

First
Kentucky
State Trauma Registry
Report
1995-2000

A Summary of Cases Seen at

- Kosair Children's Hospital
- University of Louisville Hospital
- University of Kentucky Hospital

Summer 2002

Amy Jennings, M.S. and Susan H. Pollack, M.D.
Bryony N. Orwick, M.S.
John W. Poe, D.V.M.
Clella Hagans, B.A.
Tim Struttman, M.S.P.H., Acting Director

Kentucky Injury Prevention and Research Center
333 Waller Avenue, Suite 202
Lexington, Kentucky 40504-2915
(859) 257-4954

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Forward

The Kentucky State Trauma Registry Report 1995-2000 is a publication of the Kentucky Injury Prevention and Research Center (KIPRC) at the University of Kentucky, Lexington, Kentucky. This report presents trauma data collected by the three major trauma centers in the state. This information was gathered and computerized by each hospital and submitted to KIPRC, where it has been analyzed as a whole for the first time. SPSS software (SPSS Corporation: Chicago, Illinois) was used for data analyses.

Requests for copies of this publication and any other inquiries should be directed to:

Kentucky Injury Prevention and Research Center
333 Waller Avenue, Suite 202
Lexington, Kentucky 40504-2915

(859) 257-4954 office
(859) 257-3909 fax

or by accessing our website:
www.kiprc.uky.edu

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Colleen H. Swartz, R.N., M.S.N., C.C.R.N., C.F.R.N., Director, Trauma and Emergency Transport

Patty Sturt, R.N., M.S.N., Trauma Coordinator

Portia Loveless, B.A., Trauma Research Coordinator

University of Louisville Hospital

Jorge Rodriquez, M.D., Director of Trauma and Chief of Surgery

Dana Davidson, R.N., Nurse Manager, Trauma Institute

Michelle Carroll, R.N., Trauma Coordinator

Janet Wallace, R.N., Trauma Coordinator

Kentucky Injury Prevention and Research Center

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W. Jay Christian, B.A., Project Manager, TBI / SCI Surveillance Project

Allison Huck, B.A., Research Assistant, Intimate Partner Violence and the TBI/SCI Surveillance Projects

Eddie Napier, B.A., Systems Administrator

Mark Schneider, MCP, CNE, IT Manager

Michael Singleton, M.S., Injury Surveillance Coordinator

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We would like to acknowledge the generous donation of time, energy, staff support, and data access from the three regional trauma centers in Kentucky: Kosair Children's Hospital (KCH), the University of Kentucky Hospital (UKH) and the University of Louisville Hospital (ULH). The Emergency Medical Services for Children (EMSC) Implementation Grant was the foundation for the state trauma registry during 1996-2001.

Under the leadership of Dr. Pamela Kidd (the former Director of KIPRC, now Associate Dean, College of Nursing, Arizona), a contract between ACS and UK enabled the purchase of Trauma Registry of the American College of Surgeons (TRACS) software and provided training and recruitment of hospitals willing to contribute their data and participate in the system. Tim Struttman, the current Acting Director of KIPRC, continued to support the project without designated federal or state resources for trauma data management or analysis.

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Trauma Centers:*

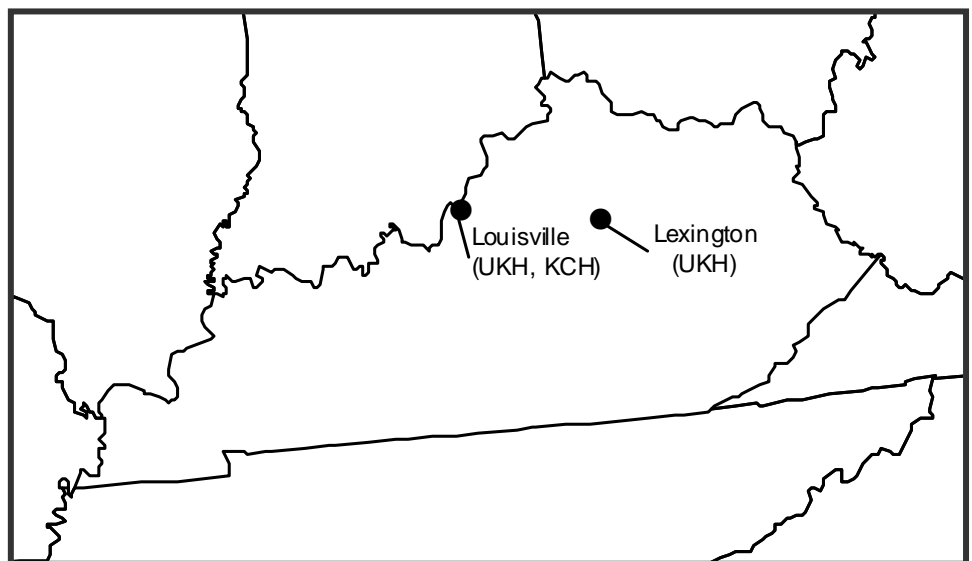
- *Kosair Children's Hospital, Louisville*
- *University of Louisville Hospital, Louisville*
- *University of Kentucky Chandler Medical Center, Lexington*

Introduction

This initial Kentucky state trauma registry report covers six years, 1995 through 2000. Kentucky statute defines "trauma" as a single or multi-system life threatening or limb threatening injury requiring immediate medical or surgical intervention or treatment to prevent death or permanent disability (KRS 311.6521).

This report is the summary of the data for trauma registry cases seen at the three regional trauma centers in Kentucky. Data from 1995-2000 in the registry does not include any trauma data from the smaller 100 plus hospitals in the Commonwealth, unless individuals were subsequently transferred from a smaller hospital to one of the 3 regional centers. It is important to note that this data is thus a select group of the most serious injuries that occur and does not represent the much larger group of all injuries that occur in the state. It also excludes trauma cases occurring in Kentucky but treated in hospitals outside of the state. When possible, these data are compared to the National Trauma Data Bank (NTDB).

Figure 1. *Geographic location of hospitals.*



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*Registry inclusion
criteria differ between
the three trauma
centers.*

Inclusion Criteria

Inclusion criteria for trauma registry entry vary somewhat from hospital to hospital.

Kosair Children's Hospital (KCH) trauma registry includes all patients admitted to the hospital (including 23 hour admits) after being involved in a trauma incident. All trauma alert or trauma stat patients are initially admitted to the trauma service. Patients for whom trauma alerts are called, but who after evaluation are found not to need admission, are not included in the registry. Injured patients not admitted to the trauma service via trauma stat or trauma alert may be admitted to services such as orthopedics or neurosurgery and still be included in the registry. Patients who arrive at the emergency department and have died due to trauma are also included in the registry, since had the patient not died, he/she would have been admitted. Patients range in age from 0 to 18 years, and include transfers from other facilities. Trauma admissions can involve any source of injury (motor vehicle crashes, bicycle incidents, falls, penetrating injuries, near-drowning, burns, child abuse, sports related incidents, all-terrain vehicle injuries, motorcycle/moped crashes, assaults, crush incidents, and poisonings). KCH has used Kales software, which includes N codes, but no cost data. In 2001 KCH began using TRACS software for data collection.

The University of Kentucky Hospital (UKH) trauma registry inclusion criteria includes patients receiving blunt, penetrating, or burn injury who require inpatient admission. Patients are admitted to a variety of services including neurosurgery, orthopedics, plastics, trauma surgery, pediatric surgery, etc. All patients who meet trauma alert criteria, where the injury is potentially life threatening prior to and upon arrival, and who may or may not require admission, are entered into the registry. Similar to the Kosair registry, patients who have an injury and die in the emergency department are also entered into the registry. UKH uses specially designed software. Text on nature of injury is present, but N codes are not included. UKH has also coded motor vehicle crashes somewhat differently than the other two centers.

The University of Louisville Hospital (ULH) utilizes TRACS software and uses the following criteria for patient inclusion in the registry:

- 1) All traumatically injured patients admitted to the hospital for greater than 48 hours;
- 2) All traumatically injured patients transferred from an outlying facility (regardless of length of stay);
- 3) All trauma related deaths.

(Note: This criterion is substantially different from the other two hospitals and may result in a relative under-count in comparison.)

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I. Demographics

Hospital Distribution

Kosair Children’s Hospital (KCH), a pediatric regional trauma center located in Louisville, accepts local and regional referral patients from birth through age 18 years. The University of Louisville Hospital (ULH) is an urban trauma center that draws most of its patients from the state’s largest city and surrounding metropolitan area. ULH will care for patients of any age, but reports few pediatric cases due to their proximity to KCH. The University of Kentucky Hospital (UKH) in Lexington is the state’s largest hospital. It serves its central Kentucky urban and rural neighbors but was also designed to serve the people of rural eastern Kentucky and receives approximately 2/3 of its patients from outside of Fayette County.

Anyone referred for treatment from any other facility in the state to one of these hospitals is included in the trauma registry data regardless of their state of residence. Conversely, any Kentucky resident treated at an out-of-state trauma center is not included.

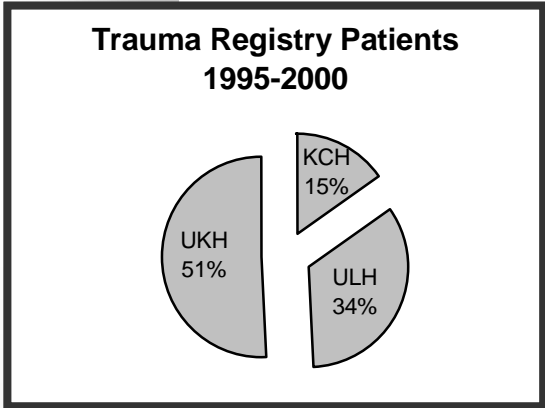


Table 1. *Trauma registry patient distribution by hospital, 1995-2000.*

KCH	ULH	UKH	Total
4,027	8,844	13,279	26,150
15.4%	33.8%	50.8%	

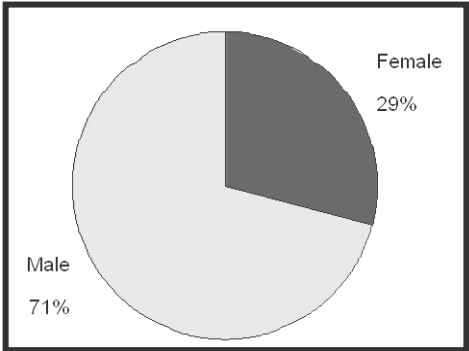
Note: data for ULH is probably underestimated due to the exclusion of patients admitted for less than 48 hours.

The number of cases differs among the three trauma centers.

Gender

Across six years of data collection, each of the three hospitals' trauma registries consistently indicated over two-thirds of patients were male.

Figure 2. *Gender composition of the three hospitals, 1995-2000.*



Nearly three-quarters of trauma cases are male.

Age Distribution

Table 2. *Trauma registry age distribution, 1995-2000.*

Age in Years	KCH		ULH		UKH		Total	
	Cases	%	Cases	%	Cases	%	Cases	%
< 1 yr.	384	9.5	0	.0	149	1.1	533	1.8
1-4	980	24.3	0	.0	512	3.9	1492	5.9
5-9	1026	25.5	2	.0	519	3.9	1547	5.9
10-14	1036	25.7	47	.5	578	4.4	1661	6.4
15-17	600	14.9	465	5.3	793	6.0	1858	7.1
18-25	1	.0	1919	21.7	2707	20.4	4627	17.7
26-35			1919	21.7	2683	20.2	4602	17.6
36-45			1739	19.7	2245	16.9	3984	15.2
46-55			1162	13.1	1300	9.8	2462	9.4
56-65			625	7.1	754	5.7	1379	5.3
66-75			487	5.5	588	4.4	1075	4.1
76-85			379	4.3	348	2.6	727	2.8
86-95			95	1.1	99	.7	194	.7
96-120			5	.1	4	.0	9	.3
Total	4027		8844		13279		26150	

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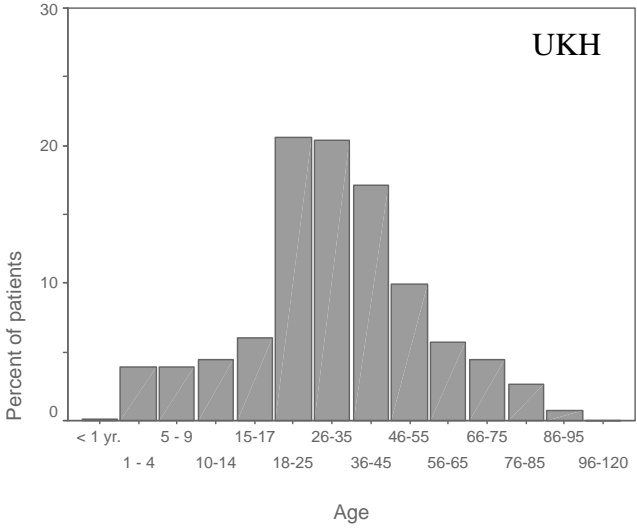
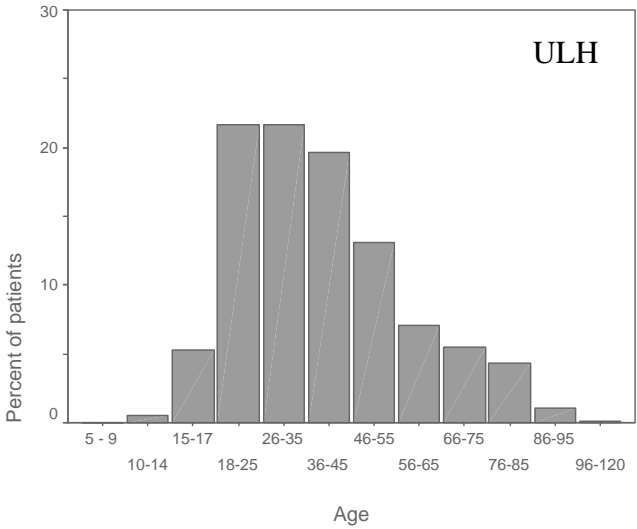
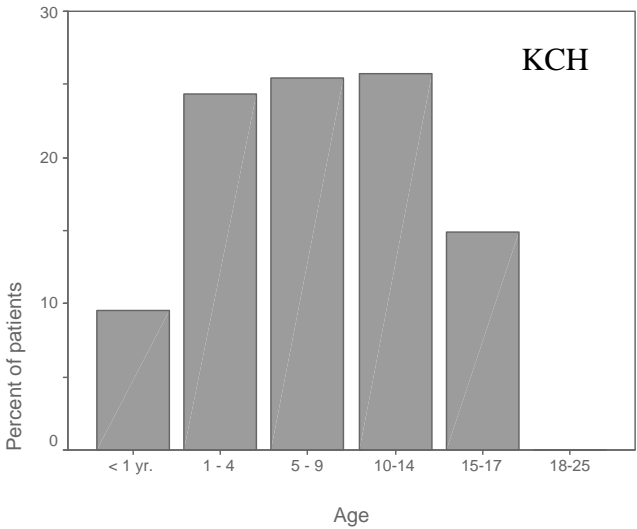
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Kentucky has a greater proportion of patients less than 15 years old compared to the NTDB.

Significant differences between Kentucky and the National Trauma Database (NTDB) exist with respect to age. In the NTDB, children ages birth to sixteen account for 12% of the trauma patients. In Kentucky, children birth to fifteen account for 20% of the trauma patients. On the other end of the age spectrum, the NTDB includes 26% of trauma patients greater than age 55; whereas, in Kentucky there is 13.2%. ULH doesn't include patients admitted for less than 48 hours and may contribute to the under representation of adult patients. The large burden of pediatric trauma needs to be investigated further.

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Figure 3. Trauma registry age distribution by hospital, 1995-2000.



Compared to ULH, the UKH registry includes proportionately more children less than 18 years of age.

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Most trauma patients were Kentucky residents. ULH and KCH also had a significant number of Indiana residents.

Patient Residence

Table 3. *Patient residence (percent), 1995-2000.*

	KCH	ULH	UKH
Kentucky	83.8	78.5	95.2
Indiana	15.6	17.5	.4
Michigan	.0	.4	.5
Ohio	.0	.7	1.6
Tennessee	.3	.4	.4
Other	.3	2.5	1.9

Most patients in the trauma registry were residents of Kentucky. A significant number of patients at KCH and ULH were residents of Indiana. UKH is more centrally located in the state, and 95.2% of its trauma patients were Kentucky residents (see map).



Table 4. *Leading counties of residence, 1995-2000.*

Jefferson	6129	28.9%
Fayette	1855	8.7%
Hardin	526	2.5%
Madison	483	2.3%
Bullitt	424	2.0%
Nelson	414	2.0%

The counties representing the most trauma patients are the same counties as the trauma centers or adjacent counties. All off the 120 counties in Kentucky are represented.

At KCH and UKH about one quarter of those patients who reside in Kentucky live within 50 miles of the trauma center, an approximate 1-hour ground transport time. At ULH, over half of Kentucky residents live within 50 miles of the hospital.

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*There has been an
increase in the
proportion of Hispanic
cases at UKH.*

Race

Table 5. Race (percent) by hospital.

Race	1995	1996	1997	1998	1999	2000	Total
<u>KCH</u>							
Caucasian	76.6	81.4	78.2	75.6	80.6	78.0	78.4
African-American	20.8	17.9	20.5	22.2	17.0	19.1	19.6
Hispanic	0.3	0.0	0.4	0.2	0.2	0.4	0.2
<u>ULH</u>							
Caucasian	80.7	80.2	80.3	84.1	81.7	82.0	81.5
African-American	17.3	17.8	16.9	13.6	15.1	13.9	15.8
Hispanic	1.2	1.1	2.1	1.0	1.1	1.5	1.3
<u>UKH</u>							
Caucasian	93.3	91.4	91.8	92.7	92.8	92.6	92.4
African-American	5.0	6.2	6.5	4.6	4.4	4.2	5.2
Hispanic	.9	1.9	1.5	2.5	2.6	3.0	2.0
<u>All 3 Hospitals</u>							
Caucasian	86.2	86.0	86.1	87.6	87.2	86.3	86.6
African-American	11.8	12.1	12.0	9.9	9.9	10.2	11.0
Hispanic	.01	1.3	1.4	1.6	1.7	2.0	1.5

ULH and KCH see proportionately more African-American trauma patients than UKH, while UKH has a slightly larger Hispanic patient population than does ULH.

The Caucasian population across the three hospital trauma registries remained relatively stable during the years of 1995 through 2000. The African-American trauma registry population has fluctuated and decreased slightly at ULH. In the UKH registry, the African-American population has notably decreased over the last three years. Although total numbers are still small, the Hispanic population increased considerably across the six-year registry period, a trend that is important in planning resources for translation and other related services.

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The leading causes of injury for Hispanic and African-American patients were motor vehicle crashes and assault/homicide.

Hispanic Data Summary

Hispanic trauma registry patients received care at the three hospitals. Their mean age was 29.1 years with a median age of 27 and mode of 23. 6.5% of Hispanic trauma registry patients were under the age of 18. Males comprised 91.4% of patients entered into the registry. Hispanic patients primarily resided in Fayette County (site of UKH). The most common zip codes were 40504 (n=20), 40505 (n=19), and 40508 (n=31) – all Lexington locations near the University of Kentucky medical center.

The leading causes of injury for these Hispanic patients were the same for both UKH and ULH. (KCH Hispanic patients were missing e-code data.) Nearly half (46%) of the Hispanic patients were injured in motor vehicle crashes. Very few were pedestrians (6%) or pedal cyclists (2%). The next leading cause was assault/homicide (24%), with the highest number of these injuries due to assault by cutting and piercing instrument (11%). Falls were the only other cause of injury significantly represented in the data (16%). Almost half of falls were from or out of a building or other structure (46%).

African-American Data Summary

African-American patients received care at all three hospitals. Their mean age was 26.8 years with a median age of 24 and the most common recorded age was children under age 1. 34.9% of African-American trauma registry patients were under the age of 18. Males comprised 71.6% of patients entered into the registry. Most (72%) African-American trauma registry patients resided within Jefferson County (site of KCH and ULH). The most common residential zip codes were 40211 (n=286, 10%) and 40210 (n=197, 7%), in the Louisville metropolitan area, and 40508 (n=166, 6%) in the Lexington metropolitan area.

The leading causes of injury for African-American trauma registry patients were the same for all three hospitals: motor vehicle crashes, assault/homicide, and falls. At KCH, the leading cause of injury was falls (22%), followed by motor vehicle occupants (19%) and pedestrian in a motor vehicle crash (15%). At UKH and ULH, motor vehicle crash of any type was the leading cause of injury among African-Americans (42%, and 41%, respectively)¹. Assault and homicide accounted for 32.5% and 37%, while falls were a leading cause at UKH only, at 11%. Firearms were the major cause of assault/homicide injury among both UKH and ULH African-American patients (51% of assault/homicide cases).

¹ Due to coding differences, direct comparisons of specific motor vehicle crash causes cannot be made between UKH and ULH.

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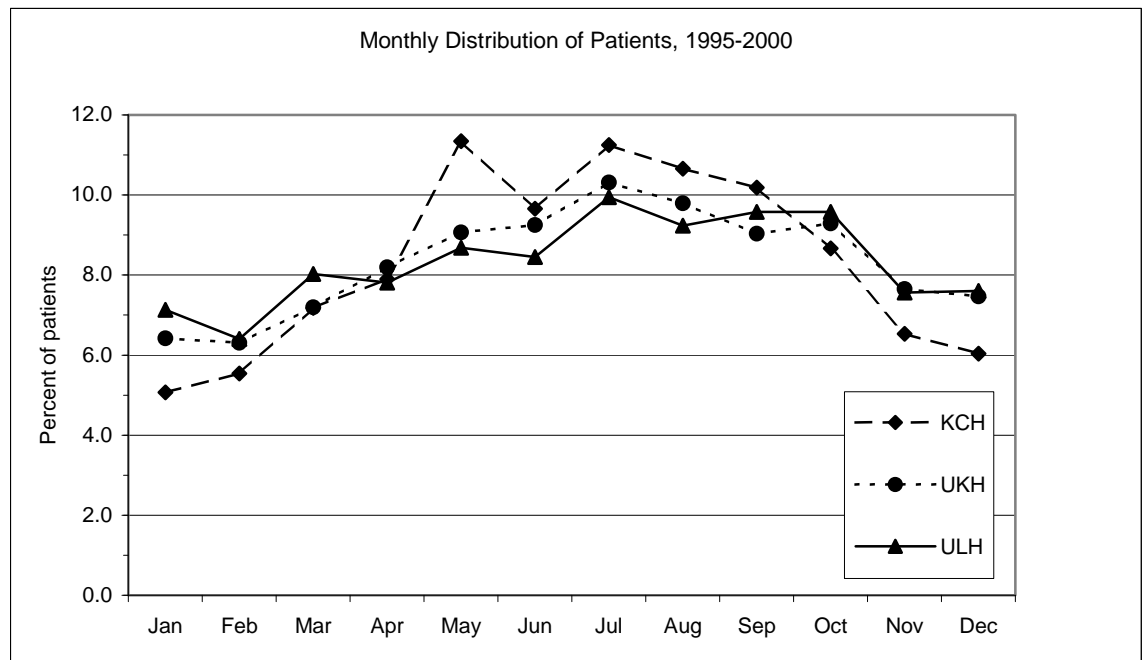
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Monthly Distribution

The summer months of July, August, and September had the most trauma registry cases. Conversely, the winter months of January and February had the least cases, although some level of traumatic injury is present throughout the year. Analysis of monthly trends over the 6 years revealed essentially the same distribution each year, thus only the aggregate is shown here. Trauma registry increases in the summer months could be influenced by factors such as temperature (e.g., heightened levels of outdoor activity), many students out of school (e.g. less supervision and possible risk for injury), and increased traveling/vacationing (e.g. potential risk for motor vehicle crashes). Implications for a trauma system include modifications to staffing patterns and prevention program implementation.

Figure 4. *Distribution of patients by month, 1995-2000.*

There is a seasonal pattern for trauma cases, with more cases occurring in the summer months, especially at KCH.



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E-codes are necessary for describing the causes of injury. Moreover, consistent coding among facilities is paramount.

II. Cause of Injuries

E-codes describe the external cause of injury. For example, a broken arm might be the result of a motor vehicle crash, or a playground fall or child abuse. Prevention strategies for a school or a community would thus differ substantially even though the end injury might be the same. E-codes are essential for translating injury into prevention through education, engineering, enforcement or other solutions (Karaffa, 1993, pp. 261-292).

Table 6. Cause of injury, 1995-2000.

E-Code Group	Kosair	UK	UofL	All Hosp
Missing	9 0%	1 0%	4 0%	14 0%
Cut/Pierce	44 1%	275 2%	34 0%	353 1%
Drowning/Submersion	50 1%	48 0%	4 0%	102 0%
Fall	1047 26%	1735 13%	823 9%	3605 14%
Fire/Flame	134 3%	347 3%	293 3%	774 3%
Burn	212 5%	198 1%	100 1%	510 2%
Firearm	50 1%	223 2%	168 2%	441 2%
Machinery	18 0%	236 2%	109 1%	363 1%
Motor Vehicle				
MV Occupant	895 22%	2424 18%	4199 47%	7518 29%
Motorcycle	52 1%	157 1%	350 4%	559 2%
MV-Other	10 0%	9 0%	18 0%	37 0%
MV-Unspecified	31 1%	19 0%	102 1%	152 1%
MV-Missing	0 0%	0 0%	0 0%	0 0%
Pedal Cyclist	322 8%	203 2%	64 1%	589 2%
Pedestrian	317 8%	520 4%	419 5%	1256 5%
ATVs	42 1%	222 2%	61 1%	325 1%
Transport-Other	71 2%	3964 30%	385 4%	4420 17%
Nature/Environment	79 2%	156 1%	31 0%	266 1%
Overexertion	41 1%	1 0%	2 0%	44 0%
Poisoning	12 0%	3 0%	4 0%	19 0%
Struck	235 6%	525 4%	114 1%	874 3%
Suffocation	11 0%	3 0%	1 0%	15 0%
Other Unintentional	132 0%	356 3%	166 2%	654 2%
Adverse Medical	1 3%	0 0%	11 0%	12 0%
Adverse Drugs	1 0%	0 0%	5 0%	6 0%
Suicide	8 0%	351 3%	275 3%	634 2%
Homicide	177 0%	1249 9%	1014 11%	2440 9%
Undetermined	24 4%	46 0%	82 1%	152 1%
Unintentional-Missing	2 1%	1 0%	6 0%	9 0%

Coding of motor vehicle crashes was not consistent across all hospitals, so specific categories of MVCs are not comparable. Motor vehicle crashes accounted for 43%, 58%, and 63% of all trauma patients at KCH, UKH, and ULH, respectively. The top five causes of injury for all trauma patients were motor vehicle crashes (57%), falls (14%), homicides (9%), fire/flame (3%), and struck by/against (3%). KCH patients had more injuries due to falls, and ULH and UKH registries included more admissions due to homicide or suicide.

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Over one half of all cases in the three trauma registries were due to a motor vehicle crash.

Table 7. *Leading causes of injury by hospital, 1995-2000.*

KCH		ULH		UKH	
Motor Vehicle*	43%	Motor Vehicle*	63%	Motor Vehicle*	58%
Falls	26%	Homicide	11%	Falls	13%
Struck	6%	Falls	9%	Homicide	9%
Burns	5%	Fire/Flame	3%	Struck	4%
		Suicide	3%	Fire/Flame	3%
				Suicide	3%

* Motor vehicle includes occupant, motorcycle, pedal cyclist, pedestrian, ATV, other and unspecified motor vehicle crash injury causes.

At KCH, the first and second leading causes of injury are motor vehicle crashes and falls. These results are consistent with national data (National Safe Kids Campaign, 2002). Neither homicide nor suicide was a leading cause of injury at KCH.

Motor vehicle crashes comprise a large percentage of injury in Kentucky's trauma registry. The ULH registry data indicate a slightly larger percentage than UKH, and a significantly larger percentage of injuries KCH, which is located in the same metropolitan area. One out of ten cases in the ULH registry was due to homicide.

Falls were the second leading cause of injury among trauma patients at UKH. Pediatric patients are included in the UKH trauma registry, and since falls are a leading cause of unintentional injury in children under age 14, a higher percentage of fall injury would be expected.

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Direct comparison of the nature of injury among the three trauma centers is not possible because of differences in coding and reporting.

III. Nature of Injury

The nature of an injury (N codes) designates an anatomical site and type of injury, e.g. broken arm, skull fracture, lacerated liver. Hospital personnel assign N codes to patients according to the injuries with which they arrive. N codes do not indicate the circumstances of injury, or how it occurred.

ULH recorded n-codes across the six years of data collection. KCH has text describing the nature of injury but did not forward n-codes for those descriptions. UKH also describes nature of injury in text and does not send n-codes. The state trauma registry has extremely limited n-codes for UKH for 1999 and 2000 only. Due to differences in recording trauma cases and limited data, direct comparisons are not possible.

Head trauma was defined by the Center for Disease Control's definition which includes N codes 800.0 through 801.9, 803.0 through 804.9, and 850.0 through 854.1.

(Note: These hospital N codes percentages total more than 100% because each case has up to 9 codes.)

Table 8. *Percent of patients by diagnosis, UKH and ULH 1999-2000.*

	<u>1999</u>		<u>2000</u>	
	UKH	ULH	UKH	ULH
Internal Injury	7.8%	30.5%	11.8%	30.8%
Head Trauma	8.9%	21.7%	10.3%	22.8%
Fractures of Face, Neck, Trunk	22.8%	33.7%	21.0%	40.1%
Fractures of Lower Limbs	12.0%	22.3%	16.5%	22.6%
Fractures of Upper Limbs	11.8%	19.7%	11.1%	19.6%
Open Wounds of Head, Neck, Trunk	34.6%	29.0%	35.1%	25.1%
Open Wounds of Upper Limbs	0.6%	6.3%	0.5%	5.9%
Open Wounds of Lower Limbs	0.2%	7.6%	0.6%	7.1%
Poisonings	0.0%	0.3%	0.0%	0.2%
Superficial Injuries	1.3%	9.4%	1.3%	9.6%
Other	12.4%	28.7%	11.1%	26.4%
Number of Patients with Diagnosis Codes	474	1517	828	1639

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Table 9. *Percent of patients by diagnosis, ULH 1995-2000.*

	1995	1996	1997	1998	1999	2000
Internal Injury	30.9%	28.4%	34.0%	30.7%	30.5%	30.8%
Head Trauma	38.8%	40.0%	45.9%	26.3%	21.7%	22.8%
Fractures of Face, Neck, Trunk	31.2%	32.9%	35.1%	37.4%	33.7%	40.1%
Fractures of Lower Limbs	19.6%	19.9%	21.2%	19.9%	22.3%	22.6%
Fractures of Upper Limbs	16.8%	15.8%	18.3%	18.1%	19.7%	19.6%
Open Wounds on Head, Neck, Trunk	31.0%	30.2%	30.7%	27.8%	29.0%	25.1%
Open Wounds on Upper Limbs	6.9%	8.3%	7.8%	7.6%	6.3%	5.9%
Open Wounds on Lower Limbs	7.6%	7.8%	8.0%	7.8%	7.6%	7.1%
Poisonings	0.4%	0.3%	0.2%	0.2%	0.3%	0.2%
Superficial Injuries	9.0%	10.4%	10.2%	11.1%	9.4%	9.6%
Other	20.7%	21.2%	17.0%	24.6%	28.7%	26.4%
Number of Patients with Diagnosis Codes	1517	1475	1295	1364	1517	1639

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More than 60% of cases arriving at UKH were transfers from other health care facilities.

30% of all patients arrived at the trauma center within one hour of injury.

IV. Pre-Hospital Transport

Table 10. *Patient arrival, 1995-2000.*

Arrival	UKH		ULH		Both	
From scene	4134	31%	5781	65%	9915	38%
Transfer	9151	69%	3123	35%	12274	47%

Due to the number of patients residing in rural areas in Kentucky, the UKH receives the majority of its patients through transfers from local hospitals, while ULH has a higher percentage of direct from the scene transports because of its urban setting and catchment area. Data was not available for the method of transport for the KCH patients.

Table 11. *Percent of patients arriving at UKH by transport type, 1995-2000.*

Patient Arrival	UKH
Ambulance Transfer	44.1%
Ambulance Scene	19.1%
Helicopter Transfer	19.5%
Helicopter Scene	9.0%
Private Transportation	9.0%

Table 12. *Arrival times post injury, 1995-2000.*

Hrs to Arrival	KCH		ULH		UKH		All	
Up to 1	356	30%	2569	69%	2405	19%	5330	30%
1-2	185	16%	417	11%	1839	14%	2441	14%
3-5	373	31%	450	12%	4983	39%	5806	33%
6-12	179	15%	205	6%	3069	24%	3453	19%
13-24	92	8%	58	2%	558	4%	708	4%

A greater percentage of ULH patients arrive within one hour of injury than KCH or UKH.

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ULH patients transported directly from the scene were more likely to arrive within 1 hour than UKH patients.

Table 13. *Percent of patients transported directly from scene by arrival time, 1995-2000.*

<u>Hours to Arrival</u>	<u>UKH</u>	<u>ULH</u>	<u>Combined</u>
Up to 1	59%	86%	70%
1-2	31%	12%	23%
3-5	7%	1%	4%
6-12	2%	0%	1%
13-24	2%	1%	2%

Of those patients transported directly from the scene, a larger percentage arrived within an hour to ULH (86%) than UKH (59%), due in part at least to the urban nature of the area and that more of ULH patients reside in Jefferson County and likely were injured not far from their home. Most of the patients arriving more than three hours after injury were transferred from another hospital.

Table 14. *Percent of deaths by arrival time, 1995-2000.*

<u>Hours to Arrival</u>	<u>KCH</u>	<u>UKH</u>	<u>ULH</u>	<u>Combined</u>
Up to 1	42%	30%	74%	45%
1-2	18%	28%	14%	23%
3-5	29%	34%	8%	25%
6-12	11%	6%	3%	5%
13-24	0%	2%	1%	2%
	100%	100%	100%	100%

A smaller percentage of deaths of UKH patients (30%) or KCH patients (42%) occurred when patients arrived within one hour of injury than ULH deaths (74%). These results may be related to the severity of the injury ULH patients incurred.

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*Compared to ULH, UKH
had a greater proportion
of transferred patients
residing more than 50
miles from the trauma
center.*

Table 15. *Residence of transferred patients, 1995-2000.*

<u>Patient Residence</u>	<u>UKH</u>	<u>ULH</u>	<u>Combined</u>
In same county	14%	8%	10%
In KY county within 50 miles	67%	69%	67%
In other Kentucky counties	88%	64%	82%
In other state	70%	43%	60%

A greater percentage of UKH patients living more than 50 miles from the trauma center (88% in KY and 70% out of KY) were referral patients than ULH patients (64% in KY and 43% out of KY). This represents the nature of rural transports in Kentucky because UKH serves the rural area of Eastern Kentucky. A trauma patient is more likely stabilized at a local hospital before transport to the UKH trauma center.

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*Most trauma cases
arrive between 3:00
and 11:00 pm.*

V. Hospital Parameters

Admissions by Shift

The frequency of admissions according to standard hospital employee work shift was examined. There were twice as many admissions on the second shift, 3:00 p.m. to 11:00 p.m., as there were on the first shift, 7:00 a.m. to 3:00 p.m., and the third shift, 11:00 p.m. to 7:00 a.m. This information is important for trauma systems planning. While we do not have information this year on the relative percent of a hospital's admissions that are trauma versus non-trauma, this information can be used to assist in hospital staffing, surgery room scheduling, and planning for employee child care needs.

Table 16. *Patient admission by standard work shifts (percent), 1995-2000**.

Shift of Arrival	KCH	ULH	UKH	All
7:00 am – 3:00 pm	24.1	26.3	22.5	24.0
3:00 pm – 11:00 pm	63.9	43.8	48.2	49.1
11:00 pm – 7:00 am	12.0	29.9	29.3	26.9

* 1.1% of data missing

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*Nearly one quarter
of patients in the
UKH and ULH
registries had a
GCS below 15.*

Glasgow Coma Score

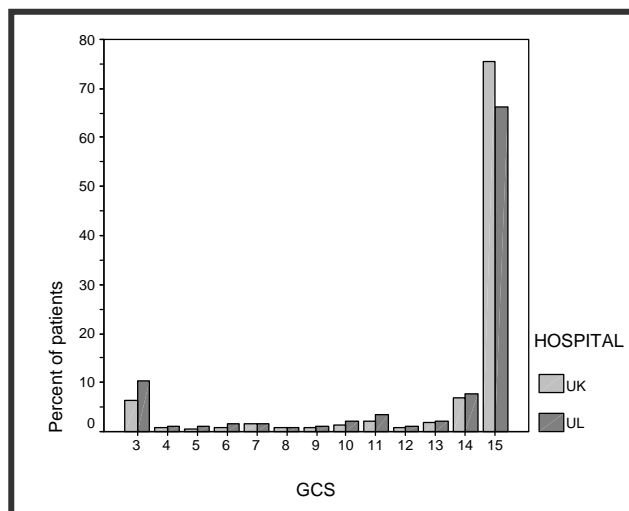
The Glasgow Coma Score (GCS) is a numerical system used to quantify significant neurotrauma. GCS is scored between 3 and 15, with 3 being the most severe classification and 15 the least severe. The three categories of best eye response, best verbal response, and best motor response are used to compile this value (Teasdale & Jennett, 1974). The time frame in which scores are recorded in the registry can affect GCS statistics (i.e., at point of walk-in, 1 hour later, 2 hours later, or not indicated). Trauma registries record the first available GCS, since that is the most predictive of outcome.

Table 17. *Glasgow Coma Score Scale*

<i>Verbal Output</i>		<i>Eye Opening</i>		<i>Motor (movement) Responses</i>	
<u>Score</u>	<u>Finding</u>	<u>Score</u>	<u>Finding</u>	<u>Score</u>	<u>Finding</u>
5	normal, fluent, appropriate speech	4	eyes open without stimulation	6	patient follows commands
4	normal, fluent, appropriate speech	3	eye opening to loud noise	5	patient locates pain on his body
3	mumbling, occasional word recognizable	2	eye opening pain only	4	patient pulls away from pain
2	vocalizations but not verbalizations (no words)	1	no eye opening	3	patient flexor postures
1	no vocalization or verbalization			2	patient extensor postures
				1	no motor response

The mean GCS for UKH and ULH was 13.2 with a standard deviation of 3.7. KCH reported limited data and did not yield adequate numbers for comparison across hospitals. Figure 5 depicts the distribution of GCS scores for UKH and ULH. While the mean and standard deviation are the same, ULH had a greater percentage of patients with GCS of 3.

Figure 5. *Distribution of GCS, UKH and ULH 1995-2000.*



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*Four out of 5
trauma patients
had an ISS less
than 20.*

Injury Severity Score

The Injury Severity Score (ISS) is an anatomical scoring system that provides an overall numerical value for patients with multiple injuries. Each injury is assigned an Abbreviated Injury Scale (AIS) according to one of six body regions: head, face, chest, abdomen, extremities (including pelvis) and external. The three most severely injured body regions have their score squared and summed to produce the ISS, with values from 0 to 75. An AIS of 6 is an unsurvivable injury and is automatically assigned an ISS of 75 (Baker et al, 1974). There are limitations to the ISS, including the difficulty of comparing multiple trauma with life threatening injury of one isolated system.

The combined ISS for the three hospitals had a range of 0 to 75 with a mean of 11.8 and a standard deviation of 9.9.

Table 18. *Distribution of ISS by hospital, 1995-2000.*

ISS	KCH	UKH	ULH	Combined
0 - 4	54.8	27.9	17.4	29.2
5 - 9	28.5	27.4	25.1	26.9
10-14	7.3	14.7	20.3	15.1
14-19	4.7	10.0	14.2	10.3
20-24	1.0	5.5	8.7	5.7
25-29	2.5	8.2	9.3	7.6
30-34	0.7	2.5	2.6	2.2
35-39	0.5	1.5	1.1	1.2
40-75	0.2	2.4	1.2	1.7
	100	100	100	100

A significant number (22.7%) of ULH trauma registry entries were missing ISS data; therefore, comparisons between the ULH and UKH registry data may not be reflective of actual trauma cases.

The KCH ISS mean and median were considerably lower than both the ULH and the UKH. These results should be examined in the context of the ISS range for each of the hospitals (0-45 at KCH, 0-75 at ULH, and 0-74 at UKH), as well as each hospital's missing data percentage.

VI. Outcomes

Length of Stay (LOS)

Table 19. *Distribution of the length of stay (LOS), 1995-2000.*

<u>Percent of patients</u>	<u>KCH</u>	<u>UKH</u>	<u>ULH</u>
Up to 1 week	88%	75%	58%
1 week to 1 month	11%	22%	36%
more than 1 month	1%	3%	6%
Mean (days)	3.9	5.9	9.6
Standard Deviation	6.0	8.4	11.6
Range	0-93	0-99	0-240

The length of stay did not vary significantly for the 6 years, 1995-2000; therefore, the overall distribution is shown. The ULH registry data indicated a much larger range in LOS with an average significantly higher than both the UKH and KCH. The three trauma centers had different distributions of the LOS. These results are multi-factorial. For example, KCH data indicated a lower mean and median ISS in their trauma patient population and LOS comparisons correspond accordingly.

Intensive Care Unit Days

Table 20. *Distribution of the number of days in the Intensive Care Unit, 1995-2000*

<u>Percent of patients</u>	<u>KCH</u>	<u>UKH</u>	<u>ULH</u>
Up to 1 week	81.4%	90.7%	80.6%
1 week to 1 month	16.3%	8.5%	16.9%
more than 1 month	2.3%	.9%	2.5%
Mean (days)	5.2	2.1	4.2
Standard Deviation	7.76	7.16	8.91
Range	0-58	0-472	0-148

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Kosair Children's Hospital had a 5.2 ICU day average, the highest of the three hospitals, but with only 13% of trauma patients admitted to the ICU and included in the KCH trauma registry. ULH and UKH's average ICU days differed somewhat. While the range of ICU days is larger for UKH, ULH and KCH have greater percentages of patients having longer ICU stays.

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Comparisons of patient outcomes are not feasible among the three hospitals due to coding and inclusion criteria differences.

Hospital Outcome

Table 21. *Percent of patients by discharge status, 1995-2000.*

	KCH	UKH	ULH	Combined
Home	92.8	79.1	68.4	77.5
Medical Facility	3.8	10.8	18.3	12.3
Hospital	*	1.4	3.4	*
Rehab	*	9.2	14.9	*
Death	3.0	6.2	10.2	7.1

* Kosair software did not distinguish type of medical facility. Combined percentages are not available for discharge to hospital and rehab, only to medical facility.

Coding differences between hospitals could affect the results shown here. Caution should be exercised when interpreting these data. For example ULH may differ considerably in their hospital outcome data possibly due to differing inclusion criteria and the potential for a patient population with more severe trauma. Rehabilitation referral patterns may differ at different institutions. Transport times to UKH are often longer than either ULH or KCH and patients may die en-route.

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VII. Special Studies

Table 22. *Number of children in the trauma registry aged 3 to 8 years involved in motor vehicle crashes, 1995-2000.*

Year	Count
1995	110
1996	85
1997	85
1998	86
1999	87
2000	103
Total	556
Average	93 per year

During the 2002 Kentucky General Assembly, the trauma registry data was analyzed in context of specific legislative initiatives. Injuries to children ages 3-8 resulting from a motor vehicle crash were reviewed to educate lawmakers about booster seats. Most children ages 3 to 8 should be in a booster seat. Cases shown in Table 22 likely lacked a booster seat. These injuries might have been prevented had a booster seat been used. Similarly, to educate policy makers about the need to strengthen the graduated drivers' licensing law, the trauma registry data was used to describe injuries to 16 and 17 year olds who were injured in a motor vehicle crash. See Table 23.

Table 23. *Number of 16 and 17 year olds in the trauma registry involved in motor vehicle crashes, 1995-2000.*

Year	Count	Driver only
1995	147	81
1996	152	75
1997	152	76
1998	154	80
1999	188	102
2000	127	86
Total	920	497
Average	153 per year	83 per year

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Recommendations

1. The effort to establish and perfect a statewide trauma registry should continue, because it has important information to add to evaluation of current trauma causes, services and care. A state trauma registry also provides data essential for planning of future trauma services and injury prevention efforts at multiple levels including hospital, locality, county and state.
2. Stable, ongoing funding should be sought to make the state trauma registry, data analysis and report an ongoing, sustainable effort.
3. Authority for a state trauma system, funding, hospital designation, transfer arrangements, prevention data systems, evaluation protocols and rehabilitation should be addressed in legislation.
4. Conduct training and standardized assessments on both N and e-coding to facilitate uniform coding and reporting across hospitals.
5. Hospitals should be added to the data collection system. Additional facilities help build a more complete picture of traumatic injuries and the systems needs of trauma patients in the state.
6. EMS data should be linked to the trauma data to determine how services compliment one another and identify areas for improvement. Additionally, these data should be linked to rehabilitation data to evaluate additional outcomes.
7. Cooperative agreements should be developed with trauma centers at Kentucky borders to facilitate the exchange of data on patients. This includes University of Cincinnati Hospitals and Cincinnati Children's Hospital, Cabell-Huntington Hospital (WV), University of Tennessee Hospital in Knoxville and Knoxville Children's Hospital, Vanderbilt University Hospital, and possibly others such as Riley Children's Hospital in Indianapolis). When an injury occurs near a state border, the patient may be taken to an adjacent state, yet the cause of injury was amenable to prevention in Kentucky and some services in the Kentucky trauma system may have been used for the care of that injured patient.
8. Whenever possible, the Kentucky data should be compared to the national trauma data bank (NTDB). Specifically, a detailed analysis of the pediatric trauma injuries in Kentucky is needed to address the apparent higher-than-national relative percentage of pediatric trauma.
9. Trauma places an economic burden on the medical care delivery system. A more detailed analysis of the hospital charges and costs is necessary to put trauma in context with other health care issues.
10. The trauma data should be further analyzed to inform prevention initiatives of the state legislature and other entities on such topics as head injury, Graduated Drivers Licensing, All Terrain Vehicles, and booster seats.

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