaviors score, evaluating drinking, drug use, smoking, etc., in high school students.[9] Our results are consistent with this literature, showing that the alcohol abuse that occurs on college campuses contributes to the global burden of TBI.[6]

Our results illustrate that most of the student population who sustained a concussion under the influence of alcohol were male. Furthermore, males had significantly higher levels of alcohol than females. The current literature demonstrates that young adult males have greater risks of partaking in alcohol abuse or binge drinking behaviors than young adult females.[2,10] The literature from Spain also showed that overall 51% of overall TBI were sustained under the influence of alcohol' however, 54% of TBIs in males were sustained under the influence of alcohol.[3] The results of the present study, taken into consideration with the presented literature, should be used to influence the target audience of deterrence policies for alcohol abuse in college. These policies could serve tremendous importance in lowering the burden of TBI, considering the literature has shown that pre-injury alcohol abuse and being male have been linked to increasing post-TBI alcohol abuse.[11,12] This finding could be linked to the susceptibility of the ventromedial prefrontal cortex in closed head injury leading to reported increased impulsivity and aggression following TBIs.[13] Thus, one danger of the increasing incidence of TBI in college students under the influence of alcohol is that the damage from the TBI can lead to further intensified alcohol abuse.

In terms of alcohol abuse in college-age students, several studies have found that underaged students drink less frequently than students over 21 years of age; however, underage students have more drinks per occasion and are more likely to drink to excess.[14,15] In contrast, our results found that the study population under 21 did not have a significantly higher alcohol level than those aged over 21. Only 12% of the students in the study were under the age of 21; hence, a more extensive study population may yield different results. We did find that more students were under the age of 21 than non-students. A study by Wechsler *et al*. highlighted that access to alcohol for underage students is more accessible and cheaper on and around college campuses.[15] Effective control of access to alcohol may be another approach to reduce the contribution of college aged students to the global burden of TBI.

These results should be considered bearing in mind the study's limitations. A large group of patients could not be effectively categorized as students or non-students and had to be left out of the data analysis of the study. Another limitation was that the population studied was only patients seeking medical attention in the emergency department, which created a potential bias against patients with milder TBIs who

did not seek medical attention. Injury severity is assessed as an overall score of injury, not specific to TBI. More research is indicated to assess the relationship between ISS, alcohol levels, and outcome. Finally, this is a single-center study, in a mostly rural state, and results in our patient population may not be generalizable to other centers, particularly as our patient population is not a racially diverse sample.

CONCLUSION

TBI represents a leading cause of long-term disability in young adults, yielding an enormous socioeconomic and health-care burden. Alcohol consumption continues to contribute to the incidence of TBI in students, with males having a higher prevalence of TBI and higher alcohol levels than females. We found alarmingly high alcohol levels for all the young people in the study; however, the student population had significantly higher alcohol levels than non-students, which could be contributed to the "party culture" and binge drinking associated with college life. Addressing the "party culture" and underage drinking could reduce the incidence of TBI among students. These results can be used to inform and better target harm reduction and alcohol awareness programs especially for young male students.

Declaration of patient consent

The Institutional Review Board (IRB) permission obtained for the study.

Financial support and sponsorship

Research reported in this publication was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number 2U54GM104942-07. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Pavlovic D, Pekic S, Stojanovic M, Popovic V. Traumatic brain injury: Neuropathological, neurocognitive and neurobehavioral sequelae. Pituitary 2019;22:270-82.
2. Leute PJ, Moos RN, Osterhoff G, Volbracht J, Simmen HP, Ciritsis BD. Young adults with mild traumatic brain injury--the influence of alcohol consumption--a retrospective analysis. Eur J Trauma Emerg Surg 2015;41:299-305.
3. Tagliaferri F, Compagnone C, Korsic M, Servadei F, Kraus J. A systematic review of brain injury epidemiology in Europe. Acta Neurochir (Wien) 2006;148:255-68, discussion 268.
4. Hingson RW, Zha W, Weitzman ER. Magnitude of and trends in alcohol-related mortality and morbidity among U.S. college students ages 18-24, 1998-2005. J Stud Alcohol Drugs Suppl 2009;16:12-20.
5. Plesnila N. The immune system in traumatic brain injury. Curr Opin Pharmacol 2016;26:110-7.
6. van Dijck JT, Dijkman MD, Ophuis RH, de Ruiter GC, Peul WC, Polinder S. In-hospital costs after severe traumatic brain injury: A systematic review and quality assessment. PLoS One 2019;14:e0219529.
7. Wilkinson B, Ivsins A. Animal house: University risk environments and the regulation of students' alcohol use. Int J Drug Policy 2017;47:18-25.
8. Martin RJ, Chaney BH. Exploration of the relationship between concussions and depression symptoms, anxiety symptoms, and hazardous drinking among a sample of college students. J Dual Diagn 2018;18:220-7.
9. Shore J, Janssen I. Adolescents' engagement in multiple risk behaviour's is associated with concussion. Inj Epidemiol 2020;7:6.
10. Secades-Villa R, López-Núñez C, Fernández-Artamendi S, Weidberg S, Fernández-Hermida JR. Gender differences in the prevalence of DSM-IV alcohol use disorders in adolescents. Adicciones 2013;25:260-8.
11. Kreutzer JS, Witol AD, Marwitz JH. Alcohol and drug use among young persons with traumatic brain injury. J Learn Disabil 1996;29:643-51.
12. Bombardier CH, Temkin NR, Machamer J, Dikmen SS. The natural history of drinking and alcohol-related problems after traumatic brain injury. Arch Phys Med Rehabil 2003;84:185-91.
13. Alcock B, Gallant C, Good D. The relationship between concussion and alcohol consumption among university athletes. Addict Behav Rep 2018;7:58-64.
14. Wechsler H, Lee JE, Nelson TF, Kuo M. Underage college students' drinking behavior, access to alcohol, and the influence of deterrence policies. Findings from the Harvard school of public health college alcohol study. J Am Coll Health 2002;50:223-36.
15. Wechsler H, Kuo M, Lee H, Dowdall GW. Environmental correlates of underage alcohol use and related problems of college students. Am J Prev Med 2000;19:24-9.

How to cite this article: Chandi S, Dekeseredy P, Brandmeir NJ, Fang W, Sedney CL. Traumatic brain injury in college students and the influence of alcohol consumption: A retrospective review from a rural state. J Neurosci Rural Pract 2023;14:298-301.