

# ALCOHOL-ASSOCIATED ILLNESS AND INJURY AND AMBULANCE CALLS IN A MIDWESTERN COLLEGE TOWN: A FOUR-YEAR RETROSPECTIVE ANALYSIS

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## ABSTRACT

**Background.** Alcohol is often a factor in illness and injury among college-aged individuals. Ambulance services responding to 9-1-1 calls in college towns regularly encounter patients who have consumed alcohol to the point of intoxication and subsequently suffered an injury or experienced an illness necessitating prehospital emergency care. **Objectives.** The first objective was to review ambulance calls in a Midwestern college town in order to identify patterns or trends related to alcohol consumption. Another objective was to determine to what extent, if any, underage drinking was a factor in these calls. A final objective was to determine whether there were types of illness or injuries related to 9-1-1 calls that were involved with alcohol consumption among college-aged students. **Methods.** This was a retrospective study using secondary data of four years of ambulance calls that occurred in a specific geographic region of a college town. All patient care reports (PCRs) included alcohol consumption as a pertinent factor in the call. Data were de-identified and in some cases aggregated to ensure confidentiality. Descriptive statistics were used to identify prevalence and incidence of injury and illness and patient demographics. **Results.** Of the ambulance calls for service in the geographic area, 44.4% to 45.8% identified as "downtown" had alcohol consumption as a reported factor in the PCR. The number of calls for service that involved patients below the legal drinking age (21 years) was small but increased between 2004 and 2007. Calls involving male patients made up the majority of calls with alcohol as a factor. The majority of alcohol-related calls for service were for traumatic injuries, sexual assaults and rapes, poisonings or drug ingestions, and altered levels of consciousness. **Conclusion.** Alcohol consumption was a comorbid factor in illness and injury that necessitated prehospital emergency medical care in one Midwestern college town. Further research is needed to determine whether these results can be generalized beyond this one geographic location or if causality can be determined between alcohol consumption and injuries or illnesses that

lead to emergency medical services calls. **Key words:** emergency medical services; alcohol abuse; college

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## INTRODUCTION

Ambulance services, fire agencies, and other prehospital emergency medical services (EMS) providers that respond to 9-1-1 calls in college towns face a unique set of challenges and circumstances when responding to calls in situations where alcohol is a factor. Students entering college often take advantage of a newly discovered sense of autonomy to experiment in activities that can be unhealthy and dangerous, including overconsumption of alcohol.<sup>1</sup> On these calls violence is often a factor, and the scene has the potential to become unsafe very quickly. Patients and bystanders are typically poor historians, and the events frequently involve law enforcement and possible criminal charges against the patient.

Overconsumption of alcohol has been shown to be a contributing factor to high-risk behaviors, including unsafe or high-risk sexual activity. Wechsler and colleagues' seminal study of alcohol consumption and American college students identified binge drinking as "the single most serious public health problem confronting American colleges."<sup>2</sup>

Binge drinking has been defined as "consumption of a sufficiently large amount of alcohol to place the drinker at increased risk of experiencing alcohol-related problems and to place others at risk of experiencing secondhand effects."<sup>3</sup> A 2006 report by the Office of Applied Studies of the Substance Abuse and Mental Health Services Administration (SAMHSA) found that, nationwide, 57.8% (3.0 million) of college students between the ages of 18 and 20 years report having consumed alcohol within the preceding month, and 40.1% (2.1 million) of these students self-reported having engaged in binge alcohol use.<sup>4</sup>

Research into the effects of alcohol consumption by college students has shown that students who consume alcohol in large, episodic quantities experience health-related problems and injuries due to this alcohol consumption,<sup>5</sup> and that among college students seen for alcohol-related complaints in emergency departments, injuries, particularly unintentional injuries, are more common than illnesses.<sup>6,7</sup> This study was conducted to examine the factors and circumstances that are involved when prehospital EMS

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providers respond to calls for injuries and illnesses by college-aged students where alcohol is a factor. Objectives of this study included identifying patterns or trends in alcohol consumption—including the prevalence of underage drinkers—and determining if specific injuries or illnesses were related to 9-1-1 calls where alcohol was a factor.

## METHODS

This study was a retrospective study using secondary data of four years of calls for service of a county-owned and -operated ambulance service in a college town. The ambulance service from which the data were obtained was the primary 9-1-1 EMS agency for the county in this Midwestern state. The service employs 55 emergency medical technician (EMT)-basics and paramedics. The service staffs three advanced life support (ALS) ambulances 24 hours a day, seven days a week, in a two-paramedic staffing model. EMT-basics are used for standby events and as drivers for scheduled transfers. They do not respond to 9-1-1 calls within the service's response area.

The service responds to 9-1-1 medical and trauma calls in a 60,000+ -resident metropolitan area and the surrounding county. This includes seven incorporated towns spread out over 620 square miles with 115,000 residents. Patients who are transported are taken to a university-affiliated level I trauma center or a 45-bed community resource hospital—both located within the city limits. These hospitals are located 1.3 and 0.5 miles, respectively, from the geographic area designated as "downtown" in this study. Of the residents of the town, approximately 30,000 are college students. The college has buildings and facilities throughout the town and the surrounding communities, but its primary geographic location is in the center of town.

In its computer-based charting and documentation system, the ambulance service identifies a 30-square-block area in the geographic center of town as "downtown." In this area there are 50 bars or restaurants that serve alcohol. The city council in this town has defined a "bar" as an establishment where more than 50% of revenue is derived from the sale of alcohol. A "restaurant" was defined as an establishment where alcohol was sold but at least 50% of revenue was derived from the sale of food. Whereas a small number of apartments are located above businesses in this downtown area, almost all of the buildings in the downtown area are either retail or commercial spaces.

This area is close to but separate from many dormitories and apartment complexes. The dense concentration of bars and alcohol-serving restaurants makes the downtown area the nexus of the college drinking scene, where many students gather to socialize.

The number of calls for the ambulance service in the four-year period analyzed was 22,474. Of these calls,

2,215 (9.9%) occurred in the downtown region of the city. For this study, only these calls that occurred in the downtown area were analyzed. The data were further disaggregated to include only those calls in which alcohol was a pertinent factor.

The data for this study came from the Ortivus Sweet-Field computer-based charting and documentation software (TriTech Emergency Medical Systems, Decorah, IA) used by the ambulance service for the calendar years 2004, 2005, 2006, and 2007. These data were transferred to a Microsoft Excel spreadsheet (Microsoft Corp., Redmond, WA) and delivered to the principal investigator with identifying information removed. Descriptive information in the data set was limited to the date of call for service, the age and gender of the patient, and the nature of the call as determined by the reporting paramedic. No confidential or identifying information was included in the data set. All raw data were destroyed at the conclusion of the project. The project was declared exempt from human subjects research guidelines by Kirkwood Community College's Institutional Review Board prior to the collection of data.

Patient care reports (PCRs) were selected for inclusion in this study based on a qualifying set of criteria that included geographic location within the area that was identified in the ambulance service response map as downtown, and whether or not alcohol was a factor involved in the call for service.

Any incomplete data or data that included obviously incorrect information (e.g., an age of 213) were removed from the data set. The number of cases removed because of incomplete or obviously incorrect data totaled 29 (2004: 14; 2005: 8; 2006: 8; and 2007: 9). This reduced the final sample size from  $n = 1,043$  to  $n = 1,014$ . To ensure confidentiality, no information or data were reported without first aggregating the data into at least 10 cases.

All calls were identified as alcohol-related by the paramedic who had primary patient care responsibilities and wrote the report. "Alcohol as a pertinent factor in the ambulance call for service" as determined by the paramedic writing the report was a unifying element for all data analyzed. Within the computer-based charting software, this was a required field where one option from the dropdown menu was "alcohol con-

TABLE 1. Ambulance Calls for Service, 2004–2007

Year	All Calls for Service in the Downtown Area	Calls for Service in the Downtown Area with Alcohol as a Factor	All Calls for Service (All Areas)
2004	519	237 (45%)	5,039
2005	540	239 (44%)	5,316
2006	543	263 (48%)	5,482
2007	613	275 (44%)	6,637
TOTAL	2,215	1,014 (49%)	22,474

TABLE 2. Alcohol-Related Calls for Service in the Downtown Area by Patient Gender ( $N = 1,014$ )

Year	Calls for Service with Alcohol as a Factor	Male	Female
2004	237	173 (72%)	64 (27%)
2005	239	182 (75%)	57 (24%)
2006	263	182 (69%)	81 (30%)
2007	275	206 (74%)	69 (25%)
TOTAL	1,014	743 (73%)	271 (27%)

sumption." If this was affirmatively selected by the paramedic completing the report, then it was included in this analysis of the data.

Paramedics determine alcohol use by their patients through a complex and intertwined process of sensory input, including sight, smell, patient interview, and scene factors. Patient care reports were completed for all calls in which the paramedic had contact with the patient. If the patient refused care but was seen by the ambulance crew, a report was still written.

Research questions and inquiry that framed and guided this study included the following:

- What percentage of all calls occurred in the area identified as downtown?
- What percentage of the calls occurring downtown listed alcohol as a contributing factor on the call?
- What were the ages and gender of the patients involved in alcohol-related calls for service?
- To what extent did alcohol-related calls for service involve patients below the legal drinking age (21 years old)?
- What were the most common or most frequent injuries or illnesses on alcohol-related calls for service?
- Were there certain days of the week on which more alcohol-related calls for service occurred?

In this study, only ambulance calls that took place within the area identified by the ambulance service as

downtown were included in the analysis. It is possible and likely that the ambulance services responded for illnesses and injuries where the patient had been drinking in the downtown area but the call took place in his or her residence or just beyond the downtown boundaries. The data were further delimited by the fact that all calls were included and no attempt was made to identify acuity or level of care provided by the paramedics on the call. Further, it was not the researcher's intent to evaluate the quality of care provided or whether the call could be classified as "basic" or "advanced." Finally, the study included only calls where the paramedic recorded alcohol as a factor on the call in the required field of the charting software. No attempt was made to review the narrative or other data that might identify alcohol use by the patient.

## RESULTS

The results showed that alcohol use was associated with between 44.4% and 45.8% of all of the calls for service in the geographic area identified as downtown between 2004 and 2007. Table 1 illustrates the number of times the ambulance service was dispatched for calls and made contact with a patient. Not all patients were transported by ambulance, and the data do not make a distinction between transport and nontransport. While calls for service in the downtown area increased steadily from 2004 to 2007, the percentage of calls where alcohol was a factor remained constant.

Table 2 illustrates the percentage of calls for service with patient contact that involved alcohol for male and female patients. The data in Table 2 show that close to three-fourths (73%) of the alcohol-related ambulance calls involved male patients.

Table 3 illustrates the number of alcohol-related ambulance calls by patient age. The data show that the majority of calls in this four-year period (58%) involved college-aged individuals (19 to 25 years old).

TABLE 3. Alcohol-Related Calls in the Downtown Area by Patient Age

Age (years)	2004	2005	2006	2007	Total
17-20	3	7	33	70	113 (11.1%)
21-25	116	121	133	112	482 (47.5%)
26-30	51	40	33	27	151 (14.8%)
31-35	15	7	11	6	39 (3.8%)
36-40	10	5	7	7	29 (2.8%)
41-45	11	15	19	16	61 (6.0%)
46-50	11	20	9	22	62 (6.0%)
51-55	6	10	4	5	25 (2.4%)
56-60	6	2	7	2	17 (1.6%)
61-70	6	5	4	2	17 (1.6%)
>70	0	5	2	2	9 (0.8%)
No age given	2	2	1	4	9 (0.8%)
TOTAL	237	239	263	275	1,014 (100%)
	R = 116	R = 119	R = 132	R = 110	R = 473
	$\bar{x}$ = 19.75	$\bar{x}$ = 19.92	$\bar{x}$ = 21.92	$\bar{x}$ = 22.92	$\bar{x}$ = 84.5
	SD = 33.12	SD = 33.56	SD = 36.68	SD = 34.04	SD = 132.63

$\bar{x}$  = mean; R = range; SD = standard deviation.

TABLE 4. Alcohol-Related in Calls in the Downtown Area by Day of the Week (N = 1,014)

Year	Calls for Service with Alcohol as a Factor	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
2004	237	14 (5.9%)	18 (7.5%)	18 (7.5%)	24 (10.1%)	51 (21.5%)	55 (23.2%)	57 (24.0%)
2005	239	10 (4.1%)	11 (4.6%)	22 (9.2%)	24 (10.0%)	60 (25.1%)	71 (29.7%)	41 (17.1%)
2006	263	*	17 (6.4%)	17 (6.4%)	23 (8.7%)	59 (22.4%)	68 (25.8%)	70 (26.6%)
2007	275	17 (6.1%)	17 (6.1%)	16 (5.8%)	31 (11.2%)	56 (20.3%)	81 (29.4%)	57 (20.7%)
TOTAL	1,014	50 (4.9%)	53 (5.2%)	41 (4.0%)	102 (10.0%)	226 (22.2%)	275 (27.1%)	225 (22.1%)
		R = 8	R = 7	R = 6	R = 8	R = 9	R = 26	R = 29
		$\bar{x}$ = 12.5	$\bar{x}$ = 15.75	$\bar{x}$ = 18.25	$\bar{x}$ = 25.5	$\bar{x}$ = 68.75	$\bar{x}$ = 68.75	$\bar{x}$ = 56.25
		SD = 3.70	SD = 3.20	SD = 2.63	SD = 3.70	SD = 4.04	SD = 10.72	SD = 11.87

\*Fewer than 10 individuals in the cell.

$\bar{x}$  = mean; R = range; SD = standard deviation.

While only a small percentage (11%) of the calls were for patients younger than 21 years old, there was a dramatic increase in calls for these underage patients from 2004 (1%) to 2007 (25%).

The data in Table 4 illustrate that, not surprisingly, most ambulance calls in the downtown area occurred on Friday and Saturday, with Sunday—after bars had closed—also contributing to the high number of ambulance calls. The percentages of calls occurring on Friday, Saturday, and Sunday combined were 68% in 2004, 72% in 2005, 75% in 2006, and 71% in 2007.

Table 5 shows that there were 18 different identifiers listed by the paramedic writing the report for why the patient required ambulance evaluation and treatment. These identifiers were chosen from a list of choices that align with the Centers for Medicare and Medicaid *International Classification of Diseases, Ninth Revision (ICD-9)* codes by the paramedic who completed the PCR. Paramedics completing the report chose from a

list and categorized the complaints under a Provider Impression dropdown window.

In this study, calls for service where the paramedic identified alcohol as a factor in the call were cross-referenced with the first or primary Provider Impression selection. Altered level of consciousness and poisoning/drug ingestion are not unexpected, since they are often consistent with the definition of significant alcohol consumption. In many cases where the sole reason for the requirement for medical attention is acute alcohol intoxication, paramedics use this descriptor.

The data showed that four of these reasons or chief complaints for alcohol-related calls for service in the downtown area—altered level of consciousness, poisoning/drug ingestion, sexual assault/rape, and traumatic injury—made up a large percentage of these ambulance calls. These four chief complaints out of 18 (22%) listed in the reports included in this study

TABLE 5. Alcohol-Related Calls for Service in the Downtown Area by Provider Impression (N = 1,014)

Provider Impression	2004	2005	2006	2007	Total
Abdominal pain	10	5	8	4	27 (2.6%)
Airway obstruction	6	3	1	6	16 (1.5%)
Allergic reaction	0	1	0	2	3 (0.2%)
Altered level of consciousness	36	50	33	49	168 (16.5%)
Behavioral/psychiatric	5	4	7	6	22 (2.1%)
Chest pain/discomfort	4	4	3	3	13 (1.2%)
Diabetic signs and symptoms	0	3	1	0	4 (0.3%)
Hypothermia	0	1	0	0	1 (0.1%)
Inhalation injury	0	0	1	1	2 (0.1%)
Obvious death	0	0	1	0	1 (0.1%)
Poisoning/drug ingestion	41	46	53	60	200 (19.7%)
Pregnancy/OB/delivery	1	0	0	0	1 (0.1%)
Respiratory distress	3	2	3	0	8 (0.7%)
Seizure	1	2	2	1	6 (0.5%)
Sexual assault/rape	23	16	23	21	83 (8.1%)
Stroke/CVA	0	0	1	0	1 (0.1%)
Syncope/fainting	4	3	4	3	20 (1.9%)
Traumatic injury	73	72	79	99	323 (38.1%)
None given*	30	27	43	20	120 (11.8%)
TOTAL	237	239	262	275	1,014

\*Field left blank by the paramedic.

CVA = cerebrovascular accident; OB = obstetric.

account for 76% of all alcohol-associated ambulance calls for service in the downtown area.

## DISCUSSION

Discussion of the results of the study focuses on several themes. The data reveal that between 44.4% and 45.8% of the ambulance calls for service in the geographic area identified as downtown had alcohol consumption by college-aged individuals as a reported factor in the PCR. By way of comparison, a 2009 study of the demands that alcohol misuse by college students placed on college or university resources found that alcohol use was associated with 16% to 17% of all university-based ambulance transports.<sup>8</sup>

A second point of discussion involves the gender of the patients treated. The data show that by an almost three-to-one margin (73%), male patients were more likely to be involved in incidents where an ambulance had to be called and alcohol consumption was a factor. In a one-proportion z-test of the null hypothesis ( $H_0$ ), the overall proportion of male patients in calls for service with alcohol as a factor was 0.50, versus the alternative hypothesis ( $H_A$ ), where the overall proportion of male patients in calls for service with alcohol as a factor was greater than 0.50,  $z = 14.823$ , and the p-value was  $5.5 \times 10^{-50}$ . This is strong evidence that the proportion of male patients in calls for service with alcohol as a factor is greater than the proportion of female patients in calls for service with alcohol as a factor.

The data also suggest that the male patients were more likely to be involved in calls with traumatic injuries. What is not known is to what extent these are calls resulting from "misadventure" (slip and fall events or errors in psychomotor judgment) and to what degree violence and assault play a role in these calls for service. An analysis of that depth is beyond the scope of the data as provided. Further research may benefit from an integration of local law-enforcement data.

A third point of discussion is related to the age of the patients being seen by EMS where alcohol is a factor. The incidence of alcohol-related ambulance calls that involve those under the legal drinking age, while small, had increased from 2004 to 2007. In 2004, only 1.2% of the patients were 19–20 years old. In 2007, the incidence had risen to 25.4%.

It is not known if the population of students of the college and residents of the town had experienced a similar demographic change during this four-year period. It also cannot be determined from the data whether the small percentage of legally underage individuals needing prehospital medical attention is a true reflection of the number of such students consuming alcohol in the downtown area and subsequently becoming ill or injured. It is possible that the number sug-

gested by our data is low, because this is a segment of the population that is far less likely to activate emergency services when medical attention is needed. Further study with a strong qualitative component may provide an explanation.

The data reveal that a majority of alcohol-related ambulance calls in the downtown area occurred between Friday evening and Sunday morning. In past years, the college, in cooperation with city government, has attempted to provide disincentives for students to go to the bars on Thursday nights by increasing the number of core courses and courses required by freshmen and sophomores that are held on Fridays. This was countered by drinking establishments' increasing the number of promotional and discount activities and products on Thursday nights. Complicating the matter further were recently enacted city ordinances that regulated how alcohol could be served and advertised. These ordinances prohibit "two for one" or "all you can drink" specials and similar promotions that college and community leaders fear encourage binge drinking. Further longitudinal study is required to determine whether any of these actions have had an effect on the incidence of alcohol-related ambulance calls.

Finally, and perhaps most troubling, is that over the four-year period, 8.1% of all EMS calls with alcohol consumption as a factor in the downtown area were for patients reporting rape or some other form of sexual assault. The area included in this study included no dormitories and very few apartments, so it may be assumed that many of these incidents took place outside of college residences. A study conducted by the University of California at Berkeley in 2002<sup>9</sup> has suggested that up to 70% of all reported sexual assaults on college campuses identify alcohol consumption or intoxication as a contributing factor. That sexual assault and rape and traumatic injury account for such a high percentage of alcohol-related calls for service in this study (8.1%) seems to confirm research that binge drinking and alcohol consumption have serious negative consequences and lead to high-risk behaviors and situations.

## LIMITATIONS AND FUTURE RESEARCH

A thorough discussion of the results of this study would not be complete without identifying several limitations of research. One limitation to the study was that the determination of alcohol as a pertinent factor was made by a subjective analysis by the paramedic completing the report. Paramedics determine alcohol use by their patients through a complex and intertwined process of sensory input, including sight, smell, patient interview, and scene factors. Whereas it is sometimes obvious that alcohol is a factor in the call, some patient presentations are more subtle, and

it is possible that a paramedic may miss the signs and symptoms of alcohol consumption. Likewise, a paramedic may misinterpret signs and symptoms as consistent with alcohol consumption where none, in fact, exists. Diabetic crises, head injuries, and behavioral or psychological emergencies can all present with signs and symptoms similar to those suggesting alcohol consumption.

The study was also limited in that it used secondary data. With a retrospective review of ambulance calls, it is not possible to determine causality. The researcher could only speculate as to the likelihood that statistically significant relationships were suggested by the data. Further research is needed to provide definitive linkage and relationships.

## CONCLUSIONS

Emergency medical services providers who respond to calls in college towns have anecdotal knowledge and a strong suspicion that there is a link between alcohol consumption and the calls to which they respond. Results and conclusions from this study can assist EMS leaders and policymakers by providing data and evidence that confirm what has for a long time been suspected by those individuals providing care in the field.

In the data reviewed for this study, alcohol consumption was a comorbid factor in illness and injury that necessitated prehospital emergency care in this Midwestern town. The information regarding the nature and type of calls that are frequently associated with alcohol-related incidents can be helpful for EMS administrators and educators in shaping the training and continuing education they provide to current and future EMS providers. Emergency medical services providers can benefit from an awareness of the factors involved in these alcohol related calls. The knowledge from this study and future studies can help inform the EMS provider's interview, assessment, and treatment practices as they relate to college students and calls that involve alcohol consumption.

The results of the study also provide guidance for EMS administrators and leaders when it comes to logistical matters such as staffing and staging of resources. The data suggest that most alcohol-related calls occur within specific temporal and spatial pa-

rameters. Decisions to position resources in vulnerable areas and increase coverage during peak call volumes can be justified with objective data. While this review of the data did not look at the level of care provided (advanced life support or basic life support) or the acuity of the call, future studies can help determine staffing configurations for these types of calls.

This study also allows city, county, and other local policymakers in college towns to better understand their constituents and the populations they serve. This analysis of the data provides officials with a demographic snapshot of their constituents and allows them to focus with more precision on the policies, programs, and regulations that involve college students and alcohol consumption.

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