

**Standard Report
North Carolina Trauma Registry
2002**

**Funded through the North Carolina Office of Emergency Medical
Services**

The Hospitals of the North Carolina Trauma Registry (NCTR) who contributed data to
this report include:

Carolinas Medical Center
Catawba Valley Medical Center
Cleveland Regional Medical Center
Duke University Medical Center
Forsyth Medical Center
Lake Norman Regional Medical Center
Mission St. Joseph's
Moses H. Cone Memorial Hospital
New Hanover Regional Medical Center
Northeast Medical Center
University Health Systems of Eastern Carolina
University of North Carolina Hospitals
Wake Forest University Baptist Medical Center
WakeMed Center

Sharon Kromhout-Schiro, Ph.D.
Director , North Carolina Trauma Registry
Department of Surgery
Campus Box 7050
University of North Carolina
Chapel Hill, NC 27599-7050
Telephone: (919) 966-6263
Email: sharon_schiro@med.unc.edu

Table of Contents

TABLE OF CONTENTS	II
ANALYSIS OF THE 1998 NCTR DATA SET	1
ADMISSIONS PER MONTH	2
ALL PATIENTS	2
PEDIATRIC PATIENTS	3
DEMOGRAPHIC ANALYSIS OF THE PATIENTS IN THE NCTR DATASET	4
AGE DISTRIBUTION	4
GENDER AND RACE DISTRIBUTION	5
<i>Gender and Race Distribution for 2002</i>	6
AVERAGE LENGTH OF STAY BY YEAR.....	7
AVERAGE ICU LENGTH OF STAY BY YEAR	8
INJURY STATISTICS	9
MECHANISM OF INJURY BY SURVIVAL	9
MECHANISM OF INJURY BY LOS	10
MECHANISM OF INJURY BY HOSPITAL CHARGES.....	11
PRE-HOSPITAL STATISTICS	12
PATIENT ORIGIN.....	12
MODE OF TRANSPORT	13
SCENE CONDITION	14
ARRIVAL CONDITION	15
CONDITION AT SCENE VS CONDITION ON ARRIVAL	16
EMERGENCY DEPARTMENT STATISTICS	17
CHIEF COMPLAINT	17
HOUR OF ADMISSION	18
ED DISPOSITION.....	19
ADMISSION SERVICE	20
INJURY SEVERITY AND OUTCOME STATISTICS	24
INJURY SEVERITY SCORE (ISS): NUMBER OF PATIENTS, SURVIVAL RATE, LOS, AND HOSPITAL CHARGES	24
HOSPITAL DISPOSITION	25
FINANCIAL STATISTICS: PAYOR MIX	26
HOSPITAL TRANSFERS (PATIENTS TRANSFERRED TO THE TRAUMA CENTER)	27
MECHANISM OF INJURY FOR TRANSFERRED PATIENTS.....	27
MECHANISM OF INJURY BY YEAR FOR TRANSFERRED PATIENTS WHO DIED	28

Analysis of the 2000 NCTR Data set

The following report is a result of an analysis of the North Carolina Trauma Registry data for the years 1994 – 2002 available as of July 2003. The data for this report were generated using the SAS System for Statistical Analysis, PC version 8.02. The patients represented in each table or figure are those with valid data for all fields referenced in that table or figure. Therefore, the numbers of patients represented may vary.

The number of patient records in the data set was 150,748. These data were submitted by 14 hospitals.

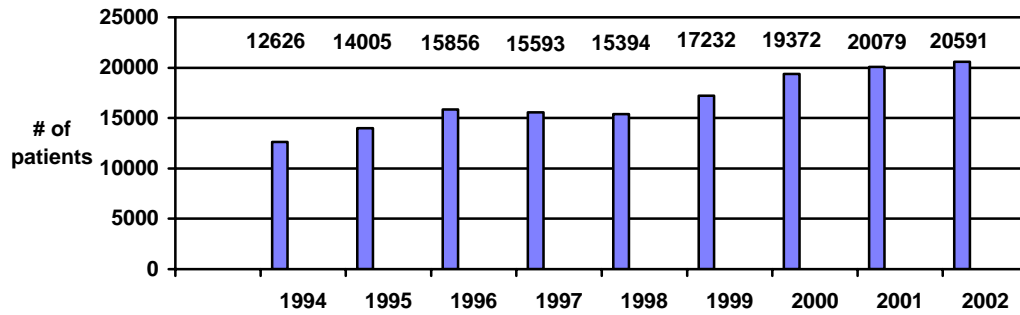


Figure 1: Number of Records by Year

Admissions per month

All patients

The number of patients seen in the Trauma Centers varies by month with little consistency to the pattern of variation over the nine year period covered in this report.

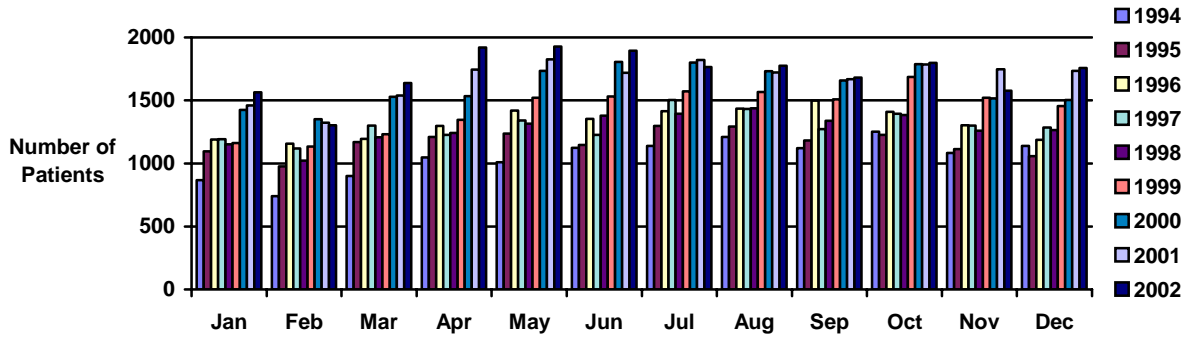


Figure 2: Admissions per Month, Grouped by Month

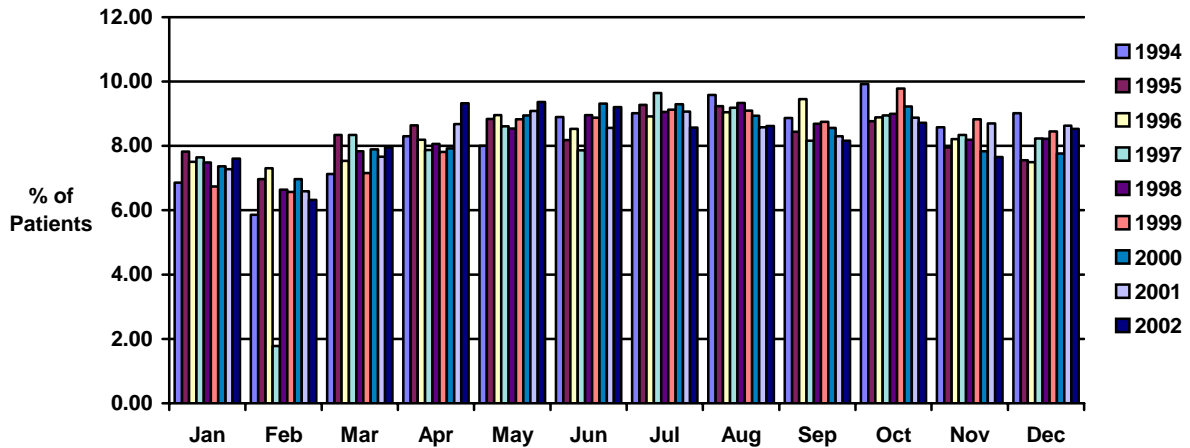


Figure 3: Percent Admissions per Month, Grouped by Month

Pediatric patients

Pediatric patients are defined for the graph below as those patients under the age of 18 years.

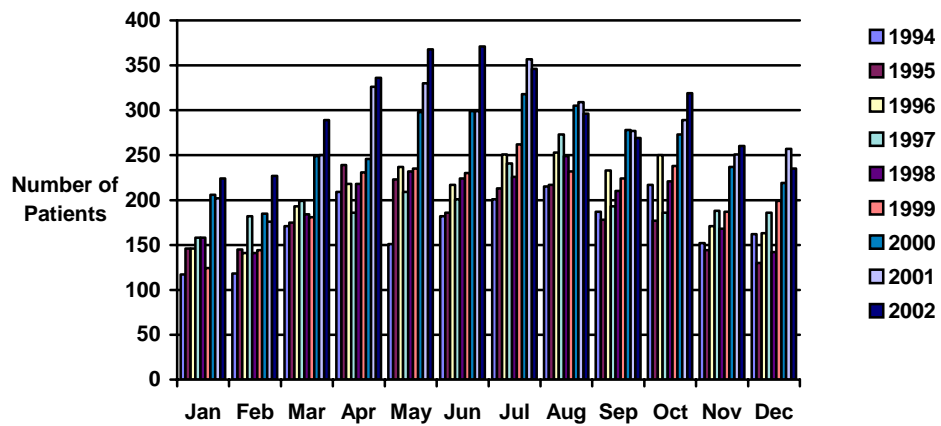


Figure 4: Number of Pediatric Admissions per Month, 1994-2002

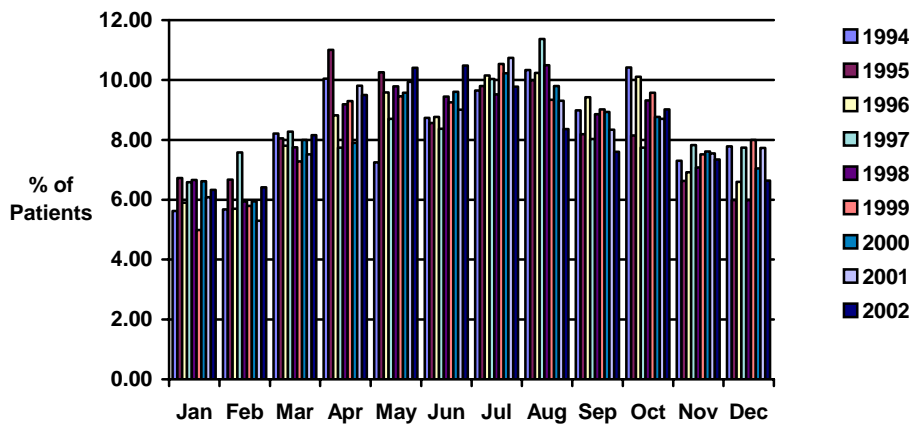


Figure 5: Percent of Pediatric Admissions per Month, 1994-2002

Demographic Analysis of the Patients in the NCTR Dataset

Age Distribution

The age distribution of trauma patients in the NCTR is shown in the figure below. Age data were missing on 197 patients. Patients with ages of greater than 119 (n=2) were excluded as probable error records.

Figure 6 demonstrates the trimodal distribution of the age of trauma patients, with peaks at infancy, between the ages of 16 and 38, and at age 80.

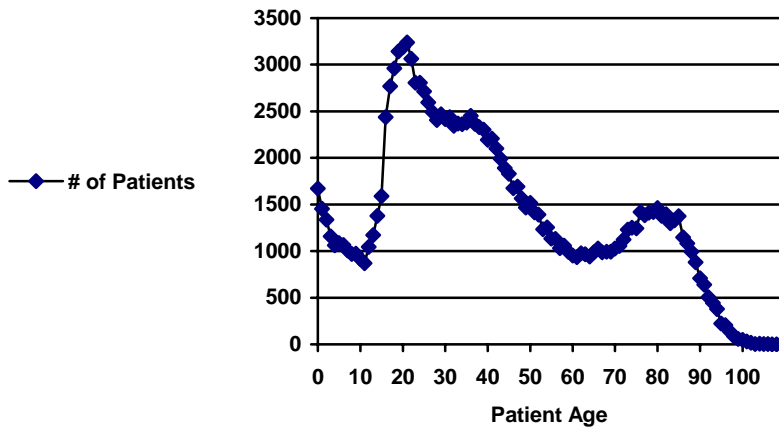


Figure 6: Age Distribution, 1994 - 2002

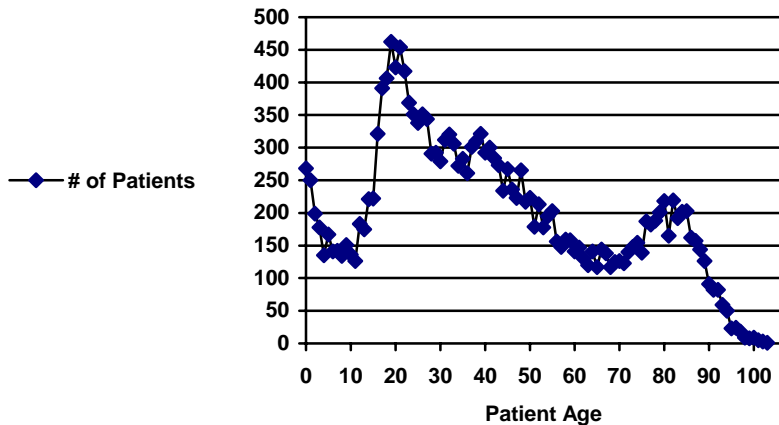


Figure 7: Age Distribution, 2002

Gender and Race Distribution

The gender and race distributions of trauma patients in the NCTR are shown in the tables and figures below.

	Female	Male	Not Done/Doc	Totals	%
American Indian (I)	206	456	0	662	0.4
Asian (A)	290	481	0	771	0.5
Black (B)	11431	26228	3	37,662	25.0
Hispanic (H)	1266	6540	0	7,806	5.2
White (W)	42977	57463	2	100,442	66.6
Other (O)	680	1603	1	2,284	1.5
Not Done/Doc (D)	415	610	96	1,121	0.7
Total	57,265	93,381	102	150,748	

Table 1: Gender and Racial Distribution, 1994 - 2002

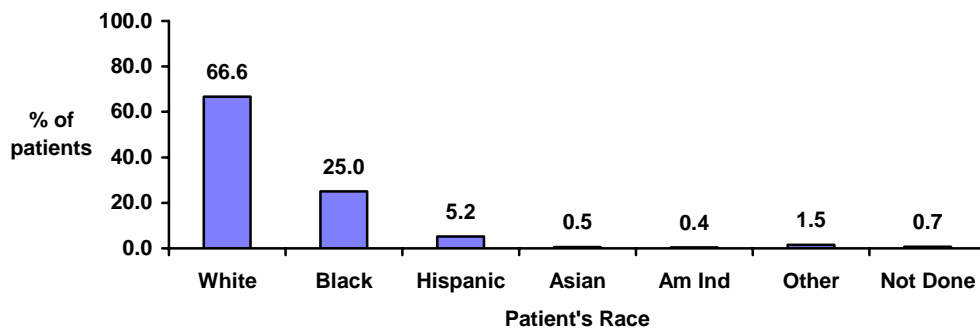


Figure 8: Racial Distribution, 1994 - 2002

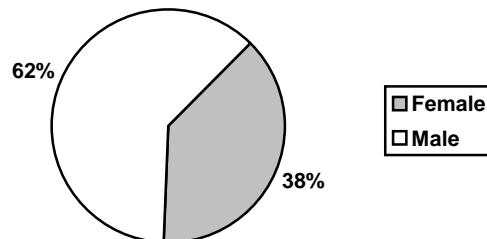


Figure 9: Gender Distribution, 1994 - 2002

Gender and Race Distribution for 2002

	Female	Male	Not Done/Doc	Totals	%
American Indian (I)	33	68	0	101	0.5
Asian (A)	45	61	0	106	0.5
Black (B)	1448	3124	1	4573	22.2
Hispanic (H)	264	1281	0	1545	7.5
White (W)	5993	7835	1	13829	67.2
Other (O)	122	218	0	340	1.6
Not Done/Doc (D)	36	45	16	97	0.5
Total	7941	12632	18	20591	

Table 2: Gender and Racial Distribution, 2002

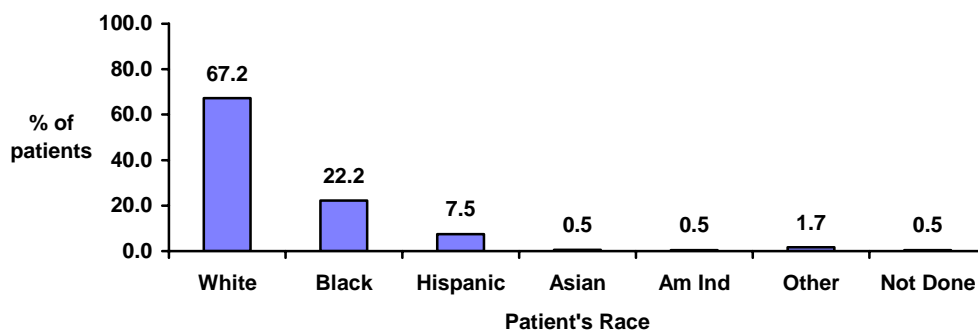


Figure 10: Racial Distribution, 2002

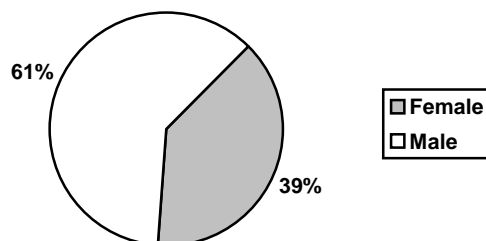


Figure 11: Gender Distribution, 2002

Average Length of Stay by Year

The average length of stay for each year is shown in Table 3. The average length of stay has decreased over the past term of this report.

Year	Mean +/- standard deviation (days)	# of patients with Hospital LOS > 0	# of patients with Hospital LOS ≤ 0
1994	8.3 +/- 30.6	12,252	374
1995	7.4 +/- 11.4	13,624	381
1996	6.8 +/- 11.2	15,450	406
1997	6.5 +/- 10.7	15,239	354
1998	6.5 +/- 10.3	15,007	387
1999	6.3 +/- 12.8	16,836	396
2000	5.7 +/- 10.1	18,690	682
2001	5.7 +/- 10.0	18,853	1226
2002	5.6 +/- 9.8	19,925	666

Table 3: Average LOS by Year

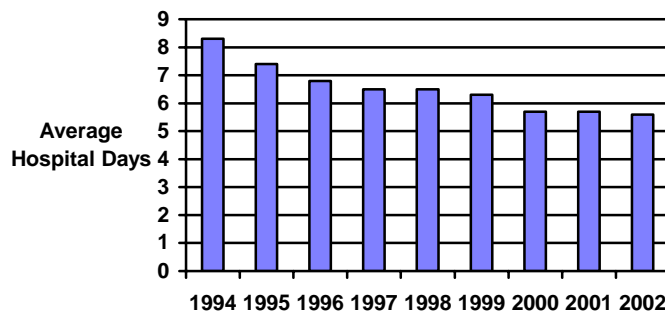


Figure 12: Average LOS by Year, 1994 - 2002

Average ICU Length of Stay by Year

The average ICU length of stay for each year is shown in Table 3.

Year	Mean +/- standard deviation (days)	# of patients with valid ICU LOS data	# of patients with ICU LOS \leq 0
1994	6.3 +/- 11.3	3764	8862
1995	6.3 +/- 10.3	3752	10,253
1996	6.3 +/- 11.2	4099	11,757
1997	5.9 +/- 10.8	3824	11,769
1998	5.8 +/- 9.5	4121	11,273
1999	6.5 +/- 10.3	4145	13,087
2000	6.2 +/- 9.3	4523	14,849
2001	6.3 +/- 10.2	4741	15,338
2002	6.1 +/- 9.4	4790	15,801

Table 4: Average ICU LOS by Year, 1994 - 2002

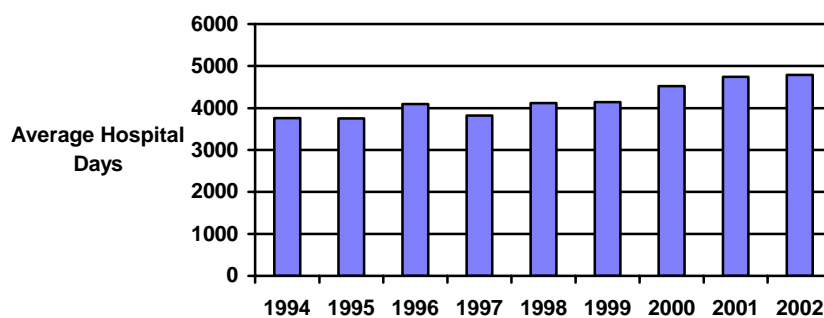


Figure 13: Average ICU LOS by Year, 1994 -2002

Injury Statistics

The distribution of injury mechanisms was analyzed for the entire term of the report (see Table 5: Injury Mechanism by Survival Rate, 1994 - 2002) and for 2002 (see Table 6: Injury Mechanism by Survival Rate, 2002). As these tables demonstrate, the majority of patients in the NCTR have sustained a blunt injury. Over the nine period, the survival rate was higher for the blunt injuries than for burn or penetrating injuries.

Mechanism of Injury by Survival

Injury Type	# of Patients	%	Survival (%)
Blunt	122167	82.0	95.1 +/- 21.5
Burn	6247	4.2	93.6 +/- 24.5
Penetrating	19421	13.0	91.2 +/- 28.4
Not Done/Doc	1130	0.8	94.4 +/- 23.0

Table 5: Injury Mechanism by Survival Rate, 1994 - 2002

Injury Type	# of Patients	%	Survival (%)
Blunt	16,839	82.33	95.6 +/- 20.5
Burn	857	4.17	95.7 +/- 20.3
Penetrating	2,306	11.26	92.0 +/- 27.1
Not Done/Doc	451	2.24	96.5 +/- 18.5

Table 6: Injury Mechanism by Survival Rate, 2002

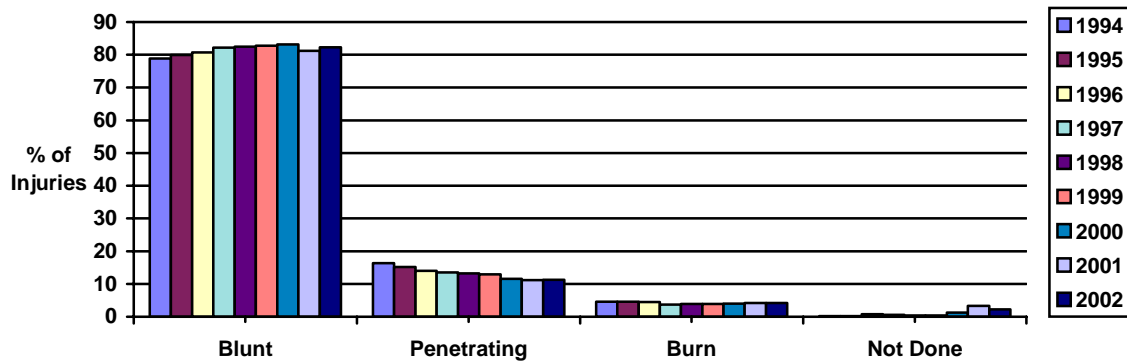


Figure 14: Mechanism of Injury by Year

Mechanism of Injury by LOS

Injury Type	# of Patients	Mean LOS	Standard Dev
Blunt	119912	6.5	14.0
Burn	6220	8.8	16.8
Penetrating	18667	5.3	9.9
Not Done/Doc	1077	3.0	4.9

Table 7: Injury Mechanism by LOS, 1994 - 2002

Injury Type	# of Patients	Mean LOS	Standard Dev
Blunt	16478	5.7	9.7
Burn	857	7.4	14.3
Penetrating	2222	4.7	8.8
Not Done/Doc	368	2.6	4.1

Table 8: Injury Mechanism by LOS, 2002

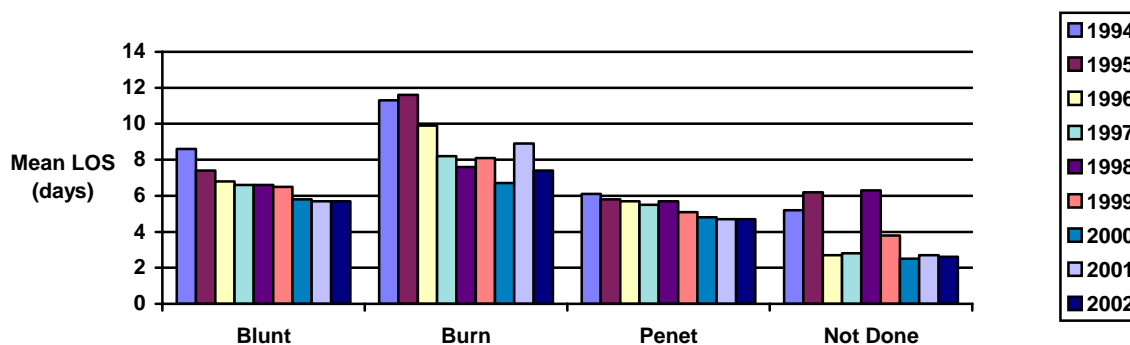


Figure 15: Mean LOS by Injury Mechanism by Year

Mechanism of Injury by Hospital Charges

Injury Type	# of Patients	Mean Hospital Charges	Standard Dev
Blunt	107,943	\$18,177	\$35,603
Burn	5,316	\$27,610	\$128,667
Penetrating	16,648	\$15,990	\$33,682
Not Done/Doc	968	\$8,497	\$14,512

Table 9: Injury Mechanism by Hospital Charges, 1994 - 2002

Injury Type	# of Patients	Mean Hospital Charges	Standard Dev
Blunt	12,892	\$23,264	\$42,439
Burn	680	\$30,404	\$80,571
Penetrating	1,649	\$19,303	\$36,227
Not Done/Doc	391	\$8,969	\$15,859

Table 10: Injury Mechanism by Hospital Charges, 2002

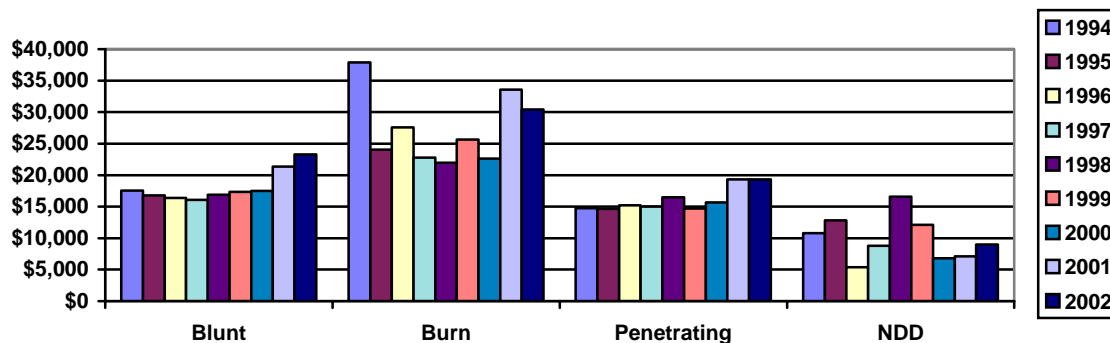


Figure 16: Injury Mechanism by Average Hospital Charges by Year

Pre-Hospital Statistics

The following table and chart indicates the type of location from which patients arrived. The numbers represent the count of patients.

Patient Origin

Patient Origin (Arriv_from)	1994	1995	1996	1997	1998	1999	2000	2001	2002	Total
Clinic	100	145	161	140	159	163	190	156	218	1432
EMS Station	4	9	7	6	6	9	12	9	4	66
Home	848	867	1056	965	1178	1144	1590	1105	1489	10242
Jail	13	12	18	25	42	41	30	30	21	232
MD Office	219	151	134	111	120	129	154	134	187	1339
Not Done/Doc	347	539	680	393	301	166	164	595	335	3520
Nursing Home	143	163	184	207	247	255	303	251	265	2018
Referral	4333	4317	4727	4636	4696	5118	5488	5728	5860	44903
Hospital										
Scene	6619	7802	8889	9110	8645	10207	11441	12071	12212	86996

Table 11: Patient Origin by Year

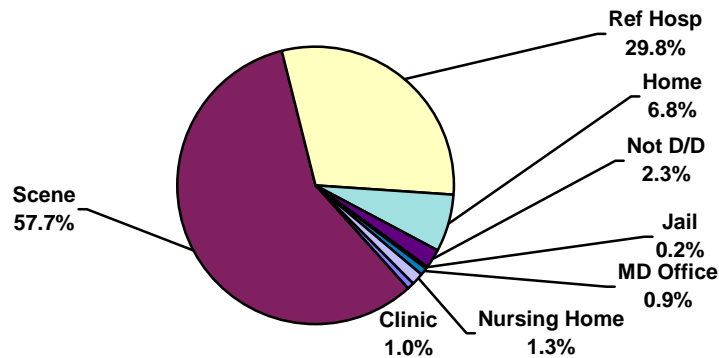


Figure 17: Patient Origin, 1994 – 2002

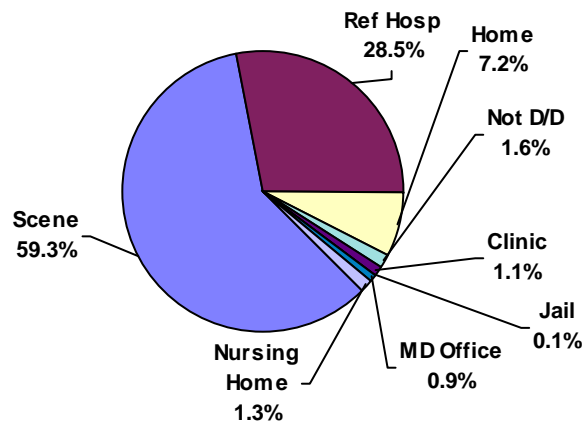


Figure 18: Patient Origin, 2002

Mode of Transport

ALS, private vehicle, helicopter, and ambulance continue to be the dominant methods of transport to the hospitals.

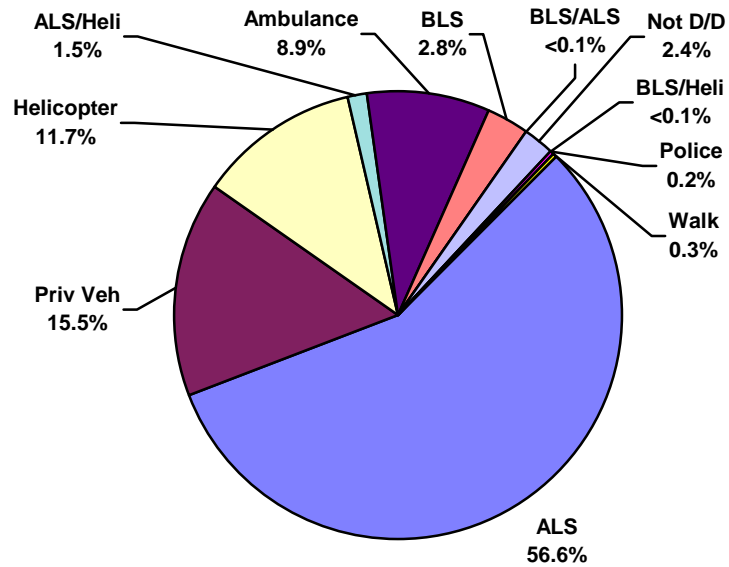


Figure 19: Mode of Transport, 1994 – 2002

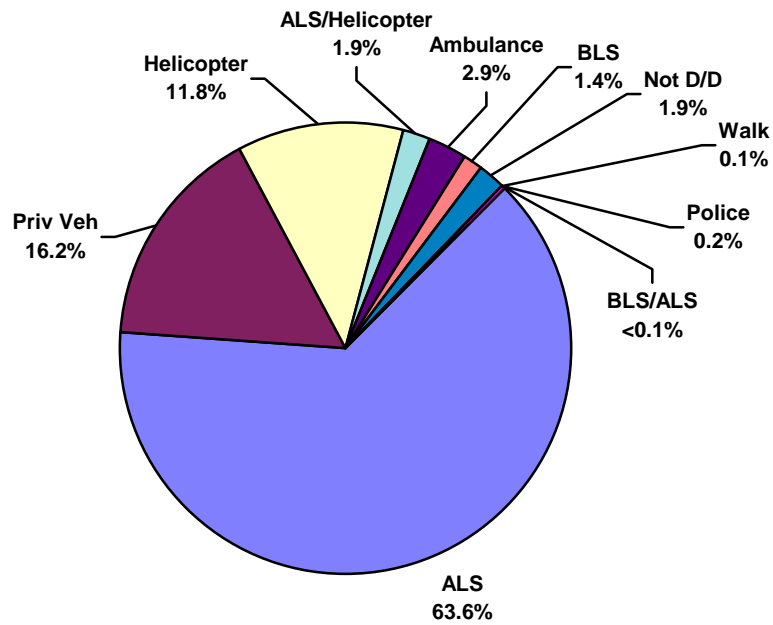


Figure 20: Mode of Transport, 2002

Scene Condition

Further analysis of the ability of simple tools to identify patients at high risk of death was performed in the database using the “AVPU” (Alert, Verbal, responsive to Pain, Unresponsive) assessment of patients’ status at the scene. The number in parentheses in the survival column is the number of cases with valid ED or hospital disposition values (which were used to determine survival). The survival rate decreases with the worsening of the patient’s status at the scene, lending support to the hypothesis that the “AVPU” assessment of patients’ status at the scene is predictive of patient survival. Note that approximately 61% of the records are missing the data for the scene condition field.

Condition at Scene	Number	Percent	Survival
Alert	48,178	32.0	97.8 +/- 14.6 (n=47,787)
Verbal Stimuli	3,833	2.5	92.9 +/- 25.6 (n=3782)
Responsive to Pain	2,134	1.4	87.8 +/- 32.7 (n=2090)
Unresponsive	5,365	3.6	48.5 +/- 50.0 (n=5279)
Not Done/Doc	91,237	60.5	95.7 +/- 20.2 (n=90,128)

Table 12: Scene Condition by Survival, 1994 - 2002

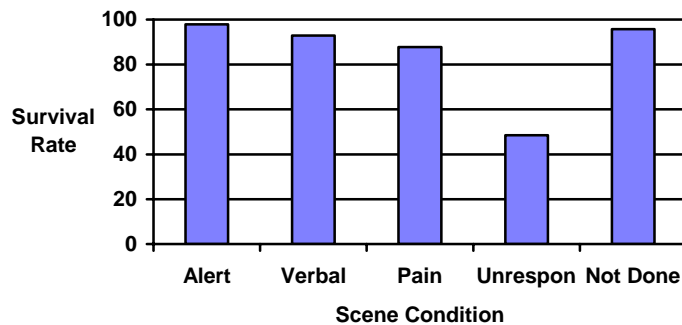


Figure 21: Scene Condition by Survival Rate, 1994 – 2002

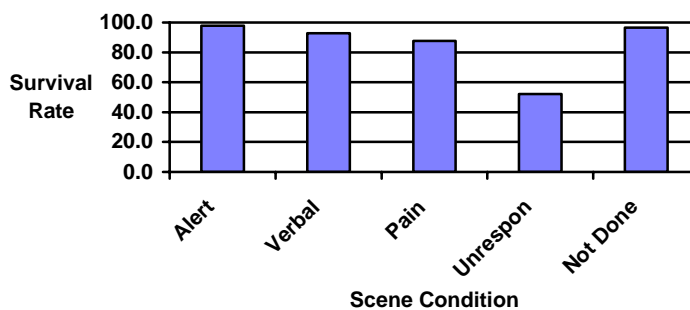


Figure 22: Scene Condition by Survival Rate, 2002

Arrival Condition

As for the scene condition, the trend in survival rate follows the “AVPU” assessment of the patient’s condition upon arrival at the Trauma Center. Note, also, that the percentage of records with missing data is smaller for the arrival condition field than for the scene condition field.

Condition on Arrival	Number	Percent	Survival
Alert	119056	79.0	98.4 +/- 12.5 (n=118,289)
Verbal Stimuli	4359	2.9	92.4 +/- 26.4 (n=4308)
Responsive to Pain	2840	1.9	87.8 +/- 32.7 (n=2782)
Unresponsive	11272	7.5	55.0 +/- 49.7 (n=11,176)
Not Done/Doc	13221	8.8	95.5 +/- 20.8 (n=12,512)

Table 13: Arrival Condition by Survival Rate

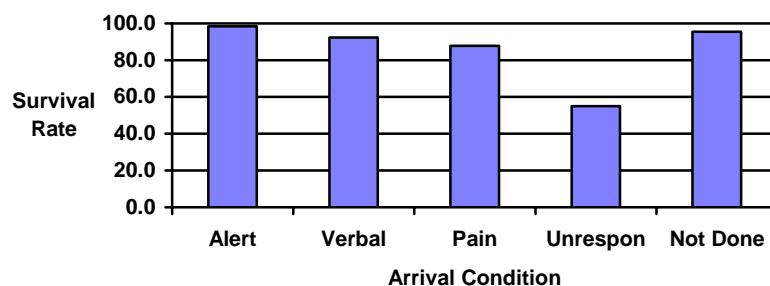


Figure 23: Survival Rate by Arrival Condition, 1994 - 2002

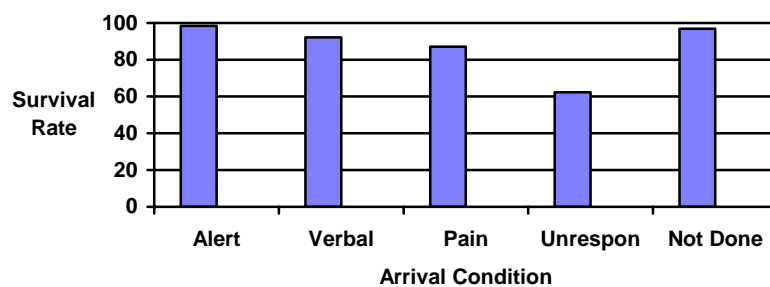


Figure 24: Arrival Condition by Survival Rate, 2002

Condition at Scene vs Condition on Arrival

The condition of the patient at the scene was compared to the condition of the patient on arrival at the Trauma Center, based on the “AVPU” assessment of condition. Of the 58,344 patients with complete scene condition and arrival condition data, the condition of 4,045 patients improved, 2,752 worsened, and 51,547 remained the same.

Condition at Scene	Condition on Arrival				
	Alert	Verbal Stimuli	Responsive to Pain	Unresponsive	Not Done/Doc
Alert	45,755	793	223	589	818
Verbal Stimuli	2110	1038	189	382	114
Responsive to Pain	562	290	649	576	57
Unresp	471	201	411	4105	177
Pending					
Not Done/Doc	70,157	12,055	1368	5620	2037

Table 14: Scene Condition vs Arrival Condition

Emergency Department Statistics

Chief Complaint

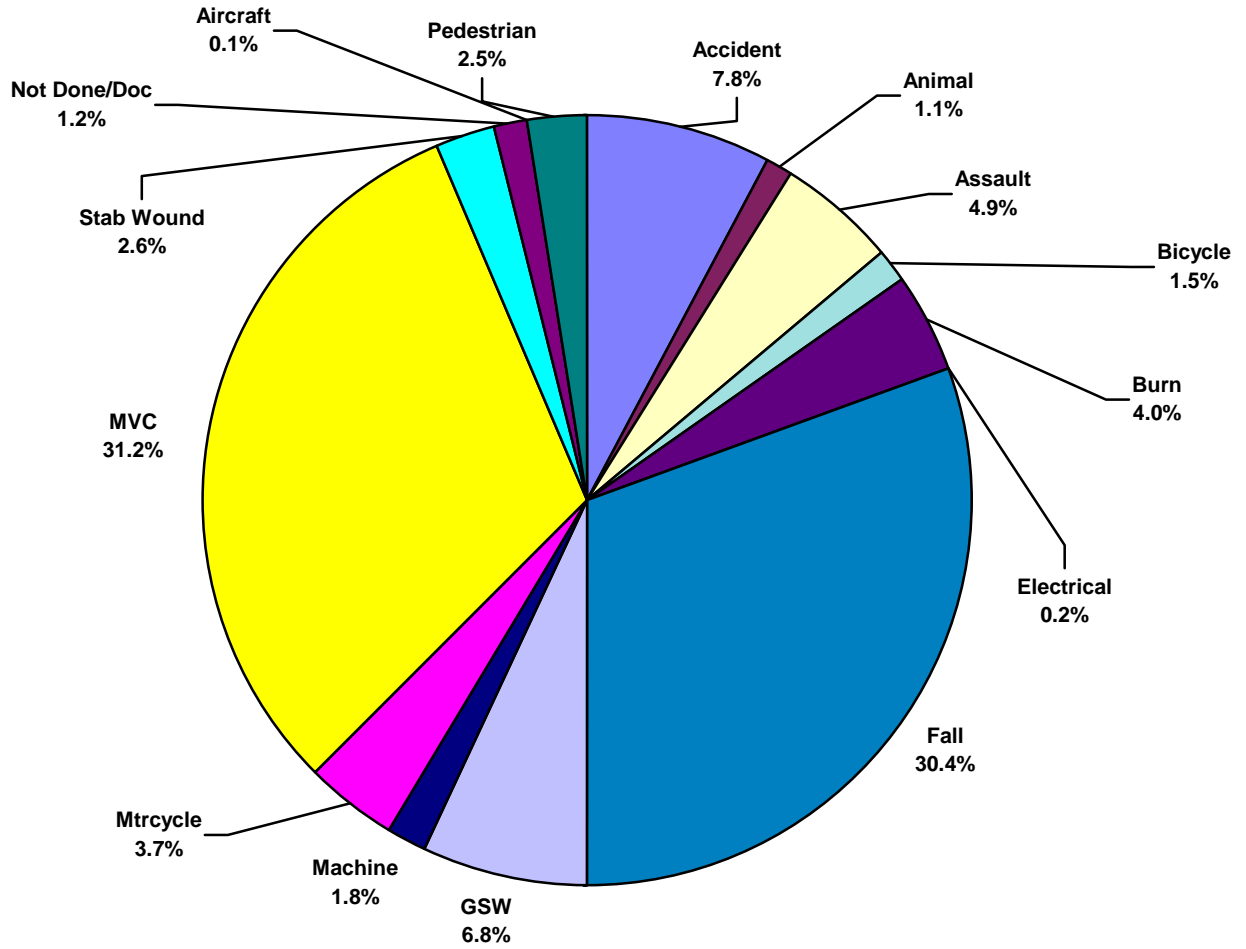


Figure 25: Chief Complaint Rate, 1994 - 2002

Hour of Admission

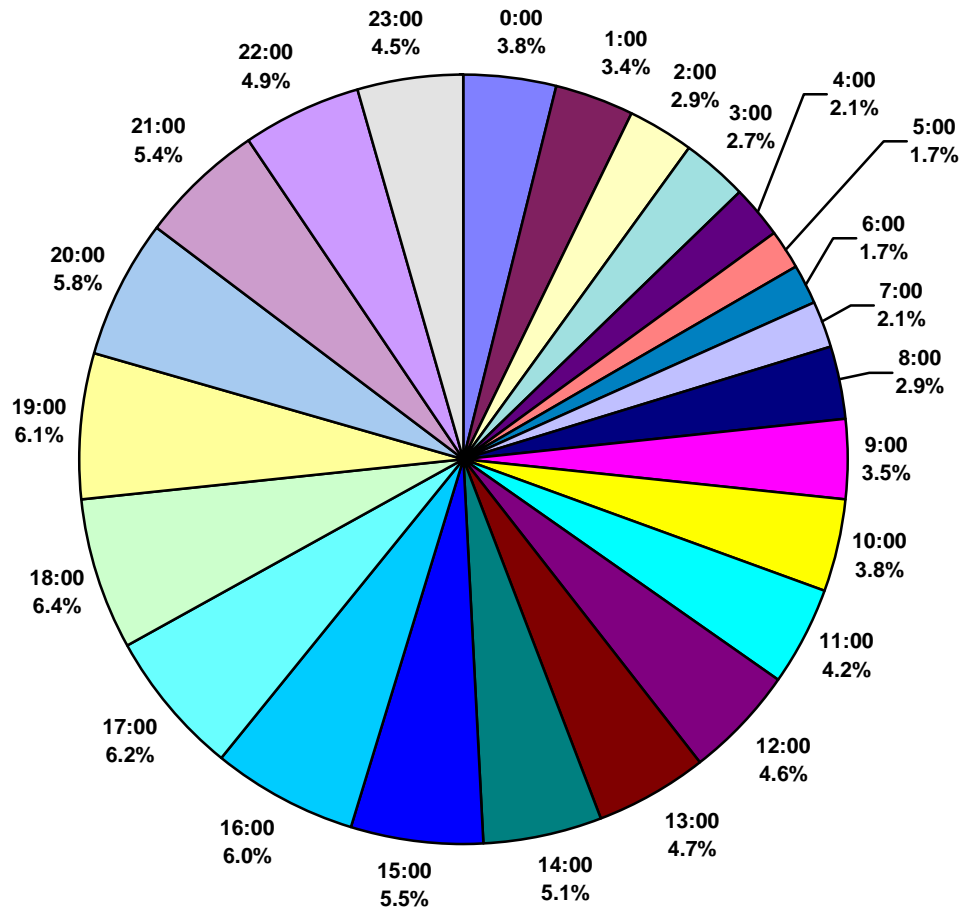


Figure 26: Hour of Admission, 1994 - 2002

ED Disposition

The majority of trauma patients were sent to the floor from the Emergency Department (ED). The number of patients with a value of Labor/Delivery, Radiology, or Step Down for the ED Disposition field for the nine-year period was less than 0.1%, so these values were not included in the graph below.

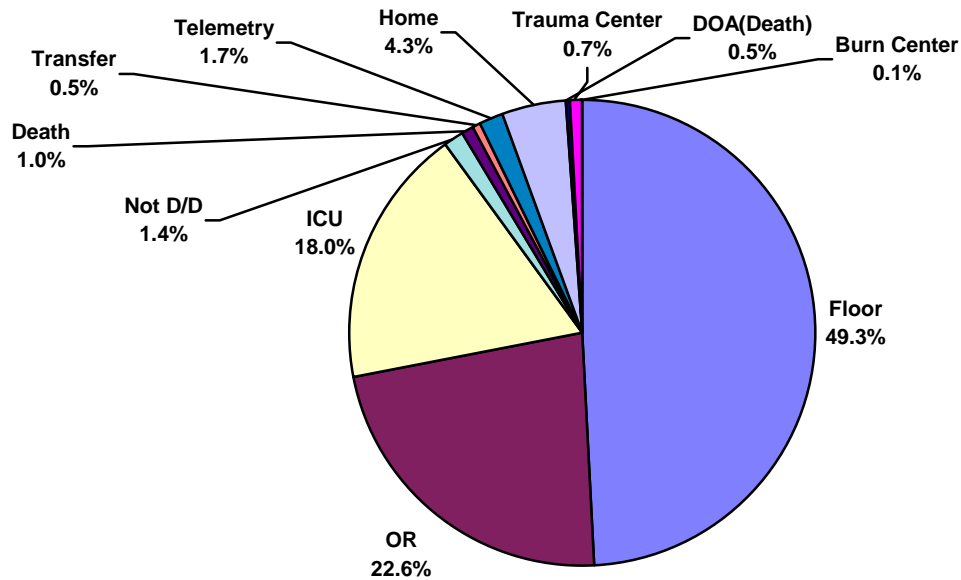


Figure 27: ED Disposition, 1994 – 2002

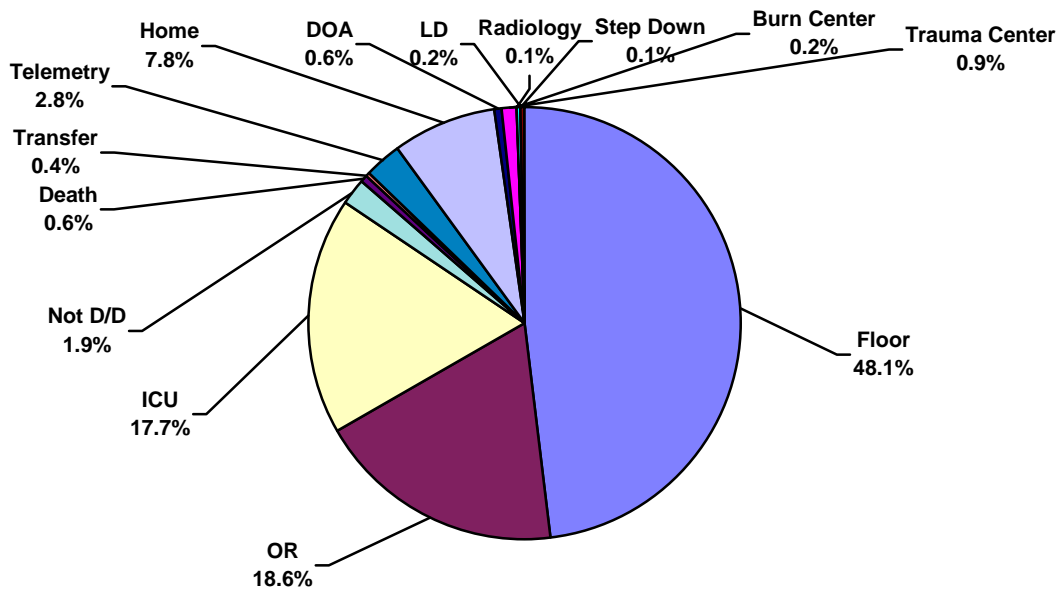


Figure 28: ED Disposition, 2002

Admission Service

Admission Service	Number of Patients Admitted	Percent	Average LOS (# of patients with valid LOS)
Burn	4373	2.9	10.9 +/-19.4 (n=4342)
Cardiology	238	0.2	8.5 +/-10.2 (n=234)
CT Surgery	487	0.3	7.1 +/- 13.3 (n=484)
ENT	1250	0.8	2.8 +/-3.2 (n=1235)
General Surgery	1278	0.8	5.2+/-7.9 (n=1227)
Hand	707	0.5	3.0+/3.2 (n=683)
Medicine	5033	3.3	7.0+/-8.5 (n=4995)
Neurosurgery	11,687	7.8	7.6+/-12.8 (n=11,411)
None	345	0.2	1.0 +/- 0.1 (n=308)
OB/GYN	324	0.2	1.9 +/- 2.1 n=323
Ophthalmology	1213	0.8	2.6+/-2.2 (n=1204)
Oral Surgery	903	0.6	2.3 +/-3.0 (n=888)
Orthopedics	46,928	31.1	5.4+/-16.4 (n=46,496)
Other	396	0.3	6.4+/-8.7 (n=390)
Pediatrics	2049	1.4	3.4+/-6.8 (n=2035)
Pediatric Surgery	3643	2.4	5.4+/-7.7 (n=3544)
Plastic Surgery	3329	2.2	3.8+/-5.2 (n=3282)
Psychiatry	97	0.1	5.9 +/- 4.6 (n=97)
Trauma	56,890	37.7	8.0+/-12.9 (n=55,287)
Urology	177	0.1	3.2+/3.5 (n=175)
Vascular Surgery	176	0.1	6.4+/-8.8 (n=175)
Not Done/Doc	9225	6.1	1.3 +/- 4.8 7061

Table 15: Admission Service by Average LOS, 1994 – 2002

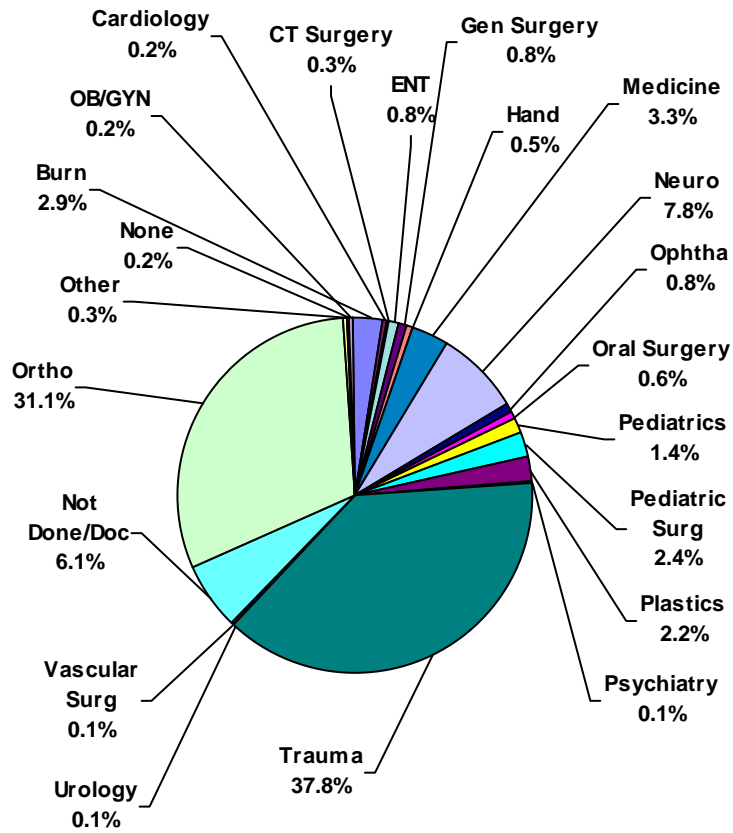


Figure 29: Admission Service, 1994 - 2002

Admission Service	Number of Patients Admitted	Percent	Average LOS (# of patients with valid LOS)
Burn	573	2.8	9.5 +/- 16.5 (n=573)
Cardiology	33	0.2	5.9 +/- 4.8 (n=30)
CT Surgery	21	0.1	7.7 +/- 6.1 (n=21)
ENT	137	0.7	2.2 +/- 1.9 (n=136)
General Surgery	188	0.9	5.9 +/- 10.2 (n=145)
Hand	125	0.6	2.0 +/- 1.8 (n=125)
Medicine	983	4.8	5.7 +/- 6.3 (n=965)
Neuro Surgery	1117	5.4	5.4 +/- 7.6 (n=1084)
None	141	0.7	1.0 +/- 0.0 (n=136)
OB/GYN	90	0.4	1.3 +/- 1.0 (n=90)
Ophthalmology	96	0.5	2.1 +/- 1.7 (n=96)
Oral Surgery	56	0.3	1.9 +/- 1.3 (n=56)
Orthopedics	5626	27.3	4.3 +/- 4.8 (n=5390)
Other	48	0.2	6.1 +/- 8.8 (n=48)
Pediatrics	416	2.0	2.8 +/- 5.3 (n=414)
Pediatric Surgery	432	2.1	5.5 +/- 8.0 (n=424)
Plastic Surgery	364	1.8	3.5 +/- 6.3 (n=361)
Psychiatry	10	< 0.1	4.6 +/- 3.6 (n=10)
Trauma	8140	39.5	7.8 +/- 13.0 (n=8027)
Urology	24	0.1	3.3 +/- 4.0 (n=23)
Vascular Surgery	25	0.1	4.6 +/- 6.1 (n=25)
Not Done/Doc	1946	9.4	1.1 +/- 1.3 (n=1746)

Table 16: Admission Service by Average LOS, 2002

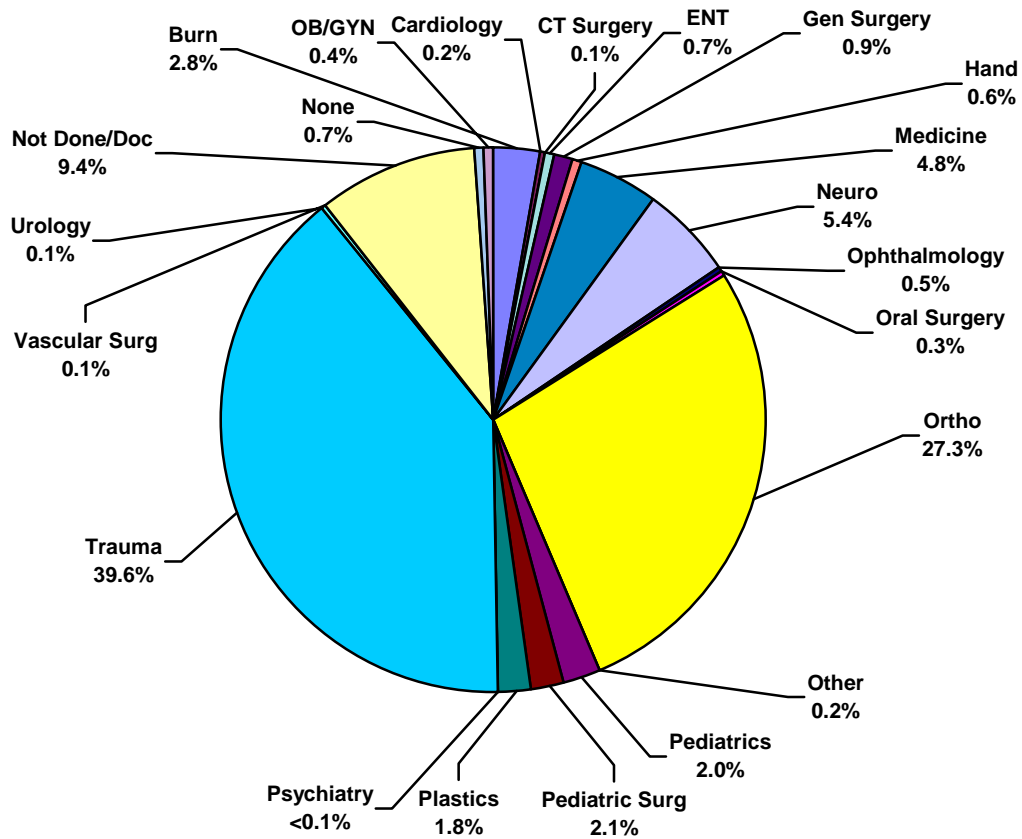


Figure 30: Admission Service, 2002

Injury Severity and Outcome Statistics

Injury Severity Score (ISS): Number of patients, survival rate, LOS, and hospital charges

As expected, the survival rate decreases as the ISS score increases. Length of stay and hospital charges increase with ISS (for ISS < 75). Several records had an erroneous ISS value of 0. These records, and records with missing ISS data were not included in the tables below.

ISS (UsrAis_Iss)	Mean Survival	Mean Charges	LOS
1-12	98.3 +/- 13.0 (n=109,852)	\$11,658 +/- \$21,234 (n=96,823)	4.8 +/- 12.2 (n=108,925)
13-24	93.0 +/- 25.4 (n=22,846)	\$30,514 +/- \$46,146 (n=20,391)	10.1 +/- 13.5 (n=22,168)
25-74	65.1 +/- 47.7 (n=11,419)	\$59,407 +/- \$115,258 (n=9,861)	16.3 +/- 21.5 (n=10,445)
75	23.7 +/- 42.6 (.n=422)	\$28,365 +/- \$51,855 (n=349)	11.0 +/- 19.2 (n=273)

Table 17: Injury Severity by Survival Rate, Average LOS, and Average Hospital Charges, 1994 - 2002

ISS (UsrAis_Iss)	Mean Survival	Mean Charges	LOS
1-12	98.6 +/- 11.9 (n=14,799)	\$14,413 +/- \$22,389 (n=11,281)	3.9 +/- 6.0 (n=14,651)
13-24	93.7 +/- 24.4 (n=3223)	\$37,614 +/- \$57,250 (n=2530)	9.0 +/- 12.1 (n=3140)
25-74	69.5 +/- 46.1 (n=1586)	\$77,147 +/- \$95,420 (n=1193)	16.4 +/- 20.8 (n=1505)
75	33.3 +/- 47.9 (n=33)	\$43,734 +/- \$63,747 (n=29)	13.2 +/- 22.5 (n=27)

Table 18: Injury Severity by Survival Rate, Average LOS, and Average Hospital Charges, 2002

Hospital Disposition

The majority of trauma patients were discharged from the hospital to home (~67%). The next tier of patients were discharged to a nursing home (~8%) or a rehabilitation facility (~9%). The field value "Pending" comprised less than 0.05% of the dataset, so this value was excluded from the graph below.

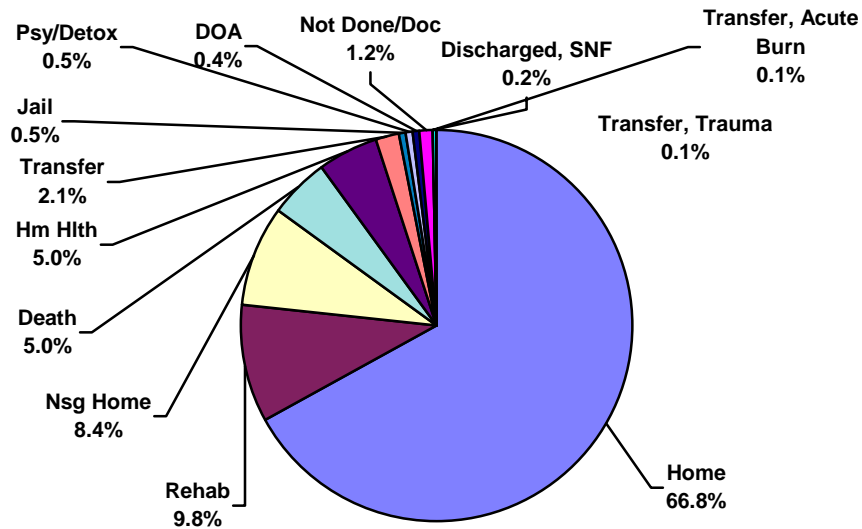


Figure 31: Hospital Disposition Distribution, 1994 - 2002

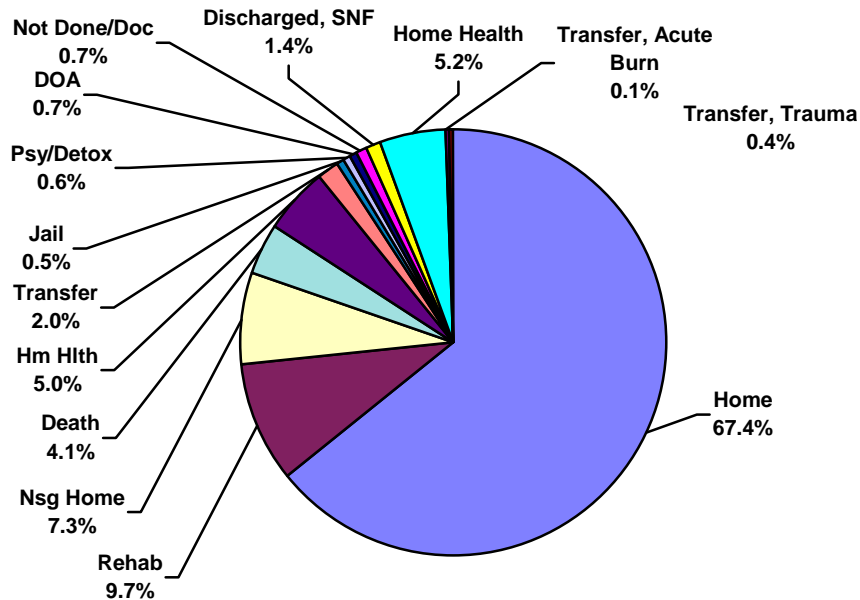


Figure 32: Hospital Disposition Distribution, 2002

Financial Statistics: Payor Mix

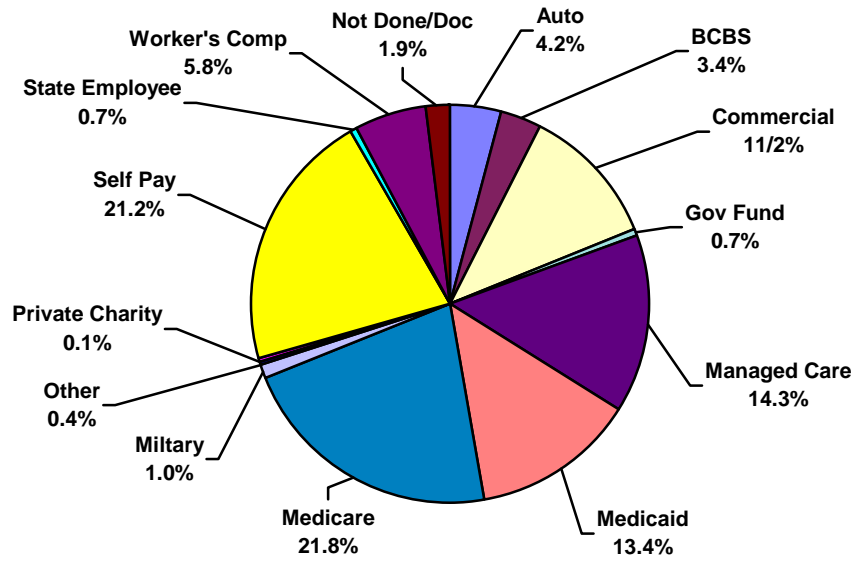


Figure 33: Insurance Distribution, 1994 - 2002

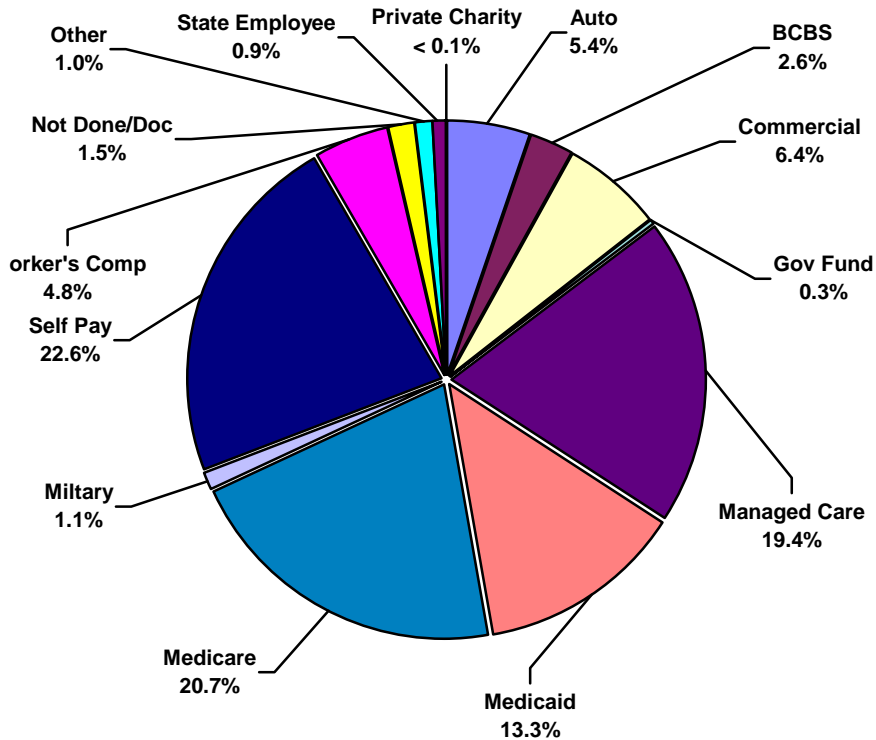


Figure 34: Insurance Distribution, 2002

Hospital Transfers (Patients Transferred to the Trauma Center)

Overall, the percentage of patients transferred to the Trauma Centers was 30.9%; 65.0% were not transferred, and the documentation of transfer status was not done in 4.1% of the patients for the period of 1994 - 2002. The breakdown by year is as follows:

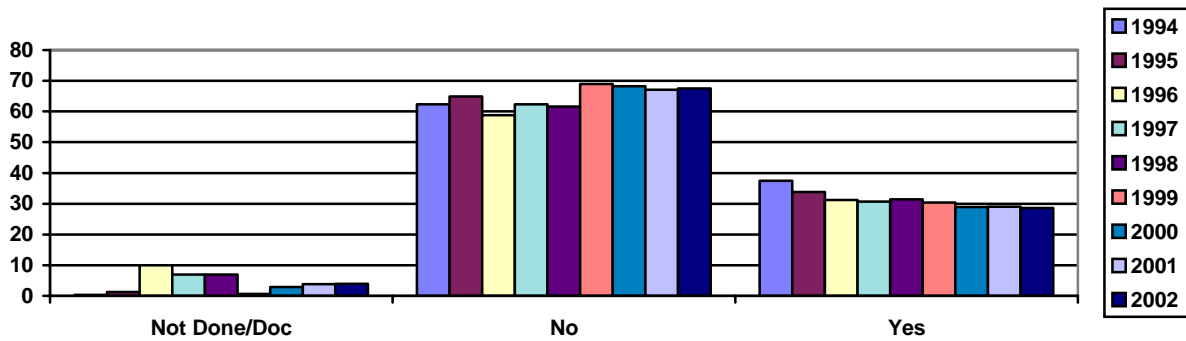


Figure 35: Hospital Transfer Rate by Year

Mechanism of Injury for Transferred Patients

Of the patients who were transferred to the Trauma Centers, 78.3% had blunt injuries, 8.2% had burn injuries, and 12.7% had penetrating injuries. The breakdown of the injury types by year of admission is presented below. The category of patients with undocumented mechanism of injury contained less than 1% of the population, and thus was excluded from the graph below.

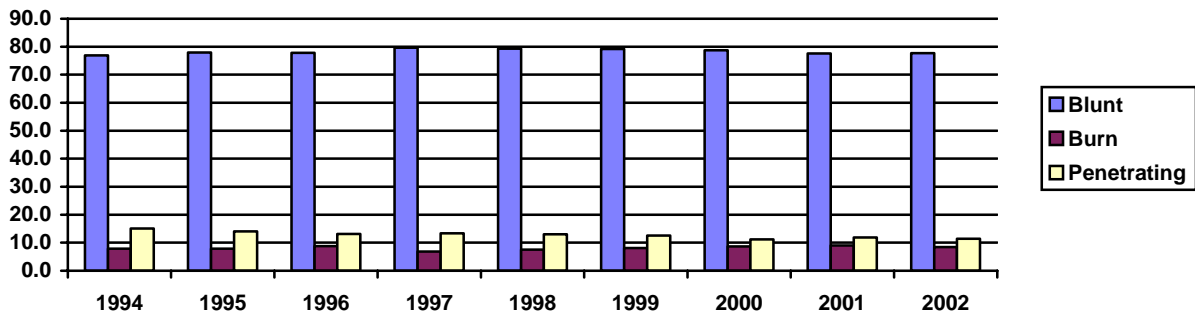


Figure 36: Distribution of Mechanism of Injury in Patients Who Were Transferred to the Trauma Centers

Mechanism of Injury by Year for Transferred Patients Who Died

Of the 2997 transferred patients who died, 26 had no mechanism of injury recorded. Of the remaining 2971 patients, 15.8% had penetrating injuries, 74.9% had blunt injuries, and 9.3% had burn injuries. The distribution of these injuries by year is shown in the graph below.

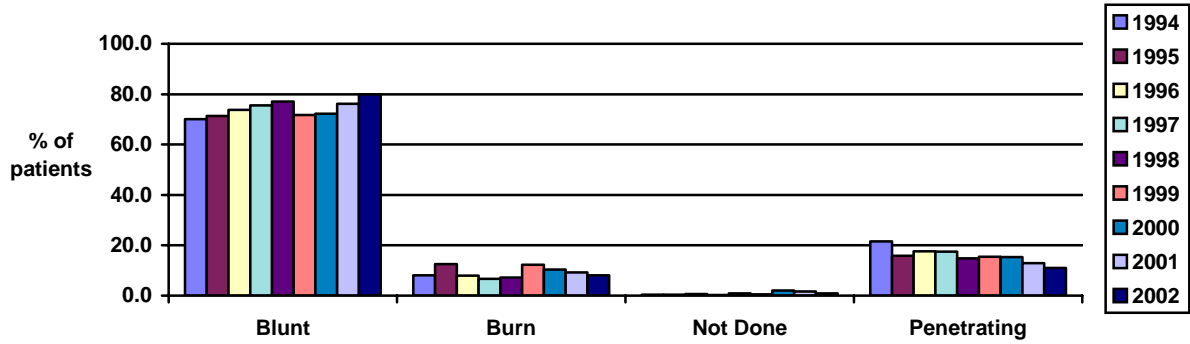


Figure 37: Distribution of Mechanism of Injury in Transferred Patients Who Died