Title
Association Between Injury Severity and Readiness to Change in Alcohol Related Trauma

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Publication Date
2015

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA,
IRVINE

Association Between Injury Severity and Readiness to Change in Alcohol Related Trauma

THESIS

submitted in partial satisfaction of the requirements
for the degree of

MASTER OF SCIENCE

In Biomedical and Translational Science

by

David Richter

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2015

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ACKNOWLEDGMENTS

I would like to sincerely thank my Committee chair and mentor Dr. Wirachin Hoonpongsimanont for all of her support, motivation and guidance through this rigorous process. She has helped me immensely to work through all of the obstacles along the way.

I would also like to thank my Committee members Dr. Craig L. Anderson and Sherrie H. Kaplan for all of their help especially with the methodological part of my Thesis. Also, great appreciation to Dr. Shahram Lotfipour for all of his logistical input during our weekly CASI meetings.

I would also like to especially thank Stephanie Sharma for all of her support and help with the Thesis editing, as well as David Wright and Justin Yanuck for insightful input.

Lastly, I would like to greatly thank the entire UCI Emergency Department staff as well as the HPRI staff for supporting me through the entire MS-BATS program.

ABSTRACT OF THE THESIS

Association Between Injury Severity and Readiness to Change in Alcohol Related Trauma

By

David Richter

Master of Science in Biomedical and Translational Science

University of California, Irvine, 2015

Assistant Professor Wirachin Hoonpongsimanont, MD, MSBATS, Chair

Out of approximately 800,000 traumas annually in the US, close to half have been deemed to be alcohol related. Despite our best efforts, over 90% of trauma deaths are deemed non preventable with current medical interventions. As we shift focus to averting alcohol related traumas, understanding the factors influencing patient's Readiness to Change (RTC) is of utmost importance for successful interventions. Severity of an alcohol related incident and traumatic injury have been linked with an increase in patient's Readiness to undergo changes in their alcohol behavior, which in turn resulted in improved alcohol behavior in follow up. Conducted at UCI Medical Center, our study explored injury severity's influence on patient's RTC which was measured on a 10-point Likert scale; injury severity was determined by the Injury Severity Score (ISS). Utilizing the UCI designed Computerized Alcohol Screening and brief Intervention (CASI) module, we found that, despite appropriate sample size, the ISS was not significantly associated with trauma patients' RTC or commitment to change. Further analysis of BAC as a potential RTC modifying factor showed that BAC positive trauma patients were almost twice as likely to be ready for change as compared to BAC negative patients after controlling for baseline characteristics including ISS and alcohol abuse/dependence risk. The results suggest that the dual effects of trauma with alcohol involvement may be more important to trauma patients than the severity of their injuries and their baseline alcohol risk in being ready for a change in their alcohol behavior.

I. Introduction

In the U.S. alone, there are approximately 800,000 traumas annually requiring hospitalization (1). A large proportion of those traumas have been found to be alcohol-related, either directly or indirectly. An extensive study pooling data from 6 trauma centers estimated that up to 40% of trauma patients had positive Blood Alcohol Concentration (BAC) upon admission and about 26% of negative BAC patients were deemed to have alcohol abuse problems upon further screening (2). Simply put majority of admitted trauma patients demonstrate high risk for alcoholic tendencies. Alcohol increases the risk of injury significantly. With even the alcohol level of 0.08% (the legal limit in most states), the individual's risk for a motor vehicle collision is increased 5-fold and the risk has been found to rise exponentially with linear increase in BAC (3). As majority of trauma deaths, up to 92%, have been deemed non-preventable with medical management, the focus in healthcare has been shifting towards trauma prevention with counseling and motivational interventions in trauma centers (4).

Healthcare professionals have come to a consensus that alcohol-related trauma incidents may serve as a “teachable moment” in order to administer a successful alcohol intervention. Preliminary intervention efforts highlight the need for an efficient alcohol screening and integration of brief motivational intervention (BMI) services into the ACS protocols. This sentiment was underscored in 2005 when the ACS Committee on Trauma passed a resolution that mandates level 1 Trauma centers to have an alcohol screening protocol in place for injured patients as well as intervention services for those who qualify. Collaborative efforts at UCI Medical Center between the Trauma and Emergency departments resulted in development of Computerized Alcohol Screening and brief Intervention (CASI) system. Follow up data have shown CASI to be superior to the Standard alcohol screening using live interview (5,6). Patients have reported greater comfort with CASI, greater ease of use and increased honesty due to anonymity of the system as opposed to a live interview (5). This system serves as the screening basis to our study with reports of patients' readiness to alcohol intervention.

The success of the alcohol intervention has been shown to be directly related to patients' readiness to change of the alcohol behavior and willingness to undergo an intervention (7). Considering the alcohol-related incident as a teachable moment some reports show that self-reported aversiveness of the injury influences the patients' readiness to change (8). With increased severity of the perceived injury or increased negative consequences attributed to the alcohol incident the patients report higher readiness to change of their alcohol behavior (8,9). Our study is to explore whether the self reported readiness to change in the CASI system is directly correlated to the objective injury assessment as reported by the Injury Severity Score (ISS) in trauma patients that test positive for alcohol in their system upon the time of the incident. Further, we would like to analyze for a correlation between the ISS and the commitment to change as reported by the Reflection score. The Reflection score corresponds to a specific alcohol intervention plan and should tailor the readiness of an individual to make a meaningful change in their alcohol behavior. Positive results would increase our understanding of the factors that play a role in the success of the alcohol intervention and allow us to generate more effective screening programs to reveal the most susceptible individuals to intervention.

As we expand our efforts to screen and administer alcohol interventions, we could prevent many unnecessary deaths while generating considerable healthcare savings. Current brief motivational interventions (BMI) have already been reported to reduce alcohol related incidents up to 65% over a 12 month period post a BMI (2). The effectiveness of BMI use in the ED has been further reported to decrease number of drinks per week, number of binge drinking days per week and number of instances of driving intoxicated (10). It's has also been projected that appropriately targeted alcohol screening and BMIs could save approximately $1.82 Billion annually in healthcare costs (11). As alcohol-related trauma incidents are highly preventable, it is our moral obligation as healthcare professionals to develop the most effective ways to not only treat but also intervene with at risk patients to combat this crucial public health issue.

Background:

Alcohol screening instruments:

BAC:

According to a recent study, at risk drinkers presenting to the ED with detectable alcohol levels were 3.9 times more likely to report risky drinking behavior (12). However, BAC alone is a poor predictor of alcohol-related hazardous behavior as approximately 38% of trauma patients with negative BAC reported alcohol-related problems (12). Using the cut-off of 80 mg/dL for BAC lowers the sensitivity of this test to successfully identify at alcohol-problem patients even further (12). BAC alone carries a poor predictability as well (12). Previous report shows that despite the increased risk of alcohol-related hazardous behavior in BAC positive at risk drinkers, only 57% of trauma patients with BAC > 80 mg/dL actually report risky alcohol-related behavior (12).

AUDIT:

The Alcohol Use Disorder Identification Test (AUDIT) was originated as a collaboration in the early 1990s by investigators from WHO and the US Alcohol, Drug Abuse and Mental Health Administration (13). The AUDIT was designed to be a 10-item, multiculturally sensitive alcohol screening instrument (13). Today it is considered a 'standard' for alcohol disorder screening especially in the primary care setting (13). Report by Saunders et al has shown the sensitivity to be 92% and the specificity to be 94% in regular use in primary care (14). Its functionality was later explored in other clinical settings especially in the Emergency Departments (ED). The performance in the ED was evaluated by Cherpitel et al in 1997 and found to be:

sensitivity varied from 88% to 92% for Black and White patients respectively

specificity varied from 82% to 80% for Black and White patients respectively (15).

Several other studies investigated the AUDIT's performance among patient subgroups and came with the following findings:

the AUDIT was consistently more sensitive and specific for adult male patients over adult female patients when using the standard cut off score of '8' for identifying 'at alcohol risk' patients (15). Overall however, little variation was found after evaluation of the psychometric properties for the dimensions defined by differences in sex or ethnicity (15).

Abbreviated versions of the AUDIT are the AUDIT-PC (AUDIT questions number: 1,2,4,5,10), the AUDIT-3 (AUDIT question number 3), and the AUDIT-C (AUDIT questions number: 1,2,3). Out of the 3 abbreviated AUDIT versions the most commonly used one is the AUDIT-C (15). The AUDIT-C has shown similar performance as the full version of the AUDIT as a measure of heavy drinking with some reports showing higher sensitivity than the full version but not as a measure of alcohol-dependence (15).

Key Concepts:

Readiness to change concept:

Readiness to change (RTC) may pave the way to taking appropriate restorative action through an alcohol intervention. Patients with a high RTC have reported overall less depression stemming from their current condition, less anger due to the averse consequences of alcohol dependence and a more positive outlook on making corrective changes (16). The importance of RTC in alcohol behavior modification has been underscored by yet another recent study that showed high RTC combined with brief session on change of behavior plan resulted in better outcomes than either alone (17). Plan formation without a good baseline RTC resulted in poor alcohol behavior outcomes in 12-month follow up surveys (17).

Physical injury as a motivator to change alcohol behavior has been previously explored. Study conducted by Apodaca and Schermer showed that the most commonly listed reasons to account for high RTC were physical health harm through risky behavior such as driving under the influence of alcohol (18). That study, however, does not delve into how influential the extent of the injury is on the RTC. Nevertheless, the trauma patient population studied that had sustained physical injuries correlated with higher RTC more than non-injured patients presenting to the ED (18). The effect of an alcohol related injury has been reinforced by another study. Cochran et al showed that previous experience of an alcohol-related injury has been found to lead to a strong change in alcohol related behavior especially much decrease in maximum alcohol consumed (19). Additionally trauma patient dissatisfaction has been previously linked with lower motivation for change (20). Major factors of trauma patient dissatisfaction included young age (18-29 years of age), ISS<16, and non-surgically treated patients (20).

According to previous research conducted with CASI at UCI Medical Center an RTC of 8 or higher is presumed to coincide with being 'ready' for an intervention (5). That definition of being 'ready' is going to be used in our study for our subsequent analysis.

Injury Severity Score (ISS):

The ISS is a widely used measure of the extent of injury in trauma patients. It represents a composite score based on the injured anatomical areas of the body (21). The ISS was originally derived from the Abbreviated Injury Scale (AIS) to better correlate its numerical scale with mortality of the trauma patients (21). In that sense, the ISS has been found by one of the original studies to explain up to 49% of the variance in the trauma patients' mortality as oppose to only 25% when AIS was used (21). The usefulness of the ISS extended beyond the initial injury assessment as it has been found to have a reasonable predictive validity of patients' disability status at the time of discharge from the hospital when controlling for previous disability and age (21). The ISS score is on a numerical scale ranging from 1 to 75. The calculation includes scoring each of the 6 body regions [Head, Face, Chest, Abdomen, Extremities (including Pelvis), External] for highest observed injury, then the 3 most severely injured body regions have their score squared and added together to produce the final ISS (22).

The National Trauma Data Bank (NTDB) report categorizes ISS into the following categories: score of 1-8 as Minor; 9-15 as Moderate; 16-24 as Severe; and greater than 24 as Very Severe. Almost half (47.05%) of trauma patients suffer only minor injuries and just under one–third (30.51%) have moderate injuries (1).

Considering the severity increase between the categories the case fatality rate increases nearly exponentially with each category as seen bellow: (case fatality rate)

Mild (0.86) Moderate (2.40), Severe (5.32), Very Severe (28.70) (1).

Considering the ISS widespread use and acceptability our analysis will use the reported scores as the objective measure of the trauma patient injury severity.

Purpose of the study:

The purpose of this study is to identify and characterize potential factors that may have mediating effects on RTC. Through understanding of the relationships between plausible mediating variables and RTC we could target our alcohol screening and Brief Motivational Intervention (BMI) efforts more effectively especially given the time and resource limited setting of the Emergency Department.

The Hypotheses to be tested:

H_{O1}: There is no difference between the RTC score between the five ISS categories in alcohol-positive trauma patient population.

H_{A1}: There is a difference between the RTC score between the five ISS categories in alcohol-positive trauma patient population.

H_{O2}: There is no association between the ISS/injury categories and RTC score/status in alcohol-positive trauma patient population.

H_{A2}: There is an association between the ISS/injury categories and RTC score/status in alcohol-positive trauma patient population.

H_{O3}: There is no association between the injury categories and the Reflection score in alcohol-positive trauma patient population.

H_{A3}: There is an association between the injury categories and the Reflection score in alcohol-positive trauma patient population.

Independent variable: ISS and injury categories for H_{O2} ; injury categories for H_{O3}

(injury category definition: ISS of 0 as no injury; ISS of 1-8 as Minor injury; ISS of 9-15 as Moderate injury; ISS of 16-24 as Severe injury; ISS greater than 24 as Very Severe injury.**)**

Dependent variable: Readiness to change score and status for H_{O2} ; Reflection score for H_{O3}

(RTC status definition: RTC status-ready defined as RTC score of 8-10**)**

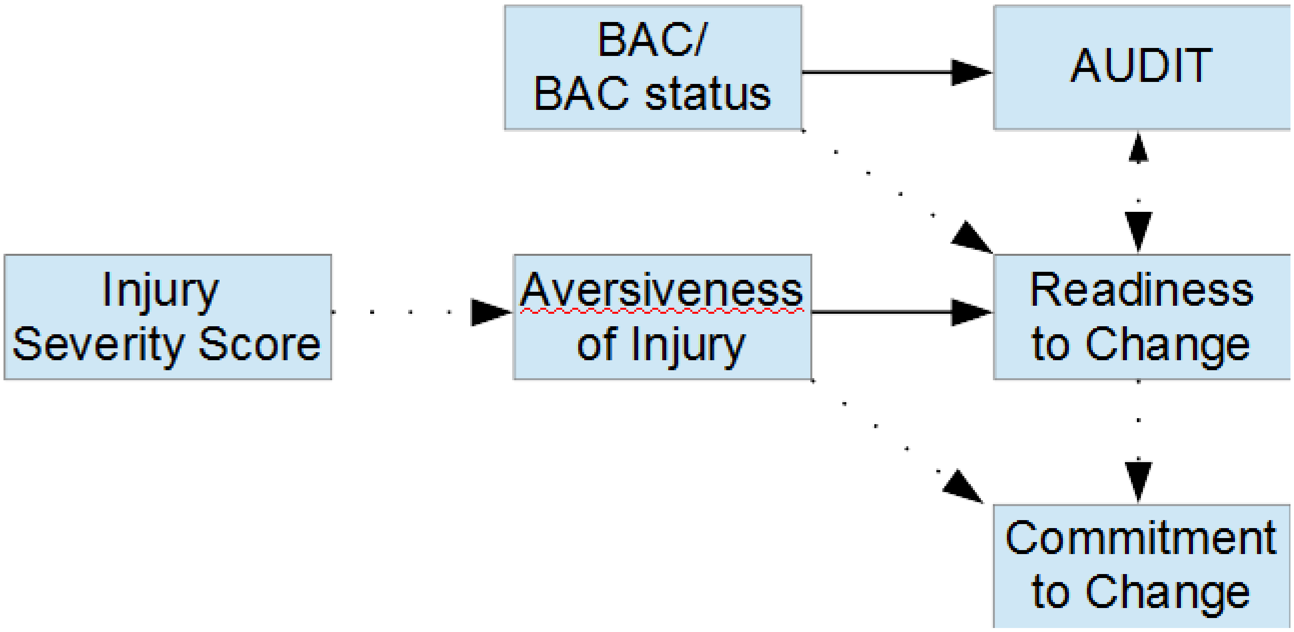
Directional Hypotheses:

H_1: We expect there to be a statistically significant difference in RTC score between the five major ISS defined injury categories. As explained in the Introduction and the RTC section, physical injury has been previously correlated with higher RTC score as oppose to no injury, and a higher aversiveness of the incident has been also correlated with higher RTC score (8,9,18). The expected trend is to be as the injury categories defined by the ISS increase from no injury to very severe injury the mean RTC score should increase with statistical significance.

H_2: We expect there to be a statistically significant association between the ISS/injury categories and the RTC score/status. As explained previously the trend expected is to be one of a positive correlation between the ISS/injury categories and the RTC score/status. We would expect as the ISS score increases the RTC score should increase as well. A better definition of that relationship can be established by linear and logistic regression, both of which are used in our analysis.

H_3: We expect there to be a statistically significant association between the ISS defined injury categories and the commitment to change following a specific plan as reported by the Reflection score. We expect as the ISS defined injury categories become more severe the commitment to make a more meaningful change in a patient's alcohol behavior would trend towards a more profound intervention. That should be represented by a higher Reflection score which coincides with a higher intensity of the intervention as explained above in the Reflection score section.

Conceptual framework for Directional Hypotheses



Solid lines represent relationships previously demonstrated in literature.

Dotted lines represent relationships hypothesized by our study.

II. General Methods

This is to be a descriptive retrospective study of a convenience sample of trauma patients participating in computerized alcohol screening, brief intervention, and referral to treatment at UCI Medical Center (tertiary care university hospital). Per the 2005 ACS Committee on Trauma all trauma patients are to undergo alcohol screening. At UCI Medical Center that is to be performed by using the Computerized Alcohol Screening and brief Intervention (CASI) module on all trauma patients except for ones meeting exclusion criteria listed bellow. CASI recorded patients' responses, length of time with the module, drinks per day, drinking days per week, the AUDIT score, and readiness to change. In addition, during the research associates implementation a quality-of-assurance survey assessing acceptability of CASI was administered to both English and Spanish-speaking patients (5). Inclusion criteria for trauma victims printed with permission from the University of California, Irvine Medical Center.

Figure 1.

Inclusion Criteria for Trauma Victim

Physical Findings	**Mechanism**
Diffuse abdominal tenderness	Penetrating injury to extremity above elbow or knee
GCS < 14 in the presence of head injury	Ejection (partial or complete) from vehicle
Bleeding disorder, anticoagulant or anti-platelet medication use	Pedestrian or bicyclist hit at > 20mph or thrown any distance
Pregnancy (Gestation > 20 weeks)	Passenger space intrusion > 12 inches
Suspected spinal injury with sensory deficit or weakness	Motorcycle crash > 20mph including laying down bike
	Person in same passenger compartment in which trauma death occurred
Seatbelt bruising/abrasions of neck, chest, abdominal	Adult: Falls > 15 feet Child: Fall > 10 feet or 2-3 times child's height.

Exclusion criteria included medical instability, in current custody or on psychiatric hold, and intoxication.

The CASI modality: consists of a bilingual (English and Spanish) audio-graphical interface software program that was up-loaded onto a mobile tablet computer and administered at the bedside of stable trauma patients in the ED and in-patient trauma units. CASI uses dynamic text, touch screen technology, and offers a text-to-speech option. Headphones with Bluetooth technology are also available for patient privacy. CASI reports the level of alcohol risk based on the AUDIT score calculated by the program. Eligible patients were required to sign an approved consent after they were recruited by the research associates (trained undergraduate students). The CASI alcohol screening section was first established based upon the National Institute on Alcohol Abuse and Alcoholism (NIAAA) guideline and AUDIT score (5).

NIAAA recommendation:

The limits that have been set are defined as no more than 4 drinks per day, and no more than 14 drinks per week, for men under the age of 65, and no more than 3 drinks per day and no more than 7 drinks per week for women of all ages and men age 65 years and older.

The ISS is on a scale of 1-75. Calculated from the Figure 2. bellow: (1)

Figure 2.

Region	Injury Description	AIS	Square Top Three
Head & Neck	Cerebral Contusion	3	9
Face	No Injury	0	
Chest	Flail Chest	4	16
Abdomen	Minor Contusion of Liver Complex Rupture Spleen	2 5	25
Extremity	Fractured femur	3	
External	No Injury	0	
		Injury Severity Score:	**50**

This report categorizes ISS 1-8 as Minor; 9-15 as Moderate; 16-24 as Severe; and greater than 24 as Very Severe.

AUDIT score:

According to the AUDIT scoring, patients were defined as “low-risk” when they are scored 0–7, and “at-risk” patients with an AUDIT score of 8–19. Patients in either group who drank more than NIAAA-recommended limits received a computer-guided brief interview, which included customized feedback, an assessment of readiness to change, reasons to cut back on drinking, goal setting, and a printed personal alcohol reduction plan. Patients who had an AUDIT score of 20 or more were “consistent-with-dependency” on alcohol, and received a follow-up consultation with a social worker (5).

The Readiness to change score:

As part of the intervention, CASI also subsequently assessed patients with drinking behavior above the NIAAA recommendations, by asking how ready they are to change their drinking behavior on a readiness to change scale from 1 to 10 (1=“not at all ready” and 10=“extremely ready” (5).

The Reflection score:

Being in the contemplation stage or action stage has been highly correlated with better alcohol behavior modification outcomes as compared to the pre-contemplation group (23). The Reflection score consists of 3 separate plan stages.

Plan number 1 is defined as: “I commit to cut back on the amount of alcohol I drink.” This plan should be followed by physician recommendations to stay within the NIAAA limits.

Plan number 2 is defined as: “I commit to drink no more than 4 (3) drinks a day and no more than 14 (7) drinks a week.” This plan is a commitment to stay within the NIAAA limits.

Plan number 3 is defined as: “I commit to quit drinking alcohol.” This plan represents the most profound commitment to change.

Statistical Analysis:

Hypothesis #1 testing:

To assess the distribution of the RTC scores in the five ISS categories we will use the Shapiro-Wilk test of Normality. The difference in the RTC score means between the five ISS injury categories is to be explored using either a standard ANOVA in case the RTC distribution is normal or a modified ANOVA test, the Kruskal-Walis H test in case of a non-normal RTC distribution. The standard ANOVA output should give us the mean values of the RTC scores per each ISS category but in the case of the Kruskal-Walis H test we would have to run a multiple T-test analysis with a Bonferroni correction in order to obtain the RTC means for each ISS category.

Hypothesis #2 testing:

Correlation:

The initial assessment of the relationship between the IV (ISS), the DV (RTC score/status) and the co-variates to be controlled for is to be performed using the correlation matrix. The ISS (IV_1) is on a linear scale of 1 to 75; the ISS injury categories (IV_2) are a categorical variable of 5 categories; the RTC score (DV_1) is on a linear scale of 0 to 10; and the RTC status (DV_2) is a Dichotomous variable.

To calculate the n of the sample needed for the correlational analysis we can use the following formula as we are dealing with a continuous variable of one group:

$$N = \frac{2 \times (S.D.)^2}{(\mu 1 - \mu 2)^2} \times f(\alpha, \beta)$$

Spearman Rho that is at least 0.15 we would need about 347 patients analyzed; that is under the conditions of:

alpha equal to 0.05 or to say that it is the maximal probability that the Null hypothesis would be rejected while true, a type 1 error; power being 0.8, or to say that the probability of correctly rejecting null hypothesis when it is actually false.

Calculating tool used: http://www.biomath.info/power/corr.htm

Linear regression:

After performing a correlation matrix analysis, the association between the ISS (IV) and Readiness to change (DV) was be analyzed using linear regression model. Linear regression model is used to assess whether a value of the IV can predict the value of the DV. In our initial analysis two separate patient groups will be presented: first group analyzed included patients that were BAC negative, the second group will be selected for intoxicated patients defined as BAC > 0.001 (a selection variable). We will report results for 3 separate models. Model #1 was performed only with the ISS (IV) and the RTC score (DV) using the selection variable of BAC negative and BAC positive. Model #2 was additionally adjusted for the following variables: Gender, Age, Unit, AUDIT score. Model #3 was additionally adjusted for the following variables: Gender, Age, Unit, AUDIT score, Cocaine, Amphetamines, THC, Methadone, Benzodiazepines, Barbiturates, MDMA.

As **illicit substance** along with alcohol use has been previously shown to introduce an initiative to change behavior through **physical health concerns** we will attempt to control for that variable by adjusting for illicit substance use listed above (24). That adjustment should allow for a more direct analysis of trauma injury severity effect on RTC as readiness due to substance based health problems is controlled for in that equation.

Logistic Regression:

That method is to explore the relationship between the injury categories (IV) and the RTC status (DV) in the BAC positive sample. The RTC status has been defined as: Not ready (RTC score 1-7); Ready (RTC score 8-10). The selection variable in this case is the BAC positive variable defined as BAC > 0.001. We will report results of 3 separate models. Model #1 was performed only with the injury categories (IV) and the RTC status (DV) using the selection variable of BAC positive. Model #2 was additionally adjusted for the following variables: Gender, Age, Unit, AUDIT score. Model #3 was additionally adjusted for the following variables: Gender, Age, Unit, Cocaine, Amphetamines, THC, Methadone, Benzodiazepines, Barbiturates, MDMA.

Hypothesis #3 testing:

Ordinal Regression:

That method is to explore the relationship between the injury categories (IV) and the Reflection score (DV) in the BAC positive sample. The ordinal regression is used instead of a binary logistic regression due to the Reflection score (DV) being an ordinal variable consisting of 3 categories that are gradated from 1 to 3. For this analysis the selection variable is the BAC positive variable defined as BAC > 0.001. The resulting model is adjusted for the following variables: Gender, Age, Unit, Cocaine, Amphetamines, THC, Methadone, Benzodiazepines, Barbiturates, MDMA. For each injury category the test output generated an odds ratio of predicting a higher Reflection category selection. If statistically significant the odds ratios were compared between the five injury categories to assess the IV/DV relationship.

Sub-analysis testing:

Logistic Regression:

That method is to explore the relationship between the patient's BAC status (IV) and the RTC status (DV). The unadjusted model will explore only the IV/DV relationship without any co-variates and the adjusted model will control for Age, Gender, Unit status, AUDIT score and ISS. The test output will generate the odds ratio and the statistical significance level reported by the p-value.

Ordinal Regression:

That method is to explore the relationship between the patient's BAC status (IV) and the Reflection score (DV) while controlling for Age, Gender, Unit status, AUDIT score and ISS. The test output generated the odds ratio and the statistical significance level reported by the p-value.

Analyses were performed using the IBM SPSS version 22 module; a p-value <0.05 was considered to be statistically significant for the outcome.

III. Results

Data acquisition:

The trauma database used for our analysis included trauma patients presenting at UCI Medical Center between the dates of 02/12/2012 and 12/03/2014. As UCI Medical Center is a level 1 trauma center every incoming patient examined by the ACS team should be screened for alcohol use disorder and if appropriate the at risk identified patient should undergo a brief alcohol intervention protocol (25). At UCI Medical Center the trauma service utilizes CASI presumably for all of the incoming patients. The primary data collected and reported by the trauma service included data for a total of **8980** of trauma patients. That primary dataset did not include any of the main variables tested: ISS, RTC score, Reflection score and contained many missing data. However, the data for the main variables mentioned above are stored in the CASI database that is part of the patient treatment record. Of note, the actual CASI screening for patients that are discharged directly from the ED is performed by the Emergency Medicine team and for the patients that are admitted to the floor by the trauma team.

In order to be able to utilize all of the main variables we had to perform a series of data mergers.

The first merge was performed for the ISS variable. The merging syntax was based on the patients' unique MRNs and Dates of admission for a trauma treatment. That merge yielded a total of **8623** patients or 96% of the original dataset.

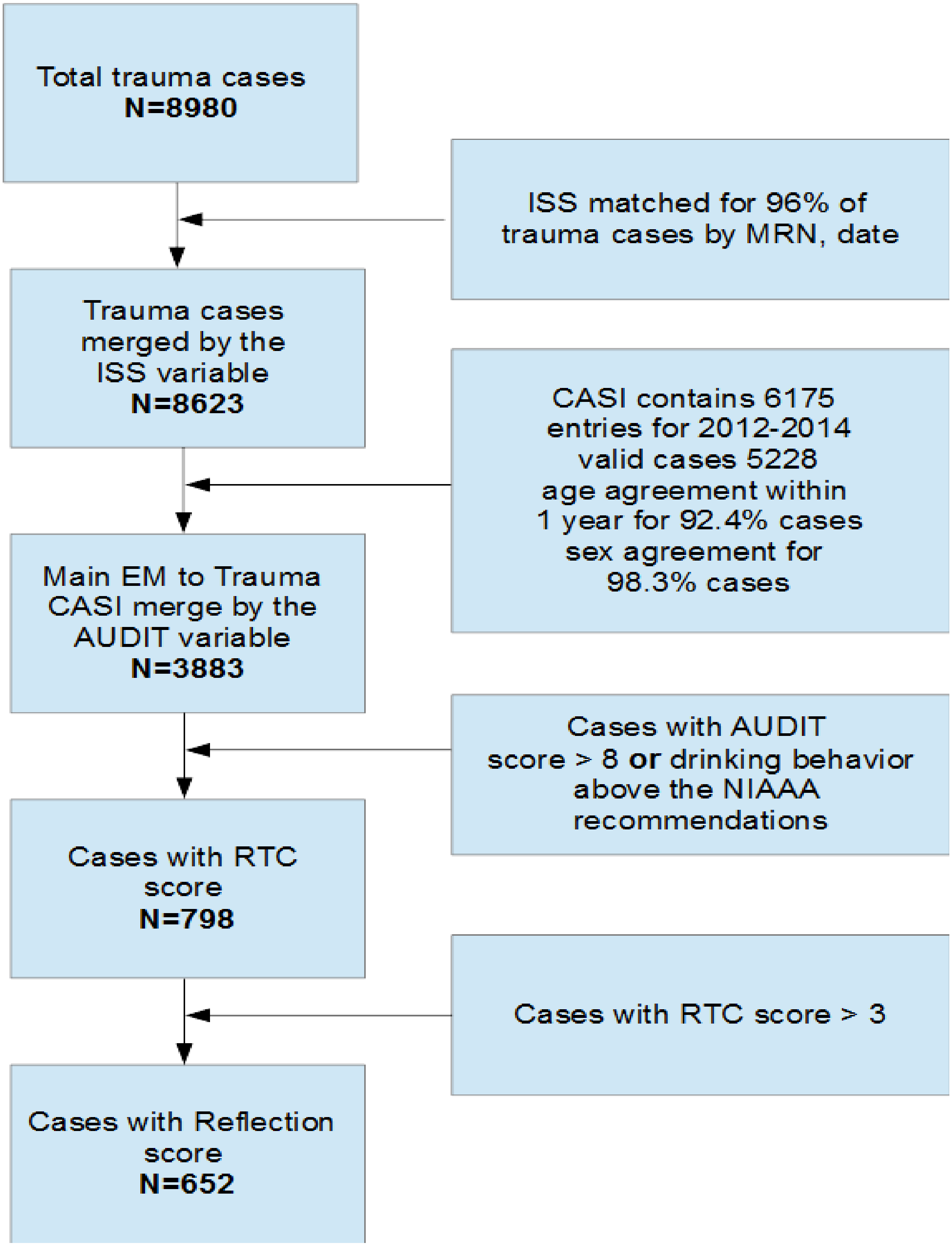
The next merge was to acquire the main dependent variables, RTC score and Reflection score, from the main CASI database. The CASI database was found to have 6175 entries for trauma cases in the years 2012-2014. After analysis of those entries, 947 of them were found to have missing key data points and were excluded from the second merge. MRN duplicate cases were to be omitted based on the date of admission difference. The second merge yielded **3883** total valid cases for entries that were successfully screened by CASI. Those cases shared age agreement within 1 year for 92.4% cases and sex agreement for 98.3% cases between the CASI and the trauma database.

The RTC score was reported for **798** of the cases. Whether an RTC score is reported is based on patients either having an AUDIT score > 8 or scoring above the NIAAA recommended drinking limit.

The Reflection score was reported for **652** of the cases. Patients are offered the commitment to change option only if they score > 3 on RTC.

Schematic illustration of this process is in Figure 3.

Data acquisition flowchart
Figure 3.



Patient Demographics:

The age mean for the five ISS injury categories varied from lowest 42.22 to highest 46.13 years of age. The lowest mean age of 42.22 years was observed in the No injury category and the highest mean age of 46.13 years was observed in the Severe injury category. In the gender categories males were the majority in all of the five ISS injury categories. The highest male dominated ISS injury category was the Severe injury category with 78.0% of males and 22.0% of females while the highest female represented category was the No injury category with 39.1% of females and 60.9% of males. The Unit status followed a general trend of the more severe the ISS injury category the higher the proportion of patients admitted. It showed the highest proportion of discharged patients in the No injury category, 72.9% of patients; and it showed the highest proportion of admitted patients in the Severe injury category, 98.7% of patients. The highest AUDIT mean score of 3.49 was in the Mild injury category and the lowest AUDIT mean score of 2.70 was observed in the Very Severe injury category. The proportions of the patients identified by CASI as either at risk of alcohol dependence and/or as alcohol dependent showed highest representation in the Moderate injury category, 15.2 % of patients; and lowest representation in the Very Severe injury category, 10.5% of patients. The BAC mean was the highest for the Very Severe injury category at 0.06337% and the lowest BAC mean was observed for the No injury category at 0.03276%. The highest proportion of BAC + patients was also observed for the Very Severe injury category at 33.9% of the patients and the lowest proportion of BAC + patients was observed in the No injury category at 16.4% of the patients. The last variable explored was the proportion of the patients in each category that were above the legal limit for alcohol (BAC above 0.08%). The highest proportion was in the Very Severe injury category at 29.5% of patients and the lowest proportion was in the No injury category at 12.5% of patients.

Patient Demographics

Table 1

	No injury	Mild injury	Moderate injury	Severe injury	Very severe injury
Age (mean, SD)	42.22 (19.63)	43.27 (21.11)	44.65 (20.51)	46.13 (19.33)	43.05 (20.26)
Gender – Male (N, %)	486 (60.9)	849 (63.2)	717 (71.8)	361 (78.0)	188 (68.4)
Gender – Female (N, %)	312 (39.1)	495 (38.2)	282 (28.2)	102 (22.0)	87 (31.6)
Unit status – Admitted (N, %)	217 (27.1)	920 (68.4)	957 (95.6)	458 (98.7)	271 (98.5)
Unit status – Discharged (N, %)	583 (72.9)	425 (31.6)	42 (4.4)	6 (1.3)	4 (1.5)
AUDIT score (mean, SD)	3.05 (5.70)	3.49 (5.97)	3.47 (5.89)	3.42 (6.28)	2.70 (4.56)
AUDIT at risk (N, %)	90 (11.2)	189 (14.0)	152 (15.2)	62 (13.4)	29 (10.5)
BAC (mean, SD)	32.76 (91.28)	43.15 (94.13)	44.58 (91.13)	39.48 (92.28)	63.37 (105.54)
BAC + (N, %)	125 (16.4)	311 (23.5)	254 (25.9)	101 (22.0)	92 (33.9)
BAC above legal limit (N, %)	95 (12.5)	243 (18.4)	208 (21.2)	73 (15.9)	80 (29.5)

Hypothesis #1 testing:

The results of the Normality test for all injury categories (no injury, mild injury, moderate injury, severe injury, very severe injury) were as follows:

The Shapiro-Wilk test was used to test for normality as all of the injury subgroups had N<2000. The Shapiro-Wilk test has resulted in p-value < 0.001 for all of the 5 groups tested. That is interpreted as the alternate hypothesis of the data not being normally distributed cannot be rejected; therefore, simple ANOVA test will not suffice as normal distribution is an essential assumption of that test.

In this case we can analyze whether a statistically significant difference in RTC score between the injury subgroups exists using the Kruskal-Walis H test which allows for non-normal data distribution of the samples. The Kruskal-Walis H test cannot tell us which specific groups of our independent variable are statistically significantly different from each other; it can only tell us that at least two groups were different (26).

We can interpret the **p-value** equaling to **0.977** as there is **no difference** between the **5 injury categories** in their respective **RTC scores**.

In order to gain at least some understanding of any possible trends in the RTC score means between the 5 injury groups we ran consecutive T-test analyses comparing each group to the remainder of the sample. Taking these analyses as multiple comparisons we can correct for the resulting p-value with simple Bonferroni correction: α/m

For our 5 analyses m=5; thus, to obtain statistical significance of α=0.05 we would need:

α'= 0.05/5 = 0.01. None of the observed mean comparisons; however, attain the needed value of 0.01 to be statistically significant.

The mean values and results of the Kruskal-Walis test are listed in the table bellow.

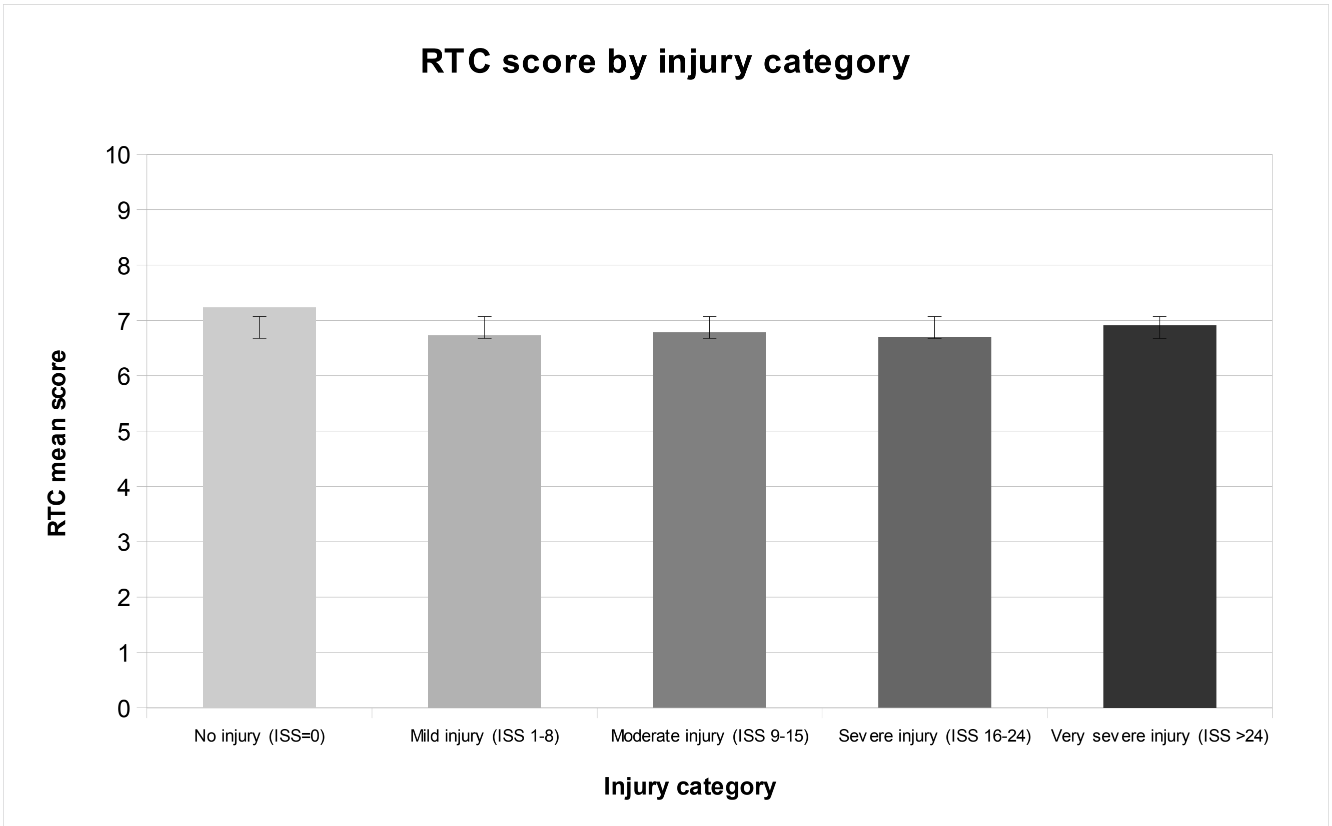
Table 2.
RTC by injury category

Readiness to change score					
Injury categories	N	Mean	Std. Deviation	Std. Error Mean	**P-value***
No injury	59	7.24	3.019	.393	**.977**
Mild injury	279	6.73	3.076	.184	
Moderate injury	240	6.78	3.006	.194	
Severe injury	113	6.70	3.173	.299	
Very severe injury	56	6.91	3.152	.421	

* Calculated using the Kruskal-Walis test with 4 degress of freedom

Graphical illustration of the mean values from Table 2 are shown the Figure 4 (see bellow).

Figure 4.



Hypothesis #2 testing:

Correlation matrix:

The results of the correlation analysis yielded the following:

BAC variable showed a positive correlation with both variables RTC score and RTC status – Ready with coefficients of **0.185** and **0.146** respectively. Both results were reported at statistical significance of p-value < 0.001 and represented 784 cases. BAC did not show statistically significant correlation with the Reflection score at p-value of 0.053.

BAC positive variable showed a positive correlation with all three variables RTC score, RTC status – Ready, and Reflection score with coefficients of **0.170** and **0.142** and **0.092** respectively. The correlations between the BAC positive variable and the variables of RTC score and RTC status – Ready were statistically significant at a p-value < 0.001 and represented 784 cases. The correlation between the BAC positive variable and the variable Reflection score was statistically significant at a p-value of 0.020 and represented 641 cases.

BAC - above the legal limit variable showed a positive correlation with both variables RTC score and RTC status – Ready with coefficients of **0.179** and **0.143** respectively. Both results were reported at statistical significance of p-value < 0.001 and represented 784 cases. BAC – above the legal limit did not show statistically significant correlation with the Reflection score at p-value of 0.331.

The AUDIT score variable showed a positive correlation with the variables RTC score and Reflection score with coefficients of **0.095** and **0.085** respectively. The correlation between the AUDIT score and the RTC score was statistically significant at a p-value of 0.007 and represented 798 cases. The correlation between the AUDIT score and the Reflection score was statistically significant at a p-value of 0.031 and represented 652 cases. There was no statistically significant correlation between the AUDIT score and the RTC status – Ready.

The AUDIT – at risk variable showed a positive correlation with the variable RTC score with coefficient of **0.083** at statistically significant level of p-value 0.020 and represented 798 cases. The AUDIT – at risk variable showed no statistically significant correlation with the Reflection score or RTC status – Ready.

The **main independent variables** of **ISS** and **ISS categories** showed **no statistically significant correlation** with any of the dependent variables **RTC score, RTC status – Ready or the Reflection score**. The correlation coefficient absolute values were all bellow 0.1.

Table 3.

Correlation (Spearman rho)

		Reflection score	RTC score	RTC-ready status
Age	Correlation Coefficient	.073	.003	-.007
	P-value	.061	.924	.844
	N	650	794	794
BAC	Correlation Coefficient	.077	.185**	.146**
	P-value	.053	.000	.000
	N	641	784	784
BAC-above legal limit	Correlation Coefficient	.038	.179**	.143**
	P-value	.331	.000	.000
	N	641	784	784
BAC-positive	Correlation Coefficient	.092*	.170**	.142**
	P-value	.020	.000	.000
	N	641	784	784
Gender-Male	Correlation Coefficient	.031	-.048	-.051
	P-value	.429	.177	.148
	N	652	798	798
Unit-admitted	Correlation Coefficient	.003	.012	.019
	P-value	.938	.732	.585
	N	652	798	798
AUDIT Score	Correlation Coefficient	.085*	.095**	.058
	P-value	.031	.007	.100
	N	652	798	798
AUDIT-at risk Score	Correlation Coefficient	.072	.083*	.042
	P-value	.068	.020	.241
	N	652	798	798
AUDIT-dependence Score	Correlation Coefficient	.059	.038	.035
	Sig. (2-tailed)	.134	.278	.329
	N	652	798	798
ISS	Correlation Coefficient	-.040	-.004	-.017
	P-value	.322	.921	.635
	N	609	747	747
ISS-severity categories	Correlation Coefficient	-.005	.013	-.020
	P-value	.911	.737	.606
	N	559	688	688
ISS-injury	Correlation Coefficient	-.037	-.045	-.032
	P-value	.366	.215	.382
	N	609	747	747
Cocaine	Correlation Coefficient	-.068	.028	.018
	P-value	.103	.452	.621
	N	585	717	717
Amphetamines	Correlation Coefficient	-.016	.020	.015
	P-value	.701	.598	.690
	N	586	718	718
THC	Correlation Coefficient	-.015	-.008	-.002
	P-value	.713	.830	.959
	N	585	717	717
Methadone	Correlation Coefficient	.013	-.018	.000
	P-value	.762	.630	.996
	N	586	718	718
Benzodiazepines	Correlation Coefficient	.081	-.033	-.042
	P-value	.051	.373	.257
	N	586	718	718
Barbiturates	Correlation Coefficient	.036	-.010	.000
	P-value	.380	.786	.996
	N	586	718	718
MDMA	Correlation Coefficient	-.004	.009	-.017
	P-value	.926	.807	.650
	N	586	718	718

** Correlation is significant at the 0.01 level

* Correlation is significant at the 0.05 level

Linear Regression:

The results of the linear regression modeling are as follows:

The following 3 model analysis represented only the **BAC negative** trauma population (Selection variable).

The first model of the linear regression **showed no association** between the main IV – **ISS** and the main DV – **RTC score**. The first model reported the Unstandardized β coefficient to be **0.014** meaning that for every one unit increase in ISS score there is a **0.014** increase in the RTC score. The model showed R square value of **0.002** meaning it explains **0.2%** of the Variance in the RTC score. The results were not statistically significant at p-value of **0.522**.

The second model of the linear regression **showed no association** between the main IV – **ISS** and the main DV – **RTC score** while controlling for Age, Gender, Unit status, and AUDIT score. That model reported the Unstandardized β coefficient to be **0.020** meaning that for every one unit increase in ISS score there is a **0.020** increase in the RTC score. The model showed R square value of **0.029** meaning it explains **2.9%** of the Variance in the RTC score. The results were not statistically significant at p-value of **0.416**.

The third model of the linear regression **showed no association** between the main IV – **ISS** and the main DV – **RTC score** while controlling for Age, Gender, Unit status, AUDIT score and illicit substances used. That model reported the Unstandardized β coefficient to be **0.020** meaning that for every one unit increase in ISS score there is a **0.020** increase in the RTC score. The model showed R square value of **0.048** meaning it explains **4.8%** of the Variance in the RTC score. The results were not statistically significant at p-value of **0.418**.

Table 4.
Linear regression

Variable	β coefficient - Unstandardized (95% CI)	β coefficient – Standardized	R square	P-value
ISS (Unadjusted)¥	0.014 (-0.029 – 0.057)	0.039	0.002	0.522
ISS (Adjusted)¥*	0.020 (-0.028 – 0.067)	0.056	0.029	0.416
ISS (Adjusted)¥**	0.020 (-0.028 – 0.068)	0.056	0.048	0.418

¥ Selection variable BAC -

* Adjusted for Age, Gender, Unit status, AUDIT score

** Adjusted for Age, Gender, Unit status, AUDIT score, Cocaine, Amphetamines, THC, Methadone, Benzodiazepines, Barbiturates, MDMA

The following 3 model analysis represented only the **BAC positive** trauma population (Selection variable).

The first model of the linear regression **showed no association** between the main IV – **ISS** and the main DV – **RTC score**. The first model reported the Unstandardized β coefficient to be **-0.004** meaning that for every one unit increase in ISS score there is a **0.004** decrease in the RTC score. The model does not explain any Variance in the RTC score and the results were not statistically significant at p-value of **0.825**.

The second model of the linear regression **showed no association** between the main IV – **ISS** and the main DV – **RTC score** while controlling for Age, Gender, Unit status, and AUDIT score. That model reported the Unstandardized β coefficient to be **-0.008** meaning that for every one unit increase in ISS score there is a **-0.008** decrease in the RTC score. The model showed R square value of **0.003** meaning it explains **0.3%** of the Variance in the RTC score. The results were not statistically significant at p-value of **0.664**.

The third model of the linear regression **showed no association** between the main IV – **ISS** and the main DV – **RTC score** while controlling for Age, Gender, Unit status, AUDIT score and illicit substances used. That model reported the Unstandardized β coefficient to be **-0.007** meaning that for every one unit increase in ISS score there is a **-0.007** decrease in the RTC score. The model showed R square value of **0.007** meaning it explains **0.7%** of the Variance in the RTC score. The results were not statistically significant at p-value of **0.673**.

Table 5.
Linear regression

Variable	β coefficient - Unstandardized (95% CI)	β coefficient – Standardized	R square	P-value
ISS (Unadjusted)¥	-0.004 (-0.035 - 0.028)	-0.011	0	0.825
ISS (Adjusted)¥*	-0.008 (-0.042 - 0.027)	-0.024	0.003	0.664
ISS (Adjusted)¥**	-0.007 (-0.042 - 0.027)	-0.023	0.007	0.673

¥ Selection variable BAC +
* Adjusted for Age, Gender, Unit status, AUDIT score
** Adjusted for Age, Gender, Unit status, AUDIT score, Cocaine, Amphetamines, THC, Methadone, Benzodiazepines, Barbiturates, MDMA

Logistic Regression:

The results of the logistic regression modeling are as follows:

The following 3 model analysis represented only the **BAC positive** trauma population (Selection variable).

The first model of the logistic regression **showed no difference in odds** between the main IV – **ISS categories** and the main DV – **RTC status**. The odds ratio was **1.028** at a p-value of **0.756.**

The second model of the logistic regression **showed no difference in odds** between the main IV – **ISS categories** and the main DV – **RTC status** while controlling for Age, Gender, Unit status, and AUDIT score. The odds ratio was **1.014** at a p-value of **0.891.**

The third model of the logistic regression **showed no difference in odds** between the main IV

– **ISS categories** and the main DV – **RTC status** while controlling for Age, Gender, Unit status, AUDIT score and illicit substances used. The odds ratio was **1.018** at a p-value of **0.861.**

Table 6.
Logistic regression

Variable	Odds ratio (95% CI)	P-value
ISS categories (Unadjusted)¥	1.028 (0.862-1.228)	0.756
ISS categories (Adjusted)¥*	1.014 (0.833-1.235)	0.891
ISS categories (Adjusted)¥**	1.018 (0.834-1.242)	0.861
¥ Selection variable BAC +		
* Adjusted for Age, Gender, Unit status, AUDIT score		
** Adjusted for Age, Gender, Unit status, AUDIT score, Cocaine, Amphetamines, THC, Methadone, Benzodiazepines, Barbiturates, MDMA		

Hypothesis #3 testing:

Ordinal regression:

The results of the ordinal regression modeling are as follows:

None of the **five injury categories** (IV) were **associated** with the **Reflection score** (DV) at statistically significant levels with p-values ranging from lowest **0.242** to highest **0.529.** The respective injury categories for those p-values were the **Moderate** injury category and the **Mild** injury category. Of note, the Very Severe injury category failed the analysis.

Table 7.
Ordinal regression

Variable	Odds ratio (95% CI)	P-value
ISS category – no injury*	1.524 (0.714 – 3.253)	0.276
ISS category – mild*	1.235 (0.641 – 2.378)	0.529
ISS category – moderate*	1.473 (0.770 – 2.821)	0.242
ISS category – severe*	1.326 (0.644 – 2.730)	0.444
ISS category – very severe*	N/A	N/A
* Adjusted for Age, Gender, Unit status, AUDIT score, BAC status, Cocaine, Amphetamines, THC, Methadone, Benzodiazepines, Barbiturates, MDMA		

Sub-analysis of BAC variable:

The results of the **logistic regression** modeling are as follows:

The first model of the logistic regression demonstrated that **BAC positive** trauma patients were **1.866** times more likely than **BAC negative** trauma patients to be **ready to change**. This result was statistically significant at a p-value of **<0.001**.

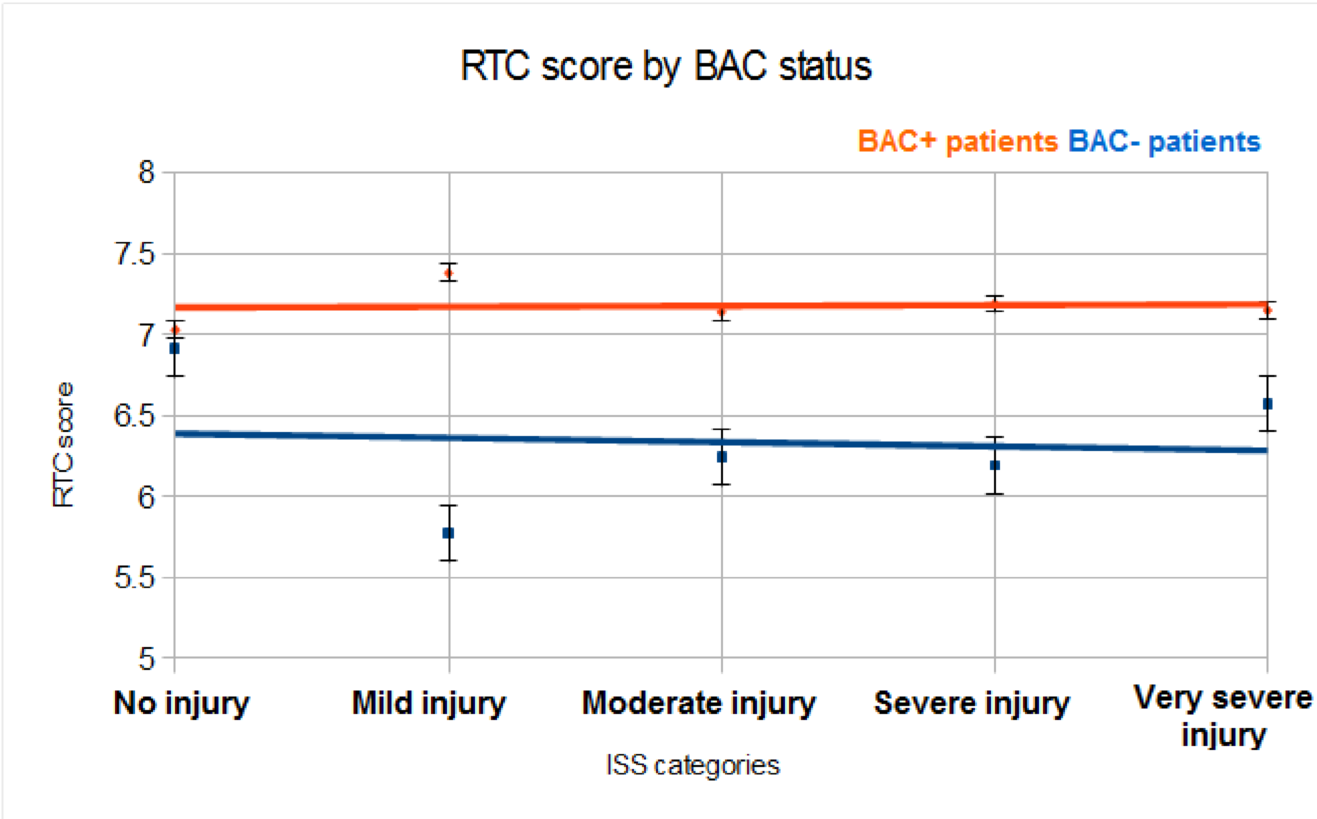
The second model of the logistic regression demonstrated that **BAC positive** trauma patients were **1.823** times more likely than **BAC negative** trauma patients to be **ready to change** while controlling for Age, Gender, Unit status, AUDIT score, and ISS. This result was statistically significant at a p-value of **<0.001**.

Table 8.
Logistic regression (DV= RTC - Ready for change)

Variable	Odds ratio (95% CI)	P-value
BAC status (Unadjusted)	1.866 (1.385 – 2.513)	<0.001
BAC status (Adjusted)*	1.823 (1.327 – 2.505)	<0.001
* Adjusted for Age, Gender, Unit status, AUDIT score, ISS		

Graphic illustration of the RTC means for the BAC positive and BAC negative patient cohorts plotted for each injury severity category is demonstrated in Figure 5. The graph shows consistently higher RTC values for the BAC positive patients across all of the five injury categories.

Figure 5.



The results of the **ordinal regression** modeling are as follows:

The resulting model showed no statistically significant association between the **BAC status (IV)** and the **Reflection score (DV)**, the p-value equaling to 0.473.

4. Discussion:

As outlined in the Introduction, alcohol screening and prevention is of the utmost importance in healthcare. The ability to target the at-risk population with effective screening and intervention helps establish more effective 'teachable moments' that Emergency Department visits may represent for trauma patients. Patients exposed to a traumatic event may be more amenable to consider choices they've made and consequences of their actions. This 'teachable moment' may be enhanced by an effective alcohol intervention to such a susceptible patient population. As described previously, readiness to change likely contributes to the effectiveness of such an intervention; thus, it is vital to understand its essential components and contributors. Our original hypothesis of injury severity, as reported by ISS being able to explain to some extent patient's readiness to change, has shown no association. Despite higher severity of consequences and injury being shown in the past research to generally increase the readiness to change, our study has found that the objective injury assessment as reported by the ISS has no bearing on the patient's decision making process.

Results of our first hypothesis showed no statistically significant difference in mean RTC scores between the ISS defined injury categories. Surprisingly, a quick analysis of the mean values of the five injury categories even shows the highest RTC mean score in the no injury category. Even though we cannot assess the mean values with any objective numerical accuracy, values trend still appears to be contrary to our previous assumption that there should be at least some quantifiable association between patients with no injury versus the ones with very severe injury and an increase in the mean RTC score. The result should not be limited by our patient sample size as the previously shown power analysis sample number was well exceeded by our study.

Results of the second hypothesis showed no statistically significant association between the ISS score and the RTC score in either the BAC negative or the BAC positive trauma cohort. The reasoning for exploring the possible association in both cohorts was based on previous findings of Longabaugh et al that showed significant effects of the interacting terms of traumatic injury and alcohol involvement in the incident on RTC (8). That study demonstrated that the more averse the injury combined with alcohol involvement the higher the RTC (8). Those findings were furthered by another research group later on. Ramsey et al confirmed the significant positive correlation of alcohol related incident combined with aversive nature of the injury but also added the partial mediating effect of alcohol negative expectancies (27). Alcohol negative expectancies represent harmful effects and consequences of alcohol drinking. The variable of negative alcohol expectancies was, however, not addressed in our analysis and might have potentially altered the described association or lack thereof. Despite the previously described interactions, our findings, however, showed no difference in ISS effect on RTC whether alcohol was or was not involved. Our result, to some extent, coincides with another recent study exploring the factors that affect RTC. That study has not been able to demonstrate an association between an alcohol attributed injury and RTC score in admitted patients at level 1 trauma center (28). Major limitation of the previously described study has been small patient population size of only 50 patients as compared to ours of nearly 800 patients. As the second hypothesis was basically the main association tested, we have to delve into the plausible explanations of the reported observations.

One of the possibilities could be related to discrepancies in the patient's perception of severity of injury and the actual ISS index. There are still many inconsistencies in the current literature about the ISS correlating with the patient's perception of health status (29). Brasel et al have investigated that issue and found no statistically significant association between the ISS and patient's perception of the extent of their injuries (29, 30). Plausible explanations of this observation include patient's incomplete understanding of their physical injuries or the attributing of the psychological distress of the incident as more significant than the actual physical harm (29).

Similar observations were illustrated by Reed et al in another RTC investigative report. This study attempted to identify RTC contributing factors and found that even though negative consequences such as motor vehicle accident or physical injury were significantly correlated with RTC, injury assessment, as reported by ISS, was not (31). However, that study was limited by a smaller patient population size and its corresponding inability to analyze the ISS defined injury categories separately. That helped form the basis for our investigation because even though trauma patients have been found, on average, to over-estimate the extent of their injuries, as reported by Brasel et al, they have still been able to differentiate between whether an injury occurred or not (29). Our results of no difference in RTC between the injury categories, as well as no association between injury severity categories and RTC status, even when looking at the most extreme injury groups, underlines how much the patient's subjective perception of the incident's aversiveness actually matters. This further emphasizes the need for our screening and BMI efforts to be individually tailored and target patients with high risk behaviors that result in great physical harm but are not perceived as such by those individuals.

The results of our third hypothesis showed no association between the ISS defined injury categories and the Commitment to Change as reported by the Reflection Score in the BAC positive trauma cohort. This is to be expected after our initial findings showing no relationship between the injury categories and the RTC status toward committing to a more profound intervention plan. This result simply reiterates that factors that might or might not be affecting RTC are expected to be commonly affecting the commitment to change alcohol behavior.

As the ISS and the ISS defined injury categories have failed to show any association with RTC score and status, we have attempted to investigate the BAC variable as another potential predictor of the primary outcome. In previous literature, BAC has been well established as a factor associated with high risk alcohol behavior within the trauma population (12). However, the reports somewhat conflict on the association of the BAC status with the RTC. From our exploratory analysis, we have shown BAC positive status to be correlated with both RTC and Reflection which led us to analyze the possible association further. Our regression models have shown a statistically significant association between the BAC status and RTC - ready status. After controlling for other important co-variates especially the AUDIT score and the ISS, the model predicted that BAC positive patients are almost twice as likely to be ready for change as BAC negative patients.

Plotted results in Figure 5 confirmed this trend as BAC positive patients have higher mean RTC values than BAC negative patients in all of the five injury categories. This trend aligns with previous literature which shows patients presenting with an alcohol related trauma as having on average higher RTC scores than patients for whom alcohol was not involved (8,9). Previous reports have also linked BAC positive trauma patients and a higher risk behavior compared to BAC negative trauma patients (12, 32). Higher risk patients, as measured by higher AUDIT scores, tend to have a higher baseline motivation to change when presenting with an alcohol related trauma. What is especially significant about our findings is that the alcohol involvement in trauma alone drives the RTC of trauma patients substantially, after controlling for their baseline alcohol risk and physical injuries. This observation broadens our understanding of the 'teachable moment' phenomenon described previously and adds to our understanding of the RTC mediators. The result is a reminder that even though BAC negative trauma patients, who are at a similar baseline alcohol risk to BAC positive trauma patients, present with lower RTC, they may still need to be cautioned their behavior poses just as much of a risk as higher RTC patients.

As the long term success of the brief alcohol interventions has been linked to a high baseline RTC, it is imperative to understand patients' decision making in being ready for a change (7). Despite some controversy behind certain sub-populations not clearly benefiting from a brief alcohol intervention, most studies agree that well-targeted brief alcohol interventions in the Emergency

Department show effectiveness in lowering the alcohol risk behavior up to 12 month follow up periods (33, 34, 35). Our study has shed some light into what factors are likely to influence the RTC and can hopefully help combat the far reaching public health issue that alcohol related incidents represent.

Conclusion:

The trauma population presents a unique cohort of patients who tend to present with a higher baseline of at-alcohol risk tendencies than general population. Effective alcohol screening and successful intervention with those at risk patients are of utmost importance from a pubic health perspective. Alcohol related traumas may present a unique opportunity for physicians to intervene, if directed appropriately. One of the major factors ensuring a successful long term intervention is the patient’s Readiness to Change. Understanding the contributing shaping a patient's Readiness to Change may help physicians intervene those most susceptible in the patient population. Even though previous reports have shown alcohol related injuries to affect the patient's Readiness to Change in a positive fashion, our study has not found any evidence that injury severity, as measured by the ISS index, has any bearing on patient's Readiness after an alcohol related incident. We have shown, however, that the fact of alcohol involvement in the incident at all is associated with an almost double likelihood of a patient’s Readiness regardless of their physical injuries. This should serve as a reminder that patients presenting with no alcohol in their system may be omitted from an intervention due to their lower baseline Readiness scores, but may be in the same risk category as the BAC positive trauma patients.

Limitations:

One of the limitations of this study is that the cohort studied is a convenience sample from trauma patients presenting to UCI Medical Center. The patients who were eligible to be screened had to be either English or Spanish speaking and have some base level of technological understanding in order for them to use CASI. This may have introduced a selection bias for which we cannot entirely account. Even though the 2005 ACS Committee on Trauma mandated all trauma patients should be screened for alcohol use disorders, our patient sample included 3883 patients from a total of 8980 trauma patients which only represents 43.2% of total trauma patients between the years of 2012 through 2014. The patient sample size was adequate for our analysis but may have presented some selection biases due to dataset merging issues between the Trauma and EM patient databases. The omitted patients included incorrect entries, missing variables, and duplicates. The dataset merge itself may have also introduced some inaccuracies due to imperfect agreement between some of the identifying variables.

Another limitation were missing key covariates to be included in our regression analyses. Three important variables not included in our analysis are Ethnicity, Education and Income level. Ethnicity has been shown to have some relation to AUDIT score and potentially could have affected the RTC scores. Education and Income have been reported as part of the socioeconomic status construct and has been directly correlated with quality of life. Overall, quality of life can introduce another bias as perceived poor health can affect the resolve to change, as reported previously.

Future aims:

The first step is to include the missing key co-variates of Ethnicity, Education and Income level to assess their contribution to the RTC.

We could attempt to re-run the merge of the patient datasets with a different syntax based on other key identifiers in order to assess whether this study accurately represented the trauma patient population.

Also not performed in this study is the analysis of BAC positive and BAC negative cohorts, which were included in our sub-analysis. We would like to ascertain whether those cohorts varied in their baseline alcohol risk and if they represented a risk similar patient population.

Last direction is to more thoroughly assess the relation of RTC to the Reflection score and whether their combined effects translate into more effective long term intervention. That could be a prospective study with a 3 to 6 month follow up outcome assessment instrument.

5. Appendix:

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