Defining a Necessary Emergency Department Visit For Alcohol Intoxication

By

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Defining a Necessary Emergency Department Visit For Alcohol Intoxication

INTRODUCTION

Emergency department (ED) visits for acute alcohol intoxication are common and increasing in frequency.\textsuperscript{1,2} Many of these visits are uncomplicated, resulting in a discharge without the need for significant medical intervention.\textsuperscript{3} Recognizing this, communities have looked to diverting this population to alternative care facilities or sobering centers.\textsuperscript{4}

Since most states adopted The Uniform Alcoholism and Intoxication Act of 1972, which espoused a medical (as opposed to police) response to a person “incapacitated with alcohol,” EDs have been the default care area for intoxicated people.\textsuperscript{5,6} Alternative care settings including sobering centers have been mostly a grassroots, local response to this national phenomenon.\textsuperscript{4} Prior work has looked to determine the performance of triage checklists to differentiate between patients who need ED care and those who were safe for an alternative setting.\textsuperscript{7–10} Problems with these studies and research on this topic in general are threefold: what determines a necessary ED visit has not been systematically defined for this population; the clinical predictors studied in these checklists were not derived empirically; and finally, the checklists studied were tailored to the capacity of the local alternative sobering center and not to a generalized definition of a necessary ED visit.

The primary objectives of this study were to systematically define a necessary ED visit for an intoxicated patient using the input of an expert panel, and then using these criteria to estimate rates of the defined necessary ED visits among intoxicated patients. A secondary objective was
to identify potential clinical factors that predicted necessary ED visits as defined by our first objective. In doing so we focused on practical realities addressing this problem: namely patients who had an initial impression (not final diagnosis) of alcohol intoxication and using information that would be available to emergency medical services (EMS) in the community (not upon hospital-based evaluation).

**METHODS**

This study was conducted in two parts: Delphi Method and retrospective chart review. Both parts were approved by Lifespan’s Institutional Review Board.

**Part 1: Delphi Method**

**Study Design and Population**

The Delphi Method consisted of a panel of experts who were all involved with the management of intoxicated patients within their professions. The experts were recruited through their involvement in The National Sobering Collaborative, a national society on alternative care models for alcohol intoxication. The panel was anonymous to each other. The subjects were sent two rounds of surveys with the following objectives: to define a Necessary ED Visit (NEDV) and Unnecessary ED Visit (UEDV) for alcohol intoxication, and to identify potential predictors of a NEDV that can be assessed by first responders. Participants were reimbursed with a $15 gift card.

**Study Protocol**
The first online survey consisted of 75 questions in yes-or-no, multiple choice, and free response modalities. To define whether an ED visit was necessary, experts were asked if certain services provided in the hospital (consultations, medications, procedures, diagnostic imaging and labs) would classify as a NEDV. To identify predictors of a NEDV, questions posed hypothetical scenarios of various patient presentations and asked whether the expert thought this patient required testing and/or treatment at the level of care in a hospital. Follow up free response questions allowed experts to comment on any stipulations to their answers. In addition, the panel was asked to set high and low numerical cutoffs for vital signs, breathalyzer, blood alcohol level, and blood glucose measurements that would indicate an intoxicated patient’s need for a NEDV. The second survey, delivered a month after the first, consisted of six follow up questions generated to clarify any ambiguity or lack of consensus agreement from the first survey. The results of the Delphi Method informed what elements to include in the second part of the study.

**Part 2: Retrospective Chart Review**

**Study Design and Setting**

A retrospective chart review was performed of charts randomly selected from a database of electronic health records ([EHR]Epic, Verona Wisconsin), comprising of intoxicated patients who attended the ED between 3/29/15-12/31/15. Our study hospital, Rhode Island Hospital, is an academic emergency department with a level 1 trauma center in an urban location with a volume of slightly more than 100,000 ED visits per year.

**Study Population**
Inclusion criteria of patient encounters were an ED visit transported by EMS with a chief complaint of alcohol intoxication within the study period. Exclusion criteria were an age less than 18 or more than 65 years at the time of visit, incarcerated patients, or encounters receiving trauma team activation in the ED. Prior to conducting the study, a sample of 100 ED patients charts were examined to determine the sample size needed to estimate the specificity of the decision rule to determine NEDV. Based on data collected from a pilot sample of 100 charts, we used Burderer’s formula to estimate the number of charts needed to be reviewed to determine with 95% certainty that the decision rule to determine a NEDV has a true specificity of 0.76 (based on the results of the pilot sample of 100 medial charts); assuming a 5% error in the estimate of specificity from the pilot sample.\textsuperscript{11} This was estimated to be 505 patient EHRs. From the 3294 eligible charts, a random number generator was used to select 505 charts for evaluation.

**Study Protocol**

Two types of data were abstracted from the chart. The first were the outcomes that, based on the results of the Delphi Method, defined whether this was an NEDV or UEDV. The second were the predictor variables that, based upon the results of the Delphi method, could potentially predict a NEDV. Two chart abstractors, blinded to outcome of NEDV or UEDV, each reviewed half of the database using standardized protocols. Abstracted predictor variables were elements of the patient’s listed demographics, prior visit records, the history of present illness, review of systems, physical exam, vital signs, and two point of care laboratory results. These variables were abstracted initially from the EMS run sheet to emphasize prehospital impressions and triage by first responders on the scene. In the event that data from the EMS run sheet was missing, information from the initial ED physician’s note was used.
The data abstraction protocol consisted of: demographic information directly obtained from the patients’ medical record, homelessness status determined by either having a listed address of a homeless shelter or reported to be homeless through a keyword search of the patient’s medical record, and outcome measures such as procedures, labs, medications and imaging obtained from orders placed during the ED visit. A patient was coded as having a prior ETOH ED visit if they were seen at the ED with a chief complaint of alcohol intoxication since the start of the study period. Vital sign data was taken directly from the EMS run sheet. In the instance of missing vital sign data, the initial set of ED vital signs were substituted and in the rare occurrence that both sources of data were missing, entry was coded as blank.

Predictor data abstraction followed the practice of examining the EMS run sheet for narrative details on the initial examination and triage of the patient on scene. Suicidal ideation and suicide attempt were positive if mentioned in the EMS run sheet or the initial ED physicians’ note as being present before arrival to the hospital. Suicide attempt and suicidal ideation were coded as mutually exclusive data entries. New head trauma was positive if the patient narrative mentions hitting their head by any method or EMS triage mentions fresh lacerations, ecchymosis, fracture, or contusions of the face, scalp, or skull. Chest pain and abdominal pain was positive if mentioned as a symptom or physical exam finding in the EMS run sheet or mentioned in the initial ED note as being present before arrival to the hospital. Respiratory distress was a recorded as present if the EMS run sheet or initial ED triage note mentions shortness of breath either through patient complaint or as an observed physical exam finding. Any secondary complaints were marked as present if the EMS run sheet or initial ED note mentions an additional complaint or clinical impression beyond alcohol intoxication.
In instances where there was no explicit mention or documentation that a predictor was present, it was assumed to not be present and was coded accordingly.

After the predictor variables were collected, the same two researchers abstracted the outcome data from the medical record. This included disposition status, procedures, consultations, and whether lab testing (other than alcohol and glucose levels) or radiologic imaging was performed. When breath ethanol levels were not recorded, serum levels were used in analysis. When both serum and breath ethanol levels were recorded, the serum levels were prioritized and recorded.

Data Analysis

Investigators abstracted data onto separate standardized Microsoft Excel spreadsheets. This software was used to calculate the odds ratios (OR). Ten percent of each chart abstractor’s charts were randomly selected by a random number generator and were secondarily reviewed independently by another chart abstractor. A kappa score was calculated on grouped categories of variables: patient demographics, outcome variables, vital signs, and predictor variables.

RESULTS

Part 1: Delphi Method

Five experts participated in the initial Delphi Method: three emergency medicine board certified physicians, one Emergency Medicine Technician, and one sobering center director. Their first task was to produce a definition of a NEDV from data obtainable in a retrospective chart review.
This would create our outcome variable for each ED visit (either NEDV or UNEDV). They could not come to a consensus that a single service provided in the ED (labs, imaging, procedure, medications, consultation, or even hospital admission) would automatically classify as a NEDV in all instances. They recognized the variance in clinician gestalt in ordering these services for an intoxicated patient. Out of the listed services, admission, procedures, and specialty consults were voted higher as an outcome measure of a NEDV than receiving labs, medication, and imaging. Consistently among all 5 experts, receiving medication was voted least likely to comprise the definition of a NEDV.

From these findings, the study authors constructed four categories of NEDV. The most stringent category was hospital admission constituting a NEDV. Next, the hard definition states that if a patient was admitted, received a consult, or a procedure then the encounter was a NEDV. The medium definition builds off of the hard definition by adding imaging alongside admission, consultation, or procedure. Finally, the soft definition contains all the components of the medium definition with the addition of lab tests (Figure 1).
As a secondary aim of the Delphi Method, the panel identified possible predictors of a NEDV. Chest pain, abdominal pain, acute head trauma, and suicidal ideation were considered likely predictors of a NEDV, with each receiving support from more than half of the experts. These predictors would later be included as variables for data extraction in our retrospective chart review. Experts could not reach consensus regarding vital sign cutoffs, with wide ranges of high and low limits suggested for each vital sign. Due to this variability, the study authors decided to adapt the Klein et al. 2018 retrospective chart review coding methodology in patients with alcohol intoxication when examining hypotension (<90mmHg), hypothermia (<95°F), fever (>100.4°F), tachycardia (>110 bpm), hypoxia (SaO2<92%), and hypoglycemia (<60mg/dL).³
On both surveys, majority of the Delphi experts commented on the poor predictive ability of the following predictors of NEDV: past head trauma, chronic low-acuity symptoms (cough, back pain, etc.), past medical history of seizures, current use of blood thinners, and inability to ambulate unassisted. These predictors were not subsequently examined in the retrospective chart review.

The second round of the Delphi Method further inquired on the nuances of alcohol withdrawal treatment and whether it would affect the experts’ opinions on its role in a NEDV definition. It was voted unanimously that if alcohol withdrawal was not present before ED visit, it had no predictive value in predicting a NEDV. Some experts did argue that being in the ED precipitated this condition. Similarly, abnormal lab results were found to be of little value in defining a NEDV, as many abnormal values are likely chronic and the occurrence of having labs drawn in the first place was because they were in the ED.

**Part 2: Retrospective Chart Review**

Of the 505 charts reviewed, 306 represented individual patients. Patient demographic data is displayed in table 1.
Table 1. Demographics of patients in chart review. Sample size of 505 charts, representing 306 unique patients. (n, Sample size; SD, Standard Deviation; ETOH, Alcohol intoxication; ED, emergency department)

<table>
<thead>
<tr>
<th>Demographic Variables</th>
<th>Values (% of n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age ± SD</td>
<td>46 ± 12</td>
</tr>
<tr>
<td>Sex, Male</td>
<td>397 (79%)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>331 (66%)</td>
</tr>
<tr>
<td>Black</td>
<td>72 (14%)</td>
</tr>
<tr>
<td>Asian</td>
<td>7 (1%)</td>
</tr>
<tr>
<td>Other</td>
<td>95 (19%)</td>
</tr>
<tr>
<td>Latino/Hispanic</td>
<td>101 (20%)</td>
</tr>
<tr>
<td>Homeless</td>
<td>283 (56%)</td>
</tr>
<tr>
<td>Previous ETOH ED Visit</td>
<td>341 (68%)</td>
</tr>
</tbody>
</table>

Interrater reliability was calculated with Cohen’s kappa scores between the two chart abstractors show strong levels of agreement for all grouped categories of variables (κ>0.8): demographics (κ=0.84), outcomes measures (κ=0.98), vital signs (κ=0.82), predictors (κ=0.88).12

According to the definitions determined by the Delphi Method, there was a NEDV rate of 8.3% by the admission only definition, 13.5% by the hard definition, 33.7% by the medium definition, and 42.4% by the soft definition. (Table 2).
Table 2. Rates of a necessary emergency department visit for alcohol intoxication by definition.

Sample size of 505. (NEDV, Necessary Emergency Department Visit)

<table>
<thead>
<tr>
<th>NEDV Definition</th>
<th>Rate</th>
<th>Number of Visits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft</td>
<td>42.4%</td>
<td>214</td>
</tr>
<tr>
<td>Medium</td>
<td>33.7%</td>
<td>170</td>
</tr>
<tr>
<td>Hard</td>
<td>13.5%</td>
<td>66</td>
</tr>
<tr>
<td>Admit Only</td>
<td>8.3%</td>
<td>42</td>
</tr>
</tbody>
</table>

The demographic characteristics of the sample are very similar across the levels of NEDV, with most of the patient sample being male (79%), white (66%) with an average age of 46 (SD =12) (Table 1).

Odds ratios of a NEDV were calculated for each predictor (Table 3).
Table 3. Odds Ratio of a Necessary ED Visit for Predictors. 95% confidence intervals displayed in brackets. Predictors ordered from lowest to highest odds ratio according to the soft definition. (CI, confidence interval; ETOH, alcohol intoxication; ED, emergency department; HR, heart rate; FSG, finger stick glucose level; SaO2, oxygen saturation level; SBP, systolic blood pressure)

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Soft Definition</th>
<th>Medium Definition</th>
<th>Hard Definition</th>
<th>Admit Only Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds Ratio [95% CI]</td>
<td>Odds Ratio [95% CI]</td>
<td>Odds Ratio [95% CI]</td>
<td>Odds Ratio [95% CI]</td>
</tr>
<tr>
<td>Previous ETOH ED visit</td>
<td>0.47 [0.42-0.52]</td>
<td>0.63 [0.55-0.71]</td>
<td>0.57 [0.45-0.71]</td>
<td>0.57 [0.45-0.71]</td>
</tr>
<tr>
<td>Homeless</td>
<td>0.57 [0.52-0.63]</td>
<td>0.74 [0.66-0.84]</td>
<td>0.77 [0.56-0.89]</td>
<td>0.76 [0.57-1.03]</td>
</tr>
<tr>
<td>Tachycardia (HR&gt;110)</td>
<td>1.30 [1.14-1.49]</td>
<td>1.27 [1.08-1.50]</td>
<td>1.21 [0.90-1.65]</td>
<td>0.99 [0.65-1.50]</td>
</tr>
<tr>
<td>Hypoglycemia (FSG&lt;60)</td>
<td>2.75 [2.05-3.69]</td>
<td>1.99 [1.32-3.00]</td>
<td>1.34 [0.53-3.35]</td>
<td>2.23 [0.89-5.63]</td>
</tr>
</tbody>
</table>

Several predictors were rare in our sample set: fever (>100.4F) with a count of 2 and hypothermia (<95F) with a count of 3. Due to the small sample size, any statistical analysis would have been inflated for these predictors and thus they are omitted from our reported results.
Chest pain and new head trauma were found to have the highest odds ratios out of the clinical predictors for the less stringent definitions (soft and medium), while respiratory distress was the highest for the hard and admit only definitions. Patients presenting to EMS with any other secondary complaints had more than six times the odds of being a NEDV across all definitions, with the exception of the admit only definition (OR 5.73 [3.59-9.14]). Hypotension (SBP<90) was the examined vital sign with the highest odds ratio for both the soft and medium definitions (OR 5.52 [4.39-6.95] and 8.05 [6.38-10.15]), while hypoxia (<92% on room air) had the highest odds ratio for the hard and admit definitions (OR 5.9 [4.16-8.41] and 4.38 [2.61-7.33]).

DISCUSSION

Increasingly, inappropriate use of the emergency department has become a subject of debate in efforts to reduce health care expenditures.\textsuperscript{13,16,17} What is a necessary ED visit, how is it determined, and by whom are contested and poorly defined.\textsuperscript{17} In this study we set out to define, in a systematic manner, a necessary ED visit for alcohol intoxication, a common ED chief complaint. We used a modified Delphi process to create the definitions. Consensus was difficult to achieve. Because of this, we synthesized and examined multiple definitions to define a NEDV for alcohol intoxication using the feedback of the Delphi panel. We did this in recognition that a necessary ED visit cannot be determined by evaluating the ED visit in isolation and one must consider the community’s resources for care or treatment outside the emergency department of an intoxicated person.\textsuperscript{15} Whether or not an ED visit for alcohol intoxication is avoidable may also be dependent on whether there are alternative options available, like sobering centers.
Our rates of NEDV can be compared to two studies, both using data from the National Hospital Ambulatory Medical Care Survey (NHAMCS).\textsuperscript{2,13} Employing a similar definition to our “hard” definition, Pletcher et al. found only 12\% of patients with primary diagnoses of alcohol intoxication required an admission.\textsuperscript{2} This compares well with our 13.5\% NEDV rate for our hard definition (Table 2). However, when they examined a definition similar to our “soft” definition, they found 80\% of these patients could be categorized as a necessary visit, in contrast with our soft definition NEDV rate of 42.4\% (Table 2). Likewise, Hsia and Neidzwiecki (2017), using the same data set, found approximately 89\% of patients with diagnoses of alcohol use would categorize as a necessary ED visit when using a definition similar to our “soft” definition.\textsuperscript{13}

Also for comparison, the rates of hospital admission for all patients (not just alcohol intoxicated) arriving to our study hospital by EMS during our study period is 40\%. This is higher than our rates of a NEDV for our “admit only” definition (8.3\%).

Why did we find lower rates of necessary visits when using our “Soft” definition compared with these historical controls? One explanation is that we included patients with a chief complaint of alcohol intoxication, while the NHAMCS data evaluated a final diagnosis of alcohol intoxication. This prior work included those whose final impression at discharge was alcohol intoxication, often after a work-up. Our inclusion criteria best reflects the patients’ initial clinical impression on scene as triaged by first responders, rather than what may be diagnosed after extensive diagnostic testing and monitoring while in the ED. Therefore our inclusion criteria better encompasses our prehospital/EMS study population and study objectives. Supportive of
our findings, Klein et al’s 2018 study found very low rates of unsuspected critical illness of patients initially triaged as having alcohol intoxication after also employing a chief complaint-based analysis of alcohol intoxication. ³

A secondary goal of this study was to evaluate predictors of a necessary ED visit. We specifically chose patient factors that would be evident to EMS personnel evaluating a patient. We evaluated secondary complaints, physical exam findings, vital signs, and glucose levels across all definitions of a NEDV. For the soft definition, we found chest pain and new head trauma to be the most predictive of a NEDV. Not surprisingly these decrease in their positive predictive value as the definition becomes more stringent. This is likely because of the liberal ordering of laboratory tests and imaging to evaluate these findings and the low rates of abnormal results requiring a service defined by our stricter NEDV definitions, such as a procedure or consult. Hypotension and hypoxia were the vital signs most predictive of a NEDV. Homelessness and previous visits for ETOH were the least predictive of NEDV. This likely reflects these populations’ use of the ED for non-medical reasons such as temporary shelter, meals, and safety. Additionally, providers may be familiar with these individual patients who are frequent users of ED services, and are more comfortable with observation as opposed to testing or admissions.

Prior studies have evaluated the performance of triage checklists for determining the need for an ED visit in this population. The largest study to date by Ross et al, evaluated the performance of a clinical checklist that was found to be highly sensitive (99%) and poorly specific (42%) in
identifying patients with a need for hospital based care, using a definition similar to our soft definition. This checklist was not derived or validated, but was created by a sobering center that accepted intoxicated patients from EMS. Future studies using our findings could derive and validate a clinical decision rule that may have better specificity than the Ross study.

However, when considering a clinical decision rule that could identify patients who could be safely diverted from an ED, it is paramount to consider the place that they would be diverted to and the medical capabilities at that facility. Therefore, application of a clinical prediction rule for the diversion of the intoxicated patient would likely need to be adjusted at the local level.

LIMITATIONS

The main limitation to this study is the lack of consensus on what constitutes a necessary ED visit. We attempted to mitigate this in part one of the study, and by evaluating the performance of the clinical characteristics across multiple definitions of a necessary ED visit. Our Delphi panel identified multiple ways to categorize a necessary versus an unnecessary ED visit. Inherent in this conversation of “what is a necessary ED visit,” is “what are the local alternatives to the ED?” In this population of intoxicated patients arriving by EMS, a necessary ED visit is likely to be defined differently across communities. For instance, a community with a large active sobering center that is staffed by registered nurses (RNs) might define a necessary visit more strictly than a community without this resource.
This study has limitations from its design as a retrospective chart review of a single study site. There were many factors that may be predictive of a necessary ED visit that we did not measure because they were unreliably documented in the chart. Measures of how incapacitated the patient was such as the Glasgow Coma Scale, Hack Intoxication Index,\textsuperscript{13} and ambulation status are examples of this. Additionally we have no counterfactual data to compare our analysis to, specifically we do not know the rates at which these symptoms and presentations are to be found in the intoxicated population who do not have an ED visit. Additionally we presented the symptoms present in the ED chart as individual predictors of NEDV when in many cases these are co-occurring within the same individual ED presentation. The effects of the linear combination of these symptoms is beyond the current scope of this study, requiring a much larger sample of EHR data.

Finally, there is the difficult issue of reconciling alcohol withdrawal as a necessary ED visit. We did not adjust for those patients who developed alcohol withdrawal while in the department, but who may not have had withdrawal upon arrival. The intent of our study is to examine clinical presentations and triage decisions made in a prehospital setting and not over the ED hospital course.

**CONCLUSION**

In summary, our study generated multiple definitions of a NEDV for alcohol intoxication by using expert opinions of a Delphi panel. Our rates of a NEDV are lower than previous studies examining similar definitions. Through a retrospective chart review, we were also able to
identify clinical predictors of a NEDV that can be assessed by EMS on scene. From our findings, clinical decision rules may be developed and validated for EMS use in safely diverting alcohol intoxicants for care beyond an emergency department.
REFERENCES


