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Differentials and trends in emergency department visits due to alcohol intoxication and co-occurring conditions among students in a U.S. public university

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ABSTRACT

Background: Few studies have explored the epidemiology of students presenting to the emergency department (ED) as a consequence of hazardous drinking. This study examined differentials and trends in ED visits following alcohol intoxication and co-occurring conditions among students presenting to a major U.S. university health system.

Methods: The ED electronic medical records from academic years 2010–2015 were queried for student visits and their records were linked to the university's student admission datasets. Student alcohol-related visits were identified based on ICD-9 codes. Student characteristics and trends in the rate of alcohol intoxication per 100 ED student visits were analyzed. A random sample of 600 student clinical records were reviewed to validate diagnostic codes.

Results: There were 9616 student ED visits (48% males) to the ED of which 1001 (10.4%) visits involved alcohol intoxication. Two thirds of ED visits with alcohol intoxication had a co-occurring diagnosis, with injuries (24%) being the most common condition. The rate of alcohol intoxication varied greatly by student demographics and campus-related factors. There was a linear increase in the rate of alcohol intoxication from 7.9% in 2009–10 to 12.3% in 2014–15 ($p < 0.01$). The increase was greater among female students, students below 20 years of age, Asian students, and student athletes. In the sample reviewed, only two thirds of ED visits with alcohol intoxication were recorded by diagnostic codes.

Conclusion: The rate of ED visits following alcohol intoxication varied by student demographic characteristics and campus-related factors with a rising trend over the study period.

1. Introduction

Numerous studies have identified that excessive alcohol use is a problem in the general college age population. Data from the Substance Abuse and Mental Health Services Administration (SAMHSA) from 2010 demonstrated an increase of 24.3% past-month alcohol users between 16 and 17 year olds and 18–20 year olds, and a 21.1% increase from 18 to 20 year olds to 21–25 year olds (SAMHSA, 2011). More specifically, 18–22 year olds enrolled full time in college had a higher prevalence of past month alcohol use (63.3% versus 52.4%), binge drinking (42.2% versus 35.6%), and heavy drinking (15.6% versus 11.9%) than those not enrolled in full time college. The most commonly presented direct and indirect outcomes of excessive alcohol consumption that are seen in the emergency department (ED) include trauma, injuries, mental health issues, assault, and death.

Alcohol intoxication continues to present a great burden for ED personnel and consumes a significant amount of ED resources. The 2006–2010 national statistics on alcohol-related ED visits and co-morbidities reported a rising trend in the rate of alcohol-related ED visits among young people 20–24 years of age from 97 to 120 per 100,00. A significant proportion of ED visits in this age group had co-occurring injuries (38%) or mental health concerns (35%) (NIAAA, 2013). Data from the Drug Abuse Warning Network (DAWN), which captured ED data for alcohol abuse among minors 18–20 years of age, estimated approximately 95,166 visits occurred for underage drinking (alcohol alone or in combination with drugs) in 2005. In 2010,

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however, underage drinking resulted in 114,722 ED visits, or 848.7 visits per 100,000 in 2010. This corresponds to approximately 21% increase since 2005, showing the increasing prevalence of alcohol-related medical emergencies among those 18–20 years of age (SAMHSA, 2011).

Students are a unique population whose alcohol use and drinking behavior are dependent on a range of personal, inter-personal, and campus-related factors. It is well-established that white students, first year students (Wechsler et al., 1995), and students enrolled in fraternities/sororities (Lo and Globetti, 1995; Presley et al., 2002) have higher rates of episodic heavy drinking than other students, while students who are engaged in athletics have lower rates of risky drinking. In addition, the type of residence and the college size also affect the level of binge drinking (National Institutes of Health, 2002).

While binge drinking is common among college students, most studies on college drinking behavior are self-report surveys, which are subject to reporting bias. Due to legal and social concerns, students tend not to provide honest responses to sensitive questions related to their hazardous drinking behavior, especially when it involves the use of emergency care (National Institutes of Health, 2002). Thus, EDs are in a unique position to provide objective clinical and epidemiological data enabling monitoring of hazardous drinking in college-age students. In addition, given the complex challenges in addressing dangerous alcohol use among college students, characterizing students presenting to the ED for treatment of intoxication is useful in developing adequate and targeted interventions and responses. A clearer understanding of the change over time of ED visits related to alcohol intoxication overall and within each demographic, organizational, and academic sub-group can provide important information to monitor the effectiveness of intervention efforts and determine which student sub-groups should be targeted.

To date, only three US-based, published studies have examined alcohol use and related health consequences amongst college students presenting to hospital EDs (Turner and Shu, 2004; Wright et al., 1998; Wright and Slovis, 1996). These studies indicate that prevalence of ED visits involving alcohol use ranged from 13 to 16 per 100 ED visits, of which trauma was the most common co-occurring health consequence, accounting for 53% (Turner and Shu, 2004) or 69% (Wright et al., 1998) of the total visits. Younger students, freshmen, white, and undergraduate students were more likely than other students to visit ED for alcohol-related reasons. However, these studies had certain limitations, including a limited number of ED visits ($n \leq 1529$) and a short study period (i.e., 1–2 years). Therefore, these studies were unable to delineate the trends over time in the use of a hospital ED following alcohol intoxication amongst student populations. Furthermore, the use of a single data source (i.e., ED data) does not adequately capture other important students' characteristics such as academic programs, organizational affiliation, or extra-curricular activities.

The aim of this study was to examine demographic, organizational, and academic differentials and trends in alcohol intoxication and related health consequences that were identified from diagnostic codes documented in medical records among students who presented to an ED affiliated with a major public hospital in the U.S., through the combined use of the ED database and the University's Student Information System. This study also evaluated the validity and accuracy of diagnostic codes documented in the patient medical records.

2. Methods

2.1. Study population and data sources

The current study was based on a cohort of students from a US public university who visited the university hospital ED during six academic years from 2009 to 10 to 2014–15. Data were created by linking three student datasets: ED's Patient Registration System, University's Student Information System (SIS), and the ED's Clinical Data Repository (CDR).

The ED's *Patient Registration System* is a reporting system of students visiting the university hospital ED. It generates a daily report of individuals who are flagged as students in the ED (those who identify as students have "Student Health" indicated as their Primary Care Provider at the time of registration). These reports are available 48 h after the ED visit date.

SIS is the university's student information database that contains information on student demographic characteristics (e.g., age, gender, ethnicity), extracurricular activities (e.g., athletic participation), fraternity/sorority affiliation, schools, academic level and academic program for each term that a student is enrolled. Every student has a unique student identification number. The 2013–2014 university student enrollment consisted of 21,238 students (45% male), of which 14,898 (70%) were undergraduates and 6340 (30%) were graduate students. Approximately 70% (62) of students were non- Hispanic white, 12% were Asian, 6% were African American, 6% were Hispanic, 4% were multi-racial, and less than 1% were American Indian/Alaskan Native or Native Hawaiian/Pacific Islanders (University of Virginia, 2014).

CDR is an electronic data repository of patient admissions and visits to all clinics and departments in the university health system. It contains ICD diagnostic codes for each ED visit, unstructured clinical notes, and other key clinical variables including laboratory test results (e.g., blood alcohol values, urine drug screen tests), admission characteristics (e.g., date/time of arrival and triage, disposition, acuity), medications and procedures administered during the visit, and post-visit recommendations and referrals (e.g., primary care provider, specialists).

2.2. Data linkage

A two-step process was used to link the three student databases. First, we extracted an initial subset of students who visit the ED from the patient registration system. We matched students identified from this system based on first and last names as well as date of birth with the SIS. Second, these data were de-identified and further linked to student ED clinical data for each student ED visit from the CDR, using student unique EMR number and the visit date. This process yielded an integrated dataset that contains a full record of students who experienced an ED visit in the university hospital.

Students with acute alcohol intoxication overwhelmingly seek care at the University Hospital ED, which is within a mile of campus student housing, and the majority of off-campus student housing. The nearest alternate ED is at a private hospital approximately five miles from the center of campus that is not conveniently accessible to students and rarely utilized, as confirmed by student health insurance data utilization.

2.3. Ascertainment of alcohol intoxication and co-occurring consequences

Student ED visits due to alcohol intoxication and co-occurring health consequences were identified from ICD-9 diagnostic codes documented in the patient EMR. ICD-9 codes indicating alcohol intoxication included 305.0 and 303.0 as defined by NIAAA (2013). The physician's diagnosis of this condition was primarily based on clinical presentation and/or the patient self-report of drinking before the ED visit. Co-occurring conditions examined included: (i) injury and trauma; (ii) mental health issues: depression, anxiety, suicidal behavior; (iii) other substance use, and (iv) sexual assault.

2.4. Chart review of the patient medical records

To evaluate the validity and accuracy of alcohol intoxication identified by diagnostic codes, 600 clinical records (100 records in each academic year) were randomly selected for chart review performed by two independent medical reviewers. When a discrepancy in assigning a specific alcohol-related diagnosis code was found, the two reviewers

discussed the code in order to determine a final diagnosis. Results were then compared with alcohol intoxication identified by ICD-9 diagnostic codes. Sensitivity, specificity, positive predictive and negative predictive values were calculated to evaluate the validity of diagnostic codes using the chart review as the 'gold standard.'

2.5. Data analysis

Descriptive statistics were used to calculate the rate (per 100 ED visits) of alcohol intoxication in each academic year, stratified by students' demographic characteristics, academic program, and organization affiliation. The trends in the rate in each category over the study period were evaluated using linear regression. The relative change over time for each category was then calculated by dividing prevalence in 2014-15 by prevalence in 2009–10. The proportion of alcohol-related ED visits that had a co-occurring condition was also calculated. Data were analyzed using SAS 9.4 Software (SAS Institute Inc., Cary, NC).

Ethical approval was provided by the University Institutional Review Board.

3. Results

There were 9812 student visits to the ED during the study period. After excluding 196 visits with missing diagnoses, 9616 visits (48% males) by 7035 unique students were available for analysis. Over 88% of students were aged 18–24 years (median = 20.7 years), 21% were affiliated with a fraternity or sorority, and 1.7% were members of an athletic team. White students accounted for 60% of the total ED visits, followed by Asian and Pacific Islanders (8%), African American (7.8%), non-American citizens (7.6%), and Hispanic (2.6%). Over 80% were undergraduate students, while 10% and approximately 8% were graduate or professional students, respectively (Table 1). Compared to the university enrollment data, undergraduate, African American, and male students were over-represented.

Table 1
Demographic characteristics of students.

Characteristic	n	Percent	Characteristic	n	Percent
Gender			Athlete		
Male	4723	49	No	9454	98.3
Female	4893	51	Yes	162	1.7
Age group		Academic level			
< 20	3443	35.8	Undergraduate	7740	80.5
20- < 25	5035	52.4	Graduate	948	9.9
25- < 30	892	9.3	Professional	928	9.7
30–50	246	2.6	Academic program		
Race			Arts & Sciences Undergraduate	5707	59.3
White	5975	62.1	Engineering Undergraduate	1243	12.9
Asian and HPC	1175	12.2	Arts & Sciences Graduate	450	4.7
African American	778	8.1	Law	345	3.6
Hispanic	296	3.1	Commerce Undergraduate	310	3.2
Non-resident Alien	767	8	Business	190	2
Other	1252	13	Medicine	175	1.8
Greek life member			Architecture Undergraduate	171	1.8
No	7614	79.2	Nursing Undergraduate	167	1.7
Yes	2002	20.8	Engineering Graduate	165	1.7
			Commerce Undergraduate	100	1
			Other 38 programs	593	6.2

Overall, students having an ED visit involving alcohol intoxication were more likely to be males, under 20 years of age, white, affiliated with fraternities/sororities, and undergraduate students; they were less likely to be African American students, non-US residents, and members of an athletic team (chi-square test: $p < 0.001$).

There were 1001 (10.4%) visits due to alcohol intoxication, of which 836 (83.5%) visits had alcohol intoxication as the sole or principal diagnosis. The rate of alcohol intoxication was significantly higher in males (11.1%) than in females (9.7%), and higher in white students (10.7%) than in African-American students (7.8%) ($p < 0.05$). US non-resident students (5.3%) had the lowest rate compared to other racial groups ($p < 0.05$). The rate was also higher in undergraduate (11.9%) than in graduate students (3.8%) and in students affiliated with fraternities/sororities (13.6%) than in those who were not (9.6%) ($p < 0.05$). The rate decreased linearly with age: 16% in students aged < 20 years, 8.3% in ages 20–25, and 3.5% in ages > 25 (p for trend < 0.01). The rate varied greatly by academic program, ranging from 1% among commerce graduate students to 15% among nursing undergraduate students (Fig. 1).

Overall, the rate of alcohol intoxication increased significantly by 55.7% from 7.9% in 2009–10 to 12.3% in 2014-15 ($p < 0.01$) corresponding to 141 visits in 2009–10 and 196 visits in 2014–15 academic years, respectively (Fig. 2). The relative increase was greater among female students (from 7.6% to 12.1%, $p = 0.01$), students below 20 years of age (from 10.8% to 17.6%, $p < 0.001$), Asian students (from 5.7% to 10.8%, $p = 0.04$), and members of a university athletic team (from 4.8% to 13%, $p < 0.001$) (Table 2).

Of 1001 visits with alcohol intoxication, 663 visits (66%) had co-occurring diagnoses. Injuries (24%) were the most common condition, followed by depression (3.2%), suicidal behavior (2.9%), drug use (2.7%), and anxiety (2.4%). Only 2 visits with sexual assault diagnostic codes were recorded. The percentage of visits with a co-occurring diagnosis or injuries declined over the study period (Table 2).

3.1. Validity of diagnostic codes for alcohol intoxication

The chart review of the 600 records identified 96 visits (16%) with alcohol intoxication, while the use of ICD-9 diagnostic codes identified 64 visits (10.6%) with this condition. Sensitivity was 65%, indicating that ICD-9 diagnostic codes only recorded 65% of the total ED visits with alcohol intoxication in the review sample. The specificity, positive predictive value, negative predictive value, and accuracy were 99%, 94%, 94%, and 94%, respectively (Table 3). There were 41 visits that involved both alcohol intoxication and injury or trauma, of which alcohol intoxication diagnostic codes were only given in 18 visits (44%). Notably, the chart review found that in the 2009–10 academic year, only 8 out of 15 (53%) visits related to alcohol intoxication were coded, while in 2014–15, 13 out of 17 (76.4%) were coded (data not shown).

4. Discussion

4.1. Significance of the study

To our knowledge, the current study is the first comprehensive evaluation of the differentials and trends in alcohol intoxication and co-occurring conditions among university students presenting to a university hospital ED. There was a significant linear increase in both the number and rate of recorded alcohol intoxication with a larger increase found among female students, students below 20 years of age, Asian students, and athletic students. This rising trend also mirrored the national increase in alcohol-related ED visits among college-age, young people (SAMHSA, 2011) and indicates some demographic changes in the prevalence of intoxicated students attending emergency care.

Findings from this study confirm the findings from the three previous, smaller studies of students in the EDs: young (< 20 years of age) students and undergraduate students experienced a higher rate of ED

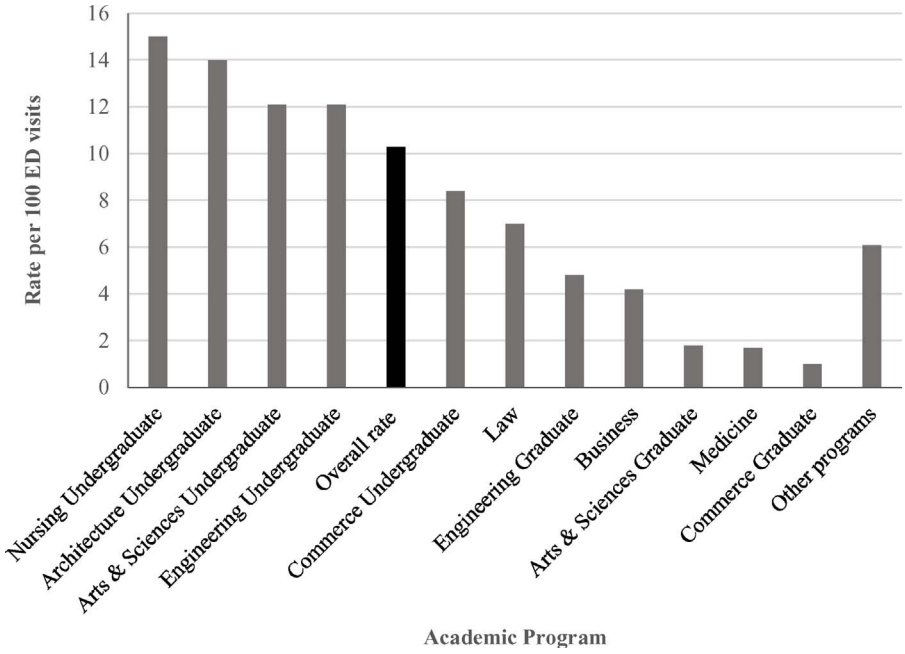

Fig. 1. Rate of alcohol intoxication per 100 ED visits by academic program.

visits with alcohol intoxication. In particular, while students under 20 years of age only accounted for over one third of the total ED visits, they retained over half of visits with alcohol intoxication. In addition, the study findings add to existing literature by showing that the rate of alcohol-related ED visits was higher in students affiliated with fraternities/sororities and varied greatly by academic programs. These results collectively suggest that segmenting and tailoring efforts to specific student groups are important to successful interventions.

Injury/trauma is the most common condition, accounting for 24% of the total ED visits associated with alcohol intoxication during the period studied. This finding is less than what has been seen in previous studies, such as Turner and Shu who found 53% of total ED student visits with alcohol intoxication also involved injuries (Turner and Shu, 2004). This change is also consistent with the declining trend in prevalence of this co-occurring condition in the present study. These findings suggest that, compared to past years, more student ED visits with alcohol intoxication were actually given a diagnostic code for that condition and/or more intoxicated students without an injury were presenting to the ED, potentially as a result of broader university outreach efforts to encourage students to use the ED as a confidential safe place to sober.

The rate of ED visits with alcohol intoxication in our study population was higher than the rate reported in studies in other Western countries (Bertholet et al., 2014; Haberkern et al., 2010; O'Farrell et al., 2004; Verelst et al., 2012) that ranged from 1.2% to 6.5%. There was also a higher proportion of females over the total intoxicated patients in the current study (51% vs. ≤ 40%). It is important to note that none of these studies specifically examined student populations. However, these studies also reported rising trends that were greater in college age (18–25), young people. In particular, one study in Switzerland that was also based in a university hospital ED found that the rate of alcohol intoxication among young adults aged 18–25 years increased from 2.6% in 2000–6.5% in 2007 (Haberkern et al., 2010). Thus, although students may form a unique population with a higher frequency of alcohol intoxication associated with ED visits, they shared a common trend with other populations.

Whether or not a student with alcohol intoxication receives emergency care is dependent on a range of personal, interpersonal, and

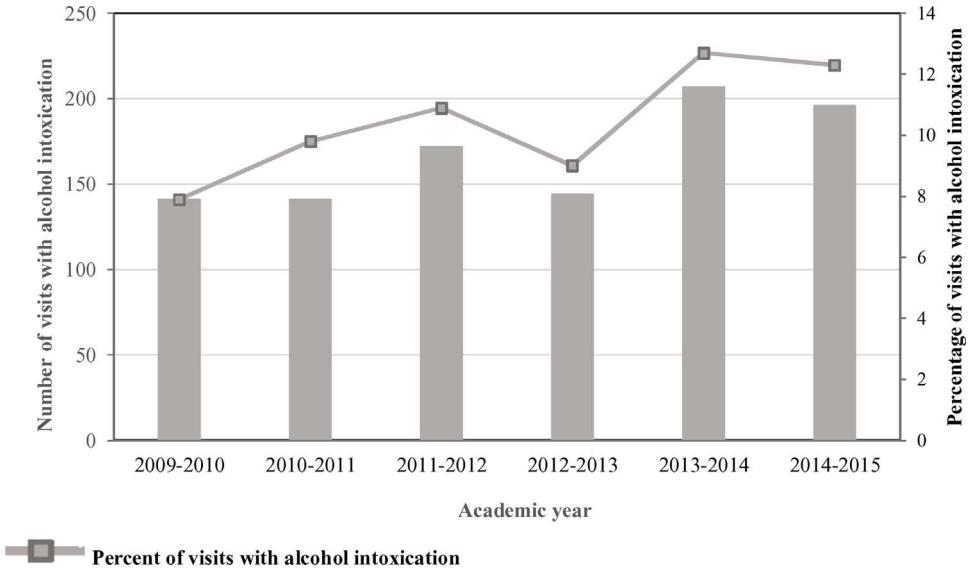

Fig. 2. Trend in alcohol intoxication among students presenting to the university hospital ED 2009/10-2014/15.

Table 2
Trends in the rate of alcohol intoxication per 100 ED visits (2009/10-2014/15).

	2009/10 (n = 1777)	2010/11 (n = 1439)	2011/12 (n = 1571)	2012/13 (n = 1603)	2013/14 (n = 1630)	2014/15 (n = 1596)	% change	P-trend	% All years (n = 9616)
All	7.9	9.8	10.9	9	12.7	12.3	55.7	< 0.001	10.4
Gender									
Male	8.3	10.3	12.4	9.4	14	12.4	49.4	0.001	11.1*
Female	7.6	9.3	9.5	8.6	11.5	12.1	59.2	0.001	9.7
Age									
< 20	10.8	17	16.5	14.7	18.8	17.6	63.0	0.001	15.9
20- < 25	7.2	7.1	10.1	6.3	10.3	9	25.0	0.06	8.3
25- < 30	2.6	3.9	2.3	3.5	0.8	4.6	76.9	0.9	2.9
30–50	7.3	0	0	6.3	3.3	4.3	−41.1		3.7
Race									
White	8.8	10.9	10.8	9.3	12.5	11.9	35.2	0.016	10.9
Asian	5.7	7.9	13.4	8.1	12.6	10.8	89.5	0.04	11.7
African American	6	8.1	8	3.1	13.3	11.1	85.0	0.11	8.2
Hispanic	7.3	4.5	17.3	7.5	13.6	20	174.0	0.06	9.8
Non-resident Alien	4.1	4	5.9	3.1	7.9	7.2	75.6	0.45	5.3
Other	8.3	10.5	10.4	12.4	13.2	14.9	79.5	0.01	12
Academic level									
Undergraduate	9.3	11.5	13.1	10.1	14.2	13.5	45.2	< 0.001	11.9
Graduate	3.3	3.7	2.3	1.5	5.7	6.2	87.9	0.14	3.8
Other	3.6	3.4	3.1	5.6	6.3	5.7	58.3	0.13	4.4
Athlete									
No	8.0	9.9	10.9	9.1	12.8	12.3	53.8	< 0.001	12.6
Yes	4.8	4.5	11.1	4.2	8.3	13	170.8	< 0.001	8
Greek life member									
No	7.6	8.9	8.9	8.1	12.5	12.1	59.2	0.001	9.6
Yes	10.9	13.8	18.4	11.6	13.4	12.9	18.3	0.7	13.6
Co-occurring diagnoses									
Injury/Trauma	31.2	20.6	32.6	25	18.4	19.9	−36.2	0.007	24.2
Depression	5.7	2.1	2.3	2.8	1.9	4.6	−19.3	0.70	3.2
Anxiety	2.1	2.8	0.6	0	3.9	4.1	95.2	0.13	2.4
Any mental health	11.3	8.5	7.6	3.5	7.7	8.2	−27.4	0.29	7.8
Drug use	5.7	3.5	4.1	0	2.9	0.5	−91.2	0.004	2.7
Suicidal Behavior	3.5	2.1	2.9	0	3.9	3.6	2.9	0.67	2.8

Table 3
Agreement in the number of ED visits with alcohol intoxication identified by the chart review and diagnostic codes in the review sample.

Chart Review				
Diagnostic codes		Yes	No	Total
	Yes	62	4	66
	No	34	500	534
	Total	96	504	600

campus-related factors. Intoxicated students may not be brought to the hospital EDs due to perceived or actual barriers related to high costs of ambulance or hospital emergency services, concerns over the penalties or disciplinary actions the university may administer, perceptions about the level of intoxication that needs medical attention, and their experience in dealing with intoxication. The observed, rising trend is not necessarily corresponding to an increase in the rate of drunkenness among students on the university campus, or to an increase in the frequency and severity of accompanied conditions (e.g., injuries or trauma). Instead, such increases in the use of medical emergency care may imply improvements in student awareness of the danger of alcohol intoxication or poisoning, which lead to a greater number of students seeking help or calling for assistance upon observing other students exhibiting symptoms of dangerous alcohol use. As a result, more intoxicated students were brought to the ED for treatment. An earlier study has shown that provision of ED transports to students with suspected alcohol intoxication on the university campus increases the number of students calling for help and more intoxicated students were transferred to the local ED (Kharasch et al., 2016).

Similar to previous studies of alcohol use in the hospital EDs among college students (Barnett et al., 2003; Benningfield et al., 2009; Wright et al., 1998), we did not find a substantial gender difference in the rate of alcohol intoxication (11.1% vs. 9.7%). This finding disagrees with repeatedly documented higher rates of binge drinking among male students outside the hospital emergency care (e.g., 43% vs. 32%;White and Hingson, 2013). A possible explanation is that female students were more aware of an acceptable level of intoxication and the need for medical treatment and were more likely to be brought by friends to medical care when severely intoxicated. Evaluating the amount of alcohol consumption and measures of blood alcohol level at the ED admission can provide a better understanding of gender-specific determinants of alcohol intoxication among students, leading to a better gender-specific intervention.

A possible explanation for a higher rate of alcohol intoxication among young students could be that younger students are often less experienced drinkers who are unable to manage the amount of alcohol or deal with intoxication; therefore, they are more likely to drink to the point of intoxication requiring emergency intervention. This highlights the need for an early education about alcohol use for incoming students and screening for high risk individuals for timely intervention. A total of 21% of students in the study population were identified as Greek Life members on a campus that had a nearly 1.5 times higher rate of alcohol intoxication compared to other students (13.6% vs. 9.6%). Students who were members of the university athletic team, on the other hand, were less likely to present to ED for alcohol intoxication. This may be due in part to the fact that their activities are better supervised or they are required to abstain from drinking during sport seasons.

The rate of alcohol intoxication varied substantially by academic

programs. Interestingly, the rate among medical students (1.7%) was the second lowest, which is in contrast to a higher rate of alcohol dependence of medical students than for similarly aged peers not attending medical school reported in earlier studies outside the ED setting (Jackson et al., 2016; SAMHSA, 2012). This finding may indicate that medical students were less likely to drink to the point of intoxication as a result of their medical knowledge. Also, medical students might be reluctant to visit EDs when intoxicated because of their close contact with the healthcare providers as part of their training. Nursing students, for an unknown reason, had the highest rate.

Our study has significant strengths. The objective measures of hazardous drinking based on clinical diagnoses could be more reliable than self-report survey data. As the chart review indicates, alcohol intoxication identified by diagnostic codes has a very high level of accuracy. The study involved a large number of ED visits, collected over an extended period of time, which allowed for evaluation of the trends and demographic changes in the prevalence of alcohol intoxication in an acute care setting. Using linked datasets beyond the patient ED data, the present study has uncovered important student characteristics (i.e., academic program, fraternity/sorority affiliation, athletic participation) that were not described in previous studies of students presenting to the ED for alcohol-related reasons noted earlier.

4.2. Study limitations

The chart review found over one third of ED visits involving alcohol intoxication were not recorded by diagnostic codes, which was similar to a previous study where only 54% of alcohol abuse cases were captured by ICD-9 diagnostic codes (Quan et al., 2008). Data for the present study did not include incidents of intoxication at other health facilities when a majority of students are off campus, such as spring or summer breaks. Subsequently, the data do not fully account for the true burden of alcohol related ED visits among the student population for the full year. The estimated prevalence and trends are specific to the ED of a public university health system, which may not be generalizable to other universities and the US college student population. However, the observed differentials by key demographic variables (e.g., age, sex, ethnicity) were consistent with previously documented demographic patterns, indicating that our data reflect generalizable patterns in hazardous alcohol consumption among student populations.

4.3. Clinical implications

Our study offers new insights to emergency care for intoxicated students. All clinicians are engaged in the recognition of alcohol misuse and subsequent efforts, when identified, to modify such behavior for healthier future lifestyle. ED clinicians often have the unique opportunity to witness and treat alcohol intoxication and related aberrant behaviors and, therefore, could use this “teachable moment” to not only identify those at high risk for alcohol use disorder, but also motivate them to seek help. It is imperative that emergency medicine clinicians adequately document such behavior in the medical record and address the subsequent plan of care for such behavior upon admission or discharge. It is also critical that overall demographic and clinical characteristics of intoxicated students be detailed to further inform research and epidemiological surveillance in an effort to appropriate resources and staff to effectively target preventive interventions and to monitor the efficacy of such interventions.

4.4. Future directions

The incomplete code-based documentation of alcohol intoxication calls for further efforts to improve physicians’ coding for this condition. In addition to medical attention, students with alcohol intoxication seen in the urgent care setting also require interventions to reduce further occurrence of this traumatic event. A rich account of student demographic, organizational, academic, and clinical characteristics together with complete and accurate recording of alcohol related clinical presentation enables the development of a robust risk-screening algorithm to identify students with higher risk trajectories. As high-risk students may not respond to interventions commonly delivered to the general student population, future research should focus on identifying more proactive or more targeted interventions and service support for the most at risk student groups.

4.5. Conclusion

This study has uncovered important characteristics of students who suffered from alcohol intoxication requiring ED evaluation, which can be used to design effective screenings and interventions to target these at risk students and reduce hazardous health consequences. Since the medical management of acutely intoxicated patients occurs primarily in the hospital ED, the ED provides an important avenue to engage high-risk students in alcohol use education to alleviate intoxication-related harms and prevent further risky drinking. While primary prevention of risky drinking continues to be a priority, early identification and medical evaluation of students who engage in high-risk drinking for timely referral and treatment are also important in order to avoid disastrous health consequences.

Contributors

CH conceived the dataset. AN conceived the study design, performed the analyses, and drafted the manuscript. All authors contributed to interpretation of the results and writing the manuscript. All authors approved the final version of the manuscript before submission. None of the original material contained in this manuscript has been submitted for consideration nor will any of it be published elsewhere.

Role of funding source

Nothing declared

Conflict of interest

All authors declare that they have no conflicts of interest.

References

Barnett, N.P., Monti, P.M., Spirito, A., Colby, S.M., Rohsenow, D.J., Ruffolo, L., Woolard, R., 2003. Alcohol use and related harm among older adolescents treated in an emergency department: the importance of alcohol status and college status. J. Stud. Alcohol 64, 342–349.

Benningfield, M.M., Trucco, E.M., Barreira, P.J., Greenfield, S.F., 2009. Treatment of alcohol intoxication at university health services: examining clinical characteristics, drinking patterns, and adherence with referral. J. Alcohol Drug Educ. 53, 54–69.

Bertholet, N., Adam, A., Faouzi, M., Boulat, O., Yersin, B., Daeppen, J.B., Clerc, D., 2014. Admissions of patients with alcohol intoxication in the emergency department: a growing phenomenon. Swiss Med. Wkly. 144, w13982.

Haberkern, M., Exadaktylos, A.K., Marty, H., 2010. Alcohol intoxication at a university hospital acute medicine unit – with special consideration of young adults: an 8-year observational study from Switzerland. Emerg. Med. J. 27, 199–202.

Jackson, E.R., Shanafelt, T.D., Hasan, O., Satele, D.V., Dyrbye, L.N., 2016. Burnout and alcohol abuse/dependence among U.S. medical students. Acad. Med. 91, 1251–1256.

Kharasch, S.J., McBride, D.R., Saitz, R., Myers, W.P., 2016. Drinking to toxicity: college students referred for emergency medical evaluation. Addict. Sci. Clin. Pract. 11, 11. http://dx.doi.org/10.1186/s13722-016-0059-4.

Lo, C.C., Globetti, G., 1995. The facilitating and enhancing roles Greek associations play in college drinking. Int. J. Addict. 30, 1311–1322.

NIAAA, 2010. Alcohol-related Emergency Department Visits and Hospitalizations and Their Co-occurring Drug-related, Mental Health, and Injury Conditions in the United States: Findings from the 2006–2010 Nationwide Emergency Department Sample (NEDS) and Nationwide Inpatient Samples (NIS). pp. 2013. Retrieved from. https://pubs.niaaa.nih.gov/publications/NEDS&NIS-DRM9/NEDS&NIS-DRM9. pdf September 6, 2017.

National Institutes of Health, 2002. High-risk Drinking in College: What We Know and What We Need to Learn; Final Report of the Panel on Contexts and Consequences. Retrieved from www.collegedrinkingprevention.gov.

O'Farrell, A., Allwright, S., Downey, J., Bedford, D., Howell, F., 2004. The burden of alcohol misuse on emergency in-patient hospital admissions among residents from a health board region in Ireland. Addiction 99, 1279–1285.
Presley, C.A., Meilman, P.F., Leichliter, J.S., 2002. College factors that influence drinking. J. Stud. Alcohol. S14, 82–90.
Quan, H., Li, B., Saunders, L.D., Parsons, G.A., Nilsson, C.I., Alibhai, A., Investigators, I.M.E.C.C.H.I., 2008. Assessing validity of ICD-9-CM and ICD-10 administrative data in recording clinical conditions in a unique dually coded database. Health Serv. Res. 43, 1424–1441.
SAMHSA, 2010. Results from the 2010 National Survey on Drug Use and Health: Summary of National Findings, NSDUH Series H-41, HHS Publication No. (SMA) 11–4658. Substance Abuse and Mental Health Services Administration, Rockville, MD.
SAMHSA, 2012. Results from the 2012 National Survey on Drug Use and Health: Summary of National Findings. Retrieved from. http://www.samhsa.gov/data/NSDUH/2012SummNatFindDetTables/NationalFindings/NSDUHresults2012. htm. September 6, 2017.
Turner, J.C., Shu, J., 2004. Serious health consequences associated with alcohol use among college students: demogrpahic and clinical characteristics of patietns seen in an emergency department. J. Stud. Alcohol 65, 179–183.
University of Virginia, 2014. Current On-Grounds Enrollment.
Verelst, S., Moonen, P.J., Desruelles, D., Gillet, J.B., 2012. Emergency department visits due to alcohol intoxication: characteristics of patients and impact on the emergency room. Alcohol 47, 433–438.
Wechsler, H., Dowdall, G.W., Davenport, A., Castillo, S., 1995. Correlates of college student binge drinking. Am. J. Public Health 85, 921–926.
White, A., Hingson, R., 2013. The burden of alcohol use: excessive alcohol consumption and related consequences among college students. Alcohol Res. 35, 201–218.
Wright, S.W., Slovis, C.M., 1996. Drinking on campus: undergraduate intoxication requiring emergency care. Arch. Pediatr. Adolesc. Med. 150, 699–702.
Wright, S.W., Norton, V.C., Dake, A.D., Pinkston, J.R., Slovis, C.M., 1998. Alcohol on campus: alcohol-related emergencies in undergraduate college students. South. Med. J. 91, 909–913.