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Article

Severe Traumatic Brain Injuries and Associated Outcomes at a Level 1 Trauma Center

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Abstract: Background: Severe traumatic brain injury (TBI) remains a leading cause of mortality and long-term morbidity, particularly in high-acuity trauma settings. We aim to evaluate the clinical, physiologic, and socioeconomic factors associated with outcomes in patients with a severe TBI at a single urban Level 1 trauma center. **Method:** This is a single-center, retrospective study of patients presenting with severe TBI between 1 January 2020 and 31 December 2023 at Elmhurst Hospital Center in Queens, New York. Patients were identified using ICD trauma codes and an Abbreviated Injury Severity (AIS) Head score of ≥3. Demographic data, injury characteristics, vital signs, airway interventions, alcohol level, and insurance status were analyzed. **Result:** A total of 1,130 patients met the inclusion criteria. The cohort was predominantly male (76.1%) with a mean age of 5ears. Blunt trauma accounted for 97.8% of cases, with a mortality rate of 13.8%, while penetrating trauma comprised 2.2%, with a markedly higher mortality rate of 48%. Patients who died as full code had lower mean systolic blood pressure (82.5 mmHg), oxygen saturation (63%), and shorter emergency department stays (~3.7 hours). The mean Glasgow Coma Scale (GCS) score was 12.6, dropping to 6.0 in patients who died. Moreover, higher AIS Head and Injury Severity Score (ISS) values were correlated with worse outcomes. Severely intoxicated patients had higher TBI incidence but demonstrated better discharge rates. Self-pay patients exhibited the highest mortality (40%). All associations were statistically significant ($p < 0.0001$). **Conclusions:** Severe TBI outcomes are significantly influenced by injury mechanisms, physiologic parameters, and socioeconomic status. These findings emphasize the need for targeted prognostic tools and improved trauma system preparedness for TBI patients at risk of poor outcomes.

Keywords: trauma; brain injury; severity; length of stay; emergency department; mechanisms; mortality

1. Introduction

Traumatic brain injury (TBI) remains one of the leading causes of death and long-term morbidity worldwide, particularly in populations requiring high-acuity trauma care [1]. It is defined as a disturbance of brain function caused by an external mechanical force, leading to a spectrum of cranium-implicated pathologies [2]. Classification of TBI severity ranges from mild to moderate to severe, where a severe TBI, typically characterized by a Glasgow Coma Scale (GCS) score of ≤8, has the highest burden of morbidity and mortality [3]. Patients with severe TBI often require intensive care and prolonged hospitalization, leading to long-term rehabilitation with substantial implications for both individual outcomes and healthcare systems [4].

In the setting of trauma, classifying the dynamics of injury can help differentiate certain aspects of injury. TBI can be classified as either penetrating or non-penetrating (blunt). Penetrating injuries

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involve direct disruption of the cranial vault and underlying brain structures, most commonly due to gunshot wounds or sharp objects. In contrast, blunt TBIs can be caused by acceleration-deceleration forces such as motor vehicle collisions, falls, and assaults. The mechanism of injury is not only important in understanding the physical insult but also in predicting clinical trajectory and determining appropriate surgical or non-operative interventions. Studies suggest that penetrating injuries are often associated with higher early mortality, while blunt injuries may involve diffuse axonal injuries and lead to prolonged rehabilitation [5].

Furthermore, assessing injury severity is critical for prognostication and clinical planning, necessitating the standardized scales to group injury severity. The GCS is widely used in the acute setting to evaluate neurologic function and guide early management [3]. The Abbreviated Injury Scale (AIS) provides an anatomical severity score for individual body regions, with a head AIS of ≥3 indicating serious injury [6]. Collectively, the Injury Severity Score (ISS), calculated from the three most severely injured body regions based on AIS, reflects the overall trauma burden [7]. These scoring systems are fundamental tools used in trauma registries and research to standardize severity comparisons, guide triage, and predict outcomes across institutions, particularly level 1 trauma centers.

Throughout the advancement of medicine, outcomes following severe TBI vary widely, making it important to understand the outcome correlations to further improve patient care in trauma centers. Outcomes range from routine home discharge to inpatient rehabilitation, and may also include death, either despite full-code measures or following withdrawal of life-sustaining therapy [8]. Additional variables such as airway management strategies, blood alcohol content (BAC) at presentation, and payer type are deemed as potential factors influencing outcomes. These variables may contribute to worsening clinical status in TBI patients and can further aid prediction of possible outcomes.

This study aims to investigate the associations and correlations between injury severity (GCS, AIS, ISS), mechanisms of injury (blunt vs. penetrating), patient-level variables (vitals, airway interventions, BAC), and socioeconomic status (payer type) with clinical outcomes in patients presenting with TBI at a Level 1 trauma center. Identifying these correlations is essential for improving outcome anticipation in critical care fields and the role of factors in clinical outcomes.

2. Methods

This is a single-center, retrospective review conducted at a level 1 trauma center verified by the American College of Surgeons in Queens, New York City. We included all patients who presented with a severe traumatic brain injury between 1 January 2016 and 31 December 2023, inclusive. Patient data were requested from the National Trauma Registry of the American College of Surgeons (NTRACS) Database at our center (Elmhurst Hospital Center). Patients were identified based on the injury mechanism, cause of injury, primary mechanisms (lCD9 or lCDL0 E-Code), and the Abbreviated Injury Severity (AIS) score on the head. The AIS score ranges from 1 to 6 per body region. This study received approval from the institutional review board (IRB) at Elmhurst Facility with IRB number 24-12-092-05G.

We included all patients who presented with a severe TBI between January 1, 2020, and December 31, 2023, inclusive. All patients with an Abbreviated Injury Severity (AIS) score of 3 or higher were included. We excluded patients with AIS less than 3 (minor and moderate injuries). We found a total of 1,130 patients with severe TBIs, and all were included in the study. In this included patient population, there were no missing data points. We utilized two sources to obtain complete information on the patient population. First, we requested protected health information (PHI) and other relevant data elements from NTRACS, our center's trauma registry. If the registry did not include a specific data point for any patient, we used PHI, such as the medical record number (MRN) and the patient's name, to review their chart and obtain the missing information.

We collected data using a data collection tool (Excel sheet or spreadsheet). We incorporated all data elements into this tool. Examples of data elements are demographics (for example, age, sex, race,

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and ethnicity), AIS, traumatic brain injury pattern, discharge disposition, mortality status, and others. The dataset underwent several preprocessing steps to ensure data integrity, confidentiality, and suitability for statistical analysis. First, to de-identify the dataset, unique identifiers such as medical record numbers (MRNs), dates of birth (DOBs), and patient names were removed. This process was performed to maintain patient privacy in compliance with ethical research standards. Next, inclusion and exclusion criteria were followed, as discussed above, followed by data analysis.

Descriptive statistics were utilized to summarize the study cohort. Categorical variables were analyzed using Pearson's chi-square test or Fisher's exact test, as appropriate. Measures of effect size, including Cramer's V, Phi coefficient, and Contingency coefficient, were calculated to assess the strength of associations. All statistical analyses were conducted using web-based SAS Studio OnDemand for Academics v9 (version # v3.8).

3. Results

A total of 1,130 patients with severe traumatic brain injury (TBI) were included in the analysis. According to *Table 1*, the mean age was 52.67 years (SD ±41.89), the mean weight was 87.19 kg, and the mean height was 165.43 cm. Most of the cohort were male (76.1%, n = 860), while females made up 23.9% (n = 270). Males were younger on average (48.96 years) than females (64.50 years), and they were also taller and heavier, with mean heights of 168.50 cm and 156.06 cm and weights of 91.08 kg and 75.18 kg, respectively. When analyzed by race, Black patients (n = 89) had the highest average weight (103.36 kg) and height (172.50 cm), while Asian patients (n = 171) had the lowest average weight (73.27 kg) and were shortest (162.06 cm). White patients (n = 201) had intermediate measures with an average weight of 93.94 kg and height of 169.80 cm. Ethnically, Hispanic patients (n = 521, 46%) were younger (mean age = 46.83 years), while non-Hispanic patients (n ≈ 563, 50%) were older (mean age = 58.60 years). Occupational analysis was not applicable in the majority. All cases were from the state of New York, with patients most commonly presenting from Queens.

Table 1. Demographics of the sampled population and associated biometric data. Counts and age averages were noted. Weight and Height averages are noted with standard deviations.

Table 1. Demographic and Biometric Characteristics.	Age (Years)		Weight		Height	
	Count	Mean	Mean	Std Dev	Mean	Std Dev
Gender						
Female	270	64.50	75.18	37.10	156.06	16.21
Male	860	48.96	91.08	42.64	168.50	14.56
Race						
American Indian	1	22.32	96.00	.	178.00	.
Asian	171	61.57	73.27	32.55	162.06	13.58
Black	89	56.63	103.36	53.97	172.50	10.47
Native Hawaiian or Other Pacific Islander	5	63.57	75.20	44.57	166.00	8.04
Other	640	48.18	86.63	40.19	163.94	15.74
Unknown	23	44.20	82.50	37.66	161.82	26.36
White	201	58.51	93.94	44.69	169.80	17.35
Ethnicity						
Hispanic Origin	521	46.83	87.45	41.98	163.21	15.10
Non-Hispanic Origin	563	58.60	86.58	41.75	168.19	13.60
Unknown	46	46.27	92.00	43.41	154.92	35.10
Occupation						
Building and Grounds Cleaning and Maintenance	1	68.49	63.00	.	158.00	.
Community and Social Services Occupations	1	59.03	124.00	.	162.00	.
Construction and Extraction Occupations	12	49.94	89.45	28.90	175.18	5.65
Food Preparation and Serving Related	6	44.11	87.17	32.98	169.00	3.74

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Healthcare Practitioners and Technical Occupations	1	32.91	210.00	.	66.00	.
N/A	1	47.52	59.00	.	179.00	.
Not Applicable	1094	52.78	86.84	41.23	165.53	15.38
Production Occupations	1	66.27	84.00	.	167.00	.
Sales and Related Occupations	1	68.88	67.00	.	56.00	.
Transportation and Material Moving Occupations	5	46.40	140.80	125.72	168.33	1.53
Unknown	7	48.89	84.33	35.44	160.00	10.05
County						
Bronx	1	33.92	77.00	.	167.00	.
Kings (Brooklyn)	72	46.32	86.04	43.50	167.55	20.93
New York (Manhattan)	2	59.71	81.00	32.53	175.00	7.07
Queens	1055	53.11	87.29	41.85	165.27	15.54
State						
NY	1130	52.67	87.19	41.89	165.43	15.91
Total	1130	52.67	87.19	41.89	165.43	15.91

Using *Table 2* as reference, blunt trauma was the most common mechanism of injury, accounting for 97.8% of cases (n = 1,103), while penetrating trauma accounted for 2.2% (n = 25). Among the 97.8% of blunt trauma, 52.2% were discharged to home/self-care, 6.4% died as full code, and 3.1% died following withdrawal of care. Other common discharge destinations included home with services (5.3%), inpatient rehabilitation (5.1%), traumatic brain rehabilitation (4.3%), and skilled nursing facilities (3.0%). In contrast, amongst the 2.2% of penetrating trauma, only 0.6% were discharged to home/self-care, and 0.8% died as full code. Considering that brain death is part of the mortality spectrum, using *Table 2*, we can infer mortality rate comparison amongst both mechanisms of injury, assuming mortality includes the following: died unknown, died after withdrawal of care, died as full code, died with care not begun (DNR/DNI), and met brain death criteria. The mortality rate in the blunt TBI category was 13.8%; meanwhile, penetrating TBI had a 48% mortality rate. Fall height was available for patients with blunt trauma and averaged 3.5 meters (SD ±7.5). The highest average fall height was observed among patients who died as full code (15.3 meters). Vital signs varied significantly across outcome groups. Among patients with blunt trauma, the mean systolic blood pressure (SBP) was 134.5 mmHg (SD ±33.8), but patients who died as full code had a mean SBP of only 82.5 mmHg. Similarly, mean diastolic blood pressure (DBP) was 81.5 mmHg but dropped to 52.8 mmHg among deceased as full code patients. On the other hand, penetrating trauma patients had a mean SBP of 117.7 mmHg (SD ±62.3) and DBP of 83.7 (SD ±47.3) mmHg. Heart rate followed similar trends in both categories, with blunt trauma patients averaging 86 bpm, but dead at full code patients averaging just 57 bpm. Oxygen saturation was markedly reduced in patients who died (~63%) compared to the overall mean of ~95%, and body temperature was also lower in patients with fatal outcomes. Respiratory rate was generally stable at around 18 breaths per minute across all groups.

Table 2. Outcome in patients with different types of TBI and associated presenting factors such as fall height, systolic and diastolic blood pressures (BP), heart rate, oxygen saturation (O_2), respiratory rate, and body temperature. Averages were noted with standard deviations.

Table 2: Trauma Characteristics and Vital Signs		Count	%	Fall Height (m)		Systolic BP (mmHg)		Diastolic BP (mmHg)		Heart Rate (bpm)		O_2 Saturation (%)		Resp. Rate (bpm)		Temp (°C)	
				Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Trauma Type	Patient Disposition																
Blunt	Died Unknown	1	0.1	.	.	0.0	.	0.0	.	0.0	.	0.0	.	0.0	.	96.9	.

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	Died after withdrawal of care	35	3.1	2.2	3.3	141.1	34.3	89.1	23.1	90.6	21.0	96.7	5.9	17.4	4.2	95.6	11.2
	Died as full code	72	6.4	15.3	18.9	82.5	72.4	52.8	49.3	56.9	52.7	63.9	43.6	12.3	10.0	94.9	11.8
	Died with care, not begun DNR/DNI	21	1.9	4.4	6.6	142.2	37.2	81.6	20.0	84.5	16.0	97.3	5.1	18.8	2.3	98.0	0.6
	Discharged to Home or Self-care (Routine Discharge)	589	52.2	2.4	4.4	136.6	22.6	83.2	15.1	86.7	17.6	97.8	2.2	18.6	4.5	97.8	3.1
	Home with services	60	5.3	2.0	3.7	140.8	28.8	78.0	16.8	81.0	15.2	97.5	2.3	18.2	2.6	98.1	0.9
	Homeless/Shelter	8	0.7	0.0	0.0	131.4	22.3	85.3	13.6	88.1	22.7	98.6	1.5	17.8	4.2	98.3	0.4
	Inpatient Psych Care	6	0.5	10.0	11.5	139.0	15.5	87.5	16.7	105.3	23.6	97.5	1.9	18.8	2.1	98.2	0.6
	Inpatient Rehabilitation	58	5.1	1.5	4.0	142.6	23.8	86.3	18.3	86.0	19.8	97.6	2.6	19.7	4.9	97.8	0.8
	Left AMA	31	2.7	1.8	3.7	136.4	20.3	82.8	15.4	92.0	22.0	97.1	2.4	18.1	3.3	98.4	1.2
	Met brain death criteria	23	2.0	1.8	4.5	126.6	43.8	76.1	26.2	95.2	26.7	95.2	10.4	18.5	7.4	93.9	14.5
	New placement at Skilled Nursing Facility	34	3.0	3.6	6.1	149.4	27.6	93.8	20.7	89.3	25.9	97.4	3.4	17.7	3.6	95.4	11.5
	Other Acute Care Hospital Emergency Department	16	1.4	2.0	2.4	119.0	21.4	74.6	14.2	100.9	27.3	99.1	1.3	23.6	8.2	98.3	0.6
	Other Acute Care Hospital Inpatient	16	1.4	1.6	3.5	139.1	28.4	85.5	16.4	85.8	20.2	98.3	1.5	21.1	5.4	97.8	0.6
	Other Health Care Facility	14	1.2	9.3	12.8	136.6	28.6	86.4	21.3	113.2	32.7	97.8	2.9	24.3	6.3	98.1	0.9
	Police Custody/Jail/Prison	5	0.4	0.0	.	120.8	8.2	80.4	6.2	95.4	14.2	97.8	1.9	19.4	5.0	98.5	0.3
	Return to Skilled Nursing Facility	3	0.3	2.0	1.7	138.0	47.0	77.3	15.7	83.7	7.4	97.7	1.2	15.7	1.5	97.9	0.4
	Sub-Acute Inpatient Rehabilitation	62	5.5	3.6	7.6	146.1	26.3	82.1	18.1	87.3	18.8	96.6	7.1	18.5	2.8	98.1	0.8
	Traumatic Brain Rehabilitation	49	4.3	7.1	12.0	142.4	30.8	87.4	17.9	95.3	23.9	96.3	5.4	20.1	5.7	97.3	4.2
	Total	1103	97.8	3.5	7.5	134.5	33.8	81.5	21.9	86.0	24.5	95.3	14.4	18.4	5.3	97.5	5.1
Penetrating	Patient Disposition																
	Died Unknown	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Died after withdrawal of care	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Died as full code	9	0.8	0.0	.	92.0	86.2	76.0	72.3	54.8	61.7	56.1	52.5	11.9	13.8	96.8	2.2
	Died with care, not begun DNR/DNI	1	0.1	.	.	132.0	.	97.0	.	101.0	.	93.0	.	24.0	.	98.4	.
	Discharged to Home or Self-care (Routine Discharge)	7	0.6	.	.	99.6	24.5	66.1	21.1	111.6	39.4	98.7	1.9	20.9	8.7	97.7	0.9
	Home with services	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Homeless/Shelter	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Inpatient Psych Care	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Inpatient Rehabilitation	1	0.1	.	.	97.0	.	84.0	.	80.0	.	95.0	.	11.0	.	97.0	.
	Left AMA	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Met brain death criteria	2	0.2	.	.	199.0	60.8	112.5	60.1	136.5	6.4	99.0	1.4	26.0	4.2	97.2	0.2
	New placement at Skilled Nursing Facility	3	0.3	.	.	152.3	60.7	109.0	48.5	85.3	30.4	98.0	3.5	24.7	4.2	97.6	0.7
	Other Acute Care Hospital Emergency Department	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Other Acute Care Hospital Inpatient	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Other Health Care Facility	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Police Custody/Jail/Prison	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Return to Skilled Nursing Facility	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Sub-Acute Inpatient Rehabilitation	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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Traumatic Brain Rehabilitation	2	0.2	.	.	140.5	24.7	98.5	4.9	86.0	4.2	100.0	0.0	19.0	1.4	97.6	0.1
Total	25	2.2	0.0	.	117.7	62.3	83.7	47.3	87.5	49.1	85.4	33.9	18.3	10.5	97.4	1.2

Concerning patient disposition of all TBI's using *Table 3*, emergency department length of stay (EDLOS) averaged 13.1 hours (SD ±13.7) but was significantly shorter for patients who died as full code (~3.7 hours), while longer stays were observed in those discharged to rehabilitation areas, such as subacute inpatient rehabilitation (~14.2 hours). Hospital length of stay (HLOS) was 11.8 days on average (SD ±21.1), with the shortest stays in routine discharges (~7 days) and the longest in patients receiving traumatic brain rehabilitation (~36.4 days). Intensive care unit (ICU) stay averaged 3.8 days (SD ±7.3), with longer durations for patients in rehabilitation (~11.7 days). Ventilation duration followed a similar trend: average 1.7 days overall, peaking at patients ending in skilled nursing facilities (12.4 days), death following withdrawal of care (8.1 days), traumatic brain rehabilitation (5.3 days), and deceased patients (1.9 days), whilst patients who were routinely discharged had a mean duration of 0.4 days. Severity scores showed a clear relationship with outcomes of TBIs in *Table 3*. The mean Injury Severity Score (ISS) was 18.7 (SD ±10.4), with routine discharges having an average of 15.2 (SD ±6.1), but among patients who died as full code, ISS was significantly higher at 35.9 (SD ±18.1). Glasgow Coma Scale (GCS) scores had a cohort average of 12.6 (SD ±4.1), while patients who died as full code had a mean GCS of 6.0 (SD ±4.8), and routine discharges had a mean of 14.2 (SD ±2.2). Lastly, the average AIS Head Score was 3.7 (SD ±0.8), with full code deaths having an average of 4.3 (SD ±1.0) and routine discharges being 3.5 (SD ±0.7).

Table 3. Outcomes in patients with associated length of stay in multiple departments, including the emergency department (ED), hospital, and intensive care unit (ICU). The ventilation period is also noted in the table for each outcome in different departments. Severity scores such as Injury Severity Score, Glasgow Coma Scale, and Abbreviated Injury Scale (AIS) for head included per associated outcome in different departments. Counts are reinforced with ratio, mean, and standard deviation.

Table 3: Length of Stay and Severity		ED LOS (hours)				Hospital LOS (days)				ICU LOS (days)				Ventilation Days				Injury Severity Score				Glasgow Coma Scale				AIS Head			
		Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev
ED Disposition	Patient Disposition	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died Unknown	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died after withdrawal of care	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died as full code	15	1.3	0.3	0.7	15	1.3	1.0	0.0	15	1.3	0.0	0.0	15	1.3	0.0	0.0	15	1.3	36.7	17.8	15	1.3	3.8	3.1	15	1.3	4.1	0.9
	Died with care, not begun DNR/DNI	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Discharged to Home or Self-care (Routine Discharge)	13	1.2	12.3	9.4	12	1.1	1.0	0.0	13	1.1	0.0	0.0	13	1.1	0.0	0.0	13	1.1	12.5	3.5	13	1.1	15.0	0.0	13	1.1	3.2	0.4
	Home with services	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Homeless/Shelter	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Inpatient Psych Care	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Inpatient Rehabilitation	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Left AMA	1	0.1	7.5	0.0	1	0.1	1.0	0.0	1	0.1	0.0	0.0	1	0.1	0.0	0.0	1	0.1	10.0	0.0	1	0.1	15.0	0.0	1	0.1	3.0	0.0
	Met brain death criteria	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	New placement at Skilled Nursing Facility	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0

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	Other Acute Care Hospital Emergency Department	9	0.8	8.3	5.1	9	0.8	1.0	0.0	9	0.8	0.0	0.0	9	0.8	0.0	0.0	9	0.8	14.7	6.5	9	0.8	13.9	3.0	9	0.8	3.7	0.9
	Other Acute Care Hospital Inpatient	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Other Health Care Facility	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Police Custody/Jail/Prison	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Return to Skilled Nursing Facility	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Sub-Acute Inpatient Rehabilitation	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Traumatic Brain Rehabilitation	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Total	38	3.4	6.5	7.9	37	3.3	1.0	0.0	38	3.4	0.0	0.0	38	3.4	0.0	0.0	38	3.4	22.5	16.4	38	3.4	10.3	5.8	38	3.4	3.6	0.8
Intensive /Critical Care Unit	Patient Disposition																												
		1	0.1	3.2	0.0	1	0.1	160.0	0.0	4	0.4	18.5	25.9	3	0.3	0.0	0.0	4	0.4	26.0	7.3	4	0.4	11.3	4.3	4	0.4	4.8	0.5
	Died Unknown	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died after withdrawal of care	22	2.0	6.9	5.1	22	2.0	15.9	17.7	22	1.9	9.4	7.2	22	1.9	8.8	8.7	22	1.9	28.0	13.5	22	1.9	8.2	4.3	22	1.9	4.5	0.8
	Died as full code	17	1.5	8.9	11.6	17	1.5	18.5	23.4	17	1.5	10.6	10.9	17	1.5	4.3	5.3	17	1.5	28.1	14.6	17	1.5	9.9	5.0	17	1.5	4.3	1.0
	Died with care, not begun DNR/DNI	16	1.4	9.7	6.7	16	1.4	11.1	14.1	16	1.4	5.2	7.2	16	1.4	0.6	1.0	16	1.4	22.9	6.2	16	1.4	11.9	4.3	16	1.4	4.3	0.9
	Discharged to Home or Self-care (Routine Discharge)	270	23.9	12.2	16.4	270	23.9	10.5	15.0	270	23.8	3.5	3.8	270	23.9	0.5	2.2	270	23.8	16.8	6.2	270	23.8	13.5	2.8	270	23.8	3.6	0.7
	Home with services	33	2.9	13.8	13.9	33	2.9	15.2	17.4	33	2.9	4.9	5.5	33	2.9	0.9	2.6	33	2.9	20.1	7.1	33	2.9	13.1	3.8	33	2.9	4.1	0.8
	Homeless/Shelter	1	0.1	6.1	0.0	1	0.1	4.0	0.0	1	0.1	2.1	0.0	1	0.1	0.0	0.0	1	0.1	10.0	0.0	1	0.1	15.0	0.0	1	0.1	3.0	0.0
	Inpatient Psych Care	3	0.3	15.1	11.7	3	0.3	9.7	6.1	3	0.3	3.1	1.1	3	0.3	0.0	0.0	3	0.3	13.7	3.5	3	0.3	15.0	0.0	3	0.3	3.0	0.0
	Inpatient Rehabilitation	33	2.9	7.8	4.8	33	2.9	20.4	18.3	33	2.9	8.2	9.5	33	2.9	3.2	5.2	33	2.9	20.5	7.4	33	2.9	12.2	3.8	33	2.9	3.8	0.7
	Left AMA	18	1.6	14.2	18.9	18	1.6	9.1	9.2	18	1.6	4.7	4.8	18	1.6	1.4	3.3	18	1.6	15.7	6.1	18	1.6	13.6	3.4	18	1.6	3.5	0.7
	Met brain death criteria	16	1.4	6.9	3.8	16	1.4	4.6	5.9	16	1.4	3.9	5.1	16	1.4	2.8	3.0	16	1.4	30.8	14.2	16	1.4	5.6	4.7	16	1.4	4.6	0.6
	New placement at Skilled Nursing Facility	19	1.7	12.4	9.7	19	1.7	37.9	41.0	19	1.7	15.7	14.4	19	1.7	6.6	7.7	19	1.7	22.9	9.5	19	1.7	11.4	4.8	19	1.7	3.8	0.8
	Other Acute Care Hospital Emergency Department	2	0.2	23.1	6.2	2	0.2	13.5	3.5	2	0.2	6.9	2.5	2	0.2	4.5	2.1	2	0.2	24.0	4.2	2	0.2	9.0	1.4	2	0.2	4.5	0.7
	Other Acute Care Hospital Inpatient	9	0.8	9.3	4.2	9	0.8	7.7	8.7	9	0.8	3.2	2.5	9	0.8	0.7	2.0	9	0.8	18.8	8.7	9	0.8	14.3	0.9	9	0.8	3.6	0.7
	Other Health Care Facility	5	0.4	5.3	2.6	5	0.4	11.0	11.3	5	0.4	8.7	7.4	5	0.4	6.6	5.7	5	0.4	25.0	13.7	5	0.4	9.4	4.3	5	0.4	4.2	0.8
	Police Custody/Jail/Prison	3	0.3	9.5	4.4	3	0.3	5.0	1.0	3	0.3	3.0	1.6	3	0.3	0.7	1.2	3	0.3	15.3	2.3	3	0.3	9.3	5.5	3	0.3	3.0	0.0
	Return to Skilled Nursing Facility	2	0.2	4.6	0.2	2	0.2	6.5	2.1	2	0.2	3.5	1.3	2	0.2	0.0	0.0	2	0.2	13.0	4.2	2	0.2	15.0	0.0	2	0.2	3.5	0.7
	Sub-Acute Inpatient Rehabilitation	39	3.5	11.3	7.4	39	3.5	25.0	23.6	39	3.4	6.9	8.7	39	3.4	2.4	6.7	39	3.4	20.1	6.9	39	3.4	13.2	3.7	39	3.4	3.9	0.9
	Traumatic Brain Rehabilitation	32	2.8	9.6	6.7	32	2.8	29.2	17.7	32	2.8	10.7	8.6	32	2.8	4.1	6.2	32	2.8	21.3	9.5	32	2.8	10.7	4.5	32	2.8	3.8	0.7
	Total	541	48.0	11.2	13.4	541	48.0	15.0	20.0	544	48.0	5.7	7.3	543	48.0	1.9	4.6	544	48.0	19.5	8.7	544	48.0	12.5	3.9	544	48.0	3.8	0.8
Not Applicable	Patient Disposition																												
		0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died Unknown	1	0.1	0.1	0.0	1	0.1	1.0	0.0	1	0.1	0.0	0.0	1	0.1	0.0	0.0	1	0.1	9.0	0.0	1	0.1	3.0	0.0	1	0.1	3.0	0.0
	Died after withdrawal of care	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died as full code	33	2.9	0.9	1.7	33	2.9	1.0	0.0	33	2.9	0.0	0.0	33	2.9	0.2	0.4	33	2.9	42.2	20.6	33	2.9	3.9	3.0	33	2.9	4.2	1.1

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	Died with care, not begun DNR/DNI	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Discharged to Home or Self-care (Routine Discharge)	11	1.0	16.6	12.6	11	1.0	1.1	0.3	11	1.0	0.0	0.0	11	1.0	0.0	0.0	11	1.0	11.6	2.9	11	1.0	15.0	0.0	11	1.0	3.1	0.3

Table 3: Length of Stay and Severity		ED LOS (hours)				Hospital LOS (days)				ICU LOS (days)				Ventilation Days				Injury Severity Score				Glasgow Coma Scale				AIS Head			
		Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev
	Home with services	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Homeless/Shelter	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Inpatient Psych Care	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Inpatient Rehabilitation	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Left AMA	1	0.1	10.5	0.0	1	0.1	1.0	0.0	1	0.1	0.0	0.0	1	0.1	0.0	0.0	1	0.1	14.0	0.0	1	0.1	15.0	0.0	1	0.1	3.0	0.0
	Met brain death criteria	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	New placement at Skilled Nursing Facility	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Other Acute Care Hospital Emergency Department	5	0.4	8.0	2.4	5	0.4	1.0	0.0	5	0.4	0.0	0.0	5	0.4	0.0	0.0	5	0.4	9.6	0.5	5	0.4	14.8	0.4	5	0.4	3.0	0.0
	Other Acute Care Hospital Inpatient	2	0.2	47.3	29.6	2	0.2	1.5	0.7	2	0.2	0.0	0.0	2	0.2	0.0	0.0	2	0.2	11.5	3.5	2	0.2	13.0	2.8	2	0.2	3.0	0.0
	Other Health Care Facility	6	0.5	7.4	4.2	6	0.5	1.0	0.0	6	0.5	0.0	0.0	6	0.5	0.0	0.0	6	0.5	11.5	3.5	6	0.5	14.2	2.0	6	0.5	3.3	0.5
	Police Custody/Jail/Prison	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Return to Skilled Nursing Facility	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Sub-Acute Inpatient Rehabilitation	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Traumatic Brain Rehabilitation	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Total	59	5.2	6.8	11.9	59	5.2	1.0	0.2	59	5.2	0.0	0.0	59	5.2	0.1	0.3	59	5.2	28.5	21.9	59	5.2	8.4	5.8	59	5.2	3.7	1.0
Operating Room	Patient Disposition	1	0.1	2.7	0.0	0	0.0	0.0	0.0	1	0.1	12.3	0.0	1	0.1	0.0	0.0	1	0.1	26.0	0.0	1	0.1	6.0	0.0	1	0.1	5.0	0.0
	Died Unknown	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died after withdrawal of care	8	0.7	2.1	1.4	8	0.7	10.5	8.4	8	0.7	9.4	7.0	8	0.7	8.4	7.5	8	0.7	22.9	8.2	8	0.7	7.8	5.1	8	0.7	4.4	0.7
	Died as full code	11	1.0	1.6	0.6	11	1.0	16.8	39.8	11	1.0	8.0	13.2	11	1.0	6.3	6.8	11	1.0	33.1	12.2	11	1.0	6.5	4.8	11	1.0	4.6	0.8
	Died with care, not begun DNR/DNI	2	0.2	1.6	0.9	2	0.2	2.0	0.0	2	0.2	2.2	0.6	2	0.2	2.0	0.0	2	0.2	38.0	18.4	2	0.2	3.0	0.0	2	0.2	5.0	0.0
	Discharged to Home or Self-care (Routine Discharge)	27	2.4	4.8	5.0	28	2.5	13.8	15.6	28	2.5	5.4	6.2	28	2.5	2.5	4.1	28	2.5	23.2	9.5	28	2.5	12.4	3.5	28	2.5	4.0	0.9

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	Home with services	2	0.2	6.0	4.9	2	0.2	23.5	16.3	2	0.2	14.3	14.8	2	0.2	0.0	0.0	2	0.2	23.5	20.5	2	0.2	15.0	0.0	2	0.2	4.0	1.4
	Homeless/Shelter	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Inpatient Psych Care	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Inpatient Rehabilitation	9	0.8	4.5	5.1	9	0.8	21.9	19.0	9	0.8	13.9	20.5	9	0.8	4.2	7.7	9	0.8	28.8	8.6	9	0.8	10.2	5.3	9	0.8	4.3	0.9
	Left AMA	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Met brain death criteria	7	0.6	1.5	1.0	7	0.6	19.0	39.3	7	0.6	4.6	6.5	7	0.6	17.7	39.9	7	0.6	35.7	10.5	7	0.6	4.0	2.6	7	0.6	5.0	0.0
	New placement at Skilled Nursing Facility	12	1.1	2.6	2.4	12	1.1	79.1	64.5	12	1.1	23.9	19.9	12	1.1	27.6	16.6	12	1.1	26.3	4.2	12	1.1	5.9	3.4	12	1.1	4.8	0.4
	Other Acute Care Hospital Emergency Department	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Other Acute Care Hospital Inpatient	1	0.1	1.2	0.0	1	0.1	1.0	0.0	1	0.1	0.0	0.0	1	0.1	0.0	0.0	1	0.1	9.0	0.0	1	0.1	7.0	0.0	1	0.1	3.0	0.0
	Other Health Care Facility	3	0.3	1.8	1.4	3	0.3	48.0	65.6	3	0.3	15.1	13.9	3	0.3	11.0	9.5	3	0.3	25.7	0.6	3	0.3	7.3	2.5	3	0.3	5.0	0.0
	Police Custody/Jail/Prison	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Return to Skilled Nursing Facility	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Sub-Acute Inpatient Rehabilitation	2	0.2	5.5	2.0	2	0.2	20.5	23.3	2	0.2	1.6	2.2	2	0.2	1.0	1.4	2	0.2	19.5	9.2	2	0.2	14.5	0.7	2	0.2	4.0	1.4
	Traumatic Brain Rehabilitation	16	1.4	4.4	4.3	16	1.4	53.4	60.5	16	1.4	14.8	9.1	16	1.4	8.6	3.5	16	1.4	24.6	8.7	16	1.4	7.5	3.7	16	1.4	4.4	0.8
	Total	101	9.0	3.5	3.8	101	9.0	29.9	44.8	102	9.0	10.7	13.0	102	9.0	8.6	14.6	102	9.0	26.3	10.0	102	9.0	8.7	4.8	102	9.0	4.4	0.8
Step-Down Unit	Patient Disposition	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died Unknown	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died after withdrawal of care	4	0.4	11.4	2.1	4	0.4	10.3	11.5	4	0.4	4.3	7.3	4	0.4	6.0	6.7	4	0.4	21.0	10.3	4	0.4	8.5	5.2	4	0.4	4.3	1.0
	Died as full code	1	0.1	28.3	0.0	1	0.1	11.0	0.0	1	0.1	4.7	0.0	1	0.1	5.0	0.0	1	0.1	38.0	0.0	1	0.1	15.0	0.0	1	0.1	5.0	0.0
	Died with care, not begun DNR/DNI	3	0.3	19.0	4.4	3	0.3	6.0	5.6	3	0.3	3.0	5.1	3	0.3	0.0	0.0	3	0.3	22.0	6.9	3	0.3	15.0	0.0	3	0.3	4.3	1.2
	Discharged to Home or Self-care (Routine Discharge)	94	8.3	22.4	16.3	94	8.3	5.1	5.1	94	8.3	0.1	0.4	94	8.3	0.0	0.3	94	8.3	14.7	5.0	94	8.3	14.8	0.8	94	8.3	3.4	0.6
	Home with services	15	1.3	21.1	13.0	15	1.3	8.8	6.7	15	1.3	0.0	0.0	15	1.3	0.0	0.0	15	1.3	18.7	6.9	15	1.3	14.7	0.8	15	1.3	3.8	0.7
	Homeless/Shelter	5	0.4	10.5	7.0	5	0.4	7.2	5.4	5	0.4	0.0	0.0	5	0.4	0.0	0.0	5	0.4	16.0	1.7	5	0.4	14.8	0.4	5	0.4	3.6	0.5
	Inpatient Psych Care	1	0.1	24.9	0.0	1	0.1	11.0	0.0	1	0.1	0.0	0.0	1	0.1	0.0	0.0	1	0.1	14.0	0.0	1	0.1	15.0	0.0	1	0.1	3.0	0.0
	Inpatient Rehabilitation	9	0.8	20.6	11.1	9	0.8	9.9	3.4	9	0.8	0.2	0.7	9	0.8	0.0	0.0	9	0.8	16.9	6.6	9	0.8	14.7	0.7	9	0.8	3.9	0.9

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	Left AMA	1	0.1	14.0	0.0	1	0.1	3.0	0.0	1	0.1	0.0	0.0	1	0.1	0.0	0.0	1	0.1	10.0	0.0	1	0.1	15.0	0.0	1	0.1	3.0	0.0
	Met brain death criteria	1	0.1	5.5	0.0	1	0.1	7.0	0.0	1	0.1	2.4	0.0	1	0.1	3.0	0.0	1	0.1	10.0	0.0	1	0.1	15.0	0.0	1	0.1	3.0	0.0
	New placement at Skilled Nursing Facility	2	0.2	10.8	5.5	2	0.2	20.0	19.8	2	0.2	0.0	0.0	2	0.2	0.0	0.0	2	0.2	21.5	6.4	2	0.2	15.0	0.0	2	0.2	4.5	0.7

Table 3: Length of Stay and Severity		ED LOS (hours)				Hospital LOS (days)				ICU LOS (days)				Ventilation Days				Injury Severity Score				Glasgow Coma Scale				AIS Head			
		Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev
	Other Acute Care Hospital Emergency Department	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Other Acute Care Hospital Inpatient	2	0.2	25.8	5.5	2	0.2	3.5	2.1	2	0.2	0.0	0.0	2	0.2	0.0	0.0	2	0.2	15.5	2.1	2	0.2	15.0	0.0	2	0.2	3.5	0.7
	Other Health Care Facility	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Police Custody/Jail/ Prison	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Return to Skilled Nursing Facility	1	0.1	11.7	0.0	1	0.1	18.0	0.0	1	0.1	0.0	0.0	1	0.1	0.0	0.0	1	0.1	14.0	0.0	1	0.1	9.0	0.0	1	0.1	3.0	0.0
	Sub-Acute Inpatient Rehabilitation	11	1.0	18.8	9.6	11	1.0	20.9	19.9	11	1.0	0.4	1.5	11	1.0	0.0	0.0	11	1.0	14.7	7.4	11	1.0	14.1	2.4	11	1.0	3.2	0.6
	Traumatic Brain Rehabilitation	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Total	150	13.3	20.8	14.5	150	13.3	7.5	8.7	150	13.2	0.3	1.6	150	13.3	0.2	1.4	150	13.2	15.8	6.1	150	13.2	14.6	1.6	150	13.2	3.5	0.7
Trauma Receiving Area	Patient Disposition	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died Unknown	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died after withdrawal of care	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died as full code	1	0.1	7.6	0.0	1	0.1	1.0	0.0	1	0.1	0.0	0.0	1	0.1	1.0	0.0	1	0.1	33.0	0.0	1	0.1	15.0	0.0	1	0.1	5.0	0.0
	Died with care, not begun DNR/DNI	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Discharged to Home or Self-care (Routine Discharge)	15	1.3	18.0	14.7	15	1.3	2.0	3.4	15	1.3	0.2	0.8	15	1.3	0.0	0.0	15	1.3	11.3	4.5	15	1.3	14.7	1.3	15	1.3	3.1	0.5
	Home with services	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Homeless/Shelter	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Inpatient Psych Care	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Inpatient Rehabilitation	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Left AMA	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Met brain death criteria	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	New placement at	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0

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	Skilled Nursing Facility																												
	Other Acute Care Hospital Emergency Department	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Other Acute Care Hospital Inpatient	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Other Health Care Facility	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Police Custody/Jail/ Prison	1	0.1	28.1	0.0	1	0.1	1.0	0.0	1	0.1	0.0	0.0	1	0.1	0.0	0.0	1	0.1	9.0	0.0	1	0.1	15.0	0.0	1	0.1	3.0	0.0
	Return to Skilled Nursing Facility	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Sub-Acute Inpatient Rehabilitation	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Traumatic Brain Rehabilitation	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Total	17	1.5	18.0	14.2	17	1.5	1.9	3.2	17	1.5	0.2	0.8	17	1.5	0.1	0.2	17	1.5	12.5	6.8	17	1.5	14.7	1.2	17	1.5	3.2	0.7
	Patient Disposition	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died Unknown	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Died after withdrawal of care	1	0.1	3.9	0.0	1	0.1	1.0	0.0	1	0.1	0.0	0.0	1	0.1	0.0	0.0	1	0.1	25.0	0.0	1	0.1	3.0	0.0	1	0.1	5.0	0.0
	Died as full code	3	0.3	22.0	14.4	3	0.3	3.0	2.0	3	0.3	0.0	0.0	3	0.3	0.3	0.6	3	0.3	18.7	7.8	3	0.3	11.0	6.9	3	0.3	4.0	1.0
	Died with care, not begun DNR/DNI	1	0.1	9.5	0.0	1	0.1	6.0	0.0	1	0.1	3.4	0.0	1	0.1	3.0	0.0	1	0.1	25.0	0.0	1	0.1	14.0	0.0	1	0.1	5.0	0.0
	Discharged to Home or Self-care (Routine Discharge)	165	14.6	19.5	12.3	165	14.6	2.6	3.2	165	14.6	0.0	0.1	165	14.6	0.0	0.0	165	14.6	12.3	3.7	165	14.6	14.9	0.3	165	14.6	3.2	0.5
Ward/Floor	**Home with services**	10	0.9	18.1	8.6	10	0.9	8.1	5.7	10	0.9	0.0	0.0	10	0.9	0.0	0.0	10	0.9	14.0	5.0	10	0.9	14.8	0.4	10	0.9	3.4	0.7
	Homeless/Shelter	2	0.2	21.4	8.6	2	0.2	10.5	4.9	2	0.2	0.0	0.0	2	0.2	0.0	0.0	2	0.2	9.5	0.7	2	0.2	15.0	0.0	2	0.2	3.0	0.0
	Inpatient Psych Care	2	0.2	16.0	3.1	2	0.2	10.0	5.7	2	0.2	0.0	0.0	2	0.2	0.0	0.0	2	0.2	15.5	3.5	2	0.2	15.0	0.0	2	0.2	3.0	0.0
	Inpatient Rehabilitation	8	0.7	20.6	13.5	8	0.7	6.6	3.7	8	0.7	0.4	1.0	8	0.7	0.3	0.7	8	0.7	13.0	3.7	8	0.7	14.6	0.7	8	0.7	3.4	0.5
	Left AMA	10	0.9	18.4	14.5	10	0.9	2.2	2.8	10	0.9	0.0	0.0	10	0.9	0.0	0.0	10	0.9	13.1	4.3	10	0.9	14.9	0.3	10	0.9	3.1	0.3
	Met brain death criteria	1	0.1	2.2	0.0	1	0.1	1.0	0.0	1	0.1	1.3	0.0	1	0.1	2.0	0.0	1	0.1	17.0	0.0	1	0.1	3.0	0.0	1	0.1	4.0	0.0
	New placement at Skilled Nursing Facility	4	0.4	22.3	20.6	4	0.4	15.3	9.2	4	0.4	0.0	0.0	4	0.4	0.0	0.0	4	0.4	13.0	4.1	4	0.4	14.5	0.6	4	0.4	3.3	0.5
	Other Acute Care Hospital Emergency Department	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0

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	Other Acute Care Hospital Inpatient	2	0.2	14.8	10.0	2	0.2	4.5	2.1	2	0.2	0.0	0.0	2	0.2	0.0	0.0	2	0.2	13.0	4.2	2	0.2	14.0	1.4	2	0.2	3.5	0.7
	Other Health Care Facility	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Police Custody/Jail/Prison	1	0.1	29.6	0.0	1	0.1	3.0	0.0	1	0.1	0.0	0.0	1	0.1	0.0	0.0	1	0.1	11.0	0.0	1	0.1	15.0	0.0	1	0.1	3.0	0.0
	Return to Skilled Nursing Facility	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0
	Sub-Acute Inpatient Rehabilitation	9	0.8	22.7	18.0	10	0.9	12.6	13.5	10	0.9	0.0	0.0	10	0.9	0.0	0.0	10	0.9	11.6	3.7	10	0.9	15.0	0.0	10	0.9	3.2	0.4
	Traumatic Brain Rehabilitation	3	0.3	15.7	13.8	3	0.3	22.3	24.0	3	0.3	6.2	10.7	3	0.3	0.0	0.0	3	0.3	17.0	7.5	3	0.3	15.0	0.0	3	0.3	4.0	1.0

Table 3: Length of Stay and Severity		ED LOS (hours)				Hospital LOS (days)				ICU LOS (days)				Ventilation Days				Injury Severity Score				Glasgow Coma Scale				AIS Head			
		Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev	Count	%	Mean	Std Dev
	Total	222	19.7	19.4	12.5	223	19.8	4.1	6.1	223	19.7	0.1	1.3	223	19.7	0.0	0.3	223	19.7	12.7	4.1	223	19.7	14.7	1.4	223	19.7	3.3	0.5
Total	Patient Disposition																												
		2	0.2	2.9	0.4	1	0.1	160.0	0.0	5	0.4	17.3	22.6	4	0.4	0.0	0.0	5	0.4	26.0	6.3	5	0.4	10.2	4.4	5	0.4	4.8	0.4
	Died Unknown	1	0.1	0.1	0.0	1	0.1	1.0	0.0	1	0.1	0.0	0.0	1	0.1	0.0	0.0	1	0.1	9.0	0.0	1	0.1	3.0	0.0	1	0.1	3.0	0.0
	Died after withdrawal of care	35	3.1	6.2	4.9	35	3.1	13.6	15.2	35	3.1	8.6	7.2	35	3.1	8.1	8.0	35	3.1	25.9	12.0	35	3.1	8.0	4.4	35	3.1	4.4	0.8
	Died as full code	81	7.2	3.7	8.1	81	7.2	7.0	19.3	81	7.1	3.4	8.2	81	7.2	1.9	4.2	81	7.1	35.9	18.1	81	7.1	6.0	4.8	81	7.1	4.3	1.0
	Died with care, not begun DNR/DNI	22	2.0	10.2	7.3	22	2.0	9.4	12.5	22	1.9	4.5	6.4	22	1.9	0.8	1.1	22	1.9	24.3	8.2	22	1.9	11.6	4.7	22	1.9	4.4	0.8
	Discharged to Home or Self-care (Routine Discharge)	595	52.7	15.7	15.4	595	52.7	7.0	11.6	596	52.6	1.9	3.4	596	52.7	0.4	1.8	596	52.6	15.2	6.1	596	52.6	14.2	2.2	596	52.6	3.5	0.7
	Home with services	60	5.3	16.0	13.0	60	5.3	12.7	14.1	60	5.3	3.2	5.5	60	5.3	0.5	2.0	60	5.3	18.9	7.4	60	5.3	13.8	3.0	60	5.3	3.9	0.8
	Homeless/Shelter	8	0.7	12.6	8.3	8	0.7	7.6	4.9	8	0.7	0.3	0.7	8	0.7	0.0	0.0	8	0.7	13.6	3.5	8	0.7	14.9	0.4	8	0.7	3.4	0.5
	Inpatient Psych Care	6	0.5	17.0	8.4	6	0.5	10.0	4.6	6	0.5	1.5	1.8	6	0.5	0.0	0.0	6	0.5	14.3	2.9	6	0.5	15.0	0.0	6	0.5	3.0	0.0
	Inpatient Rehabilitation	59	5.2	11.0	9.8	59	5.2	17.2	16.5	59	5.2	6.8	11.4	59	5.2	2.4	5.1	59	5.2	20.2	8.3	59	5.2	12.6	3.8	59	5.2	3.8	0.8
	Left AMA	31	2.7	15.2	16.5	31	2.7	6.1	7.9	31	2.7	2.7	4.3	31	2.7	0.8	2.6	31	2.7	14.5	5.4	31	2.7	14.1	2.6	31	2.7	3.3	0.6
	Met brain death criteria	25	2.2	5.2	4.0	25	2.2	8.6	21.3	25	2.2	3.9	5.2	25	2.2	7.0	21.2	25	2.2	30.8	13.6	25	2.2	5.4	4.5	25	2.2	4.6	0.6
	New placement at Skilled Nursing Facility	37	3.3	10.2	11.1	37	3.3	47.8	51.7	37	3.3	15.8	17.0	37	3.3	12.4	15.3	37	3.3	22.8	8.2	37	3.3	10.2	5.0	37	3.3	4.1	0.8
	Other Acute Care Hospital Emergency Department	16	1.4	10.0	6.6	16	1.4	2.6	4.4	16	1.4	0.9	2.5	16	1.4	0.6	1.6	16	1.4	14.3	6.6	16	1.4	13.6	2.9	16	1.4	3.6	0.8
	Other Acute Care Hospital Inpatient	16	1.4	16.3	16.2	16	1.4	5.6	6.9	16	1.4	1.8	2.4	16	1.4	0.4	1.5	16	1.4	16.1	7.4	16	1.4	13.8	2.1	16	1.4	3.4	0.6
	Other Health Care Facility	14	1.2	5.4	3.8	14	1.2	14.6	32.4	14	1.2	6.3	9.2	14	1.2	4.7	6.7	14	1.2	19.4	10.6	14	1.2	11.0	4.1	14	1.2	4.0	0.9
	Police Custody/Jail/Prison	5	0.4	17.3	11.0	5	0.4	3.8	1.9	5	0.4	1.8	2.0	5	0.4	0.4	0.9	5	0.4	13.2	3.4	5	0.4	11.6	5.0	5	0.4	3.0	0.0
	Return to Skilled Nursing Facility	3	0.3	7.0	4.1	3	0.3	10.3	6.8	3	0.3	2.3	2.2	3	0.3	0.0	0.0	3	0.3	13.3	3.1	3	0.3	13.0	3.5	3	0.3	3.3	0.6
	Sub-Acute Inpatient Rehabilitation	61	5.4	14.2	10.8	62	5.5	22.1	21.7	62	5.5	4.5	7.6	62	5.5	1.6	5.4	62	5.5	17.8	7.3	62	5.5	13.7	3.2	62	5.5	3.6	0.8
	Traumatic Brain Rehabilitation	51	4.5	8.3	7.1	51	4.5	36.4	38.2	51	4.5	11.7	9.0	51	4.5	5.3	5.8	51	4.5	22.1	9.2	51	4.5	9.9	4.6	51	4.5	4.0	0.8
	Total	1128	100.0	13.1	13.7	1128	100.0	11.8	21.1	1133	100.0	3.8	7.3	1132	100.0	1.7	5.9	1133	100.0	18.7	10.4	1133	100.0	12.6	4.1	1133	100.0	3.7	0.8

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Table 4 previews the outcomes of TBI patients according to presentation at arrival. Of the 29 patients who arrived without signs of life, all (100%) were declared dead. Among the 1,099 who arrived with signs of life, the majority (54.2%) were discharged, and only 12.2% were declared dead.

Table 4. Counts of patients with their presenting signs of life and their associated outcomes.

Table of Life by Disposition																				
	Disposition																			
Life	Died Unknown	Died after withdraw of care	Died as full code	Died with care not begun DNR/DNI	Discharged to Home or Self-care (Routine Discharge)	Home with services	Homeless/Shelter	Inpatient Psych Care	Inpatient Rehabilitation	Left AMA	Met brain death criteria	New placement at Skilled Nursing Facility	Other Acute Care Hospital Emergency Department	Other Acute Care Hospital In-Patient	Other Health Care Facility	Police Custody/Jail/Prison	Return to Skilled Nursing Facility	Sub Acute Inpatient Rehabilitation	Traumatic Brain Rehabilitation	Total
Arrived with NO signs of life	1	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29
Arrived with signs of life	0	35	53	22	596	60	8	6	59	31	25	37	16	16	14	5	3	62	51	1099
Total	1	35	81	22	596	60	8	6	59	31	25	37	16	16	14	5	3	62	51	1128
Frequency Missing = 5																				

Airway management data of presenting TBIs in *Table 5* showed that 220 patients (19.5%) underwent oral endotracheal intubation, while 890 (78.9%) had no documented airway intervention. Among intubated patients, mortality was significantly higher: 25.5% died as full code and 10% after withdrawal of care, with total mortality being 45%. In contrast, routine discharge was the most common outcome for non-intubated Patients (61.8%), with mortality being 6.3%.

Table 5. Counts of airway interventions for patient outcomes.

Table of Airway by Disposition																				
	Disposition																			
Airway	Died Unknown	Died after withdraw of care	Died as full code	Died with care not begun DNR/DNI	Discharged to Home or Self-care (Routine Discharge)	Home with services	Homeless/Shelter	Inpatient Psych Care	Inpatient Rehabilitation	Left AMA	Met brain death criteria	New placement at Skilled Nursing Facility	Other Acute Care Hospital Emergency Department	Other Acute Care Hospital In-Patient	Other Health Care Facility	Police Custody/Jail/Prison	Return to Skilled Nursing Facility	Sub Acute Inpatient Rehabilitation	Traumatic Brain Rehabilitation	Total
Assisted by Bag & Mask	0	0	4	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	6
Nasal Cannula	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Nasal Endotracheal Tube	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Non-Rebreather Mask	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	4
Not Applicable	1	10	20	19	550	56	8	6	46	27	6	18	13	13	8	4	3	57	25	890

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	Died Unknown	Died after withdraw of care	Died as full code	Died with care not begun DNR/DNI	Discharged to Home or Self-care (Routine Discharge)	Home with services	Homeless/ Shelter	Inpatient Psych Care	Inpatient Rehabilitation	Left AMA	Met brain death criteria	New placement at Skilled Nursing Facility	Other Acute Care Hospital Emergency Department	Other Acute Care Hospital In-Patient	Other Health Care Facility	Police Custody/Jail/Prison	Return to Skilled Nursing Facility	Sub Acute Inpatient Rehabilitation	Traumatic Brain Rehabilitation	Total
Oral Airway	0	1	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	5
Oral Endotracheal Tube	0	22	56	3	41	4	0	0	12	4	18	18	3	2	6	1	0	5	25	220
Total	1	35	81	22	596	60	8	6	59	31	25	37	16	16	14	5	3	62	51	1128
Frequency Missing = 5																				

TBI trauma volume as displayed by *Table 6* varied across the calendar year, with the highest case counts occurring in September (n = 130, 11.5%), followed by July (n = 115, 10.2%) and August (n = 104, 9.2%). The lowest number of cases occurred in April (n = 68, 6%). Mortality was highest in September and December (11 full-code deaths each) and lowest in April (1 death). Routine discharges were most frequent in September, in line with the overall seasonal trend.

Table 6. Counts of patient outcomes per month of a calendar year.

Table of Month by Disposition																				
	Disposition																			
Month	Died Unknown	Died after withdraw of care	Died as full code	Died with care not begun DNR/DNI	Discharged to Home or Self-care (Routine Discharge)	Home with services	Homeless/ Shelter	Inpatient Psych Care	Inpatient Rehabilitation	Left AMA	Met brain death criteria	New placement at Skilled Nursing Facility	Other Acute Care Hospital Emergency Department	Other Acute Care Hospital In-Patient	Other Health Care Facility	Police Custody/Jail/Prison	Return to Skilled Nursing Facility	Sub Acute Inpatient Rehabilitation	Traumatic Brain Rehabilitation	Total
January	0	4	5	3	43	4	0	0	5	2	2	1	1	4	0	0	0	4	3	81
February	1	3	6	0	51	7	3	0	4	2	3	2	0	2	0	0	2	3	3	92
March	0	3	4	1	41	6	1	1	2	1	2	5	2	0	0	0	0	6	4	79
April	0	2	1	0	45	2	0	1	3	2	2	1	0	2	1	0	1	3	2	68
May	0	6	8	0	43	5	0	2	4	4	2	2	2	0	1	0	0	8	2	89
June	0	1	5	2	54	5	1	0	6	2	1	3	2	1	3	0	0	7	2	95
July	0	3	9	2	60	2	1	0	7	4	4	4	2	1	1	0	0	7	8	115
August	0	4	8	1	49	7	0	1	8	5	2	4	3	1	3	2	0	3	3	104
September	0	3	11	8	61	2	0	1	8	4	4	7	1	2	1	2	0	6	9	130
October	0	2	6	2	42	7	1	0	3	3	2	2	2	1	1	0	0	4	6	84
November	0	1	7	0	61	3	1	0	4	2	1	3	1	0	2	0	0	5	5	96
December	0	3	11	3	46	10	0	0	5	0	0	3	0	2	1	1	0	6	4	95
Total	1	35	81	22	596	60	8	6	59	31	25	37	16	16	14	5	3	62	51	1128
Frequency Missing = 5																				

In addition to the type of TBI in *Table 8*, *Table 7* shows that the cause of injury further influenced outcomes: falls, assaults, and motorcycle collisions (MCC) were associated with better outcomes, where discharges occurred in 50.7% of falls, 67.2% of assaults, and 64.0% of MCC. Additionally, mortality was 11.9% in falls, 5.7% in assaults, and 14.4% in MCCs. On the other hand, gunshot wound (GSW) TBIs had no routine discharges and a mortality rate of 72.7%. (7.3%).

Table 7. Counts of patient outcomes with associated causes of injury.

Table of Disposition by Cause																	
	Cause																
Disposition	.	Accident	Animal Injury	Assault	Bicycle	Fall	GSW	Hanging	MCC	MVC	Pedestrian	Seizure	Sports	Stab Wound	Struck	Suicide	Total
Died Unknown	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Died after withdraw of care	0	0	0	1	1	26	0	1	2	0	4	0	0	0	0	0	35
Died as full code	0	0	0	4	3	22	6	0	10	0	22	1	0	1	0	12	81

Table of Disposition by Cause

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Disposition	Cause															
	.	Accident	Animal Injury	Assault	Bicycle	Fall	GSW	Hanging	MCC	MVC	Pedestrian	Seizure	Sports	Stab Wound	Struck	Suicide	Total
Died with care, not begun DNR/DNI	0	0	0	0	1	18	1	0	0	1	0	0	0	0	0	1	22
Discharged to Home or Self-care (Routine Discharge)	1	6	1	82	34	333	0	0	71	11	46	0	1	7	1	1	595
Home with services	0	0	0	5	1	45	0	0	6	0	3	0	0	0	0	0	60
Homeless/Shelter	0	0	0	3	0	4	0	0	0	0	1	0	0	0	0	0	8
Inpatient Psych Care	0	0	0	1	0	2	0	0	0	0	1	0	0	0	0	2	6
Inpatient Rehabilitation	0	0	0	3	3	36	0	0	5	1	9	0	0	1	1	0	59
Left AMA	0	3	0	5	2	17	0	0	4	0	0	0	0	0	0	0	31
Met brain death criteria	0	0	0	2	1	12	1	0	4	0	2	0	0	0	0	3	25
New placement at Skilled Nursing Facility	0	0	0	2	1	22	2	0	3	0	7	0	0	0	0	0	37
Other Acute Care Hospital Emergency Department	1	1	0	3	0	10	0	0	0	0	0	0	0	0	1	0	16
Other Acute Care Hospital Inpatient	0	0	0	3	0	12	0	0	1	0	0	0	0	0	0	0	16
Other Health Care Facility	0	1	0	1	1	8	0	0	0	0	3	0	0	0	0	0	14
Police Custody/Jail/Prison	0	0	0	2	0	1	0	0	1	1	0	0	0	0	0	0	5
Return to Skilled Nursing Facility	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3
Sub-Acute Inpatient Rehabilitation	0	0	0	1	1	55	0	0	0	0	5	0	0	0	0	0	62
Traumatic Brain Rehabilitation	1	0	0	4	2	31	1	0	4	1	6	0	0	1	0	0	51
Total	3	11	1	122	51	657	11	1	111	15	110	1	1	10	3	19	1127
Frequency Missing = 6																	

Table 8. Counts of outcome with associated trauma type.

Table of Disposition by Type			
	Type		
Disposition	Blunt	Penetrating	Total
Died Unknown	1	0	1
Died after withdraw of care	35	0	35
Died as full code	72	9	81
Died with care not begun DNR/DNI	21	1	22
Discharged to Home or Self-care (Routine Discharge)	589	7	596
Home with services	60	0	60
Homeless/Shelter	8	0	8
Inpatient Psych Care	6	0	6
Inpatient Rehabilitation	58	1	59
Left AMA	31	0	31
Met brain death criteria	23	2	25
New placement at Skilled Nursing Facility	34	3	37
Other Acute Care Hospital Emergency Department	16	0	16
Other Acute Care Hospital In-Patient	16	0	16
Other Health Care Facility	14	0	14
Police Custody/Jail/Prison	5	0	5
Return to Skilled Nursing Facility	3	0	3
Sub Acute Inpatient Rehabilitation	62	0	62
Traumatic Brain Rehabilitation	49	2	51
Total	1103	25	1128
Frequency Missing = 5			

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The alcohol level at presentation (ETOH class) shown in *Table 9* shows that severe toxic intoxication is associated with a higher incidence of TBI when compared to other levels of toxicity, and additionally, 32 mortalities, compared to 5 and 7 in mild and moderate, respectively. However, severe intoxication presented a mortality ratio of 10.5%, compared to 13.8%, 27.8%, and 10.1% seen in patients with normal, mild, and moderate blood alcohol levels, respectively. Furthermore, the discharge ratio was 67.3% in severe blood alcohol levels, compared to 57.4%, 55.6%, and 53.6% in normal, mild, and moderate levels, respectively.

Table 9. Counts of patients disposed based on groups and their ethanol classification.

Table of Disposition group by ETOH class						
	ETOH class					
Disposition group	Mild	Missing	Moderate	Normal	Severe	Total
Deceased	5	39	7	81	32	164
Discharged	10	74	37	337	206	664
Missing	0	0	3	1	1	5
Other	3	40	22	168	67	300
Total	18	153	69	587	306	1133

Statistical tests confirmed significant associations: trauma type ($\chi^2 = 49.47$, $p < 0.0001$), cause of injury ($\chi^2 = 522.96$, $p < 0.0001$), and alcohol level ($\chi^2 = 215.08$, $p < 0.0001$) in *Tables 10, 11, and 12*, respectively. All findings were supported in *Table 13* by Fisher's Exact Test. Effect sizes showed weak associations for all three (Cramer's V ranging from 0.1759 to 0.2183).

Table 10. Statistical analysis for a table of disposition by type.

Statistic	DF	Value	Prob
Chi-Square	18	49.4749	<.0001
Likelihood Ratio Chi-Square	18	37.3478	0.0047
Mantel-Haenszel Chi-Square	1	0.2794	0.5971
Phi Coefficient		0.2094	
Contingency Coefficient		0.2050	
Cramer's V		0.2094	

Table 11. Statistical analysis for a table of disposition by cause.

Statistic	DF	Value	Prob
Chi-Square	270	522.9558	<.0001
Likelihood Ratio Chi-Square	270	356.0400	0.0003
Mantel-Haenszel Chi-Square	1	6.4916	0.0108
Phi Coefficient		0.6812	
Contingency Coefficient		0.5630	
Cramer's V		0.1759	

Table 12. Statistical analysis for a table of disposition grouped by ethanol classification.

Statistic	DF	Value	Prob
Chi-Square	72	215.0783	<.0001
Likelihood Ratio Chi-Square	72	194.2561	<.0001
Mantel-Haenszel Chi-Square	1	0.3722	0.5418
Phi Coefficient		0.4367	
Contingency Coefficient		0.4002	
Cramer's V		0.2183	

Table 13. Statistics for Fisher's Exact test of TBI type, cause, and ethanol classification.

Fisher's Exact Test	
Table Probability (P)	<.0001

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Insurance status on *Table 14* was also significantly correlated with disposition. Medicaid covered the largest proportion of patients (n = 428, 37.9%), with a mortality rate of 9.3% and discharge rate of 67.5%. Medicare patients (n = 273, 24.2%) had the highest mortality rate (16.1%) and a lower discharge rate (48.4%). Commercial insurance patients (n = 142, 12.6%) showed a mortality rate of 10.6% and a discharge rate of 64.8%. The self-pay group (n = 30, 2.7%) had the most concerning profile, with a mortality rate of 40%. These differences were statistically significant ($\chi^2 = 130.79$, $p < 0.0001$) in *Table 15*, and significance was confirmed via Fisher's Exact Test on *Table 16*. Effect size analysis showed weak to moderate association (Phi = 0.3402; Contingency Coefficient = 0.3221; Cramer's V = 0.1964). Monte Carlo on *Table 17* Estimate provides a confidence interval for the exact test (to 0.0005).

Table 14. Patient count based on payor group type and their association disposition group.

Table of Payor by Disposition group					
	Disposition group				
Payor	**Deceased**	**Discharged**	**Missing**	**Other**	**Total**
.	13	6	0	2	21
Auto	1	7	0	6	14
Blue Cross	9	20	0	13	42
Commercial	15	92	0	35	142
Corrections	0	0	0	1	1
HMO	1	4	0	3	8
Managed Care	1	1	0	1	3
Medicaid	40	289	1	98	428
Medicaid Pend	0	2	0	1	3
Medicare	44	132	0	97	273
No Fault	8	22	0	14	44
None	15	41	0	12	68
Oth Govmt	0	2	0	4	6
Other	5	25	0	9	39
Self Pay	12	16	1	1	30
Workers Comp	0	5	0	3	8
Total	164	664	2	300	1130
Frequency Missing = 3					

Table 15. Statistical analysis for a table of payor group and disposition group.

Statistic	DF	Value	Prob
Chi-Square	45	130.7928	<.0001
Likelihood Ratio Chi-Square	45	106.6754	<.0001
Mantel-Haenszel Chi-Square	1	0.0005	0.9829
Phi Coefficient		0.3402	
Contingency Coefficient		0.3221	
Cramer's V		0.1964	

Table 16. Fisher's Exact test of payor type.

Fisher's Exact Test	
Table Probability (P)	<.0001

Table 17. Monte Carlo for payor type.

Monte Carlo Estimate for the Exact Test	
Pr <= P	<.0001
99% Lower Conf Limit	<.0001
99% Upper Confidence Limit	0.0005
Number of Samples	10000
Initial Seed	579318266

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4. Discussion

4.1. Outline of Study

This study offers a comprehensive evaluation of the clinical, demographic, and socioeconomic factors with associated outcomes in patients with severe traumatic brain injury (TBI) at a Level 1 trauma center. The findings not only confirm several previously established patterns but also provide new insights regarding outcome variability associations in this critical patient population. The use of initial presenting signs, trauma mechanisms, standardized scales, airway interventions, alcohol intoxication status, and payer type as predictors of outcome degree provides a multifactorial view that can inform management and future interventions.

4.2. Demographics and Seasonal Insight

Consistent with the trends observed in our cohort, male predominance in severe TBI presentations remains a striking and consistent feature. This gender disparity, with males comprising over three-quarters of the sampled population, highlights potential biological, behavioral, and societal factors that predispose younger males to high-risk situations, leading to head trauma. As suggested from previous studies, this patient group could have higher risk-taking behaviors, participation in high-velocity activities, and occupational hazards, which may collectively contribute to this representation [9]. These findings suggest a need for targeted injury prevention strategies focusing on younger male populations, specifically through public health interventions aimed at education and behavioral modification.

Age-related ethnic differences were also notable, with Hispanic patients presenting at a younger mean age compared to non-Hispanic patients. In parallel, variations in biometric profiles, where black patients demonstrated higher average weight and height compared to other racial groups, raise important considerations regarding injury biomechanics. Heavier and taller individuals may experience a different force distribution during trauma. In contrast, the shorter and lighter body habitus observed among the Asian patients may correspond differently, which can account for the higher incidence of the latter patients in this cohort. These differences are not fully elucidated within the scope of this study; however, they merit further biomechanical investigation to better understand their clinical relevance in TBI prevalence.

Seasonal variation in TBI incidence is also observed, with a consistent trend showing an increased case volume noted in late summer and early fall, peaking in September, and a decreased incidence in April. Mortality rate followed the stated trend, peaking in September. Such seasonal dynamics highlight the importance of considering temporal factors in trauma system preparedness. Trauma centers may benefit from preventive strategies seasonally to anticipate and mitigate the increased burden observed during those high-risk months.

4.3. Initial Injury Mechanism and Associated Factors

Injury mechanism profoundly influenced outcomes. Penetrating TBI accounted for a small proportion (2.2%) but was associated with disproportionately high mortality (48%), compared to blunt trauma, which had a 13.8% mortality rate. These findings align with previous studies, which demonstrated that penetrating brain injuries, especially gunshot wounds as indicated in our study, confer significantly higher mortality relative to blunt trauma [5]. This disproportionate mortality emphasizes the fundamentally distinct pathophysiological consequences of penetrating trauma. Penetrating injuries often involve direct laceration or disruption of critical brain structures, major vascular injuries, and high intracranial contamination risks, all of which contribute to rapid clinical deterioration and limited therapeutic options. In contrast, blunt trauma typically induces secondary brain injuries such as diffuse axonal injury, cerebral edema, and hematomas, which may offer a broader window for medical and surgical intervention. An additional notable finding was the higher count of blunt TBI patients requiring extended care with rehabilitation services, with outcomes compared to penetrating TBIs, including inpatient rehabilitation (58 vs 1), skilled nursing facilities

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(34 vs 3), and traumatic brain rehabilitation (49 vs 2). This pattern reflects the nature of blunt trauma, which often results in diffuse and multifocal brain injuries that, while not immediately fatal, lead to substantial long-term neurological impairment. The extended course of care needed for functional recovery emphasizes the chronic impact of severe blunt TBI. These findings highlight the importance of early rehabilitation planning and resource allocation for blunt trauma patients, even when initial survival is achieved.

As evidenced by our study, vital signs at presentation are strong clues of outcome. Hypotension and hypoxia were markedly associated with higher mortality, supporting prior evidence that secondary brain injury due to systemic hypotension and hypoxia can independently worsen outcomes [10]. Deceased patients had dramatically lower mean systolic blood pressures (~82.5 mmHg) and oxygen saturations (~63%) compared to survivors at presentation. Additionally, hypothermia was noted in patients who had outcomes of mortality. In contrast, the respiratory rate failed to provide differences in either outcome. These signs demonstrated significant prognostic value in predicting outcomes following severe TBI. Such evidence reinforces the critical role of early physiological stabilization, particularly aggressive management of hypotension and hypoxia, in influencing survival. Prompt and effective resuscitation strategies in the prehospital and early hospital phases may represent one of the few modifiable factors capable of altering the trajectory of outcomes of severe TBI.

Our findings of blunt TBI fall height analysis showed that greater heights correlated with increased mortality, especially falls reaching 15 meters, seen in patients with resultant death despite full code measures. On the other hand, shorter fall height was observed in patients with outcomes of discharge and rehabilitation measures, indicating a linear association of fall height vs outcome. This suggests that a higher fall height would exacerbate the severity of TBI, or in other words, the increase in distance of fall would yield higher velocity of impact, which can amplify the blunt injury, causing poorer outcomes with a higher fall, and more likely favorable outcomes with a shorter fall. However, fall injuries are often underestimated, particularly in elderly populations, due to risk factors in select patient populations, where those of age extremes can have more devastating impacts independent of fall height. Therefore, this association cannot apply to stated populations as other factors play a role in injury severity.

With regards to the cause of injury, as expected, penetrating injuries such as gunshot wounds (GSW) were linked to the worst prognosis, with GSW-related TBI carrying an alarming 72.7% mortality rate and no routine discharges. This was primarily the most notable association with increased mortality rate, as this type of injury would be under the criteria of a penetrating TBI. Patients with GSW have linked association to decreased survival rate possible due to the extensive injury associated with cranial fracture, brain tissue laceration from impact and impulse forces of the bullet, and increased risk of multi-vascular injury of blood supply; all of which can result is rapid loss of viable tissue, limiting treatment options for survivability. However, aggressive early management is still beneficial to gunshot wound TBI patients, as evidenced by past papers, which additionally claims the trajectory of GSW is crucial in distinguishing the severity of such injury, where trauma being trans-ventricular or bi-hemispheric leads to poorer outcomes [**11**]. **This contrasts with lower mortality injuries such as falls, assaults, and motorcycle collisions, which had higher incidence but better discharge and rehabilitation ratios. This finding suggests that the stated injuries are likely blunt TBIs, explaining the pattern of outcomes.**

Alcohol intoxication at presentation was an interesting finding; blood alcohol levels were classified into normal, mild, moderate, and severe levels. As expected, higher TBI prevalence was observed in patients with severe alcohol levels when compared to other toxicity levels if present, however, a unique finding was a decreased mortality and increased discharge ratio amongst patients who were severely intoxicated. This finding, although associated with higher TBI incidence, suggests a protective effect of outcome with severe toxicity in those patients when compared to individuals who presented with moderate to no alcohol levels. Alcohol has been theorized to have a protective effect on TBI injuries as evidenced by animal models [12]; however, many publications still

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consistently indicate severe intoxication is significantly associated with increased rate of in-hospital complications and mortality [13]. Regardless, our findings show that our sample demonstrated otherwise, with higher discharge rates in the severely intoxicated cohort. Other papers have documented this finding as well, which further strengthens the claim of a possible neuroprotective effect of alcohol on TBI at severe levels [**14**]. On the other hand, due to its increased TBI incidence, achievements of such levels increase the risk of injury, possibly due to the altered mental status of severely intoxicated patients. Further studies should investigate the association of high blood alcohol content effect on neurovascular impairment due to TBI and explain such unique findings.

4.4. Standardized Severity Scales

Severity scoring systems were strong scales that provided insight into outcomes in this cohort of severe TBI patients. The Glasgow Coma Scale (GCS) demonstrated a strong association with mortality. Patients who died as full code had a markedly lower mean GCS of 6.0 (SD ±4.8), compared to survivors discharged routinely, who exhibited a mean GCS of 14.2 (SD ±2.2). Given that GCS evaluates core neurologic functions of eye, verbal, and motor response, it remains a rapid yet powerful tool for initial assessment in the trauma setting. Additionally, this line with claims of studies where a lower GCS score at presentation yielded higher mortality risk [3].

Similarly, the Abbreviated Injury Scale (AIS) of the head region also proved to be a meaningful predictor of outcome. Patients who faced complications had a higher mean AIS Head score of 4.3 (SD ±1.0) compared to those who were routinely discharged, who had a lower mean score of 3.5 (SD ±0.7). These results highlight that even within the severe injury spectrum (≥3), a small increase in the anatomical head injury severity, as captured by AIS Head scoring, has important implications for survival. This ability to quantify isolated head trauma severity is crucial in grading the extent of damage and can be used in acute care settings to predict outcome associations.

Finally, when evaluating the overall burden of injury, the Injury Severity Score (ISS) offered additional insights beyond neurologic status alone. Patients who died as full code exhibited significantly elevated ISS values (mean 35.9, SD ±18.1) compared to routine discharges (mean 15.2, SD ±6.1), reflecting the compounded impact of multisystem trauma on outcomes. As ISS aggregates the severity of the three most severely injured body regions, it provides a valuable measure for understanding the cumulative systemic insult beyond the focus of the brain injury, and aids in predicting mortality in the wider scope of patients who are involved in multisystem trauma.

Together, these severity indices- GCS for neurologic function, AIS Head for focal cranial injury severity, and ISS for whole-body trauma assessment- proved to be essential in predicting outcomes of patients presenting with severe TBI at our Level 1 trauma center.

4.5. Airway Measures and Length of Stay

The association between airway management and mortality is also studied in our cohort. Intubated patients exhibited a higher mortality rate (45%) compared to non-intubated patients (6.3%). While this may initially suggest an adverse effect of intubation, it more likely reflects the severity of neurological compromise that prompts airway control, necessitating the need for advanced airway management to stabilize the patient. 890 of the 1128 patients did not need any form of intubation, suggesting those who underwent such measures were likely to have been in a poorer state initially, affecting their mortality risk. Regardless, prior studies support that intubation is often required in patients with GCS scores ≤8 and significant hypoxia, which are themselves predictors of poor outcome as stated above [15]. From the means of intubation offered in this cohort, endotracheal intubation dominates as the most common form, with 220 patients of the 238 that had airway support measures undergoing endotracheal intubation. The discharge ratio of non-intubated patients was also significantly higher, 61.8%, whilst the discharge ratio of patients who underwent oral endotracheal intubation was much lower, standing at a rate of 18.6%, with higher risks of mortality and rehabilitation courses. Therefore, a patient undergoing such a measure is unlikely to be routinely discharged like a patient who did not get intubated. Such results pose the question of whether the

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initial patient status that prompted airway maneuvers is responsible for the outcome, or whether those measures have an independent effect.

Length of stay metrics across emergency, inpatient, and intensive care settings also reflected significant variation based on patient outcomes and care trajectories. Patients who ultimately died as full code had the shortest emergency department length of stay (EDLOS) (mean ~3.7 hours), a finding that likely reflects limited opportunity for stabilization in these critically injured individuals. In contrast, patients discharged to rehabilitation pathways had longer EDLOS, such as those transferred to subacute inpatient rehabilitation (~14.2 hours), indicating a more prolonged stabilization or evaluation process before disposition. Hospital length of stay (HLOS) further emphasized the transition of long-term care by displaying its disposition times, where routine discharges occurred after a relatively short hospitalization (~7 days), patients requiring traumatic brain rehabilitation stayed markedly longer (~36.4 days), suggesting that survival alone does not indicate recovery but often necessitates extended multidisciplinary care. ICU length of stay showed a similar trend to HLOS, with an average of 3.8 days across the cohort, increasing to 11.7 days for those requiring rehabilitative services. This prolonged ICU duration may reflect the need for ongoing neuromonitoring, anticipation of complications, and complex medical needs in patients with survivable but severe neurologic deficits resulting from the TBI.

Ventilation duration was also stratified by disposition: patients who died after withdrawal of care or who were discharged to skilled nursing or rehabilitation centers had longer periods of mechanical ventilation, with means ranging from 5.3 to 12.4 days; in contrast, patients who died with full code resuscitative efforts had an average of 1.9 days. This can be a result of acute multisystem decompensation in latter patients due to more severe presentations than when compared to patients who died after withdrawal of care. Full code patients likely would not have benefited from ventilation, as their damage was extensive, such that ventilation would not have extended their stay. Patients who died after withdrawal of care, on the other hand, could be more stable patients with singular system dysfunction that put their life at risk, where turning the ventilator off would cause them to expire. Additionally, routinely discharged patients required minimal ventilatory support (~0.4 days), claiming that brief or absent intubation may be seen in less severe neurologic injury and more favorable recovery trajectories.

These findings collectively bring up the resource-intensive nature of TBI recovery in patients who survive but remain functionally impaired, as seen in those partaking in rehabilitation courses. They also highlight the inverse relationship between survivability and hospital burden: those with the most severe, non-survivable injuries die early and have low utilization of resources, while survivors with major neurologic compromise, and possibly less severe presentations, can often experience prolonged hospitalizations, intensive care stays, and long-term ventilation. From a systems perspective, this emphasizes the need for adequate resource allocation when long-term treatment courses of TBIs are inferred.

4.6. Socioeconomic Factors

Socioeconomic factors, particularly insurance status, demonstrated a notable influence on patient outcomes following severe TBI. Patients covered by Medicaid represented the largest subgroup and experienced a moderate mortality rate of 9.3%, suggesting access to basic post-acute care but also reflecting the challenges inherent to low-income populations that cause them to have an increased incidence of TBI. Conversely, patients with Medicare coverage had the second highest incidence but exhibited the highest mortality among insured groups at 16.1%, which may reflect the older age and greater burden of comorbidities typically associated with this population, posing them at higher risk of death secondary to their more alarming risk factors. Strikingly, the self-pay group had an alarmingly high mortality rate of 40%, raising serious concerns about disparities in access to timely, comprehensive trauma care. While the reasons behind this elevated mortality may be multifactorial, ranging from delayed presentation and self-pay population sample, it nevertheless shows the vulnerability of uninsured individuals in high-acuity trauma settings. These findings align

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with the longstanding concern in trauma literature regarding socioeconomic differences in survival outcomes, where prior studies indicate that uninsured patients had worse outcomes after trauma, and highlight insurance as an independent factor affecting mortality in post-trauma settings [16]. This reinforces the need for simultaneous and equal health interventions in acute-critical care trauma settings to improve accessibility to resources, early care coordination, and discharge planning for underinsured and uninsured patients.

5. Strengths

This study holds both clinical and statistical significance in the understanding of outcome determinants of patients with severe traumatic brain injury. The scope of the study narrows down to TBI injury but stays wide in terms of all its associated factors, which strengthens its analytic detail. It proves essential by its large sample analysis of TBI patients from an urban community over a long period, where different injury mechanisms and types are illustrated in detail alongside highly specific outcomes. Furthermore, unlike previous studies, our research is unique in terms of using multiple models at the same time; it reinforces and compares the predictive value of widely used severity indices such as GCS, AIS Head, and ISS in stratifying mortality and disposition outcomes. Collectively, this study demonstrated how multiple factors were also correlated alongside these outcomes, making it a study that identifies early physiologic indicators such as hypotension, hypoxia, and the need for airway intervention. Moreover, patient-specific influences were also noted, such as ethanol intake and insurance status. This analysis views the different trajectories of TBI presentations and what outcomes can be predicted from them, making this study essential in detecting broader multifactorial associations.

By capturing a large, diverse cohort and analyzing outcomes across a broad set of variables, this study provides actionable data for anticipating outcomes to help inform triage decisions and resource planning strategies, aiding in reducing disparities and improving TBI care delivery.

6. Limitations

Several limitations must be acknowledged. As a retrospective analysis, inherent biases such as selection bias and unmeasured confounders are present. Data from a single urban trauma center may limit generalizability to rural or non–Level 1 trauma settings. Moreover, this data was collected from the NTRACS, which may not always provide complete information. Additionally, detailed neuroimaging findings, other in-hospital interventions, and long-term functional impairments were not available but would enhance the depth of analysis. Regarding scales, the Injury Severity Scale (ISS) was used in this study, instead of the refined New Injury Severity Scale (NISS), which is the latest to date. TBI incidents were only recorded at hospital presentations, which limits extremes of injury, such as patients who died before reaching the hospital, and patients who had a milder onset in which they did not need further medical care. Future studies should avoid these limitations by enforcing up-to-date scoring systems and sourcing data from multi-facility centers to minimize any disparities.

7. Future Perspectives

It is important to further strengthen TBI findings to minimize the high mortality rate it possesses. Future studies should focus on reinforcing predictive strategies from the leads provided by this study as a guide for pattern recognition. This study oriented its aim to look at the presenting TBI and follow up with its outcome, however, future studies should investigate the various interventions of TBI, which can help optimize early resuscitation of critically injured patients. Socioeconomic care is to be further analyzed beyond insurance status; such factors can include occupational information. Moreover, integrating advanced imaging biomarkers can also be researched to explore the possibility of outcome prediction by those modalities.

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8. Conclusion

This study highlights the multifactorial determinants of outcomes in patients with severe traumatic brain injury at a Level 1 trauma center. Clinical indicators such as low GCS, high AIS Head and ISS scores, hypotension, hypoxia, and the need for airway intervention were all strongly associated with increased mortality. Blunt trauma, while associated with lower early mortality, often led to prolonged hospitalization and rehabilitation, whereas penetrating trauma, particularly gunshot wounds, carried the highest mortality risk. Socioeconomic variables, such as insurance status and alcohol intoxication, further influenced outcomes, with self-pay patients showing the highest mortality and severely intoxicated patients demonstrating unexpectedly favorable discharge rates. These findings emphasize the importance of combining clinical severity scores with physiologic and socioeconomic data to inform prognosis, guide early management, and improve trauma care delivery. Future efforts should anticipate predictive models for outcome estimation in severe TBI.

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