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OPPORTUNITIES FOR INTERVENTION: CHARACTERISTICS OF
ALCOHOL RELATED VISITS TO UNITED STATES
EMERGENCY DEPARTMENTS, 2003 - 2007

by

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Bachelor of Science
University of New Mexico
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A thesis submitted in partial fulfillment
of the requirement for the

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ABSTRACT

Opportunities for Intervention: Characteristics of Alcohol Related Visits to United States Emergency Departments, 2003 – 2007

by

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The cycle of alcohol intoxicated patients passing through United States (US) emergency departments (ED) and repeated inpatient detoxification for alcohol inebriates is costly, as these patients are continually exposed to injury and other health and legal consequences of their continued at risk alcohol use. The high proportion of ED resources used by these alcohol intoxicated patients has contributed to increased patient wait times, increased ambulance diversions, forced closures of US EDs, increased numbers of patients leaving without being seen, and an overall reduction in the quality of medical services provided in the ED. In order to contribute to efforts towards reducing the proportion of ED visits which involve hazardous alcohol consumption, this project used a national probabilistic sample of emergency department patient visits to demonstrate and quantify: 1) the burden that alcohol use and abuse places on EDs in the US; 2) the particular service needs of patients presenting for alcohol intoxication; 3) the degree to which ED clinicians refer patients with alcohol related diagnoses to treatment geared towards at risk alcohol consumption; and 4) trends in rates of hospitalizations for alcohol related visits over the study period.

Alcohol related and non-alcohol related visits were compared using national ED data to measure the impact of alcohol related visits on the emergency medical service delivery system. Using cross-sectional data from the 2003 - 2007 National Hospital Ambulatory Medical Care Survey (NHAMCS), patients were assigned to alcohol related and non-alcohol related categories using physician diagnoses. These diagnoses, present in the NHAMCS data are coded using the International Classification of Disease Ninth Revision – Clinical Modification (ICD9-CM). Once identified, patients seen for alcohol related visits were compared to patients seen for non-alcohol related visits. Weighted visit characteristics were compared with odds ratios (OR), t-tests and 95% confidence intervals (CI).

Of 575 million weighted ED visits, 1.62% were for alcohol related conditions. This translated to an average annual rate of 1,619.6 alcohol related visits per 100,000 ED admissions. No temporal trends in the rate of visits per 100,000 ED admissions were observed during the study period. Alcohol related visits took longer (1,254.2 min vs. 892.6 min; $p < 0.0001$), were triaged with a higher level of acuity, and received more diagnostic tests (5.5 vs. 4.4; $p < 0.0001$). Patients seen for alcohol related conditions were more apt to have been seen in the last 72 hours and had more visits to the same ED within the last year (2.6 visits vs. 1.5 visits, $p = 0.0028$). Alcohol related patients more frequently arrived at the ED via ambulance (51.6% vs. 16.3%; OR 5.2, 95% CI 4.7-5.5) or via public services (9.4% vs. 1.5%, OR 7.0, 95% CI 5.6-8.8). Alcohol related patients were more often male (71% vs. 46%; OR 3.0, 95% CI 1.9-2.3), aged 25-44 years (44.6% vs. 28.7%; OR 2.0, 95% CI 1.8-2.2), and homeless (13.5% vs. 0.5%; OR 5.7, 95% CI 3.9-8.3). The primary payer source was self-pay (31.6% vs. 15.1%; OR 2.6, 95% CI 2.4-2.9).

Alcohol related patients were more apt to be injured (97.2% vs. 34.7%; OR 64.5, 95% CI 45.61-91.4). Alcohol related patients were more likely to become injured due to assault (6.9% vs. 4.4%, OR 1.6, 95% CI 1.3-1.9) and unintentional injury (51.7% vs. 26.7%, OR 1.6, 95% CI 1.5–1.9) than patients without alcohol diagnoses. Alcohol related patients were more often admitted to a hospital (7.9% vs. 12.8%; OR 1.4, 95% CI 1.2-1.6) or to leave the ED against medical advice (3.2% vs. 1.1%; OR 3.1, 95% CI 2.3-4.2). Patients discharged from the ED were referred to alcohol treatment only 18.5% of the time. Patients presenting with alcohol related conditions were more frequently referred to social services (7.4% vs. 0.7%, OR 12.1, 95% CI 9.0-16.4). Only 47.8% of all alcohol related visits required medical treatment beyond alcohol detoxification.

Patients presenting to the ED with alcohol related medical conditions use more resources, have longer ED visits, and infrequently receive referral to substance abuse treatment. High priority should be placed on methods to identify patients who could safely be managed in sobering facilities. Indicated interventions with measured levels of success in reducing the frequency of alcohol related visits to the ED such as the Screening and Brief Intervention with Referral to Treatment (SBIRT) program must be employed. SBIRT has performed well in clinical evaluation for reducing alcohol related visits to US EDs.

TABLE OF CONTENTS

ABSTRACT	iii
LIST OF TABLES	vii
LIST OF FIGURES	viii
CHAPTER 1 BACKGROUND AND SIGNIFICANCE.....	1
Introduction	1
Alcohol Related ED Visits	3
Alcohol and Injury	10
ED as Detoxification Facility.....	15
Intervention: Treating Alcohol Abuse in the ED	19
CHAPTER 2 PROJECT PURPOSE AND SPECIFIC AIMS	27
Research Questions	29
CHAPTER 3 METHODS	32
NHAMCS Description	32
Computation of Standard Errors for NHAMCS ED Data.....	35
Alcohol Related Visit Variable Definitions	37
Statistical Analysis	41
CHAPTER 4 RESULTS	42
Patient Characteristics	44
General Visit Characteristics.....	53
Visit Characteristics: ED Services Provided.....	61
Patient Referral Characteristics	68
CHAPTER 5 DISCUSSION AND RECOMMENDATIONS	73
Study Limitations	73
Discussion	76
Recommendations	85
APPENDIX 1 CROSSWALK BETWEEN DSM-IV AND ICD9-CM.....	88
APPENDIX 2 NHAMCS SURVEY INSTRUMENT	96
APPENDIX 3 SAS CODE FOR CONFIDENCE INTERVAL CALCULATIONS.....	98
APPENDIX 4 SAS CODE FOR ASSIGNMENT OF ALCOHOL VISIT TYPE.....	100
BIBLIOGRAPHY.....	102
VITA	108

LIST OF TABLES

Table 1 Methodological Characteristics of ED Based Interventions.....	25
Table 2 Alcohol Related Patient Visit Category Assignments	41
Table 3 Alcohol Related Visits to US EDs, 2003 - 2007.....	48
Table 4 Patient Demographic Characteristics.....	51
Table 5 Patient Demographic Characteristics.....	52
Table 6 Comparison of Patient Characteristics.....	53
Table 7 Visit Payment Characteristics.....	58
Table 8 Visit Characteristics	59
Table 9 Comparison of Payer Characteristics.....	60
Table 10 Comparison of Visit Characteristics	61
Table 11 Diagnostic Services Provided	63
Table 12 Medical Services Provided	64
Table 13 Comparison of Diagnostic, Screening and Medical Services Provided	65
Table 14 Comparison of Selected Continuous Variables	67
Table 15 Follow Up, Referral and Patient Outcomes.....	70
Table 13 Comparison of Follow Up, Referral and Patient Outcomes	72

LIST OF FIGURES

Figure 1 Trends in the Number of EDs and Related Patient Visits, 1995 - 2005.....	5
Figure 2 Prevalence of Binge and Heavy Drinking Among Adults in the US	15
Figure 3 NHAMCS Records Merged for Analysis.....	47
Figure 4 Alcohol Related Visit Rate per 100,000 ED Visits by Year, 2003 - 2007	48

CHAPTER 1

BACKGROUND AND SIGNIFICANCE

Introduction

The burden of disease which is associated with alcohol consumption is significant. Alcohol use and abuse gives rise to a continuum of disease from acute to chronic including injuries resulting from traffic crashes to cancer and cardiovascular disease. Abusive or 'at risk' alcohol consumption patterns (i.e., moderate to heavy drinking and binge drinking) are linked to increased risk for morbidity and mortality related to more than 60 recognized disease conditions (English et Al., 1995; Ridolfo and Stevenson, 2001). In the United States (US) self reported at risk drinking has increased in the last decade (Rehm et al., 2002). Hospitalization rates for all alcohol attributable conditions across the US are also on the rise, with the highest rates in medically underserved areas (Cherpitel et al., 2008). With consumption on the rise and a continuum of adverse health outcomes associated with alcohol use, alcohol rarely receives the public health and clinical medical attention that illicit drugs do. Perhaps most often overlooked is the impact that acute alcohol consumption has on injury; increasing the risk of injury as well as subsequent morbidity and mortality (Cherpitel et al., 2004).

Alcohol consumption patterns in the US also impact the health care delivery system. In particular, emergency medical services (EMS) in the US bear the brunt of acute intoxication and related injuries. Emergency Departments (ED) across the US are not only responsible for the care of excess injuries due to alcohol consumption but serve as primary site of detoxification for acutely alcohol intoxicated patients (Duong et Al., 2009). These purely alcohol detoxification visits are often less serious, but given the

inebriated condition of the patient, require costly ambulance transport and many hours of bedside care in the ED setting (Thornquist et Al., 2001). Perhaps no other medical service provider, including the combined service output of inpatient and outpatient alcohol abuse rehabilitation facilities are visited by more at risk alcohol consumers than US EDs. Hence, one might expect that EDs are particularly qualified and involved in preventing at risk or abusive alcohol consumption. Recent research acknowledges that the opposite is often true.

Dealing with the critical health issues of acute episodic and chronic at risk alcohol consumption are much less frequently considered part of patient care in the ED setting. In fact, studies suggest that alcohol is addressed as part of the patient care process much less frequently in the ED setting than in primary care clinics (Gentilello et Al., 2005). Many barriers exist to the treatment of at risk alcohol consumption patterns in the ED setting including clinician time, training regarding alcohol issues, service availability, and attitudes towards alcohol abusers. Seemingly, health care providers still fail to recognize alcohol abuse and alcoholism as definitive disease conditions with dangerous and disabling sequelae.

Given the grave consequences of alcohol consumption for both patients and EDs, the role of EMS in the prevention of at risk alcohol consumption has come to the forefront. The prevention of alcohol abuse has recently been championed by trauma physicians, who, tired of treating preventable injuries which result from excessive alcohol consumption, have begun to look for opportunities for intervention. Slowly, this interest has led to some recent applications of an 'indicated' prevention intervention limited to intoxicated and injured patients who present to regional trauma centers in the US. These

interventions share a common strategy: using a sobering (patients are required to have a blood alcohol concentration of zero to be discharged from most EDs) and teachable moment to talk to patients about their alcohol consumption and the role it played in their subsequent health event and related hospital care. These interventions are commonly and collectively referred to as SBIRT or Screening and Brief Intervention with Referral to Treatment. SBIRT has had demonstrated success in reducing alcohol consumption among patients and in increasing rates of referral to secondary alcohol rehabilitative services or counseling (D'Onofrio et Al., 2008).

Alcohol Related ED Visits

In the last decade, the number of active emergency departments (ED) in the United States has decreased 15% while the total number of ED visits has increased by 40% (McCraig, 2002). EDs across the US are struggling to deal with this 40% increase in average annual visit volume and the concomitant increases in patient wait times, the percentage of patients who leave without being seen by a physician, ambulance diversion rates, and declines in the quality of health care. Figure 1 graphically illustrates the widening gap between visits, ED capacity, and ED patient volumes. These negative consequences of an overburdened emergency medical system have prompted attempts by public health officials and hospital administrators to identify patients who might not require emergency department services, to identify those common diagnoses which could be easily prevented, and those populations who most frequently reutilize ED services. Episodic and chronic alcohol use and abuse has been identified as a common diagnosis which contributes greatly to the burden placed on emergency medical services. Both

acute and chronic health problems that are associated with alcohol use contribute greatly to the daily burden placed upon the emergency medical systems in the US and internationally. Alcohol abuse is common among emergency department patients

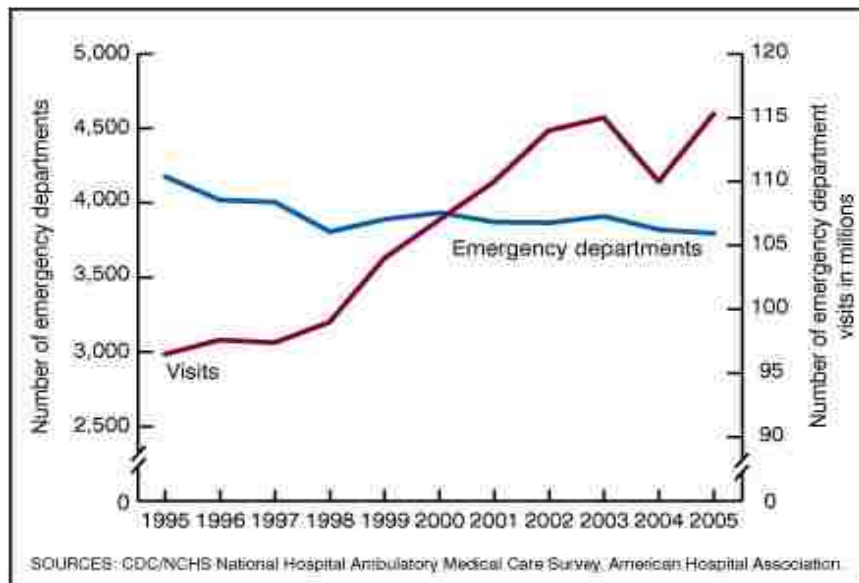


Figure 1. Trends in the Number of EDs and Related Patient Visits, United States, 1995 - 2005. Source: CDC NCHS, 2009.

(Cherpitel et Al., 1996; Rockett et Al., 2003). Emergency Room physicians as well as health officials recognize that alcohol misuse is a major public health issue faced by the US and poses a significant burden on emergency medical services including hospital EDs (McDonald et al., 2004). Alcohol intoxication and related sequelae including injury are a major source of inpatient visits to EDs across the United States. It has been estimated that between 10% – 24% of all inpatient visits to EDs in the world involve alcohol (alcohol attributable factor greater than zero) (Cherpitel et Al., 2004). So severe is the burden of

alcohol on emergency medical resources that Health People 2010 cites reducing alcohol related ED visits as of its objectives for the last decade (CDC, 2002).

The first step in assessing and preventing alcohol related emergency visits is the quantification of the magnitude of the burden of alcohol related visits on EDs nationwide. The estimation of the proportion of ED visits which are related to alcohol and alcohol intoxication is difficult for many reasons. Until recently, present practice in the ED for the detection of patient alcohol consumption has relied on self reporting or the more esoteric detection methods of patient odors or appearance (McDonald et Al., 2004). Numerous studies have demonstrated that patients fail to report their drinking habits to physicians and ED physicians fail to identify signs of alcohol misuse. Gorden et al (1988) reported that interns staffing a hospital ED failed to detect 84% of heavy drinkers. Other studies conclude that ED physicians routinely identified only half of the patients who would have been classified as alcohol misusers by the alcohol abuse scale (Seppa et al., 2004). Contemporary detection methods have incorporated the use of an alcometer or alcohol breath analysis tool to aid in the detection of alcohol. These fast, non-invasive, easy to perform tests have been reported to be an equally sensitive indicator of heavy alcohol use as patients' self-reporting (Cherpitel, 1995) and have positive correlations with alcohol use biomarker assays which are more costly and time consuming (Seppa et al., 2004).

Recently, a large body of research has been published which attempts to benchmark the proportion of ED visits which are alcohol related. Alcohol and drug use have been found to be overrepresented in samples of patients in primary care and ED settings, with ranges from 8% to 59% for positive blood alcohol concentration among

patients presenting with injury or illness. In 2004, McDonald analyzed data from the 1992 – 2000 National Hospital Ambulatory Medical Care Survey to generate national estimates of alcohol related ED visits. Trend analysis was performed to suggest the direction of the magnitude of the problem of alcohol related ED visits. The results of this NHAMCS based study showed that from 1992 to 2002 there were an average of 7.6 million alcohol related ED visits in the US each year. These visits accounted for 7.9% of all the visits during the study period and the estimated annual rate of ED visits attributable to alcohol was 28.7 (95% CI, 27.1 – 30.3) visits per 1000 population. Among those patient diagnoses that were 100% attributable to alcohol (e.g. Delirium tremens), the estimated rate of ED visits during the same study period was 5.1 (95% CI, 4.6 – 5.5) visits per 1000 population. This 1992 – 2000 NHAMCS study showed little variation in the annual rates of alcohol related ED visits per capita during the study period (McDonald et Al., 2005). However, trend analysis performed on data collected by the Alcohol Research Group National Alcohol Survey provides evidence that rates of alcohol related ED visits are continuing to increase nationally and internationally. Rates of alcohol related ED visits in the US have increased most substantially between 1995 and 2000. These rates have seemingly reached a plateau from 2000 to 2005 where they remain unchanged (Cherpitel et al., 2008). Given the low rates of detection of alcohol as a cofactor or primary cause of patient visits to the ED, these estimates of alcohol related ED visits are likely conservative but well document the fact that the health provider community is falling short from the Health People 2010 goal of reducing alcohol related hospital visits (CDC, 2002).

It is further recognized that a small number of patients make frequent use of the ED and account for a disproportionate amount of the total ED workload (Mandelberg et al., 2000). A recent study has used ED visit data to calculate the rate of chance ED attendance. This study concluded that not all observed ED attendance in the sample could be attributable to random events and that the concept of a 'frequent user' is a genuine one. These 'frequent users' could be further defined as those patients who present to the ED at multiple occasions due to non random, related events. From a cohort of patients, 'frequent users' were defined as those persons presenting to the ED more than four times per year. Among these 'frequent users', the majority had a presenting complaint of injury or trauma. When comparing 'frequent users' to 'chance users' using the previously mentioned definition, it was demonstrated that frequent users were more apt to have a presenting complaint of alcohol intoxication or abuse than chance users (1.6% chance users vs. 7.1% 'frequent users') (Locker, Baston, Mason, et al, 2007). Hence, alcohol use is predictive of frequent ED use (Cherpitel et al., 2008).

Pervasive among all 'frequent users' seen in the ED is a general lack of healthcare, transient housing status, limited access to routine primary care and substance abuse. For many frequent users, the acute care received at the ED represents the only opportunity for patients to receive treatments for chronic health conditions and counseling for negative health behaviors. Among a sample of ED visits to a regional trauma facility in Denver, Colorado, 'frequent users' were more apt to be homeless, lack insurance, and present for acute alcohol intoxication as a co-diagnosis for chief complaint than chance users. In fact, alcohol intoxication was the most common secondary diagnosis among 'frequent users' seen during the study period. Primary diagnoses for

acute alcohol intoxication and alcohol withdrawal were more common among ‘frequent users’ than chance users. Furthermore, these patients were more likely to have a transient housing status, have incomes below the poverty threshold, and lack insurance than chance users (Pearson et al., 2007). A large body of literature suggests that substance abuse is more pervasive among the transient and homeless population (Cherpitel and Borges, 2001). However, the early detection of alcohol related problems among transient populations is difficult as the ED is their primary source of medical care (Cherpitel et al., 2005). Interestingly, visits associated with homeless individuals where alcohol is an identified cofactor are less acute (severe) than visits among non-homeless individuals. Much of the transient population which comprises the ‘frequent user’ population is seen at the ED for alcohol detoxification and treatment of chronic alcohol related illness (Oates et al., 2009). While the less acute health problems faced by the common ‘frequent user’, in general, have better outcomes, they are very preventable and over utilize scarce emergency medical resources. Further, the health problems experienced by frequent ED users that are treated and retreated are preventable.

The actual magnitude of alcohol related visits and its subsequent effect on emergency medical services are obscured in part due to poor medical provider detection and documentation. A recent study by Rockett et al., (2003) found that 31% of seven general hospital emergency patients during a six month period had positive laboratory marker screening for chronic alcohol abuse, but only 1% had a recorded diagnosis of alcoholism or alcohol abuse. Even in primary healthcare, where one expects a greater patient-physician rapport than found in the ED, reports of patient alcohol use were found

in only 7% of patient medical records during a one year study. Most of this documentation was attributed to visits to the ED (Seppa et al., 2004).

Documentation and subsequent clinician acknowledgment of patient alcohol use is impacted by nurse and physician attitudes towards alcohol intoxicated patients, 'frequent user' status and related characteristics. The reasons for poor identification and documentation of patient alcohol use are manifold. Detection of alcohol abuse can be complicated and time consuming. Clinicians in the busy ED environment where patient contact time is often brief report that they simply do not have the time to discuss alcohol consumption patterns with their patients. Furthermore, even if at risk alcohol consumption is detected it may not be documented due to confidentiality and the fear of denial of insurance coverage (Rivara et al., 2000; Sillanaukee et al., 1994). Finally there is a culture of blame which is evident among clinicians in the ED setting when it comes to alcohol intoxicated patients and especially chronic inebriates. Studies indicate that many emergency practitioners believe that it is futile to treat alcohol use in individuals who are acutely ill or injured. Clinician responses to pre-SBIRT training surveys administered at five ED settings in the US showed a disbelief in the success of referring patients to substance abuse treatment. These clinicians also reported negative feelings about patients' alcohol consumption as it related to the injury or illness for which they sought ED care. Other factors which explain the lack of recognition and documentation of patient alcohol use reported by clinicians included issues of space. In busy ED settings, clinicians frequently see patients in hospital hallways and other areas not conducive to asking or answering sensitive questions. Clinicians reported that in the ED setting, family members are present that might prevent patients from answering alcohol consumption

questions honestly. In the same study, clinicians also reported that in the ED, staff did not have enough time to establish the level of patient rapport and trust necessary to illicit honest answers about alcohol use and even expressed concerns about violating the regulations set forth by the Health Insurance Portability and Accountability Act (HIPAA) (Desy and Perhats, 2008). This resistance to the detection and documentation of patient alcohol use obscures the burden created by patient alcohol use and misses perhaps the only opportunity some patients will have to get medical assistance for at risk drinking patterns.

Alcohol and Injury

The burden placed upon EDs in the US due to chronic and acute alcohol use is compounded by the fact that alcohol increases the risk, severity, morbidity, and mortality of injury. For injury, there is no greater risk factor than alcohol consumption and this risk increases proportionately with frequency of consumption (drinking pattern) and the amount of alcohol consumed (Gentilello et al., 2005). A large body of evidence exists which correlates alcohol intoxication and injury. Evidence from police report based studies suggests that the presence of alcohol in the body at the time of injury may be associated with greater injury severity and less positive health outcomes (Fuller, 1995). Studies conducted in the US have estimated that 10% – 20% of injured patients seen in EDs are alcohol related cases (Li et al., 1998). Worldwide, the proportion of injuries involving alcohol is much higher, estimated to be between 20% - 45% (World Health Organization, 2007). Probability samples of patients treated in EDs nationally have demonstrated that injured patients are more likely than non-injured patients to be positive

for blood alcohol concentration (BAC) at the time of their ED visit and to report drinking prior to the injury event (Cherpitel, 2005). Most studies document a strong association of alcohol consumption with non-fatal injury (Cherpitel, 2007). The alcohol attributable fractions based upon alcohol and injury relative risk estimates in a California based study were 2.96% for an ED treated injury and 1.65% for any other clinic type treated injury, and 1.89% for a non-treated injury. Involvement of alcohol in adolescent injury necessitating an ED visit has been reported to range from 38% to 48% (Linakis et al., 2009). Drinking alcohol however does not predict consequent injury type only dictates an increase in consequent injury risk and magnitude of injury sustained (Watt et Al., 2005).

Alcohol consumption is associated with increased risk of injury across intentional and unintentional categories. Global burden of disease estimates have documented that 28% of the disability adjusted life years (DALYs) are attributable to alcohol related unintentional injury in the world (Ezzati et al., 2002; Rehm et al., 2003). Alcohol use has been associated with increased risk of injury in a wide variety of situations including motor vehicle crashes, pedestrian crashes, falls, residential fires, injuries during sports and recreational activities as well as assault, interpersonal violence and self-inflicted injuries. Alcohol is a contributing factor in approximately 39% of the 42,800 US traffic fatalities in 2004 and approximately 500,000 people are injured in alcohol traffic crashes annually in the US (Plurad et al., 2007). Alcohol is major contributing risk factor for interpersonal violence both for the perpetrator and victim (Department of Justice, 1996). Alcohol impairs coordination and is linked to falls and most types of traumatic brain injuries (Shermer, 2005).

Patients seen at EDs for severe injuries are considered trauma patients. Trauma patients typically require more complex and intensive medical intervention (i.e. surgery, rehabilitation) and usually have long and costly inpatient hospital stays. Interestingly, trauma tends to be a recurrent disease, as many as 28% of patients admitted to US level I trauma centers have had a history of previous admissions for trauma (Rivara et al., 1998). Similarly, a five year follow up study of patients who were admitted to a level I trauma center in Detroit, MI found that 44% had experienced recurrent trauma and 20% had died as a result of trauma (Cesare et al, 1990). Alcohol use is a recurrent theme particularly among patients with a history of trauma care. Alcoholism is the most common chronic illness found among trauma patients, affecting as many as one third of all trauma victims who require hospital care for their injuries (Rivara et al., 1993). Both acute and chronic alcohol abuse increases the chances for recurrent trauma and readmission to the trauma center. In a five year follow up study, patients seen at level I trauma centers who had a blood alcohol content (BAC) of 22 mmol/L were 2.5 times more likely to be readmitted for trauma than the control group (95% CI, 1.6, 3.9). Similarly, patients who had a score consistent with abusive or chronic alcohol consumption on the previously validated Michigan Alcohol Screening Test (SMAST>3) were more 3.2 times more likely to be readmitted for trauma during the study period (95% CI: 2.4 - 4.5). Perhaps most salient, patients who had an abnormal gamma-glutamyl transferase (GGT) biomarker, a powerful measure of alcohol abuse, were 3.5 times more likely to be readmitted for trauma than patients presenting with normal GGT values (95% CI, 2.2, 5.5). While the authors of the study noted that some of the risk for trauma readmission appeared to be due to common

sociodemographic characteristics of the group such as socioeconomic status, alcohol abuse emerges as an important risk factor for subsequent trauma (Rivara et al., 1998).

Alcohol consumption patterns impact the risk of injury. The risk of injury can be related to alcohol consumption in a linear dose response relationship (Vinson et al., 2003). A meta-analysis of EDs across a number of countries found significant effect sizes for both quantity and frequency of alcohol consumption with alcohol related injury (Cherpitel, 2003). In the same meta-analysis, frequency of consumption was proportional to risk (Cherpitel, 2003). The more alcohol a person consumes, the larger the risk of becoming injured. Risk of injury is also related to general drinking patterns such as usual volume of drinking (i.e., average consumption of alcohol beverages per day) and to binge drinking (i.e., the number of times in the last month one has consumed more than five alcohol beverages on one occasion). Binge drinking appears to be a stronger predictor of injury than average volume per week of alcohol beverages consumed (Rehm, et al., 2003). In an ED based study in the US, the greatest risk of injury was found in drinkers who consumed large amounts of alcohol on few occasions whose greatest amounts consumed were much larger than their average consumption. This suggests that binge drinking is more closely related to injury than to volume of alcohol beverages consumed per week. The CDC reports that self reporting of the more risky alcohol consumption patterns of binge drinking and heavy drinking is on the rise in the US (CDC, 2002).

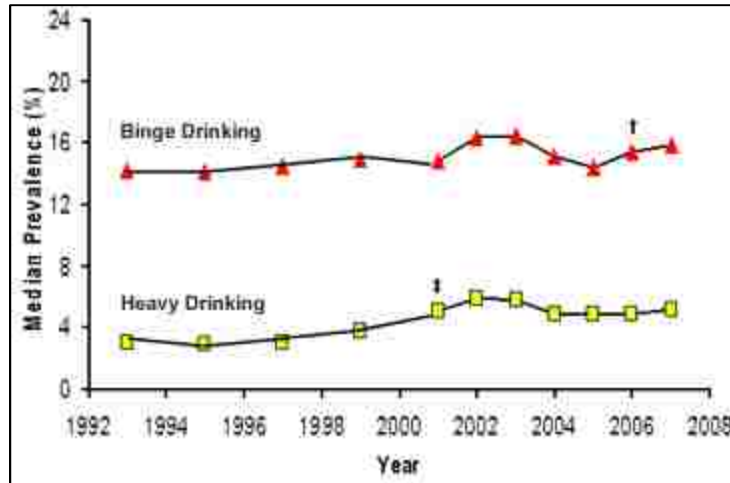


Figure 2. Prevalence of binge drinking and heavy drinking among adults in the United States, 1993–2007.

Source: CDC, Behavioral Risk Factor Surveillance System (BRFSS).

Moreover, a number of studies demonstrate that alcohol abuse and dependence are most strongly correlated with repeat traumatic injury requiring a visit to an ED. This probably outlines the effect of repeated exposure with repeated binge consumption of alcohol.

Hence, it might be that atypical heavy alcohol consumption might be related to individual or single injury events while repeated admissions for trauma (repeated injuries) are more closely associated with chronic heavy alcohol consumption such as might be observed in an alcoholic.

The alcohol consumption pattern is more important than the act of consuming alcohol when considering the link between injury and alcohol consumption. Many studies have only focused on measuring acute alcohol intake prior to injury. This does not take into consideration behavioral elements linked to alcohol consumption pattern such as episodic psychoses in the severely inebriated binge drinker. More studies need to include

a link between the DSM-IV criteria for alcohol abuse while investigating the continuum of alcohol consumption among patients.

ED as Detoxification Facility

It is estimated that in the US, each year, approximately 400,000 patients received inpatient alcohol detoxification in acute and general care hospitals (SAMHSA, 2003). Inpatient alcohol detoxification involves the medical management and monitoring of acute alcohol intoxication and withdrawal. Patients seen in EDs for alcohol detoxification present with a depressed level of consciousness, agitation, belligerence, ataxia all of which have usually contributed to injury (Thornquist et al., 2002). Inpatient treatment begins with the cessation of alcohol intake, followed by a course of intravenous fluids and persistent patient monitoring for a period until the patient BAC is zero mg/dL ethanol. In patients who have alcohol dependence, cessation of alcohol intake is coupled with the substitution of alcohol for cross tolerant drugs such as benzodiazepines that have similar effects in order to prevent alcohol withdrawal syndrome. The use of cross tolerant drugs may or may not be necessary depending upon an individual's age, medical status, and history of alcohol intake (D'Onofrio, 1996).

A large proportion of alcohol detoxification patients are referred to EDs via EMS and law enforcement. The majority of states in the US have public alcohol intoxication legislation requiring publically inebriated or alcohol incapacitated individuals to be detained and detoxified in a medical detoxification facility prior to release. Involuntary detoxification is generally coerced in that detoxification is provided as an alternative to other legal consequences such as arrest, incarceration, or loss of public assistance (Miller

et al., 1999). The goal of much inebriate detoxification legislation is the reduction of injury, crime, and incarcerated population for non-violent crimes (SAMHSA, 2003). The medical processes involved in these involuntary detoxification programs in most states are lengthy and contribute greatly to ED associated length of patient stays as well as costly inpatient medical costs.

Once in the ED setting, acutely intoxicated patients are often referred to an observation ward to mitigate the loss of medical bays for the treatment of critical patients and the overall cost of detoxification for the patient (D'Onofrio, 1996). The patient's inability to cooperate with a medical history and physical exam makes medical evaluation difficult. Clinicians may then elect to observe these patients for prolonged periods in the ED and order excessive tests to avoid missing serious illness or injury. The resultant drain on ED resources is substantial and the medical risks associated with a poor patient evaluation are high. A survey of 92 chronic inebriates was conducted at the Hennepin County Emergency Department. Total annualized charges for these chronic inebriates and their associated visits were \$3.3 million in 1999. Within this sample, the median charge per person for ED alcohol detoxification was \$9,297. The majority of these patients (73%) had no form of insurance and were considered self-pay patients (Thornquist et. al., 2002).

Although detoxification may offer patients a gateway into a substance abuse treatment program, there exists a large body of evidence to support the idea that detoxification alone does not lead to lasting improvements in alcohol consumption patterns (Duong et al., 2009; SAMHSA, 2003). In fact, studies have concluded that in many urban ED settings, detoxification programs alone without further referral or

intervention actually increased both hospitalizations and EMS transports for alcohol attributable medical conditions (Duong et Al., 2009). A growing number of studies confirm that providing a coordinated continuum of care following detoxification for alcohol abuse is critical to positive outcomes for patients. McCusker et al. (1995) demonstrated that patients who receive continuing care for substance abuse such as inpatient rehabilitation or outpatient counseling following detoxification have better outcomes in terms of alcohol abstinence and readmission rates than those who do not receive care (McCusker et al., 1995; Daley et al., 1998).

Even though there exists a clear link between positive patient outcomes and referral to a continuum of care for alcohol abuse following medical detoxification for alcohol intoxication, only a portion of people receiving inpatient detoxification receive treatment for substance abuse. In 2001, researchers from SAMHSA performed analysis of the three federal healthcare databases: the Healthcare Cost and Utilization Project National Inpatient Sample (HCUP-NIS), the MarketScan claims data, and the SAMHSA Center for Substance Abuse Treatment and Center for Mental Health Services Integrated Data Base (IDB) for three states. Analysis of these data demonstrated that the majority of people who undergo detoxification for alcohol do not receive subsequent substance abuse counseling or treatment. Analysis of procedural codes in the national hospital discharge data indicated that only 21.1% of people discharged from acute care hospitals for detoxification receive substance abuse treatment within thirty days. In these same studies, admission through the ED was a particularly strong indicator of failure to receive treatment. In the same sample, only 14.7% of people who were admitted through an ED and received medical detoxification also received substance abuse treatment within thirty

days (SAMHSA, 2003). It should be noted that other types of non-clinical outpatient counseling and rehabilitation such as Alcoholics Anonymous were not considered nor documented in this study. It may be that some patients pursue these non-clinical substance abuse treatment programs after detoxification at the suggestion of a clinician or social worker. Documentation of such referrals are absent in the data used for these studies. In most cases of medical detoxification seen during the study period, patients received services to stabilize their alcohol related condition rather than addressing their underlying addiction (SAMHSA, 2003).

Rates of substance abuse treatment following detoxification are declining. Analysis of discharge records from acute care hospitals in the United States found that fewer people received substance abuse treatment following inpatient detoxification in 1997 than in 1992. In 1997, 21.2% of detoxification patients received substance abuse treatment within thirty days of their hospitalization compared to 38.9% in 1992. The decline in inpatient substance abuse treatment may be related to lack of health insurance coverage or refusal of insurance companies to pay for pre-existing alcohol abuse problems (SAMHSA, 2003).

Patients who undergo detoxification in an ED setting who are not referred to subsequent substance abuse treatment miss an opportunity to develop a therapeutic partnership for positive change and have poorer patient outcomes. The missed chance for changing patient behavior results in continued addiction, adverse health consequences, and higher health care costs for these individuals as well as social disruption for their families and reduced employment (Burke et al, 2007). The cycle of intoxicated patients passing through the ED and repeated inpatient detoxification for inebriates is costly, as

the patients are continually exposed to injury and other health and legal consequences of their continued alcohol abuse.

Intervention: Treating Alcohol Abuse in the ED

Given the grave consequences of alcohol consumption for both patients and EDs, the role of EMS in the prevention of at risk alcohol consumption has been revisited by the CDC. In 2002, the CDC published best practices and guidelines for achieving a reduction in alcohol related injury. The CDC proposed a model for an ED based coordinated continuum of care for alcohol related activations of the emergency medical system which requires both screening and referral of patients to substance abuse counseling and treatment. CDC guidelines state that patients who present at the ED for any alcohol related condition should be screened for dangerous alcohol consumption patterns as part of patient care (CDC, 2002). Given the benefit of providing linkage to subsequent substance abuse treatment following alcohol detoxification and the directives of the CDC one might expect an increase in the rates of substance abuse treatment following medical detoxification. Conversely, inpatient substance abuse treatment provided after inpatient detoxification has declined significantly from 38.9% in 1992 to 18.3% in 2003 (SAMHSA, 2003).

In response to burgeoning alcohol related trauma, increased rates of readmission for injuries among alcohol consumers and high levels of detoxification only patients among 'frequent users' of the ED, a number of 'indicated' interventions have been implemented and evaluated whose aims are to address the alcohol behavior by providing further care (i.e. rehabilitation, counseling) when indicated. Trauma surgeons across the

United States were the first to recognize the great potential that EDs have to substantially contribute to reducing alcohol related harm. In fact, EDs possess a number of unique opportunities to intervene in problematic patterns of alcohol consumption. EDs represent a large network of healthcare facilities which treat more patients with alcohol related visits than any other health care agency type. Many individuals, particularly transient populations and those from lower income brackets, who are at greater risk for substance abuse, use the ED as their primary or only source of healthcare. Thus, the ED may provide the only window of therapeutic opportunity to impact drinking behavior in these populations. Studies also indicate that the majority of patients seen in the ED are more open to health professional's questions about their alcohol consumption patterns than in a primary care setting (Shermer, 2005). Furthermore, laws in many states require intoxicated patients (injured or otherwise) to remain in the hospital setting until their BAC=0 mg/dL. This practice of sobering individuals under threat of legal intervention prior to discharge may provide another opportunity for those with alcohol abuse problems to receive information and make choices in a safe and comfortable moment of clarity (CDC, 2002).

The impetus for the application of an indicated prevention intervention for at risk alcohol consumption in the ED setting is the concept of a 'teachable moment'. In the context of educational theory, a teachable moment is the point at which learning something new like a skill or concept becomes easiest or possible (Shermer, 2005). In terms of public health education theory, a teachable moment might be described best by the Transtheoretical Model of health behavior as the phase between contemplation of a need to change a health behavior (i.e. at risk alcohol consumption) and preparation to

actually make the behavior change. It is at this point in an individual's process of changing a health behavior where self-reevaluation is emphasized. It can be expected that patients arriving at the ED with an injury associated with at risk alcohol consumption might be amenable to an intervention intended to decrease the negative consequences of alcohol consumption. The association between the injury and alcohol ingestion provides the clinician with an opportunity to help the patient explore the association and motivate them to plan for and prepare ways in which negative consequences from at risk drinking can be reduced in the future (Shermer, 2005). Compounding the efficacy of the clinician intervention is the clearly evident causal association between alcohol consumption and an adverse health condition (e.g. injury). At this point, a sober patient might be most approachable in evaluating their own alcohol abuse with a clinician and make plans to engage in activities which will address the negative health behavior. The ED setting then provides a crossroads of sort where sober patients, after considering both their health problem and its association with alcohol, can make informed decisions about improving their health behaviors even to the point of referral to counseling and inpatient or outpatient rehabilitation.

A systematic review of SBIRT in the literature reveals its simplicity in application and consistent theme of ED physicians treating harmful alcohol consumption as part of the patients overall healthcare plan for the ED visit. Depending on the SBIRT protocol used, these brief motivational interventions have required from 10 - 45 minutes to implement. Common among many of the SBIRT prevention interventions are a motivational interview between physician or non-addiction specialists and patient, a conversation about the causal nature of the patient's alcohol consumption and the current

patient diagnosis, the administration of an at risk alcohol screening or assessment instrument followed by a discussion of the results of the alcohol screening instrument. Based on the outcome of the alcohol risk assessment and the motivational interview conducted with the patient, the physician may refer the patient to substance abuse counseling, inpatient or outpatient rehabilitation, or give the patient some self-help information and educational materials. In a smaller subset of SBIRT protocols reviewed, patients who requested assistance were also referred to a hospital social worker to coordinate the delivery of any indicated referral services and find financial assistance when needed (e.g. Veteran's Administration) (Havard et al., 2007). In all SBIRT protocols, referral to specialized care is emphasized for those patients for whom it is indicated (Gentilello et al., 2005).

A variety of motivational interview tools, intervention agents (e.g. ED physician, resident, nurse, counselor), and alcohol screening tools have been used in the last decade of the experimental application of SBIRT in EDs and trauma centers around the world. Table 1 summarizes the SBIRT implementation protocols reviewed in two meta-analyses performed by Havard et Al and Gentilello et Al., in terms of interview tools, intervention agents, and alcohol screening tools applied.

Perhaps the best argument for the implementation of SBIRT has been its success in rigorous evaluations published in peer reviewed journals over the last decade. The largest reductions in subsequent hazardous alcohol consumption and negative consequences associated with alcohol consumption have been among evaluations of trauma system based interventions where enrolled patients are both critically injured as well as screened positive for hazardous drinking behavior (Gentilello et al., 2005). Meta-

analysis of several SBIRT implementations at various EDs across the US demonstrated that individuals undergoing ED-based intervention had approximately half (OR=0.59) the odds of sustaining an alcohol related injury in the 6 and 12 months following their initial ED presentation (Havard et al., 2005). A cost benefit analysis of an SBIRT program provided for trauma patients at the University of Texas Medical Center in Dallas, TX achieved a 27% reduction in repeat visits among a sample of severely injured chronic inebriates and overall realized a net cost savings of \$39 per patient screened and \$330 for each patient who was offered an intervention. The benefit of these reduced health expenditures resulted in a savings of \$3.81 for every \$1.00 spent on SBIRT implementation (Gentilello et al., 2005).

Evaluations of SBIRT interventions with a more broad focus which have attempted to enroll all patients seen at an ED or just alcohol intoxicated patients which screen positive for hazardous alcohol consumption have had mixed results. A meta-analysis of several international SBIRT interventions provided evidence that a 15 minute brief alcohol intervention did not decrease alcohol use nor resource utilization among hazardous drinker (Daeppen et al., 2007) A randomized, controlled, clinical trial of a brief (ten minute) Patient Negotiation Interview and

Table 1. Methodological Characteristics of Evaluations of Emergency Department (ED) Based Interventions

From: “Systematic review and meta-analyses of strategies targeting alcohol problems in emergency departments: interventions reduce alcohol-related injuries,” by Alys Havard, Anthony Shakeshaft, and Rob Sanson-Fisher., 2008, *Addiction*, Vol. 103.

First author and year published	RCT design	>80% follow-up rate	Sample characteristics reported, i.e. age & gender	Eligibility criteria reported	Intervention	Intervention agent	Control	Used standardized scales or objective measures	Effect size reported	Outcome measures reported			
										Quantity/ Frequency	Frequency of heavy drinking	Drinking consequences	Alcohol-related injuries
Blow <i>et al.</i> 2006 [3]	✓	✓	✓	✓	Brief motivational counselling plus tailored or generic message booklet	Research social worker—trained in BI	Tailored or generic written advice	Partly	×	✓	✓	✓	×
Bazargan-Hejazi <i>et al.</i> 2005 [13]	✓	×	✓	✓	Brief motivational counselling plus health packet	Health promotion advocates—clinical experience & trained in BI	Standard care plus generic written advice	✓	×	×	×	×	×
Crawford <i>et al.</i> 2004 [14]	✓	×	✓	✓	Brief counselling plus drinking information leaflet	Alcohol health worker—clinical experience	Generic written advice	✓	×	✓	×	×	×
Rodriguez-Martos Dauer <i>et al.</i> 2006 [18]	✓	×	✓	✓	Brief motivational counselling plus support material	Nursing & social work staff—trained in BI	Brief advice plus generic written advice	Partly	×	×	✓	×	×
Helmkamp <i>et al.</i> 2003 [15]	×	×	✓	Reported in a previous article	Brief counselling	Research staff—trained in BI	No control	✓	×	×	×	✓	×
Longabaugh <i>et al.</i> 2001 [16]	✓	✓	✓	✓	Brief motivational counselling with/ without booster	Therapists—clinical experience, trained in BI	Standard care	✓	×	×	✓	✓	✓
Maio <i>et al.</i> 2005 [17]	✓	✓	✓	✓	Laptop-based interactive program	Computer program	Standard care	Partly	✓	✓	✓	✓	×
Spirito <i>et al.</i> 2004 [19]	✓	✓	✓	✓	Brief motivational counselling plus written personalized feedback	Research staff—trained in BI	Brief advice plus generic written advice	✓	×	×	✓	✓	✓
Wright <i>et al.</i> 1998 [20]	×	×	×	✓	Brief counselling	Alcohol health worker	No control	×	×	×	×	×	×
Daeppen <i>et al.</i> 2007 [21]	✓	×	✓	✓	Brief motivational counselling	Research staff—trained in BI plus assessment	Standard care or standard care	Partly	×	✓	✓	×	×
Neumann <i>et al.</i> 2006 [22]	✓	×	✓	✓	Computer generated personalized feedback & advice	Computer program	Standard care	✓	×	×	×	×	×
Monti <i>et al.</i> 1999 [23]	✓	✓	✓	✓	Brief motivational counselling plus handout	Research staff—trained in BI	Standard care plus generic written advice	✓	✓	×	×	✓	✓
Nordqvist <i>et al.</i> 2005 [24]	×	×	✓	✓	Simple written advice	ED staff	Standard care	✓	×	✓	✓	×	×

RCT: randomized controlled trial.

scripted discharge instructions (with referral to substance abuse treatment and counseling) was performed on hazardous and harmful drinkers during a one year period at the Yale, New Haven Hospital ED. At 6 and 12 months post-intervention, alcohol use was reduced in the intervention group versus the controls in multiple measures of alcohol consumption. Even at the twelve month measurement, intervention recipients had lower self reported mean number of drinks consumed per week (12.4 vs. 13.6; $p=0.001$); lower binge drinking episodes in the past month (3.4 vs. 4.0; $p<0.01$). Furthermore, the proportion of patients scoring greater than the National Institute on Alcohol Abuse and Alcoholism (NIAAA) scale for hazardous drinking was reduced in the intervention groups versus the control group (62.0% vs. 65.1%; $p<0.001$) (D'Onofrio et al., 2008).

Implementation of SBIRT has been aided by recent revisions to the rules regarding medical care payer federal compensation for SBIRT costs. In 2007, the Bush administration made the implementation of screening, brief intervention and referral to treatment programs a priority throughout the nation particularly among Veteran's Administration hospitals and related medical care providers. Under the direction of Bertha Madras, Ph.D., the Bush Administration Deputy Director of Demand Reduction for the Office of National Drug Control Policy, new billing codes were created to reimburse for SBIRT. These new billing categories became effective in January 2008 and were created for American Medical Association Current Procedural Terminology (AMA-CPT), Medicaid (CPT and Medicare "G" codes) and Medicare (Medicaid "H" codes) (Whyche, 2008). Since then, at least 85 healthcare insurance companies agreed to reimburse for SBIRT services, based on these newly implemented procedural codes (needs citation). In order to promote the medicalization of SBIRT protocols and to

encourage drug abuse diagnosis and treatment, the Substance Abuse and Mental Health Services Administration (SAMHSA) has sponsored medical residency training programs for SBIRT (<http://sbirt.samhsa.gov/about.htm>, last accessed Monday, January 11, 2010).

Recently, SBIRT has received endorsement by the Federation of State Medical Boards, the Accreditation Council for Continuing Medical Education, and the Federal Employee Health Benefits Program (FEHB). IN their latest guidelines, the American College of Surgeons Committee on Trauma (ASCOT) mandated that level I and level II trauma centers identify patients who are problem drinkers. Level I trauma centers must also be capable of providing an intervention for patients identified as having alcohol use problems (American College of Surgeons, 2006). In January 2008, legislation was enacted which contained an inclusion of a line item in the Federal budget for Medicaid reimbursement with assurances that the majority of federal employees' healthcare insurers would reimburse for these procedures, that certain State Medicaid plans would reimburse for SBIRT services, that the VA would mandate SBIRT for alcohol throughout the VA system, that the Federal Health Resource Services Administration (HRSA) would implement these services in underserved populations (<http://sbirt.samhsa.gov/about.htm>, last accessed Monday, January 11, 2010).

CHAPTER 2

PROJECT PURPOSE AND SPECIFIC AIMS

The purpose of this project is to contribute to national efforts towards reducing the proportion of ED visits which involve hazardous alcohol consumption. The project will contribute to contemporary EMS based hazardous alcohol consumption prevention efforts by using a five year national probabilistic sample of ED patient visits to demonstrate and quantify: 1) the burden that alcohol use and abuse places on EDs in the US; 2) the particular service needs of this population; 3) the degree to which ED clinicians refer patients with alcohol related diagnoses to treatments geared towards at risk alcohol behaviors; 4) these trends (in terms of rates of hospitalizations) over the NHAMCS sample period utilized. The project will look at the relationship between intoxication and injury and common diagnostic patterns among patients seen for alcohol related problems. Furthermore, the project will look at common medical treatment needs of alcohol detoxification patients. Perhaps most important for current and future application of the SBIRT protocol, this study will provide a national benchmark of current ED physician referral rates for patients presenting to the ED with alcohol related diagnoses (including injury). A calculated rate of ED clinician (i.e. physician, nurse, etc.) referral for patients whose ED visit was alcohol involved will be useful to researchers and public health professionals attempting to evaluate their efforts to implement SBIRT nationally. Furthermore, establishing an ED related alcohol referral benchmark will assist public health professionals in assessing the impact of interventions designed at increasing the treatment of alcohol addiction as part of the overall patient care plan for those patients at highest risk for readmission for an alcohol related diagnosis. Similarly, using these

data to calculate a proportion of ED visits which are ‘detoxification only’ inpatient visits can be utilized by subsequent researchers to evaluate the nation’s efficacy in achieving the alcohol and ED utilization goals specified in Healthy People 2010.

In order to successfully achieve the project goal of investigating alcohol related ED visits and establishing a national benchmark for alcohol related physician referral rates, the following measurable objectives were proposed and completed in the course of this study:

- Obtain five years of NHAMCS ED data from the National Center for Health Statistics.
- Identify those ED visits in the NHAMCS sample which are related to alcohol and categorize them as Alcohol Related Visits, Acute Alcohol Intoxication Visits, Chronic Alcohol Abuse Visits and Alcohol Related Injury Visits.
- Assign to each alcohol category a rate of admission which defines the proportion of all ED visits represented by the continuum of alcohol related health problem diagnoses.
- Use these data to compare the visit and demographic characteristics of patients seen for each alcohol intoxication category to those seen for other reasons.
- Quantify the burden of alcohol intoxication on patients and the emergency medical system in terms of services used, length of stay, and related medical costs.
- Identify the primary payer (e.g., private insurance vs. self-pay) for alcohol related visits.

- Itemize and describe the treatments received by patients seen for acute alcohol intoxication and other reasons.
- For each category of alcohol intoxication, calculate annual and overall patient referral rates to substance abuse related treatment (e.g. inpatient rehabilitation, counseling) and which type of clinician ordered such referral (e.g. ED physician, nurse, social worker).
- Prepare a report which emphasizes the need for ED physicians to use these visits as an opportunity to intervene in dangerous patterns of alcohol consumption.

Research Questions

Research questions were developed based on the review of past research on the nexus of alcohol, injury, and ED utilization. The research questions developed address the overutilization of ED services by intoxicated individuals, patient visit characteristics common among intoxicated individuals, patient demographics common among those presenting to US EDs for alcohol related conditions.

Patients treated in EDs for acute and other alcohol related illness such as injury, tend to over utilize services. Past research has demonstrated that these patients are more likely to repeat ED utilization within 30 days, to have multiple visits for injury and trauma, to be uninsured and receive all medical care through the ED. Alcohol abuse is associated with males of middle age and those in lower socioeconomic strata. Acutely intoxicated patients are more likely to be triaged as non-emergent, require minimal care, and arrive at the ED via EMS or law enforcement. Hence, it is hypothesized that:

- Patients seen for acute alcohol intoxication are more likely to have been seen at the same ED in the last 72 hours than patients seen for other reasons.
- Patients seen for acute alcohol intoxication will more frequently have been discharged from any kind of hospital in the last week than patients seen for other reasons.
- Patients seen for acute alcohol intoxication will be triaged as non-emergent (less than one hour in which patient needs to be seen) and have longer length of visit than patients seen for other reasons with equal triage level.
- Patients seen for acute alcohol intoxication will be more likely to arrive via ambulance than patients seen for other reasons.
- A greater proportion of patients seen for acute alcohol intoxication will be from an urban area than patients seen for other reasons.
- Patients seen for acute alcohol intoxication have different demographics than patients seen for all other complaints.
- Patients seen for acute alcohol intoxication will more frequently be male than patients seen for other reasons.
- Patients seen for acute alcohol intoxication will reside in zip codes with higher levels of poverty than patients seen for other reasons.
- Patients seen for acute alcohol intoxication will be less educated and have a lower median household income than patients seen for other reasons.
- Patients seen for acute alcohol intoxication will more frequently be self-pay (uninsured) than patients seen for other reasons.

There is a body of evidence that supports a link between injury and alcohol consumption. Hence, it is expected that alcohol intoxicated patients will have more injury and injury related medical conditions. It is hypothesized that:

- Patients seen for acute alcohol intoxication will more frequently have a co-diagnosis of injury than patients seen for other reasons.

The Emergency Medical Treatment and Active Labor Act requires all private, voluntary non-profit and government hospitals to treat all patients even if uninsured until stable and transferrable. However, regional trauma centers are more frequently operated by voluntary, non-profit or teaching medical centers. Hence, it is hypothesized that:

- A greater proportion of patients seen for acute alcohol intoxication will be treated at voluntary, non-profit, government hospitals than patients seen for other reasons.
- Patients seen for acute alcohol intoxication receive similar medical treatment.

Low rates of alcohol abuse identification and subsequent referral to alcohol related substance abuse treatment have been well documented in other studies of patients presenting to the ED for alcohol intoxication. Hence, it is hypothesized that:

- Patients seen for acute alcohol intoxication are seldom referred to alcohol related substance abuse treatment.
- Patients seen for acute alcohol intoxication are seldom transferred to psychiatric, mental health, or substance abuse care.

CHAPTER 3

METHODS

Data from the 2003 – 2007 National Hospital Ambulatory Medical Care Survey (NHAMCS) were combined to generate national estimates of alcohol related visits to emergency departments (ED) across the US. A validated procedure for combining years of data and producing corrected standard error estimates was applied to these data. The level and type of association between patient alcohol use and patient ED visit were classified using a combination of the World Health Organization's International Classification of Disease, Ninth Revision, Clinical Modification (ICD9-CM) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). Results were generated from these data to achieve project objectives and perform analyses as directed by the research questions proposed in the original prospectus presented to the thesis examination committee on June 6, 2009.

NHAMCS Description

The National Hospital Ambulatory Medical Care Survey is a national probability sample of ambulatory medical encounters to non-institutional, general and short stay hospitals in the US. NHAMCS excludes all federal, military, and Veterans Affairs hospitals as well as general hospitals with less than six beds. While NHAMCS contains data on both hospital outpatient departments (OPD) and emergency departments (ED), for the purposes of this research, the scope of NHAMCS patient visits analyzed was limited to EDs of non-federal, short stay, or general hospitals.

NHAMCS employs a four stage probability sample design. Each stage involves sampling from geographic primary sampling units within primary sampling units which incorporate emergency medical service areas. Five sampling units are included in each sample and the final sample stage involves systematic random samples taken during randomly assigned four-week reporting periods. National estimates are then obtained via the assignment of patient visit weights and are rounded to the nearest thousand. A multistage estimation procedure consists of inflation by the reciprocals of the sampling selection probabilities, adjustment for non response, as well as a population weighting ratio adjustment (Stussman, 1997).

At all NHAMCS participating hospital EDs and for each patient admission, hospital staff are required to complete a NHAMCS patient visit records form (Appendix 2). These forms query information present about each hospital visit associated with that patient's medical record chart. Data collected on each form at the visit level include: visit characteristics, patient characteristics, services and medications rendered, diagnosis and visit outcomes. After the patient visit record forms are completed for that sample, they are sent to the National Center for Health Statistics(NCHS) where the physicians' diagnoses and patient's chief complaints are recoded using the ICD9-CM codex. Information is compiled about the procedures that each patient received as well as all medications administered. Patient outcome details (e.g. deceased, left against medical advice, etc.) as well as additional medical instructions and referrals are recorded for each patient (Stussman, 1997).

After data collection, NHAMCS performs the computation of several created variables within the ED patient visit data set. These computed variables serve several

purposes. Some computed variables are meant to mask identifying information such as hospital name and specifics about where patients live by aggregating original variables into larger, more general, and less descriptive categories. Examples of variables contained in the NHAMCS data aggregated for confidentiality purposes include the omission of hospital name and the classification of hospitals by type and size. Hospital characteristics are further recoded to reflect the classification of each hospital as rural or urban using metropolitan service area designations of the US Census Bureau and location of hospital is reassigned a regional designation which describes its service area (e.g. Midwest, Southwest). Finally, patient zip code is limited to the first three digits, with the first digit representing a certain group of US states, the second and third digits together representing a specific region in that group (or perhaps a large city). The fourth and fifth digits of the zip code are omitted, they representing a group of delivery addresses within the specified region. Since one NHAMCS visit is weighted for a number of patients within a particularly sampled service area, they do not translate to identifiable patient information.

Within the NHAMCS ED public use data exist other created variables which have been calculated by the NCHS for ease of use. These variables are mostly time and date related. Patient wait times in hours are calculated from the date and time a patient presents to the ED triage nurse or technician until the date and time they are first seen by a physician. Patient length of stay in hours is calculated from the date and time of admission to the date and time of discharge. Patient's age is calculated from the date of birth to the date of admission. Patient's date of birth is omitted from the NHAMCS public use data. A description of all NHAMCS variables, their origin, and associated survey

questions and units are contained in Appendix 5 which can be found at the conclusion of this document.

Visit related treatment cost was calculated using NHAMCS Diagnostic related group (DRG) codes which are linked to each visit. DRGs are a code implemented in the US which is used to classify hospital visits into one of approximately 500 groups, also referred to as DRGs, expected to each have similar hospital resource use. The DRG system was developed for Medicare as part of the prospective payment system. DRGs are assigned by an algorithm based on ICD9-CM, procedures, age, sex, discharge status, and the presence of complications or co-morbidities (Veteran's Administration, 2000). DRGs are used by the federal government to determine how much Medicare pays each hospital for the related visit, since patients within each category are similar clinically and are expected to use the same level of hospital resources. For the purposes of this study DRGs were recalculated into Major Diagnostic Categories. Per Medicare protocol, the Major Diagnostic Categories (MDC) were formed for each patient by dividing all possible principal diagnoses (from each patients diagnosis in terms if ICD9-CM) into 25 mutually exclusive diagnostic areas.

Computation of Standard Errors for Multi-Year Analysis of NHAMCS ED Data

Because of the weighting scheme used by NHAMCS, estimates using combined years are unreliable and standard error estimates are not provided in the annual NHAMCS ED public use data (Stussman, 1997). However, included in each year of data published by the National Center for Health statistics are public masked survey design variables. These variables can be utilized by researchers to estimate standard errors for

combined years of NHAMCS data. Sample design variables released on NHMACS public use files include the following marker variables: a masked stratum marker (STRATM); a masked primary sampling unit marker (PSUM); a constant denoting survey year (YEAR); a provider stratum marker (PROSTRAT); a marker denoting each hospital (PROVIDER); and a sampling unit code (SU). Also included are population measures needed to estimate standard errors across multiple years. These population measures include: a masked count of clinic sampling units (POPSUM); and a masked count of masked primary sampling unit markers (POPPSUM) (Hing et al., 2004).

Several methods to compute adjusted standard error estimates from NHAMCS sample design variables have been proposed and evaluated. The NCHSA recommends three methods for computation of standard error estimated across multiple years of NHAMCS data: a SUDAAN linearized Taylor series option WOR design with unmasked sample design variables (the NCHS in-house method is not available to the average researcher), a SUDAAN linearized Taylor series one stage WR design using masked design variables, or the use of the SAS 9.2 SURVEYMEANS procedure with masked design variables. In a study by Hing et al., 2004, the standard errors for visit estimates for each method were evaluated because prior research suggested these estimates created clustering effects which produced standard error estimates that are less accurate than in-house standard errors for clustered variables such as race, provider seen, and expected outcome of each patient (NCHS, 2002). The results of the evaluation showed that all three methods demonstrated high correlation between the masked and in-house (unmasked) standard errors computed (Hing et al., 2002). Hence, using the method outlined by Hing et al., 2004, standard error computation was achieved using the SAS 9.2

(Cary, NC 2006) SURVEYMEANS procedure using the provided masked design variables.

The SAS SURVEYMEANS procedure utilizes the “between primary sampling units” variance estimator sampling model (Hing et al., 2004). In this model, ultimate cluster variance estimates depend only on the first stage design, so that only the first stage cluster (primary sampling unit) and first stage stratum identification are required. Then, the variance estimation procedure (SURVEYMEANS) assumes that the first stage sample is drawn with replacement. The SURVEYMEANS procedure produces tested and reliable estimates of standard errors across combined multiple years of NHAMCS public use data (Hing et al., 2004). SAS code required to execute a correct standard error estimate using this method is available at the National Center for Health Statistics and can also be found in a modified form in Appendix 3 of this document.

Alcohol Related Visit Variable Definitions

In order to create meaningful groupings of alcohol related visits, 37 different alcohol related ICD9-CM diagnostic codes present in three physician assigned patient diagnoses for each patient visit in the NHAMCS data were grouped together. In order to facilitate relevant comparisons across disciplines of research both psychological diagnoses (DSM-IV) and physician related medical diagnoses (ICD9-CM) for alcohol conditions have been related for this project. The translation of DSM-IV criteria for alcohol abuse and dependence into ICD9-CM diagnostic codes present in the NHAMCS data was performed. Appendix 1 outlines the DSM-IV criteria for each alcohol related condition and the equivalent ICD9-CM diagnostic codes.

To further facilitate ease of interpretation and consideration of the relatedness of each patient visit to alcohol, novel groupings were assigned to each patient visit which relate to both the DSM-IV criteria for alcohol abuse and dependence and ICD9-CM codes for alcohol related diagnoses. These novel groupings reflect both type and severity of alcohol abuse, its temporal nature (acute versus chronic) as well as medical correlates (e.g. acute alcohol intoxication, alcohol related injury, delirium tremens, liver disease). These novel groups are rooted in past research and incorporate the type of services a patient might expect to receive for each strata of alcohol diagnosis (e.g. detoxification versus surgery for the chronic alcoholic with liver disease and ascites). These novel groupings further incorporate the notion of alcohol attributable fraction which can be defined as the percentage of each health problem (NHAMCS ICD9-CM diagnostic code) which can be attributed to alcohol use alone (Gentilello et al., 1994). For example, a patient presenting with acute, single episode alcohol intoxication would be 100% alcohol attributable whereas, an injury occurring to an intoxicated patient might represent only a fraction of alcohol involvement. From the ICD9-CM codes present in the NHAMCS data for each patient visit, the following novel alcohol related diagnostic groups were assigned: (1) Alcohol Related Visit, defined as a patient presenting to the ED with any diagnosis for alcohol intoxication, dependence, or abuse or whose assigned injury code includes alcohol intoxication; (2) Acute Alcohol Intoxication Visit, limits the visit diagnosis to acute alcohol intoxication or the patient requires alcohol detoxification; (3) Chronic Alcohol Abuse Visit, the physician diagnosis for this patient visit is related to alcohol abuse and alcoholism and related sequelae; and (4) Alcohol Related Injury, an injury visit where the patient was intoxicated or the injury was related to alcohol use or

abuse. It should be noted that several of these groups are not mutually exclusive. Alcohol Related Visits would incorporate both acute and chronic alcohol visits as well as alcohol related injury visits. Similarly, an alcohol related injury visit might include the treatment of sequelae related to alcoholism. In order to generate these novel alcohol related diagnostic categories, an algorithm was applied which assigned a category based upon combinations of each patient visit diagnostic code (ICD9-CM) found in the NHAMCS data as well as the cause of injury code assigned to each patient (also ICD9-CM). Table 2 outlines the ICD9-CM codes and cause of injury codes used to assign each patient visit a novel alcohol related diagnosis category.

Table 2. Alcohol Related Patient Visit Category Assignments

Category	Description	ICD9CM	Diagnosis
Alcohol Related Visit	The physician diagnosis for this patient included alcohol or alcohol abuse. (DIAG1, DIAG2, DIAG3) OR The cause of injury code assigned to this patient includes alcohol. (CAUSE1, CAUSE2, CAUSE3)	291.0 – 291.9	Alcohol-induced mental disorders
		303.0 – 303.9	Alcohol abuse
		305.0	Acute alcohol intoxication
		980.0	Toxic effect of ethanol
		790.3	Excessive blood level of alcohol
		E860.0	Accidental poisoning by alcoholic beverages
		710	Alcohol use/abuse
Non-Alcohol Related Visit	None of the diagnoses for this patient included alcohol or alcohol abuse. AND The cause of injury code assigned to this patient does not include alcohol.		
Acute Alcohol Intoxication Visit	The physician diagnosis for this patient was for acute alcohol intoxication. (DIAG1, DIAG2, DIAG3) AND/OR The patient’s primary reason for this visit was related to alcohol use/abuse. (RFV1, RFV2, RFV3)	305.0	Acute alcohol intoxication
		980.0	Toxic effect of ethanol
		291.4	Idiosyncratic alcohol intoxication
		5910.0	Adverse effects of drug abuse
		5915.0	Adverse effects of alcohol
Chronic Alcohol Abuse Visit	The physician diagnosis for this patient was for alcohol intoxication related to abuse and alcoholism. (DIAG1, DIAG2, DIAG3)	303.0 – 303.9	Alcohol abuse
		291.0 – 291.9	Alcohol-induced mental disorders

Statistical Analysis

Standard error estimates of NHAMCS data were computed using the SAS 9.2 SURVEYMEANS procedure. This procedure reports non-weighted frequencies and proportions and utilizes the Rao-Scott Chi Squares Test to compare basic descriptive, univariate and bivariate analysis of combined NHAMCS data. All statistical analyses were conducted using SAS 9.2. Basic (SAS Institute, Inc., Cary, NC, 2005).

CHAPTER 4

RESULTS

Five years of NHAMCS ED visit data (2003 – 2007), representing patient visits to the ED in the US, were combined for analysis. Once merged, the final data consisted of 181,786 observations which, when weighted, represent 575,436,011 (SD of weighted frequency=7,902,688) visits to US EDs from 2003 – 2007. Patient weights were assigned using the SURVEY MEANS procedure which produces confidence intervals for each weighted frequency and incorporates them into any subsequent statistical analysis. After patient weights were applied to these data, alcohol related categories were assigned based upon the diagnostic designation in the ICD9-CM format contained in each record. Three groups were produced based upon the designation scheme described in the methods section of this paper. The first category, alcohol related visits, was most inclusive and defined as any patient visit where any alcohol related condition was indicated. Additionally, the alcohol related visit category included those patients who received a reason for visit code of alcohol intoxication or whose primary reason for being seen in the ED for that visit was for alcohol detoxification. After categorizing the data, 3,497 unweighted records were identified as alcohol related visits representing 1.9% of all unweighted visits in the data. After weights were applied, alcohol related visits represented 9,319,913 visits to US EDs during the study period, representing 1.6% of all weighted visits (SE of percent: 0.06).

Alcohol related visits were further categorized using the algorithm described in the methods section of this paper. Using the DSM IV-linked to ICD9-CM algorithm, three distinct types of alcohol related visits were identified based upon common visit

characteristics, patterns of alcohol consumption, treatment regimes, and outcome. These categories included the acute alcohol intoxication category (3,171 unweighted visits, 8,876,628 weighted visits, 95.2% of all alcohol related visits), the chronic alcohol related visits (218 unweighted visits, 325,477 weighted visits, 3.5% of all alcohol related visits), and the other alcohol related visits category (158 unweighted visits, 117,808 weighted visits, 1.3% of all alcohol related visits). For the purposes of hypothesis testing and quantification of alcohol visit and related referral rates, statistical analysis was used to compare all alcohol related visits ($n_w=9,319,913$) to non-alcohol related visits ($n_w=566,116,098$).

The three visit subcategories represented by acute alcohol intoxication, chronic alcohol, and other alcohol related visits were dropped from analysis. Chronic alcohol and other alcohol categories were removed from analysis because they produced unweighted samples which when compared across characteristics of interest for this study (e.g. patient age group) produced unweighted frequencies less than 30. Weighted estimates based on unweighted counts less than 30 are considered unreliable. According to the methods paper reviewed for this study as well as the NCHS NHAMCS data codebook, the reliability of computed weighted estimates decreases with sample size. Below 30 non-weighted observations, weighted estimates are at best inaccurate and not useful for interpretation (Hing et Al., 2002). Finally, the acute alcohol intoxication group was removed from analysis because it was the primary component of the original alcohol related visit group (95.2% of weighted alcohol related visits). Basic Chi Squares analyses were used to compare the alcohol related visit category to the acute alcohol intoxication group and no significant differences were found. Hence, the alcohol related visit group

was selected for comparison against the non-alcohol related visit group for the purposes of this study. Figure 3 summarizes the results of the NHAMCS ED records merge, the application of patient weights and the outcome of the assignment of alcohol related groups.

From 2003 to 2007 there were 9,319,913 alcohol related visits to US EDs. This represented 1.6% of all visits during the study period. During the study period, there were 1,619.6 alcohol related visits per 100,000 ED visits. While the rate of alcohol related visits per 100,000 ED visits per year varied slightly from year to year, no observable trend was identified. Results of a Poisson regression failed to detect any trend in annual visit rate during the study period ($p=NS$). The alcohol related visit rate was highest in 2006 at 1,800.9 per 100,000 ED visits (95% CI: 1,314.9 – 1,514.7) and lowest in 2003 at 1,414.9 (95% CI: 1,874.4 – 2,624.2). Table 3 and Figure 4 respectively describe the rate of alcohol visits per 100,000 ED visits during the study period.

Patient Characteristics

As hypothesized, patients seen during the study period at US EDs for any alcohol related condition were typically middle aged, adult males. Patients seen for alcohol related conditions were more apt to be male than patients seen for non-alcohol related conditions (71.1 % versus 45.5%, $p<0.0001$, OR=2.95, 95% CI: 1.89 – 2.31). Patients seen for alcohol related conditions were on average older than patients seen for other conditions (4.4 years older, 95% CI: 3.6 years – 5.2 years, $p<0.0001$). The majority of patients seen for alcohol related conditions were between the ages of 25 – 64 years (79.3%). Patients seen in the ED for alcohol related conditions were more likely to be in

the 25 – 44 year old age group and the 45 – 64 year old age group than patients seen for other conditions. Table 2 and Table 4 compare patient demographic characteristics between alcohol related and non-alcohol related visit groups.

Figure 3. NHAMCS Records Merged for Analysis and Results of Subsequent Alcohol Involvement Group Assignment.

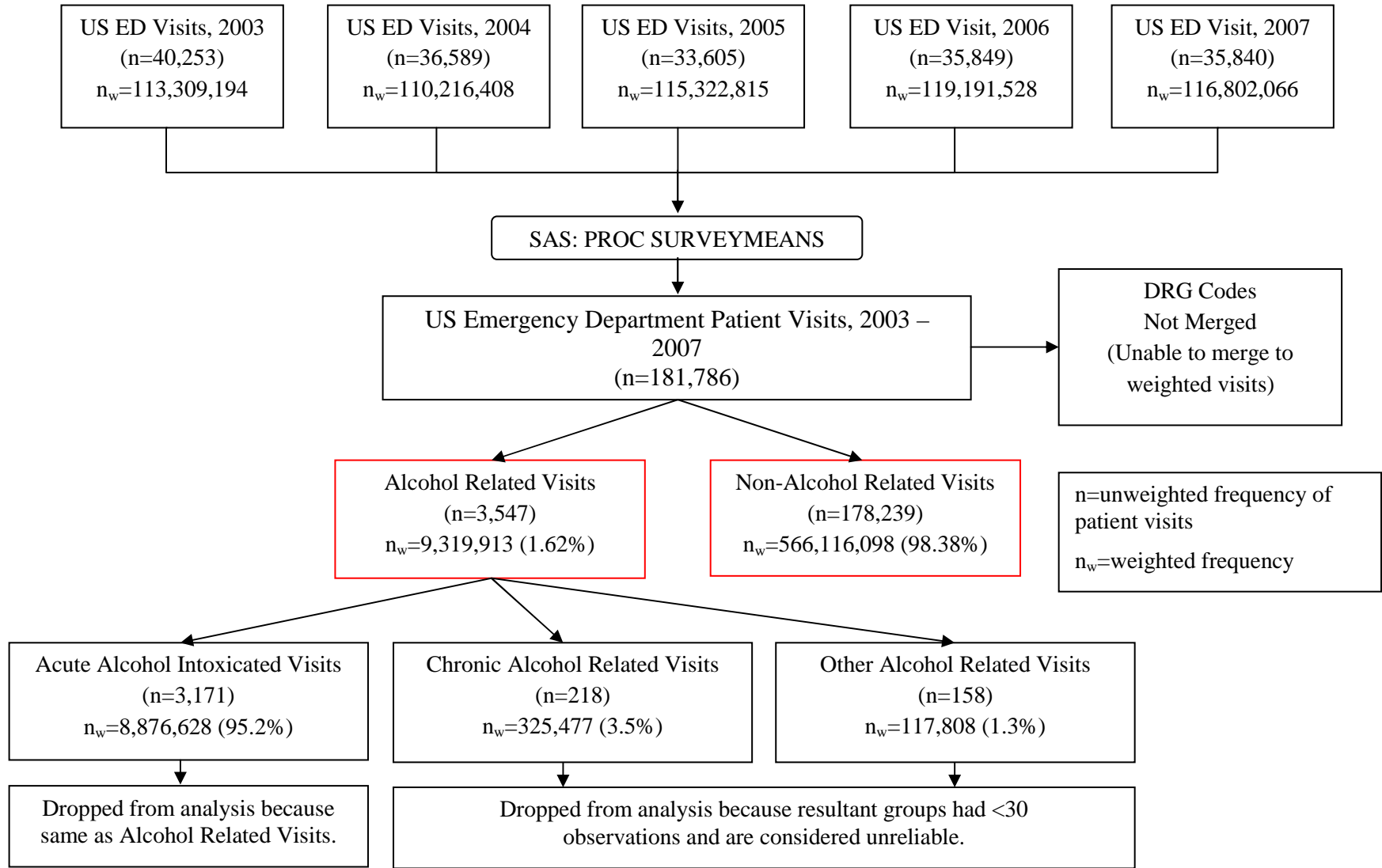
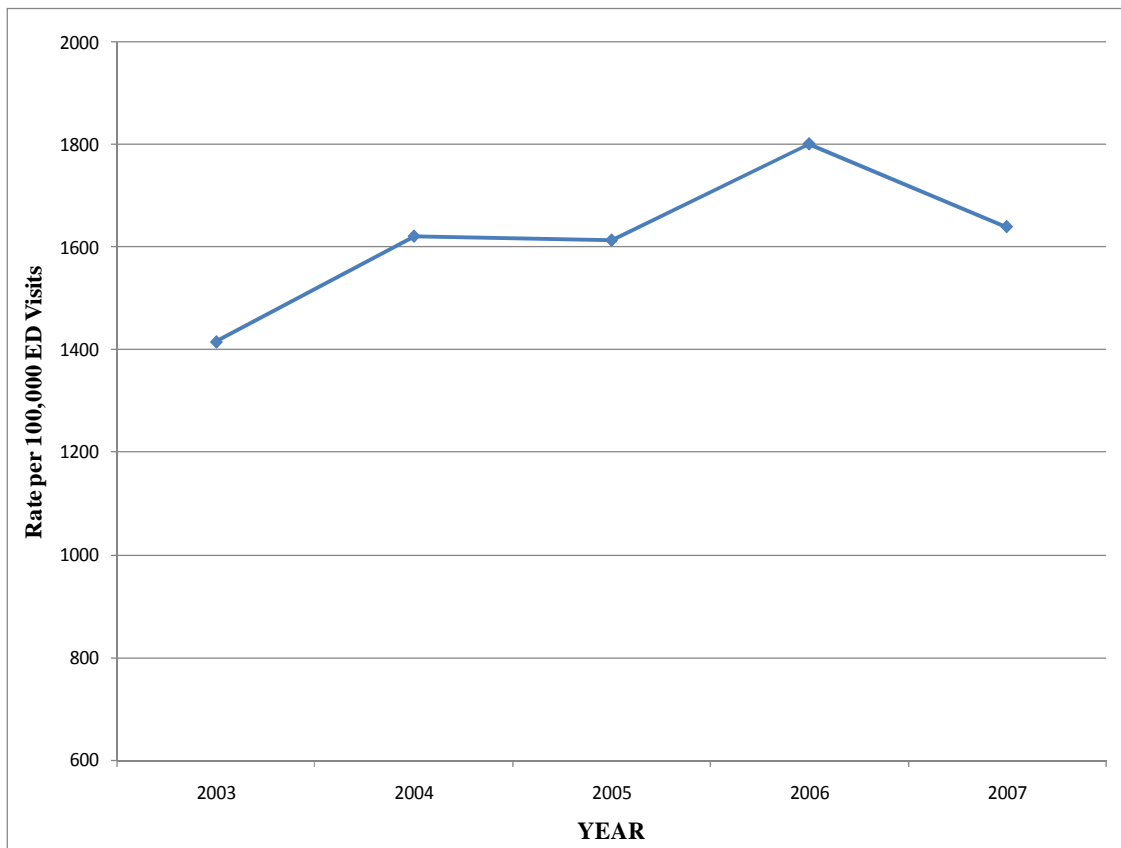


Table 3. Alcohol Related Visits to US Emergency Departments, 2003 - 2007.

Year	Alcohol Related Visits				
	Unweighted (%)	Weighted (%)	SE of Weighted Freq.	Rate per 100,000 ED Visits	95 % CI
2003	732 (1.81)	1,611,578 (1.42)	113,768	1,414.9	1,314.9 - 1,514.7
2004	719 (1.96)	1,786,432 (1.62)	143,980	1,620.8	1,490.2 - 1,751.4
2005	608 (1.81)	1,860,359 (1.61)	146,996	1,613.2	1,485.7 - 1,740.6
2006	759 (2.11)	2,146,541 (1.80)	155,642	1,800.9	1,670.3 - 1,931.5
2007	729 (2.05)	1,915,003 (1.64)	178,005	1,639.5	1,487.1 - 1,791.9
TOTAL	3,547 (1.95)	9,319,913 (1.62)	504,210	1,619.6	1,532.0 - 1,707.2

Figure 4. Alcohol Related Visit Rate per 100,000 ED Visits by Year, 2003 – 2007.



The recoded and imputed race of patients was compared between those with alcohol related conditions and those without. Patients identified with Native Hawaiian and Pacific Islander or Multiple Race heritages were dropped from comparison as the unweighted frequencies of alcohol related visits for these groups were less than 30 visits during the study period and therefore, their patient weighted estimates were considered unreliable. The majority of patients presenting with alcohol related conditions were White, Non-Hispanic (62.9% of weighted visits), followed by Black/African American (17.0% visits), and Hispanic (15.8% of weighted visits). The proportion of patients presenting to the ED for alcohol related conditions varied among racial and ethnic populations. Black/African Americans were less apt than other races to present to the ED with an alcohol related condition (17.0% alcohol related vs. 22.3% non-alcohol related, $p=0.0020$, $OR=0.77$, 95% CI: 0.66 – 0.91). Hispanics were more likely to present with an alcohol related condition than non-Hispanics (15.8% vs. 13.1%, $p=0.0187$, $OR=1.29$, 95% CI: 1.04 – 1.59). American Indians and Alaskan Natives were also more likely to present for alcohol related conditions than other races (1.6% vs. 0.8%, $p=0.0061$, $OR=2.04$, 95% CI: 1.22 – 3.41).

Measures of patient socioeconomic status were reviewed with respect to presentation to the ED with either an alcohol or non-alcohol related medical condition. Table 3 and Table 4 compare socioeconomic characteristics of patient seen at US EDs for alcohol related and non-alcohol related conditions. Most patients seen for alcohol and non-alcohol related conditions lived at a private residence. It was hypothesized that a large proportion of patients presenting for alcohol related condition to US EDs would be homeless. Results indicated that indeed patients seen for alcohol related conditions were

more apt to be homeless than their non-alcohol related counterparts (13.5% vs. 0.5%, $p < 0.0001$, OR=5.68, 95% CI: 3.89 – 8.30). Conversely, patients seen at US EDs for alcohol related conditions less frequently maintained a private residence than their non-alcohol related counterparts (80.9% vs. 91.5%, $p < 0.0001$, OR=0.36, 95% CI: 0.29 – 0.45). A greater proportion of alcohol related patients resided at an ‘other’ residence than non-alcohol related patients (3.4% vs. 0.7%). Other measures of socioeconomic status were compared between patients presenting for alcohol and non-alcohol related conditions. These measures included the percentage of individuals living in poverty in the patient’s zip code and the median household income in the patient’s zip code. Unfortunately, this information concerning patient zip code related socioeconomic indicators were only present in the 2006 NHAMCS survey. Hence, too many missing observations were generated in the final dataset (combined years 2003 – 2007) to produce statistically significant results using the SAS SURVEY MEANS procedure. Very little variation is observed when comparing these measures among patients presenting for alcohol related conditions to patients presenting for all other conditions. Results from the calculation of these measures and other measures of socioeconomic status are reported in Table 5.

Table 4. Patient Demographic Characteristics.

Characteristic	Alcohol Related Visits		Non-Alcohol Related Visits	
	Unweighted Freq. (%)	Weighted Freq. (%)	Unweighted Freq. (%)	Weighted Freq. (%)
Age Group				
0 - 14†	27 (7.6)	90,434 (0.9)	36,821 (20.7)	116,277,451 (20.5)
15 - 24	551 (15.5)	1,472,810 (15.8)	28,484 (15.9)	91,375,823 (16.1)
25 - 44	1,550 (43.7)	4,158,217 (44.6)	51,349 (28.8)	162,603,399 (28.7)
45 - 64	1,262 (35.6)	3,162,112 (33.9)	35,139 (19.7)	111,471,902 (19.7)
65 - 74	109 (3.1)	279,914 (3.0)	10,562 (5.9)	33,855,222 (6.1)
75 or more years	48 (1.4)	156,426 (1.7)	15,884 (8.9)	50,532,301 (8.9)
Sex				
Male	2,535 (71.5)	6,629,739 (71.1)	81,863 (45.9)	257,650,545 (45.5)
Female	1,012 (28.5)	2,690,174 (28.9)	96,376 (54.1)	308,465,553 (54.5)
Unknown	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Race (Recoded and Imputed)				
White, Non-Hispanic (NH)	1,241 (59.2)	3,725,741 (62.9)	60,333 (58.7)	211,666,942 (61.3)
Black/African American - NH	379 (18.1)	1,005,348 (17.0)	22,948 (22.3)	76,664,230 (22.2)
Hispanic	366 (17.5)	936,595 (15.8)	14,764 (14.4)	45,274,592 (13.1)
Asian	42 (2.0)	85,084 (1.4)	2,941 (2.9)	6,585,271 (1.9)
Native Hawaiian /Pacific Islander	10 (0.5)	31,824 (0.5)	591 (0.6)	1,317,856 (0.4)
American Indian/Alaskan Native	33 (1.6)	95,660 (1.6)	728 (0.7)	2,867,158 (0.8)
Multiple Races †	25 (1.2)	41,651 (0.7)	543 (0.5)	1,018,457 (0.3)
Missing*	1,451	3,398,010	75,391	220,721,592
Ethnicity				
Hispanic or Latino	120 (16.5)	260,565 (13.6)	4,120 (11.9)	11,940,282 (13.3)
Not Hispanic or Latino	442 (60.6)	1,096,986 (57.3)	23,033 (66.3)	74,407,956 (82.7)
Unknown	167 (22.9)	557,452 (29.1)	7,608 (21.9)	3,618,317 (4.0)
Missing**	2,818	7,404,910	143,478	476,149,543

†Frequencies less than 30 for any category are considered unreliable and should be ignored.

*Observations missing and omitted from comparison, this question not on NHAMCS Survey prior to 2005.

**Observations missing and omitted from comparison, this question not on NHAMCS Survey prior to 2007.

Table 5. Patient Socioeconomic Characteristics.

Characteristic	Alcohol Related Visits		Non-Alcohol Related Visits	
	Unweighted Freq. (%)	Weighted Freq. (%)	Unweighted Freq. (%)	Weighted Freq. (%)
Residence				
Private Residence	1,634 (78.0)	4,792,494 (80.9)	94,116 (91.5)	316,202,432 (91.5)
Nursing Home†	11 (0.5)	34,706 (0.6)	1,876 (1.8)	6,565,938 (1.9)
Other Institution	40 (1.9)	95,058 (1.6)	1,039 (1.0)	3,425,545 (1.0)
Other Residence	71 (3.4)	186,102 (3.1)	1,959 (1.9)	2,298,489 (0.7)
Homeless	284 (13.5)	676,382 (11.4)	2,073 (2.0)	1,851,325 (0.5)
Unknown	56 (2.7)	137,161 (2.3)	1,776 (1.7)	5,680,232 (1.6)
Missing*	1,451	3,398,010	75,391	220,721,592
Percent Poverty in Patient's Zip Code				
Quartile 1 (Less than 5.00%)	107 (14.1)	245,994 (11.5)	4,799 (13.7)	14,762,714 (12.6)
Quartile 2 (5.00 - 9.99%)	163 (21.5)	505,141 (23.5)	8,843 (25.2)	28,819,883 (24.6)
Quartile 3 (10.00 - 19.99%)	243 (32.0)	775,169 (36.1)	11,997 (42.2)	41,711,036 (35.6)
Quartile 4 (20.00 percent or more)	166 (21.9)	458,450 (21.4)	7,651 (21.8)	26,330,330 (22.5)
Unknown	80 (10.5)	161,787 (7.5)	1,800 (5.1)	5,421,024 (4.6)
Missing***	2,788	7,173,372	143,149	449,071,111
Median Household Income in Patient's Zip Code				
Quartile 1 (Below \$32,793)	202 (26.6)	639,019 (29.8)	10,465 (29.8)	37,611,965 (32.1)
Quartile 2 (\$32,794 - \$40,626)	173 (22.8)	619,975 (28.9)	8,376 (23.9)	30,073,150 (25.7)
Quartile 3 (\$40,627 - \$52,387)	134 (17.7)	382,823 (17.8)	7,199 (20.5)	23,772,208 (20.3)
Quartile 4 (\$52,388 or more)	170 (22.4)	342,937 (16.0)	7,256 (20.7)	20,180,006 (17.2)
Unknown	80 (10.5)	161,787 (7.5)	1,794 (5.1)	5,407,658 (4.6)
Missing***	2,788	7,173,372	143,149	449,071,111

†Frequencies less than 30 for any category are considered unreliable and should be ignored.

*Observations missing and omitted from comparison, this question not on NHAMCS Survey prior to 2005.

**Observations missing and omitted from comparison, this question not on NHAMCS Survey prior to 2007.

***Observations missing and omitted from comparison, this question only present on the 2006 NHAMCS Survey.

Table 6. Comparison of Patient Characteristics between Alcohol Related and Non-Alcohol Related Visits.

Patient Characteristic	Alcohol Related Visits Weighted Percentage	Alcohol Related Weighted Percentage	Rao-Scott χ^2 (p)	OR	95% CI
Patient Age Group					
25-44 Years	44.6	28.7	<0.0001	1.99	1.81 - 2.21
45-64 Years	33.9	19.7	<0.0001	2.09	1.89 - 2.31
Patient Sex					
Male	71.1	45.5	<0.0001	2.95	1.89 - 2.31
Race					
Black/African American	17.0	22.3	=0.0020	0.77	0.66 - 0.91
Hispanic	15.8	13.1	=0.0187	1.29	1.04 - 1.59
American Indian / Alaskan Native	1.6	0.8	=0.0061	2.04	1.22 - 3.41
Residence					
Private Residence	80.9	91.5	<0.0001	0.36	0.29 - 0.45
Homeless	13.5	0.5	<0.0001	5.68	3.89 - 8.30
Other Residence	3.4	0.7			
Percent Poverty in Patient's Zip Code					
Quartile 1 (Less than 5.00%)	11.5	13.7	NS		
Quartile 2 (5.00 - 9.99%)	23.5	24.6	NS		
Quartile 3 (10.00 - 19.99%)	36.1	35.6	NS		
Quartile 4 (20.00% or more)	21.4	21.8	NS		
Median Household Income in Patient's Zip Code					
Quartile 1 (Below \$32,793)	29.8	32.1	NS		
Quartile 2 (\$32,794 - \$40,626)	28.9	25.7	NS		
Quartile 3 (\$40,627 - \$52,387)	17.8	20.3	NS		
Quartile 4 (\$52,388 or more)	16.0	17.2	NS		

General Visit Characteristics

One of the original hypothesis proposed stated that patients seen for alcohol related visits would be more apt to be self-pay. Self-pay patients are defined as patients who pay for ED services out of pocket as the primary (largest proportion) source of payment. Self-pay patients might also receive assistance from private insurance or government co-payers such as Medicare and Medicaid. In these data, it was found that the primary source of payment identified for each visit for alcohol related conditions was most frequently self-pay (31.6% of weighted visits), followed by Medicaid (23.5% of weighted patient visits), and private insurance (21.5% of weighted visits). Overall, patients seen in the ED for alcohol related conditions were less apt to pay for services with private insurance in whole or in part than patients seen for non-alcohol related conditions (23.4% vs. 35.6%, $p < 0.0001$, $OR = 0.55$, 95% CI: 0.49 – 0.62). Patients seen in the ED for alcohol related conditions were more apt to pay for services themselves in whole or in part (33.0% vs. 16.9%, $p < 0.0001$, $OR = 2.42$, 95% CI 2.06 – 2.84). Patients with alcohol related conditions were less apt to have paid wither in whole or in part for services received with Medicare (9.1% vs. 17.2%, $p < 0.0001$, $OR = 0.48$, 95% CI = 0.39 – 0.60) and less significantly with Medicaid (22.1% vs. 25.2%. $p = 0.0756$, $OR = 0.84$, 95% CI: 0.69 – 1.00).

In general, alcohol related visits to the ED occurred more frequently during peak operating times in US EDs, primarily on Saturdays and Sundays (28.0%) and holidays. Admissions for alcohol related conditions were more apt to occur on weekends than non-alcohol related admissions (47.2% vs. 42.9%, $p = 0.0003$, $OR = 1.19$, 95% CI: 1.09 – 1.31). As hypothesized, alcohol intoxicated patients are generally transported to the ED via

ambulance more than any other means (49.4% of weighted visits). Less frequently intoxicated patients are considered walk-ins (38.4% of weighted patient visits) or are transported via public service (10.9% of weighted patient visits). It should be noted that the majority of these public service transports are made by law enforcement, but some are public service inebriate transportation services. Alcohol intoxicated patients were more apt to arrive by ambulance than non-intoxicated patients (51.6% vs. 16.3%, $p < 0.0001$, $OR = 5.19$, 95% CI: 4.71 – 5.52). Similarly alcohol intoxicated patients were more apt to arrive via public services than their non-intoxicated counterparts (9.4% vs. 1.5%, $p < 0.0001$, $OR = 7.00$, 95% CI: 5.59 – 8.78).

Linked to arrival by ambulance is the triage level of the patient. It could be assumed that patients with higher urgency for treatment would be more apt to arrive at the ED via ambulance. Since alcohol intoxicated patients more frequently arrive by ambulance, it might be expected that they have more urgent triage classifications. Alcohol intoxicated patients were most frequently triaged with moderate levels of urgency for care, with triage nurses noting that care was required between 15 and 60 minutes from time of arrival (39.2% of weighted visits). Less frequently, patients were assigned triage levels which represented more immediate medical needs with 17.5% of alcohol intoxicated patients needing to be seen within one to 14 minutes. Contrary to stated hypotheses regarding the urgency with which inebriates might need to be seen, patients presenting with alcohol related conditions were triaged as more urgently requiring medical attention than patients presenting with non-alcohol related conditions (68.6% of alcohol intoxicated patients needing to be seen in one hour or less vs. 57.3% of non-alcohol intoxicated patients, $p < 0.0001$, $OR = 1.67$, 95% CI: 1.46 – 1.91).

Interestingly, triage assignment had no impact on patient wait time in the ED. Wait time was defined as the period between assignment of a triage condition at patient check in to the time the patient saw the first medical service provider. Intoxicated patients waited an average of 888.6 minutes (SD=2605.7 minutes) while all other patients waited an average of 903.5 minutes (SD=2513.9 minutes). No statistical difference was observed between mean wait times between alcohol and non-alcohol related conditions (p=NS).

The proposed hypotheses also stated that patients with alcohol related conditions are more apt to have repeat visits to the ED. Within the NHAMCS data, two variables were used to test this hypothesis, the SEEN72 variable which asks the hospital if the patient specified had been seen in this same ED in the last 72 hours and the LASTVISIT variable which asks the hospital how many times this patient has been seen in this ED within the last 12 months. While neither variable is an all inclusive indication of a patient having repeat visits to EDs, especially in metropolitan regions with several different EDs, it is a measure of repeated use within a specific hospital within a three day and twelve month period respectively. Most alcohol related visits did not involve patients who had been seen at the same ED in the last three days (83.7% of weighted visits). However, a larger proportion of alcohol related visits involved patients who had been seen previously at this ED in the last three days than non-alcohol related visits (11.6% vs. 5.6%, $p=0.0986$, OR=1.17, 95% CI: 0.97 – 1.41). This result was not significant. Alcohol intoxicated patients had a mean of 2.6 visits (SD=7.5) within the last year while patients presenting with non-alcohol related conditions had a mean of 1.5 visits (SD=3.4) in the last year. In alcohol and non-alcohol groups, the number of patient visits within the last twelve months had a bimodal distribution; hence, a non-parametric student's t-test was

applied to these data. Alcohol intoxicated patients had a significantly larger mean number of past visits within a twelve month period than patients with non-alcohol related conditions (1.1 more visits, 95% CI: 0.4 – 1.8 more visits, $p=0.0028$).

A strong link was demonstrated between injury and alcohol intoxication. Injury was a co-diagnosis in 97.2% of all alcohol related visits and 34.7% of non-alcohol related visits ($p<0.0001$, OR=64.51, 95% CI: 45.61 – 91.35). This effect has been inflated due to the fact that 57.3% of all alcohol related visits identified in this study were assigned an ECODE (injury code) for acute alcohol poisoning (an injury). So, 42.7% of all alcohol related visits had some other kind of injury besides alcohol intoxication and the alcohol intoxication was noted among secondary diagnosis or by a related ICD9-CM ECODE (injury code). However, when looking at various intents of injury co-diagnoses, the link between injury and alcohol is confirmed. Alcohol intoxicated patients were more apt to be diagnosed with an injury that was self-inflicted than non-alcohol intoxicated patients (35.5% vs. 2.8%, $p<0.0001$, OR=18.79, 95% CI: 16.09 – 21.96). Again, the effect is no doubt artificially increased by the fact that acute alcohol poisoning is most frequently self-inflicted. To a lesser degree the alcohol and injury link was demonstrated among assault (intentional injury, not self-inflicted) and unintentional injuries (e.g. motor vehicle crashes). Alcohol intoxicated patients were more likely to have a co-diagnosis for an assault related injury than other patients (6.9% vs. 4.4%, $p<0.0001$, OR=1.55, 95% CI: 1.27 – 1.89). Similarly, alcohol intoxicated patients were more likely to have a co-diagnosis for an unintentional injury than other patients. Not surprisingly, the majority of both intoxicated and un-intoxicated patients experiencing an unintentional injury were involved in motor vehicle crashes.

Table 7. Visit Payment Characteristics.

Characteristic	Alcohol Related Visits		Non-Alcohol Related Visits	
	Unweighted Freq. (%)	Weighted Freq. (%)	Unweighted Freq. (%)	Weighted Freq. (%)
Primary Expected Source of Payment for this Visit				
Private Insurance	763 (21.5)	2,182,810 (23.4)	62,799 (35.2)	201,627,427 (35.6)
Medicare	282 (8.0)	743,265 (8.0)	26,062 (14.6)	84,162,423 (14.9)
Medicaid/SCHIP	833 (23.5)	1,921,650 (20.6)	45,760 (25.7)	135,396,001 (23.9)
Worker's Compensation	5 (0.1)	12,168 (0.1)	3,090 (1.7)	9,840,104 (1.7)
Self-Pay	1,069 (30.1)	2,949,342 (31.6)	25,724 (14.4)	85,735,700 (15.1)
No Charge/Charity	60 (1.7)	167,059 (1.8)	1,700 (1.0)	5,390,364 (1.0)
Other	443 (12.5)	1,123,756 (12.1)	10,757 (6.0)	33,699,628 (6.0)
Unkown	78 (2.2)	181,725 (1.9)	1,881 (1.1)	7,993,816 (1.4)
Blank	14 (0.4)	38,137 (0.4)	467 (0.3)	2,270,635 (0.4)
Missing	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Payment Type: Private Insurance				
No	1,628 (77.7)	4,494,994 (75.9)	62,419 (60.7)	207,950,348 (60.2)
Yes	468 (22.3)	1,426,909 (24.1)	40,429 (39.3)	137,444,158 (39.8)
Missing*	1,451	3,398,010	75,391	220,721,592
Payment Type: Medicare				
No	1,902 (90.7)	5,382,376 (83.3)	85,721 (83.3)	285,950,506 (82.8)
Yes	194 (9.3)	539,527 (9.1)	17,127 (16.7)	59,444,000 (17.2)
Missing*	1,451	3,398,010	75,391	220,721,592
Payment Type: Medicaid				
No	1,574 (75.1)	4,612,041 (77.9)	74,286 (72.2)	258,291,232 (74.8)
Yes	522 (24.9)	1,309,862 (22.1)	28,562 (27.8)	87,103,274 (25.2)
Missing*	1,451	3,398,010	75,391	220,721,592
Payment Type: Self-Pay				
No	1,432 (68.3)	3,970,140 (67.0)	86,294 (83.9)	287,122,871 (83.1)
Yes	664 (31.7)	1,951,763 (33.0)	16,554 (16.1)	58,271,635 (16.9)
Missing*	1,451	3,398,010	75,391	220,721,592

*Observations missing and omitted from comparison, this question not on NHAMCS Survey prior to 2005.

Table 8. Visit Characteristics.

Characteristic	Alcohol Related Visits		Non-Alcohol Related Visits	
	Unweighted Freq. (%)	Weighted Freq. (%)	Unweighted Freq. (%)	Weighted Freq. (%)
Day of Week of Visit				
Sunday	574 (16.2)	1,548,528 (16.6)	26,099 (14.6)	83,823,766 (14.8)
Monday	450 (12.7)	1,238,860 (13.3)	27,090 (15.2)	85,873,229 (15.2)
Tuesday	500 (14.1)	1,271,152 (13.6)	25,523 (14.3)	80,626,079 (14.2)
Wednesday	442 (12.5)	1,104,122 (11.8)	25,064 (14.1)	79,527,959 (14.0)
Thursday	461 (12.9)	1,294,949 (13.9)	24,452 (13.7)	77,076,112 (13.6)
Friday	508 (14.3)	1,303,029 (13.9)	24,587 (13.8)	77,742,708 (13.7)
Saturday	612 (17.3)	1,559,273 (16.7)	25,424 (14.3)	81,446,245 (14.4)
Mode of Arrival				
Ambulance	1,753 (49.4)	4,804,438 (51.6)	29,540 (16.6)	92,244,482 (16.3)
Public Service	388 (10.9)	872,300 (9.4)	3,521 (1.9)	8,267,444 (1.5)
Walk - In	1,361 (38.4)	3,475,125 (37.3)	142,575 (80.0)	457,568,607 (80.8)
Missing	45 (1.3)	168,050 (1.8)	2,603 (1.5)	8,035,565 (1.4)
Immediacy With Which Patient Should be Seen				
Immediate	437 (12.3)	1,125,420 (12.1)	17,206 (9.7)	52,227,028 (9.2)
1 - 14 Minutes	619 (17.5)	1,610,187 (17.3)	22,611 (12.7)	67,177,656 (11.9)
15 - 60 Minutes	1,323 (37.3)	3,649,129 (39.2)	63,996 (35.9)	205,116,963 (36.2)
>1 Hour - 2 Hour	514 (14.5)	1,333,788 (14.3)	36,899 (20.7)	120,036,565 (21.2)
>2 Hours - 24 Ho	525 (14.8)	1,248,627 (13.4)	30,379 (17.0)	97,845,120 (17.3)
No Triage†	27 (0.7)	53,527 (0.5)	2,077 (1.2)	5,868,797 (1.0)
Missing	102 (2.9)	299,235 (3.2)	5,071 (2.8)	17,843,969 (3.2)
Has Patient Been Seen in this ED in the Last 72 Hours ?				
Yes	368 (10.4)	1,086,590 (11.6)	8,512 (4.8)	26,214,945 (4.6)
No	3,018 (85.1)	7,801,316 (83.7)	162,405 (91.1)	514,681,585 (90.9)
Unknown	161 (4.5)	432,007 (4.7)	7,322 (4.1)	25,219,295 (4.5)
Is this Visit Related to Injury?				
No	102 (2.9)	264,419 (2.8)	116,280 (65.2)	369,887,146 (65.3)
Yes	3,445 (97.1)	9,055,494 (97.2)	61,959 (34.8)	196,228,952 (34.7)
Is this Injury Poisoning Intentional?				
Yes (Self-Inflicted)	1,056 (29.8)	2,666,579 (28.6)	1,657 (0.9)	4,684,319 (0.8)
Yes (Assault)	201 (5.7)	557,890 (5.9)	2,711 (1.5)	8,270,539 (1.5)
No, Unintentional	1,728 (48.7)	4,820,393 (51.7)	47,950 (26.7)	151,566,372 (26.7)
Not Applicable	102 (2.9)	116,280 (1.2)	116,280 (65.2)	396,887,146 (65.3)
Unknown	460 (12.9)	1,158,771 (12.4)	9,641 (5.4)	31,707,722 (5.6)

†Frequencies less than 30 for any category are considered unreliable and should be ignored.

Table 9. Comparison of Payer Characteristics between Alcohol Related and Non-Alcohol Related Visits.

Visit Characteristic	Alcohol Related Visits Weighted Percentage	Alcohol Related Weighted Percentage	Rao-Scott χ^2 (p)	OR	95% CI
Primary Expected Source of Payment for this Visit					
Private Insurance	23.4	35.6	<0.0001	0.55	0.49 - 0.62
Self-Pay	31.6	15.1	<0.0001	2.63	2.35 - 2.94
Medicare	8.0	14.9	<0.0001	0.49	0.42 - 0.59
Medicaid	20.6	23.9	=0.0137	0.83	0.72 - 0.96
Payment Type: Private Insurance					
Yes	24.1	39.8	<0.0001	0.48	0.41 - 0.56
Payment Type: Medicare					
Yes	9.1	17.2	<0.0001	0.48	0.39 - 0.60
Payment Type: Medicaid					
Yes	22.1	25.2	=0.0756	0.84	0.69 - 1.00
Payment Type: Self-Pay					
Yes	33.0	16.9	<0.0001	2.42	2.06 - 2.84
Weekend Visit (Fri, Sat, Sun)					
Yes	47.2	42.9	=0.0003	1.19	1.09 - 1.31

Table 10. Comparison of Visit Characteristics between Alcohol Related and Non-Alcohol Related Visits.

Visit Characteristic (continued)	Alcohol Related Visits Weighted Percentage	Alcohol Related Weighted Percentage	Rao-Scott χ^2 (p)	OR	95% CI
Mode of Arrival					
Ambulance	51.6	16.3	<0.0001	5.19	4.71 - 5.52
Public Services	9.4	1.5	<0.0001	7.00	5.59 - 8.78
Walk-In	37.3	80.8	<0.0001	0.29	0.28 - 0.31
Immediacy With Which Patient Should be Seen					
<= 1 Hour	68.6	57.3	<0.0001	1.67	1.46 - 1.91
Has Patient Been Seen in this ED in the Last 72 Hours?					
Yes	11.6	5.6	=0.0986	1.17	0.97 - 1.41
Is this Visit Related to an Injury?					
Yes	97.2	34.7	<0.0001	64.51	45.61 - 91.35
Is this Injury Self-Inflicted?					
Yes	35.5	2.8	<0.0001	18.79	16.09 - 21.96
Is this Injury an Assault?					
Yes	6.9	4.4	<0.0001	1.55	1.27 - 1.89
Is this Injury Unintentional?					
Yes	51.7	26.7	<0.0001	1.63	1.45 - 1.91

Visit Characteristics: ED Services Provided

Based on the results of a number of previous studies which indicate that chronic inebriates accessing medical care and/or detoxification at EDs utilize a large proportion of medical services, it was hypothesized that patients identified in the NHAMCS data as being seen in US EDs for alcohol related conditions would also use a large proportion of ED services. In almost every category of medical services provided in US EDs including diagnostic and screening procedures, therapeutic procedures, medication administration, and the number of clinicians seen, alcohol intoxicated patients presenting to EDs used more services than non-alcohol intoxicated patients. Patients seen for alcohol related conditions had longer mean visit durations than patients seen for non-alcohol related visits (361.6 minutes longer wait time, 95% CI: 277.1 minutes – 446.0 minutes, $p < 0.0001$). ED physicians were more apt to order diagnostic or screening services for alcohol intoxicated patients than all other patients during the patient's stay in the ED (89.6% of alcohol visits vs. 78.6% of non-alcohol visits, $p < 0.0001$, OR=1.43, 95% CI: 1.29 – 1.58). Similarly, patients seen for alcohol related conditions were subjected to more diagnostic and screening procedures than patients seen for non-alcohol related conditions ($p < 0.0001$). Alcohol intoxicated patients more frequently received a broad spectrum of diagnostic tests which are detailed in Table 10. With the exception of diagnostic imaging, patients with alcohol related conditions were more apt to receive a multitude of diagnostic and screening services including blood chemistry analysis, urinalysis, toxicological screening. Interestingly, only 36.3% of all alcohol related patients received a blood alcohol concentration (BAC) analysis.

As might be expected, patients presenting to the ED with alcohol related conditions also received more medical procedures than their non-alcohol related counterparts. Alcohol intoxicated patients were more apt to receive procedures than non-alcohol patients (60.7% vs. 51.9%, $p < 0.0001$, OR=1.43, 95% CI: 1.29 - 1.58). Alcohol intoxicated patients most frequently received intravenous (IV) fluids. Types of procedures administered to both alcohol and non-alcohol intoxicated patients are summarized in Table 11. The mean number of procedures provided at each visit was compared between alcohol related patient visits and non-alcohol related patient visits. No significant difference in the mean number of medical procedures provided at each visit was detected between alcohol related and non-alcohol related visits (4.6 medical procedures vs. 4.8 medical procedures, $p = \text{NS}$). The increased proportion of medical procedures observed among the alcohol related visit patient group did not translate into an increase in the frequency of medication administration within this group. In fact, patients seen for alcohol related conditions were less likely to have received medications during their visit to the ED (63.5% vs. 78.5%, < 0.0001 , OR=0.48, 95% CI: 0.42 – 0.54).

Within the NHAMCS visit data, patients presenting to the ED received care from a variety of medical professionals including Nurses Aides, Registered Nurses, Resident Intern Physicians, Physicians, and Physician Assistants. Patients presenting for alcohol related conditions were more apt to be seen by an attending ED physician than patients seen for all other reasons (90.5% vs. 87.4%, $p = 0.0061$, OR=1.36, 95% CI: 1.09 – 1.70). Similarly, patients seen for alcohol related conditions were more apt to be seen by an ED Resident or Intern (14.5% vs. 8.8%, $p < 0.0001$, OR=1.76, 95% CI: 1.51 – 2.06).

Table 11. Diagnostic and Screening Services Provided.

Characteristic	Alcohol Related Visits		Non-Alcohol Related Visits	
	Unweighted Freq. (%)	Weighted Freq. (%)	Unweighted Freq. (%)	Weighted Freq. (%)
Were Any Diagnostic or Screening Services Ordered or Provided at this Visit?				
No	351 (9.9)	82,973 (8.9)	34,831 (19.5)	111,098,645 (19.6)
Yes	3,145 (88.7)	8,350,458 (89.6)	140,561 (78.7)	444,685,858 (78.6)
No Answer	51 (1.4)	139,882 (1.5)	3,297 (1.8)	10,331,595 (1.8)
Complete Blood Count (CBC)				
Yes	1,797 (50.7)	4,906,008 (52.6)	5,920 (33.3)	191,350,597 (33.8)
No	1,750 (49.3)	4,413,905 (47.4)	119,019 (66.7)	374,765,501 (66.2)
BUN/Creatinine				
Yes	674 (32.2)	1,938,511 (32.7)	21,491 (20.9)	72,267,374 (20.9)
No	1,422 (67.8)	3,983,392 (67.3)	81,357 (79.1)	273,127,132 (79.1)
Missing*	1,451	3,398,010	75,391	220,721,592
Cardiac Enzymes				
Yes	298 (14.2)	823,399 (13.9)	12,077 (11.7)	40,449,956 (11.7)
No	1,798 (85.8)	5,098,504 (86.1)	90,771 (88.3)	304,944,550 (88.3)
Missing*	1,451	3,398,010	75,391	220,721,592
Glucose				
Yes	1,100 (31.0)	3,057,580 (32.8)	32,481 (18.2)	102,268,110 (18.1)
No	2,447 (68.9)	6,262,333 (67.2)	145,758 (81.8)	463,847,988 (81.9)
Liver Function Tests				
Yes	357 (17.0)	928,813 (15.7)	7,108 (6.9)	22,037,263 (6.4)
No	1,739 (83.0)	4,993,090 (84.3)	95,740 (93.1)	323,357,243 (93.6)
Missing*	1,451	3,398,010	75,391	220,721,592
Blood Alcohol Concentration (BAC)				
Yes	1,199 (33.8)	3,386,939 (36.3)	2,368 (1.3)	6,123,249 (1.1)
No	2,348 (66.2)	5,932,974 (63.7)	175,871 (98.7)	559,992,849 (98.9)
Was an Urinalysis Performed?				
Yes	1,073 (30.3)	2,738,587 (29.4)	35,657 (20.0)	114,017,453 (20.1)
No	2474 (69.7)	6,581,326 (70.6)	142,582 (80.0)	452,098,645 (79.9)
Was any Imaging Performed?				
Yes	728 (34.7)	158,701 (39.0)	44,442 (43.2)	152,658,763 (44.2)
No	1,368 (65.3)	248,124 (61.0)	58,406 (56.8)	192,735,743 (55.8)
Missing*	1,451	3,398,010	75,391	220,721,592

†Frequencies less than 30 for any category are considered unreliable and should be ignored.

*Observations missing and omitted from comparison, this question not on NHAMCS

Survey prior to 2005.

Table 12. Medical Services Provided.

Characteristic	Alcohol Related Visits		Non-Alcohol Related Visits	
	Unweighted Freq. (%)	Weighted Freq. (%)	Unweighted Freq. (%)	Weighted Freq. (%)
Were any Procedures Provided at this Visit?				
Yes	1830 (51.5)	5,156,844 (55.3)	82,897 (46.5)	263,441,431 (46.5)
No	1,543 (43.5)	3,657,399 (39.2)	86,108 (48.3)	272,096,513 (48.1)
Unknown	174 (4.9)	505,670 (5.5)	9,234 (5.2)	30,578,154 (5.4)
IV Fluids				
Yes	1,307 (36.8)	3,720,427 (39.9)	40,652 (22.8)	133,890,090 (23.7)
No	2,240 (63.1)	5,599,486 (60.1)	137,587 (77.2)	432,226,008 (76.3)
Bladder Catheter				
Yes	122 (3.4)	382,148 (4.1)	4,337 (2.4)	14,636,012 (2.6)
No	3,425 (96.6)	8,937,765 (95.9)	173,902 (97.6)	551,480,086 (97.4)
Were Medications Ordered or Provided at this Visit?				
No	1,254 (35.4)	3,403,099 (36.5)	39,347 (22.1)	121,817,781 (21.5)
Yes	2,293 (64.6)	5,916,814 (63.5)	138,892 (77.9)	444,298,317 (78.5)
Was an Attending ED Physician Seen?				
No	191 (9.1)	564,714 (9.5)	12,300 (12.0)	43,435,139 (12.6)
Yes	1,905 (90.9)	5,357,189 (90.5)	90,548 (88.0)	301,959,367 (87.4)
Missing*	1,451	3,398,010	75,391	220,721,592
Was an ED Resident or Intern Seen?				
No	2,936 (82.8)	7,964,507 (85.5)	159,215 (89.3)	516,386,575 (91.2)
Yes	611 (17.2)	1,355,406 (14.5)	19,024 (10.7)	49,729,523 (8.8)
Was an RN or LPN Seen?				
No	277 (13.2)	665,860 (11.2)	11,986 (11.7)	36,411,406 (10.5)
Yes	1,819 (86.8)	5,256,043 (88.8)	90,862 (88.3)	308,983,100 (89.5)
Missing*	1,451	3,398,010	75,391	220,721,592
Was a Nurse Practitioner Seen?				
No	3,481 (98.1)	9,138,150 (98.0)	172,674 (96.9)	548,367,883 (96.8)
Yes	66 (1.9)	181,763 (2.0)	5,565 (3.1)	17,748,215 (3.2)
Was a Physician Assistant Seen?				
No	3,375 (95.2)	8,810,358 (94.5)	165,719 (93.0)	519,431,951 (91.7)
Yes	72 (4.8)	509,555 (5.5)	12,520 (7.0)	46,684,147 (8.3)

†Frequencies less than 30 for any category are considered unreliable and should be ignored.

*Observations missing and omitted from comparison, this question not on NHAMCS Survey prior to 2005.

Table 13. Comparison of Diagnostic, Screening, and Medical Services Provided between Alcohol Related and Non-Alcohol Related Visits.

Visit Characteristic (continued)	Alcohol Related Visits Weighted Percentage	Non- Alcohol Related Visits Weighted Percentage	Rao-Scott χ^2 (p)	OR	95% CI
Were Procedure Provided at this Visit?					
Yes	60.7	51.9	<0.0001	1.43	1.29 - 1.58
Were IV Fluids Administered?					
Yes	39.9	23.7	<0.0001	2.14	1.9 - 2.42
Was a Bladder Catheter Inserted?					
Yes	4.1	2.6	=0.0002	1.61	1.25 - 2.07
Were Medications Provided?					
Yes	63.5	78.5	<0.0001	0.48	0.42 - 0.54
Was an Attending ED Physician Seen?					
Yes	90.5	87.4	=0.0061	1.36	1.09 - 1.70
Was an ED Resident or Intern Seen?					
Yes	14.5	8.8	<0.0001	1.76	1.51 - 2.06
Complete Blood Count (CBC)					
Yes	52.6	33.8	<0.0001	2.17	1.97 - 2.40
EKG/ECG					
Yes	23.4	16.5	<0.0001	1.54	1.39 - 1.71
BUN/Creatinine					
Yes	32.7	20.9	<0.0001	1.84	1.62 - 2.09
Cardiac Enzymes					
Yes	13.9	11.7	=0.0224	1.22	1.03 - 1.44
Glucose					
Yes	32.8	18.1	<0.0001	2.21	2.00 - 2.45

Table 13. Comparison of Diagnostic, Screening, and Medical Services Provided between Alcohol Related and Non-Alcohol Related Visits, Continued.

Visit Characteristic (continued)	Alcohol Related Visits	Non- Alcohol Related Visits	Rao-Scott χ^2 (p)	OR	95% CI
	Weighted Percentage	Weighted Percentage			
Liver Function Tests					
Yes	15.7	6.4	<0.0001	2.72	2.33 - 3.19
Blood Alcohol Concentration (BAC)					
Yes	36.3	1.1	<0.0001	52.2	45.94 - 59.33
Was a Toxicological Screen Performed?					
Yes	26.6	2.3	<0.0001	14.4	11.3 - 18.4
Was a Urinalysis Performed?					
Yes	29.4	20.1	<0.0001	1.65	1.47 - 1.86
Was any Imaging Performed?					
Yes	39.0	44.2	<0.0001	0.77	0.68 - 0.87
Was Medical Follow Up Planned for this Patient?					
Yes	9.8	6.1	=0.0037	1.72	1.64 - 1.81
Was Patient Referred to Physician or Clinic Follow Up?					
Yes	48.5	63.2	<0.0001	0.55	0.48 - 0.64
Was Patient Referred to Social Services?					
Yes	7.4	0.7	<0.0001	12.14	9.00 - 16.38
Was Patient Referred to Alcohol or Drug Treatment?					
Yes	18.5	0.2	<0.0001	96.27	72.80 - 127.29
Did Patient Leave Against Medical Advice?					
Yes	3.2	1.1	<0.0001	3.09	2.26 - 4.23
Did Patient Leave without Being Seen?					
Yes	1.4	1.9	=0.0827	0.73	0.50 - 1.04
Was Patient Admitted to the Hospital?					
Yes	7.9	1.8	=0.0062	1.32	1.05 - 1.51
Was Patient Admitted to an Observation Unit?					
Yes	1.9	1.0	NS		
Was Patient Admitted to this Hospital?					
Yes	17.0	12.8	<0.0001	1.39	1.21 - 1.59

Table 14. Comparison of Selected Continuous Variables between Alcohol Related and Non-Alcohol Related Visits.

Characteristic	Alcohol Related Visits					Non-Alcohol Related Visits					p
	n	Min.	Max.	Mean	SD	n	Min.	Max.	Mean	SD	
Patient Age (Years)	3547	11	100	40.5	14.2	178239	0	100	36.08	24.16	<0.0001
Patient Wait time (Minutes)	3398	0	9999	888.6	2605.7	170826	0	9999	903.5	2634.9	NS
Patient Length of Visit (Minutes)	3488	3	9999	1254.2	2800.3	175827	1	9999	892.6	2513.9	<0.0001
How Many Times Has Patient Been Seen in this ED Within the Last 12 Months?	440	0	99	2.6	7.5	19257	0	99	1.5	3.4	0.0028*
Total Number of Diagnostic/Screening Services Ordered or Provided	3527	0	99	5.5	9.7	177318	0	99	4.4	11.5	<0.0001
Total Number of Procedures Provided	3511	0	99	4.6	19.1	176633	0	99	4.8	20	NS

*Non-Parametric Student's t-test applied to unequally distributed data.

Patient Referral Characteristics

A major focus of the data analysis portion of this project was to establish a benchmark for the rate of referral of intoxicated patients to alcohol or drug treatment and other types of medical follow up. Due to changes in the design of the NHAMCS survey over the study period, estimates of patient referral rates were only available for 2003 and 2004 surveys. These were the only years that the NCHS included a question on patient referral to alcohol or drug services. Among patients who were seen for alcohol related conditions, 18.5% were referred to alcohol or drug treatment. Referral rates per 100,000 visits were computed and compared between 2003 and 2004. No observable trend in rates of referral per 100,000 visits was observed. Not surprisingly, patients presenting to EDs for alcohol related problems were more apt to be referred to alcohol or drug treatment than patient presenting for all other conditions (18.5% vs. 0.2%, $p < 0.0001$, OR=96.27, 95% CI:72.80 – 127.29). Review of patient visits which were not alcohol related but referred to alcohol or drug treatment were primarily linked to the abuse of other drugs besides alcohol (e.g. cocaine).

Related to substance abuse but not purely demonstrative of referral to alcohol or drug treatment is patient referral to either social services or transfer to an observation unit. Social services represent another level of patient care where alcohol and drug problems are often addressed as part of the coordinated response to substance abuse issues. A greater proportion of patients seen for alcohol related conditions were referred to social services than patients seen for all other conditions (7.4% vs. 0.7%, $p < 0.0001$, OR=12.14, 95% CI: 9.00 – 16.38). Similarly, patients suffering from behavioral problems or psychoses are often referred to an observation unit for observation,

evaluation, and care from behavioral health professionals prior to discharge. Many patients in an observations unit are considered to be legally held until a psychological evaluation has been conducted because the patient is thought to be a danger to themselves or others. No difference in the proportion of patient admission to an observation unit was observed between alcohol related and non-alcohol related groups (1.9% vs. 1.0%, $p=NS$).

Other types of patient referral were also calculated and compared between alcohol related visits and non-alcohol related visits. Patients seen for alcohol related medical conditions were more apt have medical follow up planned for them at discharge than patients with non-alcohol related medical conditions (9.8% vs. 6.1%, $p=0.0037$, $OR=1.72$, 1.64 – 1.81). However, alcohol related patients were less likely to be referred to a physician or clinic for medical follow up than non-alcohol related patients (48.5% vs. 63.2%, $p<0.0001$, $OR=0.55$, 95% CI: 0.48 – 0.64).

Patient behavior during the visit and certain patient outcomes impact these observed rates of referral. Measure of patient behavior which might impact ultimate referral include the patient leaving against medical advice, leaving without being seen by a health care provider, or direct admission to the hospital. Patients seen for alcohol related conditions were not significantly less apt to leave without being seen by a clinician (1.4% vs. 1.9%, $p=0.0827$). However, alcohol related patients were more apt to leave against medical advice than non-alcohol related patients (3.2% vs. 1.1%, $p<0.0001$, $OR=3.09$, 95% CI: 2.26 -0 4.23). Finally, patients seen for alcohol related conditions were more apt to be admitted to this hospital than patients seen for other non-alcohol related conditions (17.0% vs. 12.8%, $p<0.0001$, $OR=1.39$, 95% CI: 1.21 – 1.59).

Table 15. Follow Up, Referrals, and Patient Outcomes.

Characteristic	Alcohol Related Visits		Non-Alcohol Related Visits	
	Unweighted Freq. (%)	Weighted Freq. (%)	Unweighted Freq. (%)	Weighted Freq. (%)
Was Medical Follow Up Planned for this Patient?				
Yes	314 (8.9)	910,485 (9.8)	10,019 (5.6)	34,520,467 (6.1)
No	3,233 (91.1)	8,409,428 (90.2)	168,220 (94.4)	531,595,631 (93.9)
Was Patient Referred to Physician or Clinic for Follow Up?				
Yes	1,040 (49.6)	2,874,053 (48.5)	65,915 (64.1)	218,165,577 (63.2)
No	1,056 (50.4)	3,047,850 (51.5)	36,933 (35.9)	127,228,929 (36.8)
Missing*	1,451	3,398,010	75,391	220,721,592
Was Patient Referred to Social Services?				
Yes	183 (8.7)	438,904 (7.4)	958 (0.9)	2,262,263 (0.7)
No	1,913 (91.3)	5,482,999 (92.6)	101,890 (99.1)	343,132,243 (99.3)
Missing*	1,451	3,398,010	75,391	220,721,592
Was Patient Referred to Alcohol or Drug Treatment?				
Yes	281 (19.4)	629,568 (18.5)	240 (0.3)	220,201,436 (99.8)
No	1,170 (80.6)	2,768,442 (81.5)	75,151 (99.7)	520,156 (0.2)
Missing****	2,096	5,921,903	102,848	345,394,506
Did Patient Leave Against Medical Advice?				
Yes	106 (3.0)	302,802 (3.2)	1,904 (1.1)	6,084,300 (1.1)
No	3,441 (97.0)	9,017,111 (96.8)	176,335 (98.9)	560,031,798 (98.9)
Did Patient Leave Without Being Seen?				
Yes	53 (1.9)	103,645 (1.4)	2,824 (2.0)	442,563,092 (98.1)
No	2,765 (98.1)	7,301,265 (98.6)	140,654 (98.0)	8,665,943 (1.9)
Missing**	729	1,915,003	34,761	114,887,063

†Frequencies less than 30 for any category are considered unreliable and should be ignored.

*Observations missing and omitted from comparison, this question not on NHAMCS Survey prior to 2005.

**Observations missing and omitted from comparison, this question only on NHAMCS Survey prior to 2007.

***Observations missing and omitted from comparison, this question only present on the 2006 NHAMCS Survey.

****This question was present in only 2003 and 2004 surveys.

Table 15. Follow Up, Referrals, and Patient Outcomes, Continued.

Characteristic	Alcohol Related Visits		Non-Alcohol Related Visits	
	Unweighted Freq. (%)	Weighted Freq. (%)	Unweighted Freq. (%)	Weighted Freq. (%)
Did Patient Die in the ED?				
Yes †	3 (0.1)	6,326 (0.1)	316 (0.2)	1,011,920 (0.2)
No	3,544 (99.9)	9,313,587 (99.9)	177,923 (99.8)	565,104,178 (99.8)
Was Patient Transferred to a Different Hospital?				
Yes	255 (7.2)	734122 (7.9)	3,348 (1.9)	10,142,617 (1.8)
No	3,292 (92.8)	8585791 (92.1)	174,891 (98.1)	55,5973,481 (98.2)
Was Patient Admitted to an Observation Unit?				
Yes	123 (3.5)	184629 (1.9)	2,145 (1.2)	5,539,541 (1.0)
No	3,424 (96.5)	9135284 (98.0)	176,094 (98.8)	560,576,557 (99.0)
Was Patient Admitted to this Hospital?				
Yes	651 (18.4)	1581513 (17.0)	23,272 (13.1)	72,558,937 (12.8)
No	2,896 (81.6)	7738400 (83.0)	154,967 (86.9)	493,557,161 (87.2)

†Frequencies less than 30 for any category are considered unreliable and should be ignored.

*Observations missing and omitted from comparison, this question not on NHAMCS Survey prior to 2005.

**Observations missing and omitted from comparison, this question only on NHAMCS Survey prior to 2007.

***Observations missing and omitted from comparison, this question only present on the 2006 NHAMCS Survey.

****This question was present in only 2003 and 2004 surveys.

Table 16. Comparison of Follow Up, Referrals, and Patient Outcomes between Alcohol Related and Non-Alcohol Related Visits.

Visit Characteristic (continued)	Alcohol Related Visits	Non-Alcohol Related Visits	Rao-Scott χ^2 (p)	OR	95% CI
	Weighted Percentage	Weighted Percentage			
Was Medical Follow Up Planned for this Patient?					
Yes	9.8	6.1	=0.0037	1.72	1.64 - 1.81
Was Patient Referred to Physician or Clinic Follow Up?					
Yes	48.5	63.2	<0.0001	0.55	0.48 - 0.64
Was Patient Referred to Social Services?					
Yes	7.4	0.7	<0.0001	12.14	9.00 - 16.38
Was Patient Referred to Alcohol or Drug Treatment?					
Yes	18.5	0.2	<0.0001	96.27	72.80 - 127.29
Did Patient Leave Against Medical Advice?					
Yes	3.2	1.1	<0.0001	3.09	2.26 - 4.23
Did Patient Leave without Being Seen?					
Yes	1.4	1.9	=0.0827	0.73	0.50 - 1.04
Was Patient Admitted to the Hospital?					
Yes	7.9	1.8	=0.0062	1.32	1.05 - 1.51
Was Patient Admitted to an Observation Unit?					
Yes	1.9	1.0	NS		
Was Patient Admitted to this Hospital?					
Yes	17.0	12.8	<0.0001	1.39	1.21 - 1.59

CHAPTER 5

STUDY LIMITATIONS, DISCUSSION, AND RECOMMENDATIONS

Study Limitations

The results of this study are limited by several factors including the design of the NHAMCS multi-stage probabilistic survey itself, the scarcity of occurrence of alcohol related visits, project definitions and assumptions as well as processes of alcohol documentation and ICD9-CM assignment in EDs across the US. These limitations complicate the interpretation of results and make comparisons to future data impossible. Benchmarking the rate at which patients are referred to alcohol and drug treatment is no longer possible after the 2004 NHAMCS survey since the question about patient referral to alcohol or drug treatment has been removed from the survey instrument.

The nature of probabilistic patient weighting gives rise to potential errors of omission in the NHAMCS data. The NHAMCS sample used in this study takes 181,786 actual patient visits and inflates them to reflect 575,436,011 total patient visits. Hence, on average, one actual patient visit could be inflated to represent 3,165 patient visits. While sampling is random and based on geographic sampling units, during the 2006 NHAMCS study 31 patients in Arizona provided the visit profile of all hospital visits to all EDs serving the entire population of Arizona and New Mexico (NCHS, 2006). The capture of subtle details, regional and cultural variance, and relatively rare events such as alcohol poisoning are unlikely. Details regarding important aspects of patient visits such as patient referral to drug and alcohol abuse treatment and regional variations within such referrals are lost with such generalized regional sampling.

Also intrinsic to the limitations of the NHAMCS data is the difference between patient and patient visit. NHAMCS records represent visits, not unique patients. While the SEEN72 variable is useful for identifying patients with repeated visits in the last 72 hours, it does not describe visitation to the ED at the patient level. For instance, the same person might visit an NHAMCS sampled hospital once per month during the four month NHAMCS sampling period. Assuming that each of the visits was similar (in terms of patient characteristics) and that some of the medical issues were related, this one patient now represents over 12,500 patient visits. While this example oversimplifies the problem, it should be noted that NHAMCS provides no way to identify individual patients and data presented in this paper are only reflective of patient visits, not patients.

The usefulness of the NHAMCS data for the description of alcohol related patient visits is reduced as the survey instrument used for sampling has changed from year to year. Important questions which document patient alcohol and drug use, referral to specific services like alcohol and drug rehabilitation, and query issues such as patient injury are intermittently asked on the survey instrument. Many of these important questions have been discontinued to increase compliance with survey completion by overburdened hospitals. A major NHAMCS survey instrument change which impacted these study results included the discontinuation of the question about referral of patients to alcohol in surveys after 2004. Other pertinent data such as the percentage of individuals living in poverty and mean household income were only present in one year of survey data making them useless for investigating the link between socioeconomic status and relatively rare health occurrences such as acute alcohol intoxication.

NHAMCS data are best utilized for the common medical event. In anticipation that the numbers of patient visits for alcohol related conditions would be relatively small, several years of NHAMCS data were combined. The resultant proportion of patient visits in the study sample used was still relatively small (less than 2% in any given year of data). This made both the accurate comparison of patient and visit characteristics associated with alcohol related visits difficult. Issues of missing data and lack of procedure for merging DRG codes with weighted sample estimates made the quantification of the medical costs associated with alcohol related conditions impossible.

Project assumptions and definitions represent another source of potential error in this study. Alcohol related groupings assigned to each NHAMCS patient visit and described in the methods section of this paper, reflect a crosswalk of ICD9-CM diagnoses to DSM-IV diagnostic criteria. These useful categories incorporate commonalities of alcohol related visit characteristics such as procedures and medications administered. Unlike the assignment of alcohol attributable fraction for each visit, a more commonly used process in similar studies, they base alcohol related designation on actual diagnoses. However, due to both small unweighted sample size and the lack of specificity found in the three diagnostic codes assigned to each patient visit, the usefulness of these categories for describing the differences in patients between these alcohol related patient groups and proposed hypothesis testing was limited. It may be a better practice, therefore, to continue to use alcohol attributable fractions or to incorporate them into the definitions of acute alcohol intoxicated visits, chronic alcohol visits, and other alcohol related visit categories.

Finally, there exists a large body of evidence to support the inaccuracy and difficulty in translating physician diagnoses into a numeric code (ICD9-CM) (Cherpitel et

Al., 2006). This problem is compounded in this study sample by the fact that NHAMCS only allows three diagnostic codes which are meant to reflect the most primary reasons for this ED visit. For example, an alcohol intoxicated patient involved in a motor vehicle crash might present with a head trauma, laceration to the common carotid, and a femur fracture. This example scenario could be accurately recoded into ICD9-CM format in a number of ways. One could assign a code for only the head trauma, the laceration, and the fracture and omit the alcohol relatedness. One could also, assign a motor vehicle crash ECODE which codes for alcohol involvement, a code for the head trauma, and a code for the laceration. One could also code this patient for head trauma, laceration, and acute alcohol intoxication. Each of these coding outcomes accurately describes the event but change its relatedness to alcohol. In order to minimize this source of error, the most general alcohol relatedness group was used for comparison and hypotheses testing.

Discussion

This study identified an annual average of 1.9 million weighted ED visits which could be attributed to alcohol during the study period. This represents 1.95% of all patient visits to EDs annually. This proportion is consistent with past research which set the proportion of alcohol attributable visits identified in NHAMCS data between 1.8% – 2.7% using slightly different algorithms for the assignment of alcohol relatedness (Li et al., 1998; Larson et al., 2006; Locker et al., 2007). In past research, the highest identified proportions for alcohol related visits utilized an alcohol attributable fraction algorithm which assigns relatedness to alcohol by medical condition, not actual alcohol diagnosis. For example, a diagnosis of liver failure elicits an alcohol attributable fraction of 0.5,

even though no alcohol was indicated as part of a diagnosis in the patient record. Hence, the proportion of alcohol related visits calculated by this study is more an indication of intoxicated patients or patients who sustained an injury related to alcohol consumption. Only a small proportion of the alcohol related group identified in the study could attribute their designation to a chronic alcohol related diagnosis (3.5%) (e.g. alcohol induced ascites). This study failed to compare the characteristics of those alcohol related visits which are acute (e.g. alcohol poisoning) versus chronic (e.g. alcohol related ascites) in nature.

The rate of alcohol related visits to US EDs calculated for the study period was 1,619.6 per 100,000 visits. This rate is comparable with visit rates calculated in other studies which utilized ED census based data calculated with the 2005 National Alcohol Survey (Cherpitel et al., 2008). During the study period, there was no evident increase in the proportion of alcohol attributable visits to EDs nor were there any significant trends in rates per 100,000 ED visits. Again, this lack of positive or negative trend in alcohol visit rate was consistent with findings in other ED based studies which utilized other data sources such as the 2005 National Alcohol Survey. Hence, at risk alcohol consumption may be on the rise as evidenced in the latest BRFSS results but it has not translated into a significant increase in ED visits for alcohol related problems at least among the 2003 – 2007 NHAMCS survey data (CDC, 2002).

Problematic to the quantification of the actual prevalence of alcohol related visits to US EDs is the lack of documentation of alcohol intoxication at the clinician level. While the alcohol relatedness of visits in this study were designated based upon diagnostic codes related to alcohol and the treatment of alcohol intoxication,

documentation of the measurement of BAC and other toxicological findings were strangely absent. In this study, only 36.3% of patients presenting with alcohol related conditions and 1.1% of all other patients were administered a test for BAC. In studies which screened all patients encountered for alcohol use, the prevalence of alcohol related visits was much greater. In studies which screened every patient encountered for alcohol, prevalence of alcohol related visits ranged from 9% – 38% of all patients encountered (Gentilello et al., 2005). Therefore, it is expected that this study's reported proportion of alcohol related visits is far lower than the actual prevalence. Barriers to the documentation and screening of alcohol use among patients presenting to EDs need to be addressed. Procedural changes to hospital triage including the requirement of alcohol screening even if only when indicated (e.g. patient smells of alcohol) and proper documentation will increase the accuracy of attempts at quantifying the prevalence of alcohol related visits as well as the impact of interventions to reduce these visits such as SBIRT.

SBIRT advocates require data which documents the financial impact of alcohol related visits and the cost savings associated with the SBIRT intervention. Due to the problems merging DRG codes onto weighted visit in the NHAMCS data utilized for this project, visit cost estimates were not calculated. However, given that previous research using the National Alcohol Survey has identified the median cost of an alcohol related ED visit to be \$2,250.00, and that this study identified an average of 1,863,982 alcohol related visits to US EDs, the total cost of alcohol related visits in the US could be approximated at \$4,193,960,850 (Cherpitel et al., 2005). The financial impact of alcohol related visits, and the subset of these visits which are acute alcohol detoxifications or

related to chronic inebriates requires further study. The future of SBIRT programs hinges upon the provision of accurate data regarding the cost benefit of implementing the intervention. Decision makers and stakeholders will require cost data to justify the initial expense of implementing these indicated interventions.

Patient Characteristics

Consistent with the literature and predicted in the stated project hypotheses; patients seen for alcohol related visits were more apt to be males, aged 25 – 44 years. This finding is consistent with a large body of literature which identified males in this age group as the primary risk group for alcohol abuse and heavy alcohol consumption (Cherpitel, 2005; Gentilello, 2005; McDonald, 2004). The greater proportion of males in the alcohol related condition group might also be attributed to the large proportion of women seen for pregnancy and childbirth in US EDs. Other dangerous alcohol consumption patterns such as binge drinking and moderate alcohol consumption are generally associated with younger age groups and alcohol associated injuries more prevalent among younger aged males. In this study, visits to US EDs for alcohol related conditions are most commonly found among the 25 – 44 year old age group. Significant differences were found in the Hispanic, and American Indian and Alaskan Native populations in terms of greater likelihood of presenting to a US ED for alcohol related conditions. Black/African Americans had a reduced likelihood of presenting to US EDs for alcohol related conditions. While it has been demonstrated in the literature that alcohol abuse is more prevalent among Hispanics and American Indians and Alaskan Natives, the results presented in this project are questionable because the race assigned to

each patient by the NCHS was imputed and recoded (SAMHSA, 2003). Unfortunately, the race imputation procedure used by NHAMCS is not clearly defined in the data documentation and was not readily defined in the literature. Many racial imputation procedures rely on the use of surnames. The accuracy of surname based racial imputation has been questioned (Sandberg, 2009).

It was predicted that patients presenting for alcohol related conditions to US EDs would be from lower socioeconomic strata. This was not demonstrated with statistical significance using the two measures of socioeconomic status present in the 2006 NHAMCS data, percent poverty in the patient's zip code and median household income in the patient's zip code. There is a possibility that this was partially due to the survey design which samples from particular hospital services areas in order to cover all hospital services areas. The distribution of the quartiles of these two measures of patient socioeconomic status are so evenly distributed that they may reflect the sampling process. However, in the literature, insurance status or primary payer information has been used as a proxy measure for income level. Patients who are uninsured and more apt to be self-pay or to pay medical bills with Medicaid are usually from lower socioeconomic strata (Hing et al., 2004). In this study, patients presenting to the ED with alcohol related conditions were 2.63 times more apt to primarily pay for their visit themselves than patients presenting to the ED with non-alcohol related conditions. The primary payer in non-alcohol related visits was most frequently private insurance (35.6% of weighted visits). Conversely, alcohol related patients less frequently paid their medical costs with private insurance. Patients seen for alcohol related conditions were less likely to pay with government based healthcare such as Medicare and Medicaid. Since the majority of the

alcohol related visit population was between the ages of 25 – 44 years, it is expected that a small proportion of the patients would qualify for either Medicare or Medicaid due to age limitations associated with these government services.

Another proxy measure for low socioeconomic status is residence (Deonandan et al., 2000). Patients identified as homeless are expected to be from lower socioeconomic strata. Alcohol related patients were 5.68 times more apt to be homeless than non-alcohol related patients. It was hypothesized and demonstrated that patients seen for alcohol related condition would be more frequently homeless than patients seen for other condition. This finding is supported by the literature that chronic inebriates and patients seen in EDs for acute intoxication are more frequently have transient housing status (Pearson et al., 2007). There are many reasons for the link between alcohol related visits and homelessness in the literature. Homeless individuals often struggle with mental health issues which might be self-medicated with alcohol (SAMHSA, 2003). Furthermore, individuals in lower socioeconomic strata are at greater risk for alcohol abuse (Pearson et al., 2007). It is known that many homeless males between the ages of 25 – 60 years old are veterans of US wars. Past research has demonstrated that Veterans are also at greater risk for alcohol abuse and homelessness (CDC, 2002). Males in the age groups found at greater proportion in this study might be comprised of veterans. Finally, long term abuse of alcohol has deleterious effects on finances and employment. These effects may contribute to finding oneself without a permanent residence.

Visit Characteristics

A major of focus of this project was to measure the resource utilization of patients presenting to US EDs with alcohol related conditions. Based on previous research it was

hypothesized that these patients would utilize a greater proportion of medical services than patients presenting with other types of conditions. Indeed, patients who present to US EDs for alcohol related conditions utilize more medical services than non-alcohol related patients. Patients who present to EDs with alcohol related conditions do so more frequently during peak ED visit volume periods, evenings and weekends. They are more 5.2 times more apt to arrive at the ED via the costly ambulance and 7 times more apt to arrive via public services including law enforcement and inebriate transport. Patients seen for alcohol related conditions were more apt to receive diagnostic and screening services for their visit ($p < 0.0001$). These patients received more mean diagnostic services during their visit than patients presenting for non-alcohol related conditions ($p < 0.0001$). These patients received more of every kind of diagnostic test recorded on the NHAMCS survey instrument with the exception of diagnostic imaging. The increased number of diagnostic and screening services received by alcohol related patients translates into longer stays in the ED. The average length of alcohol related patient visit to the ED was 14.8 hours, significantly longer than ED visits for non-alcohol related conditions. These longer stays associated with alcohol related visits translate into longer wait times for patients, fewer ED beds available, forced closures of the ED, and ambulance diversions.

The resource intensive care of alcohol related patients is compounded by the fact that these patients frequently return to the ED on a regular basis. In the literature, these ‘frequent users’ of the ED are seen multiple times for the same diagnosis, generally acute alcohol intoxication. While the NHAMCS data analyzed does not contain variables which address what diagnosis are represented within each patient’s repeated ED use, results demonstrated that patients seen for alcohol related conditions are frequent users of the

ED. Alcohol related patients are more likely to have been seen before in the last 72 hours at the same ED. Similarly, alcohol related patients have had more mean visits to the original ED in the last year than non-alcohol related patients ($p=0.0028$). This pattern of multiple visits for alcohol related patients has been documented both in EDs as well as trauma centers by previous research (Adekoya, 2005).

Resource utilization of patients presenting to US EDs for alcohol related conditions can be explained in part by the correlation between alcohol intoxication and injury. While describing the proportion of alcohol intoxicated patients who are injured is difficult because acute alcohol intoxication can be coded as an injury; results seemed to confirm that alcohol related patients more frequently were injured than their non-alcohol related counterparts. Patient visits for alcohol related problems were 64.5 times more apt to be related to an injury of any kind. Specifically these visits were 18.8 times more apt to be related to self-inflicted injury, 1.6 times more apt to be the result of an assault, and 1.6 times more apt to be related to an unintentional injury. These results are consistent with the findings of a number of studies which suggest that alcohol increases the risk of all types of injury (Cherpitel et al., 2005).

Contrary to the original hypotheses that patients seen for alcohol related visits would have lower triage acuity, results indicated that these patients actually had higher triage acuity than patients seen for other conditions. The prevalence of injury among alcohol related patients might explain why these patients were triaged with greater urgency of being seen by a physician than patient presenting for non-alcohol related conditions. However, the clinical difficulties presented by the alcohol intoxicated patient may also contribute in increased triage acuity. Patients who are intoxicated might be

unconscious, unresponsive, and unable to answer medical questions. Furthermore, since these alcohol intoxicated patients are generally injured, physicians may seek to rule out injury related causes of lowered states of consciousness. For example, an unconscious alcohol intoxicated patient who presents to the ED with injuries consistent with an assault may require additional screening and diagnostic exams to rule out the dangerous diagnosis of head injury. The difficulty presented in assessing and diagnosing the alcohol intoxicated patient contributes greatly to length of visit and the amount of medical services utilized per visit.

Rates of Referral

It was predicted that referral rates to alcohol and drug treatment among patients presenting with alcohol related conditions would be low, however, low was never defined as a specific proportion of patients referred. In the literature, patients presenting with alcohol related conditions were referred by ED physicians between 8% - 32% (Seppa et al., 2004). During the two years of NHAMCS data analyzed which contain information regarding the specific referral of patient to alcohol and drug treatment, 18.5% of all patients presenting with alcohol related conditions were referred. In fact, these patients were 96.3 times more likely to be referred to alcohol or drug treatment than their non-alcohol related counterparts. Other measures of patient referral and outcome might impact the rates of ultimate referral to substance abuse treatment. These include patients who are admitted to the hospital for their medical problems, patients who are referred to other physicians or clinics for follow up, patients who leave the ED without being seen, and patients who leave the ED against medical advice (after being seen). Alcohol related

patients were 1.7 times more apt have medical follow up (non-specific) planned for them upon discharge. They were less 0.6 times less likely to be referred to another physician or clinic for follow up. This is no doubt related to the lack of insurance seen among the alcohol related population. Alcohol related patients less likely to leave without being seen but more likely to leave against medical advice. This is indicative of the disease etiology of the sobering patient. Patients who are inebriated and then become sober enough to be ambulatory tend to want to leave rather than complete their alcohol (and sometimes drug) detoxification (Shermer, 2005). Finally, it is not clear whether patients who are admitted to the hospital are given further referral to alcohol and drug treatment. Patients seen for alcohol related conditions are 1.4 times more apt to be admitted and perhaps received further referral upon discharge from a hospital bed.

Recommendations

The burden placed on the ED by alcohol abuse is evident. Increased patient visits, resource utilization, patient injury, and longer ED stays have been demonstrated among those who present to the ED with alcohol related conditions. These resource intensive visits translate to increased medical costs which are not often covered by private insurance and no doubt contribute to rising healthcare costs. The net effect is an emergency medical service delivery system which is overburdened; causing increases in patient wait times, the percentage of patients who leave without being seen by a physician, ED closures, ambulance diversion rates, and declines in the quality of health care.

Patients presenting with alcohol problems also face negative outcomes of their alcohol use. These patients are more difficult to accurately diagnose, treat, and have

worse health outcomes than patients presenting for other conditions. These patients face repeated visits to the ED, many of which will be for injuries related to their continued at risk alcohol consumption.

The ED is a frontline of care for a cross section of the US population. Individuals presenting to the ED are from all socioeconomic strata and represent both the insured and uninsured. The CDC has called for ED physicians to recognize and treat alcohol abuse. In response to burgeoning alcohol related trauma, increased rates of readmission for injuries among alcohol consumers and high levels of detoxification, an indicated intervention collectively known as SBIRT has been applied. This effective intervention should be implemented particularly among the chronic inebriate and alcohol related injury patient population. This ED based intervention will require funding and its importance in reducing the burden on EMS must be underscored so that it can gain greater acceptance in the already busy ED setting.

Early detection of alcohol problems and subsequent intervention relies on screening patients for at risk alcohol consumption patterns. More research is required to help identify the actual prevalence of alcohol in the ED. Changes in triage protocols and training which increase clinician awareness of the negative and costly outcomes of at risk alcohol consumption are needed to promote alcohol screening and counseling as a standard of patient care. The measurement of BAC, given its correlation in past research studies to at risk consumption patterns, should be added to the few diagnostic tests (heart rate, blood pressure, temperature) which are taken at triage upon patient entry into an ED.

Alcohol abuse treatment outcomes are related to how early intervention is provided. Better outcomes are associated with earlier intervention (SAMHSA, 2002).

Hence, further research should attempt to identify those patients at greatest risk for problematic alcohol consumption. Injuries such as motor vehicle crashes associated with driving while intoxicated may present an opportunity for early intervention. More research is needed to reveal ED utilization patterns of chronic inebriates so that intervention may be applied before they become chronic.

In order for indicated interventions such as SBIRT to be effective, more research is needed to understand the difference between patients who are referred to alcohol and substance abuse treatment in the ED and those who are not. There may be a link between insurance status and ultimate referral for substance abuse treatment. Ultimate referral may be impacted by issues in physician training, attitudes toward chronic inebriates, and awareness of alcohol and its impact on both the emergency medical service delivery system and patients alike. Furthermore, referral may be impacted by substance abuse treatment availability which in itself has greater implications for improving capacity for treatment. Public health officials and emergency medical service providers need to work together towards addressing at risk alcohol consumption because of the burden chronic inebriates place on the ED, the correlation of alcohol use and injury, and to provide better outcomes for patients.

APPENDIX 1
CROSSWALK BETWEEN DSM-IV and ICD9-CM
FOR ALCOHOL RELATED CONDITIONS

DSM-IV Category	DSM-IV Description	ICD9-CM Code	ICD9-CM Description
Alcohol Abuse	<p>A. A maladaptive pattern of substance use leading to clinically significant impairment or distress, as manifested by one (or more) of the following, occurring within a 12-month period:</p> <p>(1) recurrent substance use resulting in a failure to fulfill major role obligations at work, school, or home (e.g., repeated absences or poor work performance related to substance use; substance-related absences, suspensions, or expulsions from school; neglect of children or household)</p> <p>(2) recurrent substance use in situations in which it is physically hazardous (e.g., driving an automobile or operating a machine when impaired by substance use)</p> <p>(3) recurrent substance-related legal problems (e.g., arrests for substance-related disorderly conduct)</p> <p>(4) continued substance use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance (e.g., arguments with spouse about consequences of Intoxication, physical fights)</p> <p>B. The symptoms have never met the criteria for Substance Dependence for this class of substance.</p>	303.1 – 303.9	Alcohol abuse
		710	Alcohol use/abuse
Alcohol Dependence	<p>A. A maladaptive pattern of substance use, leading to clinically significant impairment or distress, as manifested by three (or more) of the following, occurring at any time in the same 12-month period:</p> <p>(1) tolerance, as defined by either of the following:</p> <p style="padding-left: 20px;">(a) a need for markedly increased amounts of the substance to achieve Intoxication or desired effect</p> <p style="padding-left: 20px;">(b) markedly diminished effect with continued use of the same amount of the substance</p> <p>(2) Withdrawal, as manifested by either of the following:</p> <p style="padding-left: 20px;">(a) the characteristic withdrawal syndrome for the substance (refer to Criteria A and B of the criteria sets for Withdrawal from the specific substances)</p> <p style="padding-left: 20px;">(b) the same (or a closely related) substance is taken to relieve or avoid withdrawal symptoms</p> <p>(3) the substance is often taken in larger amounts or over a longer period than was intended</p> <p>(4) there is a persistent desire or unsuccessful efforts to cut down or control substance use</p> <p>(5) a great deal of time is spent in activities necessary to obtain the substance (e.g., visiting multiple doctors or driving long distances), use the substance (e.g., chain-smoking), or recover from its effects</p> <p>(6) important social, occupational, or recreational activities are given up or reduced because of substance use</p> <p>(7) the substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance (e.g., current cocaine use despite recognition of cocaine-induced depression, or continued drinking despite recognition that an ulcer was made worse by alcohol consumption)</p>	980.0	Alcohol Dependence

Alcohol Induced Anxiety Disorder	<p>A. Prominent anxiety, Panic Attacks, or obsessions or compulsions predominate in the clinical picture.</p> <p>B. There is evidence from the history, physical examination, or laboratory findings of either (1) or (2): (1) the symptoms in Criterion A developed during, or within 1 month of, Substance Intoxication or Withdrawal (2) medication use is etiologically related to the disturbance</p> <p>C. The disturbance is not better accounted for by an Anxiety Disorder that is not substance induced. Evidence that the symptoms are better accounted for by an Anxiety Disorder that is not substance induced might include the following: the symptoms precede the onset of the substance use (or medication use); the symptoms persist for a substantial period of time (e.g., about a month) after the cessation of acute withdrawal or severe intoxication or are substantially in excess of what would be expected given the type or amount of the substance used or the duration of use; or there is other evidence suggesting the existence of an independent non-substance-induced Anxiety Disorder (e.g., a history of recurrent non-substance-related episodes).</p> <p>D. The disturbance does not occur exclusively during the course of a Delirium.</p> <p>E. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.</p>	291.8	Other Unspecified Alcohol Induced Mental Disorders
Alcohol Intoxication	<p>A. Recent ingestion of alcohol.</p> <p>B. Clinically significant maladaptive behavioral or psychological changes (e.g., inappropriate sexual or aggressive behavior, mood lability, impaired judgment, impaired social or occupational functioning) that developed during, or shortly after, alcohol ingestion.</p> <p>C. One (or more) of the following signs, developing during, or shortly after, alcohol use: (1) slurred speech (2) incoordination (3) unsteady gait (4) nystagmus (5) impairment in attention or memory (6) stupor or coma</p> <p>D. The symptoms are not due to a general medical condition and are not better accounted for by another mental disorder.</p>	303.0	Acute Alcohol Intoxication
Alcohol Intoxication Delirium	<p>A. Disturbance of consciousness (i.e., reduced clarity of awareness of the environment) with reduced ability to focus, sustain, or shift attention.</p> <p>B. A change in cognition (such as memory deficit, disorientation, language disturbance) or the development of a perceptual disturbance that is not better accounted for by a preexisting, established, or evolving dementia.</p> <p>C. The disturbance develops over a short period of time (usually hours to days) and tends to fluctuate during</p>	291.0	Alcoholic Delirium

	<p>the course of the day.</p> <p>D. There is evidence from the history, physical examination, or laboratory findings of either (1) or (2):</p> <p>(1) the symptoms in Criteria A and B developed during Substance Intoxication</p> <p>(2) medication use is etiologically related to the disturbance</p>		
Alcohol Induced Mood Disorder	<p>A. A prominent and persistent disturbance in mood predominates in the clinical picture and is characterized by either (or both) of the following:</p> <p>(1) depressed mood or markedly diminished interest or pleasure in all, or almost all, activities</p> <p>(2) elevated, expansive, or irritable mood</p> <p>B. There is evidence from the history, physical examination, or laboratory findings of either (1) or (2):</p> <p>(1) the symptoms in Criterion A developed during, or within 1 month of, Substance Intoxication or Withdrawal</p> <p>(2) medication use is etiologically related to the disturbance</p> <p>C. The disturbance is not better accounted for by a Mood Disorder that is not substance induced. Evidence that the symptoms are better accounted for by a Mood Disorder that is not substance induced might include the following: the symptoms precede the onset of the substance use (or medication use); the symptoms persist for a substantial period of time (e.g., about a month) after the cessation of acute withdrawal or severe intoxication or are substantially in excess of what would be expected given the type or amount of the substance used or the duration of use; or there is other evidence that suggests the existence of an independent non-substance-induced Mood Disorder (e.g., a history of recurrent Major Depressive Episodes).</p> <p>D. The disturbance does not occur exclusively during the course of a Delirium.</p> <p>E. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.</p>	291.8	Other Unspecified Alcohol Induced Mental Disorders
Alcohol Induced Persisting Amnestic Disorder	<p>A. The development of memory impairment as manifested by impairment in the ability to learn new information or the inability to recall previously learned information.</p> <p>B. The memory disturbance causes significant impairment in social or occupational functioning and represents a significant decline from a previous level of functioning.</p> <p>C. The memory disturbance does not occur exclusively during the course of a Delirium or a Dementia and persists beyond the usual duration of Substance Delirium or Withdrawal.</p> <p>D. There is evidence from the history, physical examination, or laboratory findings that the memory disturbance is etiologically related to the persisting effects of substance use (e.g., a drug of abuse, a medication).</p>	291.1	Alcohol Induced Persisting Amnestic Disorder
	A. The development of multiple cognitive deficits manifested by both	291.2	Alcohol

<p>Alcohol Induced Persisting Dementia</p>	<p>(1) memory impairment (impaired ability to learn new information or to recall previously learned information) (2) one (or more) of the following cognitive disturbances: (a) aphasia (language disturbance) (b) apraxia (impaired ability to carry out motor activities despite intact motor function) (c) agnosia (failure to recognize or identify objects despite intact sensory function) (d) disturbance in executive functioning (i.e., planning, organizing, sequencing, abstracting) B. The cognitive deficits in Criteria A1 and A2 each cause significant impairment in social or occupational functioning and represent a significant decline from a previous level of functioning. C. The deficits do not occur exclusively during the course of a delirium and persist beyond the usual duration of Substance Intoxication or Withdrawal. D. There is evidence from the history, physical examination, or laboratory findings that the deficits are etiologically related to the persisting effects of substance use (e.g., a drug of abuse, a medication).</p>		<p>Induced Persisting Dementia</p>
<p>Alcohol Induced Psychotic Disorder</p>	<p>A. Prominent hallucinations or delusions. Note: Do not include hallucinations if the person has insight that they are substance induced. B. There is evidence from the history, physical examination, or laboratory findings of either (1) or (2): (1) the symptoms in Criterion A developed during, or within a month of, Substance Intoxication or Withdrawal (2) medication use is etiologically related to the disturbance</p>	<p>291.3</p>	<p>Alcohol Induced Psychotic Disorder with Hallucinations</p>

	<p>C. The disturbance is not better accounted for by a Psychotic Disorder that is not substance induced. Evidence that the symptoms are better accounted for by a Psychotic Disorder that is not substance induced might include the following: the symptoms precede the onset of the substance use (or medication use); the symptoms persist for a substantial period of time (e.g., about a month) after the cessation of acute withdrawal or severe intoxication, or are substantially in excess of what would be expected given the type or amount of the substance used or the duration of use; or there is other evidence that suggests the existence of an independent non-substance-induced Psychotic Disorder (e.g., a history of recurrent non-substance-related episodes).</p> <p>D. The disturbance does not occur exclusively during the course of a delirium. Note: This diagnosis should be made instead of a diagnosis of Substance Intoxication or Substance Withdrawal only when the symptoms are in excess of those usually associated with the intoxication or withdrawal syndrome and when the symptoms are sufficiently severe to warrant independent clinical attention.</p>	291.5	Alcohol Induced Psychotic Disorder with Delusions
Alcohol Induced Sexual Dysfunction	<p>A. Clinically significant sexual dysfunction that results in marked distress or interpersonal difficulty predominates in the clinical picture.</p> <p>B. There is evidence from the history, physical examination, or laboratory findings that the sexual dysfunction is fully explained by substance use as manifested by either (1) or (2): (1) the symptoms in Criterion A developed during, or within a month of, Substance Intoxication (2) medication use is etiologically related to the disturbance</p> <p>C. The disturbance is not better accounted for by a Sexual Dysfunction that is not substance induced. Evidence that the symptoms are better accounted for by a Sexual Dysfunction that is not substance induced might include the following: the symptoms precede the onset of the substance use or Dependence (or medication use); the symptoms persist for a substantial period of time (e.g., about a month) after the cessation of intoxication, or are substantially in excess of what would be expected given the type or amount</p>	291.8	Other Unspecified Alcohol Induced Mental Disorders

	of the substance used or the duration of use; or there is other evidence that suggests the existence of an independent non-substance-induced Sexual Dysfunction (e.g., a history of recurrent non-substance-related episodes).		
Alcohol Induced Sleep Disorder	<p>A. A prominent disturbance in sleep that is sufficiently severe to warrant independent clinical attention.</p> <p>B. There is evidence from the history, physical examination, or laboratory findings of either (1) or (2): (1) the symptoms in Criterion A developed during, or within a month of, Substance Intoxication or Withdrawal (2) medication use is etiologically related to the sleep disturbance</p> <p>C. The disturbance is not better accounted for by a Sleep Disorder that is not substance induced. Evidence that the symptoms are better accounted for by a Sleep Disorder that is not substance induced might include the following: the symptoms precede the onset of the substance use (or medication use); the symptoms persist for a substantial period of time (e.g., about a month) after the cessation of acute withdrawal or severe intoxication, or are substantially in excess of what would be expected given the type or amount of the substance used or the duration of use; or there is other evidence that suggests the existence of an independent non-substance-induced Sleep Disorder (e.g., a history of recurrent non-substance-related episodes).</p> <p>D. The disturbance does not occur exclusively during the course of a delirium.</p> <p>E. The sleep disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.</p>	291.8	Other Unspecified Alcohol Induced Mental Disorders
Alcohol Withdrawal	<p>A. Cessation of (or reduction in) alcohol use that has been heavy and prolonged.</p> <p>B. Two (or more) of the following, developing within several hours to a few days after Criterion A: (1) autonomic hyperactivity (e.g., sweating or pulse rate greater than 100) (2) increased hand tremor (3) insomnia (4) nausea or vomiting (5) transient visual, tactile, or auditory hallucinations or illusions (6) psychomotor agitation (7) anxiety (8) grand mal seizures</p> <p>C. The symptoms in Criterion B cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.</p> <p>D. The symptoms are not due to a general medical condition and are not better accounted for by another mental disorder. Specify if: With Perceptual Disturbances</p>	291.8	Other Unspecified Alcohol Induced Mental Disorders
Alcohol	This designation abbreviated NOS can be used when the mental disorder appears to fall within the larger	291.9	Unspecified

Related Disorder NOS	category but does not meet the criteria of any specific disorder within that category.		Alcohol Induced Mental Disorder
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APPENDIX 2
NHAMCS SURVEY INSTRUMENT

Form Approved OMB No. 0930-0044 Exp. Date 06/30/2007 CDC W4-140

<p>NAMCS-30 (10-2002)</p> <p style="text-align: center;">U.S. DEPARTMENT OF COMMERCE Economic Development Administration U.S. Census Bureau Office of Health Statistics and Research U.S. Department of Health and Human Services Centers for Disease Control and Prevention National Center for Health Services</p> <p style="text-align: center;">NATIONAL AMBULATORY MEDICAL CARE SURVEY 2006 PATIENT RECORD</p> <p style="font-size: small;">Assurance of confidentiality - All information which would permit identification of an individual, a practice, or an establishment will be held confidential, will be used only by persons assigned to do so for the purpose of the survey and will not be disclosed or released to other persons or used for any other purpose without the consent of the individual or the establishment (in accordance with section 308(a) of the Public Health Service Act 142 USC 242a).</p>	<p>PATIENT RECORD NO.</p> <p>PATIENT'S NAME</p>	
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1. PATIENT'S DEMOGRAPHICS

<p>a. Date of visit</p> <p>Month: <input type="text"/> Day: <input type="text"/> Year: <input type="text"/></p> <p>b. ZIP code</p> <p><input type="text"/></p> <p>c. Date of birth</p> <p>Month: <input type="text"/> Day: <input type="text"/> Year: <input type="text"/></p>	<p>d. Sex</p> <p><input type="checkbox"/> Female - Is patient pregnant?</p> <p><input type="checkbox"/> Yes - Specify gestation week: <input type="text"/></p> <p><input type="checkbox"/> No</p> <p>e. Ethnicity</p> <p><input type="checkbox"/> Hispanic or Latino</p> <p><input type="checkbox"/> Not Hispanic or Latino</p> <p>f. Race - Mark (X) if more than one</p> <p><input type="checkbox"/> White</p> <p><input type="checkbox"/> Black/African American</p> <p><input type="checkbox"/> Asian</p> <p><input type="checkbox"/> Native Hawaiian/Other Pacific Islander</p> <p><input type="checkbox"/> American Indian/Alaska Native</p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Unknown</p>	<p>g. Tobacco use</p> <p><input type="checkbox"/> No current</p> <p><input type="checkbox"/> Former</p> <p><input type="checkbox"/> Current</p> <p><input type="checkbox"/> Unknown</p> <p>h. Expected amount of payment for this visit - Mark (X) if the apply</p> <p><input type="checkbox"/> Private insurance</p> <p><input type="checkbox"/> Medicaid</p> <p><input type="checkbox"/> Medicare</p> <p><input type="checkbox"/> Patient's responsibility</p> <p><input type="checkbox"/> No charge/charity</p> <p><input type="checkbox"/> Other</p> <p><input type="checkbox"/> Unknown</p>	<p>i. Primary condition (main reason for visit)</p> <p>Is this visit related to any of the following?</p> <p><input type="checkbox"/> Unintentional injury/poisoning</p> <p><input type="checkbox"/> Adverse effect of medication/drug or adverse effect of medical drug</p> <p><input type="checkbox"/> None of the above</p> <p><input type="checkbox"/> Unknown</p>
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2. REASON FOR VISIT

<p>a. Patient's complaint(s), symptom(s), or other reason(s) for this visit - Use patient's own words</p> <p>(a) Most important: <input type="text"/></p> <p>(b) Other: <input type="text"/></p> <p>(c) Other: <input type="text"/></p>	<p>b. Are you the patient's primary care provider?</p> <p><input type="checkbox"/> Yes - ICD-9 CM 90</p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Unknown</p> <p>Was patient referred for this visit?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p> <p><input type="checkbox"/> Unknown</p>	<p>c. How many past visits in the last 12 months? Exclude this visit</p> <p><input type="checkbox"/> None</p> <p><input type="checkbox"/> 1-2</p> <p><input type="checkbox"/> 3-5</p> <p><input type="checkbox"/> 6+</p> <p><input type="checkbox"/> Unknown</p> <p><input type="checkbox"/> No, new patient</p> <p>d. Major reason for this visit</p> <p><input type="checkbox"/> New problem (not this visit)</p> <p><input type="checkbox"/> Chronic problem, routine</p> <p><input type="checkbox"/> Chronic problem, flare-up</p> <p><input type="checkbox"/> Pre-Post surgery</p> <p><input type="checkbox"/> Preventive care (e.g., routine prenatal and baby screening, mammogram, gynecological)</p>
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3. PROVIDER'S DIAGNOSIS FOR THIS VISIT

<p>a. As specifically as possible, list diagnosis related to this visit including chronic conditions</p> <p>(a) Primary diagnosis: <input type="text"/></p> <p>(b) Other: <input type="text"/></p> <p>(c) Other: <input type="text"/></p>	<p>b. Regardless of the diagnosis written in 3a, does the patient now have - Mark (X) if not apply</p> <table style="width: 100%;"> <tr> <td><input type="checkbox"/> Asthma</td> <td><input type="checkbox"/> Cardiovascular disease</td> <td><input type="checkbox"/> Acute/chronic glaucoma</td> </tr> <tr> <td><input type="checkbox"/> Allergic rhinitis</td> <td><input type="checkbox"/> COPD</td> <td><input type="checkbox"/> Systemic lupus erythematosus</td> </tr> <tr> <td><input type="checkbox"/> Cataract</td> <td><input type="checkbox"/> Chronic renal failure</td> <td><input type="checkbox"/> Thyroid disease</td> </tr> <tr> <td><input type="checkbox"/> Diabetes</td> <td><input type="checkbox"/> COPD</td> <td><input type="checkbox"/> Obesity</td> </tr> <tr> <td><input type="checkbox"/> Incontinence</td> <td><input type="checkbox"/> Depression</td> <td><input type="checkbox"/> Osteoporosis</td> </tr> <tr> <td><input type="checkbox"/> Liver disease</td> <td><input type="checkbox"/> Hypertension</td> <td><input type="checkbox"/> None of the above</td> </tr> <tr> <td><input type="checkbox"/> Migraine</td> <td><input type="checkbox"/> Unknown</td> <td></td> </tr> </table>	<input type="checkbox"/> Asthma	<input type="checkbox"/> Cardiovascular disease	<input type="checkbox"/> Acute/chronic glaucoma	<input type="checkbox"/> Allergic rhinitis	<input type="checkbox"/> COPD	<input type="checkbox"/> Systemic lupus erythematosus	<input type="checkbox"/> Cataract	<input type="checkbox"/> Chronic renal failure	<input type="checkbox"/> Thyroid disease	<input type="checkbox"/> Diabetes	<input type="checkbox"/> COPD	<input type="checkbox"/> Obesity	<input type="checkbox"/> Incontinence	<input type="checkbox"/> Depression	<input type="checkbox"/> Osteoporosis	<input type="checkbox"/> Liver disease	<input type="checkbox"/> Hypertension	<input type="checkbox"/> None of the above	<input type="checkbox"/> Migraine	<input type="checkbox"/> Unknown		<p>c. Status of patient enrollment in a disease management program for any of the conditions marked in 3b</p> <p><input type="checkbox"/> Currently enrolled</p> <p><input type="checkbox"/> Considered for enrollment at this visit</p> <p><input type="checkbox"/> Not enrolled</p> <p><input type="checkbox"/> Unknown</p>
<input type="checkbox"/> Asthma	<input type="checkbox"/> Cardiovascular disease	<input type="checkbox"/> Acute/chronic glaucoma																					
<input type="checkbox"/> Allergic rhinitis	<input type="checkbox"/> COPD	<input type="checkbox"/> Systemic lupus erythematosus																					
<input type="checkbox"/> Cataract	<input type="checkbox"/> Chronic renal failure	<input type="checkbox"/> Thyroid disease																					
<input type="checkbox"/> Diabetes	<input type="checkbox"/> COPD	<input type="checkbox"/> Obesity																					
<input type="checkbox"/> Incontinence	<input type="checkbox"/> Depression	<input type="checkbox"/> Osteoporosis																					
<input type="checkbox"/> Liver disease	<input type="checkbox"/> Hypertension	<input type="checkbox"/> None of the above																					
<input type="checkbox"/> Migraine	<input type="checkbox"/> Unknown																						

4. VITAL SIGNS

<p>(a) Height: <input type="text"/> <input type="checkbox"/> ft/in <input type="checkbox"/> cm</p> <p>(b) Weight: <input type="text"/> <input type="checkbox"/> lbs <input type="checkbox"/> kg</p> <p>(c) Temperature: <input type="text"/> <input type="checkbox"/> °F <input type="checkbox"/> °C</p> <p>(d) Blood pressure: <input type="text"/> / <input type="text"/></p>	<p>5. PHYSICIAN'S CURRENT TESTS</p> <p>Mark (X) if ordered or provided at this visit</p> <p>Examines:</p> <p><input type="checkbox"/> Head</p> <p><input type="checkbox"/> Neck</p> <p><input type="checkbox"/> Heart</p> <p><input type="checkbox"/> Lungs</p> <p><input type="checkbox"/> Skin</p> <p><input type="checkbox"/> Depression screening</p> <p>Imaging:</p> <p><input type="checkbox"/> Bone mineral density</p> <p><input type="checkbox"/> Mammography</p> <p><input type="checkbox"/> MRA/CT/PET</p> <p><input type="checkbox"/> Ultrasound</p> <p><input type="checkbox"/> X-ray</p> <p><input type="checkbox"/> Other imaging</p> <p>Blood tests:</p> <p><input type="checkbox"/> CBC (complete blood count)</p> <p><input type="checkbox"/> Electrolytes</p> <p><input type="checkbox"/> Glucose</p> <p><input type="checkbox"/> High/LD lipoprotein (cholesterol)</p> <p><input type="checkbox"/> HbA1C (diabetes)</p> <p><input type="checkbox"/> PSA (prostate-specific antigen)</p> <p><input type="checkbox"/> Other blood test</p> <p>Scopes:</p> <p><input type="checkbox"/> Simple procedure (e.g., colonoscopy)</p> <p><input type="checkbox"/> Endoscopy</p> <p>Other tests:</p> <p><input type="checkbox"/> Biopsy</p> <p><input type="checkbox"/> Chlamydia test</p> <p><input type="checkbox"/> PAP test - conventional</p> <p><input type="checkbox"/> PAP test - liquid-based</p> <p><input type="checkbox"/> PAP test - unreported</p> <p><input type="checkbox"/> HPV DNA test</p> <p><input type="checkbox"/> CRP/ESR</p> <p><input type="checkbox"/> Respiratory Pathway function test</p> <p><input type="checkbox"/> Urinalysis (UA)</p> <p><input type="checkbox"/> Other laboratory - specify: <input type="text"/></p>
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6. HEALTH EDUCATION

<p>Mark (X) if ordered or provided at this visit</p> <p><input type="checkbox"/> NICE</p> <p><input type="checkbox"/> Asthma education</p> <p><input type="checkbox"/> Cholesterol</p> <p><input type="checkbox"/> Exercise</p> <p><input type="checkbox"/> Growth/development</p> <p><input type="checkbox"/> Injury prevention</p> <p><input type="checkbox"/> Blood management</p> <p><input type="checkbox"/> Tobacco use cessation</p> <p><input type="checkbox"/> Weight reduction</p> <p><input type="checkbox"/> Other</p>	<p>Mark (X) if not ordered or provided at this visit</p> <p><input type="checkbox"/> NICE</p> <p><input type="checkbox"/> Complementary alternative medicine (CAM)</p> <p><input type="checkbox"/> Diabetes medical assessment</p> <p><input type="checkbox"/> Mental health care</p> <p><input type="checkbox"/> Physical therapy</p> <p><input type="checkbox"/> Radiation therapy</p>
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7. NON-MEDICATION THERAPY

<p>Mark (X) if ordered or provided at this visit</p> <p><input type="checkbox"/> Speech/Occupational therapy</p> <p><input type="checkbox"/> Psychotherapy</p> <p><input type="checkbox"/> Other mental health treatment</p> <p><input type="checkbox"/> Exercise or leisure</p> <p><input type="checkbox"/> Chiropractic care</p> <p><input type="checkbox"/> Wound care</p>	<p>Procedure:</p> <p><input type="checkbox"/> Other non-surgical procedure - specify: <input type="text"/></p> <p><input type="checkbox"/> Other surgical procedure - specify: <input type="text"/></p>
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8. MEDICATIONS & IMMUNIZATIONS

<p><input type="checkbox"/> NONE</p> <p>Include Rx and OTC drugs, immunizations, allergy shots, anesthesia, chemotherapy, and dietary supplements that were ordered, supplied, administered or consumed during the visit.</p> <table style="width: 100%;"> <tr> <th>Medication</th> <th>Start</th> <th>Stop</th> </tr> <tr> <td>(a) <input type="text"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>(b) <input type="text"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>(c) <input type="text"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>(d) <input type="text"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>(e) <input type="text"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>(f) <input type="text"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>(g) <input type="text"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>(h) <input type="text"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table>	Medication	Start	Stop	(a) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	(b) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	(c) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	(d) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	(e) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	(f) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	(g) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	(h) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>9. PROVIDER</p> <p>Mark (X) if problem seen at this visit</p> <p><input type="checkbox"/> Physician</p> <p><input type="checkbox"/> Physician assistant</p> <p><input type="checkbox"/> Nurse practitioner</p> <p><input type="checkbox"/> RN/PA</p> <p><input type="checkbox"/> Other</p> <p>10. TIME SPENT WITH PATIENT</p> <p>Minutes: <input type="text"/> (15, 30, 45, 60, 75, 90)</p>
Medication	Start	Stop																										
(a) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>																										
(b) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>																										
(c) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>																										
(d) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>																										
(e) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>																										
(f) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>																										
(g) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>																										
(h) <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>																										

11. VISIT DISPOSITION

<p>Mark (X) if therapy</p> <p><input type="checkbox"/> No follow-up planned</p> <p><input type="checkbox"/> Return 1-2 weeks, if no improvement</p> <p><input type="checkbox"/> Refer to specialist</p> <p><input type="checkbox"/> Refer to specialist (urgent)</p> <p><input type="checkbox"/> Admit to hospital</p> <p><input type="checkbox"/> Other</p>	<p><input type="checkbox"/> Telephone follow-up planned</p> <p><input type="checkbox"/> Refer to specialist (urgent)</p> <p><input type="checkbox"/> Admit to hospital</p> <p><input type="checkbox"/> Other</p>
--	--

APPENDIX 3

SAS CODE FOR CONFIDENCE INTERVAL CALCULATIONS

```
/*PROGRAM NAME: Freq_with_SE_multiyear*/

/*This program get frequencies with standard error of ED initial injury
visits
by five year age groups and sex using data from 2003 through 2004*/

/*Data used in the example are all located in SAS work folder,
you will need to create the data from your ED data file.
The source data files were named as "ED03" and "ED04"
for ED data in 2003 and 2004.*/

DATA ED_1YR;
  SET ED03 ED04 /*Name of source data file*/;

  /*The following codes were copied from instruction 6:
  SAS statements for identifying injury record*/

  /*defining injury records*/
  /*SAS statements for 2001-2004*/
  /*CAUSE1 and DIAG1 are variable names used
  in the original SAS input statement provided by NCHS
  which you will get automatically if you follow steps in
instruction 3.
  CAUSE1 is the variable for "Cause of injury #1"
  DIAG1 is the variable for "Physician's diagnosis #1"
  EPISODE is the variable for "Episode of care"
  EPISODE=1 indicates initial visit */

  CAUSEDET=substr(left(CAUSE1),1,3);
  DX13=substr(left(DIAG1),1,3);
  DX14=substr(left(DIAG1),1,4);
  DX15=substr(left(DIAG1),1,5);

  /*defining external cause of injury*/

  EXTINJ=0;
  IF '800'<=CAUSEDET<='869' OR '880'<=CAUSEDET<='929' OR
  '950'<=CAUSEDET<='999' THEN EXTINJ=1;
  IF ('870'<=CAUSEDET<='879') OR ('930'<=CAUSEDET<='949') THEN
EXTINJ=2;

  /*defining first listed injury diagnosis*/

  NEWINJ=0;
  IF ('8000'<= DX14<='9092')
OR DX14='9094'
OR ('9099'<=DX14<='9949')
OR ('99550'<=DX15<='99559')
OR ('99580'<=DX15<='99585') THEN NEWINJ=1;

  IF DX13 < '800' or DX13 > '999' THEN NEWINJ=2;
```

```

        /* defining injury records */

        INJSPB=0;
        IF EPISODE=1 AND
            ((NEWINJ=1 AND (EXTINJ =1 OR EXTINJ=0)) OR (NEWINJ=2 AND
EXTINJ=1)) THEN INJSPB=1;
        /*End of codes copied from instruction 5*/

DATA ED_5YR;
    SET ED_1YR;
    /*Recode AGE into 5 year age groups, the program can be altered to
calculate different
    age group by changing the above format "AGEA"*/
    AGE5YR=(PUT(AGE, AGEA.))*1;
    FORMAT _ALL_;

/*Sort data for SUDAAN*/
PROC SORT DATA=ED_5YR;
BY CSTRATM CPSUM;

/*Create file "TEMP5YR" with data on weighted ED visit counts by five
year of age and sex*/
PROC CROSSTAB DATA=ED_5YR DESIGN=WR FILETYPE=SAS;
NEST CSTRATM CPSUM/MISSUNIT;
/*Selecting ED initial injury visits*/
SUBPOPN INJSPB=1;
WEIGHT PATWT;
Class AGE5YR SEX;
Tables AGE5YR*SEX;
OUTPUT NSUM WSUM SEWGT/ FILETYPE=SAS FILENAME=TEMP5YR replace;
run;

/*Transfer ED visit data into structrue similar to population data for
rate calculation*/
DATA VISIT5YR(KEEP=AGE TNSUM TWSUM TSEWGT MNSUM MWSUM MSEWGT FNSUM
FWSUM FSEWGT);
MERGE TEMP5YR(WHERE=(SEX=0) RENAME=(NSUM=TNSUM WSUM=TWSUM
SEWGT=TSEWGT))
        TEMP5YR(WHERE=(SEX=2) RENAME=(NSUM=MNSUM WSUM=MWSUM
SEWGT=MSEWGT))
        TEMP5YR(WHERE=(SEX=1) RENAME=(NSUM=FNSUM WSUM=FWSUM
SEWGT=FSEWGT))
;
BY AGE5YR;
IF _c1 NE 0;
/*If you changed your age group, remember to change format "AGEB" in
the Proc format*/
AGE=PUT(AGE5YR, AGEB.);
    Label TWSUM="Bothsexes, Weighted ED visits"
        TSEWGT="Bothsexes SE, Weighted ED visits"
        MWSUM="Male, Weighted ED visits"
        MSEWGT="Male SE, Weighted ED visits"
        FWSUM="Female, Weighted ED visits"
        FSEWGT="Female SE, Weighted ED visits";

RUN;

```

APPENDIX 4

SAS CODE FOR ASSIGNMENT OF ALCOHOL VISIT TYPE

```
/* JML attempt at combing years of data to produce SE (RSE?) using SAS
PROC SURVEYMEANS per PAST RESEARCH@NCHS */
/* only good for NHAMCS ED Data from 2003 onward - other samples have
slightly different survey designs! */
```

```
data ed.all;
set ed.ed03 ed.ed04 ed.ed05 ed.ed06 ed.ed07;
run;
```

```
/* perform grouping per JML designations, remember that groups ARE NOT
mutually exclusive! */
```

```
data ed.all;
set ed.all;
```

```
/* make missing stuff equal to missing in SAS */
```

```
if AGE<0 then AGE=.;
if WAITTIME<0 then WAITTIME=.;
if LOV<0 then LOV=.;
if PASTVIS<0 then PASTVIS=.;
if TOTDIAG<0 then TOTDIAG=.;
if TOTPROC<0 then TOTPROC=.;
if LOS<0 then LOS=.
```

```
/* define some hypothesis testing variables */
```

```
IMMEDV=.;
*if IMMED=-8 then IMMED=.;
if IMMED in(1,2,3) then IMMEDV=1;
if IMMED in(4,5,6) then IMMEDV=0;
```

```
AMBULANCE=.;
if ARRIVE=1 then AMBULANCE=1;
if ARRIVE in(2,3) then AMBULANCE=0;
```

```
ANYREFER=0;
if RETREFFU=1 then ANYREFER=1;
if REFSOCS=1 then ANYREFER=1;
if RFTRANS in(1,2,3) then ANYREFER=1;
```

```
/* create concatenated diagnosis and cause of injury fields */
```

```
RFV15=substr(left(RFV1),1,5);
RFV25=substr(left(RFV2),1,5);
RFV35=substr(left(RFV3),1,5);
CAUSEDET1=substr(left(CAUSE1),1,3);
CAUSEDET2=substr(left(CAUSE2),1,3);
```

```

CAUSEDET3=substr(left(CAUSE3),1,3);
DX13=substr(left(DIAG1),1,3);
DX14=substr(left(DIAG1),1,4);
DX23=substr(left(DIAG2),1,3);
DX24=substr(left(DIAG2),1,4);
DX33=substr(left(DIAG3),1,3);
DX34=substr(left(DIAG3),1,4);

/* define alcohol related visit (ARV)*/
ARV=0;
if DX13 in('291','303') then ARV=1;
if DX14 in('3050','9800','7903','V113','V791') then ARV=1;
if CAUSEDET1 in('860','710') then ARV=1;
if RFV15 in('11450','23200','45181','59150') then ARV=1;

if DX23 in('291','303') then ARV=1;
if DX24 in('3050','9800','7903','V113','V791') then ARV=1;
if CAUSEDET2 in('860','710') then ARV=1;
if RFV25 in('11450','23200','45181','59150') then ARV=1;

if DX33 in('291','303') then ARV=1;
if DX34 in('3050','9800','7903','V113','V791') then ARV=1;
if CAUSEDET3 in('860','710') then ARV=1;
if RFV35 in('11450','23200','45181','59150') then ARV=1;

/* define acute intoxication visit (AIV)*/
AIV=0;
if DX13 in('303') then AIV=1;
if DX14 in('3050','9800','7903') then AIV=1;
if CAUSEDET1 in('860','710') then AIV=1;
if RFV15 in('45181') then AIV=1;

if DX23 in('303') then AIV=1;
if DX24 in('3050','9800','7903') then AIV=1;
if CAUSEDET2 in('860','710') then AIV=1;
if RFV25 in('45181') then AIV=1;

if DX33 in('303') then AIV=1;
if DX34 in('3050','9800','7903') then AIV=1;
if CAUSEDET3 in('860','710') then AIV=1;
if RFV35 in('45181') then AIV=1;

/* chronic alcohol abuse visit was dropped due to numbers below
suggested levels */

/* alcohol and injury visit AAIV*/
AAIV=0;
if ARV=1 and INJURY=1 then AAIV=1;

run;

```

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